

TRAVAUX
DU
CERCLE LINGUISTIQUE
DE COPENHAGUE
VOL. XXVII

Eli Fischer-Jørgensen

Trends in Phonological Theory
Until 1975

A Historical Introduction

C.A. REITZEL
COPENHAGEN 1995



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NIELS DAVIDSEN-NIELSEN

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Tables 8.3 and 8.4 from E. C. Cherry, M. Halle and R. Jakobson, "Toward the logical description of languages in their phonemic aspect", *Language* 29, 1953 (Linguistic Society of America).

Table 8.5 from G. Fant, "Structural classification of Swedish phonemes", *Speech Transmission Laboratory. Quarterly Progress and Status Reports 2/1960*, Stockholm 1961.

The figure on p. 193 from P. M. Postal, *Aspects of Phonological Theory* 1968 (Harper and Row).

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Figs. 10.2, 10.4 and 10.5 from S. M. Lamb, *Outline of Stratificational Grammar* 1966 (Georgetown University Press).

Figs. 10.6, 10.7, 10.9, 10.10 and 10.11 from D. G. Lockwood, *Introduction to Stratificational Linguistics* 1972 (Harcourt Brace Jovanovich Inc.).

Fig. 12.1 from H. Spang-Hanssen, *Probability and Structural Classification in Language Description* 1959 (Rosenkilde og Bagger).

Fig. 12.2 from G. Fant, "Notes on the Swedish vowel system", *Form and Substance* 1971 (Akademisk Forlag).

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PREFACE 1975

This book was originally intended for phonetics students at the University of Copenhagen. It was written in Danish and mimeographed in a limited number of copies in 1970. It was planned as a short survey of about a hundred pages. However, as the work went on, I became interested in giving a more detailed characterization of the various schools of phonology, and the result was a reference book rather than a textbook.

After having finished the manuscript I felt that it might be useful to students of linguistics and phonetics and to teachers of phonology in other countries as well, and possibly also to more advanced linguists interested in a relatively easy survey of the field. I therefore sent it to some colleagues abroad who encouraged me to publish the book in English.

In spite of its size the book is elementary in the sense that very little is presupposed. The reader is only expected to have an elementary knowledge of phonetics and some idea of the commoner phonological terms.

The relatively extensive bibliography, the many references in the text and the indexes should make it possible to use the book as a starting point for more profound studies of individual schools or of the treatment of specific problems by different schools.

The book does not claim to give new contributions to phonological theory but only to summarize the characteristics of the various phonological trends and to account for the connections between them. In this way it should also procure a survey of the development of phonological theory.

I have tried to be relatively unbiased without being entirely impersonal. Particularly the chapters on more recent schools, still under discussion, contain some critical remarks, whereas I have found it less interesting to discuss details of older theories which are now considered by everybody to be obsolete, for instance Trubetzkoy's system of prosodic features. If the chapter on Prague phonology contains relatively few critical remarks it is, however, also because I have an old affection for this school, dating from the early thirties when the writings of Trubetzkoy and Jakobson opened up exciting new perspectives for a young student interested in general linguistics.

The grouping of phonologists into schools is, of course, not as absolute as the chapters of this book would seem to indicate. It is more or less valid until the

middle of the fifties; after that time there is much overlapping. Moreover, there have always been phonologists who have been influenced by various theories and who did not belong to any definite school (more important contributions of this type have been treated together in chapter 12). However, the division into schools makes the different methods and general problems stand out much more clearly, and it is therefore pedagogically preferable.

The main emphasis has been on theory, and a fair treatment of individual phonologists has sometimes been sacrificed for the sake of clarity of presentation. The emphasis on theory also means that phonological descriptions of specific languages have been mentioned only very rarely, viz. in cases where they were found to give new theoretical insight, but since I have only read very few such descriptions I may have overlooked important contributions. In view of the vast literature on the subject, some important theoretical papers may also have escaped my notice. Because of lack of competence in mathematics, I have had to leave most mathematical treatments of phonology unmentioned. As far as the older schools are concerned, the bibliography represents a – perhaps somewhat arbitrary – selection of my readings, whereas the bibliographies of the more recent trends cover most of the literature which has been available to me. The Danish version was finished in 1970, but it has been attempted to bring it up to date on the more essential points.

As I could not find time to write an English version, I was glad to accept NIELS DAVIDSEN NIELSEN's offer to undertake a translation. I want to thank him for the great care he has bestowed on this comprehensive and delicate piece of work. He cannot, however, be made responsible for single formulations, since I have undertaken a thorough revision of the manuscript after it had been translated. Chapters 10–13 were added afterwards and written directly in English.

I am grateful to A. S. Liberman (Leningrad) for providing me with literature on Russian phonology, and to Peter Molbæk Hansen for preparing extensive Danish summaries of many of the Russian books and papers quoted. In this way I have been able to concentrate my reading of the Russian originals on some of the more crucial passages. As I read Russian very slowly, this saved much time. Peter Molbæk Hansen has also prepared the indexes with great care.

I am indebted to Una Canger, Martin Kloster Jensen, Jakob Mey, Hans Vogt and Francis J. Whitfield who have read the Danish version and suggested better formulations at various points, and to Henning Andersen, A. S. Liberman and Henning Spang-Hanssen for reading the chapter on phonological theory in the Soviet Union. I am particularly indebted to Hans Basbøll and Jørgen Rischel who read the first draft of the manuscript and whose suggestions resulted in improvements on many points, particularly in the chapter on generative phonology. Hans Basbøll, moreover, read the whole manuscript in its "final" form just before it went to press. He found a great number of inconsistencies in the editing of the manuscript and several unclear formulations. The book has been improved very much by this final control, and I am very grateful to Basbøll for his help.

PREFACE TO THE SECOND EDITION

The present book has been out of print for a couple of years, and colleagues at various universities, who have found it useful as a reference book in their courses in phonology, have urged me to make it available again. I am very grateful to the Linguistic Circle of Copenhagen for taking the initiative to publish it in its series "Travaux du Cercle Linguistique de Copenhagen" and to the Carlsberg Foundation for supporting it financially.

Since 1975 other books have been published which to a large extent cover the same subjects. This is particularly true of Alan H. Sommerstein "Modern Phonology" 1977 and Stephen R. Anderson "Phonology in the Twentieth Century" 1985. The approach is, however, not quite the same in the three works. Sommerstein's presentation is not strictly historical, but rather arranged according to subjects, although it does characterize the different theoretical trends. Anderson traces the historical development, but with the specific aim of characterizing the different theories according to the relative importance they attach to "representation" versus "rule", thus from a generative point of view. His book gives a more thorough account of the forerunners of phonology than the other two. On the other hand, writing for an American public, which is assumed to know generative phonology by heart, he gives only a relatively short sketch of its main features, whereas Sommerstein and I have found it necessary to give a detailed account of this trend for a European public. Anderson hardly mentions diachronic phonology, and neither Anderson nor Sommerstein mention phonology in the Soviet Union, which is treated in a rather long chapter in the present book. Each book has its individual advantages, and they may be considered to complement each other.

The endeavour to keep the price down has made it necessary to restrict the corrections to direct misprints, although a more thorough revision would have been preferable. I shall mention a few points. In his review in *Norwegian Journal of Linguistics* (30,2,1976), Rudolf Obendorfer criticizes the chapter on Firthian phonology for being too brief. I think he is right, particularly seen in retrospect, since the Firthian prosodic analysis is still very influential in British phonology, and since similar ideas have now been taken up in autosegmental phonology. (Stephen Anderson gives a more thorough account, emphasizing this relation).

In chapter 12, "Contributions from Outside the Schools", Obendorfer misses an account of the contribution of British linguists to the analysis of intonation. I agree that I might at least have mentioned Halliday and Chrystal whose approach is interesting and very different from that of both continental and American phonologists.

A few minor corrections which could not be entered in the text are found on page 475.

The most obvious defect of the book is, however, that it stops at the year 1975. Since then, many new trends have appeared in phonology, most of them modifications of classical, generative phonology and particularly involving a (badly needed) rehabilitation of the syllable, which was neglected in early generative phonology. I have, of course, considered the possibility of adding some chapters on the recent development, but that would be more than I am able to cope with now. Instead I have added "until 1975" to the original title. I think it can be argued that a historical presentation may stop at a definite date without thereby invalidating the account of the previous development. Moreover various descriptions of the new trends are available, and a brief overview is found in John Clark & Colin Yallop: "An introduction to Phonetics and Phonology" (Blackwell 1990), p. 341-54. But a more detailed, overall presentation of phonology since 1975 is still desirable.

February 1995

Eli Fischer Jørgensen

PHONETIC SYMBOLS

In most cases the phonetic symbols of the International Phonetic Association (IPA) are used. These symbols are given in the chart on the preceding page. In the cases where there are two consonant symbols in one square, the first indicates a voiceless consonant and the second its voiced counterpart. The paired vowels of the vowel chart contain an unrounded vowel to the left and its rounded counterpart to the right. I have not used the symbols ɪ and ʊ, indicating lax vowels, but instead the older symbols: i y u.

The IPA symbols have, however, not been used consistently. In several cases the symbols used by the authors quoted have been maintained.

This means that ü and ö sometimes are used for y and ø, and that the following consonant symbols may be found:

For IPA	f	ʒ	tʃ	dʒ	ts	j
	š	ž	č	ǰ	c	y

In a few cases this may cause ambiguities because of overlapping symbols:

IPA	y	j		ts	c
	ü	y		c	kʰ

Usually the value of the symbol is clear from the context. Where this is not the case, attention is drawn to it.

In phonetic transcriptions palatalized consonants are indicated by a small j attached to the letter: ʧ ʤ ʑ as normally in IPA. In transliterations of Russian an acute accent placed after the letter is used to indicate palatalized consonants finally and before consonants. This is also used for isolated palatalized consonants (in agreement with Russian transcription), e.g. ikat', t', p'.

In phonetic transcription stress is indicated by a small vertical bar before the stressed syllable. In transliterated Russian words stress is indicated by an acute accent above the vowel, e.g. barán.

[] indicate phonetic transcription, / / phonemic. But very often, when no distinction was found to be necessary, isolated sound symbols are simply italicized.

THE INTERNATIONAL PHONETIC ALPHABET.

		Bilabial	Labio-dental	Dental and Alveolar	Retroflex	Palato-alveolar	Alveolo-palatal	Palatal	Velar	Uvular	Pharyngeal	Glottal
CONSONANTS	Plosive	p b		t d	ʈ ɖ			c ɟ	k ɡ	q ɢ		ʔ
	Nasal	m	ɱ	n	ɳ			ɲ	ŋ	ɴ		
	Lateral Fricative . .			ɬ ɮ								
	Lateral Non-fricative .			l	ɭ			ɮ				
	Rolled			r						ʀ		
	Flapped			ɾ	ɽ					ʀ		
	Fricative	ɸ β	f v	θ ð s z ʃ ʒ	ʂ ʐ	ʃ ʒ	ç ʝ	ɕ ɟ	x ɣ	χ ʁ	ħ ʕ	h ɦ
Frictionless Continuants and Semi-vowels	w ɥ	ʋ		ɹ				j (ɥ)	(w)	ʁ		
VOWELS	Close	(y ɥ u)						Front i y	Central ɨ ʉ	Back ɯ u		
	Half-close	(ɘ ɚ)						ɛ ɜ		ɤ ɔ		
	Half-open	(œ ɔ̃)						ɛ œ		ɔ̃ ɔ̃		
	Open	(ɒ)							ə			
									ɐ			

Notes: Affricates are normally represented by groups of two consonants (ts, tʃ), aspiration of plosives as h (ph, th), high lax vowels are written ɪ y ʊ or ɛ ʏ ɔ. Centralization is indicated by ~ (ē, ō), nasality by ~ (ã), length by : (a:), voicelessness by ʰ (b), and syllabicity by , (ɹ).

Chapter I

INTRODUCTION

TERMINOLOGICAL REMARKS

1.1 In this book the word **PHONOLOGY** is used in a relatively broad sense, viz. referring to all types of theories and descriptions of the linguistic function of speech sounds.¹ It is in this connection immaterial whether such theories aim at a purely formal description, as does the glossematic discipline "cenematics", or include substance, as do most other theories; whether they acknowledge the phoneme as a central phonological unit (as most older theories) or only the distinctive feature (as generative phonology); and whether they regard phonology as an autonomous discipline or as an integral part of grammar.

Until recently such theories have gone under the name of **PHONEMICS**, or **PHONEME THEORY**, but as the phoneme is gradually becoming less important, "phonology" is perhaps more suitable. This is true even though it is an over-worked term, which has been used in a number of senses: e.g., sound physiology (Saussure), general phonetics (Grammont), historical sound development (British tradition), or as a common term for phonemics and phonetics (former American terminology); sometimes it has also been used specifically for the theory of the Prague School. In a way Martinet's term "functional phonetics" is better, but it does not allow derivations.

Common to all the different schools is the fact that they are based, explicitly or implicitly, on the distinctive function of sounds, i.e., on the capacity of sounds for distinguishing meanings.

THE HISTORICAL PERSPECTIVE

1.2 The development of phonological theory does not permit a strict chronological description in the sense that each school could be seen as a new step in a continuously progressive evolution. It is possible to trace some clear lines of influence from Baudouin de Courtenay and from Ferdinand de Saussure to various phonological schools. It is also clear that a more elaborated theory of the phoneme was first developed in Russia by L. V. Ščerba and that he influenced the Prague School

1. "Phonology" is thus distinguished from "phonetics", which refers to the description of the physiological, physical, and perceptual properties of speech sounds.

and, to some extent, Daniel Jones.² But around 1930 different phonological theories were framed almost simultaneously in different centres, and the Second World War contributed to isolating these centres from each other, so that the early contact between them was broken and their theories were elaborated in different directions and without much mutual contact till well into the fifties.

By a rough simplification it is, however, possible to arrange the most important theories chronologically according to the period in which they were most active and flourishing: the Prague School in the thirties, the Bloomfield School (and glossematics) in the forties and the beginning of the fifties, Roman Jakobson's theory of distinctive features in the fifties, and generative phonology in the sixties. This relative chronology has determined the order of the chapters of this book. And as far as the two latter theories are concerned, they really started later, and there is at least a clear chronological line from Prague phonology through the distinctive feature theory to generative phonology. As for Daniel Jones, he started earlier than any of them, but did not publish his main work until 1950. In the present book he is placed after Prague phonology, because it was found preferable to start with a fully fledged and influential theory as a basis of comparison.

The chronological arrangement does not, however, imply that the theories described first are considered completely out of date. In this respect there is an important difference between phonology and phonetics. Phonetics is dependent on technical apparatus; rapid and continuous technical development, especially in recent years, has resulted in a steadily increasing growth of our phonetic knowledge. Phenomena which were formerly inaccessible to observation, let alone measurement, can now be studied in great detail; and insofar as these phenomena are measurable, it is possible to obtain general agreement concerning the results. Older phonetic studies, and this applies particularly to acoustic works, are therefore regarded by everybody as outdated and of historical interest only.

It is not quite the same with phonology. This is not only because some trends developed more or less independently. More important is that phonological analysis does not produce new concrete facts which must be acknowledged by everybody in the same way as phonetics. Of course there may be progress in descriptive technique, such that certain concrete descriptions may become outdated, and points of view which had previously been overlooked may emerge and improve our knowledge; but the phonological schools differ chiefly in having different general views due to the historico-philosophical context in which they are placed. This is especially obvious when one compares the Bloomfield School, which is deeply rooted in behaviourism and antimentalism, and transformational grammar, which reacts sharply against this attitude and once again searches inward in quest of the human mind. Phonological schools, it must be remembered, are not isolated phenomena but stages of a general development which manifests

2. Ščerba's theory will, however, not be dealt with in detail until Chapter 11 because this makes it possible to give a more coherent picture of the development of phonology in the Soviet Union.

itself also in grammatical description and in the humanities in general, including art and literature. This development may often take the form of a spiral; i.e., the distance may often be greater from the immediately preceding stage than from another stage which is more remote in time. Generative phonology, for example, is closer to Prague phonology than to Post-Bloomfieldian phonology. Former theories are therefore not outdated in the same way as, for example, Rousselot's description of acoustic phonetics. They are still of much more than merely historical interest.

Chapter 2

FORERUNNERS OF PHONOLOGICAL THEORY

ANCIENT INDIA AND GREECE

2.1 In the Introduction phonology was characterized as a relatively recent discipline. Nevertheless, its forerunners may be traced far back into the past, all the way back to the invention of alphabetic writing. From the beginning it has been a (conscious or unconscious) principle of alphabetic writing to have separate letters only for those sounds which have a distinctive function and not for sound shades which are determined by their environment.

The Sanskrit writing system was syllabic, but it was based on a segmental analysis, and Indian grammarians have also given theoretical contributions to this analysis. Some grammarians, for instance Patañjali (c. 150 B.C.), set up a concept *VARṆA SPOṬA* which has much in common with the phoneme concept of the twentieth century. In any linguistic unit two aspects are distinguished: a constant invariable entity (*spoṭa*) and the actual event realizing the *spoṭa* (*dhvani*).¹ There are *spoṭas* of different levels: of the sentence, the word group, etc. The smallest *spoṭa* is the *varṇa spoṭa*, which is a permanent unit of distinctive sound capable of semantic differentiation. The *varṇa spoṭa* itself is devoid of meaning, but the replacement of one by another can produce a different word. (See Roman Jakobson 1971, pp. 394-5, and R. H. Robins 1967, p. 140.)

Independently of the Indians Greek grammarians developed a similar concept, the *STOICHEION*. *Stoicheia* are the ultimate components of speech, capable of forming larger units. There is supposed to be a discrete number of *stoicheia* corresponding to the letters of the alphabet, and they form a coherent system. (See Roman Jakobson 1971, p. 395, and R. H. Robins 1967, pp. 31-2).²

THE "FIRST GRAMMATICAL TREATISE"

2.2 It is well known that alphabetic writing has been transferred from one language to the other and each time has had to be adapted to a new language according to the principle of distinctiveness, a problem which has been solved

1. Cp. the distinction between *langue* and *parole*, 2.7 below.

2. A latinized form of this term (*stoecheum*) is used by L. R. Palmer to designate the irreducible basic components of speech found by a first intuitive analysis ("Descriptive and Comparative Linguistics" 1972, p. 33ff).

with varying success. It is rare to find a clear and detailed account of the views that underlie such an adaptation. An exception is the so-called "First Grammatical Treatise" written by an anonymous author in the middle of the twelfth century in Iceland (Anonym. auth., ed. 1972). It is not this author, it should be noted, who introduced Roman writing into Iceland; this had already been in use for a few years when he wrote his treatise. His aim was to reform the orthography in such a way that it would be better suited to the Icelandic language. His reform proposal was not accepted, but his treatise must be characterized as the best phonological description of any language before the early 1930s. He suggests, for instance, an enlargement of the inventory of vowel letters from five to nine. To the traditional Roman letters *a, e, i, o, u* he adds the four vowel letters *ę, ɔ, ø* and *y*. *ę* and *ɔ* are used to designate open *e* and *o* sounds, and *y* and *ø* indicate rounded front vowels (this is apparent from his examples, but not very clear from his physiological descriptions). Moreover, he proposes the use of diacritical marks to distinguish nasal vowels from oral ones and long vowels from short ones. He gives the following reasons for making these distinctions (in the translation of Einar Haugen): "Now I shall take eight of these letters . . . and place each of them in turn between the same two consonants, and I shall show by examples how each of them, when supported by the same letters and placed in the same position, makes a different sound, and in this way give examples throughout this little book of the most delicate distinctions that are made between the letters: *sár, sǫr; sér, sęr; sól, sór; súr, sýr; . . .* But now each of these nine letters will bring forth a new one if it is spoken in the nose. This distinction is so clear that it can change the meaning, as I shall show in the following, and I shall place a dot above those that are spoken in the nose: *hár, hǫr; þél, þél . . .*" (with word pairs for each vowel). And he adds that there is still another difference: "This is a distinction which changes the meaning, according to whether the letter is long or short, just as the Greeks write a long letter with one shape and a short with another . . . I, too, wish to make this distinction because it changes the meaning, just like the other, and I shall mark the long ones with a stroke to distinguish them from the short: *far, fár; ramr, rámr; ɔl, ɔl . . .*" (for all vowels). Furthermore the different words are inserted into short sentences in order to show the semantic difference, e.g. "*súr eru augu sýr, slík duga betre en spryngi ýr*" ('sour are the eyes of the sow, but better so than if they popped'). Concerning the consonants he states that *x, z, y, k* and *q* can be dispensed with (although *x* may be used to represent the combination *cs*). *c* may be used in all cases instead of *k* as they are pronounced identically. For what is written *ng* he suggests one symbol *g*. He sees no reason to write *u* in a special way (*w*) when it is used as a consonant. On the other hand, he points out that long and short consonants should be distinguished, but instead of writing the long ones twice he suggests capitalizing them (*L, M, N*, etc.) in order to increase the speed of the writing and "make the parchment last longer". He also produces examples of this difference in the form of word pairs and sentences, e.g. "*eigi cru ɔl ɔL at einu*" ('not all beers are alike').

These quotations demonstrate unmistakably that his reasoning is based on distinctive function and the commutation test³ and that he is of the opinion that variants conditioned by the environment (cf. the example *u w*) can be written with the same letter. Finally he mentions that a whole book could be written about the way in which words are composed of letters and the way in which all the letters may be combined.

FORERUNNERS WITHIN CLASSICAL PHONETICS

2.3 Just as the functional principle is implicit in alphabetic writing, it is also implicit in a large number of early phonetic descriptions, e.g. in the works of all the more prominent representatives of so-called classical phonetics, such as Sievers, Jespersen, Sweet, and Passy. Their descriptions, on the whole, are restricted to sound differences which have a distinctive function.

The principle is also set forth explicitly in several works. WINTELER (1876) in his description of the Kerenzer dialect makes a distinction between "essential" and "accessory" features, which corresponds to the one made between relevant and irrelevant features in the Prague School, and he also applies the commutation test.

In his "Handbook of Phonetics" (1877) HENRY SWEET notes that in phonetic transcription separate symbols are needed only for the distinctive differences in each language. "It is necessary to have an alphabet which indicates only those broader distinctions of sound which actually correspond to distinctions of meaning in a given language ...". Sweet also explains that each language utilizes only a small number of distinctions and that these distinctions differ from language to language. For example the difference between "narrow" and "wide" (i.e. tense and lax) vowels is only "significant" in some languages, such as Icelandic, but not in others, such as French. He furthermore points out that in English, where this difference is also found, it is not independent since it always accompanies length. Only differences which are "independently significant" should be marked.

3. Here and in the following the term "commutation test" – a term coined by Hjelmslev but subsequently adopted by phonologists from several schools – is used to indicate a test which consists of replacing a sound sequence forming a minimal utterance (e.g. [pi:] 'pea') with another (e.g. [ti:]) in order to find out whether the change is accompanied by a change of meaning. If this is the case, the two sound sequences are said to be commutable. In a case like *pi:ti:* the two sound sequences are found to be minimally different because it is possible to narrow down the difference between them to a difference between *p* and *t*. Whereas *p* and *t* are independently different, the two *i:*s may for linguistic purposes be considered identical, i.e. the difference which may be found between them depends on the environment. We can even go further and narrow down the difference between the two sound sequences to a difference between the features labiality and dentality in the first segment. By a sort of shortcut it is possible to talk about commutation of segments and features and not only of utterances or words.

P. PASSY, who was influenced by Sweet, gives very similar formulations, e.g. "There should be a separate letter for each distinctive sound; that is for each sound which being used instead of another can change the meaning of a word" (1888, cp. D. Jones 1957). Sweet and Passy had a strong influence on Daniel Jones (see Chapter 4).

OTTO JESPERSEN in his book on phonetics (1897-99, p. 509) applies this functional view to quantity: "the various languages are highly different as regards the use of these quantities, which may depend partly on purely external phonetic conditions for which rules may be laid down (stress, position in the syllable, environment), EXTERNALLY DETERMINED quantity ..., partly on something internal so that the quantity is as important a component of the words as the sound segments themselves and may be used for distinctive purposes as well as these segments ... INTERNALLY DETERMINED quantity". In this passage a clear distinction is made between what has later been called allophonic or bound variation and distinctive differences. Furthermore, he gives (on p. 611) a number of examples of sound differences which are used distinctively in some languages, but not in others (voiced and unvoiced *s* are, for example, distinctive in French and English, but not in Danish).

In his comprehensive work "Vårt Språk" (1903-23) ADOLPH NOREEN used "språkljud" ("speech sound") in approximately the same way phoneme has been used subsequently, namely to refer to a group of sounds which are phonetically similar and whose divergencies are "not used for linguistic purposes, i.e. to carry a semantic difference" (Noreen 1903, p. 407). Furthermore, Noreen gives a description of the combinatory possibilities of these sounds. This has often been emphasized by Swedish writers (see e.g. B. Collinder 1938).

Finally J. FORCHHAMMER writes in his phonetic textbook (1924) that for the phonetics of specific languages it can be established as a general principle that sounds which appear only as different pronunciations of the same word should be considered as sound variants, whereas those which lead to words with different meanings should be considered as distinct speech sounds.⁴

It was therefore with a certain justification that Jespersen's, Forchhammer's, and Noreen's pupils, when confronted with the work of the Prague phonologists, maintained that these theories were not as new as their authors considered them. There is, however, a difference. The recognition of the functional point of view as an important one did not in classical phonetics result in the construction of any new theory or in any clearly formulated principles of description, and it was mainly in the description of the standard languages that the classical phoneticians, partly bound by orthography, restricted themselves to sound differences with distinctive functions. In the dialect descriptions of the same period most authors

4. "Als allgemeinen Leitsatz kann man für die spezielle Phonetik wohl die Regel aufstellen, dass Laute die nur als verschiedene Aussprache desselben Wortes gelten, als Lautschattierungen zu betrachten sind, während sie als verschiedene Sprachlaute aufzufassen sind, wenn sie zu Wörtern mit verschiedener Bedeutung führen."

enumerated a large number of sound nuances without distinguishing the functions of these nuances. Moreover, these descriptions usually start from Common Germanic (in the case of the Germanic languages) or Latin (in the case of the Romance languages), describing the development of each single sound from the proto-language to the dialect. This approach gave prominence neither to function nor to the system of the dialect proper, and the reaction of the Prague phonologists against this type of description was fully justified.

BAUDOUIN DE COURTENAY

2.4 The Polish linguist Jan Baudouin de Courtenay (1845–1929), who for many years taught at Russian universities, is one of the direct forerunners of phonological theory.⁵

In 1870, in his inaugural lecture at the University of St. Petersburg, Baudouin de Courtenay had set up three separate tasks for phonetics: (1) the description of sounds from a physiological point of view, (2) the description of the role played by sounds in the mechanism of language (also described as their significance for the linguistic intuition of the speech community), and (3) the description of sound change. By the "role in the mechanism of language" he meant, above all, the role of sounds in morphological alternations.

From 1875 Baudouin taught at the University of Kazan'.⁶ In 1878 the young Polish linguist M. Kruszewski (1850–87) came to Kazan' to study with Baudouin, and in the following years they worked in close co-operation. The introduction to the second part of Baudouin's lectures on the comparative grammar of the Slavonic languages, published in 1881, is at various points influenced by this co-operation. In this book he uses the term "anthropophonics" (which he probably took over from J. Winteler) to designate the discipline dealing with the physiological and physical nature of sounds, whereas the description of the morphological role of sounds is considered as phonetics proper. The unit of the latter discipline is now, following a proposal from Kruszewski, called a *PHONEME*. Kruszewski had taken over this term from the Swiss linguist F. de Saussure, whom he admired very much. The word "phoneme" was coined by the French linguist Dufriche-Desgenettes in 1873 as a translation of the German word "Sprachlaut", and it was thus only intended as a handy term which could replace the clumsy "son du langage". It was taken over by Louis Havet in 1874, and in 1878 by F. de Saussure in his "Mémoire sur le système primitif des voyelles dans les langues indo-européennes". Saussure used it mainly to designate a common prototype

5. The following exposition is mainly based on Roman Jakobson (1971) and Frank Häusler (1968). "A Baudouin de Courtenay Anthology", ed. E. Stankiewicz (1972), has not been accessible to me.

6. Baudouin de Courtenay and his pupils are often mentioned as the "Kazan School" of linguistics.

in a parent language which is reflected by different sounds in the languages derived from this parent language. Baudouin de Courtenay and Kruszewski adopted the term as a designation of a linguistic unit which underlies an alternation between sounds in etymologically related forms, both in cognate languages and within the same language.

Baudouin distinguished between those ALTERNATIONS that are purely phonetically conditioned (like *s* and *z* in the English plural ending after voiceless and voiced non-strident obstruents), and those that are morphologically conditioned (e.g. the alternation between *f* and *v* in English [wajf-wajvz], which is restricted to certain stems). The common denominator for the members of an alternation was called a phoneme (in most later phonological schools this entity has been called a "morphophoneme"). In later articles he sometimes used the term phoneme in a restricted sense to designate the unit underlying a phonetically conditioned alternation, and this is the sense in which the later Moscow School of phonology used the term. Baudouin was not consistent in his terminology. In accordance with Kruszewski he called the phonetically conditioned alternation "divergence", but in 1895 he extended the use of this term to include simple phonetic variation conditioned by the environment, also in unrelated forms (e.g. the different quality of English *l* initially and finally in a word). It is only the common element of this purely phonetic type of variation which is called a phoneme in the Leningrad School of phonology and in most other phonological schools.

In 1881 he included both of the requirements (alternation and common phonetic qualities) in his definition of the phoneme. This double definition, however, made difficulties which he saw very clearly himself.

In his book of 1895 "Versuch einer Theorie phonetischer Alternationen" he gave up his former definitions completely, and defined the phoneme as a psychological unit. The discipline concerned with phonemes was now called psychophonetics. The definition given in 1895 is the one most often quoted: "A coherent concept belonging to the phonetic world, which is generated in the mind by a psychological fusion of impressions made by different pronunciations of the same sound = psychological equivalent of the speech sound".⁷

Even in his earliest writings, Baudouin had described language as a PSYCHOLOGICAL phenomenon. By using a psychological definition of the phoneme he probably hoped to find a common formula for all the different types of alternations and variations, a constant psychological notion or intention lying behind the different modifications due to the surroundings. Baudouin also pointed out that the sounds which are psychologically important are the ones that are used to differentiate meanings (and he gave examples like *tam/dam*), but he did not include this in his definition.

7. "Eine einheitliche der phonetischen Welt angehörende Vorstellung, welche mittelst psychischer Verschmelzung der durch die Aussprache eines und desselben Lautes erhaltenen Eindrücke in der Seele entsteht = psychischer Äquivalent des Sprachlautes."

The hypothesis of a limited number of sound images corresponding to distinctive sounds was to become important in Prague phonology in its early form, and recently the psychological aspect has come into focus again.

Baudouin de Courtenay anticipated many other ideas which became important in the following period, and he directly influenced Saussure (see the next section). The term "morpheme", now generally accepted in the sense of a minimum meaningful linguistic unit, was invented by Baudouin.

The psychological definition of the phoneme was accepted by various of Baudouin's students, for instance by Titus Benni and L. V. ŠČERBA. Ščerba, however, added the distinctive function (probably under the influence of Passy) and later abandoned the psychological approach altogether. His description of different types of variants was an innovation compared to Baudouin de Courtenay. Ščerba's phonological theory will be described in detail in Chapter 11 (see particularly 11.3-11.6); it should, however, be emphasized here that due to Baudouin and Ščerba there was an unbroken phonological tradition in Russia from the beginning of the twentieth century, which was one of the conditions for the development of Prague phonology. Ščerba also influenced Daniel Jones.

FERDINAND DE SAUSSURE (STRUCTURALISM)

INTRODUCTION

2.5 Structuralism,⁸ which began to manifest itself in the late twenties, and which gradually became predominant in linguistics, is based on the conception of language as a structure, a system in which the individual elements are described in relation to the totality and where the relations between the elements in the system constitute the primary object of investigation.

In one sense the conception of language as such a system is nothing new. It underlies language description in both the seventeenth and eighteenth centuries as well as at the beginning of the nineteenth century when the term "organism", taken over from the natural sciences, was preferred. This point of view was rejected during the second half of the nineteenth century, however, when a historical description of the development of individual phenomena became the focus of attention. Structuralism began as a reaction to this predominantly historical, "positivist", and atomistic conception of language. This reaction was not confined to linguistics alone: a parallel development is found in literary criticism and art history as well as in the literature and art of the time. There is a clear parallel between nineteenth century historical linguistics and naturalism in art, and between twentieth century structuralism in linguistics and abstract

8. The term "structuralism" has acquired derogatory connotations in transformational grammar, but this is due to the fact that they take it in a narrow sense referring to the Bloomfield School, the principal target of their criticism.

painting. There has even been a direct influence. Roman Jakobson mentions in the partly autobiographical notes "Retrospect" which conclude his "Selected Writings I" (1962) that one of the most important sources of his endeavours to reform linguistics came from modern art (Picasso, Braque, Le Corbusier). In cubism, he says, everything is based on relations, and he quotes Braque: "I do not believe in things, only in their relations".

SAUSSURE'S GENERAL IDEAS AND BACKGROUND

2.6 The pioneer and founder of European structuralism was the Swiss linguist FERDINAND DE SAUSSURE (1857-1913), who from 1881 to 1891 lectured at l'Ecole des Hautes Etudes in Paris and subsequently in Geneva. At the age of twenty-one he published the comprehensive work "*Mémoires sur le système primitif des voyelles dans les langues indo-européennes*" (1878), which introduced a new era in the study of the Indo-European vowel system. In this work he interprets certain long vowels in Proto-Indo-European as combinations of short vowels plus an element A or O, whose phonetic characteristics he makes no attempt to describe, but which is defined by its possibilities of combination: by being capable of functioning both as vowel and consonant, as a "coefficient sonantique" like *i*, *u*, *l*, *m*, *n*, *r*. During the rest of his life he published only minor works. But after his death his pupils Bally and Sechehaye published a reconstruction of his lectures on linguistics (1907-1911), based on notes taken by various students, under the title "*Cours de linguistique générale*" (1916), and it was this book which became the foundation of European structuralism in linguistics. A critical edition by R. Engler was published in 1967-68.⁹

Saussure's achievement may be characterized best by enumerating a number of dichotomies which he established between different aspects of language, viz. langue/parole, signifié/signifiant (sign-content and sign-expression in the terminology of Hjelmslev), form/substance, syntagmatic/associative (later termed paradigmatic), and synchrony/diachrony. Taken separately these dichotomies are not new. They can be traced back to various of Saussure's predecessors, but Saussure combined them into a coherent theory, and within these distinctions he often

9. The articles and books on Saussure mentioned in the Bibliography constitute a very restricted selection of the existing literature, which is very extensive. The chapter in Malmberg's "New Trends" (1964) is an easily understood introduction to Saussure's ideas. The same is true of Lepschy (1972, pp. 42-52) and of Dinneen (1967, pp. 192-212), whereas Rulon Wells's paper (1947) contains a more detailed analysis. For those who want to study Ferdinand de Saussure thoroughly the best starting point is E. F. K. Koerner's book "Ferdinand de Saussure" (1973), which contains a wealth of references (I am indebted to professor Lepschy for drawing my attention to this book). Koerner gives an account of Saussure's ideas and their place in the history of linguistics, and he is particularly concerned with the sources of these ideas. Important for the understanding of Saussure is also R. Godel's publication of the handwritten sources of Saussure's "Cours" (1957).

stressed aspects which had until then been neglected: i.e. *langue*, as opposed to *parole*; form, as opposed to substance; synchrony, as opposed to diachrony.

In the years 1876-77 and 1878-79 Saussure studied in Leipzig, where he was in close contact with the leading figures of the NEOGRAMMARIAN SCHOOL (August Leskien, Hermann Osthoff, Karl Brugmann, Wilhelm Braune, Hermann Paul). Although he was later opposed to their view of linguistics as an exclusively historical science, this emphasis on history may have sharpened his conception of the distinction between diachronic and synchronic linguistics. He must also have known Hermann Paul's distinction between linguistic usage and individual speech activity, which is related to his later distinction between *langue* and *parole* (see Koerner, 1973, p. 107ff). Saussure was, however, also acquainted with the Humboldtian tradition. WILHELM VON HUMBOLDT (1767-1835) distinguished sharply between content and expression, between form and matter, and, less sharply, between language and speech; and he characterized the individual language as an organism (1830-35). This emphasis on language as a system lived on during the latter part of the nineteenth century and is particularly prominent in GEORG VON DER GABELNTZ (1840-93), who to a certain extent carries on the Humboldtian tradition. In the introduction to his book "Die Sprachwissenschaft" (1891) he describes Humboldt's works as "der classische Text der allgemeinen Sprachwissenschaft bis auf den heutigen Tag".¹⁰ But, in addition to that, von der Gabelentz himself sets up a very clear distinction between language and speech and between the description of the state and the development of language. He particularly stresses the importance of describing the state of a language. On several occasions E. Zwirner (e.g. 1964) has pointed out the connection between von der Gabelentz and Saussure, and E. Coseriu (1967) has called attention to a number of striking parallels in their works. Koerner (1973, p. 174ff) admits that these parallels are obvious, and he mentions that von der Gabelentz's book was found in Saussure's library, but he finds that Zwirner and Coseriu have exaggerated the influence of von der Gabelentz on Saussure.¹¹

According to Koerner Saussure owes more to the American linguist W. D. WHITNEY, particularly to his book "The Life and Growth of Language", which appeared in 1875 (Koerner, p. 74ff). Saussure's knowledge of Whitney as early as the end of the seventies is well documented, and he quotes him three times in his "Cours". Whitney described language as a social institution and he stressed the conventional character of linguistic symbols.

Saussure was also well acquainted with BAUDOUIN DE COURTENAY and KRUSZEWSKI (see 2.4 above). He met Baudouin de Courtenay in Paris on several occasions in 1881-82, he corresponded with both Baudouin and Kruszewski, and he possessed a number of Kruszewski's works. It is probable that Saussure is influenced by Baudouin's psychological concept of language, and he may also

10. 'The classical text of general linguistics even today'.

11. But the similarity between Saussure's theory and the Humboldtian tradition is reduced in Koerner's description because he does not deal with the form-substance dichotomy.

have been influenced by his distinction between signans and signatum (although this is an old tradition), by the distinction between the static and dynamic aspects of language made both by Baudouin and by Kruszewski, and by Kruszewski's distinction between relations of similarity and relations of contiguity (see below 2.10) and his idea of harmony of the linguistic system (cf. Jakobson 1971 and 1965, and Koerner 1973, p. 133 ff).

It has also been generally assumed that Saussure was deeply influenced by the French sociologist E. Durkheim, whose book "*Règles de la méthode sociologique*" (1895) was very influential. The similarities between Saussure's description of la langue as "un fait social" (see below 2.7) and Durkheim's theories are obvious. But Koerner (p. 45 ff) has not found any evidence for a direct influence (Saussure does not quote Durkheim), and he therefore assumes that the influence has been indirect, probably through Saussure's pupil, the French linguist A. Meillet.

Although it is thus possible to find distinctions and ideas in earlier and contemporary linguistic works which may have been of importance for Saussure, it should at the same time be emphasized that the original way in which he combined these ideas into a coherent and in many respects strikingly new theory started a new era in European linguistics.

LANGUE AND PAROLE

2.7 As already mentioned Saussure makes a primary distinction between LA LANGUE and LA PAROLE. The term LE LANGAGE is used more generally and vaguely as a sort of collective name for the universal language faculty. Terms like "langue" and "parole" belong to everyday speech in many languages (cf. English "language/speech", Danish "sprog/tale", German "Sprache/Sprechen" or "Sprache/Rede"); thus the distinction made is not a completely novel one. The innovation consists partly in the definitions: la langue is characterized as a system, la parole as the application of that system; la langue is social, la parole individual. Von der Gabelentz emphasized the first distinction only,¹² whereas Whitney had stressed the social aspect. Saussure describes la langue, in a wording which is reminiscent of Durkheim, as a convention, as "la partie sociale du langage, extérieure à l'individu, qui à lui seul ne peut ni la créer ni la modifier; elle n'existe qu'en vertu d'une sorte de contrat passé entre les membres de la communauté" ("Cours" p. 31). In some passages, however, la langue is also described as a psychological reality, as something deposited in the brain of each individual, like a copy of a dictionary which has been distributed to the members of the speech community. The fact that the individual must also possess the system somewhat blurs the double distinction system/application and social/individual. (With the

12. But there is a close parallelism between Saussure's triad parole/langue/langage and von der Gabelentz's distinction between Rede/Einzelsprache/Sprachvermögen.

introduction of "competence" and "performance" in transformational grammar there has been a return to a simpler distinction between system and application). However, the linguistic system of the individual and that of the community are united in the somewhat problematic concept of "la conscience collective". Another somewhat weak point in Saussure's system of terms is the use of "parole", which refers both to concrete speech performance and to its product – the texts.

What is absolutely essential, however, is Saussure's emphasis on the fact that it is *la langue* which is the true subject of linguistics, despite the fact that it can only be reached through *la parole*.¹³

SIGNIFIÉ AND SIGNIFIANT

2.8 Language, *la langue*, is now described as a system of signs, each of which consists of a SIGNIFIÉ and a SIGNIFIANT ('signified' and 'signifier'), a concept and an acoustic image. In this way linguistics becomes part of the general theory of signs: semiology. Saussure viewed the range of possible concepts and the range of possible sounds as continuous amorphous masses, not divided up a priori into discrete elements. The construction of signs is explained metaphorically by stating that language makes a number of cuts through the conceptual mass and the sound mass simultaneously. In this way both are carved into parts, and the parts of the one are put into correspondence with the parts of the other. The places of these cuts, by which the signs are delimited, are crucial to an individual language, but arbitrary in the sense that it is not determined by nature that e.g. the sound sequence *t r i:* is connected with the concept "tree" (cp. French *arbre*, German *Baum*): "l'arbitraire du signe". It is emphasized that the signifier is LINEAR, consisting of a sequence of phonemes.

The signs acquire different values according to the contrasts they form with other signs by their mutual delimitation. In a certain sense English "mutton" may be said to mean the same as French "mouton", but it has another value because it contrasts with "sheep". Plural has one value in a language in which there is also a dual number, and another value in a language without it. Similarly, in the case of phonemes it is, according to Saussure, immaterial whether a French *r* is pronounced as a fricative or as a trill; it could also be pronounced [x]; but this is not possible in German where there is a contrast between *r* and *x*.

FORM AND SUBSTANCE

2.9 What is essential is the fact that entities are different, and not the nature of the difference. Saussure here draws an analogy to the game of chess: a knight

13. Hjelmslev (1943) discusses the *langue/parole* dichotomy.

has no independent existence, and it is irrelevant what material it is made of or whether its shape differs from the usual one; what matters is its contrast to other chessmen.

The same is the case with monetary systems. It is not the metal which constitutes the value, it is the place in a system. "Toutes les valeurs conventionnelles présentent ce caractère de ne pas se confondre avec l'élément tangible qui leur sert de support" ("Cours" p. 164).

Through the concepts of system and value we arrive at language as form. Language is a system of "valeurs pures", and in its essence it is FORM, *not* SUBSTANCE. Sound and meaning constitute the substance of language, whereas the delimitation of the units constitutes form. The units of language may therefore be regarded as purely formal. About "le signifiant" it is said that "il n'est aucunement phonique, il est incorporel, constitué, non par sa substance matérielle, mais uniquement par les différences qui séparent son image acoustique de toutes les autres" (p. 164). This applies also to phonemes: "Ce qui les caractérise, ce n'est pas, comme on pourrait le croire, leur qualité propre et positive, mais simplement le fait qu'ils ne se confondent pas entre eux. Les phonèmes sont avant tout des entités oppositives, relatives et négatives" (p. 164). In the first part of the "Cours", incidentally, the term "phonème" refers simply to sounds, but later it is narrowed down to denoting a purely functional entity.

Matter and form have been discussed since antiquity, but in linguistics this distinction has often been confused with the one between content and expression. As mentioned above, however, Humboldt had already distinguished the two dimensions. He assumed that there were two forms, a "Lautform" (sound form) and an "innere Sprachform" (inner linguistic form). Hjelmslev later distinguished in a similar way between an expression form and a content form. Saussure differs from both of them by setting up only one form, which cuts up sound substance and content substance simultaneously.¹⁴

ASSOCIATIVE AND SYNTAGMATIC FUNCTION

2.10 So far we have described form as if it concerned only contrasts between units in the system (e.g. the separation of 'sheep' and 'mutton' in English; the separation of /r/ and /x/ in German). But Saussure distinguishes between two kinds of function in language. The one just mentioned based on the contrast between elements in the system he calls ASSOCIATIVE (later more commonly termed PARADIGMATIC). The functional relation between links in the linguistic chain, on the other hand, he calls SYNTAGMATIC. The paradigmatic relation is

14. Buyssens (1952) and Frei (1950) discuss the question of whether it is possible to talk about differences without talking about similarities, i.e., in what sense it is possible to talk about "pure form".

described as taking place between terms "in absentia", whereas the syntagmatic relation takes place between terms "in praesentia".¹⁵

In the word "dé-faire", for example, there is a syntagmatic relation between "dé" and "faire", and an associative relation between "-faire", "-placer", and "-coller" (in "défaire", "déplacer", "décoller") ("Cours" p. 178). In the same way *m* in a sequence like *anma* is syntagmatically opposed to the surrounding entities and associatively opposed to those which may replace it, e.g. *v* or *d*.

SYNCHRONY AND DIACHRONY

2.11 The last dichotomy to be mentioned here is the one between **SYNCHRONY**, the description of the present state of a language, and **DIACHRONY**, the description of the historical development of a language. According to Saussure, these two phenomena should be kept strictly apart. He compares them to a system of co-ordinates with two axes, a horizontal "axis of simultaneity" and a vertical "axis of successiveness". To the speaker only the synchronic aspect exists. An "état de langue" must consequently be explained as a self-contained system, and its parts regarded in their synchronic solidarity without interference from diachrony. This is the linguist's primary task. In diachrony, on the other hand, Saussure claims that it is only possible to trace one phenomenon at a time. He compares the synchronic description to a transverse cut of a tree trunk revealing the interplay of the fibres, and the diachronic description to the tracing of a single fibre by means of a longitudinal cut. The development takes place without any purpose and has no relation to the system. Saussure is here still committed to the views of his period, and posterity has not agreed with him in regard to this question. On the contrary, it has been emphasized that the essential thing to do is to compare the systems at different points in time and investigate the development of the system in its entirety.

Nowhere does Saussure go into details concerning phonemes or phonemic systems. He confines himself to the scattered examples mentioned here, but his general language theory underlies the phonemic theories of the subsequent period. Above all he influenced Prague phonology and glossematics, although in somewhat different ways.

EDWARD SAPIR

2.12 The American linguist and anthropologist Edward Sapir (1884-1939) has contributed in a decisive way to the development of phonological theory. His

15. The distinction between these two types of relations may have been influenced by Kruszewski's distinction between relations of similarity and relations of contiguity ("Ähnlichkeitsassoziationen" and "Angrenzungsassoziationen").

ideas were incorporated in various linguistic schools, but he cannot himself be included in any of these schools. He is therefore here considered one of the forerunners of phonological theory, although his phonological theory was much more elaborate than Saussure's.

Sapir started as a Germanist, but under the influence of the American anthropologist Franz Boas he took up the study of Amerindian languages. These languages became his central field of study, but his research also comprised Indo-European and Semitic. He combined a first-hand knowledge of a very great number of languages with deep theoretical insights and has made important and original contributions to both linguistics and anthropology. He was in many respects a pioneer, who anticipated later developments.

The most important of his works dealing with phonology are his book "Language" (1921) and his articles "Sound Patterns in Language" (1925) and "La réalité psychologique des phonèmes" (1933).

In "Language" he operates with the concept of "PHONETIC VALUE", which corresponds closely to Saussure's value concept, but as he was hardly acquainted with Saussure's theory when he wrote "Language",¹⁶ it is unlikely that he could have taken it over from him. He also uses the term "psychological value", and for him the psychological factor was essential. In Saussure's "Cours" purely psychological terminology also is frequently found, but there it seems like something extrinsic, a remnant of an older terminology which does not completely fit in with its purely formal point of view. In Sapir, however, it is quite deliberate. It is the internal, psychological linguistic system which is the goal of his description. The value of a sound depends on its function in the PSYCHOLOGICAL PATTERN. The concept of pattern is fundamental in Sapir's thinking. The pattern is assumed to be due in part to the oppositions in the system. For example, two languages may have both *ptk* and *bdg* as phonetic entities, but if *bdg* are mere variants of *ptk* in one language and independent units in the other, the psychological patterns must be different in the two languages, in spite of the phonetic similarity (Sapir distinguishes between conditional variants, which depend on the phonetic environment, and individual variants characteristic of different speakers of the language). Furthermore, the psychological pattern is assumed to depend on the POSSIBILITIES OF COMBINATION of the phonemes and on their participation in MORPHOLOGICAL ALTERNATIONS. For example, *ptk* in English belong to one class because of their common possibilities of combination, and *f* and *v* belong to one class because of alternations like that in *wife-wives*. The phoneme is defined as "a functionally significant unit in the rigidly defined pattern or configuration of sounds peculiar to a language" or as a "functionally significant point in a complex system of relatedness" (1925).

In his article of 1933 he mentions attempts to make speakers of unwritten Amerindian languages write their own language. It turned out that they did not

16. Sapir finished his book in 1920, and during the war he worked in the geological survey of Canada (H. Vogt, personal communication).

like to distinguish between conditional variants, but that, on the other hand, they insisted on writing latent consonants, which only turned up in other forms of the word in question. For instance, a native informant of the language Sarcee would write one of two phonetically identical words [dini] with a final *t* which only turned up in other forms of that word. Sapir concludes that objectively identical phonetic phenomena may receive different phonological interpretations. It is necessary to get behind the sense data to grasp the intuitively felt and communicated forms. What the naive speaker hears is not phonetic elements, but phonemes.

In agreement with his psychological conception of sound patterns Sapir also considers SOUND CHANGE a psychological process. To a certain extent sound change works mechanically as a slow DRIFT in one direction, whose causes are unknown. The drift of a language is constituted by the unconscious selection on the part of its speakers of those individual variations that are cumulative in some special direction. This direction may be inferred in the main from the past history of the language. There may, for example, be a tendency towards stronger or weaker stress, more or less voicing of elements. But two other factors are also important in language change, viz. "a readjusting tendency which aims to preserve or restore the fundamental phonetic pattern of the language", and a "preservative tendency which sets in when too serious morphological unsettlement is threatened by the main drift". ("Language", Chapter VIII). Phonetic and morphological phenomena should be seen in their intimate relations in language change.

Sapir exerted considerable influence in America, both on the Bloomfield School (by his emphasis on phoneme combination), and later on generative phonology (by his emphasis on the psychological pattern and on alternations and underlying forms). In Europe glossematics was influenced by his views on sound change, and by his classification of phonemes on the basis of combination.¹⁷

17. F. P. Dinneen (1967, pp. 220-38) is recommendable as a more detailed account of Sapir's linguistic approach.

Chapter 3

PRAGUE PHONOLOGY

INTRODUCTION

3.1 In the twenties there were exceptionally favourable conditions for the establishment of a structural linguistic school in Prague. Linguistic currents from both east and west converged here with the native Czech tradition.

In Prague the philosopher T. G. Masaryk had already emphasized the importance of synchronic language description in the eighties and had advanced the theory of a teleological development of language. In the years shortly before 1920 V. MATHESIUS (1882–1945) worked out a synchronic, functional language description.

From the east came not only the idea of the phoneme as a sound image as propounded by BAUDOUIN DE COURTENAY and Ščerba, but also the formal view of grammatical description propounded by the Fortunatov School in Moscow. The Russian influence was decisively intensified by the arrival of three young Russian linguists: ROMAN JAKOBSON (b. 1896), who came to Czechoslovakia in 1920, N. S. TRUBETZKOY¹ (1890–1938), who was appointed professor in Vienna in 1922, and S. I. KARCEVSKIJ (1887–1955), who lived in Prague in the mid twenties.

Karcevskij had studied in Geneva and went back to Geneva in 1928 as a university teacher. He was thus also an exponent of the western influence, particularly of the ideas of FERDINAND DE SAUSSURE. Saussure's distinction between *langue* and *parole* and his emphasis on paradigmatic contrast became very important to Prague phonology.

In 1926 the Linguistic Circle of Prague was founded on the initiative of Mathesius, who was its president until the war put an end to its activities. To its founding members belonged, besides Mathesius, Jakobson, Trubetzkoy and Karcevskij, also B. TRNKA (b. 1895) and B. HAVRÁNEK (b. 1893). Among those who joined the circle in the following years were J. M. KOŘÍNEK (1899–1945), J. VACHEK (b. 1909), L. NOVÁK (b. 1908), A. V. ISAČENKO (b. 1911), and (later) J. KRÁMSKÝ (b. 1913) and F. DANEŠ (b. 1919).

The rapidly increasing influence of the Circle all over Europe was mainly due to its two most creative and dynamic members, N. S. Trubetzkoy and Roman Jakobson. Prince Nikolaj S. Trubetzkoy, who belonged to a famous Russian

1. The form Trubeckoj would be in better agreement with the way other Russian names are transliterated in this book; but in this case I have preferred to stick to the spelling he used himself in his works written in German.

aristocratic family, began his scientific career at the age of fifteen, and before he left school he had already written a number of articles on ethnography. Later he studied philosophy and linguistics, and at the age of twenty-five he was attached to the University of Moscow. During the Revolution, however, he was forced to take flight. In 1918 he was appointed professor at Rostov, but had to flee once again in 1919. Both times he lost nearly all his research records. After brief stays in Constantinople and Sofia, he was appointed professor at Vienna in 1922.

Roman Jakobson came to Prague from Moscow, where he had studied linguistics, folklore, and poetics. Also, as mentioned above, Roman Jakobson was inspired by modern painting and architecture. From 1937 to 1939 he was professor at Brno university. It was Jakobson who at the linguistic congress in The Hague in 1928 formulated the theses which first made the Prague Circle known abroad. According to these theses, the aim of a phonological theory should be: (1) to set up phonological systems, (2) to account for the significant differences ("les différences significatives entre les images acoustico-motrices"), (3) to find correlations (e.g. contrasts like *p/b*, *t/d*, *k/g*), (4) to formulate general laws concerning the structure of phonological systems, and (5) to account for historical change in terms of a teleological development of the system. We find here already *in nuce* most of the ideas which were subsequently formulated in detail. The theses were signed jointly by Jakobson, Karcevskij, and Trubetzkoy. When Trubetzkoy, whose outlook had till then been mainly historical, was stirred by these new ideas, he systematically began to elaborate them in a long series of articles which appeared in quick succession. A number of them were published in the series "Travaux du Cercle linguistique de Prague" (TCLP), the first two volumes of which appeared in 1929. In 1930 an international conference of phonology was held in Prague. TCLP IV (1931) contains the contributions to this conference as well as a "Projet d'une terminologie phonologique standardisée" which the participants had agreed upon. On this occasion an international phonological research committee was established with affiliated circles throughout Europe. During the following years the theories of the Prague School were the subject of lively discussions everywhere. Many accepted them, including the Dutch linguists A. W. DE GROOT and N. v. WIJK, and the French linguist A. MARTINET. Malmberg of Sweden was strongly influenced by the Prague School, but he was also influenced by glossematics, and cannot therefore be considered a real Prague phonologist.

The rich, almost hectic, scientific activity of the Prague Circle (which was not restricted to phonology, but embraced grammar and structural literary analysis as well), lasted only about a dozen years. When Hitler marched into Czechoslovakia and Austria, the Circle lost its best members: Trubetzkoy died of a heart attack when for the third time he had to face prosecution by the political police. Roman Jakobson fled to Denmark, where he stayed during the spring of 1939 and where he took an active part in the work of the Linguistic Circle. From there he went to Norway, where he thought he would be safer, but on the occupation of Norway by the Germans he was forced to continue his flight, this time to Sweden, where

he stayed until 1941. From Sweden he proceeded to the United States where he obtained a position at Columbia University in New York; later he became professor at Harvard and MIT. Mathesius died in 1945, and in the beginning of the fifties the Circle was dissolved. The traditions of the Prague School were, however, preserved and continued by new centres, particularly the Linguistic Association and the Group for Functional Linguistics at the Academy. Both groups co-operated in the preparation of the revived "*Travaux Linguistiques de Prague*" which began to appear in 1964. Although the interest has partly shifted to syntax, quite a number of phonological papers have appeared in recent years. The tradition has been carried on particularly by B. Trnka and J. Vachek.

Vachek's book "*The Linguistic School of Prague*" (1966) constitutes a very valuable source of information on Prague phonology. It gives a detailed description of the history of the School and its basic ideas. A brief account of the background and general approach of the School was given by Roman Jakobson in a paper read at the Linguistic Circle of Copenhagen in 1936 (1938); his "*Retrospect*" (1962) contains interesting information about the origin and development of his own ideas. A relatively short introduction to the theories of the Prague School is found in Malmberg (1964), cf. also Lepschy (1972, pp. 53-64). The present author has given a detailed and somewhat indigestible report on the literature until 1940 with an extensive bibliography (Fischer-Jørgensen 1941).²

The chief statement of Prague phonology is Trubetzkoy's "*Grundzüge der Phonologie*" – abbreviated below as "*Grz.*" – which was published in 1939 after his death. It is a clear and systematic book, and if it seems somewhat difficult, this is mainly because a large number of the examples are taken from Slavic and Caucasian languages. It contains two principal sections, dealing with distinctive and demarcative phenomena respectively ("*Unterscheidungslehre*" and "*Abgrenzungslehre*"). A sequel, which was to provide an introduction to historical phonology, phonological geography, and morphonology, was never written. In "*Grz.*" Trubetzkoy's previous monographs on phonology are recapitulated, and the reading of "*Grz.*" supplemented by his short article on morphonology (1931c) will therefore be sufficient to give an all-round picture of his theories.

2. J. Krámský's book "*The Phoneme*" (1974), which came to my notice just before this book went to press, contains a long chapter on the Prague School (pp. 32-76) and on Trubetzkoy's and Jakobson's theories (pp. 76-103 and 103-26). The exposition is centred on the concept of the phoneme, its definition, the distinction between phoneme and variant, and the concept of neutralization (and on pp. 108-26 the distinctive feature theory, which is treated in Chapter 8 here). It thus gives a much more detailed description of what is treated briefly here in sections 3.3-3.5 (and partly 3.6-3.7), whereas it deals only in passing with the subjects treated in 3.8-3.19 of this book.

PHONOLOGY AND PHONETICS

3.2 The Prague School did not want simply to introduce new points of view in phonetics but to create an entirely new discipline – phonology – which was to be independent of phonetics. Saussure's distinction between *LANGUE* and *PAROLE* provided the theoretical foundation for this separation. In "Projet" the following definitions are given: "Phonologie: Partie de la linguistique traitant des phénomènes phoniques au point de vue de leur fonction dans la langue. – Phonétique: Discipline auxiliaire de la linguistique traitant des phénomènes physiques du langage abstraction faite de leurs fonctions dans la langue." – Trubetzkoy maintains this point of view in "Grz." (p. 5 ff).

As mentioned in the previous chapter Saussure's dichotomy "langue/parole" covers both the distinction between system and application and that between the social and the individual aspects of language. Trubetzkoy's translation "Sprachgebilde"/"Sprechakt" implies that most significance be attached to the former contrast, though the terms "norm" and "social institution" are also used. "Sprachgebilde" and "Sprechakt" are, however, also more or less equated with Saussure's distinction between *FORM* and *SUBSTANCE* (function as opposed to physical phenomena), and Trubetzkoy even maintains that phonology belongs to the humanities and phonetics to the physical sciences.

Jakobson, however, did not adhere to the formulation given in the "Projet" of 1931. In a paper read in 1939 (but not published until 1962) he rejects the parallelism between phonology/phonetics and "Sprachgebilde"/"Sprechakt" because the phoneme must also be realized in speech performance, but he maintains the equation between phonology/phonetics and form/substance.

Others, for instance v. Wijk (1939a, p. 197 ff) and Malmberg, have objected that the social norm also comprises variants, not only phonemes.

It should be added that the role assigned to phonetics by the definitions in "Projet" and "Grz." is entirely unsatisfactory. Only in terms of a general theory is it possible (but hardly useful) to set up phonetic dimensions quite independently of linguistic function. In the description of individual languages the phonetician cannot proceed without concern for the functional system. E. Zwirner (1939) argued convincingly that phonetic description presupposes phonological classification, and that it is misleading to describe phonetics and phonology as different sciences.

As a matter of fact there was a clear discrepancy between theory and practice in Prague phonology. In many instances Trubetzkoy even uses purely phonetic criteria in the identification of units and the establishment of systems. This means that in the Prague phonologists' practice phonology corresponds neither to *langue* in the sense of norm (because not all normatively determined phenomena are included in phonology), nor to Saussure's *form* (because *substance* phenomena are also described). What interests them is rather the interplay between *form* and *substance*, the forming of the substance in the linguistic system. They describe

phonetic properties which are functional, that is RELEVANT SOUND DIFFERENCES. Martinet's description of phonology as "functional phonetics" (1949) is therefore in much better agreement with the actual practice.

The sharp distinction between phonetics and phonology was probably made partly in order to bring out phonological description as something entirely new and original and thus arouse the interest of linguists throughout the world, but the result was that many phoneticians demurred, and it was a long time before functional views were accepted in European phonetics.

Vachek (1966, p. 49) still maintains that phonetics and phonology are separate sciences, although he admits that "their mutual relation is much more complex than the radical line drawn in the early thirties was likely to reveal".

Jakobson, on the other hand, in his later writings adopted the description of phonology as functional phonetics, and his theory of distinctive features (see Chapter 8) contributed substantially to bridging that gap between phonology and phonetics which he had emphasized in his early writings.

THE DEFINITION OF THE PHONEME

3.3 In their early works both Jakobson and Trubetzkoy, following Baudouin de Courtenay, defined the phoneme as a psychological unit, a sound image or sound intention, whereas Mathesius used a purely functional definition from the start (1929a/b). Jakobson soon abandoned the psychological formulation, whereas Trubetzkoy still used it in 1931. In the standardized terminology of 1931 (TCLP IV) the definition is functional, and the psychological definition is criticized in various articles in the same volume. In "Grz." Trubetzkoy expressly repudiates the psychological definition. Some of the Prague School adherents, however, maintained this point of view. To v. Wijk, for example, it is the psychological system which constitutes the subject matter of phonology (cf. also Michel 1943).

Strongly influenced by Saussure the Prague School established phonological opposition as the fundamental concept upon which the other definitions were to be based. The PHONOLOGICAL OPPOSITION is described as a difference of sound which in a given language may serve to distinguish intellectual meanings.³

In "Projet" (1931) the PHONOLOGICAL UNIT is defined as "terme d'une opposition phonologique quelconque" (e.g. *paint* : *run* or *paint* : *faint*). The PHONEME is defined as the minimal phonological unit, "unité phonologique non susceptible d'être dissociée en unités phonologiques plus petites et plus simples" (e.g. *p* and *f* in English, cf. *paint* : *faint*) – a definition which, incidentally, had been proposed by Jakobson in 1929.

Subsequently Vachek raised the objection that although it is true that *l* and *r*

3. The purpose of the term "intellectual" is to restrict meanings to those which belong to the linguistic content communicated; in this way sound differences which characterize the speaker as belonging to a certain social group or which express feelings are eliminated.

are minimal phonological units in *glow/grow*, the minimal unit in a word pair like *bad/pad* is voicing as opposed to lack of voicing. Here, then, the phonological unit is smaller than the phoneme. Consequently the phoneme should be defined as the smallest phonological unit which cannot be decomposed into smaller successive units (Vachek 1936). In "Grz." (p. 34) phonemes are defined accordingly as "phonological units which from the standpoint of the language concerned cannot be analysed into still smaller successive phonological units".⁴ By means of comparison with *Sühne*, *Bohne*, *büße*, etc. the phonological unit *Bühne* may be divided into four successive minimal phonological units.⁵ To be sure, the *b* may be further decomposed (in purely phonetic terms) into successive parts (closure-explosion), but these only occur together, and not in isolation. The point is, then, that only independently commutable units qualify as phonemes.

Later on in the same chapter ("Grz.", p. 35), in agreement with a proposal of Jakobson's from 1932, the phoneme is characterized as the totality of the phonologically relevant properties of a sound unit.⁶

It is this definition ("a bundle of distinctive features") which Roman Jakobson has subsequently maintained as the essential one (cf. also Martinet, 1949).

In both definitions the concept of opposition (or distinction) plays an important role, and Jakobson in various places quotes Saussure's formulation "les phonèmes sont avant tout des entités oppositives, relatives et négatives" (1939b, SWr. I, p. 294). Vachek (1935) pointed to the fact that the phoneme has also a positive function, and de Groot (1931, p. 116) considers the function of recognition or identification ("Wiedererkennung") to be the essential one.⁷ It can, however, hardly be decided in abstracto which is more essential. For the definition of the phoneme as member of a linguistic system the distinctive function must be decisive, whereas the function of recognition or identification is important in actual speech.

Trubetzkoy emphasizes that the phoneme contains only relevant properties. A speech sound may therefore not be equated with a phoneme, but should be considered the realization⁸ of a phoneme.

4. "phonologische Einheiten, die sich vom Standpunkt der betreffenden Sprache nicht in noch kürzere aufeinanderfolgende phonologische Einheiten zerlegen lassen".

5. This is what Martinet has later called "the second articulation of language". The first articulation consists in the analysis of facts of experience into a succession of units each endowed with a vocal form and a meaning. Language has thus a "double articulation" (see e.g. 1964, 1.8 and 1.11).

6. "die Gesamtheit der phonologisch relevanten Eigenschaften eines Lautgebildes".

7. The function of identification has also been emphasized by various Russian phonologists (e.g. S. I. Bernštejn, see 11.7 below), and more recently by H. Mol and E. M. Uhlenbeck in their paper "Hearing and the Concept of the Phoneme", *Lingua* 8, 1959, p. 161ff.

8. Jakobson later uses the term "manifestation" first used by E. Zwirner and adopted by Hjelmslev. Later he prefers "implementation".

PHONEME AND VARIANT

3.4 A phoneme may be realized as different speech sounds. These sounds are the variants of the phoneme. There are two main types: **COMBINATORY VARIANTS**, which occur in different environments, and **FACULTATIVE VARIANTS**, which occur in the same environments. The last type may, according to Trubetzkoy, be either general or individual, or (from another point of view) stylistically relevant or irrelevant.

In the list of phonological terms ("Projet", TCLP IV, 1931) a distinction is made between "**VARIANTE FONDAMENTALE**" (basic or principal variant), and "**variantes accessoires**" (secondary variants). This is in accordance with the Russian tradition (see 11.5 below). The principal variant is that variant which is least dependent on the environment, is found in the position of maximum differentiation, and is free of emotional colouring. Jakobson uses this notion ("**variante fondamentale**") in his early writings, e.g. in 1929 ("SWr" I, p. 15), but it was not much used in the later works of the Prague School, for instance not in "Grz."⁹

In his small pamphlet "Anleitung zu phonologischen Beschreibungen" (1935) reprinted in "Grz." (p. 41 ff), TRUBETZKOY lays down some **PRACTICAL RULES** for the establishment of a phoneme inventory. Three main rules serve to distinguish between cases in which different sounds are variants of the same phoneme and cases in which they are distinct phonemes. The three rules may be summarized in the following manner: (1) If two sounds in the same environment may be interchanged without a change of meaning they are facultative variants of the same phoneme. (2) If they cannot be interchanged without altering the meaning or making the word unrecognizable they are realizations of two different phonemes; and (3) If two articulatorily and acoustically related sounds never occur in the same environment they are combinatory variants of the same phoneme.

A more special fourth rule says (4) that two sounds occurring next to each other in positions where one of them also occurs alone cannot be variants of the same phoneme even if they meet the requirements of rule (3), for example *r* and *ʀ* in English [præfɛfn - pæfɛkfn].

These rules, as we know, are found in slightly different forms in the works of most phonologists. The formulation "making the word unrecognizable" was probably included because it is often the case that not all possible combinations are utilized. Trubetzkoy mentions that replacement of *i* by *a* results in a change of meaning in *Lippe/Lappe*, but in *Fisch/Fasch* it only makes the word unrecognizable. Trubetzkoy does not cite examples where no minimal pairs are found, but his formulation "making the word unrecognizable" might be used in these cases.

In rule (3) **PHONETIC SIMILARITY** is given as a basic criterion for combining two sounds in different positions into one phoneme. This criterion has often been

9. Vachek (1966, pp. 51-2) mentions the term "principal variant" as common Prague terminology. In contradistinction to most other Prague phonologists he uses the term "combinatory variant" for secondary variants only.

discussed because it is frequently difficult to define the degree of phonetic similarity which should be required. Along with one of his examples, however, Trubetzkoy offers a formulation which is superior to the ones found in the works of most other phonologists: the sounds should have common properties which distinguish them from all other sounds of the language in question (therefore *h* and *ɣ* in English – a frequently cited example – cannot be subsumed under one phoneme; the only property which these two sounds have in common is that of being consonants, and this is not characteristic of them alone).

MARTINET (1946) subsequently maintained that the problem of identifying two sounds in different environments as variants of the same phoneme is not a matter of demonstrating phonetic similarity. Rather it is a matter of showing that they differ from other sounds that occur in the same environments by the same distinctive features. For example *b* in *banc* differs from *p* in *pan* and *v* in *van* by the same features as those by which *b* in *bout* differs from *p* in *pou* and *v* in *vous*. The identification, then, is based on distinctive features. This is also the approach adopted by Roman Jakobson in his later works. Martinet refers to W. F. TWADDELL's monograph "On Defining the Phoneme" (1935, see 6.12). It was maintained there that identification is based on similarly ordered lists of minimally different forms like *pill*, *till*, *kill*, *bill* as compared with *nap*, *gnat*, *knack*, *nab*. But Twaddell concludes that it is possible to identify sounds only if the lists compared contain the same contrasts. For example there are fewer vowels before *r* than before other consonants in English, and therefore they do not enter into the same oppositions, and consequently cannot be identified with the vowels before, for example, *t*. In this way Twaddell ends up with a large and complicated phoneme inventory, but this is a logical consequence of identifying entities by means of the same distinctive features in each position. Martinet and Jakobson do not draw this conclusion.

MONO- OR POLYPHONEMATIC INTERPRETATION

3.5 The question of whether to interpret affricates and diphthongs (as well as certain other composite sound types) as one or two phonemes constitutes a special problem. TRUBETZKOY first lays down three purely phonetic conditions for their interpretation as one phoneme: the sound combination must belong to the same syllable, constitute a homogeneous articulatory movement, and have the normal duration of a simple sound. If these conditions are met, one of the following three (more structural) conditions is sufficient for considering it a single phoneme: (1) the sound behaves like a single phoneme in phoneme combinations ([ph], for example, should be considered the realization of a single phoneme if the language has no other initial consonant combinations). (2) The interpretation brings about parallelism in the phoneme inventory (in Georgian, for example, there is a distinctive difference between stops with or without glottal stop, and this contrast

applies also to the affricates but not to the fricatives. Consequently the affricates should be interpreted as stops). (3) One of the components of a sound combination cannot be interpreted as a combinatory variant of any other phoneme in the language (in Serbo-Croat, for example, a gliding vowel [ə] is often found before or after syllabic [r], but otherwise there is no /ə/ in that language).

MARTINET (1939c) has criticized the purely phonetic criteria in this list and maintained that only the last rule (3) is relevant. According to him a better formulation of this rule would be to say that the elements in the combination manifest two phonemes if they can each be commuted with other sounds, or with zero, but one phoneme if only one or neither of them is commutable. In the example with [ə] + [r] above the [r] cannot be commuted with any other phoneme because there is nothing in other positions with which [ə] can be identified. Environmental identification always enters into the commutation test, i.e. the two operations must be regarded as different aspects of the same phenomenon. But making such an identification sometimes causes problems. Martinet mentions that in Castilian [ʃ] is only found in the affricate [tʃ], whereas [t] occurs in other positions as well. Is it possible, now, to interpret [ʃ] in [tʃ] as a variant of /s/ occurring after /t/? Martinet demands that the phonetic variation should be explicable in terms of the adjacent sounds, but it is not always possible to do this with absolute certainty.

Conversely it sometimes happens that a single sound may be interpreted as the realization of two phonemes, which is possible if there is free variation between this single sound and a sound combination. An example is the case of syllabic [ŋ] in German and Danish, which occurs in free variation with [ən] and may be interpreted as /ən/ because in these languages /ə/ is found in other positions also. This example thus differs from the one above concerning [ər] in Serbo-Croat. Vachek (1933) has subjected the problem of the interpretation of diphthongs to a detailed examination.

LOGICAL CLASSIFICATION OF DISTINCTIVE OPPOSITIONS

TYPES OF OPPOSITIONS

3.6 As opposition is a central concept in Prague phonology it is natural that a fairly detailed description of different oppositional types was attempted.

At first (e.g. in JAKOBSON's study of 1929 and in the "Projet" of 1931) only two types were distinguished: CORRELATION and DISJUNCTION. In the case of correlations there is an opposition between the presence and the absence of a specific phonetic quality (the correlation quality) which differentiates the members of a number of pairs. For example, *p/b*, *t/d*, *k/g* are distinguished by the presence or absence of voicing, and *i/iː*, *o/oː* are distinguished by the presence or absence of length. The members of such pairs (e.g. *p/b*) are called correlative phonemes.

The features shared by two correlative phonemes constitute an **ARCHIPHONEME**. For example, the features shared by *p* and *b* define an archiphoneme which is a labial stop irrespective of the voicing opposition. All non-correlative oppositions are called disjunctions.

In 1936a and again in 1939 in "Grz.", p. 59ff, TRUBETZKOY sets up a far more elaborate system. The oppositions are here classified according to three different aspects: (1) their relation to the entire system, (2) the relation between their members, and (3) their distinctive validity (see 3.7).¹⁰

(1) According to their relation to other members of the system, oppositions are classified in two ways:

(a) There are **BILATERAL** (one-dimensional) and **MULTILATERAL** (multi-dimensional) oppositions. Bilateral (one-dimensional) oppositions have only two members: for example the voicing opposition *p/b* in Russian (there is no third member sharing the feature common to *p* and *b* (labial stop) and having a third degree of voicing). Multilateral (multidimensional) oppositions have more than two members. An example is place of articulation (*p* vs. *t* vs. *k*). Here the features common to *p* and *t* (voiceless stop) are shared by *k*, and they are differentiated by three degrees of place of articulation. In his early works Roman Jakobson accepted multilateral oppositions, but already in 1938 he maintained that all oppositions are bilateral (see below 3.10).

(b) There are **ISOLATED** and **PROPORTIONAL** oppositions. In the case of isolated oppositions the relation between the members does not recur in other oppositions in the language (e.g. *r/l*); in the case of proportional oppositions the same relation recurs in other oppositions, e.g. *p/b*, *t/d*, *k/g*.

(2) Corresponding to the relation between the members of an opposition, Trubetzkoy sets up three types: (a) **PRIVATIVE**, (b) **GRADUAL**, and (c) **EQUIPOLLENT** oppositions.

In the case of privative oppositions one member is characterized by the presence of a property which the other member lacks, e.g. voicing, nasalization, rounding. The member which possesses this distinctive mark is called **MERKMALTRAGEND** ('MARKED'), the other is called **MERKMALLOS** ('UNMARKED') (more precisely: 'naturally marked' and 'naturally unmarked', see below). A gradual opposition is based on the appearance of different degrees of the same quality, e.g. *u-o*. In the case of equipollent oppositions, it is not a question either of a mark or of a degree to which some property is present; the two members must be considered logically equal, e.g. *p/t*, *f/k*.

The older term "correlation" may now be defined more precisely as a bilateral, proportional, privative opposition (e.g. *p/b*, *t/d*, *k/g*; *i/i:*, *o/o:*, *a/a:*).

10. Cantineau (1955) has criticized Trubetzkoy's system of oppositions and proposed other criteria.

NEUTRALIZATION

3.7 The third relevant aspect of an opposition is its distinctive validity, and, correspondingly, **CONSTANT** and **SUSPENDABLE** (neutralizable) oppositions may be distinguished. In the case of constant oppositions both members occur in the same environments, i.e., there is no environment where only one of the members occurs. For example, it is common that open and close vowels all occur in the same environments. In the case of suspendable oppositions there are positions where no opposition exists between the two members. In German and Danish, for example, there is no opposition between *p* and *b* in final position.

The concept of **NEUTRALIZATION** is very important to both Prague phonology¹¹ and glossematics, the two schools which, under the influence of Saussure, attach greatest weight to oppositions in language. Neutralization is not normally used in other schools. It was put forward for the first time by **TRUBETZKOY** in 1929 in "Polabische Studien" and in the article on phonological systems in **TCLP IV** (1931a), but a more detailed account was not given until 1936 in **TCLP VI** (1936c). According to the conditions under which neutralization takes place Trubetzkoy here distinguishes between **CONTEXT-DETERMINED** neutralization, which is dependent on the surrounding phonemes, and **STRUCTURE-DETERMINED** neutralization which depends on position in a word or a syllable or on accent. As an example of context-determined neutralization Trubetzkoy mentions the suspension of the opposition between voiced and unvoiced consonants before fricatives and stops in Russian. On the other hand, a structure-determined neutralization is found in German and Russian where the opposition between voiced and unvoiced consonants is suspended in final position. Another structure-determined neutralization is again found in German, where the opposition between long and short vowels is suspended in final position. The opposition between different vowel qualities is often suspended in unstressed position.

The concept of neutralization covers minimal contrasts only; i.e., in order for two phonemes to be neutralized they must have common qualities which do not occur together in other phonemes. For example, *p* and *b* are both labial, oral stops, and *i* and *i:* are both close, unrounded front vowels, etc. Neutralization is thus possible between *p* and *b*, and *i* and *i:*, or *s* and *z*, but not between *s* and *l* or *p* and *r*, etc. That is, the opposition between e.g. *p* and *t* cannot be neutralized because the qualities they share (unvoiced stop) are also found in *k*. Trubetzkoy also puts it in a slightly different way by stating that there can be only neutralization of bilateral oppositions. Consequently not all instances of the absence of an opposition may be characterized as neutralization. For example, we are not justified in talking about neutralization in final position in Italian just because the only consonants found here in normal native words are *n*, *l*, and *r*. Trnka (1943, p. 70) requires that a neutralization should be the result of a structural

11. Isačenko (1956, pp. 329-30) forms an exception.

law in the language. In Czech, for instance, voiced and voiceless consonants are only distinguished before phonemes which do not take part in the voicing correlation (*ta/da, tr/dr* etc.). Otherwise there is neutralization. But the lack of opposition between *m* and *n* in English before \sharp , ϵ , $d\sharp$ cannot be called neutralization since they are distinguished before \bar{s} and *s* (in other words, the rule cannot be formulated in terms of phoneme classes or distinctive features).

In the position of neutralization only those features are relevant which are common to both members, and the sound realized represents the "ARCHIPHONEME". The archiphoneme may be realized either as a sound which is phonetically identical with one of the members of the opposition (e.g. unvoiced consonant in final position in German), or as a sound intermediate between the two members (e.g. the vowel \bar{a} in the case of neutralization of vowel qualities), or it may vary (for instance: voiced before voiced obstruent, unvoiced before unvoiced obstruent in Russian; or \bar{z} -initially and \bar{s} finally in German).

In the cases where the element which occurs in the position of neutralization is not determined by the context it must be the PHONOLOGICALLY UNMARKED (merkmallos) member of the opposition since it represents the qualities common to the two members. In German, then, it is the unvoiced consonants and the long vowels which are unmarked. Normally the sounds which are "naturally unmarked", e.g. unvoiced, unaspirated sounds, will be those occurring in the position of neutralization and therefore also phonologically unmarked. There may be conflicts, however, and in such cases the phonological system is decisive.

Sometimes one realization is found in one position and a different one in another (in German, for example, only \bar{z} - occurs initially and only \bar{s} finally). In such cases that member is considered unmarked which occurs in the position which is most "normal" or where a maximal number of phonemes are distinguished. In the case of \bar{s}/\bar{z} in German this is the initial position, and thus \bar{z} must be unmarked (Trubetzkoy 1936c, p. 34).

In the same volume of TCLP which contains Trubetzkoy's article, there is also an important paper on neutralization by MARTINET (1936). Martinet suggests that the use of marked/unmarked should be limited to instances where there is neutralization, and he also thinks that the concept of archiphoneme should be restricted to cover only such cases. In a later study (Martinet 1946) he suggests that the term archiphoneme should be abolished altogether¹² and that neutralization should be considered to take place not between phonemes but between distinctive features. In contradistinction to Trubetzkoy Martinet recognizes neutralization also in the case of multilateral oppositions, provided that the opposition between all of the members is suspended (e.g. *m, n, ŋ* before certain consonants and several vowels neutralized in [ɔ]).

There has been much difference of opinion as to the transcription of the member of an opposition occurring in the position of neutralization. For some time Tru-

12. Vachek (1966, p. 62) also rejects the concept of archiphoneme and says that it has been virtually abandoned by the Prague group. Martinet, however, uses it again (in 1964, 3.18).

betzkoy used capital letters (e.g. *T* finally in German and Russian for *t/d*), and he was inclined to consider the archiphonemes as independent units in the phoneme inventory. In this way the number of phonemes is increased and the transcription becomes somewhat clumsy. In 1931a Trubetzkoy entertained the idea that the "linguistic instinct" in the case of neutralization always perceives the unmarked member, irrespective of the phonetic realization. According to this theory a Russian would perceive *z*- in the cluster *zd*- as unvoiced *s* and it should therefore be transcribed as *s*. Several other Prague phonologists were of the opinion that it would be better to transcribe it the way it is pronounced (cf. Vachek 1966, pp. 61ff), but these problems were never really clarified.

SYSTEMATIZATION ACCORDING TO DISTINCTIVE SOUND OPPOSITIONS

INTRODUCTORY REMARKS

3.8 The Prague phonologists also analysed oppositions from the point of view of the distinctive qualities utilized. On this basis the phonemes are arranged in systems: vowels, for example, are often set up in a two-dimensional system in the shape of a triangle or quadrangle. This interest in systematization is typical of the Prague phonologists and is very rarely found in other phonological schools.

The problems of distinctive qualities are discussed in several of TRUBETZKOY's articles (particularly 1929 and 1931a) and again in "Grz." (p. 80ff). He sets up a universal inventory of phonetic properties (or dimensions) and explains how they may combine to form systems in individual languages, presenting a great number of examples of vowel and consonant systems in various languages.

Trubetzkoy distinguishes between VOCALIC, CONSONANTAL, and PROSODIC distinctive oppositions. Vowels and consonants are defined by the presence or absence of air-stream obstruction, i.e. phonetically. Prosodic qualities are described as characterizing rhythmic or melodic units.

The terminology is partly articulatory and partly acoustic or auditive. He does not attach much importance to these questions.

VOCALIC PROPERTIES

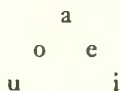
3.9 The vocalic oppositions are first discussed in Trubetzkoy's pioneer monograph of 1929 ("Zur allgemeinen Theorie der phonologischen Vokalsysteme") and again in "Grz.", pp. 86-114. Three main types of vocalic properties are distinguished: LOCALIZATION, DEGREE OF APERTURE, and RESONANCE.

LOCALIZATION is also called "Eigentone" ('proper tone'). This term dates from a time when it was believed that each vowel is characterized by a specific

tone. Trubetzkoy describes high "Eigenton" as prominence given to high overtones, and low "Eigenton" as prominence given to low overtones. This corresponds to what would now be described in acoustic terms as the position of formant 2. He also employs the term "Helligkeit" ('brightness'), vowels with high Eigenton being bright, and vowels with low Eigenton dark. As the brightness of a vowel (or the height of its second formant) is conditioned both by the place of articulation and by the degree of rounding, the term "localization" is rather inaccurate. Trubetzkoy himself admits this, but he probably uses it in the headings to obtain a certain parallelism with the consonants. In the text he most often uses "Eigenton" or "Helligkeit".

"DEGREE OF APERTURE" (= tongue height) is also called "Schallfülle" ('sonority') or "Sättigung" ('saturation'). The most important RESONANCE property is nasalization; but "Trübung" (i.e. an opposition between "clear" and "muffled" vowels found, for instance, in some African languages) also belongs to this category.

As resonance properties are utilized rather infrequently, the relevant properties are often only brightness and degree of aperture. Vowel systems are therefore arranged in two-dimensional systems with brightness indicated horizontally and degree of aperture vertically. It often happens that there is no brightness distinction for the most open vowels. The configuration will then be a triangle with *a* as the peak. If there are two degrees of brightness for all degrees of aperture, the configuration will be a quadrangle. The following triangle is very common:



In Trubetzkoy's diagrams the figure has been turned 180 degrees as compared to the vowel triangle now generally used. In a triangle it is frequently not possible to decide whether it is rounding or place of articulation which is relevant in the brightness dimension, i.e. the *i/u* opposition is considered equipollent, *i* being "maximally bright" and *u* "maximally dark". In some languages, however, there is a basis for interpreting the brightness opposition more precisely in articulatory terms as an opposition of either rounding or place of articulation. In Russian, for example, the place of articulation of the phonemes *u* and *o* varies between back and nearly front according to whether the adjoining consonants are palatalized or not, and *i* may be almost a back vowel after unpalatalized consonants. The constant feature is thus the rounding opposition; consequently rounding must be considered RELEVANT (it may then be regarded as a privative opposition), whereas the place of articulation is an irrelevant concomitant. It is also not difficult to arrive at a decision if *a* behaves like *e* and *i* rather than like *u* and *o*, or vice versa, e.g. in phoneme combinations. For example, Trubetzkoy mentions a language where the consonantal rounding correlation is suspended before *u* and *o*, but not

before *a*, *e*, and *i*. As *a*, *e*, and *i* thus constitute a class, the relevant vocalic opposition in this language must be rounding. Conversely Trubetzkoy observes that the palatalization opposition in Japanese is suspended before *i* and *e*, for which reason *i* and *e* constitute a class as opposed to *u*, *o* and *a*. In this case, then, the opposition is one of place of articulation. A further argument which can be adduced is neutralization of the vowel opposition itself. In North-Ostyak, for example, *i e ε a ɔ u* are found, but only in the first syllable of a word, whereas only *i e ε a* occur in other positions. As the vowels found in the position of neutralization must be considered unmarked, the relevant opposition here is that of rounded-unrounded. In some cases, then, it is possible to find criteria for the relevance of one or the other of these oppositions. If there are two degrees of brightness in the most open class, it is also frequently possible to arrive at a decision, for example, in the case of the first two of the following systems:

(1)	i	u		(2)	ī	u	or	(3)	i	u
	e	o			e	o			e	o
	æ	a			a	ɔ			æ	ɔ

In the first case there is an opposition between front and back, in the second between unrounded and rounded, but for the third system it is impossible to decide. It should be added, however, that (1) and (2) might also be arranged as triangular systems:

i		u	i		u
e		o	e		o
æ					ɔ
a			a		

That this latter arrangement is not preferred is due to an implicit assumption of symmetry in phonological systems.

Sometimes instead of just two degrees of brightness (*i-u*), there are three (*i-y-u* or *i-u-u*). In such cases the three degrees may be equally opposed to one another; or it may be that one of the oppositions (rounding or place of articulation) is superior to the other. In Finnish the front/back opposition (*y/u*, *ø/o*, *ε/ɑ*) is suspended through vowel harmony in certain positions, and consequently the rounding correlation must be considered higher in rank. There is thus in Finnish an opposition between rounded and unrounded vowels, of which only the former category divides into front vowels and back vowels; the difference front-back is irrelevant in the case of the phonetically unrounded non-low vowels *i* and *e*.

There may also be four degrees: *i*, *y*, *u*, *u*.

As regards degree of aperture two to five degrees in one dimension are possible. Five degrees, however, are rarely found.

A. W. de Groot (1939) placed the French vowels in a hierarchical system of distinctive properties, so that not all vowels were characterized by the same number of properties.

CONSONANTAL PROPERTIES

3.10 Consonantal properties were first discussed by TRUBETZKOY in 1931a and again in a somewhat different form in "Grz.", p. 114ff. In "Grz." the main groups to be distinguished are (1) "Lokalisierungseigenschaften" ('properties of localization'), (2) "Überwindungsarteigenschaften" ('properties reflecting different modes of surmounting an obstacle'), and (3) "Resonanzeigenschaften" ('properties of resonance'). (1) and (2) correspond to what in English is often distinguished as "place" and "manner". (3) covers only nasality, which is often (in American terminology usually) included under "manner".

Within this trichotomy there are several subdivisions. Thus (1) is subdivided into (a) basic series ("Grundreihen"): labial, apical, dorsal, etc. (b) equipollent, related series ("äquipollente Schwesterreihen"): e.g. bilabial/labiodental, dental/retroflex, etc., and (c) secondary series ("Nebenarbeitsreihen"), including palatalization, rounding, velarization, etc. (2) is divided into properties of different degrees: (a) first degree ("Überwindungsarteigenschaften ersten Grades"): sonorants as opposed to obstruents, stop as opposed to incomplete stricture, momentary sounds as opposed to continuous sounds, etc., (b) second degree ("Überwindungsarteigenschaften zweiten Grades"): intensity, voicing, aspiration, etc., and (c) third degree ("Überwindungsarteigenschaften dritten Grades"): gemination.

From a logical point of view this classification is quite satisfactory, but the terminology is obviously somewhat forbidding.

In most cases only bilateral (one-dimensional) oppositions are set up. Only in the case of (1a) (the place of articulation series) is a multilateral opposition assumed to exist. As early as 1938 ROMAN JAKOBSON proposed to modify this series in such a way that it would consist only of bilateral (BINARY) oppositions. He divides the localization series into three oppositions: (1) according to place of articulation he posits an opposition between front and back consonants (labials and dentals as opposed to palatals and velars), (2) according to resonance frequency he posits an opposition between "grave" (labials and velars) and "acute" (dentals and palatals); and finally (3) according to presence or absence of sharp frictional noise an opposition between "strident" and "mellow" (labiodentals vs. bilabials, sibilants vs. non-sibilants, uvulars vs. velars, affricates vs. stops).

Trubetzkoy's arguments regarding the RELEVANCE of consonantal properties have basically the same character as those concerned with vowel features. In some cases the concept of "naturally unmarked", which for the oppositions of "Überwindungsart" applies to the member whose production requires the least deviation

from normal breathing (p. 141), is also taken into account; thus unvoiced, lenis, and unaspirated in the oppositions voiced/unvoiced, fortis/lenis, aspirated/unaspirated are considered "naturally unmarked".¹³ If, as in Russian, there is an opposition between unvoiced fortis and voiced lenis, and if unvoiced fortis occurs in the position of neutralization, then voicing should be considered the relevant property since it is the naturally unmarked member of this pair which is found in the position of neutralization. In English, on the other hand, where unvoiced lenis appears after *s*, it is not possible to decide which property is relevant. Only when there are clear indications in the system that the naturally unmarked member is phonologically marked can the consideration of naturalness be disregarded (cf. 3.6-3.7).

PROSODIC PROPERTIES

3.11 Prosodic properties were studied in detail in the Prague Circle, and a number of articles were written on this topic. It was first discussed by TRUBETZKOY in his monograph on vowel systems (1929), and subsequently by ROMAN JAKOBSON (1931c), who later returned to this question (1937). In the meantime Trubetzkoy had given a new presentation (1935), and in "Grz." he offered a more exhaustive systematization. In these latter studies he is clearly influenced by Jakobson. N. v. Wijk (1940) raised a number of well-founded objections to Trubetzkoy's system, and later Martinet (e.g. 1954) put forward another system.

It would take us too far afield to deal with this extensive discussion and the complicated systems that were suggested. A summary is given in my survey article (Fischer-Jørgensen 1941). In the following only some of the principal points are dealt with.

In his first study Trubetzkoy considered prosodic phenomena to be vocalic attributes. Under the influence of Roman Jakobson he subsequently regarded them as belonging to the syllable or part of the syllable, and he also considered quantity to be a syllabic feature, a decision which was objected to by v. Wijk. According to him and many others this property frequently belongs to the vowel alone.

The unit which is the carrier of prosodic properties according to Jakobson and Trubetzkoy can be either a SYLLABLE or part of a syllable, called a MORA. Accordingly Trubetzkoy distinguishes between syllable languages and mora languages. Syllables may be divided into morae for various reasons (cf. Jakobson 1937): (a) long vowels may contain a morphological boundary; or (b) long vowels are treated in the system in the same way as polyphonemic diphthongs; or (c) a long vowel functions like two short ones with respect to accent rules; or (d) long vowels may have different tone contours so that the beginning and the end of a

13. One might expect aspirated consonants to be unmarked according to this criterion. But the term "normal breathing" probably does not quite cover what Trubetzkoy intended.

vowel have different tones; or (e) the last part of a vowel may be pronounced with a glottal stop ("stod").

Trubetzkoy's system of prosodic properties is rather complicated. MARTINET (1954 and 1964, p. 75ff) sets up a simpler system:

The prosodic properties may be either CULMINATIVE or NON-CULMINATIVE. In the former case one syllable is thrown into relief compared to others. Martinet calls this ACCENT, whereas other prosodic differences are called TONES.

The culminative accent may be either FIXED in one particular syllable of the word and thus contribute to the delimitation of words (in Icelandic and Czech, for instance, accent is fixed on the first syllable, in Polish on the penultimate), or it may be FREE, as in Russian, and thereby have a distinctive function. Martinet emphasizes that in the case of the culminative accent a syllable is always brought into contrast with the preceding or following syllables, and he wishes to reserve the term "contrast" to cover this syntagmatic opposition.¹⁴ In recent years this usage has been widely accepted, though contrast is the normal term for paradigmatic opposition as well both in the Bloomfield School and in generative phonology.¹⁵

In the case of non-culminative prosodic properties a syllable may be characterized by a certain tone level, REGISTER, or by a tonal movement, a CONTOUR (Martinet also uses the terms PUNCTUAL and MELODIC tone). If the syllable is characterized by a contour it is sometimes feasible to analyse it into two morae, each with a level tone, so that, e.g., a syllable with a falling tone contour is analysed as high mora + low mora.

Culminative and non-culminative prosodic properties (accent and tone) may normally be combined in such a way that only the accented syllable has distinctive tones, cf. Greek or Lithuanian. (In the case of tone contours Trubetzkoy prefers to consider the high mora as more prominent, so that the culminative accent can be said to belong to a mora).

Finally there may be different types of CONTACT between the vowel and the following consonant. This is often called close and open contact (German "fester und loser Anschluss") and the vowels are sometimes designated as "checked" and "unchecked" respectively. Trubetzkoy sets this up as a specific prosodic property, whereas Martinet regards it as a specific type of tone.

For Roman Jakobson's more recent system of prosodic properties, see Chapter 8.

Trubetzkoy deals with QUANTITY in a specific way because he wants to exclude the dimension of time from the phonological level of description. Vowel length is interpreted in one of three different ways: (1) in mora languages quantity is interpreted analytically, i.e. a long vowel is analysed as two short ones. In syllable

14. See also Prieto (1954) and Martinet (1964, 1.20 and 3.1).

15. In the present book "contrast" is used synonymously with "opposition" in the chapters dealing with these schools.

languages quantity may be either (2) viewed as an intensity opposition,¹⁶ or (3) regarded as the manifestation of a contact correlation, for example, in German where free vowels and checked vowels are distinguished. In this way quantity, at a certain level of abstraction, is totally disposed of. This complete reduction, however, does not seem to have been taken over by other Prague phonologists, and Jakobson explicitly rejects Trubetzkoy's analysis on this point (1939b, "SWr." I, pp. 308-9). And it is, indeed, difficult to understand why the time dimension should not be recognized as a phonological feature when intensity, voicing, nasality, etc. are admitted without hesitation. - S. Karcevskij (1931) has given an interesting contribution to the phonological description of sentence intonation.

GENERAL LAWS

3.12 Trubetzkoy's purpose in setting up vocalic, consonantal, and prosodic systems for a number of different languages was not just to give a survey of the way in which distinctive properties are utilized, but to arrive at general laws concerning the structure of such systems. Already in the theses propounded at the congress at The Hague in 1928 two such laws had been proposed: that free intensity accent (culminative accent) cannot be combined with free quantity; and that the palatalization correlation cannot exist in tone languages. In languages which apparently have both free quantity and accent (e.g. German), quantity is interpreted as a difference in contact ("Anschluss").¹⁷ Trubetzkoy furthermore lays down the rule that there are never more than two degrees of quantity.

In the monograph on vowel systems (1929) and again in "Grz." Trubetzkoy maintains that degree of aperture is always relevant in the case of vowels. A few languages possess a minimal system with only two degrees of aperture, and no other functional opposition, but by far the majority also exhibit differences in brightness. The maximally bright and the maximally dark series normally contain the same number of degrees of aperture, whereas the middle series may have fewer degrees (but never more), and if this is the case it will be the most open degrees which are absent. It is therefore possible to have *i e ε u o ɔ* combined with only *y*, or with *y* and *o*, or with *y*, *o*, and *æ*, but not with *o*, *æ* alone.

A much more ambitious attempt at formulating general laws is found in ROMAN JAKOBSON's book "Kindersprache, Aphasie und allgemeine Lautgesetze" (1941). On the basis of the existing literature on child language Jakobson arrived at the conclusion that in all languages children acquire the phonemes in essentially the same order. In the babbling period, it is true, the child is capable of pronouncing

16. This does not conflict with stress since it is maintained by Jakobson and Trubetzkoy that no languages have both intensity accent and distinctive length.

17. N. v. Wijk (1940) has objected that both free quantity and accent seem to have existed in Proto-Indo-European, cf. also the counter-examples adduced by Pavle Ivić (1965, p. 41). Later Jakobson formulated these laws in a less categorical way.

all types of sound. But as soon as he begins to utilize the sounds linguistically, i.e. to keep them apart for distinctive purposes, their number suddenly becomes quite small and then gradually increases in steps which are determined by general laws. At first the child distinguishes only between *p* and *a*, next the opposition between oral and nasal consonants (*p/m*) is acquired, and later the oral consonant is split up into *p/t*. The first vocalic opposition is *i-a*, i.e. degree of aperture, and subsequently there may be a third degree of aperture or an opposition between front and back vowels, i.e. *i* *u*.

a

After that no fixed order can be laid down, but only a number of separate rules: fricatives are acquired after the corresponding stops. Affricates presuppose both stops and fricatives. Back consonants appear later than front consonants; a back fricative, then, presupposes both a back stop and a front fricative. Liquids do not split up until very late. Oppositions between open vowels presuppose oppositions between close ones. Differentiation in degree of aperture of rounded vowels presupposes aperture differentiation of unrounded vowels. Rounded front vowels presuppose both unrounded front vowels and rounded back vowels. Nasal vowels are acquired at a later stage.

It will be seen that these rules are of two different kinds. In certain cases it is stated that one opposition presupposes another (for example the opposition in degree of aperture of back vowels presupposes the corresponding opposition of front vowels), but in other, more frequent cases it is stated that one phoneme presupposes another (e.g. that *f* presupposes *p*) or that one category presupposes another (e.g., that fricative presupposes stop). This could be expressed more precisely by saying that as long as the *p/f* opposition is not found, the phoneme in question is realized as *p*; or, as long as the fricative/stop opposition is not found, the obstruents are realized as stops. It is therefore a question both of opposition and of the phonetic realization of oppositions. Jakobson adduces some rather problematic psychological arguments taken over from the psychologists Köhler and Stumpf. However, the statement that the child starts with phonetically maximal contrasts and only subsequently differentiates these into more detailed ones seems plausible. These laws have since been tested by several linguists.¹⁸ They are probably not valid in every single detail, but on the whole they seem to be borne out. It would perhaps be more reasonable to call them tendencies rather than laws.

Jakobson further demonstrates that certain types of aphasics (i.e. patients with speech disorders resulting from cerebral lesions or diseases) lose the ability to distinguish between phonemes, and the order of succession in which they lose the phonemes is the reverse of the one in which children acquire them. This is not very surprising because, as a rule, that which has been acquired last is lost first. Another even more striking and important observation is that those phonemic

18. E.g. by H. Abrahams in an article in "Nordisk Tidsskrift for Tale og Stemme", XV, 1955.

distinctions which children acquire first are found in all languages. The ones which are acquired next occur in a large number of languages, and those acquired last are the rare ones that are found in few languages (cf. Trubetzkoy's rules about vowels). The explanation of this observation must be that in both cases maximal phonetic contrasts are utilized before the more subtle ones. It is therefore possible to lay down laws of the same type as those applying to child language. For example there are no languages which have fricatives but no stops, or which differentiate between back vowels but not between front vowels. Clearly it is of great interest to investigate the validity of such universal laws, and this is a problem which has aroused a great deal of interest in recent years.

PHONEME COMBINATIONS AND PHONEME UTILIZATION

3.13 The establishment of phoneme inventories and their systematization on the basis of distinctive properties – that is to say their paradigmatic systematization – were the central concern of the Prague phonologists. However, they also dealt with syntagmatic aspects of language, with the question of the possibilities of phoneme combinations and with quantitative phenomena. The most important studies within this field were made by the founder of the Prague Circle, V. MATHESIUS, and were written very early (1929a, 1929b, 1931). Mathesius emphasized the importance of investigating the number and structure of phoneme combinations in different positions, and he himself carried out several concrete comparative investigations in this area. In Czech words consisting of up to four phonemes he found 160 different consonant combinations in initial position, but only sixteen in final position. For German the corresponding numbers are twenty-one and forty-seven. This demonstrates numerically the greatly different structures of the two languages. There are also many more types of combinations in Czech than in German. Mathesius also contributed significantly to the investigation of FUNCTIONAL LOAD, i.e. the utilization of the existing phonological oppositions. He distinguished between utilization in vocabulary and in running text and compared the utilization with the range of structurally given possibilities. His student Trnka has carried out a detailed investigation of English according to these principles (1935).

TRUBETZKOY also deals with these problems in a separate chapter of "Grz." Among other things he discusses which frame unit one should select for such an analysis. He states that while in some languages the word is the most suitable frame unit, in others it is the morpheme (in the Prague School, as in American linguistics, "morpheme" refers to the minimal linguistic sign). Strangely enough the syllable is not mentioned as a possible frame unit. He draws attention to the fact that the degree of frequency may depend on the style of the texts chosen

(in the case of German this holds true for consonant clusters but not for single phonemes). In addition, the unmarked member of an opposition normally seems to be more frequent than the marked member.

Trubetzkoy points out that in certain languages the separate phonemes may be defined by their possibilities of combination (he mentions Greek as an example), but he emphasizes that this is not possible if the word structure is either very simple or very complicated.

BOUNDARY SIGNALS

3.14 At the end of "Grz." TRUBETZKOY included a chapter on boundary signals, i.e. phonetic properties which are used for the delimitation of words and morphemes. They are analysed from four points of view:

- (1) They may be PHONEMATIC¹⁹ (for example, the phoneme /h/ is found only initially in morphemes in English and German) or APHONEMATIC (fixed accent on the first syllable indicates word boundary; glottal onset in Danish and German may signal word- or morpheme boundary, cf. German "den Bauer kennen" – "den Bau erkennen").
- (2) They may be SINGLE SIGNALS (single phonemes or single sounds as in the examples above), or they may be GROUP SIGNALS, i.e. certain phoneme combinations which are found only at the boundary between units (in English *sts*, e.g. *posts*, there must be a morpheme boundary between *t* and *s*) or certain combinations of variants which are only found at boundaries (German back vowel followed by the variant [ç] indicates morpheme boundary (*Mama-chen* as opposed to *machen*, *Frau-chen* as opposed to *rauchen*)).
- (3) They may be POSITIVE, i.e. they may indicate that there is a boundary (as in the examples above) or NEGATIVE, i.e. they may indicate that there is not any boundary. For example, *-mp-*, *-rst-* and *-ks-* in Finnish may only occur medially, etc.
- (4) Finally they may be WORD DELIMITING or MORPHEME DELIMITING. As an example of a German sentence where all morphemes are indicated by means of boundary signals Trubetzkoy mentions "Die Hausfrau wäscht mein Hemd". What is called "juncture" in American phonemics corresponds to Trubetzkoy's aphonematic positive single signals.

MORPHONOLOGY

3.15 In "Projet" (1931) morphonology is defined as the part of word phonology which deals with the phonological structure of morphemes. But in a short article

19. Trubetzkoy at this point uses "phonematisch" in the sense of "distinctive".

by TRUBETZKOY (1931c) this is described as just one of the tasks of morphonology. Morphonology is here defined as the study of the morphological utilization of phonetic resources and is said to cover:

1. The study of THE PHONOLOGICAL STRUCTURE OF MORPHEMES, including e.g. the description of such differences as there may be between verbal, nominal and pronominal morphemes, or between the structure of roots and suffixes.
2. The study of THE COMBINATORY SOUND CHANGES WHICH MORPHEMES ARE SUBJECT TO IN MORPHEME COMBINATIONS (also called "internal sandhi", a term borrowed from the Indian grammarians) – including both phonetically and morphologically conditioned alternations.
3. The study of THE ALTERNATIONS WHICH HAVE MORPHOLOGICAL FUNCTION.

In TCLP V, 1934, Trubetzkoy gives a morphonological description of Russian. In this monograph (and also in an earlier paper (1929)), Trubetzkoy sets up a specific morphonological unit, the "morphoneme" (a term coined by H. Ułaszyn) defined as the totality of phonemes taking part in an alternation and conceived by the speakers as a morphonological unit (1934, p. 30), for instance *k/č* in *ruká* ('hand') – *ručnój*, an adjective derived from *ruká*. A more detailed account of the underlying principles was meant to be included in a second volume of "Grz.", which was never written.

Trubetzkoy attached great importance to morphonology and considered it the best foundation on which to develop a language typology, but apart from his own contribution very little concerning this subject was written by the Prague phonologists.²⁰

According to Prague linguistics morphonology constitutes an independent discipline which is intermediate between phonology and morphology. Only very rarely are morphological arguments applied in phonemic analysis. However, Trubetzkoy adduces the presence of a morphological boundary in a long vowel as an argument for dividing it into two morae, and Martinet (1936) mentions that the existence of morphological alternations may support an analysis positioning neutralizations.

In a later paper (1965b) Martinet has criticized Trubetzkoy's and also Bloomfield's conception of morphonology. He now emphasizes the necessity of a strict distinction between phonology (comprising what is exclusively phonetically conditioned) and morphology (dealing with the form of signifiers and including morphonology), cf. also Martinet 1964, 3.41 and 1968.

20. Roman Jakobson's interesting morphonological analysis of Russian verbal forms (1948) is rather in the Bloomfield tradition.

DIACHRONIC PHONOLOGY

ROMAN JAKOBSON

3.16 As mentioned above Saussure's systematic approach was restricted to the synchronic state of a language and did not apply to its historical development, which in his opinion only affected individual phenomena separately. From the very beginning the attitude adopted by the Prague phonologists on this point was quite different from Saussure's.

As early as 1927 ROMAN JAKOBSON delivered a paper to the linguistic circle in Prague (reprinted in "Selected Writings" I 1962, pp. 1-2) in which he pointed out that Saussure's view of blind and destructive sound laws is incompatible with his position that the synchronic state of language is a system. This incongruity may be avoided by considering sound change from the point of view of the system and as partly determined by the system. If the equilibrium is upset new changes may help to restore it. The mechanistic point of view should be replaced by a teleological one.

In the introduction to his paper on the phonological development of Russian (1929) Jakobson attempts to outline a systematic diachronic phonology. The synchronic system should not be thought of as something static; there are different layers of style with slightly different systems, and particularly emotional language may create new means of expression, which subsequently may lose their emotional overtones and be absorbed by the normal language. This fact is a constant source of instability, and changes which create balance at one point may bring about disorder at another with the result that the continual disturbance and re-establishment of equilibrium continue. But phonological change is not only dependent on this tendency towards harmony. Other general laws concerning the structure of systems contribute to their development.

Finally Jakobson points out that different types of change should be distinguished. It may be a question of phonemic merger or split, or of the change of a distinctive feature, or a change in phoneme combinations.

These issues are dealt with in more details in his article "Prinzipien der historischen Phonologie" (1931a). This article contains many examples of the different types of change. Since nearly all of these are taken from Slavic languages, which may be less familiar to some readers, they have been replaced by other examples in the following.

First, one should distinguish between purely phonetic changes (such as the development of *u* to *y* before *k*, or of apical *r* to uvular *r*) and phonological changes. The latter fall into six main types:

1. **PHONOLOGIZATION:** a relation between variants is changed into a phonological opposition. In the development from Latin to French, for example, *k* becomes *f* before *a* but is retained as *k* before *o* and *u*; when *au* subsequently changes into *o* and *u*, *f* now also occurs before these vowels. What was originally a

bound variant has thereby become an independent phoneme. Umlaut is another typical example. In some languages an *i* or *j* has affected back vowels in the preceding syllable by changing them into front vowels (e.g. *u* to *y*). At this stage only bound variants are involved, but at the moment that *i* and *j* are lost the difference between *u* and *y* is phonologized.²¹

2. DE-PHONOLOGIZATION: a phonological opposition is abolished. In Middle High German, for example, there were two *s*-phonemes, one probably somewhat more dental than the other, which have coalesced in Modern High German. In English *y* and *ī* have merged as *i*.
3. RE-PHONOLOGIZATION: an opposition is changed in such a way that its relation to the system becomes different. For example, it may be a disjunction which turns into a correlation: In some Slavic languages *g* becomes *γ*, whereby *x* gets a voiced correlate. Or it may be a correlation which turns into a disjunction – here the same example may be used, since *k* loses its voiced partner. Furthermore one correlation may change into another correlation with different distinctive features; this happens, for example, in the Armenian and Germanic consonant shifts. In the case of the Germanic consonant shift it may be said roughly that *p t k* change into *f θ x*; *b d g* into *p t k*; and *bh dh gh* (via *β δ γ*) into *b d g*.
4. CHANGE IN THE STOCK OF PHONEME COMBINATIONS: This happens when a merger is restricted to certain positions. As an example Jakobson mentions that *č* in some Slavic languages has merged with *i* before palatalized consonants. Thereby the combination *č* + palatalized consonant has disappeared. Later this would probably have been referred to as neutralization, but this concept had not yet been introduced. As another example the loss of initial *h* before a consonant in many Germanic languages may be mentioned.
5. A PHONEME may be changed to a PHONEME COMBINATION by fission (e.g. in the case of diphthongization).
6. A PHONEME COMBINATION may FUSE into a SINGLE PHONEME (e.g. *sk* into *f* in German).

In agreement with E. Polivanov Jakobson sets up the law that apart from the cases where a new phoneme emerges through a mixture of styles, phonologization is always bound up with de-phonologization (see the examples under 1). This formulation is probably somewhat too categorical, at any rate if phonologization by fusion is included: for instance, when *sk* became *f* in German, neither *s* nor *k* was lost phonemically.

N. v. WIJK

3.17 N. v. WIJK has dealt with diachronic phonology in several papers (e.g. 1939b). On a number of points he is in agreement with Jakobson's theories, for

21. Note that the letters *j* and *y* are here used according to the IPA alphabet, i.e. symbolizing a palatal glide and a close front rounded vowel respectively.

instance in accepting the influence of the system and in emphasizing the tendency towards symmetry, and he furthermore mentions the tendency to keep a certain distance between phonemes. (This tendency was mentioned by de Groot as early as 1931). But v. Wijk is opposed to the complete severance of phonetics and phonology. According to him phonetic and phonological changes are closely related, and phonetic changes may also be systematic.

A. MARTINET

3.18 It was A. MARTINET in particular, however, who developed diachronic phonology further. His focus of interest is not the systematization of types of change, but rather an analysis of the general forces and determining factors of phonological change. Within this field he has made a number of original contributions. His first monographs on this subject date from 1938 and 1939 (1938, 1939a, 1939b); a preliminary summary is given in his article of 1952 "Function, Structure, and Sound Change" (see also 1953). His comprehensive book of 1955 "Economie des changements phonétiques" contains a detailed theoretical presentation of his views as well as a number of applications to separate languages. A shorter presentation is found in "Manual of Phonetics" (1957; reprinted in the new edition of 1968).

Martinet stresses the importance of a permanent antinomy between the need of expression and communication and the inertia of the speech organs, but he rejects explicitly Jakobson's teleological point of view (1968 (1957), p. 486). – It is difficult to see, however, why "communicative need" should not be a teleological factor.

Martinet's main ideas may be summed up in four points: he emphasizes the importance of (1) functional load, (2) the necessity of having a certain phonetic distance between phonemes, (3) the tendency towards harmony, interpreted as economy, and (4) physiological factors which counteract the tendency towards harmonious systems.

(1) By FUNCTIONAL LOAD is meant the degree of utilization of a phonological opposition (cf. 3.13 above). It may be assumed that an opposition which is highly utilized is more resistant than one which is put to less work. Functional load can be measured in various ways: by investigating the number of word pairs involved, or their frequency in running speech, or the number of pairs which can occur in the same sentence context, etc. According to Martinet it is usually sufficient to measure the frequency of phonemes. The more frequent they are, the stronger the possibility of their having distinctive function. To illustrate the importance of this factor Martinet mentions that in modern French / \bar{e} / and / $\bar{\alpha}$ /, whose functional load is very low, are now merging, whereas / \bar{u} / and / $\bar{ɔ}$ / have merged only in certain dialects, those where *en* and *an* have not fused into / \bar{u} /, and where consequently the functional load of / \bar{u} / is lower (1968 (1957), p. 479). This factor, however, should be compared with others; actually many mergers take place.

(2) In order to preserve the communicative power of language there is a tendency to keep a certain PHONETIC DISTANCE BETWEEN PHONEMES. If the realization of one phoneme approaches that of another, the latter may be pushed further away, and if the manifestation of a phoneme moves away from that of another, the latter may approach the former. In other words, a "push" or "pull" ("drag") mechanism may be present, and it is not always easy to say whether a given change began as a push or a pull. Martinet mentions that in the Portuguese dialect of São Miguel in the Azores a development $a > \text{ɔ}, \text{ɔ} > o, o > u, u > y$ is found (1955, p. 52). The long vowels of Swedish have undergone a very similar development: $a:$ has become somewhat rounded, $\text{ɔ}:$ and $o:$ have changed to $o:$ and $u:$ respectively, and $u:$ has been fronted but is kept apart from original $y:$ by means of a special type of rounding. This tendency towards distance between phonemes is also mentioned by v. Wijk, but Martinet has developed this idea much further. It must, however, be emphasized that this tendency is not always sufficient to prevent merger.

(3) Trubetzkoy, Jakobson, de Groot and van Wijk all emphasize the tendency towards HARMONIOUS SYSTEMS. Martinet's contribution consists in a reinterpretation of this somewhat vague concept as something more concrete: HARMONY IS A MANIFESTATION OF ECONOMY (a view which was suggested earlier by de Groot (1931)). A system which utilizes a limited number of distinctive features in several pairs is more economical than one with many different distinctive features none of which are put to much work. Consider, for example, two nine-consonant systems, one of which (a) consists of the phonemes /p t ʃ m l r g h f/, whereas the other (b) contains the phonemes

p	t	k
b	d	g
m	n	ŋ

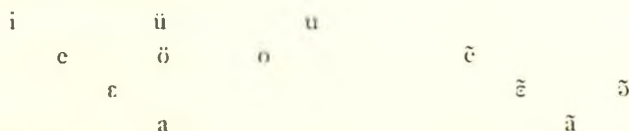
Obviously the last system, which manages with three points of articulation and the distinctions unvoiced/voiced and oral/nasal, is more economical than the first where all phonemes are kept apart by different means. It will furthermore be seen that if there is a gap in such an otherwise regular system, if, e.g., /ŋ/ were lacking in example (b), then nothing would be gained; although there would be one phoneme less, the same features would be needed. Conversely, if the gap is filled no additional features are necessary. There will therefore be a tendency towards filling out such gaps. Martinet points out in one of his examples that if a system contains f s ʃ x plus a trilled uvular /R/, there will be a natural

v z ʒ

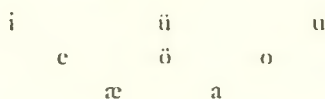
tendency to change this /R/ into a velar fricative and thus make it fit into the system. It should be added, however, that such gaps are not invariably filled ("isolated phonemes do not rush into structural gaps", as Martinet puts it) as many other factors may be involved.

It can also be assumed that recurrent distinctive features are more resistant than features that distinguish only single phoneme pairs. For example, the functional load of θ/δ in English is very low, but this opposition is retained because it is supported by a number of other pairs which are distinguished by means of the opposition voiced/unvoiced (1968 (1957), p. 483).

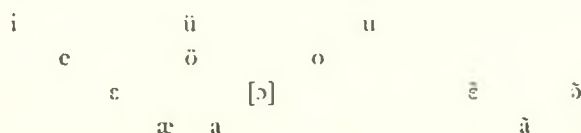
As a more detailed example of the importance of both factor 2 and factor 3 Martinet mentions the development of the vowel system in the French dialect of Hauteville (1955, p. 86 ff). At a certain time this vocalic system contained eight oral and four nasal vowels:



As the distance between $/a/$ and $/o/$ in the oral system was relatively great and as the difference between $/ɛ/$ and $/a/$ was more complicated than necessary (they differ both in degree of aperture and in the front-back dimension), the first thing to happen was presumably a change of $/a/$ into a back vowel corresponding to $/ɛ/$. We thus get:

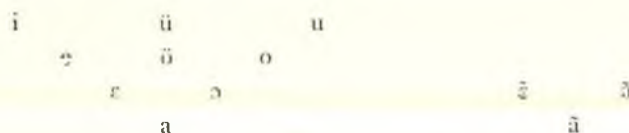


Within the nasal system $/ẽ/$ is badly integrated, and (as there is a general tendency towards lowering of nasal vowels) a pressure has been exerted on $/ẽ/$, which had no possibility of moving into another position but was denasalized instead. The result of these changes is a system found in some neighbouring dialects:



where $[ɔ]$ is a bound variant of $/a/$.

In Hauteville all variants of $/a/$ were rounded, and $/æ/$ was changed to $/a/$, with the result that the following quite regular system emerged:



(4) RESTRICTIONS OF SYMMETRY DUE TO PHYSIOLOGICAL AND ACOUSTIC FACTORS. Theoretically it would be optimal to have quadrangular systems where

all distinctive features were maximally utilized. But this is only truly economical if the necessary combinations of articulations are easy to produce and distinguish auditorily.

The different articulatory features do not occur together with equal ease. The opposition voiced/unvoiced, for example, may be combined with any other articulation because articulations in the glottis and in the supraglottal cavities are relatively independent. But there are auditory restrictions because very open sounds are difficult to hear if they are unvoiced. In the case of fricatives and stops those at the back do not combine freely with voicing because the air pressure in the cavity between the glottis and the point of articulation may quickly become too high (cf. the fact that *g* is lacking in Dutch and has changed into *h* in many Slavic languages, e.g. Czech). Nasality may be combined with all kinds of articulations, but nasal fricatives are rare because the open nasal passage entails less air-flow through the mouth and consequently only slight frictional noise. The stop-fricative correlation is fairly unstable because the points where the most distinctive noise is produced are not identical with the points where closures are made most easily, cf. the fact that labial stops are usually bilabial, whereas labial fricatives are usually labiodental.

The fact that the speech organs are *ASYMMETRIC* is also of great importance. With the same degree of jaw lowering, the opening will be larger at the front than at the back, and the distance between front vowels will be greater than that between back vowels. It is therefore only natural that differentiation as regards degree of openness is often smaller in the case of back vowels.

Rounding may be combined with all articulations, but when the lip aperture is wide, there is little difference between the presence and the absence of rounding. Nor will the cavity differences resulting from moving the tongue forwards and backwards be very marked when the tongue position is low. Consequently there is a tendency towards differentiating open vowels less, i.e. towards triangular systems.

In order to explain phonemic changes general tendencies should be related to the phonetic possibilities.

One of the first applications of Martinet's principles was the description of French sound history by A. G. Haudricourt and A. Juilland (1949). They have since been applied by many others.

W. G. MOULTON has applied Martinet's ideas to the study of Swiss German dialects and obtained interesting results (see e.g. Moulton 1961 and 1968).

Martinet's points of view have also influenced the Prague group in the post-war period and have been integrated in their own view of sound change. In the Prague group it was emphasized from the start that no synchronic state of a language is in perfect balance. There are always remnants from earlier stages, *PERIPHERAL* elements which are not fully integrated, and which may lead to restructurings of the system (VACHEK 1966a, p. 27). In standard languages the restructuring is hampered because the pattern is stabilized by codification, and there will be a

constant conflict between the natural tendencies of the language and the conservatism imposed upon it from without. Standard languages will therefore contain many peripheral elements (Vachek 1964, p. 14). Much attention has been given to the studies of standard languages by Czech phonologists both in earlier and in more recent times, and a whole volume of "Travaux linguistiques de Prague" (2, 1966) has been devoted to the problems of centre and periphery in linguistic systems. Vachek (1962) accepts Martinet's explanations, but with some more weight on the interplay between external and internal factors.

GEOGRAPHICAL PHONOLOGY

3.19 The Prague phonologists have also been interested in the geographical range of phonological phenomena. TRUBETZKOY (1931b) points out that ETYMOLOGICAL, PHONETIC, and PHONOLOGICAL DIALECT BOUNDARIES should be clearly distinguished. The case of etymological boundaries involves the question of different pronunciations of the same word, i.e. they presuppose a common vocabulary. In the case of phonetic boundaries, different pronunciations of the same phoneme are concerned, and here a common phonological system is presupposed. In the case of phonological boundaries differences in the phonological system are involved. Only these last lines of demarcation are drawn sharply.

ROMAN JAKOBSON demonstrates in several papers that language boundaries and phonological boundaries do not necessarily coincide. Unrelated neighbouring languages may have relatively similar phonological systems, whereas other related languages may have relatively different systems. Several quite conspicuous phonological properties, e.g. palatalization, distinctive tone contours, and glottalization often extend over large geographical areas in spite of language boundaries. Such a group of languages is called "SPRACHBUND" ('language union', see Jakobson 1931b and 1936).

CONCLUSION

3.20 The Prague School took over the concept of the phoneme and the distinction between phonemes and different types of variants from Baudouin de Courtenay and Ščerba. Their important and original contribution was an elaboration of a consistent theory of phonological oppositions and phonological systems and the application of phonological points of view to sound change.

The specific character of the Prague School compared to other (later) schools can perhaps be summarized in the following way:

Following Saussure closely the Prague phonologists chose the concept of opposition as their starting point and derived their definitions of phonological unit and phoneme from this basis. This entailed that main stress was laid on

paradigmatic relations, and it is characteristic that "function" as a rule simply means paradigmatic function (distinctive function) to the Prague School. The concept of neutralization also became important in that way. Mathesius was practically the only Prague linguist who took an interest in syntagmatic relations, and his work did not receive the attention it deserved. In its accentuation of paradigmatic relations the Prague School contrasts sharply with the Bloomfield School.

Another characteristic feature is the arrangement of phonemes into systems according to relevant phonetic properties, and in this respect the Prague School differs from all other schools. In glossematics this practice was regarded (probably incorrectly) as pure phonetics. But in Roman Jakobson's presentation the theory of relevant properties ("distinctive features") subsequently became very important, particularly to generative phonologists.

Finally, and in contrast to the Bloomfield School and the British schools, the Prague School is characterized by its aim of propounding universal laws, another question which was subsequently taken up in generative phonology.

Chapter 4

DANIEL JONES

INTRODUCTION

(BACKGROUND AND PURPOSE)

4.1 Daniel Jones's approach to phonology differs considerably from that of the Prague School; he belongs to a completely different tradition and had a quite different purpose. The Prague linguists viewed phonology as part of a new structural theory of language, and in this theory the distinctive opposition was a central concept. Daniel Jones (1881-1967), on the other hand, was interested in practical phonetics rather than in linguistic theory. He did not begin as a linguist, but took university degrees in mathematics (1903) and law (1907). At the same time, however, he acquired a knowledge of a number of foreign languages and discovered that he had an exceptional talent for languages. In 1900 he studied German phonetics at Marburg, and in 1905-06 French phonetics under Passy. In 1907 he began teaching phonetics at University College, London, and in 1921 became a professor. Gradually he built up a department which became an international centre of practical phonetic training. Jones's principal contribution was made within the area of English phonetics (his "Outline of English Phonetics" of 1918 is still a standard work). He was highly interested in the problem of English spelling reform. However, he also found time to familiarize himself with the phonetics of a number of European, African, and Indian languages by working with native informants, and he published descriptions of these languages as well as phonetic texts. Both as regards English spelling reform and the phonetic description of foreign languages the problem of selecting an adequate number of symbols was crucial. It was for the solution of this problem that he found the phoneme concept very useful.

At a very early point Jones learned from Sweet and Passy that in practical orthography and "broad transcription" it is only necessary to have separate symbols for sounds with distinctive value (cf. 2.3). Passy had already formulated this rule in 1888 in the first formal statement of the aims of "the Phonetic Teachers' Association": "There should be a separate letter for each distinctive sound; that is, for each sound which, being used instead of another, can change the meaning of a word". It was not until 1911, however, when he became acquainted with Baudouin de Courtenay's theories, that Jones realized the full scope and far-reaching importance of the phoneme concept. This was due to a paper by Ščerba on Russian phonetics in "Le maître phonétique", and in 1913 the theory was

explained to him in more detail by Titus Benni, another student of Baudouin de Courtenay. "The immense importance of the theory then became very clear to me, especially its relation to the construction of phonetic transcriptions, to the devising of alphabets for languages hitherto unwritten or unsuitably written, and in general to the practical teaching of foreign spoken languages. Consequently by about 1915 the theory began to find a regular place in the teaching given in the Department of Phonetics at University College" (Jones 1957, p. 6). It was in this early period, before Saussure's "Cours" and long before Prague phonology, that Jones worked out his view of the phoneme, and it remained practically unaltered. He gave a comprehensive description of his views in his book, significantly entitled "The Phoneme, its Nature and Use", 1950. Both in this book and in a historical survey of 1957 he mentions other theories briefly without really discussing them. In the preface to "The Phoneme" he admits that he has not had sufficient time to read all of the voluminous literature on the subject. He does not pretend that his definitions are better than those proposed by other authors, but experience has taught him that his theory "works well in practical language study" (1950, p. VII).

In his review (IJAL 18) of "The Phoneme, its Nature and Use" F. W. Householder characterizes the difference between the Prague School, the Bloomfield School, and Jones in the following manner: "The European asks: 'Is it true?', the American: 'Is it consistent?', the Englishman: 'Will it help?'".

PHONOLOGY AND PHONETICS

4.2 Daniel Jones emphasizes that he has arrived at his phoneme concept through phonetics, and he regards phoneme theory as part of phonetics. "Since phonetics can neither be studied nor applied without the use of phonetic transcriptions, and since adequate systems of transcription require for their construction the theory of phonemes, I see no reason for regarding the theory of phonemes as other than an integral part of phonetic science, or at least an indispensable adjunct to it" (1950, p. VII). In this attitude he differs markedly from the Prague School.

THE DEFINITION OF THE PHONEME

4.3 As mentioned above (2.4) Baudouin de Courtenay and his students defined the phoneme as a sound image. From Sweet and Passy, on the other hand, Jones had learned that it was a physical unit. He considers both these views possible and even compatible, but finds that the notion of the phoneme as a physical unit is more expedient as regards its application to language teaching and the establishment of orthographies. It is also more easily understood by students of phonetics. In 1917, using the term "phoneme" for the first time (see 1957, p. 10), he describes

phonemes as "the significant phonetic elements of speech," but already in the first regular definition (1919) reference to distinctive function is omitted: "A phoneme is defined as a group of related sounds in a given language which are so used in connected speech that no one of them ever occurs in positions which any other can occupy" (1919). This definition is improved in his following papers (1929, 1931a, 1933), until in his book of 1950 he arrives at a formulation which he subsequently maintained: "A phoneme is a FAMILY OF SOUNDS in a given language which are related in character and are used in such a way that no one member ever occurs in a word in the same phonetic context as any other member" (1950, p. 10). The phoneme, then, is a class of sounds which are in complementary distribution. But the definition is even narrower than this formulation might at first suggest, for "a given language" is meant to imply "the speech of one individual pronouncing in a definite and consistent style". The reason for this is that there may be phonemic differences between different styles and persons within the limits of what is usually called one language. By "related in character" is meant "phonetically similar", but phonetic similarity is not defined as precisely as it is by Trubetzkoy. Jones even mentions that this concept is necessarily quite vague, since it is not possible to indicate exactly a degree of dissimilarity which will rule out the inclusion of two sounds in one phoneme. However, *h* and *ɣ*, for example, are so different that it "would obviously be absurd" to subsume them under one phoneme. By "phonetic context" is understood surrounding sound segments as well as stress, tone, and length, although only inside the word boundary (cf. the addition "in a word"). The word has been selected as the frame in order to avoid complications. Jones mentions, for example, that if word groups were taken as frames French *y* and *ɣ* would have to be interpreted as two phonemes because of the opposition *tua* – *tu as* (1950, pp. 85–86).

DISTINCTIVE FUNCTION is not included in the definition (1950, p. 13ff). "It is my considered opinion that any reference to meaning is out of place in a physical definition of the phoneme. It is incumbent on us to distinguish between what phonemes *are* and what they *do*. Phonemes *are* what is stated in the definition. What they *do* is to distinguish words from one another. Different sounds belonging to the same phoneme cannot do this" (1957, p. 15). Even though distinctive function is excluded from the definition, Jones considers the discovery of minimal pairs the fastest and safest method of establishing the phonemes of a language (1950, p. 39ff). When such pairs cannot be found, however, it is sufficient to find cases where the sounds investigated occur in similar environments. Two sounds belong to separate phonemes if it can be demonstrated that the difference between them does not depend on other differences in the words in question. Jones, then, uses the commutation test as a practical aid in discovering the phonemes. A positive result of the test proves the phonemic status of the sounds involved, but it is not a necessary requirement; the only indispensable condition is that they should be independent of the environment. This view seems unobjectionable, provided that free variation has been excluded in advance. That

this exclusion is actually intended appears from Jones's description of "speech sound" (1950, pp. 2-3): "The linguistic conception of the "speech sound" is determined by the possibility of removing a section from a chain and replacing it by a section of another chain, the sections being such that the exchange is capable of changing the word into another word". This means that "distinctive function" is used in determining speech sounds, and it is therefore possible to omit reference to it in the definition of the phoneme as a class of speech sounds in complementary distribution.

Considering Jones's aim of creating simple and unambiguous orthographies as well as broad transcriptions for teaching purposes it is surprising that he does not include distinctive function explicitly in the definition of the phoneme. It was precisely this function that his predecessors Sweet and Passy stressed, and for the anonymous Icelandic grammarian mentioned in the Introduction (2.2) it was the main criterion. Perhaps the explanation is that Jones was in a different situation. The old Iclander was confronted with a recently introduced alphabet which did not have letters enough for the distinctions necessary in Icelandic (e.g. rounded front vowels and nasal vowels). He therefore had to emphasize the necessity for differentiating sounds with distinctive function. Jones was interested partly in English orthography, where too many distinctions are made rather than too few, and partly in creating orthographies for previously unwritten languages, where the linguist at first is overwhelmed by sound nuances whose function he is uncertain about. It was therefore essential to Jones to emphasize that sounds which do not occur in the same environments can be included under one phoneme.

VARIPHONES AND DIAPHONES

4.4 Since Jones has limited the phoneme to a class of sounds in complementary distribution in one style of one person's speech, it is necessary for him to introduce other types of sound classes. By VARIPHONE he understands a class of sounds which the speaker uses "absolutely indifferently and apparently at random" (1929). Variphones are particularly frequent in languages with a very small number of phonemes, where a great range of variation is possible without consequences to the message communicated. A typical example is Japanese /r/, which in the speech of the same person may have the variants [ɾ, ɽ, d, l]. Another example is initial /d/ in Spanish, which varies freely between [d] and [ð]. A variphone, then, comprises free variants in the speech of one person; it follows from the use of the word "indifferently" that there is no contrast. Naturally Jones realizes that there are always small variations in speech, but it is only when they are clearly perceptible to "outside observers" that he considers it necessary to speak about variphones. Variphones enter into the establishment of phonemes in such a way that they count as a single sound which may either in itself constitute a phoneme (e.g. Japanese /r/) or be a member of a phoneme (e.g. [d/ð] initially in Spanish, which

belongs to the phoneme /d/, whose other members are the [d] which is found after *n* and the [ð] which occurs medially otherwise and finally).

DIAPHONES are sound classes of a somewhat more complex nature. For one thing they comprise variants of the same phoneme in the speech of different persons within the same speech community. For example, the vowel in English *get* may vary a good deal from person to person as regards tongue height. It may even be the case that one person's /e/ overlaps another person's /a/ (as in *cat*). There are also great individual differences in the pronunciation of the vowel in e.g. *home* [o:, ou, əu, ʌu, öü], and together these variants constitute a diaphone. Such variation does not necessarily apply to all the members of a phoneme. For example, some speakers pronounce the medial *t* in *better*, *getting* as [ʔ], but this variation is not found initially. There is therefore a diaphone comprising medial [t] and [ʔ].

Secondly stylistic variation in the speech of a single person is included under this heading. In a word like *fire* a speaker may, for example, use the variants *aia*, *aə* and *a:* in different styles. These sounds constitute separate phonemes in English, but they represent the same diaphone.

One sound may belong to two diaphones. Scottish English, for example, has the same vowel ([u]) in both *food* and *good*, whereas Southern British English has [u:] in the first type of word and [ʊ] in the second. Scottish *u* is therefore a member of two diaphones (*u/u:* and *u/ʊ*).

A particularly complicated case is that of the two *a*-sounds in French: [a] and [ɑ]. They are members of the same diaphone, since some speakers use the former and others the latter, but at the same time they represent two different phonemes in the pronunciation of certain persons.

Jones's system is rather complicated, but in contradistinction to that of traditional phonemics it has the merit of keeping classes which are based on different criteria clearly apart, viz. (1) a class of free variants grouped together because they replace each other in the same position without distinctive difference ((a) variants used by one individual, i.e. Jones's variphone, (b) variants used by different individuals, i.e. some of Jones's diaphones); (2) a class of bound variants joined together because they are in complementary distribution and have common phonetic features, i.e. Jones's phoneme. It would seem simpler, however, to have a procedure in two steps, according to which free variants are joined in classes first and these classes are grouped together into phonemes secondly (cf. Twaddell's micro- and macrophonemes discussed in 6.12). In his paper "Concrete and Abstract Sounds" of 1939 Jones proposes that phonemes and diaphones should be regarded as abstractions on different levels and that a special "diaphoneme," covering different speakers' diverging pronunciations of phonemes, should be set up as the highest level of abstraction. This idea was given up in his subsequent papers. In practice, however, he nearly always uses "phoneme" in the sense "diaphoneme". In his comprehensive study of 1950 there are numerous references to "phonemes" in German, English, Japanese etc. (not just to phonemes in the

pronunciation of certain persons), and the term "diaphone" is not introduced until p. 193. Obviously, Jones, like other phonologists, was primarily interested in setting up a system shared by a large group of people.

Curiously enough variphones are discussed in a chapter entitled "Erratic Pronunciation". Dialect mixture and style mixture (for example the random use of apical and uvular *r* by French actors) also fall under this heading, and according to Jones such phenomena should be excluded from the theory of the phoneme. "The speech of those whose pronunciation is unstable cannot be reduced to phonemes at all, unless the instability is due to the existence of a variphone".

NEUTRALIZATION AND OVERLAPPING

4.5 As distinctive opposition is decidedly of secondary importance to Jones it is only natural that he is not inclined to treat the suspension of oppositions in certain positions as a special phenomenon, and he does not, consequently, employ the concept of neutralization. When confronted with a sound occurring in a position where an opposition is suspended he therefore has to decide which of the two members it should be identified with. In such cases he follows the principle that it should be identified with the member it resembles most. In English, for example, there is no opposition between *z* and *s* finally after stops and fricatives. After an unvoiced sound, e.g. *puts*, *box*, it is often a lenis *s*, which phonetically should be marked as [z], and which may be identical to initial [z], e.g. in *zeal* [zi:l], which is opposed to [s] (*seal*). In this case the final [z], according to Jones, should be identified with the phoneme /z/ (1950, pp. 46-8). In other theories morphophonemic considerations might lead one to the same conclusion as regards *puts*, but this is not what Jones has in mind, as is apparent from the use of the example *box*. In a case like *please yourself* [z] may be replaced by [ʒ] through assimilation. If it is really identical to the [ʒ] which occurs in words like *prestige*, Jones is of the opinion that it should be regarded as /ʒ/, i.e. the speaker has substituted the phoneme /ʒ/ for the phoneme /z/ (1950, p. 49 ff).

It is not possible for Jones to identify [ʒ] in *please* with the phoneme /z/, or [z] in *box* with /s/, because from the very outset he regards it as axiomatic (1950, p. 11) that the same sound cannot belong to two different phonemes in a language. He does, however, sometimes permit overlapping in different contexts (p. 92) (for example French /æ/ before /r/ (e.g. *cœur*) may overlap with /ɑ/ before other consonants (e.g. *homme*)), but it is inadmissible in the same context. In the variety of English in which [p, t, k] are replaced by [p̚] medially this sound should be subsumed under only one phoneme. Jones chooses to regard it as a member of the *t*-phoneme, with the result that [beɪp̚ə] (*baker*) is /beɪtə/ phonemically (p. 202). Only in a few isolated cases is an exception to this rule permitted, viz. when there would otherwise be great morphological complications or when the relationship between words would be unnecessarily obscured (p. 98 ff) (*baker* interpreted

as /beitə/ is not considered sufficiently troublesome, apparently). As an example he mentions that in some Indian languages an oral vowel may be nasalized after a nasal consonant, e.g. [nẽ] instead of [ne], but at the same time nasalized vowels occur as independent phonemes, even after nasals, e.g. /mẽ/. A speaker of the language will accept [ne] besides [nẽ] as a correct pronunciation of /ne/, but not [me] as a correct pronunciation of /mẽ/, and therefore the vowel in the first word should be considered oral, i.e. /ne/, which means that the same sound [ẽ] may be a representation of either /e/ or /ẽ/. Here, then, Jones makes allowance for native reaction, a guiding criterion which he also mentions elsewhere, but which would probably rule out the interpretation of *baker* as /beitə/ in any variety of English. Another example is Japanese [dz] and [dʒ], which are in complementary distribution with both [d] and [z]. In this case Jones hesitatingly acknowledges the possibility of including these sounds under /d/ in some words and under /z/ in others, partly because they are related to words with /d/ in some instances and to words with /z/ in others; partly because some dialects actually do have [d] and [z] respectively here; and finally because this convention is followed in the Kana writing system.

In his view of neutralization and overlapping Jones is opposed to the Prague phonologists, but on the whole in agreement with the Bloomfield School.

MONO- OR POLYPHONEMATIC INTERPRETATION

4.6 As mentioned in the chapter on Prague School phonology it is often debatable whether a diphthong or an affricate, for example, should be regarded as one or two phonemes. As a rule Jones prefers to consider them monophonematic but he rarely gives explicit arguments. Nevertheless, he prefers to write them with two letters. This may seem inconsistent since the purpose of his phoneme analysis is to arrive at a simple system of transcription. His argument is that there would otherwise be too many symbols, and that the use of diacritics renders reading more difficult. He also prefers, therefore, to write breathy vowels with a vowel + *h*, even though he considers them monophonematic.

CHRONEMES, TONEMES, AND STRONEMES

4.7 Jones wants to limit the term "phoneme" to segmental units only and he rejects Bloomfield's term for prosodic units, "secondary phonemes", as unfortunate. He finds it more satisfactory to treat prosodic phenomena separately, one reason being that the differences involved are relative, and there is therefore more overlapping in the case of prosodic phenomena than in the case of segmental phonemes (1944 and 1950, p. 108 ff).

Consequently Jones suggests that in addition to phonemes one should assume

the existence of "chronemes" ("a set of lengths which count as if they were one and the same"), "tonemes" ("a family of tones in a given tone language which count for linguistic purposes as if they were one and the same, the differences being due to tonal or other context" (1950 p. 153)), and in certain cases also "stronemes" (i.e. a family of stresses or "strones").

BOUNDARY SIGNALS

4.8 Since his phoneme theory is based on isolated words Jones does not deal with boundary signals or juncture in his phonological monographs. But in "The Word as a Phonetic Entity" (1931b) he enumerates some of the different phonetic means by which word boundaries are signalled, e.g., stress, length, intensity etc. He cites a number of examples, mostly from English.

DIACHRONIC PHONOLOGY

4.9 Jones was primarily interested in synchronic phonology, but in his book on the phoneme a chapter on "The Phoneme in the History of Language" is included (1950, pp. 233-52). Here thirty-two different types of change are enumerated, the first seventeen of which deal with different types of phoneme merger and split, fusion of phoneme combinations and fission of single sounds into phoneme combinations: in short, all the types mentioned by Jakobson (whom Jones apparently had not read) plus some others. The rest of Jones's types of change are prosodic. No systematization is attempted, but a number of examples are cited.

CONCLUSION

4.10 Because of the limited goals of Jones's phonological theory (application to orthography, transcription, and language teaching) what is of primary interest to him is the establishment of phoneme inventories (and the inventory of chronemes, tonemes, and stronemes). Nothing corresponding to Trubetzkoy's systematization of logical oppositions or of relevant sound properties is found in his works, nor are phoneme combinations mentioned. Morphological views are not found either, except by way of suggestion as in the example mentioned above of overlapping in Japanese. Jones is of the opinion, however, that an orthography (in contradistinction to phonetic or phonemic transcription) should consider the identity of words.

The crucial problem in Jones's theory is, therefore, how different sounds may be combined as members of a limited number of phonemes. In "The Phoneme" a large number of examples are discussed, which raise problems of various kinds,

but Jones always argues very cautiously. He hesitates to take definite standpoints, and he is generally sceptical about the possibility of proposing exact definitions. He is a practical man, not a theorist. However, the book is of great value because of the very extensive collection of examples, which derive from the author's lifelong studies of a large number of languages, and which are therefore exceptionally reliable.

Daniel Jones passed on his phonological theories to his students and staff members, who – on the whole – took over these theories without altering them (some of his staff members, though, subsequently attached themselves to Firth; cf. Chapter 5). Outside this circle very few have adopted Jones's special brand of phonology. It has been of great importance, however, that the many students who came to University College from all over the world to study practical phonetics were at the same time initiated into the basic ideas of a phonological approach.

Chapter 5

THE PROSODIC SCHOOL

(Firth School)

INTRODUCTION

5.1 The founder of the Prosodic School was the English linguist J. R. FIRTH (1890–1960). In the twenties he was for some years Professor of English in the Punjab in India; he then taught phonetics at University College, London, under Daniel Jones, and was subsequently attached to the School of Oriental and African Studies, from 1944 to 1956 as Professor of General Linguistics. His phonological views constitute part of a general linguistic theory which has been very important to a new generation of English linguists. These views differ radically from Jones's phoneme theory, and as a consequence two quite dissimilar phonological theories were taught at the University of London in the forties and fifties.

Firth's theories of phonological analysis were first propounded in two papers of 1935 and 1936, and further developed in the article "Sounds and Prosodies" (1948). His mode of expression, however, is not very clear, and Robins (1957), Dinneen (1967, pp. 299–325) and F. R. Palmer (1970, pp. IX–XVI) provide better introductions to the Prosodic School. A number of independent applications of the theory to different languages, particularly Oriental and African, are found in papers by W. S. ALLEN, J. CARNOCHAN, E. J. A. HENDERSON, F. R. PALMER, R. H. ROBINS, A. E. SHARP, R. K. SPRIGG, E. M. WHITLEY, and others.¹

GENERAL CHARACTERIZATION

5.2 Firth makes a distinction between "structure", which refers to syntagmatic relations and units, and "system", which refers to paradigmatic functions and classes. A syllable, for example, is a structure, whereas a class of elements which are commutable in the same position constitute a system. The main stress is laid on SYNTAGMATIC relations, and the concept of "context" plays an important part. In this connection it may be mentioned that it is not the word which is considered the fundamental unit of analysis (as in Jones's theory) but the SENTENCE. In direct contradistinction to Jones it is emphasized that the aim of a phonological analysis cannot be merely to arrive at a simple system of transcrip-

1. Langendoen (1968) gives a critical account of the Prosodic School from the point of view of generative phonology.

tion or an orthography. To set up a simple alphabetic transcription is a useful thing, but for this purpose an analysis is needed which attaches greatest importance to the establishment of a limited number of segmental units following each other linearly; in this process many complex relations between the various phonetic features of the utterance are obscured. In an adequate phonological analysis the phoneme is not the central point, but rather the different systemic and structural relations between phonetic features. Phonetic features may form part of **PHONEMATIC UNITS**, which are segmental, e.g. consonants and vowels, or of **PROSODIES**, which are attached to units longer than the individual segment. Nearly all features may be prosodies in one language or another (e.g. palatalization, retroflexion, nasality, place of articulation). The systems of phonematic units are normally not the same, for example, initially and finally, and as there may also be several levels of prosodies, the description as a whole can be characterized as **POLY-SYSTEMIC**. No sharp distinction is made between the **GRAMMATICAL** and phonological levels; grammatical boundaries are taken into account in the phonological analysis, and importance is attached to the morphological function of the features (in this respect Firth is in agreement with generative phonology). F. R. Palmer (1970, p. XV) characterizes phonology as a bridge between grammar and phonetics.

Robins (1967, p. 219) gives the following characterization of prosodic analysis: "The outcome of prosodic analysis is not a readable transcription, but a diagrammatic representation of the interrelations of elements and features in a stretch of utterance, that can be put into connection with its grammatical structure".

BACKGROUND

5.3 It is probably no mere coincidence that the prosodic theory originated and obtained adherents among orientalist, who are used to analysing languages, such as Hindi, which use not alphabetic but syllabic writing. Most likely it was also of consequence that ancient Indian grammarians considered the sentence the fundamental unit and that many assimilations are marked in writing. Firth was, however, also acquainted with other phonological theories both in Europe and in America (see Firth 1934, Bibl. to ch. 2).

DIFFERENT SYSTEMS IN DIFFERENT POSITIONS

5.4 The approach adopted by most phonologists is to set up only one inventory of phonemes on the basis of the segments appearing in the position where there is maximal differentiation. In positions with less differentiation certain phonemes are considered to be lacking. The sounds actually found in such positions are either identified with the phonemes they resemble most in the position with

maximal differentiation (in Italian, for example, where *n*, *l*, and *r* are the only consonants found finally in normal native words, these sounds are identified with initial *n*, *l*, *r*); or – in Prague phonology – regarded as neutralized manifestations of oppositions found in the position of maximal differentiation (e.g. final *p*, *t*, *k* in German, cf. 3.7). (Cf., however, Twaddell, 6.12 below).

Firth was of the opinion that such a procedure can only be justified if the purpose of the analysis is to construct a practical system of transcription. Since the phonemes enter into quite dissimilar oppositions in the various positions, a scientifically adequate analysis can only be reached by establishing different systems in different positions and combinations. In Marathi, for example, there are two nasal consonant phonemes initially, three finally, and only one preceding a consonant, i.e. the nasal which is homorganic with the following consonant. [n] occurs in all three positions but enters into different systems in each position. "That they are the same 'phoneme' is the very last thing I should say" (Firth 1936, p. 51).

PROSODIES

5.5 The most characteristic feature of the Firth School, however, is the establishment of prosodies. These are of many different types, since everything that is attached to a unit larger than the separate segment is included under the prosodies. Firth does not provide any systematic survey of these types, but there are roughly speaking three main types:

(1) Everything which in the Prague School is included under the description of **PHONEME COMBINATIONS** falls under prosody: i.e. word structure, syllable structure, consonant combinations, vowel combinations, etc.

(2) Another type of prosody is constituted by what are called **BOUNDARY SIGNALS** in the Prague School and juncture in American linguistics. To this type belong, for example, *h* in French, linking *r* in English, the various lengthenings found before open juncture in English, aspiration if it only occurs initially, explosion of stops in languages where they are unexploded finally (e.g. Siamese), stress in so far as it is fixed and used for word delimiting purposes etc. Such phenomena are also dealt with in other theories but from a different point of view. In the Prague School the description of boundaries constitutes a sort of appendix to phoneme theory. In American linguistics juncture phonemes are set up, which form part of a linear transcription, and which, like other phonemes, are regarded as functionally identical in all positions. The demarcative prosodies of the Firth School, on the other hand, are units which are connected functionally with larger entities (syllable, word etc.).

(3) Finally there are **PROSODIES WHOSE PHONETIC REALIZATION EXTENDS ACROSS A UNIT LARGER THAN THE PHONEME**. To this type belong in the first place those phenomena which are also called prosodic units in the Prague School

and suprasegmental phonemes in American phonology: e.g., stress, tone, and, partly, length. In addition, however, a number of other phonetic features may be prosodic. In the Prague and Bloomfield Schools prosodic (suprasegmental) features are isolated not only as a result of their non-segmental status but also as a result of their phonetic character. According to Trubetzkoy they are rhythmic-melodic properties, and according to Pike, for example, they are quantitative characteristics which modify a sound without changing its quality. But in the Firth School no such restrictions are considered necessary. Any property may be prosodic if it extends beyond the individual segment. (Similar views are found in the works of a few Americans, cf. Harris's "long components", see 6.31).

In order to understand how the analysis is carried out it is useful to consider some examples.

One well-known case is retroflexion in Sanskrit, which is discussed in two papers by Allen (1949-51 and 1954). In Sanskrit there is a rule according to which an *n* which precedes a vowel, a nasal, *j* or *w* becomes retroflex after *r* (syllabic or non-syllabic) or *ṣ*. This rule is also valid if *n* is separated from *r* or *ṣ* by other sounds which are not palatals and dentals. This is normally considered distant modification, which skips intermediate sounds. Allen prefers to say that it is a case of an *R*-prosody which extends across a certain portion of the word and that this prosody is realized as retroflex where this is phonetically possible. In certain dialects the intervening vowels are also retroflex. According to this

analysis, consequently, a word like *niṣaṇṇa* is represented as $\overset{R}{niṣanna}$, and $\overset{R}{ārabhyamāṇa}$ as $\overset{R}{ārabhyamāṇa}$. According to the same principle *iṣṭa* and *taddāyah*

are written $\overset{R}{iṣṭa}$ and $\overset{R}{taddāyah}$. It would also be possible to include the preceding vowel under the *R*-prosody. Furthermore, since there is only one *r*-sound, and since it behaves like a retroflex sound, *r* may be interpreted as the retroflex partner of *l*, and if this solution is chosen, *l* should be written instead of *r* under the line in the above examples. Retroflex *t d n* do not have the same effect as *r* and *ṣ*, and Allen therefore considers the possibility of positing two different *R*-prosodies.

Vowel harmony is another instance of what is usually called distant assimilation, but which may also be given a prosodic interpretation. Non-foreign words in Turkish, for example, normally contain either back vowels only or front vowels only, whereas there are no such restrictions as regards the distribution of close and open vowels. In this case, consequently, vocalic place of articulation constitutes a prosody while tongue height belongs among the phonematic units. Cf. also Carnochan's treatment of vowel harmony in Igbo (1960).

Breathiness, for example in Gujarati, is also interpreted as a prosody, since preceding and following sounds are involved.

A similar interpretation may be advanced as regards palatalization (e.g. in Russian), where not only the consonant but also to some extent the preceding

and following vowels are palatalized phonetically. Usually this palatalization is considered distinctive in the consonant and redundant in the vowel, because it is found finally in a consonant group but not in a vowel alone. Robins (1957, p. 4-5) considers this decision arbitrary and is of the opinion that a more adequate description consists in regarding palatalization as a prosody which extends across both vowel and consonant.

E. M. Whitley (1958) mentions an example from Malayalam, where a palatal *r* occurs which is different from the normal *r*. Since the remaining sounds in a word are also pronounced differently in connection with the palatal *r*, it is considered to be a difference between words, not just between two *r*-phonemes. She also refers to recent phonetic experiments, which have demonstrated that in the case of different consonantal points of articulation there are concomitant differences of vowel transition and that these differences are often of greater perceptual importance. However, she does not make it quite clear that if this argument is accepted then consonantal place of articulation will have to be regarded as a prosody in most languages.

The Prosodic School differs from other (older) phonological schools in that it does not attempt to make a clear distinction between the phonetic and phonemic levels, or between the latter and the grammatical level. In this way many phenomena are seen in a new light, and interesting relations are emphasized. On the other hand, when various degrees of coarticulation and assimilation are included in the analysis, the distinction between phonematic units and prosodies becomes vague and fluctuating. Almost anything, apparently, can be regarded as a prosody, and as a consequence the description sometimes gets rather complicated and fuzzy. The prosodic approach can be considered a useful supplement to the more traditional descriptions but hardly a substitute for them.

Chapter 6

THE BLOOMFIELD SCHOOL

Introduction

6.1 The Bloomfield School is not a specifically phonological school. It represents a trend in structural linguistics which was practically uncontested and universally accepted in America for nearly twenty years, from the mid-thirties to the mid fifties.¹ It is not a school in as narrow a sense as the Prague School, let alone the London schools. Rather it consists of a group of linguists decisively inspired by Bloomfield. They do not all follow him in every particular, but have modified his ideas in different ways and made original contributions to structural linguistics. The terms "post-Bloomfieldians" and "neo-Bloomfieldians" are therefore often used. In spite of the differences, the uniformity is, however, amazing, particularly considering the size of the country.

One important reason for the general acceptance of Bloomfield's ideas was the fact that most American linguists were faced with the same problem: the numerous undescribed Amerindian languages, a challenge which called for new methods. The only fully developed method, historical linguistics, was useless since very little was known about the history of these languages. What was needed was a method of synchronic description of languages whose structure differed radically from those of Indo-European languages, the main object of linguistics in the nineteenth century. It was the anthropologist FRANZ BOAS, who in the introduction to his "Handbook of American Indian Languages" (1911) first propounded methods for the phonetic and grammatical description of Amerindian languages, and a close co-operation between anthropologists and linguists has since Boas been a characteristic feature of American descriptive linguistics. Bloomfield learned much from Boas and writes in his obituary ("Lg." 1943) that "the progress which

1. Although the phonological and grammatical theories of the Bloomfield School constitute a whole based on the same principles, no attempt is made here to give a systematic account of their grammatical methods. The concentration on phonology is possible because in the Bloomfield School phonology and grammar form strictly separated chapters, and the analysis starts with phonology (the situation is quite different in glossematics and in transformational grammar). Grammatical parallels have, however, been mentioned in a few cases (for instance in 6.26), and some morphological concepts are treated in the section on morphophonemics (6.34-6.39).

General characterizations of the Bloomfield School are found in Ch. C. Fries (1963), Robert A. Hall (1951-52), Ch. F. Hockett (1968, pp. 9-37), B. Malmberg (1964, pp. 158-85), G. C. Lepschy (1972, pp. 84-91 and 110-25), and F. P. Dinneen (pp. 239-98).

has since been made in the recording and description of human speech has merely grown forth from the roots, stem, and mighty branches of Boas's life work".

Another reason for the general acceptance was that Bloomfield's antimentalistic attitude was in conformity with a general climate of positivism in American philosophy and in the social sciences of the time.

Finally it should be mentioned that there has been close contact and co-operation among linguists in America (supported by their common association "the Linguistic Society of America" and its periodical "Language") to a degree unknown in Europe even within the separate countries, with the possible exception of Czechoslovakia. On the other hand, the connection with European linguistics has been very loose. Most American linguists have preferred to start from scratch, unhampered by the European tradition.

EDWARD SAPIR (cf. Chapter 2 above) was a student of Boas, and also he influenced Bloomfield as well as American linguistics in general. His theory of the psychological reality of phonemes, it is true, was not accepted by the Bloomfield School, but his view of the phoneme as a distinctive unit, and particularly his proposal of defining phonemes on the basis of their possibilities of combination and their participation in alternations became important to American phonology. The American linguist who was influenced most by Sapir was Swadesh.

Leonard Bloomfield

BACKGROUND AND GENERAL APPROACH

6.2 By education Leonard Bloomfield (1887-1949) was an Indo-Europeanist who specialized in Germanic. As mentioned above, several of Bloomfield's successors had little contact with European linguistics, but this is not true of Bloomfield himself. His uncle, M. Bloomfield, was a well-known Sanskritist. Leonard Bloomfield studied in Leipzig and Göttingen under the neogrammarians Leskien and Brugmann and maintained the neogrammarian conception of regular sound change. To Bloomfield the theory of completely regular sound change was the only scientifically justifiable foundation of historical linguistics. It forces the linguist to search for phonetic explanations of apparent exceptions and this search is often successful. It is this assumption which has made historical phonology a scientific discipline.

On the other hand Bloomfield did not share the neo-grammarian conception of language history as the only acceptable type of linguistics. Through Boas he had become interested in American Indian languages and realized the importance of a synchronic method, and Saussure's "Cours" (the second edition of which

he reviewed very favourably in 1924) confirmed his belief in the importance of synchronic description. The problem, as he saw it, was to make this description as rigorously scientific as historical linguistics.

Some of Bloomfield's works dealt with Indo-European (among them a large number of reviews), but his influence is based mainly on his work in general linguistics and his studies of the Algonquin languages. His general linguistic views are stated in a preliminary form in "A Set of Postulates" (1926) but in much more detailed form in his book "LANGUAGE" (1933).² From 1927 to 1940 he was Professor of Germanic at Chicago and from 1940 to 1949 Professor of Linguistics at Yale, but he was not as influential through his teaching as through his publications. By nature he was reserved, modest and tolerant. He detested scientific schools, and it is therefore something of a paradox that he himself came to found one.

Bloomfield regarded his book "Language" as an unpretentious introduction intended for undergraduates. It contains, indeed, explanations of the various traditional aspects of linguistics, but the account of synchronic language description, in America termed "descriptive linguistics", is new.

Following Saussure he considers LA LANGUE, viewed as a social system, the subject of linguistics. It is probably also under the influence of Saussure that he calls it "a rigid system".³ But he rejects Saussure's psychologism. In his young days Bloomfield was somewhat influenced by Wundt's psychology and later on by behaviourism, and he sometimes employs behaviouristic terminology ("stimulus - response", etc.), but the important thing for him was to exclude all mentalistic psychology from linguistics. Linguistics should confine itself to language facts and describe their mutual relations. If behaviourism appealed to him as a psychological method, it was because of its ANTIMENTALISM. Bloomfield was of the opinion that a scientific description should be PHYSICO-MECHANISTIC and use only terms such as are derivable by rigid definition from a set of everyday terms concerning physical happenings. What happens in the mind of humans can only be inferred from their speech and other observable facts, and one should restrict oneself to this and avoid mentalistic terminology.

FORM AND MEANING

6.3 Bloomfield's antimentalism does not imply that he wants to exclude semantic considerations in his language description. Meaning does not have to be defined

2. This book is a radically revised edition of a far more traditional book from 1914. In the following it is referred to as "Language", whereas the periodical "Language" is abbreviated to "Lg".

3. The distinction between langue and parole (language and speech), however, is not clearly drawn in Bloomfield's "Language", and several of his successors describe language as the totality of the possible utterances" (cf. Bloch 1948).

mentally, and he regards semantic considerations as necessary in both phonology and morphology.

Bloomfield distinguishes between FORM and MEANING. "Form" corresponds roughly to Hjelmslev's "expression". A phonetic form which has a meaning is a "linguistic form", e.g. word, sentence etc. It thus corresponds to Hjelmslev's "sign expression" (Saussure's "signifiant"), but it is somewhat more comprehensive since the relations between sign expressions are also covered by the term. It includes a number of syntactic relations, which according to Hjelmslev belong to content form. The smallest linguistic form is called a "morpheme", this term corresponding to Hjelmslev's "minimal sign expression" and to Martinet's "moneme" (see 6.35).

What "meaning" covers is not quite clear. On p. 139 of "Language" it is stated that "we have defined the meaning of a linguistic form as the situation in which the speaker utters it and the response which it calls forth in the hearer", and this is repeated on p. 158. But according to Hockett (1968, p. 22) this is not what Bloomfield really meant. Hockett does not, however, explain clearly what Bloomfield did have in mind, but refers to a (to me inaccessible) Bloomfield paper of 1943. It is obvious that the quoted definition refers to the speech act, and it is therefore inconsistent with Bloomfield's view that the language system constitutes the subject of linguistics. In his explanation of "meaning" he has mixed up "language" and "speech". On p. 145 the language system is apparently referred to: "Our fundamental assumption implies that each linguistic form has a constant and specific meaning". This kind of "meaning" includes only certain distinctive features of the outside world and is called "linguistic meaning" (p. 141), but at the same time it is emphasized that "meaning cannot be analysed within the scope of our science" (p. 161). It therefore seems as if "meaning" is in all cases a property of the outside world, which does not belong to language. Partly at variance with this view, grammar and lexicon are characterized as part of "semantics", which deals with the meanings attached to phonetic forms (p. 138). All this is somewhat obscure, but it is evident that to Bloomfield's successors "meaning" does not belong to language.

At any rate Bloomfield regards meaning as very difficult to investigate. In a linguistic analysis it is therefore necessary to start from form and never to include meaning in the definitions. The definitions of linguistic units should be based on their mutual relations (later called "distribution"). In the establishment of the units, however, meaning must be considered. "In human speech different sounds have different meaning. To study this co-ordination of certain sounds with certain meanings is to study language" (p. 27). If meaning is not taken into consideration it is not possible to decide whether two forms are the same or different. "We must assume that in every speech community some utterances are alike in form and meaning". This is characterized as "the fundamental assumption of linguistics" (pp. 144-5).

THE PHONEME

6.4 A minimal linguistic form, a morpheme, is divided into PHONEMES. On p. 136 phonemes are defined as "the smallest units which make a difference in meaning", and on p. 78 phonology is defined as "the study of significant speech sounds".⁴ These definitions are close to those of the Prague phonologists. On p. 77 ff a distinction is made between distinctive and non-distinctive phonetic features, and it is stated that "these distinctive features occur in lumps and bundles, each of which we call a phoneme". Immediately before the quotation mentioned he writes "a minimum unit of distinctive sound feature, a phoneme", and immediately after it: "The phonemes of a language are not sounds, but merely features of sounds which the speakers have been trained to produce and recognize in the current of actual speech sound". The phoneme is thus that feature, or those features, by means of which one sound is distinguished from another, i.e. the distinctive content of a sound, cf. also the definition in "A Set of Postulates" (1926): "A minimum same of vocal feature is a phoneme or distinctive sound".

Bloomfield's account of phonology is very brief, and he advances no detailed procedure by which the phonemes of a language may be found. We should pretend, he argues, that science is capable of describing meaning and then "... trust our everyday knowledge to tell us whether speech-forms are 'the same' or 'different'" (p. 77); we can investigate, for example, how many "replaceable parts" there are in a word like *pin*, and arrive at the conclusion that there are three. As regards the identification of sounds in different positions it is simply stated that "a little practice will enable the observer to recognize a phoneme even when it appears in different parts of words, as *pin*, *apple*, *map*" (p. 79).

CLASSIFICATION OF PHONEMES

6.5 It is the phonemes, and not their components, which are of interest to Bloomfield, and consequently he rejects arrangements in vowel triangles etc. according to distinctive features as purely phonetic and irrelevant to linguistic structure. The phonemes of a language should be defined on the basis of the parts they play in the language, and according to this principle they should first be divided into PRIMARY AND SECONDARY PHONEMES. The latter are stress and tone. "These are not part of any simple meaningful speech-form taken by itself, but appear only when two or more are combined into a larger form, or else when speech-forms are used in certain ways – especially as sentences" (p. 90). Bloomfield here

4. In the bibliography of "Language" he quotes not only Sapir, but also Baudouin de Courtenay, the Prague School's TCLP I 1929 (containing Trubetzkoy's extensive monograph on vowel systems), and various papers by Jones. Bloomfield was thus well acquainted with previous phoneme theories.

introduces a terminology which deviates from the one common in Europe, where only primary phonemes are termed phonemes, and secondary phonemes are called prosodemes or (by Jones) tonemes and stronemes. Primary phonemes are subdivided into consonants and vowels, where the latter are always syllabic while the former may be so. Consonants are further divided according to their combinatory possibilities within initial, medial, and final groups. Vowels are divided according to which consonants they may be combined with. This is not, however, done by progressive divisions into classes, but by means of a large number of intersecting "STRUCTURAL SETS". In English, for example, a set of consonants is established which never occur initially (η , ζ); another including the consonants which occur initially after s (p , t , k , f , m , n); another set consisting of those consonants which can be followed by w , r , l initially (and in this way w , r , l are also established as a set), etc. Final consonant clusters are described as consisting of a main final consonant which may be preceded by a pre-final (e.g. /test/), which in turn may be preceded by a second prefinal (e.g. /tekst/); further the main final may be followed by a post-final (e.g. /teksts/). The possibilities of combination of these various types give rise to further sets. A total of thirty-eight such sets are established in English. A particular phoneme will be a member of several sets, but not of exactly the same sets as any other, and it can therefore be defined as belonging to certain structural sets, e.g. numbers 1, 5, 6 and 7, whereas another phoneme perhaps belongs to the sets 1, 2, 7 and 9, etc. This type of arrangement is rather complicated, and as pointed out by Trubetzkoy it presupposes that the language under investigation has a relatively complex syllabic structure. Phoneme combinations occupying the same positions as simple phonemes (e.g. certain English diphthongs) are called "compound phonemes".

ALTERNATIONS (MORPHOPHONEMICS)

6.6 The possibility of basing phonemic classification on alternations is only briefly mentioned in "Language" (p. 214), but in an earlier paper (1926), influenced by Sapir, Bloomfield attached more importance to alternations.

In "Language" alternations are treated in the chapter on morphology (p. 207ff). Here different types of alternations are established according to (1) the nature of the alternating units (if the change can be described as a phonetic modification, such as English plural /-s, -z/, it is called PHONETIC; if not, as for example plural /-s, -ən/, Bloomfield calls it non-phonetic, or suppletive), (2) the determining factors (if the determining factor is phonemic, the alternation is termed AUTOMATIC, if it is grammatical, the alternation is termed GRAMMATICAL), and (3) whether the alternation is REGULAR or not. The English plural alternation /-s, -z, -ɪz/ is therefore a phonetic, automatic, regular alternation, whereas the German noun plural alternation /-ə, -ən/ which, by and large, is dependent on gender

(e.g. *Tage*, *Frauen*), is a non-phonetic, grammatical, regular alternation, etc. (in "Postulates" (1926) the classification is slightly different).

The alternating forms are called ALTERNANTS. In cases of phonetic alternation the alternants are phonetically related (e.g. /-s, -z, -iz/). In SUPPLETIVE alternations they may be completely unrelated (e.g. the plural endings /-iz/ and /-ən/). As another extreme case Bloomfield mentions ZERO-ALTERNANTS (e.g. the plural of *sheep*). He also recognizes "SUBSTITUTION-ALTERNANTS" (e.g. *goose-geese*). Bloomfield does not discuss whether the alternants are separate morphemes or members of the same morpheme. According to his description of a morpheme as consisting of phonemes, they should be different morphemes.

Bloomfield now points out that some alternations can be formulated more simply if one of the alternants is selected as the "UNDERLYING FORM" or "BASIC ALTERNANT", and the others are described as forms which replace this underlying form under certain conditions. In the case of English /-s, -z, -iz/ Bloomfield chooses to consider /-z/ the underlying form since the same alternation applies to the verb *is* and only /iz/ can be regarded as basic here; and consequently his rule states that /-iz/ loses its vowel except when preceded by sibilants and affricates, and that /z/ is replaced by /s/ after unvoiced sounds. In an example like *knife-knives*, where the alternation occurs in the stem, /najf/ is regarded as the underlying form; in the plural /f/ is first changed to /v/, then the suffix is added, and after /v/ the plural alternant /-z/ must be selected. Thus, a definite "descriptive order" is established which ensures the simplest formulation. In the case of French adjectives Bloomfield selects the feminine as the underlying form (interpreted as ending in a consonant: *plate, basse, laide* /plat, ba:s, led/), and the masculine is then formed by subtracting the consonant. If the masculine form had been regarded as basic it would have been necessary to establish a number of special rules as regards the various consonants which must be added to the feminine forms.

Sometimes it is necessary to set up an "artificial underlying form" (whereby Bloomfield probably simply means a form which does not occur in isolation); in the German alternations /rundə - runt, hauzə - haus/, for example, /rund-/ and /hauz-/ are selected as underlying forms since it is then possible to lay down the rule that *d* and *z* are changed into *t* and *s* finally. If the form occurring in isolation had been considered basic instead, it would not be possible to state in a rule when medial voicing of the consonant takes place and when it does not: cf. the forms /buntə - bunt/ and /ʃpa:sə - ʃpa:s/.

Later (e.g. in his paper "Menomini Morphophonemics" 1939 b), Bloomfield transfers the phonetically determined alternations (and, more specifically, the phenomena of internal sandhi) to a special discipline called MORPHOPHONEMICS. The basic forms are now assumed to consist of MORPHOPHONEMES, and Bloomfield establishes both an inventory of morphophonemes and an inventory of phonemes, which differ from each other in various ways. For example, the morphophonemic front vowels of Menomini comprise *e*, *e*ː, *ə*, *ɛ*, *ɛ*ː, but phonemically

– “in actual speech” – *i*, *i*ː, *e*, *e*ː, *ɛ*, *ɛ*ː are found. The morphophoneme *a* is changed into *e*, and the two phonemes *i* and *i*ː arise through alternations.⁵

It will be seen that underlying forms and ordered rules, which are characteristic of generative phonology, are found already in Bloomfield's works (though ordered rules are not normally used by the post-Bloomfieldians). The main difference is that Bloomfield and his followers keep morphophonemics separated from phonemics. Moreover, Bloomfield emphasizes that the descriptive order of rules is a fiction which results from our method of describing the forms. It has no reality for the speaker (“Language”, p. 213).

SUMMARY

6.7 In summary it may be said that Bloomfield differs clearly from the Prague phonologists by his behaviouristic antimentalistic attitude and by attaching far less importance to paradigmatic oppositions and, conversely, by being much more interested in syntagmatic relations.

The Post-Bloomfieldians

INTRODUCTION

6.8 Bloomfield's relatively short and incomplete outline of phonology (morphology and syntax are dealt with more fully) left many questions open, and it was possible to elaborate the theory in various ways. Important contributions to its further development were made by Morris Swadesh (1909–67), Bernard Bloch (1907–65), W. Freeman Twaddell, George L. Trager, Zellig S. Harris, Charles F. Hockett, Einar Haugen, and Kenneth L. Pike. Among the more well-known members of the Bloomfield School are also: Ch. C. Fries (1887–1967), Martin Joos, A. A. Hill, H. M. Hoenigswald, Dwight D. Bolinger, N. McQuown, C. F. Voegelin, Rulon Wells, Sol Saporta, F. W. Householder, F. Lounsbury, H. L. Smith, Paul Garvin, H. A. Gleason, and E. Nida. Some of the most important theoretical studies are listed in the Bibliography; a large number were published in the periodical “Language”. Furthermore, numerous descriptions of specific languages, particularly Amerindian, have been published in the “International Journal of American Linguistics” (IJAL); of these only a few are mentioned in the Bibliography.

5. In this paper Bloomfield uses the specific term “semi-phoneme” to describe an element of the phonemic level which occurs only in a given alternation and which can therefore not be considered a full phoneme. This is the case of long *u*: in Menomini, which is an alternant of *o*: under a given condition. Under the same condition *i*: alternates with *e*ː, but *i*: is also found elsewhere, and is thus a full phoneme.

SHORT CHARACTERISTICS OF SOME MEMBERS OF THE BLOOMFIELD SCHOOL

6.9 The most important contributions from the thirties are due to Swadesh and Twaddell. As mentioned above, MORRIS SWADESH was a student of Sapir and not so directly dependent on Bloomfield as most other American linguists from this period. In a series of articles (1934, 1935, 1936) he discusses the criteria of establishing phoneme inventories and mentions various problems which had not been treated by Bloomfield, such as phonetic similarity, pattern congruity, lack of minimal pairs, lack of contrast in certain positions, etc. W. FREEMAN TWADDELL also occupies an independent position. In a monograph which is still highly readable ("On Defining the Phoneme" 1935), he analyses the definitions of the phoneme given by the Prague School, Jones and Bloomfield, and proposes a new definition (cf. 6.12 below). Contrary to nearly all other Bloomfieldians he attaches great importance to paradigmatic opposition and even carries this so far that he refuses to identify sounds which are in complementary distribution as members of the same phoneme if they do not enter into the same oppositions (if, for example, there is neutralization in one of the positions). Twaddell also deals with a problem which was only investigated much later in any depth, namely that of distinguishing phoneme combinations which are possible in a given language, but which happen not to be utilized ("accidental gaps"), from combinations which are structurally impossible. His book did not have quite the influence it deserved.

BERNARD BLOCH, GEORGE L. TRAGER and RULON WELLS are more directly Bloomfield's students (although Trager was also a student of Sapir); the first two are probably the most typical exponents of what is normally understood as the Bloomfield School. For twenty-six years (1939-65) Bloch was the editor of "Language", the leading linguistic periodical in America. Both in this capacity and as a teacher he became very influential. In collaboration with Trager he published an analysis of the English phoneme system (1941) and wrote "An Outline of Linguistic Analysis" (1942). They follow Bloomfield rather closely but give more detailed directions concerning the establishment of phoneme inventories. Bloch's "A Set of Postulates" (1948) is also significant, among other things because it deals with the problem of segmentation, but it is somewhat difficult to read. Bloch and Trager's description of the English phoneme system was attacked sharply by Haugen and Twaddell (1942), but nevertheless became very influential. In 1951 it was replaced by Trager and Smith's "Outline" (1951), which for a number of years was virtually unchallenged. This analysis was, for example, taken over almost without modification by Gleason in his very widely used "Introduction to Descriptive Linguistics" (1955) and also in its revised edition (1969).

ZELLIG S. HARRIS occupies a place apart, partly as a result of his analysis in terms of "long components" (cf. 6.31 below), and partly because his syntactic analysis gradually drifted away from that of Bloomfield. For example he introduced

syntactic transformations, which were later to exert great influence on Chomsky. In particular he is interested in problems of method, and his principal work, "Methods in Structural Linguistics" (1951), which is an attempt to establish logically coherent procedures leading to the simplest possible language description, is an important contribution to structural linguistics. As a result of this endeavour Harris has diverged more from the phonetic foundation of phonemics than many other post-Bloomfieldians.

On this point he differs from CHARLES F. HOCKETT who has repeatedly recommended the principle of "hugging the phonetic ground", and who prefers phonetic realism to rigidly logical definitions. In many respects Hockett follows Bloomfield, but in his later works he is clearly influenced by the Prague School (partly through Roman Jakobson). In his "Manual of Phonology" (1955) arrangements into vowel triangles and quadrangles of the Prague type are found for the first time in American phonemics, connected with a decomposition into features which are largely similar to that of Prague phonology. Hockett also attempts to establish a typology from which certain general laws concerning the structure of phoneme systems can be deduced.

EINAR HAUGEN occupies a rather independent position because of his ties to European (particularly Scandinavian) linguistics. In the article "Directions in Modern Linguistics" (1951) he gives a comparison of glossematics with the Bloomfield School. He has made several contributions to prosodic analysis, for example to the analysis of the syllable (1956), but his principal achievement is the study of bilingualism, particularly that of Norwegian immigrants in America.

It is questionable whether YUEN R. CHAO should be included under the Bloomfield School (he is first and foremost a sinologist). His paper, "The Non-Uniqueness of Phonemic Solutions of Phonetic Systems" (1934), which deals with the criteria employed in the establishment of phoneme inventories, is an important contribution to the discussion of some basic problems of phoneme analysis.

KENNETH L. PIKE and his students are probably the least typical post-Bloomfieldians. The principal aim for Bloomfield himself and all his other successors was to arrive at an exact scientific description of linguistic structure; Pike, too, is interested in theory, but his linguistic work has a direct practical purpose as well. He is a professor at the University of Michigan, but above all he is a missionary and the leader and organizer of a number of courses in linguistics for missionaries through the Summer Institute of Linguistics. After having received a linguistic training these missionaries are sent out to Indian tribes in South and Central America, to New Guinea, Mexico, and other places. Here it is their task to learn the language, describe it scientifically, set up an alphabet, teach the natives to read, and translate the Bible into the language in question. According to Pike, as also to Daniel Jones, the phonological analysis is thus meant to form the basis of an orthography which must be acceptable to the native. His comprehensive book "Phonemics" (1947a), which is intended as a field work manual and therefore much easier to read than Bloch's and Harris's purely

theoretical works, indicates this purpose clearly by carrying the subtitle "A Technique for Reducing Languages to Writing".

This practical attitude is probably one of the reasons why Pike is less dogmatic than other post-Bloomfieldians. He differs from the hard core (Bloch, Trager, Harris, Hockett) on a number of points: he is not afraid of including meaning (cf. 6.19), he does not insist on keeping grammar and phonology strictly apart (cf. 6.23 and 6.29), and he wants not only to describe language, but also a number of other human activities according to the same method.

Pike considers language as consisting of three hierarchies: the phonological, the lexical, and the grammatical hierarchy, with three different minimal units: the phoneme, the morpheme, and the tagmeme. A derivation of the latter term: "TAGMEMICS" is used as a general designation of Pike's theory. Language can, however, not only be seen as made up of units (or "particles"); it can also be viewed as a constant flux of movement (as "wave") and as a system of contrastive features (as "field") (Pike 1959).

A detailed account of the project of including other human activities in the same description is given in his book "Language in Relation to a Unified Theory of the Structure of Human Behavior" (I-II, 1954-5), and a brief review of the leading ideas is found in his paper "Toward a Theory of the Structure of Human Behavior" (1956). Here he writes that it is his thesis "that every purposeful activity of man is structured, and that certain basic characteristics are common to every such activity, so that it should be possible to develop a theory and a technique which would pass without jar from the study of the structure of one kind of activity of man to that of any other kind. Ideally, this would result in one basic theory of structure, one basic set of terms,⁶ and one basic methodology which could be applied to the analysis of language, the analysis of ritual behavior, the analysis of sports, the analysis of occupational activity, or even the processes of thought itself" (1956, p. 659). This has a strong resemblance to proposals which have been made by Saussure, by the philosopher Cassirer, by the glossematians, and, more recently, by the French semiologists: namely that linguistics should constitute part of a general semiological science. Pike could also have been dealt with in a special chapter, but he is, after all, strongly influenced by Bloomfield, for instance in his behaviouristic attitude and particularly in his phonological analysis. I have therefore found it most practical to discuss him together with the post-Bloomfieldians and to account for his diverging views in the separate sections of this chapter.

Pike's chief contribution to phonology was made in the field of prosody. "Tone Languages" (1947b) and "The Intonation of American English" (1946) both contribute significantly to prosodic theory, and at the same time they contain an abundance of concrete observations. Furthermore Pike is a brilliant teacher and a fascinating personality, and also in this way he has exerted great influence.

6. On the basis of the distinction: "phonemics"/"phonetics" he has, for instance, coined the more general terms "emics" and "etics".

The procedures of phonemic analysis mentioned in Gleason's textbook (1955) are chiefly based on Pike.

In spite of many differences, a number of features unite these linguists in one post-Bloomfieldian "school". In the following their approaches to various phonological problems are discussed, and finally the important common characteristics will be summed up.

PHONETICS AND PHONOLOGY (PHONEMICS)

6.10 On p. 78 of "Language" Bloomfield states: "The study of significant speech sounds is phonology or practical phonetics". The addition of "or practical phonetics" is rather strange (on p. 93, however, it is mentioned that a new language is learned more easily once the distinctive differences have been established).⁷ It is noticeable that under the heading "Types of Phonemes" a phonetic description of various oppositions is presented, whereas under "Phonetic Structure" the structural (syntagmatic) description of phonemes is dealt with. Thus Bloomfield did not always make a sharp terminological distinction between phonetics and phonology, but he emphasized that the important thing about language is not the way it sounds; what matters is the way the sounds are used to distinguish meanings.

After Bloomfield a terminological change takes place: most American linguists begin to use the term "phonemics" about the functional discipline (the terms "phonemic" and "phonemics" are natural choices when prosodic units are also called phonemes). "Phonology", on the other hand, refers to the whole science of expression, i.e. phonetics plus phonemics. This change implies a clearer distinction between phonemics and phonetics; they are not, however, regarded as two completely different branches of science, as in the Prague School, but as levels in a hierarchy. Phonemics is based on phonetics, it is a classification of phonetic data. Pike expresses this in the following statement: "Phonetics gathers raw material, phonemics cooks it" (1947a, p. 57). It should be added, however, that a certain tendency to regard phonetics as partly outside the scope of linguistics, or as a marginal linguistic discipline, is also found (cf. Trager 1950 and Hockett 1955, p. 14).

THE DEFINITION OF THE PHONEME⁸

THE PHONEME AS A PHYSICAL UNIT

6.11 To BLOOMFIELD the phoneme was a PHYSICAL unit, that part of a sound which recurs in all its occurrences and which distinguishes it from all others ("a minimum same of vocal feature", cf. 6.2).

7. Later on in "Language" (p. 127) "practical phonetics" refers to the practical acquisition of pronunciation and is characterized as "a skill".

8. See also L. R. Palmer (1972, pp. 79-82).

THE PHONEME AS A FICTITIOUS UNIT

6.12 Bloomfield's physical definition of the phoneme is criticized by TWADDELL (1935, pp. 17-24), who points out that such constant physical features have not been found experimentally (this objection also applies to Jones's definition of the phoneme as a family of sounds, i.e. of physical entities); the psychological definition is also rejected, but Twaddell does not go into details as regards the later functional definition given by the Prague School, which he considers a variety of the psychological definition. He himself sees phonemes as "ABSTRACTIONAL FICTITIOUS UNITS", and he establishes them in the following way:

First word lists of the type *pill, till, kill, bill*, etc. are set up, which are characterized as classes of minimally different phonological forms, since they differ only by one "fraction". The terms of such minimal phonological differences are called MICROPHONEMES; in the list mentioned above the initial segments are therefore microphonemes. The same applies to the final segments of *nap, gnat, knack, nab*, etc. The lists *pill, till, kill, bill* and *nap, gnat, knack, nab* are called "similarly ordered", i.e. the phonetic differences between the words in the two lists are similar and in one-to-one correspondence: the difference between *pill* and *till* is similar to the difference between *nap* and *gnat* etc. *p* in *pill* may now be joined with *p* in *nap*, *t* in *till* with *t* in *gnat* etc., and the resulting units are called MACROPHONEMES (or simply phonemes). "The sum of all similarly ordered terms (microphonemes) of similar minimum phonological differences among forms is called a macrophoneme" (p. 48). It is a necessary prerequisite that the microphonemes in question really do occur in completely similarly ordered lists. In English, for example, there are fewer vowels before *r* than before other consonants (cp. *bite, beet, bait, bet, bat, bot, bought, boat* with *pyre, pier, pair, par, pour*). The vowels before *r* cannot be joined with those occurring before other consonants, and consequently they constitute separate (macro)phonemes. In this way Twaddell arrives at a far larger number of phonemes than other phonologists, but he points out that this is only unfortunate if the purpose of the analysis is a simple system of transcription. "For me, the phoneme is a unit defined for a convenient description of phonological relations" (p. 54). He emphasizes that his macrophonemes are not positive additive units; it is not possible to say that a word consists of such and such phonemes. The phoneme is an "abstractional, fictitious unit" which is negatively and relationally determined, and in this connection he quotes Saussure ("dans la langue il n'y a que des différences sans termes positifs").

Twaddell's monograph did not attract much attention in the U.S.A., although it was reviewed by Swadesh (1935). By and large American linguists continued to count on constant physical differences.

THE PHONEME AS A CLASS

6.13 BLOCH (1948) also takes constant physical features for granted; to him, however, it is not the feature which constitutes the phoneme, but the CLASS of sounds containing the feature. Altogether this conception of the phoneme as a class prevails among Bloomfield's successors, who in this respect are in agreement with Jones. But the criteria employed for the establishment of such classes vary somewhat (cf. 6.18-6.24 below). BLOCH and TRAGER (1942, p. 40) propose the following definition: "A phoneme is a class of phonetically similar sounds, contrasting and mutually exclusive with all similar classes in the language". HOCKETT and PIKE also talk about classes, but they hesitate to offer any real definition. Pike calls the phoneme "a significant sound unit", but prefers to account for further particulars in purely operational terms: the significant sound unit is the one reached by means of the established procedures. Hockett ventures several different definitions, of which the following is the last (1958, p. 26): "The phonemes of a language, then, are the elements which stand in contrast with each other in the phonological system of the language"; the difference from other phonemes is the decisive factor.

The difference from other phonemes was also emphasized in CHAO's definition of 1934 (RL 1958, pp. 39-40): "A phoneme is one of an exhaustive list of classes of sounds in a language, such that every word in the language can be given as an ordered series of one or more of these classes and such that two different words which are not considered as having the same pronunciation differ in the order or in the constituency of the classes which make up the word".

THE PHONEME AS A PURELY LOGICAL SYMBOL

6.14 HARRIS (1951, p. 35) also uses the term class to designate the phoneme: "The classes, or phonemes, are thus a derived (but one-one) representation for the phonemic distinctions". But he adds that phonemes are highly abstract units and should be regarded as "PURELY LOGICAL SYMBOLS, upon which various operations of mathematical logic can be performed" (p. 18). Harris thus arrived at a conception of phonemes which in many respects is similar to the one advanced by Twaddell in 1935. Harris's formulation provoked, however, much more attention and contradiction.

THE PROBLEM OF NON-UNIQUENESS

6.15 It is possible to maintain, as do Jakobson-Halle (1956, bibl. to ch. 8) that as long as the conception of the phoneme as a fiction only means that any scientific concept is a fiction (or a construction), then it is simply a question of

philosophical attitude, which need not affect phonemic analysis. But it becomes problematic if it is concluded that there is no fixed correlation with the physical units and that a sound may be subsumed under any of several phonemes arbitrarily. And this was precisely the conclusion drawn by Harris. In several places he points out that the analysis may be performed in various ways according to the purpose (e.g. pp. 9 and 72). Chao (1934) also maintained that sounds may be grouped into phonemes in more than one way. This view is rejected by both McQuown (1952) and Householder (1952). McQuown writes that "if phonemics is merely what the linguist does to the data, it is no more than an interesting game. If, on the other hand, it is the way the data structure for the bearer of the culture, then again it is not immaterial which grouping is chosen" (p. 496). He compares Harris's attitude to the one which anthropologists call the "culture-of-the-informant-be-damned-approach", and he is of the opinion that an analysis should be attempted which harmonizes with the speaker's intuition. Householder characterizes the analysis performed by Harris as "hocus-pocus linguistics", deriving from the view that only the data are given and that the structure is the work of the linguist. At the other extreme so-called "God's truth-linguists" assume that language *has* a structure, which it is the linguist's task to uncover. The difference between these two views is probably largely metaphysical, but it leads to greater or lesser respect for phonetic facts. Pike is clearly a "God's truth-linguist". To him not only the structure of the language, but also its particular phonemes are existing linguistic facts (1947a, p. 57), which the linguist is under the obligation of finding. He admits that with our present knowledge alternative analyses are sometimes possible; but there is only one which is correct. Hockett shares this view: "A language is what it is, it has the structure it has, whether studied by the linguist or not" (1948, p. 271). The criterion of correctness of an analysis is whether possible new sentences of a language can be predicted. Probably the truth is somewhere in between these extreme views. There may be areas in which more freedom of interpretation is possible than in others. J. Lotz once said that micro-phonemes are created by God, whereas macrophonemes are the work of linguists. There are certain contrasts which must be recognized in any description.

ONE OR MORE SYSTEMS IN A LANGUAGE

OVERALL PATTERN AND COMMON CORE

6.16 A question which has often come up in American linguistics is whether a language can be described on the basis of one system only.

It is evident that there are many differences between the various types of American English, both as regards the number of phonemes and their distribution in different words, and naturally this applies to an even greater extent to English as a whole. It was difficulties of this type which made Jones restrict his phoneme

analysis to one person's pronunciation in one particular style. Similarly Bloomfield (1935) confines his description of American English to the Chicago dialect, but he mentions that there are two subtypes according to whether the vowels in *hot* and *father* are kept apart or not. Bloch (1948) distinguishes between IDIOLECT (one person's language in one particular style) and dialect (a class of idiolects with the same phonological system). Trager and Smith (1951, p. 9ff) are of the opinion that it is insufficient to describe an idiolect, since there are always at least two persons involved in a speech situation. Their aim is to describe the system of English as a whole, and consequently to include all the distinctions made in any type of English in their analysis. The system which they set up, therefore, contains more "distinctive" units than are found in the speech of any single person (according to their analysis there are thirty-six different vowels and diphthongs, most of which, however, are subsequently reduced to phoneme combinations). The number of possible combinations is, for example, higher when dialects both with and without post-vocalic *r* are included. What is involved, therefore, is a system which is not realized anywhere, and it seems doubtful whether it is justifiable to speak about a system in this case. Trager and Smith refer to such an abstraction as an "OVERALL PATTERN". Hockett (1958, p. 331ff) believes that the description of an "overall pattern" is useful, but he also mentions another possibility: namely, to describe the distinctions which are common to all idiolects, and he characterizes this as "the COMMON CORE of the idiolects". In French, then, the opposition *a/u* belongs to the "overall pattern" but not to the "common core". Finally, it is also possible to content oneself with describing the separate dialects and then comparing them afterwards.

COEXISTING PHONEMIC SYSTEMS

6.17 The problem is somewhat different in the case of languages which have adopted a large number of loan words entailing new phonological distinctions (this is the situation in many Amerindian languages). The question is whether such a language should be described as consisting of two or more systems, or whether the entire vocabulary should be included under one system. FRIES and PIKE (1949) are of the opinion that first all of the material must be described as belonging to one system, but then more systems may be isolated on the basis of phonetic and distributional data as well as native reaction (evidenced, for one thing, by the way the natives write their language). As an example they mention Mazateco, where [t] and [d] are variants of one phoneme in native words, and where the variant occurring after *n* is [d]. Now the word *siento* (hundred), which has been borrowed from Spanish (*ciento*), is pronounced with a [t]; and in this way a contrast between *t* and *d* has been introduced. Nevertheless, native speakers still react to these two sounds as if they were variants, and consequently such loanwords must be assumed to belong to a separate system. Harris (1951, p. 9) also regards such a distinction as possible, whereas HAUGEN (1950) considers it

impossible to sort out loanwords except on historical grounds. Synchronically he claims that there is only one system and a continuous spectrum of more or less common phoneme combinations. BLOCH (1950) inclines to the same opinion in theory, but in his description of Japanese he nevertheless excludes certain features as foreign. Probably this problem cannot be solved once and for all. The possibility of setting up two systems must depend on how sharply the two parts of the vocabulary differ in the language under investigation (cf. the discussion of "peripheral phonemes" in the Prague School, 3.18 above).

ESTABLISHMENT OF PHONEME INVENTORIES

TERMINOLOGICAL REMARKS

6.18 Nearly all members of the Bloomfield School follow Bloomfield in using the term "phoneme" both about phonemes in the European sense (consonants and vowels) and about prosodic units (stress, tone, and sometimes quantity), but they do not employ his terminology. Whereas Bloomfield spoke about "primary phonemes" and "secondary phonemes", his successors operate with "SEGMENTAL PHONEMES" and "SUPRASEGMENTAL PHONEMES". Only Hockett (1955) follows the European tradition in this respect.

Variants are normally called "ALLOPHONES" by the Bloomfield School, although the term "variant" is sometimes used when distinguishing between "free" and "positional" variants, of which the latter are said to be in "COMPLEMENTARY DISTRIBUTION". "Allophone", however, does not mean exactly the same as "variant", since only those variants which are clearly distinguishable from a perceptual point of view are considered allophones. It is therefore possible to say that a phoneme has, for example, three allophones. Furthermore the term "allophone" sometimes refers simply to "speech sound", regardless of whether variants are involved or not. For example it is stated by Hockett (1958, p. 107) that "two allophones cannot represent the same phoneme if they stand in contrast". In such cases the usual practice is to talk about "phones". Haugen (1957) uses "allophone" for positional variant (this restriction is also made by other linguists) and "variphone" for free variant. Moreover, he introduces the term "diaphone" for the situations of interdialectal or interlinguistic communication. If a speaker identifies /ε/ and /e/ of a foreign dialect with /e/ of his own, they may be called diaphones of his /e/. (The terms "variphone" and "diaphone" are taken from Jones (see 4.4), but they are used in a somewhat different sense).

The phenomenon which in European phonology is most often termed "distinctive opposition" is usually called "CONTRAST" in the Bloomfield School, although some American linguists in recent years have begun to use "contrast" to designate syntagmatic opposition, e.g. between strong stress and following weak stress, and "opposition" to designate paradigmatic opposition (cf. 3.11 above).

As it is not usual to perform a distinctive feature analysis in the Bloomfield

School, or to go into details concerning the definition of phonemes on the basis of combinations, the establishment of phoneme inventories becomes a point of primary importance. Furthermore the fundamental principles laid down by the post-Bloomfieldians concerning the procedures for the establishment of such inventories are very characteristic. In the following only segmental phonemes will be dealt with, on the whole, since the principles involved are the same in the case of suprasegmental phonemes. Specific problems arising in the analysis of suprasegmental phonemes will be treated later.

CONTRAST VERSUS FREE VARIATION

6.19 All phonological theories want to reduce the endless number of sound shades to a strictly limited number of units which are relevant in the language in question. But the procedures used to obtain this end are not the same. Usually communicative function is a decisive criterion. In the Prague School, as well as in glossematics, the commutation test plays a central role, i.e. the method used for establishing the number of distinctive units in each position consists in replacing one sound by another and testing whether this change may bring about a change in meaning. The relation between sound and semantic content is thus considered important. Bloomfield also regarded the relation of sound to meaning as the decisive point. At the same time, however, he emphasized that it is extremely difficult to describe "meaning" scientifically, and his successors, who above all wanted to carry his idea of an exact, scientific type of linguistics into effect, attempted to exclude meaning altogether from linguistics and to base their analysis exclusively on syntagmatic relations. This, however, turned out to be very difficult as regards the sorting out of free variants, which by definition occur in the same environments. It was particularly HARRIS, HOCKETT, and BLOCH who attempted to get rid of meaning altogether. In the first place they pointed out (like Hjelmslev, incidentally) that it is not necessary to carry out any real semantic analysis. It is only necessary to know whether there is a semantic DIFFERENCE between the two words compared or not. As it is not permitted to find this difference through a semantic analysis, the only way is to ask native speakers. It is not necessary, however, to ask directly whether the meaning is the same or not. "In principle meaning need be involved only to the extent of determining what is repetition" (Harris 1951, p. 7). This can be done by means of a test. For example, one informant can be asked to say "She's just fainting" and "She's just feigning" several times and another to guess which of the sentences is spoken in each particular case. If his answers are correct in nearly one hundred per cent of the cases a "regular descriptive difference" is present, while if his guesses are only correct in approximately fifty per cent of the cases, there is no difference (p. 32). HOCKETT (1955, p. 144) proposes a similar test but attempts to evade meaning in a somewhat different way. He suggests that the informant should be asked not whether two words (or rather utterances) mean the same thing or not, but whether they *sound*

the same or not. It is obvious that Hockett's method implicitly presupposes that informants cannot distinguish among free variants. If they could do this, they would be capable of distinguishing between two versions of the same word; these would consequently be judged as "sounding" different, and in that case free variation and contrast could not be separated.⁹ Hockett also admits that it is difficult to find an informant who can understand what is meant by "sound the same or different", and perhaps this is not too surprising. Hockett's method further presupposes that the test words can be kept apart, either orthographically, by reference to objects, or in other ways.

An even more radical attempt was made by BLOCH, who tried to establish a method by which free variants can be distinguished from contrasting elements without the aid of informants, but simply by a DISTRIBUTIONAL ANALYSIS of a large amount of linguistic material. As his first version (1948) was criticized from various quarters, he worked out another (1953) where the following classification is made: the environments of two sounds may be either (1) "coincident" (i.e. exactly the same), (2) "complementary" (i.e. completely different), (3) "incorporating" (i.e. one of the sounds may occur in environments where the other cannot occur, but not vice versa), or (4) "overlapping" (i.e. they have certain environments in common but each may further occur in environments where the other cannot). If the ranges are incorporating or overlapping, and if the common environments cannot be distinguished from the environments which are specific to each of the sounds by a general definition, but only by a complete listing of all individual environments, then the two sounds are in contrast. Otherwise they are non-contrastive. Bloch gives no examples, but seems to rely on the assumption that languages do not normally utilize all the possible phoneme combinations in sign expressions. In English, for example, *i* and *e* occur in the same environments (*bit* - *bet*), but there are also environments where only *i* occurs (*spit*) and others where only *e* is found (*fence*). *i* and *e*, consequently, occur in environments which are only partially similar, and it is not possible to lay down any general rule as regards the absence of one of them since this is due to accidents of their utilization in sign expressions. It seems as if Bloch's method could be used in the case of languages like English and Danish.

It is very likely, however, that there are languages with very simple syllable and word structures which actually do utilize all the possible phoneme combinations, and in such cases Bloch's method is inapplicable. Here it is necessary to return to the formulation in his first paper, where "environment" implied whole sentences. Two different phonemes will not occur in exactly the same sentences ("He sold his house" is, for example, a normal sentence, but you would hardly hear sentences like "He gold his house" or "He cold his house" etc.). Free variants, on the other hand, will occur in exactly the same sentences if one

9. An experiment carried out with Spanish has shown that an informant was in fact able to identify free variants. When asked to repeat a word he would, however, frequently use another variant (H. Contreras and S. Saporta 1960).

waits long enough. HARRIS (1951, p. 7) entertains the same idea. In continuation of his statement concerning repetition quoted above he writes: "If we know that *life* and *rife* are not entirely repetitions of each other, we will then discover that they differ in distribution (and hence in "meaning"). It may be presumed that any two morphemes A and B having different meanings also differ somewhere in distribution: there are some environments in which one occurs and the other does not. Hence the phonemes or sound features which occur in A but not in B differ in distribution at least to that extent from those which occur in B but not in A". But environment understood in this very broad sense of the word (= sentences) is really a semantic phenomenon, as is also apparent from this quotation from Harris. It is meaning that determines in which environments *life* and *rife* may occur.

As mentioned above, Bloch's method is applicable to languages of a certain type, but it is tremendously laborious. Nor is Bloch of the opinion that it should be put into actual practice. He also uses the commutation test, but both he and Harris emphasize that this is only a short cut and theoretically unnecessary.

However, not all post-Bloomfieldians agreed with these endeavours to exclude "meaning" altogether. Pike (1947 a) as well as Haugen and Twaddell (1942) emphasized the importance of taking meaning into consideration.¹⁰

CONTRAST VERSUS COMPLEMENTARY DISTRIBUTION

6.20 Sounds which do not share any common environments are said to be in complementary distribution, but it is usually assumed (although it is not always stated expressly) that it is possible to give a relatively simple definition of the environments where the sounds in question occur (e.g. initially or finally, before front or back vowels, etc.). This condition is also part of BLOCH's possibility number two, "complementary distribution", in the paper quoted above. But in this way a fifth type is missing in his classification, namely one covering sounds which do not occur in the same environments in a broad sense (i.e. in words and sentences) but whose distribution cannot be accounted for by any simple rule. It is possible, for example, that in some language *f* and *b* are not found in exactly the same environment in words and sentences, but that no rule for their distribution can be found; and that furthermore no minimal pair with *f-b* can be discovered. The reason why Bloch did not include this possibility was presumably that it is not relevant to the problem of distinguishing between contrast and free variation. However, it is highly relevant to the problem of distinguishing between contrast and complementary distribution. For it is generally held, not only in the Bloomfield School but also in other phonological schools, that such sounds cannot be grouped together as bound variants of a single phoneme, but should be

10. A more detailed discussion of the attempts of the Bloomfield School to avoid the commutation test is given by Fischer-Jørgensen in "FRJ" (1956, pp. 140-51); see also Diderichsen 1958.

regarded as belonging to different phonemes. The argument which can be adduced in favour of this analysis is that it is less complex, since it would otherwise be necessary – when a simple distributional rule cannot be found – to give a list of all the words in which either of these variants is found. Furthermore, since occurrence in the same position cannot be precluded by any rule, the possibility must be taken into account that a new word providing a minimal contrast may come into existence, or that a minimal pair actually does exist, but has simply been overlooked. This situation is quite probable when the analysis is based upon a restricted vocabulary, or when the linguist has not yet mastered the language, as is often the case with Amerindian languages. As a matter of fact Pike (1947a) gives explicit rules concerning this situation in his analytical procedure one-A: “The phonemic separation of similar segments upon finding them in contrast in analogous environments” (p. 73 ff). Here he mentions that simplicity of description should be taken into consideration, but he also attaches importance to the phonetic argument that in order for the sounds to be recognized as variants of one phoneme it should be possible to explain the differences between them in terms of the influence of neighbouring sounds. Hockett formulates this condition even more strictly (1955, p. 156).

Minimal pairs, then, are considered useful as proofs of distinctive difference, but not necessary. It is a characteristic feature of many American phonological descriptions that far less importance is attached to the presentation of minimal pairs than is customary in the Prague School, for example, or in glossematics. This is clearly illustrated by Trager and Smith’s description of English (1951) and Harris’s description of Swahili (1951, p. 97 ff). However, in works of a more introductory nature, such as those of Gleason (1955) and Hockett (1958), more weight is attached to the presentation of commutation examples.¹¹

IDENTIFICATION OF SOUNDS IN COMPLEMENTARY DISTRIBUTION

Phonetic Similarity

6.21 As far as grouping sounds together in complementary distribution is concerned, the principal criterion for American structuralists, as also for Prague phonologists, is phonetic similarity. Bloomfield regarded this as so obvious that he did not even bother to discuss it (“a little practice will enable the observer

11. In Trager and Bloch (1941, p. 229), a strange argument is found. In English it is difficult to find minimal pairs with *ŋ* and *ʒ*. “But such a pair is easily supplied by the series *singer sitter letter leisure*”. It seems as if Trager and Bloch have borrowed this line of reasoning from Trubetzkoy (1939, p. 32), who maintains that *h* and *ŋ* in German are different phonemes since they both contrast with *p* (*hacken, packen, Ringe, Rippe*). He calls this “indirect opposition”. Jones (1950, p. 41) quotes Trager and Bloch’s example and supports their procedure. It is amazing that such a mistake has been passed on from one phonologist to another. In this way it would be possible to prove that all bound variants are in contrast, e.g. German *ç* and *x*: *rechen, retten, rotten, rochen*.

to recognize a phoneme . . .", cf. 6.4 above). To many of his successors also phonetic similarity was something quite evident which it was unnecessary to define. PIKE uses 'phonetic similarity' in a rather vague sense and states expressly that it is not possible to put forward any precise criterion concerning the degree of similarity required. Primarily, he makes use of this concept for a preliminary isolation of phonetic differences which should be investigated more closely. In "Phonemics" (1947a, p. 70) a schematic arrangement is given of different sound types, where the areas which are said to cover "suspicious pairs" are circled. For example: *p* and *b* constitute a suspicious pair, and also *p* and *f*, but not *p* and *m*. In both the vowel and consonant charts a number of intersecting circles of different sizes are drawn. Sounds which are inside small circles are more suspicious than those occurring only inside larger circles. Those sounds which are not circled by any common ring, e.g. *p* and *m*, *w* and *s*, need not be investigated at all, since they are never found to be variants of one phoneme. Actually this procedure is followed by most linguists, who normally do not waste their time finding minimal pairs with, for example, *w* and *s*. In practice Pike's use of the concept of phonetic similarity is made somewhat more precise, namely by his demand mentioned previously that the difference between two sounds in complementary distribution should be explicable in terms of the environments. As mentioned above this also applies to Hockett.

Bloch and Trager specify their demand for phonetic similarity in approximately the same way as Trubetzkoy: "Phonetically similar in the sense of sharing a feature of articulation absent from all other sounds" (1942, p. 42). The same is the case with Harris (1951, p. 64): "We may try to group segments into phonemes in such a way that all the segments of each phoneme represent sounds having some feature in common which is not represented by any segment of any other phoneme". Hockett (1955, p. 157) argues that the demand for common distinctive features is difficult to maintain, because a decomposition into features cannot always be performed with absolute certainty.

As mentioned above, HOCKETT requires that the phonetic differences between two bound variants should be attributable to the environments in a phonetically realistic way. If, for example, palatalized *k* is found before *i* and *e* (front vowels) and unpalatalized *k* before *u* and *o* (back vowels), they are in complementary distribution, and the differences are attributable to the surroundings. In this case the two *k*-sounds can be grouped together in one phoneme. But if palatalized *k* occurs before *i* and *a*, and non-palatalized *k* before *e* and *u*, the difference cannot be attributed to the environments. Although a rule concerning these environmental differences would be quite simple, it cannot be formulated generally in terms of classes of vowels (front/back, open/close, rounded/unrounded), and strictly speaking it is not correct to call this complementary distribution. These two factors – generality of rules and phonetic explanation – are therefore often bound up with each other.

Hockett further points out that it is possible to interpret the special phonetic

features of a variant as belonging to the environments. For example, the palatal feature of a *k* before a front vowel may be said to belong to the vowel. Hockett calls this a "method of redrawing boundaries" (1955, pp. 156-7), and he maintains that in this way all the members of a phoneme will be exactly alike and the concept of allophone can be dispensed with.¹²

Twaddell occupies a place apart by attaching less importance to phonetic similarity between sounds grouped together in one phoneme than to their occurrence in similarly ordered lists (cf. 6.12 above).

Pattern Congruity

6.22 Besides phonetic similarity the criterion of pattern congruity is of great importance to the Bloomfield School. Trubetzkoy adduces arguments of this type in his analysis of diphthongs and affricates; but on the whole, pattern congruity does not play a great part in Prague phonology, or for that matter in glossematics, and it is thus a peculiarity of the Bloomfield School. Apparently it is not due to Bloomfield himself, but it was formulated clearly by Swadesh already in 1934, and ultimately it can probably be traced back to Sapir's paper "Sound Patterns in Language" (1925, cf. Chapter 2). Chao (1934), who goes into some detail, mentions "simplicity or symmetry of phonetic pattern" as an important criterion in the establishment of phonemes. Trager and Bloch (1942) even include it in their phoneme definition: "The sound types constituting a phoneme must be phonetically similar, complementarily distributed and congruently patterned". It is of great importance to Pike (1947a, p. 116) and Harris (1951, p. 64ff), whereas it has been attacked by Haugen and Twaddell (1942) as bringing about completely arbitrary decisions. Bloch later (1948) became more cautious, and Hockett (1955, p. 158ff) has certain reservations.

The reason why some American phonologists have become uneasy about this criterion is probably that it is not always clear what pattern congruity covers, and how far to go in applying it. It is quite likely that a symmetry is thereby forced upon a language which does not follow from the established contrasts.

At any rate pattern congruity means at least three different things:

(1) SYMMETRY WITHIN THE PHONEME SYSTEM, i.e. the same distinctive difference is normally found in a number of pairs. If, for example, a contrast has been established between *p* and *b* and between *t* and *d*, it is permissible to regard *k* and *g* as separate phonemes even if this cannot be inferred with certainty from the data (Pike 1947a, p. 116). Pike, however, regards this as a point of secondary importance. A tendency towards symmetry is to be expected in a language, but this symmetry is never complete.

12. E. Uldall has drawn my attention to the fact that this analysis can only be applied to allophones which are due to coarticulation, not to those which are due to position in the syllable or the word, to stress etc. (for example, clear and dark *l* in English) or, in P. Ladefoged's terminology: it can be applied to "intrinsic", but not to "extrinsic" allophones.

(2) **PARALLEL PHONETIC VARIANTS** of phonemes in parallel environments. Trager and Smith (1951, pp. 19ff) emphasize that general rules of variation can be laid down for all vowels; for example, they are nasalized before nasal consonants, lengthened before voiced consonants etc. Harris (1951, p. 66) mentions, that this aim is the justification for grouping *p* with *ph* rather than with *th*. When *p* has been grouped with *ph*, *t* with *th*, and *k* with *kh*, a general rule concerning their variation can be given.

(3) **SIMILAR ENVIRONMENTS** of the different phonemes to the extent that this is possible (symmetry of environment). Trager and Smith thus analyse the English long vowels and diphthongs as short vowels followed by *j*, *w*, *h*, and (in certain dialects) *r*, with the result that all the established vowel phonemes occur before these consonants. In this way, furthermore, the distribution of *j*, *w*, *h*, and *r* agrees better with that of the remaining consonants (this analysis only applies to an overall pattern where all the English dialects are dealt with collectively). Harris mentions (1951, p. 70) that it is most expedient to interpret aspirated stops in English monophonematically, since there would otherwise have to be a rule according to which *h* occurs after *p*, *t*, *k*, but not after other consonants.

Pike (1947a, p. 131ff) relies heavily on this last aspect of pattern congruity, particularly when making decisions as regards the monophonematic versus polyphonematic interpretation of, for example, affricates, diphthongs and long vowels. In particular he counts on a parallelism in syllable structure and morpheme structure. If there are otherwise no consonant clusters, for example, affricates are interpreted as single phonemes. If open syllables do not occur elsewhere (i.e. CVC is the predominant syllable type), final diphthongs should be analysed as vowel plus consonant, and final nasalized vowels as vowel plus nasal consonant. Furthermore long vowels are interpreted as a combination of two short ones if they occur in the same environments as vowel clusters. Like Trubetzkoy, Pike also considers morpheme boundaries important to the analysis.

Underlying this approach there is an endeavour to simplify the rules of (1) combination of features, (2) distribution of variants, and (3) phoneme combination and syllable structure. However, a reduction of the number of phonemes is also a simplification. In glossematics a small phoneme inventory is considered the most important type of simplicity. In the Bloomfield School such a reduction is aimed at as well, for example by Trager and Smith and by Harris, who attempt to cut down the number of phonemes, but they weigh this against other forms of simplicity. Hockett is of the opinion that reduction of the number of phonemes is of secondary importance only (1955, p. 159ff).

It is obvious that the different types of simplicity may come into conflict, and particularly they may clash with the demand for phonetic similarity. It was therefore emphasized strongly by Chao, and later by Harris, that the sounds of a language may be grouped into phonemes in several ways ("non-uniqueness") (cf. 6.15 above).

REJECTION OF MORPHOLOGICAL CRITERIA IN PHONEMICS

6.23 In the Bloomfield School phonemics and morphology are considered two distinct structural layers. Phonemics, which is the lower layer, must be described first, and morphemes can then be described as combinations of phonemes. The analysis of morphemes thus presupposes the analysis of phonemes, but no morphological considerations may be introduced into phonemics, since this would create a vicious circle. For example, it is not allowed to take grammatical boundaries into account at the establishment of junctures (cf. 6.29 below), nor is it permitted to let the phonemic analysis be influenced by the aim that different variants of the same morpheme should be described as consisting of the same phonemes.

This aim plays a great role in glossematics, where e.g. French *petit-petite* [pti-ptit] is analysed as /pətit – pətitə/ and *bon-bonne* [bɔ̃-bɔ̃n] as /bɔ̃n – bɔ̃nə/ (in this way the stem is the same in the masculine and the feminine, and the feminine morpheme has the same expression, /ə/, in all cases). Sapir also sometimes operates with latent consonants and has found that such consonants have a psychological reality for the speakers (cf. Bibliography to Chapter 2, Sapir 1933). CHAO (1934, RL, p. 45) assumes that English *sore* has a latent *r* and that it differs from *saw* in having such a “conditional consonant” which appears under certain conditions. He also mentions that French *pas* [pa] may be interpreted as /paz/ because an [z] appears in cases of liaison, and he adds that such analyses are not advanced “purely for the pleasure of perversity” (p. 46).

But in the Bloomfield School the phonemic structure of morphemes, including alternations, is dealt with in a special discipline called “morphophonemics” (cf. 6.6 and 6.34–6.39), and in the phonemic analysis proper no reduction of morpheme variants is attempted. This is asserted by HOCKETT several times (1942, 1949), and also in “Manual” (1955) morphophonemics is kept apart. This separation is also demanded by Bloch (1941) and by Trager and Smith (1951, p. 54), whereas HARRIS is less dogmatic. He points out that by taking morphology into consideration in the phonemic analysis the description of morphemes can be simplified (1951, p. 76ff and p. 111). But such considerations are tentative and should not be allowed to complicate the phonemic analysis unduly. “If we wish to be completely orderly in our work, we would not recognize at this stage any criterion of morphemic identity, except as the personal intuition of the particular linguist” (1951, p. 89).

It is, according to Harris, more correct to return to phonemics when the morphemes have been established, and then revise the phoneme analysis, e.g. establish junctures in accordance with grammatical boundaries, and perhaps make new decisions in cases where several phonemic analyses are possible. A word like English *simple*, for example, may be analysed phonemically as /simpəl/ or /simpl/. The first solution results in less complex consonant clusters and is probably the one which will be preferred at the phonemic level. Later, however, it is discovered that the second solution brings about a less complex morphological

description (cf. the forms *simpler*, *simplest*) and therefore may be superior after all. "When so considered, our phonemes become the expression of two independent relations: primarily the phonemic relation of complementary distribution (plus free variation); secondarily the morphophonemic relation of substitutability in various members of a morpheme" (1951, pp. 233-4). The second analysis is more expedient with regard to orthography and morphological description. It is not difficult to understand that Harris's student Chomsky goes one step further and abolishes the boundary between the two disciplines.

Whereas Harris, although reluctantly, stays within these limits, PIKE protests emphatically against the sharp separation between phonemics and grammar (1947a, pp. 62-3, 90, 130; 1947d, 1952 and 1957). He does not consider phonemics and morphology two levels in one hierarchy, of which phonemics is the lower; instead (as mentioned in 6.9) he sets up three parallel hierarchies: a phonemic, a lexical and a grammatical. The units of these three hierarchies are interrelated in various ways, and one hierarchy cannot be analysed independently of the others. Pike demands that language should be studied as a whole, and that the relations between its different parts should continually be taken into consideration. Phonology and morphology should be analysed simultaneously and elucidate each other, and this also applies to field procedure. Pike does not, however, set up latent consonants in order to obtain greater similarity between different forms of the same word. He attaches too much importance to the possibility of immediate phonetic identification for that. But he emphasizes that morphological boundaries must be considered in the establishment of phonemes, and that prosodic phenomena and juncture especially cannot be described without doing this. This has been called "the Pike heresy".

THE BIUNIQUENESS CONDITION. NEUTRALIZATION AND OVERLAPPING

6.24 The BIUNIQUENESS condition states that it must be possible to infer which string of sounds corresponds to a given string of phonemes and, conversely, which string of phonemes corresponds to a given string of sounds, i.e. unambiguousness is demanded in both directions. This condition, like the one concerning separation of phonemics and morphemics, belongs to the post-Bloomfieldian period, and was first advanced by Bloch (1941). It is permissible to carry out an analysis resulting in partial overlapping, according to which a variant of one phoneme occurring in certain environments is phonetically identical with a variant of another phoneme in different environments. In Danish, for example, the realization of /æ/ after /r/ may be identical to the realization of /a/ after other consonants. But overlapping in the same position is "inadmissible". For example, Bloch (in contrast to Bloomfield) does not consider it permissible to identify [ə] in English with various other vowels, e.g. with /æ/ in *at home*, and with /e/ in *them*. Such an analysis is impracticable "because there can be nothing in the facts of pronunciation

– the only data relevant to phonemic analysis – to tell us which kind of *x* we are dealing with in any particular utterance” (Bloch 1941, p. 283). It will be seen that the biuniqueness condition is bound up with the condition that morphological considerations are inadmissible. It is not until the morphemes have been analysed, and it has been found that [ðem] and [ðəm] are variants of the same morpheme, that an argument for interpreting [ə] as a variant of /e/ is available. Hockett (1942 and 1955, p. 219) agrees with Bloch, and so does Harris (1951, p. 65). (Cf. Chomsky’s criticism 9.68.)

The treatment of NEUTRALIZATION is connected with these demands. Since the post-Bloomfieldians are much less interested in opposition than in the establishment of phoneme inventories, they feel no inclination to single out the cases where oppositions are suspended, nor to complicate the inventory with archiphonemes. Instead they subsume a given sound under a definite phoneme and simply operate with defective distribution in all cases. According to the Prague School, for example, there is neutralization between final /t/ and /d/ in German, whereas a member of the Bloomfield School would state that in final position /t/ occurs, whereas /d/ is absent, just as, for example, /h/ does not occur in final position. When choosing between /d/ and /t/, it is obvious that /t/ should be selected, since this is phonetically more realistic. To consider *das Rad* [ra:t] as ending in /d/ because of [ra:də] would be to mix in grammatical facts; such alternations should be dealt with by morphophonemics. This attitude is expressed quite clearly by nearly all the post-Bloomfieldians, e.g. Swadesh (1934), Harris (1941), Hockett (1942 and 1955, p. 165), Trager (1939), and Pike (1947a, p. 141). In cases of vacillating pronunciation, e.g. *t* and *d* alternately in final position, the sound in question should be identified with the phoneme it resembles most in each separate case (cf. Hockett 1942). There will then be a free interchange of two phonemes. Pike (1947a, p. 96) writes that “when, by contrast in identical environments, two segments are once proved to be phonemically separate, they must each be considered as phonemically distinct wherever they occur, regardless of the mechanical, arbitrary, or grammatical substitutions which they may undergo elsewhere”. It is this principle which has been called “once a phoneme, always a phoneme”.

Only Twaddell occupies a place apart by assuming that there are special phonemes in positions of neutralization (cf. 6.12), and in a late article (1969) Haugen adopts the concept of neutralization in the form of “phonemic indeterminacy”.

PHONEME COMBINATION AND SYLLABLE STRUCTURE

PHONEME COMBINATION

6.25 Considering the importance which Bloomfield attaches to the description of phoneme combinations, and to the definition of phonemes on this basis, the post-Bloomfieldians’ contribution within this area is quite modest. It is true that

in most concrete language descriptions by American structuralists an enumeration of the consonant clusters occurring initially, medially, and finally is found, but practically no one has attempted to give a distributional definition of the individual phonemes. The only exception is Trager (1939), who analysed the Polish phoneme system by means of structural sets, which are arranged in an elaborate diagram so that a partial correlation with phonetic classes is obtained. Incidentally, Trager takes morphophonemic facts into account, in spite of theoretical assurances to the contrary.

Nor have the Bloomfieldians made a great many contributions to the general problems involved in the description of phoneme combinations, such as which unit to select as basic (syllable, morpheme etc.), how to distinguish between structural rules and accidental gaps etc. Particularly in the early period, when the problem of the phoneme inventory itself was apparently paramount, such contributions are very scarce. Once again, however, Twaddell (1938a) constitutes an exception by carrying out an interesting analysis of German consonant clusters, and in so doing he attempts to determine syllable boundaries on the basis of the structural rules of initial and final clusters. Many years later Saporta and D. Olson (1958) discussed the same problems with reference to Spanish, but apparently Twaddell's paper was unknown to them. A fairly early contribution was also made by Whorf (1940, reprinted in 1950 and 1956), who attempted to give a diagrammatic account of monosyllabic words in English. Harris devotes only six pages to this problem in his extensive treatise (1951, p. 150-5), but nevertheless he gives a very clear diagrammatic representation of initial clusters in English. The most interesting contributions, however, are due to Pike and particularly Hockett.

SYLLABLE STRUCTURE

6.26 Most post-Bloomfieldians select the "utterance" as the unit in relation to which combinations are described. Many of them do not recognize the syllable (or the word) as a phonemic unit, and this complicates the description of combinations. At the same time, however, the term "syllabic" is used, but it is not defined.

PIKE (1947a) attempts to tackle this problem. He makes a distinction between PHONETIC and PHONEMIC SYLLABLES. The phonetic syllable is defined as containing one "chest pulse" and one peak of sonority. The phonemic syllable is characterized as the basic structural unit which serves best as a point of reference for describing the distribution of the phonemes in the language" in question (p. 144). However, this frame of reference may vary according to the language involved. It may be "a unit of actual or potential stress placement, or tone placement, or intonation placement, or rhythmic grouping, or of morpheme structure. In general (but by no means exclusively), a phonemic syllable tends to be constituted of a single phonetic syllable" (p. 60). Stress units or tone units

are frequently suitable for the purpose. As a particularly striking example of disagreement between phonetic and phonemic syllables Pike mentions the word [ɲdā:] in the Mixteco language. Both phonetically and phonemically it is disyllabic, but whereas the syllable separation is [ɲ-dā:] phonetically, it is /nda-a/ phonemically. Mixteco is a tone language, where each syllable has a tone, but [ɲ] has no tone, and *nd-* is one complex phoneme (there are otherwise no consonant clusters). Moreover long vowels behave like two short ones and have two tones, and all normal words are disyllabic. In this particular case the long [a:] has "level tone", but has to be decomposed into two short /a/s, each with level tone. The phonemic form must therefore be /nda-a/ (p. 146). Haugen (1956) criticizes Pike on various points, but in actual fact he endorses Pike's more general definition by suggesting that the syllable should be defined as "the smallest unit of recurrent phonemic sequences" (p. 216).

In "Immediate Constituents in Mazateco Syllables" (1947) K. L. Pike and E. Pike attempt to apply syntactic analytical principles to the syllable. The term "immediate constituent" is taken over from Bloomfield and refers to elements which are directly related to each other. By an IC-ANALYSIS, as it is frequently called, a sentence is divided into progressively smaller parts, and in this way a hierarchy of immediate constituents emerges. In a sentence like *Peter's big brother goes to school* the first cut should be made after *brother*, after that *Peter's big brother* should be divided into *Peter's* and *big brother* etc. Such an analysis may be indicated by parentheses, e.g. ((*Peter's* (*big brother*)) (*goes* (*to school*))). As another example the noun phrase (*a* (((*very poorly*) *dressed*) (*little girl*))) may be mentioned. In most constructions some elements are subordinated to others, e.g. *big* in relation to *brother*, since the latter word may occur alone with the same function as the whole construction. Such an analysis is often based on a more or less intuitive conception of the connections between the elements of a sentence. However, it is also possible to establish certain criteria, for example that there should be relatively great freedom of combination at the place where the cut is made. In the sentence mentioned above, *Peter's big brother* may be replaced by many other units (for example by a single word) having the same relation to the rest of the sentence. In a parallel way Pike now analyses the Mazateco syllable *ncʔoai*³⁻⁴, where 3-4 indicates a tonal glide in the vowel cluster, as *n - - c - ʔ - - - o - a - - i - - - 3-4*. (Pike's vertical bars have here been replaced by dashes. The number of the dashes indicates the degree of cohesion; the smaller the number, the higher the degree of cohesion). In a parenthesis notation this would be (*n(cʔ)((o*a*)i)3-4*). It will be seen that the first cut is made between the initial consonant group (the margin) and the rest (the nucleus). Here there is great freedom of combination, and phenomena like tone and nasality extend across a whole vowel cluster, but not across a preceding consonant cluster. The next cut is made between the tonal glide and the vowel cluster, and within the latter a division is made between *oa* and *i*, since there is always a morpheme boundary before the last of three consecutive vowels, and since it is pronounced more weakly. Within the consonant

cluster the first segment is separated from the others and considered subordinate, because it is phonetically weak, and because there is less possibility of variation in this position. This approach also enables Pike to give a more satisfactory account of diphthongs in those cases where there is uncertainty as regards a mono- or polyphonematic interpretation. Frequently the possibilities of commutation will point toward interpreting them as combinations of two phonemes, whereas pattern congruity makes it more plausible to regard them as single phonemes, because they enter into the same combinations as single vowels. In such cases Pike uses the term "close knit nucleus". Such a nucleus may also consist of a vowel plus glottal stop.

In accordance with the distinction between phonetic and phonemic syllables Pike also makes a distinction between phonetic and phonemic vowels and consonants. The former are called VOCOIDS and CONTOIDS, and the latter VOWELS and CONSONANTS. Vocooids and contooids are defined on a physiological basis. Vowels and consonants are defined as the two main distributionally determined classes of phonemes. For a particular language the vowels comprise that one of the two classes whose members are most frequently syllabic and which is largely made up of vocooids, and the consonants comprise that one of the two classes whose members function most frequently as nonsyllabics, and which is largely, but not exclusively, made up of contooids (1947a, pp. 235 and 254). This distinction has been taken over by various other linguists, for instance Hockett and Hjelmslev.

HOCKETT (1955, pp. 51ff and 150ff) proceeds along the same lines as Pike, but he is also somewhat influenced by discussions of the same problems in European linguistics (he quotes Hjelmslev, Kurylowicz and others in his notes). He does not give any definition of the syllable, but he describes it as containing a PEAK, which may be preceded by an ONSET and followed by a CODA (onset and coda are MARGINS). The peak is defined as containing a vocoid, or a tone, or by means of vocoid and stress, or by vocoid and duration; a peak may be simple (consist of a single vocoid) or complex (consist of a vocoid cluster). In words with more than one syllable an intervocalic cluster is termed INTERLUDE, unless it contains a juncture internally.

An English word like *scrimp* consists of the onset *skr-*, the peak *i*, and the coda *-mp*. The first IC cut is made between onset and peak, i.e. *skr-imp*, since there is more freedom of combination between onset and peak than between peak and coda. Onset is here subordinate to peak plus coda because the latter may occur alone, i.e. without any onset. The dominant unit (*-imp*) is termed NUCLEUS, and the subordinate unit (*skr-*) SATELLITE. Subsequently *imp* is divided into *i* and *mp*. This brings about greater freedom of combination than the cut *im-p* as well as greater homogeneity of constituents. A peak may be subdivided in a similar way: for example, *i* in *ai* may be considered the satellite of *a*, and if a nasalized vowel (e.g. *ã*) is interpreted as vowel plus *n* (e.g. *an*), the vowel may be described as the peak and *n* as the satellite, and it hereby differs from the ordinary combination *an*, where *n* is a coda.

English diphthongs are complex peaks which have the same possibilities of combination as simple vocoids. There are also, however, languages where diphthongs have the same possibilities of combination as a vocoid followed by a contoid (where *ai* parallels *au* and *ar*, for example), and in such cases the second element of the diphthong is regarded as belonging to the coda.

The phonemes of a language may now be classified according to their possibilities of constituting a peak (nucleus or satellite) or a margin. A **VOWEL** is defined as a phoneme occurring as peak nucleus, a **CONSONANT** as a phoneme occurring as margin, whereas phonemes occurring both as peak nucleus and as peak satellites are called semivowels, and phonemes occurring both as peak satellites and as margin are called semiconsonants. Further classifications can be made on the basis of possibilities of combinations, approximately in the way suggested by Bloomfield. Hockett gives some examples on p. 92 ff.

JUNCTURE

GENERAL REMARKS

6.27 "Juncture" is a concept which is very important to the post-Bloomfieldians. It corresponds approximately to Trubetzkoy's aphonematic boundary signals, which mark divisions between phonemes by certain phonetic modifications of the surrounding segments. This concept is of greater importance in the Bloomfield School, however, because the analysis is here based on whole utterances, whereas it is based on words only in the Prague School. If the primary object of the analysis is to establish the phonological differences which distinguish word meanings, modifications relating to whole sentences may be temporarily disregarded, and it will suffice to add a supplementary description of boundary signals. But if the analysis proceeds from sentences, such variations are relevant even for the preliminary operations. Bloomfield, like Trubetzkoy, was mainly interested in the phonological differences which are distinctive in words, and Hockett points out that in this respect there is an important difference between Bloomfield himself and the post-Bloomfieldians. This is due to the fact that whereas Bloomfield drew a sharp line between morphology (which deals with the word) and syntax, his successors were of the opinion that the most clear-cut division goes between phonology on one hand and grammar and lexicon on the other (Hockett 1968, p. 25 ff).

TYPES OF JUNCTURE

6.28 The concept of juncture seems to have been introduced by **TRAGER** and **BLOCH** (1941), who point out that special variants are often found initially and finally in a sentence. Initially (after a pause) there are clearly aspirated stops, increasing loudness etc.; and finally (before a pause) vowels and voiced consonants are lengthened, stops are frequently unexploded etc. These phenomena are

comprised under the designation OPEN JUNCTURE, which is defined as "the totality of phonetic features which characterize the segmental and suprasegmental phonemes at the beginning and at the end of an isolated utterance" (1941, p. 225). If such variations were only found initially and finally in sentences, they would contribute to marking utterance boundaries (EXTERNAL OPEN JUNCTURE), but they would have no bearing on the analysis of the utterance itself. However, similar variations often occur within sentences. For example, the phonetic transitions are different in *syntax* and *tin-tax*, *minus* and *slyness*, *nitrate*, *night-rate* and *dye-trade*, *a name* and *an aim*, and these differences are phonologically relevant. The simplest solution is to assume that there are two different phonological junctures, CLOSE JUNCTURE and INTERNAL OPEN JUNCTURE (the word "juncture" alone is frequently used referring to open juncture). The difference between *nitrate* and *night-rate* is a difference between close and open internal juncture, the one between *night-rate* and *dye-trade* a difference in the placing of internal open juncture. An alternative solution would be to establish two different *ai*-phonemes, one relatively short (*nitrate*) and the other relatively long (*dye-trade*), as well as two different *t*-phonemes, one weakly aspirated (*night-rate*) and the other more strongly aspirated (*dye-trade*, *nitrate*), or possibly two *r*-phonemes, one voiced (*night-rate*) and the other unvoiced (*nitrate*, *dye-trade*). This approach, however, would increase the number of phonemes unduly.

MOULTON (1947) has given an interesting description of German where by the aid of juncture he avoids establishing ζ and x as separate phonemes (cf. the examples *Kuhchen* [ku- ζ ən] and *Kuchen* [ku: x ən]). In this way he furthermore avoids setting up the hard attack as a separate phoneme (cf. *Arbeiter suchen* and *Arbeit ersuchen*, where *er* in the last example is preceded by [ʔ]).

In TRAGER and SMITH's description of English (1951) the concept of juncture is extended. Here three different types of external open juncture are proposed, which are manifested by three different terminal intonations: level, rising, and falling. These tonal differences are not described, then, as three types of intonation, but as three modifications of the end of an intonation contour, indicating three different transitions to what follows: i.e. they are considered junctures. These three "terminal junctures" are symbolized with /, // and # respectively and accordingly called SINGLE-BAR, DOUBLE-BAR, and DOUBLE-CROSS juncture, a terminology which is frequently used in American linguistics. Internal open juncture is indicated by the symbol + and is often termed "plus-juncture".

In his description of syllable types HOCKETT gives examples of languages with "syllable juncture". In Cantonese, for example, there is a difference between *an-a*, *a-na*, and *a-n-a*. A medial cluster which does not contain any juncture is called an interlude (see 6.26 above), e.g. *nitrate*, *subscribe*, *asking*. If it does contain a juncture, it is divided into coda + onset (e.g. *night-rate* [nayt-reyt]). By comparison with occurring codas and onsets it is sometimes possible to divide an interlude at a definite point. The interlude in *subscribe* can, for instance, be divided only into *b* + *skr* because *bskr-* does not occur initially, and neither *-bs* nor *-bsk* occur

finally (only *ps* and *bz* are found). In such cases the syllable division is quite clear, whereas it is indeterminate in *asking* (since both *-sk*, *sk-*, *-s*, and *k-* occur). But even if the syllable division is clear, the cluster cannot, according to Hockett, be interpreted as coda + onset. This interpretation requires a juncture.

THE NATURE OF JUNCTURE

6.29 Juncture is normally considered a phoneme, but the peculiar thing about this phoneme is that it is constituted by a class of phonetically highly heterogeneous features, and in this particular case the criterion of phonetic similarity has to be given up. HARRIS gets round this by considering juncture a kind of "zero-phoneme", which in itself has no phonetic manifestation, but which affects the surrounding sounds in various ways (1951, p. 81). This is rejected by Hockett as "a most unfortunate and misleading kind of hocus-pocus" (1955, p. 172). According to him junctures must involve phonetic material which can be identified. Furthermore he considers it more expedient to attribute the phonetic features in question to the juncture than to regard them as variations of the surrounding vowels and consonants, since this results in a simpler phonetic description of the phonemes involved. This approach is on a par with Hockett's proposal that the difference between sounds in complementary distribution should be attributed to the environments, with the result that the same "phone" will be found in different environments (1955, p. 156, cf. also 6.21 above). But it is open to discussion whether Harris's method entails more "hocus-pocus" than Hockett's. A third possibility of interpretation is to regard juncture as a pause (cf. Pike's treatment of intonation in 6.30), but the difficulty connected with this solution is that such a pause is usually only potential (and this only in open juncture).

HOCKETT emphasizes that juncture phonemes are not established in order to show grammatical boundaries, such as word boundaries. They will often coincide with them, but it is both possible to have juncture without grammatical boundary (e.g. *Pla+to*) and a grammatical boundary without juncture (e.g. *find her*, which is frequently pronounced like *funder* in English). Harris likewise points out that junctures and grammatical boundaries need not coincide, but at the same time he writes that "the great importance of junctures lies in the fact that they can be so placed as to indicate various morphological boundaries" (1951, p. 87). Junctures belong under the phonemic analysis, but when the morphemes of a language have been established, it is permissible to return to phonemics and make certain junctural revisions on the basis of the discovered morpheme boundaries.

PIKE, on the other hand, regards junctures as phonological-grammatical boundary phenomena (1947a, p. 160ff and 1947d). According to him it is impractical to call them phonemes, since their variants do not share common phonetic features, and since furthermore the phonetic differences involved are so slight that they frequently cannot even be demonstrated. Pike's conception of juncture seems to be the more fruitful one. In the description of segmental phonemes

(vowels and consonants) it is possible to keep phonology and grammar apart. In the case of juncture, however, a sharp distinction leads to artificial descriptions. In actual practice nearly all phonologists base their junctural analysis on grammatical boundaries. Normally it is a question of grammatical boundaries which may or may not manifest themselves phonetically, i.e. junctures are optional phenomena.¹³

SUPRASEGMENTAL PHONEMES

6.30 As mentioned above suprasegmental phonemes correspond to the prosodic phenomena of the Prague School; i.e. they include **STRESS**, **TONE**, **INTONATION** and (often) **LENGTH**.

In an early paper by Trager (1941) a classification of stress, tone, and length is proposed, according to which it is possible to distinguish both between different degrees and between different movements (contours). Stress may be loud, medium, or soft, tone high, middle, or low, and length long, medium, or short. Moreover, both stress and tone can be rising, level, or falling, and correspondingly length may be staccato, normal, or drawling. The Norwegian and Swedish word tones are interpreted as rising and falling stress.

Swadesh (1937) discusses the interpretation of long consonants. If they do not contrast with the corresponding short consonants, they are, of course, merely variants; but if they do contrast at least in some positions, they are interpreted either as sequences of like phonemes or as unit consonants, according to the criterion of pattern congruity.

Later length is normally excluded from suprasegmental phonology. In Trager and Bloch's description of English (1941), long vowels are interpreted as a vowel followed by *j*, *w*, or *h*. Hockett (1955) usually regards long vowels as a combination of two segmental phonemes, for example as two vowels, as a vowel plus a "covowel" (indicated by a dot), as a vowel plus *j* or *w* etc. In some cases, however, he is of the opinion that length should be considered accentual, i.e. suprasegmental (p. 76ff). Also Pike frequently interprets long vowels as two short ones, but nevertheless he includes length among the suprasegmental units on the basis of a purely phonetic distinction between qualitative and quantitative phenomena.

In their description of English Trager and Bloch (1941) give a detailed description of **STRESS**. Four phonemic degrees of stress are set up, loud ('), reduced loud (^) – which presupposes a preceding internal open juncture –, medium (') and weak, and to this must be added contrastive stress. A frequently quoted example illustrating these differences is *élevàtor-ôperàtor*. Haugen and Twaddell (1942) criticized the establishment of these four stresses as arbitrary^{13a}, but although

13. Ilse Lehiste (1960) contains a very useful survey of the different concepts of juncture.

13a. cf. also the important paper by Newman (1946), which had escaped my notice.

their criticism seems justified, the analysis was retained in "An Outline of English Structure" (Trager and Smith 1951) and subsequently generally accepted. It was not until 1956 that this type of stress analysis was radically changed by Chomsky, Halle, and Lukoff in a paper ushering in generative phonology (cf. 9.44).

The most important contributions to the analysis of suprasegmental features are due to PIKE and concern TONE and INTONATION. In "Tone Languages" (1948) Pike gives a detailed description of languages of this type; he defines them as having lexically significant pitch on each syllable (by this rather narrow definition, consequently, languages like Lithuanian and Serbo-Croatian, which do not have significant pitch on all syllables, are excluded). A distinction is made between register systems and contour systems. In pure register systems there are only "level tonemes", but there are also some register systems where, in addition to "level tonemes", tones gliding from one level to another occur; these may, however, be decomposed into two level tonemes with an intervening non-significant glide. If such an analysis of the glides is not possible, the language in question is considered to have a contour system, i.e. a system with undissolved glides (Pike's description thus differs from that of Roman Jakobson, who always decomposes glides (cf. Chapter 8)). The book provides moreover excellent instructions for the analysis of tone languages, and by way of illustration Pike examines two very different tone languages, Mixteco and Mazateco, the first of which is characterized by a number of tonal assimilations and alternations.

In "The Intonation of American English" (1945) Pike proposes a new type of intonation analysis, whereby a stretch of intonation is decomposed into a small number of pitch phonemes (pitch levels) with mechanically intervening glides. The same hypothesis, incidentally, was advanced independently by Wells (1945) almost simultaneously.¹⁴ The largest unit in Pike's analysis is the "rhythm unit", which corresponds to what is called "intonation group" or "tune" in British studies of intonation. A rhythm unit is followed by a "pause", but there are two different types of pause: final pause, which effects a lowering of the preceding tones, and tentative pause, which sustains the tone level. In the case of tentative pause no real interval is necessary if only the final sound segments are lengthened. What is involved, therefore, is really a kind of juncture. If two pauses were not assumed to exist, it would be necessary to introduce a fifth, extra low, tone level instead.

A rhythm unit is divided into "contours", which in actual practice are stress groups, and these contours are subdivided into the pitch levels mentioned above. The levels are symbolized by numerals from 1 to 4, where 1 stands for the highest and 4 for the lowest pitch. The contours may be falling, rising, falling-rising, rising-falling, or level. It is only necessary to mark the pitch level at the beginning and end of a contour and, in the case of more complex contours, at the point where there is a change in direction. The contours carry meanings, although of

14. At an even earlier date Harris (1944) used the numbers from zero to three in order to represent intonation patterns, but he regards the whole contour as one long component.

a highly general nature, and they therefore constitute some kind of intonation morphemes. For example, the common 2-4 contour indicates "moderate contrastive pointing"; 3-4 is gentler and contains an element of "detachment"; the rising contours signify incompleteness, and if they rise to level 1 they furthermore express surprise or politeness. It will be seen that from a semantic point of view this is something of a jumble. The pitch levels, on the other hand, are intonation phonemes without any semantic content, and naturally the reduction of fundamental tone units to four levels constitutes a real descriptive simplification. This four level analysis, which also from a pedagogical point of view works nicely for American English (although less well for British English), has been accepted by almost all American linguists, and it is used by Trager and Smith, for example, in their study of English (1951). Their description, however, differs from that of Pike by including three terminal junctures in addition to the four pitch levels (cf. 6.28), and by excluding the contours, which are considered to belong under morphology.

It is somewhat confusing that Pike counts pitch levels downwards, whereas Trager and Smith, and Gleason begin from the bottom, i.e. use the number 1 to indicate the lowest pitch. Hockett has modified Trager and Smith's analysis somewhat in his book on phonology (1955, p. 45).

DWIGHT D. BOLINGER forms an exception to the general acceptance of the phonemic function of the four pitch levels. He maintains that it is the movement of pitch which carries the meaning (1951). Moreover, he emphasizes the interrelation between pitch and stress. He makes a terminological distinction between (1) "accent" (also called "pitch accent") corresponding to what is generally called sentence stress (i.e. the relative prominence of a word in the sentence) and (2) "stress" corresponding to what is generally called word stress, and he has demonstrated experimentally (1958) that "accent" is manifested phonetically by pitch prominence (i.e. a quick rise or fall in pitch). A stressed syllable of a word is the one that gets the accent if the word is important enough to get one, i.e. it is a potential carrier of pitch accent (see also 1964). He is also opposed to the general distinction between emotional and intellectual accent and intonation, and his papers abound with fine descriptions of individual examples from American English.

COMPONENTIAL ANALYSIS

6.31 As mentioned in 6.5, Bloomfield rejected the distinctive feature analysis of the Prague School, and also arrangements in systems on this basis, as purely phonetic. Similarly, most of his successors have abstained from such an analysis and considered the phoneme the minimal unit. There are, however, two exceptions, viz. Harris and Hockett.

HARRIS (1944, 1945 and 1951, p. 125ff), who is the more original of the two, analyses strings of phonemes into so-called LONG COMPONENTS. This type of

analysis is generally accepted as regards tone and stress, but Harris extends it so that it covers many other features as well, such as voicing and nasality. This method has considerable resemblance to the one employed in the prosodic school (cf. Chapter 5), which Harris, however, does not seem to be familiar with. What is common, for example, is that those features which are isolated as long components are not regarded as belonging to a new analytical level (as they are by Jakobson), but as being on a par with the phonemes proper. There are, however, also important differences. Whereas the adherents of the prosodic school analyse each position in a chain separately and do not establish a general inventory, Harris generalizes his componential analysis from one position to another, e.g. from initial to final position. Furthermore he pays much less attention to phonetic facts than is customary in the Firth School.

The purpose of Harris's analysis is a simplification, both as regards the number of elements and as regards distribution rules. These two aims frequently clash (for instance, a decomposition of Danish *p* into *bh* results in very complex combinations), but Harris attempts to attain both ends simultaneously by basing the reduction of phonemes on distributional facts. In many languages, for example, obstruent clusters will be either exclusively unvoiced or exclusively voiced, i.e. *sp* and *zb* may be found, but not *sb* and *zp*. In such cases it is most economical to regard either voicing or unvoicing (Harris chooses the latter) as a long component which extends across two phonemes. According to this analysis *sp* may be regarded as *zb* plus unvoicing, and if this approach is generalized all the unvoiced obstruents can be dispensed with. On the other hand it is necessary to state the length of the sequence to which the unvoicing component applies. It is also common that nasal consonants are of limited distribution, for example in such a way that the only nasal stop clusters are *mp*, *nt*, and *ŋk*. Here the features "labial", "dental", and "velar" may be extracted and considered long components, with the result that the cluster in all three cases is nasal plus stop.

In his paper on Navaho (1945) Harris reduces the inventory established by Hoiijer, partly by reinterpreting a number of phonemes as combinations of successive phonemes, and partly by extracting certain features as long components. The long vowels are regarded as combinations of two short ones, and nasalized vowels as oral vowels followed by *n*; in this way the number of vowels is cut down from sixteen to four. Unvoiced consonants are interpreted as voiced consonants plus *h*, and stops as other consonants plus a "stop making component" symbolized by *d*. Sibilants articulated with the blade of the tongue (*f*, *ʒ*, *tʃ*) are decomposed into sibilants produced with the tip of the tongue (*s*, *z*, *ts*) plus tongue blade articulation, indicated by the symbol \sim . The justification of this analysis is that in a given Navaho word only sibilants of one or the other of these two types occur. ^{68 = 38}, therefore, is a long component which applies to a whole word, whose phonetic value is laminal articulation when applied to *s*, *z*, *ts* and zero in the case of other sound segments. In this way Harris manages to reduce the number of consonants from thirty-six to eleven.

In "Methods" (1951, p. 136ff) Harris analyses Swahili along these lines and ends up with four, highly abstract components, which he marks —, ---, ~~~, and /. Of these symbols the dash line normally indicates unvoicing (it separates *k* from *g* and *t* from *d*, for example), but in the case of *l*, where there is no need for unvoicing, it represents laterality, and when applied to vowels it represents backness.

The advantage of this method is that it brings about a reduction in the inventory and also in the number of distributional rules, since these new components occur in more positions than the traditional phonemes. Furthermore phonemes are redefined in such a way that they are only distinguished in those positions where they are really distinctively opposed to each other. But Harris's approach does not lend itself to an easily legible notation, and a component does not represent a unique phonetic feature.

At a very early point HOCKETT (1942) entertained the idea of decomposing phonemes into distinctive features, and he mentions that it is possible to regard unvoicing as a suprasegmental feature in a cluster like *pt* in English. In his description of Sierra Populca (1947a) he attempts a feature decomposition of the phonemes and writes these features in columns. Labial closure is marked with *p*, oral articulation with *O*, unvoicing with *H*, voicing with *V*, and nasality with *N*. *p*, *b* and *m*, for example, are represented in the following way:

/p/	/b/	/m/
P	P	P
O	O	N
H	V	V

In running speech it is sufficient to write a line if a feature continues unchanged in the next segment. Hockett compares this transcription to musical notation.

In "Manual" (1955, p. 126ff) Hockett first gives examples of a feature analysis which bears a strong resemblance to that of Roman Jakobson (see Chapter 8) and which is arranged in a matrix with pluses and minuses. However, the features which Hockett sets up are more traditionally phonetic, and he operates with more than two members in the case of place of articulation and degree of openness. After that he attempts another arrangement, in which the various articulatory organs are represented vertically and the phonemes horizontally, and where it is indicated at each intersection whether the articulator involved produces a stop, a fricative stricture etc. Each articulator, furthermore, is given a limited number of possibilities; the glottis, for example, only those of closure and voicing (when neither appears, the glottis is quiescent), the lips only closure and rounding, the blade of the tongue six different articulations.

Hockett (1955, p. 166) also follows the Prague School in distinguishing between marked and unmarked members of an opposition. He considers a member unmarked if it has more freedom of distribution or greater phonetic variation. In

Russian, for example, *p* constitutes the unmarked member of the *p* : *b* opposition because only *p* occurs finally.

TYPOLOGY

6.32 One of the main objectives of the Prague School was to establish general laws about phonemic systems through descriptions of a large number of languages. This, however, does not really appeal to American structuralists, who normally shun generalizations. Once again HOCKETT, who is clearly influenced by the Prague School, constitutes an exception. "Manual" (1955, pp. 42-142) contains a description of phonological systems in several languages. Syllable structure, vowel systems, and consonant systems are treated separately. Vowel systems are arranged in triangles and quadrangles as they were by Trubetzkoy. As regards consonants Hockett contemplates the possibility of establishing a typology on the basis of distributionally defined classes, but he has to give up this approach as entailing too many complications. Instead an arrangement based on distinctive oppositions is proposed, i.e. according to the same principle as in vowel classification, but with a division into subsystems. First he gives several examples of "obstruent systems" (stops and fricatives), then of "sonorant systems" (semi-vowels, nasals, laterals and vibrants); laryngeals are also dealt with separately. Furthermore each subsystem is arranged as a symmetrical set, often obtained by excluding some of the so-called "leftovers" (these, incidentally, may also form smaller symmetrical sets). This method, however, frequently results in ambiguities. For example, the Latin obstruents /*p t k b d g f s*/ cannot all be arranged in one symmetrical set because there is no fricative corresponding to *k* and *g*. Therefore some phonemes must be excluded as "leftovers", and this can be done in two ways: either with $\begin{matrix} p & t & k \\ b & d & g \end{matrix}$ as a symmetrical set and /*f s*/ as leftovers, or with

$\begin{matrix} p & t \\ b & d \end{matrix}$

as a symmetrical set and /*k g f s*/ as leftovers. Thus great importance is attached to symmetry.

This procedure has the disadvantage, however, that only parts of a system are presented at a time, and that the holes are not clearly recognizable.

Hockett, like Trubetzkoy, also describes certain general tendencies; for example, there are seldom more open than close vowels in the horizontal dimension; there are rarely less than three or more than four points of articulation in the case of stops; if only one nasal is found in a language it is normally *n*, etc.

DIACHRONIC PHONOLOGY

6.33 The Prague phonologists were greatly interested in language history and in studying language change from a structural point of view (sec 3.16-3.18), and

particularly Roman Jakobson and Martinet contributed significantly to diachronic phonology. In the Bloomfield School there has been less interest in this subject, and only few important new views have been advanced. BLOOMFIELD himself, it is true, was very interested in sound change and dealt with this subject in great detail in "Language" (1933, p. 346ff). His description, however, is quite traditional. Like Saussure he restricts the structural approach to the synchronic aspect of language, and he endorses the neogrammarians' concept of sound change as being purely phonetically conditioned, mechanical processes, whose regularity is only affected by borrowing and analogy. This view is largely maintained by HOCKETT as late as 1965 in the paper "Sound Change". Like Bloomfield, Hockett considers the normal variability of pronunciation, which leads to "drift of allophones", i.e. gradual sound change, the principal cause of sound change.

It should be mentioned, however, that A. HILL (1936) at a very early date, and apparently without knowing Jakobson's works, made a distinction between phonetic and phonemic changes, and in the latter category he furthermore distinguished between merger of phonemes, emergence of new phonemes, and changes in the distribution of phonemes in words. Also at a relatively early time Twaddell described German sound history from a phonological point of view. In a short paper on umlaut (1938b) he points out that the absence of umlaut indication in Old High German is simply due to the convention that only phonemes and not variants are normally distinguished in orthographical systems, and as long as the weakly stressed *i* effecting the umlaut (e.g. **sunī* > *synī*) was still present, the umlaut vowel is only a variant (in the example mentioned [y] is a variant of /u/ before /i/).

The most comprehensive theoretical contributions are due to HOENIGSWALD, who partly in a short paper (1946), and partly in his book "Language Change and Linguistic Reconstruction" (1960), gives a systematic survey of different types of phonemic change. While the paper is easily comprehensible, the book is quite difficult to understand, in part because the diagrams illustrating the various types of change are very complicated.

The distinction between phonological and phonetic change is not drawn in the same way by Hoenigswald and Hill as by Jakobson, since Jakobson's "re-phonologization" (for example the Armenian and Germanic consonant shifts) is regarded by the Americans as a purely phonetic change. The reason for this is that neither the rise of new phonemes nor a new distribution of phonemes in words is involved, but only a change in the distinctive features, and the American structuralists base their analysis on phonemes, not on distinctive features. Hoenigswald's classification of the various types of change differs from that of Jakobson mainly in the importance he attaches to the process rather than to the result. Therefore Hoenigswald does not set up phonologization and de-phonologization as principal classes, but instead makes a primary distinction between (conditioned and unconditional) SPLIT and MERGER. Furthermore he introduces a distinction between PRIMARY and SECONDARY SPLIT, a separation which is made already

in his paper 1946, although the terminology is only found in his book (1960). By primary split he means a cleavage by which some of the variants of a phoneme become part of another phoneme. An example of this is that intervocalic *s* changes into *r* in Latin, while *s* remains unchanged in other positions, i.e. *s* is split up into *s* and *r*. By secondary split he means a cleavage which is due to a merger of the environments or to a loss. The latter may be called merger between a sound and zero. An example is English *θ* and *ð*, which are normally supposed to have been bound variants in early Middle English, *ð* occurring between vowels and *θ* in other positions. Through the loss of weak final vowels both these sounds came to occur finally, and thereby the difference was phonologized. Only in the case of secondary split, then, does a phonologization take place (cf. also the examples in 3.16). Conditioned merger and primary split are dealt with by Jakobson under the heading "Change in the Stock of Phoneme Combinations".

Hoenigswald points out that conditioned merger often results in alternations. For example, the merger of unvoiced and voiced final stops in German brings about alternations like *bunde* – *bunt*. On the basis of such alternations it is possible to make inferences about the earlier stages of a language, and this approach is called the method of internal reconstruction.

In the main both Hill and Hoenigswald concentrate on a purely descriptive account of the various types of change. However, Hill mentions that an imminent merger may provoke a reaction so that the distance between the phonemes is increased if the distinction is important in the language, and Hoenigswald refers to low functional load and a tendency towards symmetry as possible causes of change. They are thereby opposed to Bloomfield, who rejected teleological explanations of language change.

MOULTON's article "Types of Phonemic Change" (1967) is largely based on Jakobson's work, although part of Hoenigswald's terminology has been taken over. It is very clearly written and must be characterized as the best survey available of the different types of phonological change. Moulton has written several other interesting papers on these problems, but these belong clearly to the Jakobson and Martinet tradition.

MORPHOPHONEMICS

MORPHOPHONEMICS AND PHONEMICS

6.34 As mentioned in 6.23, it is an important dogma in the Bloomfield School that no morphological considerations are permitted in phonemic analysis; there should be no "mixing of levels". This claim may seem somewhat strange since morphology (morphemics) also belongs to the plane of expression (in glossematic terminology), at any rate according to the view of many post-Bloomfieldians, e.g. Bloch and Harris, who want to keep meaning out of grammar. But the reason

is that the analysis should proceed from the smallest units, the phonemes, to the larger units, the morphemes, and the introduction of morphemic considerations at the level of phonemics might lead to circularity of definitions. Alternations have therefore no place in American phonemics. They belong to morphophonemics, which is considered to be a morphological discipline and should be kept strictly apart from phonemics. It is, nevertheless, included in the present chapter, for the sake of comparison with other phonological theories which take morphophonemic facts into account (for example Baudouin de Courtenay, 2.4), generative phonology (Chapter 9) and (partly) the Moscow School (11.8–11.13).

MORPHEMES AND MORPHEME ALTERNANTS

6.35 Morphemes¹⁵ are minimal meaning-carrying linguistic forms and to Bloomfield a morpheme is composed of phonemes, e.g. *bag* is composed of the phonemes *b-a-g*, and the forms *nayf* and *nayv-* (in *knife-knives*) must consequently be two different morphemes (see 6.6). Harris proposed to call such forms as *nayf* and *nayv-* MORPHEME ALTERNANTS (in 1951 he uses the term morpheme segments). Two or more alternants which have the same meaning and are in complementary distribution are grouped together into a single MORPHEME UNIT. Hockett (1947b) introduced the term MORPH for morpheme alternant, and designated the morpheme units as morphemes. Morphs belonging to the same morpheme were subsequently (Nida 1948) called ALLOMORPHS of that morpheme. Thus a close terminological analogy to phonemics was established. Allomorphs are members of the same morpheme just as allophones are members of the same phoneme. The procedure by which morphemes are established is also parallel to the procedure in phonemic analysis. An utterance is first segmented into morphs, i.e. minimal meaning-carrying units; morphs which are in complementary distribution and have the same meaning (or, according to Harris 1951, the same total environment) are grouped into the same morpheme; they need not be phonetically similar. As mentioned above *nayf* and *nayv-* are members of the same morpheme, and this is also true of the plural endings *-s* and *-en* and of *go* and *went*, to take an extreme example. An allomorph is thus a variant of a morpheme occurring in certain positions.

The segmentation into morphs is often evident; for example, the English word *wonderfully* is analysed into three morphs: *wonder-* *ful-* *ly*. But it is not always

15. It is rather confusing that the term "morpheme" is used differently in different schools and even within the same school. In the Prague School and in generative grammar it designates a minimal sign. In the Bloomfield School it is also sometimes used for a minimal sign, but sometimes in a more restricted sense for a minimal sign expression (by those who want to exclude meaning from grammar), or even (Hockett 1955, p. 16) for a minimal sign content. Martinet uses the term "moneme" for the minimal sign, and "morpheme" for monemes with a grammatical function ("Elements of General Linguistics" 1960, 1.9). Hjelmslev (see 7.19 below) and L. R. Palmer (1972, p. 104), finally, use it for a content unit with grammatical function.

so simple. Bloomfield ("Language", pp. 215-16) had already drawn attention to the existence of zero-alternants and substitution-alternants. Hockett (1947b) gives a more detailed analysis of these more complicated types of alternations. Like Bloomfield he sets up ZERO-MORPHS, such as the number morpheme in the English plural *sheep*, or the tense morpheme in the preterite *cut*. Conversely it may be necessary to operate with EMPTY MORPHS, i.e. units which do not carry meaning: Hockett (1947b) mentions that in the Fox language an *i* is inserted between a morph ending in a consonant and a following morph beginning with a consonant. This was earlier called an epenthetic vowel, whereas Bloomfield and Hjelmslev call it a connective.¹⁶ There are furthermore special problems connected with what Hockett calls PORTMANTEAU MORPHS, also termed "overlapping morphs". Examples of this are French *au* (= *à le*) and inflectional suffixes in older Indo-European languages (e.g. *-o* in Latin *amo*, which indicates both person and number, and *-us* in Latin *dominus*, which expresses gender, number, and case). Forms like *take-took*, *sing-sang*, and *man-men*, which have been discussed frequently in American linguistics, also raise problems. The most common approach is to assume that preterite and plural are here expressed by a REPLACIVE MORPH, which in the case of, for example, *man-men* is characterized by removal of *a* and insertion of *e* (Bloomfield (cf. 6.6), Nida 1948, Harris 1951, p. 167ff). Others prefer to say that there is a zero-morph in *men*, and that *a-e* is an alternation, i.e. *man* and *men* are allomorphs of the same root morpheme (Bloch, quoted by Nida); and still others (e.g. Hockett 1947b) are of the opinion that there is only one morph in *men*, but that it belongs to two different morphemes (*man* and *s*).¹⁷ A number of special types of morphs are found, then: zero-morphs, empty morphs, overlapping morphs and replacive morphs.

Morphology deals with the structure of morphemes and with their classifications from various points of view, particularly their possibilities of combination. A good deal of traditional morphology and syntax is therefore included in this discipline.

THE SCOPE OF MORPHOPHONEMICS

6.36 Morphophonemics constitutes part of morphology, but it is not a well-defined part. Sometimes the term is used referring to everything dealing with the phonological form of sign-expressions, as by Swadesh (1934), who uses the term "morphonology", by Hockett (1942) and by Trager and Smith (1951). Trager and Smith state explicitly that morphophonemics covers the registration of all morphemes in a language as well as a description of their phonological structure

16. Later Hockett gave up the term "empty morph" and preferred to talk of "non-morphemic phoneme sequences".

17. This is a rather odd formulation. On the whole, the discussion of allomorphs in the Bloomfield School suffers from the vacillating conception of the morpheme. (See the criticism by L. R. Palmer 1972, pp. 128-32).

(phoneme combinations, stress, intonation, juncture etc.) and an account of all allomorphs.

Others regard morphophonemics more narrowly as describing alternations, as for example Bloch and Pike. The latter divides the subject further into phonomechanics and tonomechanics. Hockett shares this restricted outlook in a paper of 1950, but later he returns to the more comprehensive definition. Bloomfield defines it even more narrowly as dealing with internal sandhi (cf. 6.6). Finally, morphophonemics is used to refer to a particular method of describing alternations, viz. the one consisting in setting up morphophonemes. This is approximately the way Harris uses it in "Methods" (1951).

At any rate the description of ALTERNATIONS constitutes a central part of morphophonemics and has been dealt with in great detail, whereas the principles which may be employed in a description of morpheme structure (in terms of phoneme combinations) has received less attention.

DIFFERENT TYPES OF ALTERNATIONS

6.37 HOCKETT (1958, p. 277ff) gives a survey of different TYPES OF ALTERNATIONS:

(1) They may, with a term borrowed from Indian grammar, be divided into INTERNAL and EXTERNAL SANDHI. External sandhi refers to alternations which take place at word boundaries in sentences: e.g., the alternation between the variants *a* and *an* of the indefinite article in English according to whether the following word begins with a consonant or a vowel, the alternation in French between voiced and unvoiced consonant in phrases like *une robe jaune* and *une robe courte*, etc. Internal sandhi refers to alternations within words, such as the one between *f* and *v* in English *wife-wives*.

(2) An alternation may be REGULAR or IRREGULAR. For example, the English plural alternation between /-s/, /-z/, and /-əz/ is regular, whereas the alternation between the forms (/s, -z, -əz/) and /-ən/ (*oxen*) is irregular.

(3) An alternation may be PHONEMICALLY or MORPHEMICALLY conditioned. For example, the alternation /-s, -z, -əz/ just mentioned is phonemically conditioned, since /-əz/ occurs after sibilants, /-s/ after unvoiced sounds, and /-z/ elsewhere; also the alternation between the indefinite articles *a* and *an* is phonemically conditioned, the former occurring before a consonant and the latter before a vowel. On the other hand, the alternation /f-v/ in *wife-wives* is morphemically conditioned, since it only takes place in certain morphemes, e.g. *knife-knives*, *leaf-leaves*, but not in others, e.g. *fife-fifes*, *cave-caves*.

(4) Finally, a distinction may be drawn between AUTOMATIC and NON-AUTOMATIC alternations. The alternation between the forms of the indefinite article *a* and *an* is non-automatic, since it only applies to this word – it is otherwise phonemically possible to have /a/ before vowels or /an/ before consonants. If, on

the other hand, a vowel is always dropped before another vowel (Hockett mentions such an example from Fox), it is an automatic alternation. Also the alternation between /p/ and /b/, /t/ and /d/, and /k/ and /g/ in German, e.g. /ra:də - ra:t/, is automatic. Only phonemically conditioned alternations may be automatic.¹⁸

By means of somewhat different classificational criteria HARRIS (1951, p. 208ff) makes a distinction between alternations which are conditioned either by the alternating unit itself, by the environments, or by both these factors. In examples like *opaque-opacity*, *electric-electricity* the environments are decisive, since the *k-s* alternation is conditioned by the morpheme *-ity*. In the example *a-an* the alternant itself is the conditioning factor. In *wife-wives* it is both the alternant itself and the environments which are decisive, since this alternation is restricted to certain stems only (cf. *five-fifes*) and furthermore it only occurs before the plural suffix (not before a genitive suffix, for example *wife's*).

DESCRIPTION BY MEANS OF ALLOMORPHS OR UNDERLYING FORMS

6.38 These ALTERNATIONS may now be described in various ways. In the first place the different alternants may be regarded as ALLOMORPHS of the same morpheme, occurring under different conditions, but considered to be on the same level.

Another method consists in setting up one of the alternants as a basic or "UNDERLYING" FORM and then deriving the others from this form by means of morphophonemic rules. This method was preferred by BLOOMFIELD (cf. 6.6), whose description in "Language" (1933, pp. 210-19) is still the best introduction to this technique; the same method is used by Swadesh, Pike, Nida, and Hockett. PIKE hardly touches on morphophonemics in his book "Phonemics" (1947a), but in "Tone Languages" (1947b) he deals in detail with "tonal perturbation" (also termed "tonal sandhi", "tonal substitution", and "tonomechanics"), which is described as shifts from one toneme to another which are caused by a purely mechanical interaction of the tonemes in a specific context. By way of illustration he analyses tonal perturbation in Mixteco and Mazateco, and here he operates with basic forms which are modified under the influence of surrounding tonemes.

According to Pike the main criterion in selecting a basic form is "predictability of description". In agreement with Bloomfield (cf. 6.6) he selects as basic that tonemic pattern "which will most easily allow for the statement of rules predicting how tones will be perturbed elsewhere" (1947b p. 75). NIDA (1948, RL I, p. 262) mentions three more specific criteria: (1) "Parallel structure", i.e. a solution is chosen on the analogy of other unquestionable cases. As an example he mentions

18. Hockett's terminology differs somewhat from that used by e.g. Bloomfield (cf. 6.6 above) and Wells (1949). Types (2) and (3) in Hockett's typology of alternations correspond to types (3) and (2) respectively in Bloomfield's typology mentioned in 6.6.

that it is most reasonable to select /-əz/ as the basic form of the English plural morpheme, because this morpheme varies in a way parallel to the verb *is*, which has the variants /-s, -z, -ɪz/, and whose basic form can only be /ɪz/ (Nida here follows Bloomfield). (2) "General patterns of morphophonemic change", i.e. the basic form should be selected in such a way that the other forms can be derived from it by means of well-known phonological processes, such as palatalization, assimilation, reduction etc. Since it is easier to explain loss than emergence of new sounds, one should furthermore select full forms and explain the reduced forms against this background. Once again the example /-əz/ may be mentioned. Implicit in this criterion there is an insistence on phonetic plausibility, which goes beyond Bloomfield's demand for simplicity of rules, and which is not found in the works of Harris or Hockett either. (3) "Limitation of distribution", i.e. that form should be considered basic which occurs in most environments, and rules should then be set up to take care of those which occur in more specific environments. HOCKETT (1958, p. 282) gives the same rule, although in a somewhat different form. He demands that in the case of automatic alternations that form should be selected as basic which occurs in environments where all the different alternants would be possible according to the rules of phoneme combinations. In this way he arrives at the conclusion that /-z/ must be the basic form of the English plural morpheme, since it occurs after vowels, and since /-z/, /-s/, and /-əz/ are all possible in this environment (*seize, cease, ideas*).¹⁹ Rules may then be given as to the environments in which the other forms occur. This solution seems preferable to Nida's, but even on the basis of his own formulation of the third criterion, Nida would have to give up /-əz/ as the basic form.

Hockett points out (1947b and 1958, p. 282) that it is sometimes necessary to set up a "theoretical" base form. As an example he mentions some Latin stem alternations, *ars-artis, re:ks-re:gis, noks-noktis, niks-ni:twis*, and he then proceeds to select the roots *art-, re:g-, nokt-, nigw-* as underlying forms. On the basis of these base forms plus the endings *-s* (nominative) and *-is* (genitive), and by means of the general rules of phoneme combinations in Latin, it is possible to derive the actually occurring forms: the final clusters *rts, gs, kts* and *gws* are not possible in Latin and they are therefore reduced or assimilated in voicing; nor is the medial cluster *gw* possible, and *igw* is therefore simplified to long *i* + *w*. Whereas *art-, re:g-* and *nokt-* actually do occur, e.g. in the genitives, *nigw-* is a theoretical form, but it is supported by verb forms like *ninguit*.

In the last example Hockett has gone beyond the mere derivation of one form from another. *nigw* is a non-existent phonemic form, i.e. a purely morphophonemic form has been established. Hockett, however, does not use this terminology, though Bloomfield, in his paper on "Menomini Morphophonemics" (1939) had already set up special MORPHOPHONEMES.

19. Hockett and Nida identify the vowel in the plural ending as /ə/, Bloomfield as respectively /ə/ and /ɪ/ in the American and British editions of "Language".

Swadesh also (1934, RL, p. 37) operates with morphophonemes and points out that *f* in *cuff* is morphologically different from *f* in *leaf*, although they are phonemically identical, because only the latter alternates with *v*.

Harris mentions that Bloomfield establishes a definite DESCRIPTIVE ORDER when several alternations are combined. In Menomini, for example, *n* is changed into *s* before *e* and *y*, and a final vowel is dropped. Corresponding to plural *o:nan* ('canoes'), the morphophonemic singular form is *o:n-e*, and by means of the two rules this is changed into the phonemic form *o:s*. But the rules should be applied in the order mentioned above, for if the final vowel *-e* is dropped first, *n* cannot be changed into *s*. Harris adds, however, that it would also be possible to avoid a fixed rule order by stating that *-e* is lost finally, and that *n* turns into *s* before a morphophonemic *e* or *y*, and applying the rules simultaneously. Wells (1949) discusses similar problems.

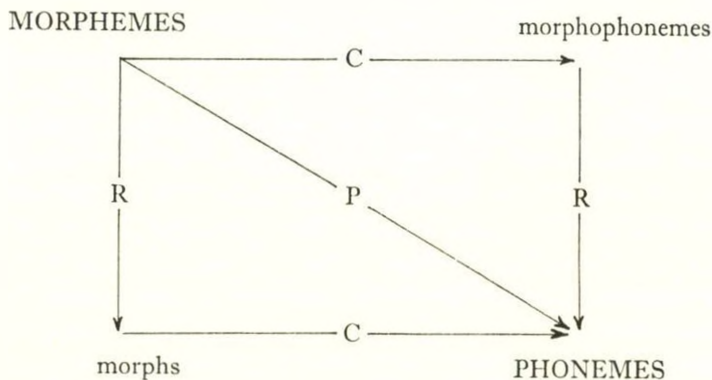
THE STATUS OF THE MORPHOPHONEME

6.39 HARRIS (1951) wishes to describe the structure of morphemes in such a way that all alternants consist of the same elements. The phonemes should be replaced by new elements which will permit this. "We group together into one morphophoneme the phonemes which replace each other in corresponding parts of the various members of a morpheme" (p. 224). In the case of purely phonemically defined alternations it is not necessary to represent these morphophonemes with special symbols, since both the morphemes and the environments may be identified by means of the phonemes. Nor are special symbols necessary if the environments consist of a small number of morphemes. For example, the alternation *k-s* in English is found before *-ity*, and it may therefore be defined as a morphophoneme which belongs to this environment. But in the case of morphemically conditioned alternations, such as *knife-knives*, it is necessary to have a special symbol, e.g. *F*. The notation *nayF* indicates that an alternation with *v* occurs, whereas *fayf*, for example, indicates that there is no such alternation in this form. In *nayF*, then, *F* is a morphophoneme which is represented by the phoneme /f/ in certain positions and by the phoneme /v/ in others. It should be pointed out that all the segments in *nayF* are morphophonemes (p. 362). Each morpheme is considered to consist of a number of morphophonemes, which in their turn are classes of phonemes, but when such a class contains only one phoneme, the morphophoneme may be represented by means of the usual phoneme symbol. It is always possible to infer which phoneme corresponds to a given morphophoneme, but not vice versa. On the basis of the phoneme string *nayf*, for example, it is impossible to decide whether *f* alternates with *v* or not, but in the other direction safe rules may be laid down.

LOUNSBURY (1953) argues that the status of morphophonemes is somewhat dubious. Sapir and Swadesh considered them as psychological realities. Harris

characterizes them as classes of phonemes, and Bloomfield and Hockett regard them as fictions, set up in order to facilitate the description.

The relation between morphemes, morphs, morphophonemes and phonemes is, on the whole, somewhat unclear in American structuralism. It seems obvious that one cannot at the same time say that morphemes are composed of phonemes and that they have alternants (morphs) which differ in phonemic structure. Nevertheless this is often done, more or less implicitly. It is not until 1955 that HOCKETT states explicitly (in "Manual", p. 15) that morphemes are not composed of phonemes. In "Manual" he adopts Hjelmslev's distinction between content and expression. Morphemes, then, are content units, whereas phonemes are expression units. Morphemes are represented by morphs, and these consist of phonemes. In a paper of 1961 Hockett discusses the relations between the different units in more detail. Here he makes a clear distinction between COMPOSITION and REPRESENTATION. Morphemes are composed of morphophonemes, and morphs are composed of phonemes. On the other hand morphemes are represented by morphs and morphophonemes are represented by phonemes. We thus get the following figure:



where C means "is composed of" and R means "represents", whereas P indicates the relation between morphemes and phonemes (morphemes are "programmed into" phonemes).

This way of looking at units and their relations has been of importance for Sydney Lamb's theory of Stratificational Grammar (see Chapter 10); but at the end of the article Hockett rejects it himself. Instead he sets up two strata: phonology and grammar. In the phonological stratum the smallest unit is the component (i.e. distinctive feature) and further units of this stratum are (in increasing size): phonemes, syllables, microsegments (phonological words), macrosegments and utterances. In the grammatical stratum the smallest unit is the morpheme, and further units of this stratum of increasing size are: words, phrases, clauses and sentences. The grammatical stratum as a whole is "programmed into" or "mapped

into" the phonological stratum. Morphs and morphophonemes are mere artifacts of analysis or conveniences for description, not elements in a language. Morphs are sliced out of phonological sequences as size-matches for units in the other stratum, i.e. morphemes; and in the same way morphophonemes are set up in the morphological stratum as size-matches for elements of the other stratum, i.e. phonemes. The possibility of setting up morphophonemics as a separate stratum is also rejected. Hockett prefers to regard morphophonemes as symbols with which it is convenient to state the morpheme-to-phoneme programming of the language (1961, p. 50).²⁰

CONCLUSION

6.40 The most important features characterizing the post-Bloomfieldians can perhaps be summed up in the following way:

Like Bloomfield, they all wished to make linguistics an exact science, a science where the concepts employed are defined, and where it is illegitimate to use "mental" terminology or to proceed from hypotheses about what goes on in the speaker's mind. Swadesh and Pike, it is true, wish to establish systems which are in accordance with "native reaction", but this is not the same as psychologism. The definitions of linguistic units are based on their possibilities of combination in syntagmatic structures and not on meaning. In the actual establishment of phoneme inventories, it is true, Bloomfield, as well as Pike and Haugen, thinks it necessary to take meaning into consideration, but several of Bloomfield's adherents, particularly Bloch, Harris and Hockett, go further and try to exclude meaning in the establishment of the inventory.

Following Bloomfield, most of the American structuralists regard the phoneme as the smallest unit and refrain from a decomposition into distinctive features (in this respect Harris and Hockett constitute exceptions). The concept of neutralization is not used. This is partly due to a lack of interest in paradigmatic oppositions as compared with syntagmatic relations, but it also results from two principles which are very important to the post-Bloomfieldians, although not to Bloomfield himself: namely, the biuniqueness condition (which states that it should be possible to infer which string of sounds corresponds to a given string of phonemes and

20. The status of the morpheme in this article is not quite clear. Since it is the smallest unit in the series "morpheme, word, phrase" etc., one might expect it to be a minimal sign. On p. 43, however, it is rather seen as a content unit, since the ending *-o* in Latin *amo* is supposed to contain two morphemes. But neither signs nor sign contents can be composed of morphophonemes. It would make more sense to consider the morpheme as composed of morphophonemes if it were seen as a class of sign expressions (morphs) connected with the same content (as in earlier writings of the Bloomfield School), and if the morphophoneme were seen as a class of alternating phonemes. But in that case the relation of "representation" and the distinction between strata would not be appropriate. (Cf. also L. R. Palmer 1972, p. 28).

vice versa) and the condition that the phonemic and morphological levels should be kept strictly apart (though the latter condition is rejected by Pike). There is great interest in the study of sign-expressions, and particularly in the study of alternations between sign-expressions, regarded as the subject of a special discipline – morphophonemics – which belongs under morphology.

The endeavour to make linguistics an exact science, in itself a laudable endeavour, had the drawback of narrowing down the perspective. Much importance was attached to the methods of segmentation and classification by which the units were set up, and the object was to a large extent purely descriptive. This is also true of the approach to diachronic linguistics (cf. the criticism of A. Juillard (1967) on this point). Generalizations from the observation of a single language to universal tendencies were avoided, and language was separated from extralinguistic phenomena, for instance the social environment (Haugen constitutes an exception on this point). The questions asked were rather "how"-questions than "why"-questions. Martin Joos even went so far as to say: "We try to describe precisely, we do not try to explain. Anything in our description that sounds like explanation is simply loose talk – deliberately loose, perhaps, for the sake of persuasion by analogy – and is not to be considered part of current linguistic theory" (1950, RL, p. 349).

For a number of years the Bloomfield School was virtually uncontested in America, and it has had great influence in Europe, perhaps especially in Norway, but also in Denmark.

Bloomfield's insistence on syntagmatic definitions of linguistic units, particularly of phonemes, had great influence on glossematics and thereby indirectly on many European linguists.

In America the generative phonologists have since the late fifties reacted strongly against a number of the principles adhered to by the post-Bloomfieldians (less so against the ideas of Bloomfield himself). They have attacked the linear conception of phonemes and advocated a distinctive feature analysis of the Jakobsonian type. They have furthermore criticized the biuniqueness condition and the sharp distinction between phonemics and morphology. And they have criticized the narrow descriptive approach. They were, however, clearly influenced by Bloomfield's morphophonemic description.

It is remarkable that Hockett, who in many ways is one of the least doctrinaire Bloomfieldians, and who himself accepts a distinctive feature analysis, is now considered the chief adversary of the new ideas, which he has attacked in his book "The State of the Art" (1968).

Chapter 7

GLOSSEMATICS

Introduction

HJELMSLEV AND ULDALL AND THEIR GENERAL BACKGROUND

7.1 Glossematics is a linguistic theory which was worked out by the two Danes Louis Hjelmslev (1899-1965) and Hans Jørgen Uldall (1907-57). Outside Denmark one often talks of a "Copenhagen School of Linguistics", but such a school can hardly be said to exist. It is quite true that many Danish linguists are more or less influenced by glossematics, but there are nevertheless such clear differences among them that they cannot be said to constitute a school in the same way as the Prague phonologists, or even the post-Bloomfieldians, and it would probably not be correct to call any of them glossematicians (with the possible exception of Borge Andersen, Jens Holt, and Una Canger). In the following we will therefore restrict ourselves to that version of the theory which is represented by Uldall and, especially, Hjelmslev, and only subsequently and very briefly comment on those Danish linguists who were particularly influenced by glossematics.

LOUIS HJELMSLEV studied Indo-European comparative linguistics under Holger Pedersen and thereby received a thorough training in the traditional comparative method. His doctoral thesis (1932), "*Études Baltiques*", also lies within the scope of this tradition. In the same year he edited the complete works of Rasmus Rask and in 1935 he wrote a four hundred page commentary on these writings. In 1935-37 he published "*La catégorie des cas*" I-II, which contains a semantic analysis of the category of case. However, these works only constitute an interlude in the development of his basic ideas, which are apparent already in his first book, "*Principes de grammaire générale*" (1928), and were elaborated further in the late thirties, leading up to the distinctly glossematic works. Already in 1928 in "*Principes*" he emphasized the importance of establishing a general linguistic theory and demanded that grammatical categories should be defined formally, i.e. on the basis of their syntagmatic relations, and not on the basis of their semantic content (as he had attempted in his book on case, probably under the influence of Viggo Brøndal). The inspiration for "*Principes*" can be traced back to four main sources: (1) The Danish grammarian H. G. Wivel, who in 1901 wrote a book "*Synspunkter for dansk Sproglære*", in which he emphasized the importance of synchronic language description and pointed out that only such grammatical categories as have a phonetic expression in the language in question

should be recognized. This is really the same as demanding that the commutation test should be applied to the content; (2) E. Sapir, and in particular his suggestion that phonemes should be defined on the basis of their combinations and alternations; (3) the Russian school of formalism (Fortunatov, Peškovskij and Peterson), with its establishment of formally defined grammatical categories; and, most importantly, (4) the French-Swiss school of linguistics (Saussure, Meillet, Sechehayé, Grammont), particularly their endeavour to establish a general grammar and their emphasis on the importance of synchronic studies. In 1926-27 Hjelmslev studied in Paris, and this sojourn became crucial to his development.

In 1931 Hjelmslev and some other young Danish linguists founded the Copenhagen Linguistic Circle, whose prime mover he was from the very beginning to his death in 1965, except for a short interruption between 1934 and 1937 when he was a lecturer at the University of Aarhus. In 1937 he succeeded Holger Pedersen in the chair of comparative linguistics at Copenhagen University. Through his teaching, and even more through his publications and his direction of the Linguistic Circle, Hjelmslev came to influence a whole generation of young Danish linguists strongly. He had a clear and constructive mind, an exceptional gift for concise formulation, and a good deal of personal authority. He was therefore an excellent teacher and a brilliant debater, who left his mark on any discussion.

Until the early thirties Hjelmslev was mainly interested in grammatical theory, but through the publications of the Prague School, which were discussed eagerly in the Linguistic Circle, phonological problems also began to arouse his interest. When, on the initiative of the Prague School, phonological research committees were established in various European countries (cf. 3.1), a committee was also set up by the Linguistic Circle of Copenhagen (1931), with the assigned task of describing the phonology of Danish. When the phonetician H. J. Uldall returned from America in 1933, he immediately became a member of this committee, and through collaboration with Uldall Hjelmslev's interest in linguistic expression increased.

HANS JORGEN ULDALL first studied English for a few years at Copenhagen University and then phonetics under Daniel Jones in London. When he returned to Copenhagen in 1933 at the age of twenty-six, he had furthermore been appointed temporarily university professor in Cape Town, studied anthropology under Franz Boas, recorded a number of Amerindian languages, and written several papers on phonetics and on Amerindian languages. His text recordings of Maidu have recently been edited and published by Shipley. Uldall had not only an exceptional talent for languages, but also a keen interest in linguistic theory. He had a very clear mind, and he was an excellent teacher. He did not share Hjelmslev's wide linguistic background, and in the collaboration which began in 1933 it was Hjelmslev who was the dominant partner, but Uldall made many constructive contributions, and in the years 1935-40 they worked together so closely that it was impossible for them to decide afterwards who proposed what.

THE DEVELOPMENT OF GLOSSEMATICS

7.2 The work in the phonological committee quickly carried Hjelmslev and Uldall away from the Prague views to the construction of a new theory, called by them PHONEMATICS, which they presented in 1935 at the Congress of Phonetics in London (Hjelmslev 1936, Uldall 1936). The central idea of this theory is the demand that the individual phonemes should be defined on the basis of possibilities of combination, implications (i.e. phonemically determined alternations), and alternations (in the restricted sense of grammatically determined alternations). Their presentation is clearly inspired by Sapir and probably also by Bloomfield, whose book "Language" had been discussed in the Linguistic Circle in 1934. In Hjelmslev's paper to the congress (1936, p. 51) the term "commutation" is used for the first time.

Towards the end of 1935 they introduced a distinction between phonematics and cenematics (the latter was meant to be a purely formal discipline), and in 1936 they realized that these views might be combined with Hjelmslev's proposal for a syntagmatic definition of grammatical categories to yield a complete linguistic theory, where content and expression were analysed according to the same principles. At the suggestion of Uldall this theory was called GLOSSEMATICS.

Hjelmslev and Uldall worked hard in order to publish a treatise on glossematics before the 1936 linguistic congress in Copenhagen, but they only managed to bring out a booklet containing some specimen pages with the title "An Outline of Glossematics" and the addition "to be published in the autumn". But that autumn never came. In the following years they continued revising and improving the definitions and procedures, and by 1939 they had almost reached the final form. In the autumn of 1939, however, Uldall had to go to Greece, where he had obtained a post with the British Council, and in 1940 the war severed the contact between them completely.

In 1941 Hjelmslev worked out a two hundred page summary of all of the procedures and definitions, but he decided to postpone the publication of it until Uldall's return. On the occasion of the tenth anniversary of the Linguistic Circle (1941), Hjelmslev gave a talk in which he put forward the leading ideas in an easily comprehensible form (published in Hjelmslev 1973), and at the same time he wrote a short book "Sproget", which, however, was not published until 1963 (= "Language", 1970).

This book is not a description of the glossematic theory, but a general introduction to linguistics. Nevertheless, several of the chapters show strong traces of glossematics and may serve as an easily comprehensible introduction. In 1943 Hjelmslev published "OMKRING SPROGTEORIENS GRUNDLÆGGELSE", normally abbreviated "OSG", in which he expounds his ideas on the nature of language, on linguistic theory and on the principles of linguistic analysis. This book, which is the most important glossematic publication, was intended as an introduction to the theory itself. An English version, with the title "Prolegomena to a

'Theory of Language', was published in 1953,¹ and in 1968 it was translated into French and later into various other languages. Although lucidly written, "OSG" is very concentrated and contains a large number of new terms, and consequently it is not very easy to read. It is therefore advisable to begin the study of glossematics not with "OSG", but with some of the numerous articles which Hjelmslev wrote in these years (e.g. 1939a, or 1947).

Whereas Hjelmslev, on the whole, continued to hold the views he and Uldall had formed about 1940, Uldall elaborated the theory further during and after the war in the brief periods of his wandering life that permitted it. In 1949 he became a lecturer at the University of Edinburgh, and in 1954 at Ibadan in Nigeria. He had spent the year 1951-52 in Copenhagen, the idea being that he and Hjelmslev jointly should bring their glossematic project to a conclusion. Uldall was to write the first part and Hjelmslev the second part of this book. In 1952 Uldall finished his part, which contains a general introduction, largely in agreement with "OSG" although much more easily comprehensible, and a description of the algebraic system which he had elaborated in the intervening years. Hjelmslev, however, could not accept this system, and consequently Uldall's book was not published until 1957. A few months later, at the age of fifty, he died of a heart attack. In the following years Hjelmslev attempted to write his part, but he found it difficult to proceed from Uldall's algebraic system. When he finally decided to adhere to his own original formulations, his capacity for work had been weakened so much that he was unable to finish the job, and the second part of the book on glossematics was never published. During his last years he thought of publishing the summary mentioned above. It will be published in 1975, but it will only be comprehensible to readers who are already familiar with glossematic theory, since it consists of several hundred definitions and rules with no supporting examples.

It is easy to see now that it would have been better if Hjelmslev and Uldall, realizing that they had developed in different directions during their long separation, had decided to publish independently of each other. But it is quite natural that they found it difficult to give up a team-work which for many years had been so rich and fruitful.

Malmberg (1964), Spang-Hanssen (1962) and Whitfield (1954) are recommendable as good introductions to glossematics. The reviews of "OSG" by Martinet (1946), Garvin (1954) and Haugen (1954) are also very informative, whereas the chapter on glossematics in Krámský's book "The Phoneme" contains various misunderstandings. F. P. Dinneen (1967, p. 326-54) gives a summary of "Prolegomena". B. Siertsema (1954) gives a detailed report of Hjelmslev's views with

1. The quotations given below have been taken from the English edition, but page references are made to the Danish original "OSG", since these page numbers are also found in the margin of the English translation. As regards "Sproget", reference is made to both the Danish and the English version.

many references. Haugen demonstrates a number of similarities between glossematics and the Bloomfield School.

More detailed biographical information on Hjelmslev and Uldall and on their co-operation is found in obituaries by Fischer-Jørgensen (1965, 1967) and Tøgeby (1965).

The following description is mainly based on Hjelmslev's presentation in "OSG". At the end of this chapter (7.13), however, some of Uldall's diverging views are also discussed.

General Characteristics of Glossematics

PURPOSE, IMMANENCE, GENERAL CALCULATION

7.3 The principal purpose of glossematics was to establish linguistics as an EXACT science. According to Hjelmslev all previous theories had been loose speculations, and a real linguistic theory simply did not exist. In order to be exact, linguistics should be IMMANENT, i.e. a self-sufficient science, which describes the specific structure of language, and which does not consider language a conglomerate of extra-linguistic phenomena, e.g. physical, psychological, logical or sociological ("OSG", p. 7). In this view Hjelmslev is largely in agreement with the Bloomfield School.

Behind the linguistic "process" (text) one should seek a system, through which the process can be analysed as composed of a limited number of elements that recur in various combinations ("OSG", p. 10). For this purpose a method of description should be established, a procedure, by which each operation depends on the preceding operations, and where everything is defined. The only indefinables necessary are a few concepts that belong under general epistemology, such as "description", "dependence" and "presence". It is furthermore the duty of linguistics to provide a general calculation of the range of language systems that are possible. In order to do this, it is necessary to carry out a preliminary investigation of those objects which people agree to call languages and to attempt to find certain properties which are common to such objects. These properties are then established by definition as characterizing a language. A certain amount of experience, then, enters into the theory as its precondition, and by virtue of this experience the theory is appropriate. But the calculation itself is independent of experience, since it computes the possibilities that follow from its premises. By virtue of this independence the linguistic theory may be called arbitrary ("OSG", p. 14, "Sproget", p. 102 = "Language", p. 105).

In the main "OSG" contains only a presentation of the general premises, i.e. of Hjelmslev's view of the nature of language. This view is strongly influenced by Saussure's, and following Saussure Hjelmslev sets up a number of dichotomies:

system and process, content and expression, form and substance. Saussure's influence is much more directly felt in glossematics than in Hjelmslev's first book, "Principes". Probably Hjelmslev returned to the study of Saussure and read him in a new way.

SYSTEM AND PROCESS

7.4 The distinction between system and process corresponds to Saussure's distinction between associative and syntagmatic. Hjelmslev also employs the term "syntagmatic" frequently, but instead of Saussure's psychological designation "associative", he uses the term "paradigmatic" which has become generally accepted.² When referring to everyday language he often simply talks about "language" and "text" corresponding to system and process. The existence of a system is assumed to be a prerequisite of the existence of a process, and it is the system which is the object of linguistics. The objects analysed are texts, but the purpose is to find the system which underlies the process ("OSG", p. 36).

CONTENT AND EXPRESSION, SIGNS

7.5 As mentioned above (2.8), Saussure viewed language as a system of signs and considered the individual sign two-sided, i.e. as consisting of a signifié and a signifiant (or, a concept and an acoustic image). Hjelmslev takes over this conception but uses the terms "content" and "expression" (and, when signs are involved, "sign-content" and "sign-expression"). Content and expression are called the two planes of language ("OSG", p. 44ff). Hjelmslev thus regards language as biplanar, like Saussure and the Prague School, but in contradistinction to many members of the Bloomfield School. It is a particularly characteristic feature of glossematics that content and expression are regarded as completely parallel entities, which are analysed in the same way, and whose categories are defined according to the same principles (cf. 7.20). At the same time, however, it is emphasized that the two planes are not conformal, i.e. it is not the case that a given sign-content is structured in the same way as the corresponding sign-expression, so that they might be divided into corresponding constituents (or "figuræ", as Hjelmslev calls them). Whereas the Latin sign-expression *-us* in *dominus* can be divided into two parts (*u* and *s*), the corresponding sign-content is divided into three parts: masculine, singular, and nominative. And it is not the case that *u* corresponds to one or more of these contents and *s* to others. In the same way the English sign-expression *ram* can be divided into *r*, *a* and *m*, and the corresponding sign-content into 'he' and 'sheep', but it is not the case that *r* corresponds to 'he' and *a* or *m* to 'sheep'. If there had been such a conformity,

2. Syntagmatic and paradigmatic relationships are defined as both-and and either-or functions respectively.

these smaller constituents would themselves be signs, and it would then be unnecessary to talk about two planes, since they would be formally identical. Language differs from other sign systems (e.g. certain games) precisely by this absence of conformity. By virtue of its internal structure language is thus a system of content and expression *figuræ* which may be used for sign formation.³ It is not unlikely that there are some biplanar sign systems which are not normally called languages. Language in the narrow sense of the word (everyday language) differs from such sign systems by being a system into which all other languages can be translated ("OSG", pp. 43ff and 96ff, "Sproget", p. 100-1 = "Language", p. 104).

COMMUTATION

7.6 Content and expression must be analysed separately, but allowance should constantly be made for the function between sign-content and sign-expression. This function – the sign function – is a solidarity, sign-expression and sign-content being mutually dependent. Replacement of one sign-content by another therefore normally (except in cases of homonymy and synonymy) results in another sign-expression, and, conversely, replacement of one sign-expression by another brings about another sign-content. It is also possible to replace parts of signs. The smallest parts reached by the given procedure of analysis, and whose replacement may bring about a change in the opposite plane are called *TAXEMES*.⁴ By means of such a replacement test it is decided how many elements a given sign-expression can be divided into. Replacement tests had of course also been employed in the Prague School and by Bloomfield, but Hjelmslev applied the test to both content and expression, and he furthermore gave it a name – the *COMMUTATION TEST* – which was subsequently generally accepted.

Hjelmslev distinguishes between "commutation", which is a function, and "commutation test".⁵ In glossematic terminology paradigmatic functions are called "correlations" and syntagmatic functions "relations". Commutation is the fundamental paradigmatic function, namely a correlation between two units in one plane which has relation to a correlation in the opposite plane, e.g.



3. The analysis of the sign expression into *figuræ* corresponds to what Martinet calls "the second articulation" (see e.g. A. Martinet 1960 (1.8 and 1.11) and section 3.3 above).
4. In the expression plane the level of *taxemes* corresponds roughly to the level of phonemes; Hjelmslev considered distinctive feature analysis to be purely phonetic (cf., however, 7.21 for his analysis into *glossemes*).
5. This distinction, it should be added, is not made in his earliest works, e.g. Hjelmslev (1936), and it also sometimes happens in his later publications that "commutation" is used instead of "commutation test". – Note that "substitution" means lack of commutation.

The vertical lines indicate the two correlations (commutations) and the horizontal line the relation between them. This relation is a direct consequence of the sign function ("OSG", pp. 59, 66ff, 101).⁶

VARIANTS AND INVARIANTS

7.7 By means of the commutation test we arrive at a limited number of elements in both planes, and such commutable elements, e.g. *l* in English, Hjelmslev calls INVARIANTS. Each invariant comprises a number of variants, partly bound variants, which Hjelmslev terms VARIETIES, e.g. *l* in final position, partly free variants, which he calls VARIATIONS. In contradistinction to the number of allophones in American linguistics the number of variants does not depend on whether they are phonetically clearly distinct. There are as many varieties as there are positional possibilities, and each variety in its turn comprises an infinite number of variations ("OSG", p. 74; "Sproget", p. 109 (= "Language", pp. 113-4)).

FORM AND SUBSTANCE

FORM, SUBSTANCE, AND PURPORT

7.8 Saussure assumed that there were two substances (sound and meaning) and one form, and that this form could be described metaphorically as a number of simultaneous cuts through the two amorphous substance masses (cf. 2.9). In his early works Hjelmslev shared this view, but from 1938 on he sets up two forms, an EXPRESSION-FORM and a CONTENT-FORM. On this point Hjelmslev is in agreement with von Humboldt, whom he was familiar with and quoted (1938a, p. 132, cf. also 2.6); but what was probably more decisive was his realization of the fact that the two planes are not conformal, and that each should therefore be described on the basis of its own form (cf. 7.5 above). According to him, then, the distinction between form and substance applies to both content and expression. Form comprises all paradigmatic and syntagmatic functions as well as the terminal points of these functions, i.e. elements and categories.

In addition to form and substance Hjelmslev introduces a third concept in "OSG", which in Danish is called "mening", in English PURPORT, and in French "sens" or "matière". "Purport" refers to linguistically unformed sounds and meanings, whereas substance designates linguistically formed purport. Instead of Saussure's metaphor of simultaneous cuts, Hjelmslev uses the image that form is projected on to purport like a net which casts its shadow on an undivided surface, thereby forming it into a substance ("OSG", p. 52). As an example of a

6. The formal definition of commutation is considerably more complicated (see "Prolegomena", definition no. 59).

purport mass belonging to the expression plane the normal vowel diagram may be mentioned. This can be carved up differently in different languages since there may be more or fewer cuts, and since furthermore the cuts may be placed differently. Hjelmslev is justly dissatisfied with Saussure's concept of "the amorphous substance" and himself defines "purport" as that which is common to all languages apart from the structural principle ("OSG", p. 46). However, he comes quite close to Saussure's idea in his own description by stating that purport is an amorphous mass which eludes cognition until it is formed ("OSG", p. 47ff). Hjelmslev also mentions, however, ("OSG", pp. 69-73) that purport can be described from the point of view of physics and psychology, and that the way it is formed linguistically should be compared with the way it is formed in these sciences. This seems to be more adequate, for it is not possible to state that "the same" purport is formed differently in different languages if the purport cannot be identified extra-linguistically. Sometimes "amorphous" is apparently used in the sense of "continuous", but there is an important difference between these two concepts. The colour spectrum, which is frequently cited as an example of amorphous content, is for example physically continuous but by no means amorphous, and the same applies to the vowel diagram. In both cases the different points may be defined physically without ambiguity. For the same reason it is not correct, either, to say that phonetic similarity is something purely subjective (Hjelmslev 1937 c, p. 170).⁷

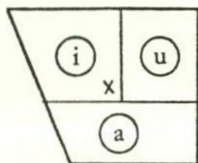
The function between form and substance is called **MANIFESTATION** in "OSG" (p. 73), a term which is due to E. Zwirner, and which Hjelmslev prefers to the Prague School's "realization". In "Language", however, it is referred to as "representation of elements" (pp. 41-2). Roman Jakobson, incidentally, uses the term "implementation" in much the same sense.

SCHEMA, NORM, AND USAGE

7.9 In "OSG" **USUS** ("usage") is used almost synonymously with "substance", and in "Sproget" the terms **LINGUISTIC USAGE** and **LINGUISTIC STRUCTURE** are employed instead of substance and form. However, "usage", or "linguistic usage", is also used in a wider sense – and in greater agreement with its use in everyday speech – referring to linguistic habits, to that which is not determined by form. For example, it refers to the choice which speakers habitually make from the structural possibilities, e.g. from the inventory of signs found in a given language (which in its turn constitutes a choice from a much larger number of structurally possible signs). Form is also called **SCHEMA**. Sometimes Hjelmslev uses a trichotomy instead of the dichotomy of form and substance, namely that of **FORM** (or **schema**), **NORM**, and **USAGE**. The concept of norm is not mentioned

7. The distinction between substance and purport is not drawn quite consistently in "OSG", and it is noticeable that in the English translation "substance" has been changed to "purport" in several places.

in "OSG", but in a paper from approximately the same period, "Langue et parole" (1943b), this trichotomy is discussed in some detail. In the traditional vowel diagram, for example, the quadrangle itself represents "purport" or "matter":



The areas which are determined by the boundaries projected by the form constitute the norm, and the areas which are actually used in the language in question (the circles in the illustration) constitute usage. Hjelmslev sometimes uses the terms "pure form" and "material form", referring to form and norm respectively. Pure form, then, is the number of commutable entities and their syntagmatic relations. Italian *r* may be used as an example. In a description of usage this sound will be characterized as a voiced, alveolar trill. In a description of norm it will be characterized simply as a trill, since this is sufficient to keep it apart from laterals, fricatives, etc. From a purely formal point of view *r* may be defined as being commutable with other consonants (paradigmatic form) and by occurring in certain positions in the syllable (syntagmatic form).

However, after having set up the three concepts – form (schema), norm and usage – Hjelmslev rejects the concept of norm as superfluous (1943b, p. 43), since it is really only something we infer from usage. In actual fact it is not possible to know where the norm boundaries are situated, e.g. whether a vowel which in a three-vowel system is outside the *i*-area of usage (e.g. at the cross in the figure) will be perceived as *i* or *a* (or *u*). This may be correct, but it conflicts with Hjelmslev's own image of the net casting its shadows on purport, because the boundaries which emerge in this way are precisely norm boundaries and not usage boundaries. And the purpose of setting up a norm is not in the first place to decide how a sound situated in a no-man's-land between usage islands might be perceived, but rather to establish the simplest possible substance definition of the elements, based on their mutual delimitation. It was this which the Prague phonologists wanted to accomplish by their distinction between relevant and irrelevant properties; their phonemes belong to Hjelmslev's norm. What the Prague phonologists were interested in was the interplay between form and substance, the way in which purport is formed, and there is no doubt that this was also central to Saussure, even though Hjelmslev (e.g. 1947) emphasizes Saussure's syntagmatically formal definition of certain units in Indo-European.

In Hjelmslev's book on case norm is a central concept; and later on, returning to semantic problems in a paper of 1957 ("Essais ling.", p. 96ff), he needs it once again in order to determine semantic range. In the intervening period, however, he dropped it completely, and this enabled him to reject the Prague School's

conception of the phoneme. Coseriu (1954), who has given an interesting criticism of Hjelmslev's concepts of form and substance, makes a distinction between "sistema" and "norma", corresponding to Hjelmslev's norm and usage respectively.

According to Hjelmslev (1943b) Saussure's *LANGUE* covers both form (schema), norm and usage, although in a rather vague way, whereas *PAROLE* refers to the speech act.

Partly influenced by discussions with Uldall in 1950-1, Hjelmslev modified the theory on a number of points. He also revised the terminology in a late paper, "Stratification du langage" (1954). Content-form, content-substance, expression-form, and expression-substance are now characterized as the four strata of language, and a distinction is made between intrastratal (or intrinsic) and interstratal (or extrinsic) functions. "Schema" covers the intrastratal functions in the two form strata, whereas norm, usage, and the speech act cover various sorts of interstratal functions. Usage is no longer identical with substance.

THE RELATION BETWEEN FORM AND SUBSTANCE

7.10 More characteristic of glossematics than the separation of form and substance is the conception of the relation between form and substance. According to Hjelmslev it is a unilateral dependence, since *SUBSTANCE PRESUPPOSES FORM*, but not vice versa. That substance presupposes form really follows from the definition of substance as formed purport, but the claim that form does not presuppose substance is somewhat problematic. To a certain extent its validity depends on the level of abstraction which is selected. Hjelmslev argued that it is possible to construct, or reconstruct, a linguistic form system without attaching any substance to this system. What is involved here is the calculation of the possible language systems and the reconstruction of a form on the basis of given languages (e.g. Hjelmslev 1937b). Where concrete languages are involved, however, it seems fairly obvious that both form and substance must be there. Here Hjelmslev's argument for unilateral dependence is that there may be several substances corresponding to the same form, e.g. sound and writing ("OSG", pp. 92-4 and 1938a). To this it has been objected (e.g. Coseriu 1954, pp. 56-7 and Siertsema 1954, pp. 111-20) that, historically, writing is dependent on spoken language, and that in this case the dependence of form on substance is reflected by the formal differences which normally distinguish writing from speech, such as spaces between words, capital letters, no indication of tone etc. The reply to these objections is that the crucial point is whether the same form *may* be manifested in different substances. It need not always be so. What this illustrates, however, is not that form is independent of substance, but that it is independent of any specific substance.

Hjelmslev sometimes also formulated the idea of unilateral dependence by saying that the *description* of substance presupposes the description of form, but not vice versa ("OSG", p. 71 and 1947, p. 75). This has been strongly criticized by several linguists (e.g. Coseriu 1954, pp. 47ff, Fischer-Jørgensen 1943, p. 91f,

Martinet 1946, p. 37, and Siertsema 1954, pp. 23 ff and 169 ff). The problem is what is meant by "description". In some of his early papers (1937 c, p. 158, and 1939 b, p. 3) Hjelmslev mentions that the "cognition and definition" of linguistic units and categories should be independent of substance, and by "cognition" he probably understands the establishment of the inventory of invariants, obtained by means of the commutation test and identification. But in the case of the commutation test it is necessary at least to ascertain whether there is a substance difference in the opposite plane, and for the identification of units in different positions a fairly detailed description of substance is necessary. Later on Hjelmslev modified these views somewhat and pointed out that when he demands that form should be described first, and that substances should only be attached to it afterwards, he is thinking not of a field-work situation, or a discovery procedure, but of the glossematic procedure as a formal control of what has already been found. In "Stratification" (1954, p. 171) it is stated expressly that substance has to be taken into consideration in the operations of commutation and identification.

Whereas Hjelmslev's theory of unilateral dependence between form and substance is of dubious validity, his idea that the DEFINITION OF CATEGORIES in both planes can be based exclusively on formal criteria, particularly syntagmatic relations, is both valid and important. A more detailed criticism of form and substance in glossematics is found in Fischer-Jørgensen (1966); cf. also the discussion in Spang-Hanssen's paper (1962, particularly pp. 147-69) and the monograph by Coseriu (1954) mentioned above.

THE ANALYTICAL PROCEDURE

7.II The glossematic procedure is described as an analytical procedure which starts from a whole text and divides it into progressively smaller units. At each stage of the analysis the inventory of commutable entities is established. The analytical procedure is followed by a synthesis, where the elements are assigned to various categories. Hjelmslev points out that in traditional linguistics the analysis is often performed implicitly and according to vague principles, and he insists instead that, in order to ensure that nothing has been overlooked, we should set up a completely explicit and fixed hierarchy of operations which should be followed in the analysis. The analysis must be carried out according to a fixed procedure in order that different languages may be compared. Such a progressive analysis Hjelmslev refers to as "DEDUCTION" ("OSG", p. 29), with a somewhat uncommon use of this word.⁸

In addition to being deductive in this particular sense, the method should be

8. On other occasions, however, Hjelmslev uses "deduction" in the more common sense, e.g. when he mentions that a linguistic theory should deductively make a calculation of the possible functions and categories which are applicable to all languages.

EMPIRICAL ("OSG", pp. 11–12). This word also, it should be added, is used in a rather special sense. According to Hjelmslev an empirical description is one which is free of contradiction, exhaustive, and as simple as possible. These claims however, have nothing in particular to do with glossematics, but should be satisfied by any scientific description. The demand for simplicity creates most problems, since it may be interpreted in several ways. To Hjelmslev the simplest description is the one which results in the smallest number of elements.⁹ Now it is obvious that if the number of phonemes, for example, is reduced considerably, then this simplification may lead to complications of other sorts, e.g. as regards rules of combination and, particularly, rules of manifestation, but this is of secondary importance to Hjelmslev. In this respect he is opposed to the Bloomfield School, which set greater store by simplicity of rules.

A principle which is essential in glossematic analysis is the PRINCIPLE OF GENERALIZATION: "If one object admits of a solution univocally, and another object admits of the same solution equivocally, then the solution is generalized to be valid for the equivocal object" ("OSG", p. 63). Another important concept connected with the analytical procedure is CATALYSIS ("OSG", p. 83 ff), by which is understood an interpolation into the text of an entity which is implied by the context. In German "guten Morgen!", for example, a verb is encatalyzed as a necessary prerequisite of the accusative, and in Danish [man?] *mand* ('man') a /d/ is encatalyzed because – according to Hjelmslev's rules – "stod" on a consonant presupposes a consonant cluster; that the cluster must be /nd/ in this case appears from [mandi] *mandig* ('manly').

The procedure itself has not been described in any of the published works on glossematics, but only in Hjelmslev's summary mentioned in 7.2 above.

FUNCTIONS

7.12 To Hjelmslev a function is "a dependence that fulfils the conditions for an analysis" ("OSG", p. 31). The glossematic system of functions is quite simple, three main functions being distinguished only: (1) unilateral dependence (a is presupposed by b, but not vice versa), (2) reciprocal dependence (a and b presuppose each other), and (3) freer dependences (a may occur without b, and vice versa). These three functions are designated by means of three sets of terms: a general set and two additional sets which are used referring to paradigmatic and syntagmatic functions respectively ("OSG", p. 37 and "Sproget", p. 94 ff (= "Language", p. 97 ff)). The terms which are needed most frequently are the syntagmatic ones, namely SELECTION (unilateral dependence), SOLIDARITY (reciprocal dependence) and COMBINATION (freer dependences). By way of example it may be mentioned

9. It is implied, however, that the analysis must not be arbitrary, i.e. *t* and *k*, for example, cannot be analysed as $p + p$ and $p + p + p$ respectively, in order to reduce the inventory of taxemes.

that there is normally selection between vowel and consonant (consonant presupposes vowel, but not vice versa). There are, however, also some languages where only the syllable type CV occurs, and in this case there is solidarity between the two categories. Combination is frequently found between consonants in consonant clusters; for example, the syllables *pi*;, *li*;; *pli*;; all occur in English, which shows that *p* and *l* can be combined.

In his analysis of the total text Hjelmslev first selects a definite function as the principle of classification, and when the analysis based on this particular function has been completed, he starts afresh with another function as the basis of classification. Taxemes, for example, are the minimum units we arrive at through an analysis where selection is the principle of classification.

One of the chief purposes of the established procedures is to provide the foundation of a general TYPOLOGY. "Only through typology does linguistics rise to quite general points of view and become a science" ("Sproget", p. 93 = "Language", p. 96).

DIFFERENCES BETWEEN HJELMSLEV'S AND ULDALL'S THEORIES

7.13 The preceding discussion has been based on Hjelmslev's account of glossematics, but Uldall ("Outline of Glossematics", 1957) advanced his own version of the theory. In most respects it is identical with Hjelmslev's, but there are certain important differences.

In the first place Uldall aimed explicitly at a more general theory than Hjelmslev. Hjelmslev wished to establish an exact linguistic method which he hoped would serve as a model for the remaining humanities, whereas Uldall aimed directly at creating an algebra which was to be common to all humanities. Hjelmslev, however, thought that this algebra was too complicated for linguistic analysis to be based on it.

It is also important to mention that Uldall did not accept the idea that substance is unilaterally dependent on form (1957, p. 28). He even thought that the terms form and substance could be dispensed with altogether. To him all four strata were equal and should be analysed one by one according to glossematic methods. Uldall also considered the distinction between variants and invariants superfluous and was of the opinion that by attaching importance to this distinction the significance of the relation between content and expression was exaggerated. Nor did he wish to perform the analysis from the point of view of a fixed principle of classification, but rather to select the appropriate function in each particular case. Finally, he defines the three main functions in a somewhat different way (1957, pp. 78-9). To Hjelmslev these functions take place between invariants. That a given entity is presupposed (selected) by another means that it may occur unaccompanied by the other, but not vice versa. This implies that all occurrences

in the text of the entities involved must be investigated in order to decide whether there is selection or not. To Uldall selection means that the entity in question is presupposed by another in a certain textual position, i.e. the function between the two entities may be different in another position. It is not invariants which are involved, then, but classes of variants. One of the main reasons for the differences between Hjelmslev and Uldall is probably that Uldall was concerned with field work, whereas Hjelmslev was more interested in the analysis of already known Indo-European languages (cf. Fischer-Jørgensen 1967).

Cenematics - the Glossematic Analysis of Expression

TAXEME VERSUS PHONEME

7.14 We now proceed to discuss how the general principles are applied to the analysis of expression. In glossematic terminology, expression analysis is also called "cenematics", whereas content analysis is termed "plerematics".

By way of introduction it may be pointed out that strictly speaking it is not correct to include the glossematic analysis of expression in a description of "phonological" schools. Hjelmslev emphasized himself that cenematics differs radically from phonology and that an expression taxeme is not the same as a phoneme. To most members of the Bloomfield School the phoneme is a class of sounds, i.e. substance units,¹⁰ and the same applies to Jones's phoneme. In the Prague School it is a more abstract entity, but it still belongs to norm - and not to pure form - since it is established by means of a substance delimitation based on so-called relevant properties. The glossematic expression taxeme, on the other hand, is defined purely formally as a point of intersection in a net of functions, and independently of its manifestation in substance. When referring to the substance unit corresponding to an expression taxeme, Hjelmslev sometimes uses the term "phonemateme" (1937d, p. 182).

ESTABLISHMENT OF THE TAXEME INVENTORY

INTRODUCTION

7.15 There are certain difficulties involved in comparing the glossematic establishment of taxeme inventories with the establishment of phoneme inventories in the Bloomfield and Prague Schools. In these schools the linguist is concerned with a classification, or identification, which is carried out according to definite rules

10. This is not true of Harris, however.

and is part of a "discovery procedure". But Hjelmslev took no interest in "field work" or "discovery procedures", but only in the purely formal analytical procedure, which presupposes that the language is already known to the linguist and that a preliminary establishment of units has already been made. Hjelmslev did not always keep the different analytical stages clearly apart, however, and in his earliest papers it is evident that he refers to a "field work" situation and that he thinks that the analysis already at this stage can be purely formal (cf. also 7.10). When understood as applying to this early stage of the analysis Hjelmslev's criteria seem very unrealistic.

THE COMMUTATION TEST

7.16 The commutation test is of great importance in glossematics, not only at the preliminary stages of the analysis, but at all levels of the final analytical procedure. In this respect Hjelmslev is in agreement with the Prague School, and this is quite natural considering the influence which Saussure's theories – particularly the importance he attaches to the function between content and expression – had on both Prague phonologists and glossematians. To them the commutation test is not merely a short-cut, as it is to the Americans, but a fundamental linguistic function. In "OSG" a distinction is made between commutation between signs and commutation between sign-constituents (*figuræ*), since only the former units have both content and expression. This distinction is important. But also in the case of *figuræ* (e.g. taxemes) commutation relates to the whole sign; the *figuræ* are only commutable in their capacity assign constituents. What is involved is, therefore, in my opinion, not a real commutation between *figuræ*, but rather a further analysis of sign-expressions (and sign-contents) between which commutation has been demonstrated.

According to the more rigid procedure proposed in Hjelmslev's unpublished summary the sign is of much less importance. Here the two planes are broken down separately. In the expression plane a progressive decomposition is carried out into modulation units, accent groups, syllables and segments, and at each stage the commutation test is applied.

IDENTIFICATION (REDUCTION) OF UNITS IN DIFFERENT POSITIONS

7.17 Hjelmslev does not use the term "identification", which may cause philosophical complications, but prefers to talk about REDUCTION ("OSG", p. 56). Originally it was apparently his plan that the commutation test should be used not merely in order to distinguish between free variants and invariants, and to demonstrate which invariants the free variants belonged to, but also in order to identify bound variants. By means of the so-called "experimental commutation

test" (cf. 1937 c, p. 156), whereby sound segments are excised from recordings and inserted in other environments, a German [ç], for example, can be placed after a back vowel in order to ascertain whether this brings about a change of meaning. Togeby (1951, p. 72) has endorsed this proposal. Others, e.g. Martinet (1946, p. 37) and Fischer-Jørgensen (1949, p. 223), have pointed out that when sounds are placed in positions where they do not belong, the listener can arrive at a decision only on the basis of phonetic similarity, i.e. on the basis of pure substance criteria. This also implies that it is not possible to operate with phonetic overlapping between taxemes. For example, initial [t] in Danish, e.g. in [tal] *tal* ('number'), cannot be grouped with final [d], e.g. in [kad] *kat* ('cat'), as it has been suggested by the glossematians themselves (Uldall 1936, Hjelmslev 1951), since a final [d] which is moved to initial position will be identified with initial [d] by the listener and not with initial [t]. The experimental commutation test cannot possibly be a purely formal method. Furthermore it may lead to strange results because sounds are often identified auditorily by means of the environments.¹¹ Hjelmslev therefore had to give up this proposal.

Identification is a very great problem in glossematics, because the theory does not permit phonetic similarity to be taken into account – it is only at a subsequent stage of the analysis that substance is attached to form. Sometimes it is possible to find other identification criteria. Hjelmslev mentions that in Danish [g] may be grouped with [ɣ] and similarly [d] with [ð] as bound variants of the same phonemes, because free variation between [g] and [ɣ] and between [d] and [ð] is found in a few words of foreign origin, e.g. *psykologisk* and *medicin*. But there are very few examples of this type in Danish, and they are of no help to the identification of these sounds in other words. Uldall, who discusses this problem in "Outline" (1957, p. 52ff and particularly in a footnote on p. 88), admits that the only way out of this dilemma is simply to assume that certain units – in science as in everyday life – are the "same" (cf. Bloomfield); but it should be realized, of course, that this is only a hypothesis. As mentioned in 7.9, Hjelmslev arrived at the conclusion in "Stratification" (1954) that substance is involved in the commutation test and in the identification of variants. In actual practice he bases identification on substance like all other linguists.

By means of the commutation test and groupings according to phonetic similarity one arrives at what Hjelmslev has sometimes called the "pre-taxemes", i.e. a preliminary inventory of units, whose number it is subsequently attempted to reduce further.

NEUTRALIZATION (SYNCRETISM)

7.18 The concept of neutralization is of great significance to the glossematians, as it was to the Prague phonologists. Uldall (1936) mentions the merging of /p/

11. See Fischer-Jørgensen, 1956, pp. 140–51).

and /b/ finally in Danish and refers to it as "mutual implication", a term which is used in a somewhat different sense later on. Hjelmslev treats neutralization for the first time in his paper "Note sur les oppositions supprimables" (1939d), and he returns to it in "OSG" (pp. 78-84). In the paper he uses the term "neutralization" (or "suppression") to indicate the suspension of a commutation under certain conditions and the terms "implication" and "syncretism" to refer to two different types of manifestation of this "suppression". These distinctions are retained in his later papers, although the terminology was modified several times. The term "implication" remained unchanged, it is true, but in "OSG" "syncretism" is used about the formal phenomenon, and "fusion" (Danish "sammenfald") refers to the type of manifestation originally called syncretism.¹² It is this terminology we intend to use in the following discussion.

In "OSG" the suspension of a commutation, e.g. the suspension of the commutation between /p/ and /b/ finally in German, is called an **OVERLAPPING**, and this term thus refers to the same phenomenon as "neutralization" in the Prague School. The category established by an overlapping, e.g. /p/ and /b/ in German together with their overlapping, is called a **SYNCRETISM**. A syncretism can be manifested either by an implication or by a fusion. An **IMPLICATION** is a manifestation of a syncretism which is identical with the manifestation of one or more of the members entering into the syncretism, but not with all; the manifestation of the German syncretism /p/ - /b/ is thus an implication, since only [p] occurs in this position. As another example we may mention the Russian syncretism /o/ - /a/ in pretonic syllables, which is manifested as [a]. A **FUSION**¹³ is a manifestation of all or none of its members. In Danish, for example, the commutation between /p/ and /b/ is suspended finally in a syllable, and the manifestation is sometimes [p] and sometimes [b]. In this case the manifestation comprises the manifestations of both members entering into the syncretism and is therefore a fusion. In Russian the commutation between /o/ and /a/ is suspended, not only in pretonic syllables, where the manifestation is [a] (an implication), but also in other unstressed syllables. Here the manifestation is [ə], and since it is identical with neither [o] nor [a] it is a fusion.

LATENCY is considered to be a special case of syncretism, namely a syncretism between an entity and zero. An example of latency is final *r* in British English, e.g. in *far* [fa:]. Before a vowel there is no latency, e.g. in *far away* ['far ə'wei], but /r/ is latent elsewhere. A latent consonant is also assumed to exist in the genitive plural of most English nouns; *boys'*, for example, should really be /bojzz/

12. In later papers (e.g. the one on the Danish expression system of 1951) and in lectures Hjelmslev returned to the older, more special use of "syncretism", and used the Danish term "sammenfald" (fusion) about the general formal phenomenon. However, in the English translation of the paper on Danish the terminology has been modified so as to agree with the one used in "OSG".

13. In the first edition of the English translation of "OSG" (1952), the term "coalescence" was used instead of "fusion".

(cf. *men's*), but the last /z/ is latent. In French there are many instances of latent consonants (Hjelmslev 1970), e.g. the final /t/ of *petit* [pti], which only appears before vowels, as in *petit homme* [ptitɔm].

A syncretism may be FACULTATIVE. In French, for example, the manifestation of the consonant /ʒ/ in *je* may, according to Hjelmslev, be identical with the manifestation of /ʃ/, e.g. in *je pense* [ʃpās], but this is not obligatory. In Danish the consonant *γ* is frequently facultative, e.g. in *søge* ('to seek'), which may be pronounced both [sø:ɣə] and [sø:ə] or [sø:].¹⁴

When a syncretism is manifested by implication, i.e. by one of the two members, this member is called the EXTENSIVE member; in the Russian /a-o/ syncretism /a/ is extensive and /o/ INTENSIVE. This distinction corresponds more or less to the one made between unmarked and marked members in Prague phonology.

Although Hjelmslev's syncretism and the Prague phonologists' neutralization are closely related they are not based on the same criteria. According to Prague phonology the two members of a neutralization must have common phonetic properties by which they are distinguished from all other phonemes of the language (e.g. /t-d/ in German or English). This condition is considered irrelevant by Hjelmslev, since it relates to substance. On the other hand Hjelmslev lays down the condition that the recognition of a syncretism manifested by an implication presupposes some alternation between the entities involved. In German, for instance, there are alternations like [ra:də - ra:t, li:bə - li:p, ve:gə - ve:k] (*Rade-Rad, liebe-lieb, Wege-Weg*), which indicate that final [p], [t] and [k] are manifestations of the syncretisms /p-b/, /t-d/, /k-g/. In English, furthermore, the [t] in e.g. *hopped* [hɒpt] can be recognized as manifesting a syncretism between /t/ and /d/, because there is alternation between these two entities in the preterite of regular verbs, cf. *begged* [begd]. But in contradistinction to the Prague phonologists Hjelmslev does not recognize any syncretism in the case of voiced and unvoiced stop consonants following initial *s* in English or Danish, since there are never alternations in this position. To him this is an example of defective distribution.

In order for a syncretism to be recognized it is not necessary, however, that an alternation is adduced in each individual case. For example, there is no intervocalic [b] alternating with the [p] in German *ab* ('off'), but nevertheless this [p] is considered a manifestation of the /p-b/ syncretism, in the same way that [p] in *lieb* is. But whereas the syncretism in the latter case is said to be RESOLUBLE, it is characterized as IRRESOLUBLE in [ap]. In [li:p] the syncretism can be resolved by generalizing from the position where there is commutation between /p/ and /b/, i.e. [li:bə]. A RESOLUTION of the syncretism in [li:p] will thus produce /li:b/, a resolution of the syncretism in [ra:t] *Rad* ('bicycle'), which in the dative is [ra:də], will result in /ra:d/, and a resolution of the syncretism in [ra:t] *Rat* ('council'), which in the dative is [ra:tə], will bring about /ra:t/. A notation with

14. Hjelmslev's use of the term "facultative" has been criticized in Fischer-Jørgensen (1972).

resolved syncretisms, e.g. /li:b/, is termed IDEAL, whereas a notation with unresolved resolvable syncretisms, e.g. /li:P/ or /li:p/b/, is called ACTUALIZED. In many respects Hjelmslev's ideal notation corresponds to the underlying representations now current in generative phonology (cf. also Avanesov's "morphophonemic" and "word-phonemic" transcriptions, 11.15 below).

FURTHER REDUCTION OF THE INVENTORY

7.19 One of the characteristics of glossematics, as compared with other trends in linguistics, is the narrow interpretation of simplicity as equivalent to having a small number of ultimate constituents (cf. 7.11). A great REDUCTION OF THE INVENTORY OF TAXEMES is therefore aimed at. But at the same time it is attempted to REDUCE THE INVENTORY OF SIGN EXPRESSIONS as much as possible. This implies that in the analysis of taxemes, the reduction of sign expressions is also taken into consideration, and that an analysis according to which there is only one sign-expression corresponding to each sign-content is generally given preference. This may particularly be accomplished by means of an ideal notation, where syncretisms have been resolved (cf. 7.18 above). As in generative phonology, then, the ultimate analysis of expression is really morphophonemic.

In order to accomplish the reduction, various expedients are resorted to, some of which are also used in other schools, e.g. the Bloomfield School. But since Hjelmslev attaches little importance to simplicity of manifestation rules, he frequently moves further away from phonetic realities than most linguists.

A frequently used method consists in setting up formal syllable boundaries which then function as conditions for certain manifestations. This recalls the Bloomfield School's use of juncture, but Hjelmslev largely confines himself to operating with syllable junctures. In Danish, for example, – at the suggestion of Uldall (1936) – the members of the pairs *t-d*, *d-ð*, *k-g*, and *g-γ* are regarded as bound variants of single taxemes occurring initially and finally in syllables, respectively. [t-] in [tam?] *tam* ('tame') and [-d] in [mad] *mat* ('dim') are bound variants of the taxeme (or rather pre-taxeme) /t/; [d-] in [dam?] *dam* ('pond') and [-ð] in [mað] *mad* ('food') are variants of the taxeme /d/; and in the same manner initial [k-] and [g-] are grouped with final [-g] and [-γ] respectively. It is now possible to generalize from marginal to medial position and assume, for example, that there is a syllable boundary after [ð] in [ba:ðə] *bade* ('to bathe'), i.e. /bad-ə/ (Hjelmslev 1951). In the same way [ç] in German *Kuchen* and [x] in *Kuchen* are interpreted as being dependent on syllable boundary (Hjelmslev 1937 c), namely as /ku:-xən/ and /ku:x-ən/ respectively. Similarly Hjelmslev generalizes from initial [z-] and final [-s] in German, e.g. in *sehen* [ze:ən] and *das* [das], to medial position and assumes that there is a syllable boundary after [s] in *reißen* [rajsən] and before [z] in *reisen* [raizən]. In this way [s] and [z] are reduced to bound variants of one phoneme in German. Such phonemic syllable

boundaries are used very freely. For example, a boundary is hypothesized after *r* in Danish [gæ:rə] *gore* ('to do') and before *r* in [kø:rə] *kore* ('to drive') in order to reduce [ø] and [œ] to variants of the same phoneme. Such *ad hoc* solutions are numerous. Hjelmslev thus gets rid of the opposition [dø:ʔr] *dor* ('dies')/[dœ:ʔr] *dor* ('door') by interpreting the former word as /'dø₀er/ (ø indicates an unstressed syllable) and the latter as /door/. The -er ending is here hypothesized in the verb form by analogy with other present tense suffixes, and from this particular word it is generalized to the adjective *for* /'fø₀er/ ('stout'), which is thereby distinguished from the adverb *for* /foor/ ('before'). However, Hjelmslev does not explain how we are then supposed to distinguish between the adjective [mø:ʔr] *mor* ('tender') and the plural noun form [mø:ʔər] *moer* ('maidens').

Another means of reduction is to interpret single sounds as TAXEME CLUSTERS, a device which is commonly resorted to in other phonological schools as well. This device is, of course, primarily used in the interpretation of long vowels. Danish long vowels are in most cases construed as "identity diphthongs", cf. *ben* /been/ ('leg'), *nåde* /nød₀e/ ('mercy'). Sometimes, however, an "actualized identity diphthong" is interpreted as an ideal (short) monophthong on the analogy of a short vowel occurring in other forms of the same word, cf. *guder* ('gods', plural of *gud*), which is actualized /'guud₀er/ and ideal /'gud₀er/ (this necessitates a rule of vowel lengthening before single consonant followed by weakly stressed *ε*). In this manner a reduction in the inventory of sign-expressions is brought about.

Generalizing from examples like *trouvé-trouvée*, where the latter form may be pronounced with a long vowel (although rarely), Hjelmslev suggests that long vowels in French might be interpreted as short vowels followed by /ə/, e.g. *tette-tête* as /tət/ and /tətə/ (Hjelmslev 1970).

The Danish consonant inventory is simplified in various ways, for example by considering [ŋ] as a manifestation of /ng/, except before *g* and *k*, where it is a variant of /n/. Furthermore the number of stops is reduced by regarding [p^h, t^h, k^h] as /b, d, g/ in combination with /h/. This is not very surprising, but it is more remarkable that /h/ in certain cases is assumed to precede /b, d, g/. The reason for this is that Hjelmslev, in so far as it is possible, wishes to maintain a rule according to which clusters of three consonants would be decomposable into clusters of two which may occur in isolation. If [plas] *plads* ('place'), for example, were interpreted as /bhlas/, the combination /hl-/, which is otherwise non-existent, would arise, and Hjelmslev therefore prefers /hbl-/ in this particular case. On the other hand [mælʔg] *mælk* ('milk') is interpreted as /mælgh/ in order to avoid the non-existent cluster /lh/. Hjelmslev's analysis of Danish, it may be added, raises a number of problems (cf. Basholl 1971 and 1972, Fischer-Jørgensen 1972).

Another important method by which the number of sign-expressions may be reduced, in addition to resolution of syncretisms between given taxemes, is the encatalysis of LATENT CONSONANTS, a method which is used particularly frequently by Hjelmslev in his analysis of French (1970). In the feminine declension of French adjectives there are many irregularities from a purely phonetic

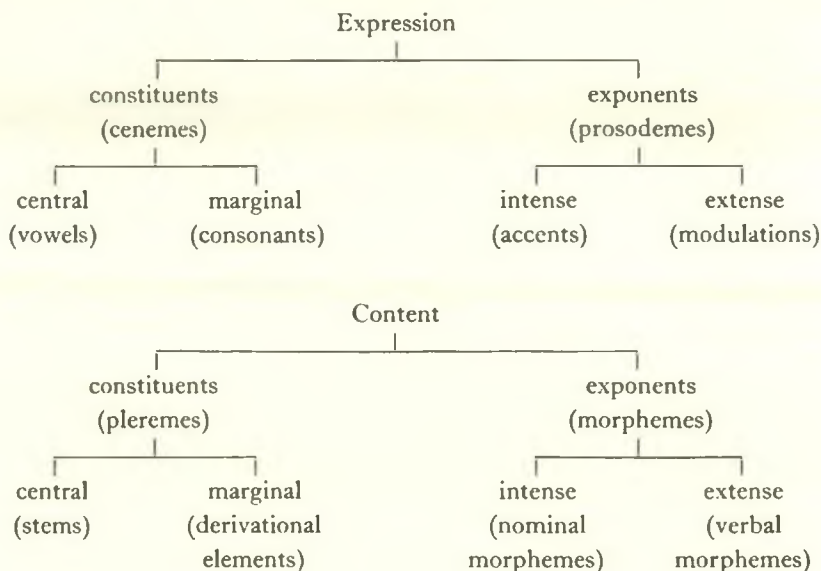
point of view, e.g. *petit* – *petite*, *bon* – *bonne*, *doux* – *douce* [pti – ptit, bō – bōn, du – dus] etc. Bloomfield retained such phonetic forms in his phonemic analysis, but in his chapter on alternations he chose to regard the feminine form as basic and to derive the masculine from it by means of consonant loss (cf. 6.6). Hjelmslev, on the other hand, includes these alternations in the taxeme analysis itself; and he prefers to start from masculine, interpreted as ending in a latent consonant, and then to derive feminine by addition of /ə/, which is latent or facultative. Furthermore a nasalized vowel is decomposed into an oral vowel followed by a nasal consonant. The adjectives mentioned here are thus analysed as /pətit – pətitə, bōn – bōnə, dus – dusə/, whereby regularity of both stem and ending is obtained, and this results both in fewer taxemes and fewer sign-expressions. It is also possible to extend this approach of latent consonants to other cases and to interpret the noun *pot* [po], for example, as /pət/, since there are forms of this word with liaison, such as *pot-au-feu*. The form /bōn/ for [bō] is an example of ideal notation. At an actualized level there is assumed to be syncretism between different nasal consonants; [bō] is here transcribed /bōN/, and words like *faim*, *sain* and *bain* are transcribed as /fēN, sēN, bēN/ (where N indicates the neutralization product). Ideally, however, these words are interpreted as /fēm, sen, bep/ cf. *famine*, *saine*, *baïne*. There is a striking resemblance between this analysis and Schane's generative analysis of French (cf. 9.27).

Sometimes the ideal forms are far removed from the phonetic ones. Some typical examples from French are *œf* [œf], plural *œfs* [ø], which are interpreted as /œf – œfəz/, and *os* [ɔs], plural *os* [o], construed as /ɔs – ɔsəz/. These forms may be said to be completely regular, provided there is a very special rule according to which /f/ and /s/ are latent before /ə/ (the plural ending is interpreted as /-z/ because a [z] may be carried over in liaison).

From Danish the word *kalv* [kʰalʔ(v)] ('calf'), which is interpreted as /hgaldu/, may be mentioned. The cluster /ld/ may here be explained by the fact that "stød" in a consonant is interpreted as a signal of double consonant, and /d/ is chosen by analogy with e.g. *mand-mandig* [manʔ – mandig]; *u* and *v*, furthermore, have been grouped together into one phoneme. It amused Hjelmslev to shock his readers with such examples.

ESTABLISHMENT AND DEFINITION OF CATEGORIES

7.20 In glossematics great importance is attached to the establishment of categories according to syntagmatic relations, and a point is made of using the same system of definitions in the description of expression and content. As an example of this parallelism a number of the most important categories, as they are set up by Hjelmslev in some of his early works, can be given (cf. 1937 a, p. 317 ff; 1938 a, p. 218 ff; and 1939 a, p. 271 ff):



A combination of constituents and exponents is called a SYNTAGMA. In the expression plane the minimal syntagma is the SYLLABLE, in the content plane the noun. The difference between constituents and exponents is that only exponents may be governed by an entity outside the syntagma; for example, a weak stress presupposes a strong stress, and a rising modulation a falling one. In the same way "morphemes" – which in Hjelmslev's terminology refer to inflectional categories (i.e. they are content units) – are governed by entities outside the word they are attached to: for example, case may be governed by prepositions.

The difference between extense and intense exponents is that only the extense exponents may characterize a whole utterance, cf. modulations as opposed to accents, and verbal morphemes like tense and mood, which strictly speaking do not belong to the verb but to the whole utterance, as opposed to nominal morphemes like case and number. The difference between central and marginal constituents is that the marginal constituents presuppose the central, i.e. consonants presuppose vowels, and derivational elements presuppose stems. A minimal syntagma comprises only one intense exponent.¹⁵

In the early papers discussed here there is a certain circularity in the definitions of ACCENT and SYLLABLE, since the syllable is defined as containing a single accent unit, and the exponent (including accent) as being governed by something outside the syllable. In "Sproget" (1963, p. 107 (= "Language", pp. 107–8)) this is avoided by laying down the condition that exponents (which are here called characterizing elements, whereas constituents are termed basic elements) enter into a particular type of government which establishes a clause and is called a

15. Remember that morpheme is a content unit in glossematics (for the different uses of the term morpheme, see 6.35).

direction. But establishment is not defined. Hjelmslev's paper on the Danish expression system (1951) and his *Resumé* (1975) contain more exact and detailed definitions.

In the earliest papers VOWELS are defined as being capable of constituting sentences by themselves, later as being capable of constituting syllables by themselves. (Like Pike, Hjelmslev distinguishes between the phonetic units "vocoid" and "contoid" and the functional categories "vowel" and "consonant"). This implies that languages which do not possess any structural syllable, e.g. French, have neither vowels nor consonants. Now it also follows from the definition of accent that vocoids in languages with vocoid harmony are defined as accents (they are governed by an entity in another syllable), and consequently there are no vowels, or consonants, here either. This is another characteristic proposal with which Hjelmslev enjoyed shocking his readers, but actually it is only a matter of definition. French is said to have pseudo-vowels (capable of constituting an utterance) and consequently also pseudo-consonants and pseudo-syllables.

Vowels and consonants are arranged in CATEGORIES according to their possibilities of combination within the central and marginal parts of the syllable respectively, i.e. vowels in relation to diphthongs and consonants in relation to consonant clusters. As regards consonants, a distinction is drawn between vowel-adjacent and vowel-non-adjacent position. It may be objected that these order phenomena really belong under substance, but like so many other formulations in Hjelmslev's works, including "OSG", this is a slightly "popular" version of something more abstract and functional. In actual fact he operates with presupposed and presupposing positions, regardless of whether they are initial or final.

As an example we may mention Hjelmslev's establishment of (pseudo-) consonant categories in French (1970). The consonants are here divided into four groups: (1) those which occur only initially and outside clusters (/h/ and /ʒ/); (2) those which occur both initially and finally but only outside clusters (/m/ and /ʃ/); (3) those which occur both initially and finally but only in vowel-adjacent position (/n, ɲ, r, l/), and (4) those which occur both initially and finally and both in vowel-adjacent and non-adjacent position (the remaining consonants, i.e. /p, t, k, b, d, g, f, s, v, z/). "Initial" and "final" is to be understood as "(pseudo-) syllable initial" and "(pseudo-)syllable final", and it should be pointed out that the above classification is based on an ideal notation, i.e. /k/ is final in *acte* /ak-tə/ and /n/ final in *bon* /bɔn/, for example.

In glossematics it has not been attempted – as it has by Bloomfield with English and Tögeby (1951) with French – to subcategorize consonants and vowels according to special combinations and thereby define them individually. Hjelmslev feared that this would lead to the use of differences which were merely due to accidental gaps in the inventory of signs. Furthermore he thought that by not going beyond the more general categories a better foundation was laid for the typological comparison between different languages, and this comparison is precisely one of the main purposes in establishing categories (cf. Fischer-Jørgensen 1952).

ESTABLISHMENT OF GLOSSEMES

7.21 Within each category the taxemes are arranged in dimensions in such a way that there is a minimal number of dimensional elements. These dimensional elements are called GLOSSEMES. The dimensions correspond to a certain extent to the oppositions of Prague phonology and the glossemes to the relevant properties. However, since the demand for a minimal number of elements is absolute, it follows that e.g. four taxemes should always be arranged as 2×2 , six as 2×3 , nine as 3×3 , ten as 2×5 , etc., and when deciding on the number of dimensions the peculiarities of the individual language cannot be taken into account. It is therefore emphasized that this is not a particular but a universal analysis; the smallest elements of the particular analysis are the taxemes. The way in which the taxemes are placed in the dimensions, on the other hand, depends on the individual language.

As an example the analysis into glossemes of French and Danish consonants (Hjelmslev 1970 and 1951, respectively) may be mentioned:

French

Category 3			Category 4					
α A			α	A	β	B	I'	
α			p	t	f	k	s	
A			b	d	v	g	z	
	n	l						
	ɲ	r						

Danish (which has only one category)

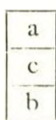
α	A	β	B	γ
f	s	m	h	n
b	l	d	g	r

It will be noticed that category 4 in French and the Danish consonants are defined glossematically in almost exactly the same way, although the consonants placed in the squares corresponding to each other (e.g. French *v* and Danish *d*) are greatly different in the two languages, both phonetically and distributionally.

In order to understand these glossematic arrangements with Greek letters, it is necessary to go back to Hjelmslev's book on case of 1935 (pp. 98-105 and 111-26), where the system is explained. At that time Hjelmslev was interested in semantic definitions based on the range of the members of grammatical categories, and it was with this purpose in mind that he developed the descriptive system involving Greek letters. The crux of this theory is that most linguistic oppositions are considered PARTICIPATIVE. This means that an entity may be simultaneously a and not a. In an opposition like *big-little*, for example, *big* may be used referring to the whole semantic range of "size" (e.g. in questions like

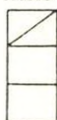
"How big are you?"), whereas the meaning of *little* is more limited. *Big* is EXTENSIVE and *little* is INTENSIVE. In most languages, similarly, present tense is extensive as compared with past tense, and indicative mood in relation to the subjunctive. Exclusive oppositions are special cases of the participative ones. Hjelmslev is here influenced by Lévy-Bruhl's theories of primitive mentality and by Roman Jakobson's theory of marked and unmarked members of an opposition. The latter source of influence is not clearly apparent in the book on case, but it is evident in a paper on grammatical systems of 1933, which is published in Hjelmslev's "Essais II" (1973).

Hjelmslev operates with a conceptual zone which is divided into three sections:



a indicates a quality and *b* its opposition; *a* is called the intensive field, *b* the extensive field, and *c* the neutral field. The opposition *big-little* may now be characterized in the following way:

little



α

big



A

Little is the intensive member of the opposition, which occupies the field *a*, whereas *big* is extensive and may spread out over the whole semantic range. If there are several members in a correlation a somewhat more complex system is needed. Hjelmslev is of the opinion that four additional configurations are necessary:



β



B



γ



Γ

Capital letters refer to extensive members of an opposition and small letters to intensive members. β "insists on" the intensive field *a*, *B* on the extensive field *b*. Both have a tendency to spread out, but this is more marked in the case of *B*.¹⁶ γ is intensive because it insists on the intensive field *a*, and Γ is extensive because it insists on the neutral field.

16. That an entity "insists on" a field means that all its main variants cover this field, but not always the other fields as well.

A dimension with three members may consist of $\beta B \gamma$ or $\beta B I'$. It is possible to have all six letters in one dimension (in this way the system differs clearly from Jakobson's system).

Furthermore Hjelmslev has noticed that syncretisms nearly always take place between an extensive and an intensive member of an opposition (in the case of implication, where one member represents the whole zone, this seems clear),¹⁷ and furthermore that a syncretism is usually dominated by the intensive member of another opposition. For example, there are more syncretisms of person and number in the subjunctive than in the indicative mood.

When Hjelmslev later changed his views and adopted a purely formal point of view, he used these observations definitionally, with the result that oppositional members are identified as intensive or extensive not on the basis of their semantic range, but on the basis of syncretisms. The consequence of this is that the arrangement of taxemes does not always agree too well with substance. However, once allowance has been made for syncretisms, one can attempt to arrange the taxemes in such a way that there is the greatest possible agreement with substance.

In the French category 3 (see above) there is syncretism between /n/ and /ɲ/. They must therefore be arranged in such a way that one of them becomes extensive and the other intensive.

In category 4 there is syncretism between /p/ and /b/, /t/ and /d/, /f/ and /v/, /k/ and /g/, /s/ and /z/, and they must therefore be arranged in pairs as intensive and extensive members (vertically: fortis/lenis). In the horizontal dimension the arrangement of the taxemes agrees tolerably well with substance: /p/ and /b/ are markedly front, /f/ and /v/ relatively front, /k/ and /g/ rather back, /t/ and /d/ both-and, and /s/ and /z/ neither-nor. This makes at least a certain amount of sense.

In the case of the Danish consonants there are no syncretisms. The only example Hjelmslev is able to adduce – *købt/køft* ('(to have) bought') – probably never occurs in Standard Danish. He has therefore attempted an arrangement with a certain affinity to substance. The horizontal dimension is called front/back, as in the case of French, and the vertical dimension is called open/close.

As mentioned above, this kind of arrangement bears a certain resemblance to an analysis into oppositions and distinctive features (see Chapter 8). However, it differs from such an analysis, principally in being a universal classification, where the specific traits of the language under investigation have little attention paid to them; and furthermore by the fact that each category is classified separately. Since every entity is defined by all dimensions, there is solidarity between the dimensions in each category.

Both Hjelmslev (1954, p. 182) and Uldall (1957, p. 28) rejected a distinctive feature analysis. They seem to think that such an analysis will have to be carried out lengthwise, the features being a sort of long components, and that it therefore

17. Cp. the example "big" above, and German final [p] which represents both /p/ and /b/; cp. also Trubetzkoy 3.7 above.

cannot consist in a decomposition of single phonemes. Hjelmslev, furthermore, wants to rule out such an analysis because it refers to pure substance; because the classifications by categories is not respected; and because the features would be different if they were transferred to writing. He also rejects it because features are solidary,¹⁸ whereas the entities at the preceding stage of the analysis exhibit selection (vowel/consonant, strong stress/weak stress, etc.). These objections, however, are not immediately convincing. It would be quite possible to decompose each category separately into distinctive features, and it would be perfectly feasible to transfer the features to writing and construct a system of feature writing which could replace alphabetic writing. The fact that there is solidarity between features, moreover, only demonstrates that a new level of analysis has been reached, not that features should be rejected. Thus nothing seems to prevent the recognition of distinctive features as the ultimate formal units of the expression (see 8.2, and Fischer-Jørgensen 1966, pp. 23-7).

Finally it should be mentioned that Hjelmslev also uses his logical apparatus with Greek letters for the purpose of specifying categories. In the case of selection, for example, the selecting categories are symbolized with β , the selected with B , whereas γ symbolizes both selecting and selected, and I' neither-nor (cf. Hjelmslev 1951 and 1954).

DIACHRONY

7.22 In a series of lectures dating from 1934, published in 1972 under the title "Sprogssystem og sprogforandring" ('Language System and Language Change'), Hjelmslev has put forward his views on linguistic change and illustrated these views with mainly grammatical examples. He boldly hypothesizes that the system (pure form) develops completely independently of substance according to certain inherent tendencies. He assumes, for example, that there is an optimal number of elements in the different categories; thus the number of expression elements in Proto-Indo-European was above optimum and was subsequently lowered somewhat. Furthermore he believes that there is a tendency for all elements to become fully integrated in the system, for instance for all vowels to participate in alternations, and for elements with special possibilities of combination, e.g. s in Proto-Indo-European, to be changed. Substance changes also take place according to certain laws of their own, being dependent on tendencies of language communities, substrate, ease etc., but they can be held in check by the system. Hjelmslev seems to have maintained these theories later on, although he only refers to them very briefly (e.g. 1937a, p. 322ff, and, in a little more detail, 1937b, p. 38ff) and in subsequent lectures he persisted in distinguishing sharply between changes in the system and changes of usage or substance. He preferred to restrict the reference

18. In one of his latest papers (1954, pp. 181-2) Hjelmslev sets up features like oral : nasal, etc., but as features of substance.

of the term "diachrony" to substance change and introduced the term "metachrony" to designate systematic change. Only through language typology is it possible to arrive at more reliable laws of change in language systems.

THE INFLUENCE OF GLOSSEMATICS (OR "THE POST-GLOSSEMATICIANS")

7.23 As is clear from the Bibliography, glossematics has been discussed more than it has been applied. This is probably due partly to the somewhat forbidding terminology, which has only been exemplified sporadically above, and partly to the fact that, except for some fragments in scattered papers, the analytical procedure itself has never been published. This has greatly impeded the application of glossematic theory. In addition to Hjelmslev's own brief accounts of the Danish and French expression systems, the only really glossematic descriptions of expression¹⁹ are BORGE ANDERSEN's analysis of a Danish dialect (1959), MARIE BJERRUM's analysis of Faroese (1949 and 1960), and UNA CANGER's analysis of the Mexican language Mam (1969). Andersen's book provides a good introduction to the method, which is followed very closely, except for the fact that allowance is made for simplicity of manifestation rules. It is easier to understand than Hjelmslev's extremely condensed description of the Danish expression system. Marie Bjerrum's papers are more difficult, for one thing because the Faroese expression system is in itself fairly complex, but they clearly demonstrate how highly morphophonemic a glossematic description can be.

KNUD TOGEBY (1918-1974) has given a detailed analysis of French (1951) which is strongly influenced by glossematics, but cannot be said to be a completely glossematic work. Tøgeby subscribes to the biplanar view of language and attaches great importance to the commutation test. One minimal pair is considered both necessary and sufficient, and as regards bound variants, he adheres to experimental commutation. Like Hjelmslev he is of the opinion that the procedure should be purely formal, i.e. substance should be disregarded completely, but nevertheless he takes substance into consideration on several occasions in his own investigation. He also rejects a distinctive feature analysis on the ground that a distinctive feature does not occur in isolation in the same position as the segmental unit. On a number of points, however, his view differs from that of glossematics. For example he advances a special theory of signs, and he attempts to carry the establishment of categories to its logical conclusion, with the result that each taxeme is defined separately in the end. In order to accomplish this he takes both syncretisms and the difference between extensive and intensive members (see 7.18) into account in addition to position, and at the stage of classification into intensive

19. They are quoted here and in the Bibliography, although applications of other theories have only been quoted in exceptional cases, because the number is small, and they may help understanding the theory.

and extensive members he considers not only syncretisms, but defective distribution as well. In his discussions Togeby is also influenced by American linguistics, and his book is a useful introduction to structural linguistics generally. H. A. Kofoed's introduction to phonology (1967) is also influenced by glossematics in many points.

Although glossematics has seldom been applied, it has had great influence both in and outside Denmark. In recent years many translations both of "OSG" and of "Sproget" into various languages have appeared. One of the most wholehearted foreign adherents is FRANCIS J. WHITFIELD, who has translated "OSG", "Sproget" ("Language"), and the Résumé of the glossematic theory into English. In Denmark a whole generation of linguists has been influenced more or less by glossematics: partly by the general view of language which Hjelmslev puts forward in "OSG" (nearly everybody regards language as a biplanar structure and attaches importance to the commutation test), partly by the demand for stringent method and definition of terms employed. It is also chiefly due to Hjelmslev that Danish dialectology, in contradistinction to dialectology in nearly all other countries, already in the thirties was clearly structurally oriented.

Chapter 8

ROMAN JAKOBSON'S THEORY OF DISTINCTIVE FEATURES

Introduction

8.1 The theory of distinctive features can be considered as a further development of the Prague School conception of "relevant sound properties". The germs of this development can be traced back to some of Jakobson's very early papers, but the theory was not fully elaborated until 1949 (Jakobson 1949; Jakobson and Lotz 1949). It was presented in detail in "PRELIMINARIES TO SPEECH ANALYSIS" in 1952 (abbreviated below as "PrI."), which Jakobson wrote together with Gunnar Fant and Morris Halle, and again in 1956 (in a somewhat different form, particularly as regards the phonetic descriptions) in the monograph "Phonology and Phonetics", written in collaboration with Morris Halle and published together with an article on aphasia as "FUNDAMENTALS OF LANGUAGE". This monograph was reprinted (with some abridgement) under the title "Phonology in Relation to Phonetics" in "Manual of Phonetics" (ed. Kaiser 1957), in "Selected Writings" I (1962, pp. 464-504), and with a number of changes in "Manual of Phonetics" (ed. Malmberg 1968) quoted in "SWr." 2. ed. 1971, pp. 738-42. The theory gained ground very quickly and has become of great importance to generative phonology.¹

Distinctive feature theory differs from the classical Prague theory on the following points:

- (1) Relevant distinctive properties are no longer regarded simply as classificational dimensions, which permit an arrangement of phonemes into a system, but rather as components of phonemes, and consequently as minimal linguistic units.
- (2) Trubetzkoy's multilateral (multidimensional) oppositions (e.g. *p/t/k*) are rejected, and only one-dimensional (now termed binary) oppositions are accepted.

1. Pavle Ivić (1965) has given an account of the development of Jakobson's distinctive feature theory with an interesting discussion of the appropriate uses of the different features in language description. As I did not become aware of this important paper until shortly before the manuscript of this book went to print, I could not fully utilize his remarks.

- (3) The number of distinctive features in each individual language is reduced as much as possible in order to simplify the description.
- (4) It is further assumed that there is a limited set of universal "distinctive features", and an attempt is made to keep the number of these features as low as possible by combining into one feature phonetically related features which are never independently distinctive in the same language.
- (5) Importance is attached to a detailed physiological-acoustic-auditory description of the features; in this description the auditory aspect is regarded as most important.
- (6) For each language a matrix is set up with the phonemes arranged horizontally and the distinctive oppositions vertically in such a way that e.g. voicing is marked + in the case of *b*, but — in the case of *p*. In any such representation there will be a number of cases where some given feature is not relevant (e.g. nasality in the case of *s*), and is specified as 0 in the matrix.

In the following we will discuss these separate points.

In addition to (1) **DISTINCTIVE FEATURES** Jakobson assumes the existence of (2) **CONFIGURATIONAL FEATURES**, which serve to divide the utterance into smaller units (i.e. certain types of accent and intonation), (3) **EXPRESSIVE FEATURES**, which create emphasis or indicate the speaker's emotional attitude, and (4) **REDUNDANT FEATURES**, which have no independent function because they are dependent on the environment, but which contribute to the identification of the environment in question. Configurational and expressive features are not discussed in detail in the monographs mentioned above. We will return to redundant features in 8.15–8.16.

Components versus Dimensions

COMPONENTS AS MINIMAL UNITS

8.2 As mentioned in 3.3 the conception of the phoneme as "the totality of the phonologically relevant properties of a sound unit" ("die Gesamtheit der phonologisch relevanten Eigenschaften eines Lautgebildes") is found in Trubetzkoy's "Grz." in addition to the definition of the phoneme as the smallest phonological unit. This formulation is due to Jakobson, who as early as 1932 in an article in a Czech encyclopedia² defined the phoneme as "a set of those concurrent sound properties which are used in a given language to distinguish word meanings". It is only a very short step from this formulation to the conception of the phoneme as consisting of components such as voicing, labiality, etc., whereby these components, and not the phonemes, become the smallest phonological units.

2. Reprinted in "Selected Writings" I (1962, p. 231–3) in English translation.

If by analogy we apply these points of view to yellow and blue triangles and rectangles, we might say that Trubetzkoy's arrangement of relevant properties would lead to a classification of the figures according to shape and colour, whereas Jakobson's decomposition into distinctive features would lead to interpreting e.g. the yellow triangle as consisting of the components yellow colour and triangularity.

Hjelmslev regards this as a purely phonetic description, but Jakobson (1949) argues convincingly that the decomposition of phonemes into features is carried out by exactly the same procedure as the decomposition of sign expressions into phonemes by means of commutation and identification. Voicing in *b* is found to be commutable with voicelessness in *p*, and the same is observed for *t/d* and *k/g*. Voicing in *b* may now be identified with voicing in *d* and *g*, and voicelessness in *p* with voicelessness in *t* and *k*, in the same way that *p* in *pan* is identified with *p* in *pin* and *pack* and *b* in *ban* with *b* in *bin* and *back*. The number of distinctive features contained in a phoneme is equal to the number of commutable components it contains (e.g. "voiceless", "stop" etc. in *p*), just as the number of phonemes contained in a sequence is equal to the number of commutable segments in the sequence, e.g. *p-a-n* in *pan*. There is therefore a close parallel between the analysis of sequences into phonemes and the analysis of phonemes into distinctive components (features). According to Jakobson this parallelism had not been seen clearly because Saussure characterized the sign expression as linear, i.e. as consisting of successive elements. If this point of view is accepted the further decomposition of phonemes into simultaneous features becomes impossible (see also 1939b, p. 304 ff).

THE TERM "DISTINCTIVE FEATURE"

8.3 In his early studies Jakobson talks about "property" (*propriété*, *Eigenschaft*), but in the articles of 1949 he uses the term "distinctive feature". This expression has been taken over from Bloomfield, who in his book "Language" (1933) distinguishes between distinctive and non-distinctive features. Bloomfield's statement "the distinctive features occur in lumps and bundles each one of which we call a phoneme" is quoted at the beginning of a paper by Cherry, Halle, and Jakobson (1953). (According to Bloomfield, however, the distinctive features do not form part of a structural description.)

The reinterpretation of dimensions as components entails a terminological ambiguity because "feature" is used referring both to dimensions, e.g. "degree of openness", and to the components, e.g. "openness" and "closeness". (Notice that it is common usage to talk about "voicing", both when referring to "the dimension of voicing" and to "presence of voicing" as opposed to "lack of voicing"). This usage is in some cases confusing.

In Jakobson's papers of 1949 the term "feature" is almost exclusively used in the sense of "component" ("ultimate constituents (or "components") of phonemes"). He talks about "two opposite features" and about the fact that there

are six "oppositions of distinctive features" in French, among which are listed the "oral feature" and the "nasal feature" (Jakobson and Lotz 1949). This is also often the practice in "Prl." ("one feature: the grave character of /b/"). In connection with the opposition vocalic/non-vocalic it is stated that a phoneme may possess the vocalic "feature". But in "Prl." "feature" is also used in the sense "distinctively utilized dimension" (which in the case of an opposition with only two members is the same as distinctive opposition). What were formerly called "oppositions of distinctive features" are now called "dichotomous features"; it is mentioned, for example, that each language has at least one tonality feature, which can only be taken to mean a tonality opposition between two members. Frequently the intended meaning is evident from the context, but when, for example, it is stated that the phonemes of a language can be decomposed into eight distinctive features, it is not immaterial whether this refers to components or oppositions, for in the latter case there will be sixteen components. In generative phonology "feature" is also used in both ways, but more often in the sense "opposition" or "dimension", and the feature as member of an opposition is sometimes called a "feature value".³ In a few places a "distinctive feature" is described as a "choice" between two possibilities (in "Prl.") or as a "question" which may be answered by yes and no (Cherry, Halle, and Jakobson 1953).

THE PHONEME AS A BUNDLE OF DISTINCTIVE FEATURES

8.4 Even though the breaking down of phonemes into components and the recognition of these components as the minimal elements in the analysis of an expression is clear and fully acceptable, the definition of the phoneme as a bundle of distinctive features (in the sense of components) is not altogether clear. Jakobson (1962a) maintains that there are positions where an opposition is neutralized and that in such cases the number of distinctive components of the phoneme is reduced. But the question arises whether segments containing a different number of features can be considered the same phonemes, or whether it would be preferable to return to the older Prague theory in which an archiphoneme is interpreted as a special phoneme. In this connection it should be added that there are sometimes positions where very few commutable entities may occur and where this cannot be interpreted as due to the neutralization of particular oppositions. In many languages only a few consonants occur in final position; and it is evident that a final *s* which can only be commuted with, for example, *n* and *l* contains fewer commutable

3. It might have been preferable if Jakobson had adhered to the use of "feature" in the sense of "component of a phoneme" or "term of a distinctive opposition", but the use of the word in the sense of distinctively utilized dimension (or opposition) is now so common that it can hardly be changed. In this book it is therefore also used in both senses except in cases where ambiguity might arise.

features than an initial *s* which may perhaps be commuted with *z*, *t*, *f*, and several others, in addition to *l* and *n*. In his description of German Heike (1961) follows this argument to its logical conclusion by decomposing the consonants into different numbers of features in four different positions (initially, medially, finally after a short vowel, and finally after a long vowel). If in the above example initial *s* and final *s* are combined into one phoneme it is no longer possible to say that phonemes are identified by means of their distinctive features, as has been maintained by Martinet (cf. the above discussion of this problem in 3.4). Roman Jakobson, in "Prl.", also argues that the study of distinctive features is the only objective way in which to identify phonemes.

The Binary Principle

8.5 Trubetzkoy considered the bilateral opposition to be the most frequent type, but he also allowed for multilateral oppositions, particularly in the case of point of articulation and degree of aperture (e.g. *p-t-k* and *i-e-ε*).

Already in his paper on phonological classification of consonants (1939a) Jakobson maintains that all linguistic oppositions are bilateral, i.e. they may all be broken down into dichotomies. As mentioned in 3.10, Jakobson suggests in this paper that the problem of the consonantal oppositions may be solved by establishing two intersecting oppositions: front (*p, t*) as opposed to back (*c, k*),⁴ and grave (*p, k*) as opposed to acute (*t, c*), and furthermore by distinguishing between consonants with strong frictional noise (strident) and without such noise (mellow), thereby separating labiodentals from bilabials, sibilants from nonsibilants, uvulars from velars, and affricates from unaffricated stops.

As regards the degree of aperture of vowels, the problem is solved in the description of French (Jakobson and Lotz 1949) by assuming a further opposition between tense and lax, thus distinguishing *e/ε*, *o/ɔ*, *ø/œ*, and *a/a*. However, in "Prl." Jakobson has given up his attempt to reduce degree of aperture to a binary opposition, and admits that there are three degrees of aperture in several languages. In such cases *i* is characterized as $-$, *ε* as $+$, and *e* as \pm . This type of representation had been used already in 1949 in the case of *r* and *l*, which are considered both vocalic and consonantal, as well as in the case of affricates, which combine stop closure with frictional stricture. In later presentations the problem of affricates is solved by means of the opposition: strident/mellow (as proposed already in 1938, see 1939a), and the vocalic/consonantal opposition is split up into two: vocalic/non-vocalic and consonantal/non-consonantal. This is possible because these two oppositions are described phonetically by at least partly dissimilar characteristics. In Cherry, Halle, and Jakobson (1953) the same method

4. The letter *c* here symbolizes a palatal stop.

is applied to the degree of aperture of vowels, viz. by establishing two oppositions: "diffuse (= close)/non-diffuse" and "compact (= open)/non-compact". As, however, only one common phonetic description of the opposition compact/diffuse is advanced, this approach must be characterized as a purely descriptive trick. It is not a question of two different oppositions whose members may be combined freely (as in the case of *p t c k*), but of an artificial division of one opposition into two. Such a method is applicable when there are three degrees of aperture in which case *i* may be characterized as [+diffuse, -compact], *ε* as [-diffuse, +compact], and *e* as [- -]. If there are four degrees of aperture, however, it does not work. The fourth possible combination [+ +] is logically impossible since compact and diffuse are defined as opposites. Consequently, this approach is abandoned again in "Fundamentals" (1956), where it is stated expressly that the vocalic opposition compact/diffuse often presents a higher number of terms, mostly three. The same wording is used in "Manual" (1968, p. 444), but in the same paper (p. 430), it is said that compact/diffuse "often appears to be split up into two autonomous features". This problem arises once again in generative phonology, and we shall return to it in Chapter 9.

To Jakobson the binary principle is not simply a practical descriptive approach but something fundamental. He is of the opinion that this principle is inherent in the structure of language and in the human mind. In "Fundamentals" he advances several arguments for this position: (1) it is the optimal, most economical structure; (2) language is acquired in early childhood, and according to many psychologists the binary opposition is the child's first logical operation; (3) most phonological oppositions are clearly binary (voicing, aspiration, tenseness, etc.); and (4) the binary description provides a picture of the structure of language which is so clear that it must be inherent in the system.

Jakobson has also put forward the argument that nerve fibres have an all-or-none response like computers. This is correct as regards separate motor units, but in the case of an entire muscle there may be many degrees of contraction depending on how many motor units are involved and how frequently they are excited. In "Fundamentals" reference is also made to psychological experiments in which subjects had to learn new acoustic systems in which a definite number of units had to be identified. These experiments demonstrated that the systems that are acquired most easily are binary (however, it is not quite clear from the paper referred to (Pollack and Ficks in JASA 26) that oppositions with three members do not yield equally good results).

Not all adherents of distinctive feature analysis have followed Jakobson on this point. Martinet attaches much importance to the analysis into distinctive features, but he does not apply Jakobson's feature system, and he rejects the binary interpretation (1958); nor does Fant insist on this interpretation any longer (see, e.g., 1969). Halle follows Jakobson but confines himself to regarding it as a working hypothesis (cf. the discussion of this problem in Halle (1957) and Ladefoged (1966)).

Limitation of the Number of Features

LIMITATION OF FEATURES IN THE INDIVIDUAL LANGUAGE

8.6 One of the objectives of linguistic analysis is to arrive at a simple description of a particular body of facts, and as one element in this endeavour an attempt is usually made to establish the smallest possible number of minimal units. As the same distinctive oppositions are often used in several phoneme pairs, it is usually possible to set up fewer distinctive components than phonemes, a fact which provides one of the arguments for decomposing phonemes into features. In "Fundamentals" Jakobson writes: "We seek the smallest set of distinctive oppositions which allow the identification of each phoneme in the messages framed in this language" (p. 45). From a purely theoretical point of view n oppositions will enable us to distinguish 2^n phonemes (i.e. by means of two oppositions we can distinguish $2^2 = 4$ phonemes, by means of three oppositions $2^3 = 8$ phonemes, by means of four oppositions $2^4 = 16$ phonemes etc.). The case of three oppositions, which can distinguish eight phonemes, may be illustrated by the following diagram from Jakobson, Cherry and Halle (1953):

	A	B	C	D	E	F	G	H
1	—	—	—	—	+	+	+	+
2	—	—	+	+	—	—	+	+
3	—	+	—	+	—	+	—	+

Each of these eight units (A, B, C, D, E, F, G, H) differs from any one of the others as regards at least one of the three oppositions; there are eight distinct combinations of + and — possible.

This calculation, however, presupposes that all oppositions are utilized in the case of every single phoneme and that there are equal numbers of + and — for each opposition. No natural phonemic systems are constructed so regularly: for example, there are probably no languages with the same number of nasal and oral phonemes. If the aim is to establish oppositions which are supported by phonetic data, it is therefore not possible to reduce the number of oppositions to the above extent. As an example of this "non-optimal" character of natural languages, the authors mention that the forty-two phonemes which they assume for Russian could theoretically be obtained by an average of $5.38 +/—$ specifications for each phoneme. But in actual fact, eleven distinctive oppositions must be set up in Russian, i.e. twice as many.

However, Jakobson gains a considerable reduction (as compared with traditional descriptions) by using the same distinctive oppositions for vowels and consonants.

Obviously the nasal/oral opposition may be applied to both phoneme categories, as has always been done. The same is true of tense/lax. In addition, however, Jakobson identifies degree of aperture in vowels (*i, u* vs. *ε, ɔ*) with the consonantal dimension front/back (*p, t* vs. *c, k*) through the use of an opposition diffuse/compact; and the vocalic dimension front/back (*i, ε* vs. *u, ɔ*) with the consonantal dimension central/peripheral (*t, c* vs. *p, k*) by means of an opposition acute/grave. The result of this is the following parallelism:

	acute	grave		acute	grave
diffuse	t	p	diffuse	i	u
compact	c	k	compact	ε	ɔ

or (with three members):

t	p	i	u
k		a	

We shall return to the phonetic basis of this approach in 8.11 (IV) and 8.13 (X); however, it may be mentioned here that this reduction of features can only be obtained through a somewhat procrustean interpretation which turns out to be inappropriate in some respects.

The attempt to operate with a small number of distinctive oppositions may clash with the effort to use only binary oppositions (cf. "Prl." p. 44). If there are assumed to be three elements in one dimension, e.g. *i e ε* or *p t k*, only one distinctive opposition is needed, whereas a binary arrangement requires two oppositions.

A LIMITED NUMBER OF UNIVERSAL DISTINCTIVE FEATURES

8.7 Jakobson wants not only to restrict the number of features in an individual language but also to arrive at a limited set of universal "distinctive features" of which each language utilizes some but not all. A total of twelve such features is established, exclusive of the prosodic features. This is achieved by combining phonetically different features which are never used distinctively in the same language and which have common qualities which distinguish them from all other features. For example it is suggested that pharyngealized/non-pharyngealized, rounded/unrounded, and retroflex/dental should be combined into one "distinctive feature" which is called flat/plain. Acoustically the common quality is a lower resonance (of formant 2 and formant 3) in the first member of the three oppositions than in the second, and articulatorily both rounded and pharyngealized consonants are characterized by a narrowing of the resonance chamber (at the front and back respectively) ("Fundamentals", pp. 27-8). As a further argument it is mentioned that the pharyngealized (so-called emphatic) consonants of Arabic

words are replaced by labialized consonants in the Bantu languages ("Prl.", p. 31). Jakobson further suggests that aspirated/unaspirated should be combined with tense/lax, and explosive/implosive with explosive/ejective (Jakobson 1962a, p. 453). Here, then, the same procedure is adopted as in the case of identification of phonetically similar sounds and features which are in complementary distribution within the same language. The extension of this procedure beyond the individual language seems, however, somewhat questionable, since different languages do not constitute a single functional system. When Jakobson sets up a limited number of "distinctive features" for all languages he is therefore not referring to distinctive oppositions, but to general phonetic dimensions, which may be used distinctively in the individual languages. To designate these dimensions as "distinctive features" is to cover up a crucial difference.

Trubetzkoy's system of general phonetic dimensions was undoubtedly too complicated and in need of simplification. It does not seem advisable, though, to identify phonetic dimensions involving different articulatory mechanisms, as is probably the case with tenseness and aspiration as well as with rounding and pharyngealization. The establishment of twelve universal features must, however, be regarded as an interesting attempt to find general laws concerning the structure of languages, even if the time for establishing a conclusive number of dimensions has not yet come. It is likely that new features will be found, which have not yet been described.

It is probably possible to discover general laws (or at least tendencies) in another field, viz. concerning the compatibility of some member of one opposition with a member of another opposition; the feature "vocalic", for example, is not compatible with the features "abrupt" and "strident". Martinet has touched on this (see 3.18 above), and Jakobson and Lotz have laid down rules for a single language (French, see Jakobson and Lotz 1949). Both in general and as regards individual languages, however, it may be possible to establish more detailed rules concerning the possibilities of combining distinctive components.

Phonetic Description of the Features

GENERAL POINTS OF VIEW

8.8 In the classical Prague theory, as represented by Trubetzkoy, phonetic description was by and large restricted to a labelling, which was sometimes articulatory (e.g. rounding), and sometimes auditory (e.g. Eigenton). The Prague phonologists based their identification of variants on phonetic similarity, but at the same time they wanted to keep aloof from phonetics. However, in his paper on consonant classification of 1938 Roman Jakobson was already attempting to arrive at more accurate phonetic descriptions. Since then he has contributed

greatly to bridging the gap between phonology and phonetics, for example by collaborating with the acoustician Gunnar Fant. It is a characteristic feature of his phonetic analysis that he aims at a combined ARTICULATORY, ACOUSTIC and AUDITORY DESCRIPTION, and he emphasizes that THE AUDITORY ASPECT IS MOST IMPORTANT. The justification given for this is that the closer we are to the destination of the message the more accurately we can determine the information contained in the sound chain. Moreover dissimilar articulations may yield the same acoustic results, and different acoustic stimuli may call forth identical auditory impressions. In articulatory and acoustic descriptions consequently, the effect on subsequent stages of the speech act should be taken into account. "The specification of distinctive oppositions may be made with respect to any stage of the speech event, from articulation to perception and decoding, on the sole condition that the invariants of any antecedent stage be selected and correlated in terms of the subsequent stages, given the evident fact that we speak to be heard and need to be heard in order to be understood" ("Fundamentals", p. 34). Jakobson does not believe in the so-called motor theory of speech perception, according to which the motor centre is involved in speech perception. As an argument against this hypothesis he points out that children can perceive many phonetic differences which they cannot reproduce, and that the same incongruity can be observed in the case of foreign language acquisition.

Roman Jakobson's interest in the auditory aspect is long-standing and is probably ultimately due to a Russian phonetic tradition (Ščerba and Tomson). It was heightened by the study of the works of the psychologists Stumpf and Köhler, whose theories concerning the connection between the perception of speech sounds and colours he developed further in his book "*Kindersprache, Aphasie und allgemeine Lautgesetze*" (1941). According to this theory the dimensions of brightness and saturation (see 3.9 above) are essential to the perception of both sounds and colours, and the vowel triangle

i u
 a

corresponds to the colour triangle with brightness indicated horizontally and saturation vertically. This parallel is supported by cases of "audition colorée", i.e. subjective associations between vowels (and sometimes consonants) and colours.⁵ On the whole consonants are associated with less saturated colours, i.e. more greyish shades, but persons who have colour associations for consonants seem to prefer brighter shades for *t* than for *p*, and more saturated shades for *k*, so that the triangle

t p
 k

5. As regards brightness (but not saturation) this theory has been confirmed by subsequent experiments, see Fischer-Jørgensen (1967, pp. 667-71).

corresponds⁶ to

i u
a

It was mainly on the basis of these auditory theories that Roman Jakobson arrived at the features compact/diffuse (= saturation) and grave/acute (= brightness), and he subsequently attempted to find their acoustic and articulatory correlates. Some of the other Jakobsonian features are based on traditional articulatory descriptions, e.g. nasality and abrupt/continuant.

In "Prl." the different features are described articulatorily, acoustically, and auditorily. In "Fundamentals" the auditory definitions are omitted. This, however, should not be interpreted as a change in Jakobson's point of view, but rather as an acknowledgement that the present stage of research does not permit a precise description of the auditory characteristics of all features.

THE INDIVIDUAL FEATURES⁷

PROSODIC FEATURES

8.9 A fundamental distinction is drawn between **PROSODIC** and **INHERENT** distinctive features. Prosodic features are connected with phonemes which constitute syllabic peaks and can only be defined in relation to the syllable or a sequence of syllables, whereas this is not the case with inherent features.







In the case of prosodic features there is always a contrast between successive units, which is indispensable to the identification of these features and consequently to the opposition between the alternatives. A high tone is opposed to a low tone but can only be recognized as high by comparison with preceding or following tones, whereas the identification and definition of inherent features can be undertaken independently of the environment. Experiments carried out by Ladefoged and Broadbent have, however, demonstrated that this distinction is not absolute since the perception of vowel quality is determined partly by the quality of the preceding vowels.

There are three types of prosodic features: tone, force, and quantity, whose closest physical correlates are considered to be fundamental frequency, intensity, and time. Each of these is divided into two subclasses: a given prosodic feature is either intersyllabic or intrasyllabic. In the former case the syllable peak is compared with other syllabic peaks in the same sequence while in the latter the beginning of the syllable peak is compared with its end, or the peak is compared

6. For a discussion of this parallelism, see 9.35.

7. Parts of Roman Jakobson's feature system will be discussed in more detail in 9.33-37 in connection with the changes made in generative phonology.

with the margin of the syllable. On the basis of this double classification six prosodic features are distinguished, which can be arranged in the following table where graphic illustrations suggesting the differences have been added:

	tone	force	quantity
intersyllabic	level 	stress 	length 
intrasyllabic	modulation ⁸ 	"stød" 	contact 

Intersyllabically the opposition is between different tone levels (high and low syllables), different syllabic force (strong and weak syllables), or different length (long phonemes as opposed to short ones at the syllable peak). Intrasyllabically it is a matter of tone movement within the syllable (rising or falling), a marked intensity decrease within the syllable ("stød") as opposed to absence of such a decrease, or of close or open contact ("Anschluss"), which Jakobson defines as a difference in relative length between a vowel and a following consonant. In the case of close contact the vowel is relatively short and the consonant relatively long, whereas the opposite applies to open contact. In many respects this is an attractive system, and far simpler than previous ones. The definition of contact gets nearer to phonetic reality than the traditional definition, which was based on the intensity contour of the vowel. On the other hand, investigations of stress perception have so far demonstrated that this depends more on length and frequency than on intensity.

INHERENT FEATURES

INTRODUCTORY REMARKS

8.10 Paralleling the classification of prosodic features according to tone, force and quantity, the inherent features are divided into TONALITY FEATURES, SONORITY FEATURES and "PROTENSITY" FEATURES (the last group covers only the tense/lax opposition, which in "Fundamentals" is included among the sonority features, but is set up, somewhat artificially, as a separate group in the paper "Tenseness and Laxness" (Jakobson and Halle 1961) and in "Manual of Phonetics" (1968) in order to obtain the parallelism mentioned). Jakobson's twelve inherent features have been applied in the description of a number of languages (see Jakobson 1962a, pp. 440-1). It is therefore useful to be acquainted with the terminology as well as with the corresponding phonetic descriptions even though both

8. By the term "modulation" Jakobson refers to the tone movement that takes place within a syllable and not (as Hjelmslev) to sentence intonation.

have subsequently been changed in generative phonology (see 9.32-9.37). As the terminology is somewhat peculiar, and as the phonetic descriptions are not transparent, we shall here go through the individual features by quoting the definitions given in "Manual of Phonetics" (1968, pp. 429-32) and by adding short commentaries.⁹

The most important changes since "Fundamentals" (1956) concern the acoustic description of the features "consonantal", "nasal", "strident", "tense" and the articulatory description of "checked".

8.11 SONORITY FEATURES

I Vocalic/Non-Vocalic

"acoustically – presence (vs. absence) of a sharply defined formant structure;
genetically – primary or only excitation at the glottis together with a free passage through the buccal tract".

II Consonantal/Non-Consonantal

"acoustically – presence (vs. absence) of a characteristic lowering in frequency of the first formant, a lowering which results in a reduction of the overall intensity of the sound and/or of only certain frequency regions;
genetically – presence (vs. absence) of an obstruction in the buccal tract".

As mentioned above only one opposition, vocalic/consonantal, was proposed originally, but subsequently it was split up into two. In this way the binary principle could be maintained, and the two oppositions could be used to account for four major groups of phonemes: vowels, consonants, liquids, and "glides".

These four groupings can be represented schematically in the following way:

	VOWELS	CONSONANTS	LIQUIDS	"GLIDES"
vocalic	+	—	+	—
consonantal	—	+	+	—

The phonetic definitions of vocalic and consonantal have been changed several times. The reference to the low first formant in the acoustic definition of consonantal/non-consonantal constitutes an improvement over the previous definition.

The liquids (*l* and *r*) are somewhat more difficult to describe acoustically. It is true that they have a sharply defined formant structure like the vowels, and that they may have relatively low intensity like the consonants, but their intensity may also be as high as, or even higher than that of adjoining vowels, and their

9. Note that "genetically" means "articulatorily".

first formant often has higher frequency than the first formant of close vowels. What is most characteristic is rather that most of their energy is concentrated in the first formant, at a frequency where the ear is less sensitive, as is also the case with other voiced consonants. In this way they become auditorily weaker.

The articulatory description of the liquids as having both free passage and obstruction in the buccal tract is based on the facts that *l* is pronounced with a closure in the mid-sagittal region of the mouth and free passage laterally, and that the buccal tract during the production of trilled *r* is alternatively open and closed.

The glides comprise *w*, *j*, *h* and *ʔ*. Acoustically *w* and *j* might as well have been considered [+ +].¹⁰ Articulatorily, however, they differ from the liquids in not being both open and obstructed. They may be as open as vowels and they generally resemble this category acoustically. Consequently they are sometimes grouped with vowels, as in the analysis of English in "Prl.". The description of *h* and *ʔ* as —vocalic and —consonantal is not very convincing. From an articulatory point of view they must be +vocalic, since they are articulated without any constriction in the buccal tract. On the other hand, they have traditionally been regarded as consonants, and a classification with the consonants would seem more appropriate in view of their normal distribution (cf. also that Fant (1967) considers the definition of *h* and the glides as —vocalic, —consonantal to be rather arbitrary).

III Nasal/Oral (*properly speaking, nasalized/non-nasalized*)

"acoustically — presence (vs. absence) of the characteristic stationary nasal formant with a concomitant reduction in the intensity of the sound and an increased damping of certain oral formants;

genetically — mouth resonator supplemented by the nose cavity (vs. the exclusion of the nasal resonator)".

In comparison with its treatment in "Fundamentals" the acoustic description of nasality has been improved.

IV Compact/Diffuse

"acoustically — concentration of energy in a relatively narrow, central region of the auditory spectrum (vs. a concentration of energy in a non-central region), with a concomitant increase (vs. decrease) of the total amount of energy and its spread in time;

genetically — forward-flanged vs. backward-flanged. The difference lies in the relation between the shape and volume of the resonance chamber in front of the narrowest stricture and behind this stricture. The resonator of the forward-flanged phonemes (wide vowels, and velar

10. P. Ivić (1965, pp. 69–70) proposes to combine the glides *j* and *w*, liquids and nasals as [+vocalic +consonantal], and to add a feature "lateral" or "liquid" (see 9.34).

and palatal, including post-alveolar, consonants) is horn shaped, whereas the backward-flanged phonemes (narrow vowels, and labial or dental, including alveolar, consonants) have a cavity that approximates a Helmholtz resonator".

As mentioned above this opposition separates open vowels from narrow ones as well as back consonants from front ones, i.e.

a – u i

k – p t

The articulatory definition covers the facts best. The acoustic definition exemplifies the difficulty involved in combining two oppositions which actually differ considerably. Concentration of energy in a relatively narrow region of the spectrum applies to the consonants (*k* and *c* vs. *p* and *t*), and concentration in a relatively central region applies to the vowels (*a* vs. *u* and *i*), but energy located in a region of the spectrum which is both central and narrow does not apply to either of the two categories (*k*'s frequency is often peripheral, and *a*'s frequency area is not necessarily narrow).¹¹

As mentioned above this opposition may be divided into two.

V Abrupt/Continuant

"acoustically – silence (at least in the frequency range above the vocal cord vibration) followed and/or preceded by a spread of energy over a wide frequency region, either as a burst or as a rapid transition of vowel formants (vs. absence of abrupt transition between sound and 'silence');

genetically – rapid turning on or off of source either through that swift closure and/or opening of the buccal tract which distinguishes plosives from constrictives, or through one or more taps which differentiate the abrupt liquids like a flap or trill /r/ from continuant liquids like the lateral /l/".

Abrupt was formerly called interrupted ("Prl.") or discontinuous ("Fundamentals").

This opposition is meant to separate stops from fricatives and *r* from *l*. The acoustic description does not cover *r* very well, and it is difficult to say where nasal stops belong in this framework. Acoustically nasals are continuous, but articulatorily they are characterized by swift closure and opening and are therefore

11. In this connection it is interesting to notice that a majority of subjects participating in perceptual experiments have preferred to call *a* diffuse and *i* and *u* compact (see Fischer-Jørgensen 1967).

discontinuous. This uncertainty, incidentally, applies to the traditional classification of speech sounds also. But as there is rarely opposition between abrupt and continuant within the class of nasal consonants it is common to consider them to be neutral. This approach is followed in the description of English nasals in "Prl."

VI Strident/Non-Strident (mellow)

- "acoustically – presence (vs. absence) of a higher intensity noise accompanied by a characteristic amplification of the higher frequencies and weakening of the lower formants;
- genetically – rough-edged vs. smooth-edged; supplementary obstruction creating edge effects ("Schneidenton") at the point of articulation distinguishes the production of the rough-edged phonemes from the less complex impediment in their smooth-edged counterparts".

By this feature labiodentals are opposed to bilabials; sounds articulated with a groove in the tongue to sounds produced with a slit (e.g. *s* as opposed to *θ*) and uvulars to velars. The categories mentioned first have more prominent noise because the air passes a sharp edge (in the case of *f* and *s* the teeth, in the case of uvulars the uvula). It may be objected that an opposition may exist (as demonstrated by Ladefoged) between velar and uvular without any concomitant difference in noise type, and that strident/mellow is not necessarily related to place of articulation (cf. that Dutch *w* [v] and *v* [v] may both be labiodental, and that Danish labiodental *v* is clearly mellow). Jakobson also distinguishes affricates from stops by this feature, the former having an extra noise interval. In "Fundamentals" only the intensity of the noise is mentioned, not its frequency. It is true that most of the consonants which are here considered strident have noise at higher frequency than their mellow counterparts, but this hardly applies to uvulars as opposed to velars or to velar affricates as opposed to velar stops.

VII Checked/Unchecked

- "acoustically – higher rate of discharge of energy within a reduced interval of time (vs. lower rate of discharge within a longer interval), with a lower (vs. higher) damping;
- genetically – reduced (vs. non-reduced) portion of air due to the stoppage of egressive as well as ingressive pulmonic participation. Checked phonemes are implemented in three different ways – as ejective (glottalized) consonants, as implosives or clicks".

The acoustic definition of this feature is very questionable, and it is hardly possible to give a common acoustic definition of ejectives, implosives, and clicks.

Moreover, P. Ladefoged in "Preliminaries to Linguistic Phonetics" (1971, p. 27) adduces an example of a language having both implosives and ejectives. They must therefore be differently described.

VIII Voiced/Voiceless

"acoustically – presence (vs. absence) of periodic low frequency excitation;
genetically – periodic vibrations of the vocal cords (vs. lack of such vibrations)".

This presents no problems.

8.12 PROTENSITY FEATURES

*IX Tense/Lax*¹²

"acoustically – longer (vs. reduced) duration of the steady state portion of the sound and its sharper defined resonance region in the spectrum;
genetically – a deliberate (vs. rapid) execution of the required gesture resulting in a lastingly stationary articulation; greater deformation of the buccal tract from its neutral, central position; heightened air pressure. The role of muscular strain, affecting the tongue, the walls of the buccal tract, and the glottis, requires further investigation".

Tense/lax is considered a special type of feature (protensity feature) in order to obtain a classification parallel to the prosodic features (see 8.10 above).

As in the case with compact/diffuse, difficulties arise concerning the phonetic definition because the description is intended to apply both to vowels and to consonants. In this particular instance it is intended to apply to tense vowels (like German *i:*, *u:*, *y:*) as opposed to lax vowels (German *ɪ*, *ʊ*, *ʏ*), and to fortis/lenis consonants as well as to aspirated/unaspirated consonants. The acoustic definition covers the vowels and in this respect represents an advance on the definition in "Fundamentals", where tense sounds were described as having "... a higher total amount of energy in conjunction with a greater spread of energy in the spectrum and in time". The first part of the acoustic definition fits fortis consonants but not aspirated consonants since the steady state must be the closure, whereas the second part (sharper defined resonance region) is irrelevant to consonants. The first part of the physiological definition applies only to vowels, the last part (heightened air pressure) only to consonants, and even here it does not seem to be essential (cf. e.g. Fant (1967), who regards it as a secondary and not constant effect of a more basic difference in glottal articulation).

12. See also Jakobson and Halle (1962).

8.13 *Tonality Features*

X Grave/Acute

“acoustically – predominance of the low (vs. high) part of the spectrum;
genetically – peripheral vs. medial: peripheral phonemes (velar and labial) have an ampler and less compartmented resonator than the corresponding medial phonemes (palatal and dental)”.

As in the case with compact/diffuse this opposition applies to both vowels and consonants, viz. back vs. front vowels and peripheral consonants (*p, k*) vs. medial ones (*t, c*). The peripheral consonants have a larger undivided resonance chamber (behind the closure in the case of *p*, in front of it in the case of *k*) whereas the medial consonants have a divided resonator. In this respect front vowels are medial while back vowels have a large resonator in front of the constriction. Here the common definition does not present the same problems as with compact/diffuse.

XI Flat/Non-Flat

“acoustically – flat phonemes are opposed to their non-flat counterparts by a downward shift and/or weakening of some of their upper frequency components;
genetically – the former (narrowed-slit) phonemes, in contradistinction to the latter (wider-slit) phonemes are produced with a decreased back or front orifice of the mouth resonator and a concomitant velarization which expands the mouth resonator”.

The terminology, which is auditory and has been borrowed from music, e.g. “g flat”, is rather confusing since “flat” is intended (in one sense) to mean ‘rounded’. As mentioned above the oppositions rounded/unrounded (applying to vowels as well as consonants), pharyngealized/non-pharyngealized, and retroflex/dental are included under this designation. In all cases a certain lowering of the higher formants takes place, which is caused by a narrowing at the lips (rounding) or at the pharynx (pharyngeals), or by a retraction of the tongue (retroflex consonants). The articulatory description does not really cover the last category.

XII Sharp/Non-Sharp

“acoustically – sharp phonemes are opposed to their non-sharp counterparts by an upward shift and/or strengthening of their upper frequency components;
genetically – the former (widened-slit) phonemes, in contradistinction to the latter (narrower-slit) phonemes, are produced with a dilated back orifice (pharyngeal pass) of the mouth resonator and a concomitant palatalization which restricts and compartments the mouth cavity”.

This is meant to account for the difference between palatalized and non-palatalized consonants. It seems odd that most importance is attached to the dilation of the pharynx since the primary reason for the emphasis on higher frequency components must be the raising of the front part of the tongue towards the hard palate.

In "Fundamentals" non-flat and non-sharp are termed "plain".

GENERAL PROBLEMS IN THE PHONETIC DESCRIPTION OF DISTINCTIVE FEATURES

8.14 In spite of the many revisions the phonetic definitions given by Jakobson and Halle (1968) are still not satisfactory on all points. One reason is that it is difficult to give definitions which are both articulatorily and acoustically precise. Another reason is that the attempt to reduce the number of features often results in a rather artificial phonetic description. This is particularly obvious in the cases where the same features are intended for application to both vowels and consonants (e.g. compact/diffuse and tense/lax). Fant has later improved the acoustic definitions of some of the features (1960, 1967, 1969, see also 12.13).

But satisfactory definitions can probably only be reached by enlarging the number of features. This is what has been done in generative phonology (see 9.32-9.37) and by Peter Ladefoged (12.14).

A special problem arises because it often happens that what is generally considered to be one feature is manifested differently in different positions. In most cases this difficulty can be overcome by describing the oppositions as relative. Jakobson has repeatedly emphasized that what is relevant is a *RELATIVE* value of a given property. What is shared by two variants of the same component in dissimilar combinations, then, is not any absolute phonetic property but the same relative difference from the other member of the opposition (cf. also Twaddell 6.12). This is quite obvious as regards e.g. vowel length or pitch. A long vowel is only longer than a short vowel, or a high tone higher than a low one, under the same conditions. This is sometimes also true for vowel qualities. In Danish, for instance, vowels are retracted and lowered before uvular /r/; /ɛ/ before /r/ may thus be lower than /a/ before other consonants, but as /a/ is still lower before /r/, the relative difference can be maintained. In Greenlandic the lowering and retraction of vowels before uvular consonants is still more drastic.

In "Prl." Jakobson also mentions the opposition between Danish /t/ and /d/, accepting Uldall's and Hjelmslev's analysis according to which initial [t-] and final [-d] belong to one phoneme /t/ (e.g. *top* and *kat*), whereas initial [d-] and final [-ð] belong to another phoneme /d/ (e.g. *da* and *mad*). Jakobson characterizes the distinctive difference between these two phonemes as "strong/weak" (= tense/lax). It does not matter that initial /d/ (*da* [da]) and final /t/ (*kat* [kad]) overlap in [d]. The crucial point is that initial [t] is stronger than initial [d], and that

final [d] is stronger than final [ð]. The principle is clear enough. However, the acoustic definition of tense/lax does not cover *d/ð* very well, since it is *ð* which is stronger and longer.

Danish /t/ as opposed to /d/ is a particularly conspicuous example, but also in English and German, for example, the manifestations of the stops in different positions are very dissimilar. In these languages the opposition between *t* and *d* is manifested initially mainly by means of aspiration, but medially mainly by means of voicing. As in the Danish example the difficulty arises that it is not just a matter of relative differences within one feature but of differences which are normally classed with different features. If the analysis were carried out in each position separately, one would arrive at different features: in Danish aspiration initially and stop-fricative medially; in German and English aspiration initially and voicing medially.¹³

It is difficult to describe these manifestations by means of relative differences. It thus seems necessary to distinguish at least two levels in the description of distinctive features: (1) a functional level where the minimal oppositions are established and marked + and —, and (2) a phonetic level where the phonetic manifestation of the features is described on the basis of a general inventory of phonetic dimensions. Normally an opposition will be manifested by the same phonetic dimension in different environments (i.e. there is one relevant dimension), but sometimes more than one phonetic dimension is involved (as in the case of stop consonants mentioned above). It also sometimes happens that one functional opposition is realized by a complex of phonetic dimensions (for example, the opposition *i/u* in Spanish is realized by means of both rounding ("flatness") and front/back ("acute/grave")). This latter fact is acknowledged by Jakobson (1962a, p. 445), who characterizes it as a fusion between two distinctive features, or as a syncretic feature (cf. also Trubetzkoy's discussion of relevant features 3.9 and 3.10 above).

It may, however, be useful to distinguish still a third level constituted by the many different phonetic factors which make up the separate phonetic dimensions (e.g. duration and intensity contributing to tenseness; or duration, intensity and pitch contributing to stress). For this problem of levels cf. Martinet (1958), Malmberg (1962; see also 12.3), Šaumjan (1962; see 11.20 below), and Romportl (1965).

A special problem arises when a phoneme has two variants containing opposite features. For example, the consonants *m*, *n*, *ɲ*, and *ŋ* are analysed in the following way in the Jakobsonian feature analysis:

13. This conclusion, however, is not drawn by Heike in his description of German, although he sets up different inventories in different positions (see 8.4 above); in both positions he assumes that it is a question of tense/lax (which according to Jakobson also includes aspiration).

	<i>m</i>	<i>n</i>	<i>ɲ</i>	<i>ŋ</i>
compact/diffuse	—	—	+	+
grave/acute	+	—	—	+

In several languages, however, *n* and *ŋ* must be regarded as variants of the same phoneme (since *ŋ* occurs only before a velar consonant, where *n* is not found, but where both *m* and *ɲ* occur). This is the case, for example, in Hungarian and Czech. Jakobson attempts to solve this problem by claiming that the compactness feature is not involved in these cases, but rather two independent grave/acute oppositions. One of these (grave/non-grave) is identical to the one described above and depends on the resonance during the transition to the vowel at the oral release (i.e. the locus of formant 2). The other (acute/non-acute) depends on the resonance produced during the stop closure ("murmur") by the nasal cavity and the back part of the oral cavity (which is smaller in the case of *ɲ* and *ŋ* because of the location of the closure) ("Manual of Phonetics", p. 431).

Jakobson sets up the following matrix:

	<i>m</i>	<i>n</i>	<i>ɲ</i>	<i>ŋ</i>
high/low ("release")	—	+	+	—
acute/grave				
high/low ("murmur")	—	—	+	+

The intended advantage of this analysis is that *m* and *ɲ* are the extremes (grave and acute), whereas *n* and *ŋ* agree in being intermediates. However, *n* and *ŋ* have opposite feature specifications. More acoustic investigations seem to be called for before this interpretation can be accepted as the correct one.

In cases where the phonetic arguments for choosing between two alternative feature solutions are weak, other factors can be taken into account, e.g. simplicity in the description of assimilations, distributional restrictions, and historical change.¹⁴ As an argument in favour of the binary decomposition of consonantal points of articulation in compact/diffuse and acute/grave, for example, Jakobson mentions that historical shifts between labials and velars, e.g. *f* and *x*, are accounted for more satisfactorily in this way: Members of both these categories are grave, and differ in only one feature (compact/diffuse). If, on the other hand, the consonantal points of articulation are looked upon as a series such a shift becomes an inexplicable leap¹⁵. By the same logic, however, one could argue against decomposing four pitch levels found in many tone languages, and similarly four degrees of vowel height, into two oppositions since, in the historical development, they may all be shifted upwards or downwards collectively (cf. 9.30 and 9.35).

14. See also P. Ivić (1965, p. 56f).

15. Cf. Ladefoged's retention of the feature "grave" (12.14).

Distinctive and Redundant Features

TYPES OF REDUNDANT FEATURES

8.15 In the classical Prague theory a distinction was drawn between relevant and irrelevant properties (cf. 3.9 and 3.10 above). Jakobson correspondingly distinguishes between distinctive and redundant features; this terminology is more suitable since non-distinctive features may be important for perception and therefore cannot be said to be irrelevant. Unlike distinctive features, however, they are not independent but rather concomitant phenomena.

Jakobson distinguishes two main types of REDUNDANT FEATURES ("Prl.", p. 4ff).

(1) Certain features depend mechanically on the surrounding features in the speech chain. For example, the *k*-explosion is higher (more acute) before *i* than before *u*; in English vowels are longer before phonologically voiced than before phonologically unvoiced consonants; English *l* is more grave finally than initially; and, in Russian, vowels are more front (acute) between palatalized consonants than between unpalatalized ones, a difference which is particularly marked in the case of /i/, which alternates between [i] and [i̯]. This is normally called bound variation.

(2) Some features depend on other features in the same phoneme. In French, for example, the tenseness distinction found in stops and fricatives (e.g. *p/b*) is normally accompanied by a voicing difference (tense stops being voiceless and lax stops voiced). Since voicing assimilation occurs before other stops or fricatives (*une nappe jaune* with voiced *p*, *une robe courte* with unvoiced *b*), whereas the tenseness difference is normally retained, tenseness must be regarded as distinctive and voicing as redundant; in French a voicing difference presupposes a tenseness difference, but not vice versa.

In English, vowels are normally oral, and there is no opposition between oral and nasal vowels. This implies that the feature "vocalic" is always accompanied by the feature "oral", and this latter feature must therefore be considered redundant. Similarly, English nasal consonants are phonetically lax, but since there is no opposition between lax and tense nasals, the feature "lax" must be regarded as redundant.

Some phonetic shades in the manifestation of a feature may depend on the combination with other features. In French, for example, there is a distinctive opposition between stops and fricatives (abrupt/continuant), but the points of articulation do not correspond exactly: a labial (grave) stop is bilabial (*p*), whereas a labial fricative is labiodental (*f*); an apical (acute) stop is dental (*t*), but an apical fricative is alveolar (*s*); a compact stop (*k*) is velar, while on the other hand a compact fricative (*ʃ*) is prepalatal, etc.

MATRIX REPRESENTATION AND REDUNDANT FEATURES

8.16 As mentioned above, Jakobson introduced the practice of showing the phonemes of a language in a MATRIX where distinctive features are arranged vertically, and phonemes horizontally. For each phoneme the features are marked as either + or —, whereas redundancy is marked by means of a zero. As examples of this procedure a feature matrix for English (from "Prl.") is shown in table 8.1, a matrix for German (from Halle 1954) in table 8.2, and a matrix for Russian (from Cherry, Halle and Jakobson 1953), arranged in two different ways, in table 8.3. If a phonetic opposition is redundant for all the phonemes of a language it is usually excluded from the matrix altogether.

In a matrix representation of the phoneme inventory of a particular language, redundancy of type (1), i.e. bound variation, is normally disregarded, since it is only pertinent to running speech, and only redundancy of type (2) is taken into consideration. Logically, 0 indicates "either + or —" (Cherry, Halle and Jakobson 1953), i.e. the phoneme may theoretically take on either value and it does not matter which, since it is sufficiently characterized by means of the pluses and minuses already specified. On the level of the phonetic manifestation, however, 0 does not always cover the same facts. It may signify (1) that an opposition does not really apply to a particular phoneme, even as a phonetic, redundant property. For example, it is difficult to decide whether *h* is compact or diffuse. It may also mean (2) that the manifestation of a given phoneme is intermediate between + and —; for example, Italian *a* is intermediate between acute and grave. A 0 may further indicate (3) that some of the variants of a phoneme are + and others —; in many languages, for example, *k* is phonetically (redundantly) acute before *i* and grave before *u*; Danish /a:/ is acute before most consonants, but grave before *r*, etc. In such cases it seems most reasonable to mark the particular opposition as 0. Finally, and most frequently, it can mean (4) that the phoneme does take on one of the phonetically opposite values, but that there is no distinctive opposition. In some cases (a) the dimension in question may not be used distinctively in the language at all. For example, all English consonants are unchecked (non-ejective), but since there is no opposition between ejective and non-ejective consonants in English, the phonemes are not marked as checked but as zero-checked. Alternatively, the dimension may be omitted from the matrix altogether, a solution which seems more practical in this case. In English, German, and Danish, similarly, the dimension sharp/plain (palatalization) is not needed, nor is strident/mellow necessary in Danish; Danish *s* may be called strident and e.g. *d* mellow, it is true, but there are no two phonemes which differ in stridency alone. In other cases (b) a particular dimension may be used distinctively in a language, but not in relation to all phonemes. It must therefore be included in the matrix, but for some phonemes it will be marked as 0. When this situation obtains there may sometimes be alternative solutions possible. If, for example, *p*, *b*, and *m* are found

Table 8.1

Feature-matrix for English (Jakobson, Fant, Halle, "Preliminaries", p. 43)

	o	a	e	u	ə	i	l	ŋ	ʃ	ʒ	k	ʒ	g	m	f	p	v	b	n	s	θ	t	z	ð	d	h	#
1. Vocalic/Non-vocalic	+	+	+	+	+	+	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2. Consonantal/Non-consonantal	-	-	-	-	-	-	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	-	-
3. Compact/Diffuse	+	+	+	-	-	-		+	+	+	+	+	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-
4. Grave/Acute	+	+	-	+	+	-								+	+	+	+	+	-	-	-	-	-	-	-	-	-
5. Flat/Plain	+	-		+	-																						
6. Nasal/Oral								+	-	-	-	-	-	+	-	-	-	-	+	-	-	-	-	-	-	-	-
7. Tense/Lax									+	+	+	-	-		+	+	-	-		+	+	+	-	-	-	-	+
8. Continuant/Interrupted									+	-	-	+	-		+	-	+	-		+	+	-	+	+	-	-	-
9. Strident/Mellow									+	+	-	+	+	-						+	-	-	+	-	-	-	-

 $\hat{j} = tʃ, \hat{z} = dʒ$

Table 8.2
Feature-matrix for standard literary German (Halle 1954)

	m	p	b	f	v	ŧ	n	t	d	s	z	ŝ	k	g	x	ŋ	r	l	u	o	a	ü	ö	i	e	æ	h
Vocalic vs. non-vocalic.....	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	+	+	+	+	+	+	+	+	+	+	—
Consonantal vs. non-consonantal.....	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	—	—	—	—	—	—	—	—	—
Compact vs. diffuse	o	—	—	—	—	—	o	—	—	—	—	—	+	+	+	+	o	o	—	±	+	—	±	—	±	+	o
Grave vs. acute....	+	+	+	+	+	+	—	—	—	—	—	—	+	+	+	—	o	o	+	+	+	—	—	—	—	—	o
Flat vs. plain.....	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	+	+	o	+	+	—	—	o	o
Nasal vs. non-nasal.	+	—	—	—	—	—	+	—	—	—	—	—	—	—	—	—	o	o	o	o	o	o	o	o	o	o	o
Continuant vs. interrupted.....	o	—	—	+	+	—	o	—	—	+	+	—	—	—	+	o	—	+	o	o	o	o	o	o	o	o	o
Strident vs. mellow.	o	—	o	o	o	+	o	—	o	o	o	+	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o
Tense vs. lax.....	o	+	—	+	—	o	o	+	—	+	—	o	+	—	o	o	o	o	o	o	o	o	o	o	o	o	o

The symbol ± indicates an intermediate degree of compactness, for the feature of compactness is ternary for vowels.

The vowels are further differentiated into long vs. short. Among short vowels the distinction between /e/ and /æ/ is non-phonemic.

ŝ = ts, ƒ = pf

Table 8.3

Feature-matrix for Russian (Cherry, Halle and Jakobson 1953)

	k	k	g	g	x	c	ʃ	ʒ	t	t	d	d	s	s	z	z	ʂ	n	n	p	p
VOCALIC	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
CONSONANTAL	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
COMPACT	+	+	+	+	+	+	+	—	—	—	—	—	—	—	—	—	—	—	—	—	—
DIFFUSE	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o
GRAVE	+	+	+	+	+	—	—	—	—	—	—	—	—	—	—	—	—	—	—	+	+
NASAL	o	o	o	o	o	o	o	o	—	—	—	—	—	—	—	—	—	+	+	—	—
CONTINUANT	—	—	—	—	+	—	+	+	—	—	—	—	+	+	+	+	—	o	o	—	—
VOICED	—	—	+	+	o	o	—	+	—	—	+	+	—	—	+	+	—	—	—	—	—
SHARP	—	+	—	+	o	o	o	o	—	+	—	+	—	—	+	+	o	—	+	—	+
STRIDENT	o	o	o	o	o	o	o	o	—	—	—	—	o	o	o	o	+	o	o	o	o
STRESSED	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o

	b	b	f	f	v	v	m	m	'u	u	'o	e	'i	i	'a	a	r	r	l	l	j
VOCALIC	—	—	—	—	—	—	—	—	+	+	+	+	+	+	+	+	+	+	+	+	—
CONSONANTAL	+	+	+	+	+	+	+	+	—	—	—	—	—	—	—	—	+	+	+	+	—
COMPACT	—	—	—	—	—	—	—	—	—	—	—	—	—	—	+	+	o	o	o	o	o
DIFFUSE	o	o	o	o	o	o	o	o	+	+	—	—	+	+	o	o	o	o	o	o	o
GRAVE	+	+	+	+	+	+	+	+	+	+	+	+	+	+	—	—	o	o	o	o	o
NASAL	—	—	—	—	—	—	+	+	o	o	o	o	o	o	o	o	o	o	o	o	o
CONTINUANT	—	—	+	+	+	+	—	—	o	o	o	o	o	o	o	o	—	—	+	+	o
VOICED	+	+	—	—	+	+	—	—	o	o	o	o	o	o	o	o	o	o	o	o	o
SHARP	—	+	—	+	—	+	—	+	o	o	o	o	o	o	o	o	—	+	—	+	o
STRIDENT	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o
STRESSED	o	o	o	o	o	o	o	o	+	—	o	o	+	—	+	—	o	o	o	o	o

A. THE PHONEMES OF RUSSIAN

showing their distinctive feature patterns as represented by the answers
yes (+), no (—), either (o)

to be commutable units, then *m* may be characterized as nasal and *p*, *b* as oral; *p* and *b* can now be distinguished as unvoiced and voiced respectively, whereas *m* will be specified as 0 for voicing, even though it is normally voiced phonetically, since it is not opposed to any unvoiced nasal. However, it would also be possible to characterize *m* and *b* as voiced, *p* as unvoiced, and then distinguish *b* and *m* by means of the opposition oral/nasal and mark nasality as 0 in the case of *p*:

	p	b	m		p	b	m
voiced/unvoiced	—	+	0		—	+	+
nasal/oral	—	—	+	or	0	—	+

Since *p* is always oral while *m* may be unvoiced, the former solution seems preferable. Notice that it is not possible to use 0 both for voicing in *m* and nasality in *p* since these two phonemes would then not be distinguished by means of any

Table 8.4

Feature matrix of Russian (Cherry, Halle and Jakobson 1953), continued

	k	g	x	c	f	ʒ	ʰu	ʰo	ʰe	ʰi	ʰa	r	l	ʲ
VOCALIC	-	-	-	-	-	-	+	+	+	+	+	+	+	-
CONSONANTAL	+	+	+	+	+	+	-	-	-	-	-	+	+	+
COMPACT	+	+	+	+	+	+	-	-	-	-	+	+	+	+
GRAVE	+	+	+	+	+	-								
CONTINUANT	-	-	-	+	-	+								
VOICED	-	-	+	+		+								
SHARP	-	+	-	+										
							+	+	-	-	+	+		
							+	+	+	-	-	-		
							+	-			+	-		
												SHARP		
												CONTINUANT		
												-	+	-
												-	-	+
	t	d	s	z	ʃ	ʒ	̃n	n	p	b	f	v	m	
VOCALIC	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CONSONANTAL	+	+	+	+	+	+	+	+	+	+	+	+	+	+
COMPACT	-	-	-	-	-	-	-	-	-	-	-	-	-	-
GRAVE	-	-	-	-	-	-	-	-	+	+	+	+	+	+
NASAL	-	-	-	-	-	-	-	+	+	-	-	-	-	+
SHARP	-	+	-	+	-	+	-	+	-	+	-	+	-	+
CONTINUANT	-	-	-	+	+	+	+	-	-	-	-	+	+	+
VOICED	-	-	+	+	-	+	+	-	-	-	+	+	-	+
STRIDENT	-	-	-	-			+							

B. THE PHONEMES OF RUSSIAN
re-ordered to eliminate the ambiguous zero

+/- opposition. The problem discussed here remains nearly unaltered if the opposition between *p* and *b* is characterized as tense/lax, although it is probably even rarer for *m* to be tense than unvoiced.

In accordance with the view mentioned above the nasals are marked with 0 in the tables.¹⁶ But there is a certain discrepancy in the treatments of strident/mellow in the different tables, and this is not due only to the fact that different languages are involved. Halle only makes use of this opposition in the case of *pf/p* and *ts/t* in German, and marks all other consonants as 0. In the analysis of English *s* and *z* are naturally marked as plus strident in contradistinction to *θ* and *ð*, which receive a minus, and *tʃ* and *dʒ* are plus strident as opposed to *t* and *d*, which are marked minus. But *f*, *ʒ* and *k*, *g*, which are marked + and - strident respectively,

16. The minus for voicing in the A-analysis of Russian nasals must be a simple misprint; it must also be a misprint that "continuant" is marked as minus under *m* but as 0 under *n*.

could equally well have received 0 since they also differ by being fricatives and stops, i.e. these distinctions are not minimal. In the Russian example only the affricate *ts* is marked as + strident, which is reasonable, but all dental stops have minus, although *ts* is minimally distinct only from *t*.

The Russian system is arranged in two different ways, once as a system with zeros (A) in the same way as the other languages, and once with all of the phonemes divided into categories (B). In the latter case the same questions are not asked for all categories, nor are they asked in the same order. When, for example, a category has been characterized as +vocalic, the features 'continuant' and 'sharp' are skipped, and in this way the description is simplified. The matrix is here regarded as a codebook identifying the different phonemes. Certain answers entail certain new questions and preclude others. This arrangement in some ways resembles a tree structure diagram, where the total number of phonemes are divided into progressively smaller categories, and where the branches are not subdivided in the same way. As an example of such a diagram Fant's analysis of Swedish consonants (1960) is shown in table 8.5. Jakobson does not make use of this type of arrangement, however.

In the normal type of matrix arrangement the question of zeros is really a question of a division into categories. If, for example, *m*, *n* and *ŋ* are given a plus for the feature "nasal", and all other consonants a minus, this is equivalent to setting up two primary categories of consonants in the language: nasal and oral. If on the other hand *m*, *n* and *ŋ* are described as plus nasal and only *b*, *d*, *g* are marked as minus nasal, while other consonants get a zero, this is equivalent to setting up a subcategory of voiced stops and dividing this subcategory into nasal and oral voiced stops.

A system where all dimensions are utilized in the case of each phoneme may be arranged in a tree diagram in many ways with different orderings; but if there are many zeros they will determine the order, since a binary division does not permit zero as a subcategory in addition to plus and minus; this is only possible if one is willing, as Fant is, to accept neutral branches (i.e. tripartitions).

Also included in "Prl." is a matrix of a somewhat different type, where a greater number of features are regarded as redundant and put in brackets; "consonantal", for example, is considered redundant in the case of the consonants since it follows from the use of the dimension tense/lax that they are consonants. The minus is omitted in the case of all diffuse consonants since it is evident from their splitting up into acute and grave that they are not compact. The result is that several phonemes are only kept apart by means of 0 versus + or -. It is furthermore pointed out that in connected speech those pluses and minuses which are predictable from the context may be omitted.

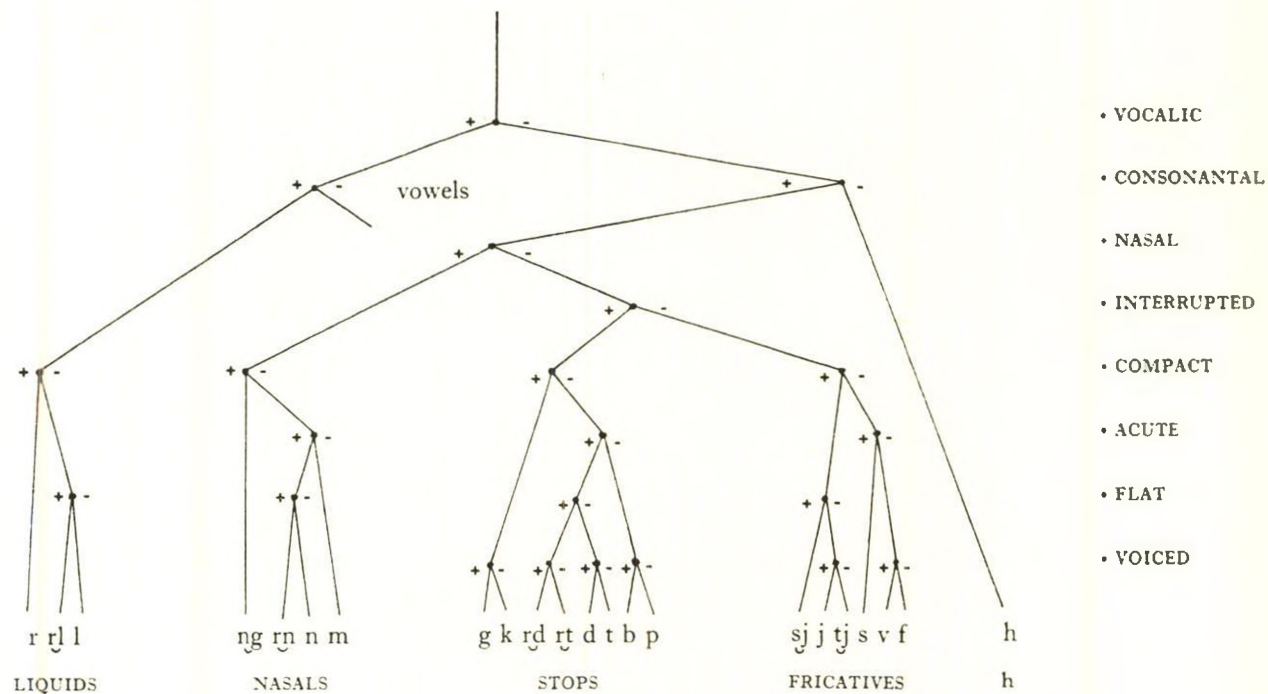


Table 8.5

Distinctive feature coding of Swedish consonants (Fant 1961).

Concluding Remarks

8.17 Roman Jakobson's distinctive feature analysis has been of great importance to the development of phonology. The general principles of such an analysis (i.e. that distinctive features, in the sense of components, are the minimal units in phonological analysis, and that the normal situation is a binary opposition whose members can be designated by + and -) have been accepted by the vast majority of linguists both in America and in Europe. Many have also adopted the specific set of features defined by Jakobson and applied them to phonological descriptions of various languages.¹⁷ Others have found some of the features rather artificial and unsatisfactory, and it has often been argued that not all of them can be reduced to binary oppositions.

The theory has had a decisive influence on generative phonology (see Chapter 9). Jakobson's twelve rather abstract features have, however, gradually been replaced by a much larger number, which are intended to be more realistic phonetically.

17. Among those who have adopted Jakobson's specific set of features is HENNING ANDERSEN, who, however, applies them in an original way, particularly to language change. In the paper "Diphthongization" (1972) he describes different types of diphthongization as differentiations of distinctive features; the development of *y* to *iu* is thus a diphthongization with respect to the feature tonality, and the development of *i* to *ei* is a diphthongization with respect to the feature diffuseness, etc. He further sets up a universal tendency to the effect that the opposite values of the feature with respect to which the segment is diphthongized are distributed over the duration of the segment in the order unmarked/marked.

Chapter 9

GENERATIVE PHONOLOGY

Introduction

9.1 Generative phonology constitutes one part of the linguistic theory which is called TRANSFORMATIONAL GRAMMAR, or more precisely transformational generative grammar, and which was originated by the American linguist NOAM CHOMSKY in the late fifties. The theory can be said to date from 1957 when Chomsky published "Syntactic Structures" (1957b). As the title indicates, this book deals mainly with syntax, but in a review from the same year of Jakobson and Halle's "Fundamentals of Language" Chomsky gave a brief outline of a new approach to phonology, conceived as an abstract underlying system which is connected with actual speech by means of rules (1957a, pp. 238-9). The new theory of phonology was, however, largely worked out by MORRIS HALLE and was first described in detail in Halle's book "The Sound Pattern of Russian" (1959). In the following years the theory was further elaborated and thoroughly revised especially in the domain of syntax and semantics. Between 1964 and 1968 Chomsky published five monographs: "Aspects of the Theory of Syntax" (1965, in the following referred to as "Aspects") contains a full account of Chomsky's new conception of syntax. "Current Issues in Linguistic Theory" (1964b, in the following abbreviated to "Current Issues")¹ contains a fairly detailed description of generative phonology as opposed to structural phonemics (pp. 65-110), and "Topics in the Theory of Generative Grammar" also deals with phonology, although more briefly (1966a, pp. 76-90). In "Cartesian Linguistics" (1966b) and "Language and Mind" (1968) questions of a more general nature are discussed.

In the beginning of the sixties Halle published a number of contributions to phonology (1961, 1962a, 1962b, 1964), and in 1968 Chomsky and Halle jointly published the comprehensive book "THE SOUND PATTERN OF ENGLISH" (in the following abbreviated to "SPE"), which must be regarded as the principal work in generative phonology.

Chomsky and Halle soon obtained an enthusiastic following, at first mainly among young linguists in America, but gradually also in Europe, and the new theories must now be said to be predominant in the greater part of the linguistic world, particularly among the young generation of linguists.

Transformational grammar marks a new epoch in the history of linguistics,

1. This book is to a large extent a revised edition of his contribution to the 9th Congress of Linguists (1964a).

and the revolution it has created can best be compared to the rise of structuralism about 1930. Just as then, the adherents of the new linguistics are very self-confident. The old generation of structuralists have put up a bitter defense, but the new revolution has proceeded much more rapidly than the old one did.

However, these theories have not been taken over passively by the adherents, but have been subjected to numerous modifications, which have sometimes been quite radical. Some of the younger transformationalists regard Chomsky as more or less *passé*, an attitude which seen from without appears somewhat exaggerated. Among linguists who have contributed significantly to transformational grammar are EMMON BACH, MANFRED BIERWISCH, WALLACE L. CHAFE, CHARLES FILLMORE, RAY JACKENDORFF, PAUL KIPARSKY, ROBERT B. LEES, DAVID M. PERLMUTTER, P. POSTAL, JOHN R. ROSS and RICHARD P. STOCKWELL. Further contributions, particularly to phonology, have been made by STEPHEN R. ANDERSON, MICHAEL K. BRAME, CHARLES E. CAIRNS, ROBERT T. HARMS, ROBERT D. KING, CHARLES W. KISSEBERTH, ROGER LASS, THEODORE M. LIGHTNER, JØRGEN RISCHER, SANFORD A. SCHANE, MASAYOSHI SHIBATANI, ROYAL SKOUSEN, THEO VENNEMANN, WILLIAM S.-Y. WANG, WOLFGANG ULRICH WURZEL, KARL E. ZIMMER, ARNOLD E. ZWICKY, J. MCCAWLEY, and various others.

Because of the many revisions it is difficult to give a rounded description of the theory. A number of new ideas have not been completely integrated, for example the so-called marking conventions, which provide valuable new points of view, but which at the same time raise problems that have not yet been solved. Considering the unfinished character of the theory most weight is attached to the fundamental ideas as they appear in "SPE", but more recent developments have also been taken into account although less consistently.

It can be recommended to begin the study of transformational grammar with JOHN LYONS's book "Chomsky" (1970), which is a short and easily understood introduction to the basic ideas. The first part of NICOLAS RUWET's introduction to generative grammar (1967) contains a searching and highly interesting discussion of the general principles. Bach's introduction (1964) must now be characterized as somewhat dated, although some of the chapters are still very useful. For a short general introduction see Lepschy (1972, pp. 126-38).

The first chapter of MCCAWLEY's book on Japanese phonology (1968) provides a very good and lucidly written introduction to generative phonology (although his view of boundaries has not been generally accepted). BIERWISCH (1967) is very clear and somewhat more comprehensive (it contains, for example, a description of marking conventions which is not found in McCawley's book), but as it is very condensed it does not make easy reading. ROBERT HARMS's book on generative phonology (1968) contains some excellent chapters (e.g. ch. 4 on distinctive features), but others are pedagogically unfortunate, since various concepts are employed which are not explained until later on.

S. A. SCHANE's paper of 1967 gives a brief and clear summary of the main

points; more recently (1973) he has published an excellent elementary book on generative phonology, which is the best and most modern introduction to the field. FRANÇOIS DELL's introduction (1973) is also excellent. Compared with Schane's book, the account of phonological theory is shorter and not quite as clear in the pedagogical set-up, but it contains a good general linguistic introduction and various detailed applications to concrete languages.

POSTAL's "Aspects of Phonological Theory" (1968) is a temperamental clash with other phonological trends; it contains some interesting chapters on diachronic phonology. EVEN HOVDHAUGEN (1969, revised edition 1971) is recommendable to those who read Norwegian. For those who want to go somewhat deeper into generative phonology the reading of CHOMSKY and HALLE's "Sound Pattern of English" ("SPE") is indispensable, but it is not an easy book to start with.

In the following reference will generally be made to the most important treatments in the beginning of the main sections, but as far as details of the phonological analysis are concerned references will only be given to "SPE", which so far must be regarded as the principal work. However, references to other works are given in the cases where the approach differs from that of "SPE".

Transformational generative grammar has been violently attacked by some of the older structuralists, for example HOCKETT (1968) and Householder (1965). More interesting is, however, the criticism raised by some of the younger linguists who have worked with transformational grammar (particularly generative phonology) in practice, but have been disappointed by the purely hypothetical character of some of its basic tenets. Particularly important are the works of RUDOLF P. BOTHA (1971), BRUCE L. DERWING (1973) and PER LINELL (1974). Most of the criticism of generative phonology is concentrated in sections 9.69-72.²

General Characteristics of Transformational Grammar

BACKGROUND

9.2 NOAM CHOMSKY studied linguistics, mathematics and philosophy at the University of Pennsylvania. His mathematical and philosophical training has certainly been of importance for the descriptive formalization which is characteristic of transformational grammar. He was taught linguistics by ZELLIG HARRIS and thus grew up in the post-Bloomfieldian tradition in its most exact

2. The books by Schane, Dell, Botha, Derwing and Linell did not come to my notice until the manuscript of this book was completed. They have, therefore, not been fully integrated in the following presentation, but references have been added in various places.

and procedurally oriented form. This is noticeable in his very first works, e.g. in the paper "Semantic Considerations in Grammar" (1955), where "meaning" is rejected as irrelevant to the description of formal structure. In "Syntactic Structures" (1957b, pp. 92 ff) he still regards syntactic theory as purely formal and non-semantic, although a certain parallelism between syntactic and semantic phenomena is recognized. One of the most crucial innovations in "Aspects" (1965) is precisely the introduction of a semantic component. He also refers to Harris's pair test which does not take meaning into consideration (cf. 6.18 above), and it is from Harris that he has taken over grammatical transformations, although in a modified form (cf. 9.16 below). However, "Syntactic Structures" already contrasts with the Bloomfieldian tradition in several important respects: e.g. by rejecting "discovery procedures" (cf. 9.4 below) and by emphasizing that a description shall account not only for a given corpus of sentences, but for all possible sentences in the language under investigation. In the following period Chomsky detached himself more and more from this tradition and gradually became strongly opposed to it. In "Language and Mind" (1968, p. 2) he relates that as a student he received the impression that all fundamental linguistic problems had been solved, and that the task of contemporary linguistics was restricted to improving a given technique and applying it to a larger corpus. Linguistic methods were hardly discussed in the early fifties. Chomsky's development should be regarded as an attempt to break away from this scientific attitude, to burst its constrictive framework and to open up wider perspectives. The strongly polemic tone which is frequently found in transformational works, and which often strikes European linguists as fighting against windmills, should be seen against this background. It is an internal American showdown. The situation was quite different in Europe, for example in Copenhagen, where theoretical problems were discussed eagerly in the early fifties, and where very few problems were considered solved.

In his syntactic analysis Chomsky looks back to the period before structuralism, to TRADITIONAL GRAMMAR, and he even characterizes his own grammatical description as a formalization of features implicit in traditional grammar ("Current Issues" p. 16). "Its roots are firmly in traditional linguistics" (ibid. p. 25). Nevertheless he retains the "immediate constituent" analysis of the Bloomfield School as part of his syntactic description.

As regards the general conception of language and the aim of linguistics, Chomsky goes even further back into the past for confirmation of his views, partly to Descartes and the Port-Royal grammarians in the seventeenth century, partly to Wilhelm von Humboldt in the early nineteenth century.

DESCARTES and his followers stressed the universal elements in human language and particularly man's capacity for forming new statements which express new thoughts. This, it was felt, must be due to a special human faculty, for whereas it is impossible for an otherwise intelligent ape to speak, this presents no difficulties to even the most stupid human. SEVENTEENTH CENTURY GRAMMAR is not descriptive, but RAISONNÉE. It attempts to explain characteristics of individual

grammars on the basis of a universal grammar, and it furthermore seeks to account for the latter on the basis of general assumptions concerning mental processes.

In the works of WILHELM VON HUMBOLDT, who differs from the philosophers and grammarians of the seventeenth century by stressing the differences between languages, Chomsky finds an even stronger emphasis on the creative aspect of language. To Humboldt language is not something established, but something which is continually created, and only the laws of this creativity are unchanging. Language is "the eternally recurring effort of mind to make articulated sounds capable of expressing thoughts", cf. "Cartesian Linguistics" (1966)³ and "Language and Mind" (1968, ch. 1). Chomsky's distinction between competence and performance (cf. 9.9 below) can be traced back to Saussure's *langue-parole* distinction, but his conception of competence is influenced by Humboldt.

From 1951 to 1955 Chomsky was a junior fellow at Harvard, and here he began to collaborate with Morris Halle, who was a pupil of ROMAN JAKOBSON (Chomsky and Halle are now both professors at M. I. T.). The importance which in transformational grammar is attached to general laws is probably partly due to Jakobson, and his influence on generative phonology is quite obvious. Halle, it should be remembered, worked in close co-operation with Jakobson when the theory of distinctive features was being framed and is the co-author of both "Preliminaries" and "Fundamentals" (cf. Chapter 8). Various aspects of this theory were now taken over in generative phonology, such as the conception of distinctive features as the minimum linguistic units, the binary interpretation of features at the phonological level, and arrangements of features in matrices. At first the twelve distinctive oppositions set up by Jakobson were used, but later a number of revisions have been made (cf. 9.33-37 below). It is interesting to notice that it is the Jakobsonian features which were adopted, and not Harris's long components (cf. 6.31 above).

In the later stages of generative phonology the influence of early PRAGUE PHONOLOGY is also quite noticeable, since the distinction between marked and unmarked has been taken over, although in a greatly modified form (cf. 3.6-10 above, and 9.31 below).

Although opposed to post-Bloomfieldian methods, generative phonologists have been crucially influenced by EARLY AMERICAN PHONOLOGY, i.e. by BLOOMFIELD himself and, even more so, by SAPIR. As mentioned in 6.6, Bloomfield established a special discipline, called morphophonemics, dealing with morpheme alternations. It was a characteristic of Bloomfield's approach, as compared with that of the Prague phonologists (cf. 3.15), to set up a basic or underlying form, from which the remaining morpheme variants were derived by means of ordered rules (cf. 6.6). Such an establishment of underlying forms, together with a considerably elaborated system of ordered rules, is a characteristic feature of generative

3. The historical account of seventeenth- and eighteenth-century grammar given in this book has recently been criticized as inaccurate, partly by H. Aarsleff in "Language" (46, 1970) and partly by Robert A. Hall in "Acta Linguistica Hafniensia" (XII, 1970).

phonology. As mentioned in 6.34-39, many of Bloomfield's followers, for example Chomsky's teacher Harris, also set up a morphophonemic discipline, but to them ordered rules played no important part. What is common to all of them, however, is that morphophonemics constitutes a special discipline which is kept apart from phonology. SAPIR, on the other hand, integrated these two aspects into one discipline by taking morphophonemic alternations into consideration in the establishment of phoneme inventories, and similar tendencies are found in the works of Swadesh and in the early works of Trager. This is one of the important points on which generative phonologists follow Sapir rather than Bloomfield. Another such point is the assumption that phonological units are psychological realities, and that it is the psychological "pattern" which constitutes the real object of description.

Glossematics has not influenced generative phonology, although there are many common features in the two schools (e.g. the interest in linguistic universals, the deductive method, the integration of morphophonemics and phonemics). Hjelmslev's "Prolegomena" is mentioned in the bibliography of "Current Issues" but is not discussed. In a footnote on p. 75 Chomsky writes that in his criticism of various phonological theories he has chosen to disregard glossematics, "which, for reasons unclear to me, is often referred to as extremely rigorous and of high "operational preciseness"".

THE GENERATIVE VIEWPOINT

9.3 CHOMSKY defines a LANGUAGE as a set of sentences. In "Syntactic Structures", for example, a language is characterized as "a set (finite or infinite) of sentences, each finite in length and constructed out of a finite set of elements" (1957b p. 13), and it is added that in natural languages the number of sentences is infinite. In "SPE" the definition runs as follows: "We may think of a language as a set of sentences, each with an ideal phonetic form and an associated intrinsic semantic interpretation" (1968, p. 3). This definition seems to be an inheritance from the Bloomfield School,⁴ where it probably originated in a wish to exclude everything which is not immediately observable, a view which is not shared by Chomsky at all. In his definition "sentences" probably should be understood as "potential sentences". But the taking over in transformational grammar of such a definition, according to which sentences are regarded as the main objects of linguistic analysis, has the consequence that most importance is attached to syntagmatic description, and the notion of system is relegated to the background. Compare the fact that a language to Hjelmslev and other European structuralists is a system and is often specified as a system of signs. The system is called "GRAMMAR" by Chomsky. But he sees it as a system of rules. In the passage

4. Cf. Bloomfield (1926) "the totality of utterances that can be made in a speech community is the language of that speech community".

in "SPE" quoted from above it is stated further: "The grammar of the language is the system of rules that specifies this sound-meaning correspondence", and in "Current Issues" the following statement is found: "The grammar, then, is a device that (in particular) specifies the infinite set of well-formed sentences and assigns to each of these one or more structural descriptions" (1964b, p. 9). It is not immaterial whether the aim is (as for Hjelmslev) to find the system underlying the text, or whether it is (as for Chomsky) to go from the system to the texts. In both cases, it is true, the establishment of the system is essential, but the perspective is different.

In this connection it is worth mentioning that Chomsky uses the word "grammar" very broadly and includes both lexicon and phonology as parts of grammar. Actually it is the equivalent of "language description". "Syntax" is also used in a wider sense than traditionally, since it includes morphology and very often even the lexicon. This terminology is rather confusing since it conceals the distinction between grammar (in the normal sense of the word) and lexicon, and thus also the great difference in the generality of rules applicable to these two parts of language description.

Although Chomsky follows the American structuralists in emphasizing the description of sentences, there is a crucial difference. According to Chomsky it is a fundamental characteristic of human language that each member of a given language community is capable of producing and understanding an infinite number of new sentences. This explains why reference is made to "the infinite set of well-formed sentences" in the definition of grammar quoted above. It is not a question of a definite, actually observed set of sentences, but of all sentences which are possible in the language. A grammar should not just be descriptive; it should be capable of predicting all possible sentences in the language. It is this capacity which makes a grammar *GENERATIVE*. In "Syntactic Structures" (1957b, p. 13) this is expressed in the following way: "The grammar of L will thus be a device that generates all of the grammatical sequences of L and none of the ungrammatical ones". This should not be understood in the sense that a grammar is a sort of sentence producing machine, or that it describes the production of speech itself. "Device", in another work of Chomsky's (1967), is paraphrased as "a set of rules", and "generate" does not mean "produce", but is a term from the standard vocabulary of mathematics which according to Ruwet (1967, p. 33) means "enumerate explicitly by means of rules". Chomsky himself sometimes employs the term "enumerate" synonymously with "generate" (e.g. Chomsky and Miller 1963, pp. 276-7), and Halle (1962b, p. 54) writes "describe, define, or generate". In "Aspects" (1965, p. 9) Chomsky states that "When we speak of a grammar as generating a sentence with a certain structural description, we mean simply that the grammar assigns this structural description to the sentence".⁵

5. See also John Lyons "Introduction to Theoretical Linguistics" 1968, pp. 155-6.

In "Current Issues" (1967, p. 16) it is mentioned that the traditional grammarians also wanted to distinguish between possible and impossible sentences, but that they did not succeed because their rules were insufficient. The important thing about Chomsky's model is that it is explicit, i.e. that nothing is omitted.

According to Chomsky the American structuralists almost exclusively occupy themselves with the description of concrete texts, i.e. with a closed corpus. Harris, for example, states this explicitly (1951). It should be mentioned, however, that Hockett in several places (e.g. 1948, p. 269) makes it quite clear that the analysis should be prognostic, i.e. it should permit the correct prediction of possible new utterances, and this attitude also characterizes other structuralists. But Chomsky makes generativeness the central aspect of grammar, and descriptive methods are discussed from this point of view. It is strange, incidentally, that Chomsky in his discussions of the generative method never refers to H. Spang-Hanssen's book, "Probability and Structural Classification", which is a direct contribution to the methodology of prognostic language description. But perhaps the reason is that Chomsky rejects statistical methods in grammatical description.

GRAMMATICALITY

9.4 A concept which is closely connected with generativeness is "well-formedness", or GRAMMATICALITY (cf. the definitions of grammar above). A grammar should be capable of generating all the grammatical sentences in a language, and only these. Naturally grammaticality does not depend on whether the sentences actually occur in the data or not, or on their probability. Both false and tautological sentences, such as *black ravens are white* and *black ravens are black*, are highly improbable but still "grammatical" (Chomsky and Miller, 1963). Nor is grammaticality equivalent to "correctness", for this is dependent on the stylistic level. According to CHOMSKY ("Syntactic Structures", p. 15) it is not possible, either, to identify the notion "grammatical" with "meaningful", for a sentence like *colourless green ideas sleep furiously* must be regarded as well formed, in contradistinction to *furiously sleep ideas green colourless*. This example dates from the period before semantics had been incorporated into the grammar, but Ruwet, who discusses the notion of grammaticality in great detail (1967, pp. 30-44), is of the opinion that the former sentence must still be regarded as grammatical, but not interpretable. On p. 78 of "Syntactic Structures" and on pp. 74-7 and 148ff of "Aspects" Chomsky mentions the possibility of recognizing degrees of grammaticality. For example, *John admires sincerity* is clearly grammatical, and *sincerity admires eat* is clearly ungrammatical, but *sincerity admires John* is something between the two. It may be rejected by means of a grammatical rule, if classes of "animate" or "human" and of abstract nouns are set up in the grammar, but it is not as ungrammatical as *sincerity admires eat*. There is some vacillation in

his treatment of this intermediate type: as ungrammatical or as only semantically deviant (see "Aspects" p. 78).⁶

Grammaticality should also be distinguished from "acceptability". A grammatical sentence may be unacceptable because it expresses a false proposition, cf. *black ravens are white*, or because it is too complex, cf. *the rat the cat the dog chased caught ate the malt*.

It is a problem how it is possible to decide whether a sentence is grammatical or not. In "Syntactic Structures" (pp. 13 ff and 49 ff) Chomsky writes that in the first place grammatical sentences should meet an external condition of adequacy: they should be acceptable to the native speaker. There is, however, another criterion: if the grammars of individual languages have been constructed on the basis of a general theory and according to the same principles, and if it turns out that the rules of the various grammars generate the clearly grammatical sentences and exclude the clearly ungrammatical ones, then these rules can be used to decide the unclear cases. This approach is advocated by Ruwet (1967, p. 44), but other linguists are more sceptical, and the problem of whether the linguistic theory itself can be used to decide grammaticality is still being debated.

In phonology "grammaticality" refers to permitted combinations. Whereas /bnik/, for example, is an ungrammatical form in English, both /brik/ and /blik/ are grammatical, though only the former actually occurs as a word (see also Scholes 1966).⁷ In this case it is also possible to talk about degrees of grammaticality. /mɪŋlʃʊp/, for example, is more clearly ungrammatical than /bnik/ in English, because it violates a larger number of rules as well as more general rules. It may be pointed out, incidentally, that there is a difference between grammaticality as regards sentences and grammaticality as regards sign-expressions. Grammatical sentences are such as any speaker is capable of forming within a given synchronic system. Grammatical sign expressions are such as are found in the actual inventory or might be introduced into the language in order to express new contents without changing the rules of phoneme combinations.

6. Cf. the critical remarks in L. R. Palmer (1972, p. 151) and E. M. Uhlenbeck (1967, p. 303 ff).

7. Is it not really true to say that the post-Bloomfieldians' analytical methods preclude such statements, i.e. that they are only intended to describe what is actually found. Their description of phoneme combinations, like those of other phonological schools, is given in the form of general rules (e.g. initial *b* may be followed by *r* and *l*), and not in the form of rules applying to individual morphemes. According to the established rules, then, /blik/ is permitted. Furthermore the concept of "possible forms" is implicit in the principle that minimal pairs may be disregarded at the establishment of phoneme inventories, i.e. potential minimal pairs are sufficient. A certain predictability is thus built into the traditional methods also. Bloch, it is true, operates only with actually occurring signs in his analysis, but the result of his analysis depends on whether a missing combination is accidental or due to a general rule (cf. 6.19). Hockett deals explicitly with this problem in "Manual of Phonology" (p. 165-6).

DEDUCTIVE THEORY VERSUS INDUCTIVE "DISCOVERY PROCEDURE"

9.5 The Bloomfield School – as also glossematics – wanted to make linguistics as exact as possible. One of the means to this end was the establishment of a careful "discovery procedure", which progresses by well-defined steps, and by which the elements of a given text can be isolated and classified. Harris advances a very precise procedure of this type in "Methods" (1951), CHOMSKY, however, is of the opinion that such a procedure is ultimately impracticable. There are frequently several equally justified analyses, and it is not possible to arrive at a unique result (cf. the description of the Bloomfield School above, particularly 6.19 and 6.22). One of the elements in such a discovery procedure is the commutation test. As mentioned in 9.2, Chomsky prefers Harris's pair test to the commutation test, but he points out that difficulties arise as regards the definition of "environments". The environments must be identified before the commutation test can be applied, and the linguist is therefore liable to argue in a circle. How should it be decided, for example, whether the distinction between *writer* and *rider* is due to the diphthong or the consonant? "Minimal pair" is not an elementary concept; it can only be defined on the basis of a completed phonemic analysis, and consequently it cannot be used as a procedural instrument ("Current Issues", pp. 83–4). Ruwet (1967, pp. 75–6) makes a similar point and draws attention to the fact that it is impossible to dispense with a general knowledge of the language and with general considerations of simplicity. (This is obviously true; it is not a question of purely mechanical procedures.) Chomsky emphasizes that the attempt to reach a unique grammatical analysis by means of such procedures is simply too ambitious.

On the other hand, Chomsky regards the aim of the analysis in the Bloomfield School (namely the segmentation and classification of utterances) as overly modest, and he characterizes a scientific description with only these ends in view as TAXONOMIC. Science does not deal with data for their own sake, but in order to gain an insight into more deeply organized principles. On the basis of a limited number of observations we should establish general theories and hypothetical models and on this basis explain known facts and predict new ones. (It should be remembered in this connection that a grammar of a concrete language is also considered a theoretical model of that language.) For this purpose a discovery procedure is quite insufficient. A theory cannot be constructed by means of induction, and it is not possible to give directions about how to get good ideas. The paths by which a scientist arrives at his theory are irrelevant. The crucial point is whether the theory is verifiable (cf. Chomsky 1957b, p. 49ff and also the preface of Halle 1959, and Ruwet 1967, pp. 11ff and 67ff).

On this point transformational grammar is in agreement with glossematics. Hjelmslev uses the term "deduction" in several senses (cf. 7.11), but glossematics is also deductive in the normal sense of the word. Lamb criticizes Hjelmslev for

adopting the deductive point of view only in the general theory, and not in the description of individual languages. But to Hjelmslev these things formed a whole. He wished to construct a theory which would predict all possible languages, and his analytical procedure served the purpose of determining which concrete language, out of the many possible languages predicted by the theory, the linguist was confronted with in each particular case. There is a strong resemblance between this aspect of glossematics and Chomsky's conjectures about the mental activities of a child in the process of acquiring his native language (cf. 9.10 below).

It has been objected from various quarters that a certain descriptive technique is extremely useful. If there is no such technique available, it is only possible to describe one's native language (and actually this is what a number of transformational grammarians confine themselves to, particularly in syntax). Chomsky acknowledges this argument, but points out that a distinction should be made between methodology and theory. Certain heuristic procedures are useful, but only as regards methodology (cf. also Ruwet, p. 77ff and Derwing's criticism 1973, p. 56ff).

VERIFICATION AND ADEQUACY

9.6 As regards VERIFICATION two possibilities are mentioned in "Syntactic Structures" (p. 51, cf. also Ruwet, p. 67f): a decision procedure, by which it is determined which of several grammatical descriptions is the correct one, or an evaluation procedure, by which it is decided which is best. According to CHOMSKY we should lower our sights to the latter and more modest goal, but even the attainment of this goal is a difficult task. It is not possible to use a vague criterion of simplicity and on this basis evaluate the relative simplicity of two grammars based on different theories. It is necessary to have a well-defined concept of simplicity within a given theory. But it is possible to compare different grammars as regards their "adequacy" ("Current Issues" p. 28-55). Chomsky distinguishes between three levels of adequacy:

(1) The lowest is OBSERVATIONAL ADEQUACY. A description is observationally adequate if it accounts for the units found in a given corpus. If we establish a rule, for example, which states that in the combination *b-ik* only *r* is found in English, we have attained observational adequacy. What is involved is simply agreement with the data. According to Chomsky it is this lowest level to which the American structuralists confine themselves. Since a number of different descriptions accounting for the same data may be given, this criterion is not of great help in selecting a grammar, but it is the least we can ask for.

(2) The next level is that of DESCRIPTIVE ADEQUACY. Here we go beyond the data and establish more general rules, which account for the actually found forms, and which furthermore permit the prediction of non-occurring grammatical

forms.⁸ A rule which states that in English only a liquid is found between *b* and a vowel is descriptively adequate. As a syntactic example the sentences *John is eager to please* and *John is easy to please* may be mentioned. On the surface they are identically structured, and they would not, Chomsky points out, be distinguished in a taxonomic grammar. But at the level of descriptive adequacy two different constructions are assigned to them. One grammar may have greater descriptive adequacy than another.

(3) The highest level of success is that of EXPLANATORY ADEQUACY. This pertains not to the individual grammars, but to the theory. It is an important linguistic task to construct a deductive theory about the structure of human language and to demonstrate the universal and essential properties of language. The theory should provide a basis for selecting a descriptively adequate grammar from among the observationally adequate ones. When this can be done we have reached the level of explanatory adequacy. In the phonological example mentioned above we should be able to advance a general evaluation criterion, which demonstrates that the rule "between *b* and a vowel only a liquid occurs" is better than the rule stating that only *r* is found in the frame *b-ik*. As another example it may be mentioned that in English [e] occurs in the noun /tórment/ whereas [ə] is found in /tórrent/. If this distribution is merely stated, we are confining ourselves to observational adequacy. But we may also establish a rule which states that the vowel is not weakened in a noun which is derived from a corresponding verb (/tormént/), i.e. a rule which applies to other cases as well, and this is descriptive adequacy. Finally we may set up a general theory which prescribes the general form of such syntactically conditioned phonological processes, and in this way we reach the level of explanatory adequacy.

The general theory should formulate a GENERAL EVALUATION CRITERION. It is not sufficient to claim, as the glossematians do, that the simplest description is the one which sets up the smallest number of minimum units. What is involved is OVERALL SIMPLICITY, i.e. the total description should be considered. This was emphasized by Halle as early as 1954 (cf. the Bibliography for ch. 4). It should be possible to account for a maximum of facts with a minimum of rules. But the concept of simplicity should be made even more precise. Conventions and formulas should be selected in such a way that we arrive at a simple formulation of LINGUISTICALLY SIGNIFICANT GENERALIZATIONS, a concept which, incidentally, is not defined, probably because it has not yet been sufficiently clarified. This concept is discussed in more detail in 9.56 together with the general problem of evaluation.

In practice these views lead to the establishment of hypothetical UNDERLYING FORMS, e.g. underlying syntactic structures, from which the actually occurring sentences may be derived by means of rules, and, in phonology, a string of underlying morphophonemes (or "systematic phonemes", cf. 9.24-27), from which the phonetically occurring forms may be derived by means of a set of (partly) ordered

8. These should be in agreement with the native speaker's intuition (cf. 9.8-9 below).

rules. From the point of view of traditional phonology one would be inclined to ask how the generative phonologists arrive at such underlying forms. But it is implicit in the theory that there are no rules as to how these forms are reached. They are hypothetical models, which are set up more or less intuitively (although this intuition sometimes seems to lean heavily on traditional methods), and whose validity is tested by investigating whether they permit a description that is both adequate in each of the three respects mentioned above and that satisfies the demand for significant generalizations.⁹

UNIVERSALS

9.7 The construction of a general linguistic theory, a **UNIVERSAL GRAMMAR**, partly serves the purpose of limiting the number of possible analyses in the description of individual languages, but it is also an end in itself. **CHOMSKY** distinguishes between formal and substantive universals ("SPE", p. 4; "Language and Mind", p. 57; Lyons 1970, p. 99ff). By formal universals he understands the general principles which determine how a grammar is constructed, which form and ordering the rules may have, etc. The substantive universals define the sets of elements that may figure in particular grammars. They need not be found in all languages, but they are available to all languages.^{9a} Their definition must be independent of their occurrence in any particular language. Among these universals the phonetic features and the rules governing their possibilities of combination may be mentioned. There are furthermore semantic universals, and also categories such as noun, verb and adjective are considered substantive universals.

By its emphasis on the importance of a universal linguistic theory transformational grammar forms a sharp contrast to the Bloomfield School. Bloomfield maintained that the only useful generalizations about language are the inductive ones, and the post-Bloomfieldians showed little interest in universal linguistic phenomena. (Recently, however, there has been a growing interest in these problems in America, an interest which seems to have emanated from anthropologists and psychologists and to be independent of transformational grammar, cf. Greenberg 1966). On the other hand, transformational grammar is in this respect in close agreement with Hjelmslev, who regarded the establishment of a general theory as the main object of linguistics (Hjelmslev, however, rejected semantic universals), and also with the Prague School, which was greatly interested in the establishment of general laws (cf. 3.12 above).

The different kinds of "adequacy" were first discussed in "Current Issues"

9. A. Zwicky (1973) has tried to set up a list of the methodological principles actually used, more or less implicitly, by generative phonologists in choosing the underlying representations.

9a. Botha (1971, p. 212ff) asks how this can be tested.

(1964), but otherwise the above account refers to Chomsky's position at the time he wrote "Syntactic Structures". In the following years his views became more and more psychological. The psychological aspect has deliberately been excluded in this section in order to emphasize that some of the most basic ideas of transformational grammar, as well as the whole descriptive apparatus, are really independent of any hypothesis as regards the psychological reality of the description. One may reject this hypothesis without rejecting transformational grammar in toto. But the psychological viewpoint is an essential feature of Chomsky's conception of language and will therefore be discussed in the following section.

THE PSYCHOLOGICAL ORIENTATION OF TRANSFORMATIONAL GRAMMAR

LINGUISTICS AND PSYCHOLOGY

9.8 In "Syntactic Structures" (1957b) it is demanded that the non-observed sentences which are considered grammatical should be acceptable to the native speaker, and it is pointed out that the linguist's extrapolation from observed to possible sentences reflects the speaker's ability to understand new sentences and may be said to explain his linguistic behaviour. On p. 56 it is, however, stated expressly that "our ultimate aim is to provide an objective, non-intuitive way to evaluate a grammar once presented, and to compare it with other proposed grammars".¹⁰ In "Aspects" (1965), on the other hand, it is asserted that "there is no way to avoid the traditional assumption that the speaker-hearer's linguistic intuition is the ultimate standard that determines the accuracy of any proposed grammar, linguistic theory, or operational test" (p. 21). The difference between these two views is not quite as great as it might appear at first glance, since the intuition referred to in the first quotation is the intuition of the linguist (which may only be utilized at the first stage of the analysis, viz. at the advancement of hypotheses, but is ruled out at the stage of verification), whereas the intuition referred to in the second quotation is the INTUITION OF THE SPEAKER (which is crucial to the verifications). Nevertheless a marked change has taken place in the attitude towards the goals of linguistics. In "Syntactic Structures" linguistics was still considered an autonomous science, but in the subsequent works it is regarded as a branch of cognitive psychology.

In traditional grammar it was the usual practice to seek psychological explanations of grammatical phenomena. The established linguistic units were here frequently regarded as psychological entities, cf. for example Baudouin de Courtenay's "psychophoneme", which also appeared in the early Prague School works,

10. In Ruwet (1967, p. 66) almost the same is stated, and the psychological implications of transformational grammar are largely ignored here. Lyons, on the other hand, discusses them in some detail (1970, pp. 83-108).

and whose validity some of the Prague phonologists continued to maintain. N. van Wijk, for example, considered it the task of phonology to describe the speaker's sound images, and in certain passages of "Cours" Saussure described "la langue" as a psychological entity, an imprint of "la langue" in the individual's brain. In Hjelmslev's first book "Principes de grammaire générale" (1928), linguistics is described as part of psychology, although its independence is stressed at the same time. Nor should we forget Sapir, whose work influenced Chomsky directly.

But from the early thirties on it was the general opinion among structuralists that linguistics should be autonomous, or, in Hjelmslev's terminology, "immanent". This demand was part of the endeavours to establish linguistics as an exact science, and it was considered particularly important to weed out all mental elements. In particular this point was emphasized by Bloomfield, who demanded that any scientific description should be mechanistic and that mentalistic terminology should be avoided (cf. 6.2 and 6.3 above). Chomsky's new mentalism, therefore, is probably primarily a reaction against the Bloomfield School, but at the same time it is also a reaction against structuralism generally. That this aspect of his theories has also met with general approval can perhaps be explained by the young generation's reaction against our mechanistic culture and by its search for deeper values.

COMPETENCE AND PERFORMANCE

9.9 In "Aspects" CHOMSKY makes a distinction between COMPETENCE and PERFORMANCE, which is closely related to Saussure's *LANGUE*/*PAROLE* distinction.¹¹ Competence is a purely psychological concept: "The speaker-hearer's knowledge of his language" ("Aspects", p. 4), "his knowledge of the grammar that determines an intrinsic connection of sound and meaning for each sentence" ("SPE", p. 3). Chomsky points out that this knowledge is normally unconscious, and he therefore often refers to it as "tacit knowledge". "Competence" differs from Saussure's "langue" by designating a set of rules used for the purpose of forming (creating) sentences, rather than an inventory of elements. Following Humboldt, Chomsky here emphasizes the creative aspect of language (cf. "Current Issues", p. 23 ff). Performance is "the actual use of language in concrete situations" ("Aspects", p. 4), "what the speaker-hearer actually does" ("SPE", p. 3).¹²

The linguist's primary task is to describe competence, which is also called an "internalized grammar". A grammar should thus be a replica of the speaker's

11. Cf. Derwing's critical account (1973, pp. 259-300).

12. It is not quite clear where in this division into system and application one should place the product itself, the texts. To Saussure they appear to belong under *la parole*. In Hockett's formulation (1968, p. 39), which has been accepted by Chomsky, performance is described as "what he actually says and hears", and this seems to indicate that the texts belong under performance as is also stated expressly by Ruwet (1967, p. 18). It is somewhat confusing that at the same time language is described as "a set of sentences". Ruwet uses the word "langage" to designate the sentences, but adds that this is a technical term.

competence. A grammar is "descriptively adequate to the extent it correctly describes the intrinsic competence of the idealized native speaker" ("Aspects", p. 24). In "SPE" and elsewhere "grammar" is deliberately and systematically used ambiguously, partly referring to the theory which the linguist advances as a description of the speaker's competence, partly referring to this competence itself. In the opinion of the present writer this indicates a somewhat rash belief in the identity of these two phenomena. Chomsky and Halle, it is true, talk about the "ideal speaker", so that individual differences may be disregarded, but even so this identification seems questionable.¹³ In his review of "Aspects" Matthews asks how it is possible to know whether the brain eliminates redundant rules in the same way as the linguist does (Matthews 1968). Householder (1966) also is sceptical in the matter of redundancy. The rule system constitutes another problem, and the agreement with the speaker's competence on this point should at least be tested somehow. In their reply to Householder Chomsky and Halle write the following about this problem (1965, p. 103): "All linguistic work is, obviously, guided by certain assumptions about the nature of linguistic structure and linguistic patterns; and such assumptions, which are the heart of linguistic theory, can be tested for adequacy in only one way, namely, by determining whether the descriptions to which they lead are in accord with tacit knowledge concerning the language". And a little earlier they write: "Without reference to this tacit knowledge there is no such subject as descriptive linguistics. There is nothing for its descriptive statements to be right or wrong about". It is naturally quite true that all linguists, including those of other schools, hope that the results they reach as regards possible sentences in a given language will agree with the sentences which native speakers can accept and will perhaps produce; i.e. the grammar may be regarded as a sort of abstract model, which generates the same sentences as the speaker's competence does. Most linguists probably also hope that there is some psychological reality corresponding to the systems and dependencies they have arrived at in their analysis. But Chomsky goes further and assumes that the system of underlying forms and ordered rules which the grammarian sets up is so close a copy of the structure in the speaker's brain that it is justifiable to use the same word when referring to these two phenomena. But he gives absolutely no instructions as to how this correspondence could be tested, and he does not even regard such testing as a very important task ("Aspects", pp. 20-1). This may be one of the reasons why so little has been done in this field by his followers (cf. the discussion 9.72 below).

P. Kiparsky has pointed out that language history may disclose part of the mental linguistic system (1968b, cf. 9.65 and 9.72 below). The acquisition of the native language should also reveal some aspects of the internal grammar (cf. 9.10 and 9.72 below).

The investigation of performance is considered to be of secondary importance, among other things because it presupposes a knowledge of competence. Per-
13. Cf. also Ladefoged's criticism of "the ideal speaker" (1970).

formance does not, however, depend on competence alone, but also on other factors, such as memory, attention, context, etc. Halle (1962a) thinks that the same model is used in speech production and perception, with different peripheral parts attached, and that in perception a preliminary analysis is made before the generative rules are applied. Chomsky and Miller (1963) also are of the opinion that there is a heuristic component which makes preliminary choices. Victoria Fromkin (1966) attempts to establish a model of speech production, and in this connection she investigates a number of problems: How large are the units encoded? Is there an invariant motor command for each distinctive feature? for each phoneme? or for certain allophonic units, or groups of allophones (e.g. syllables)? There is some evidence that the last is the case.

INNATE IDEAS AND LANGUAGE ACQUISITION

9.10 Whereas the description of individual languages according to CHOMSKY deals with the speaker's competence, i.e. his internal grammar, the subject-matter of general linguistic theory is the set of innate ideas which makes language acquisition possible for the child. Chomsky bases this statement on the following line of reasoning: in the course of a few years any child, even the stupidest, gains mastery of his native language, i.e. an enormously complex system, and he does this on the basis of scattered, incomplete, and partly erroneous data, and without being actually taught. The child does not learn whole sentences, but constructs a grammar on the basis of the utterances he hears, and in this way he becomes capable of understanding and producing an unlimited number of new sentences. This is a fantastic achievement, which cannot be explained in terms of concepts like stimulus, response and analogy. The only plausible explanation is that the child has innate linguistic ideas. Human language is probably just as species-specific as bird song, both requiring innate predispositions. Chomsky refers to Descartes's theory of man's innate capacity for language. But he himself assumes the existence of a far more specific and structured ability and believes that the child is born with a set of general rules concerning the structure of language: not only rules concerning the features shared by all languages, but also rules which permit alternative linguistic structuralizations. What is involved, then, is an innate theory of potential structures, an ability to select – on the basis of innate criteria of simplicity – the potential structure which harmonizes best with the sentences which are encountered and a capacity for determining the structural description of a given sentence in a language. Given these premises the child's accomplishment is comprehensible. "His task, then, is to search among the possible grammars and select one that is not definitely rejected by the data available to him. What faces the language learner, under these assumptions, is not the impossible task of inventing a highly abstract and intricately structured theory on the basis of degenerate data, but rather the much more manageable task of determining whether these data belong to one or another of a fairly restricted

set of potential languages" ("Language and Mind", p. 76, cf. also Hockett 1968, pp. 40-1).

According to this theory, then, the description of linguistic universals is tantamount to a description of the child's innate linguistic faculty, and the study of the child's language acquisition therefore occupies a central position in linguistic studies. What was mentioned above about the three types of ADEQUACY may now be re-formulated in relation to the child's ACQUISITION MODEL (abbreviated AM). A description which is only observationally adequate may be said to represent the data which are accessible to the child, i.e. the input to his AM. A description which satisfies the demand for descriptive adequacy, i.e. which accounts for the rules of the grammar constructed by the child, corresponds to the output of his AM. And in order to satisfy the demand for explanatory adequacy, a linguistic theory should account for the basis on which a child selects a specific grammar, i.e. it describes the internal structure of his AM.

It is quite true that the acquisition of the native language is an impressive accomplishment. Nevertheless it is certainly exaggerated to claim that the child is capable of understanding and producing sentences "not similar in any significant sense to those previously encountered" ("SPE", p. 249) and to speak about "completely new sentences", since he knows both the elements and the structure. Nor is it easy to understand, as pointed out by Uhlenbeck (1963) and Householder (1969), why analogy is rejected as a completely inadequate explanation.

One problematic aspect of the theory is that an underlying morphophonemic system is set up for English, whose forms are established largely on the basis of alternations in learned words such as *divine-divinity*, *profound-profundity*, *harmony-harmonious*, i.e. words which are quite unknown to the child at the time when his language is being built up. It seems probable that the child in the course of a few years acquires mastery of the phoneme system, in the traditional sense of this word. In generative phonology, however, this is rejected in favour of a predominantly morphophonemic system, which the learner may have no possibility of acquiring until later on in his adolescence, or until he has reached full maturity. Chomsky and Halle are, of course, aware of this problem, but they claim that it is necessary – as a first approximation and for reasons of simplicity – to assume that language acquisition is instantaneous and that the vowel alternation rules are learned at once. "Since the order of presentation of linguistic data is, for the moment, an extrinsic factor that has no place in our theory, we cannot take account of this fact, and we can therefore state our conclusion about psychological reality only in hypothetical form: *if it were the case that language acquisition were instantaneous, then the underlying lexical forms with pre-Vowel-Shift representations would be psychologically real*" ("SPE", p. 332). This point is not unimportant, particularly when it is taken into consideration that adults, according to the theory, are unable to incorporate recently acquired rules in the system in a simple manner (cf. 9.61 below).

It might be added that Chomsky's mentalism does not involve any hypothesis

concerning the existence of a mind as a special substance ("Language and Mind", pp. 83-4). According to Chomsky it is a question of neurological processes. "We do assume that a grammar has a physical representation in the speaker's brain" (Chomsky and Halle 1965, p. 110).

It is gratifying that the transformationalists have broken the isolationism of linguistics and taken up extremely important psycholinguistic problems, and it is to be hoped that a future collaboration between linguists and psychologists may permit a verification of the theories propounded. For the time being, however, they must be regarded as highly speculative.

DERWING's criticism of generative phonology (1973) concentrates on the problem of language acquisition (see particularly pp. 44-83). He emphasizes that Chomsky's theory is completely hypothetical, and that it is not necessary to assume innate universals. The argument that some parts of linguistic structure are too complicated to be learnable is based on the transformational analysis of linguistic structure, but it may be possible to arrive at a simpler description which is not unlearnable. Moreover, it should not be forgotten that the child works hard for several years on the job of language learning. Derwing finds the hypothesis of innate processes, a sort of innate learning algorithm, more plausible, and this algorithm need not be very specific. Perhaps it is sufficient to assume an innate capacity for discrimination, generalization and extraction of regularities and a capacity for using symbols, and we know already that human beings have these capacities (cf. also Botha 1971, pp. 144ff and Linell, pp. 119ff).

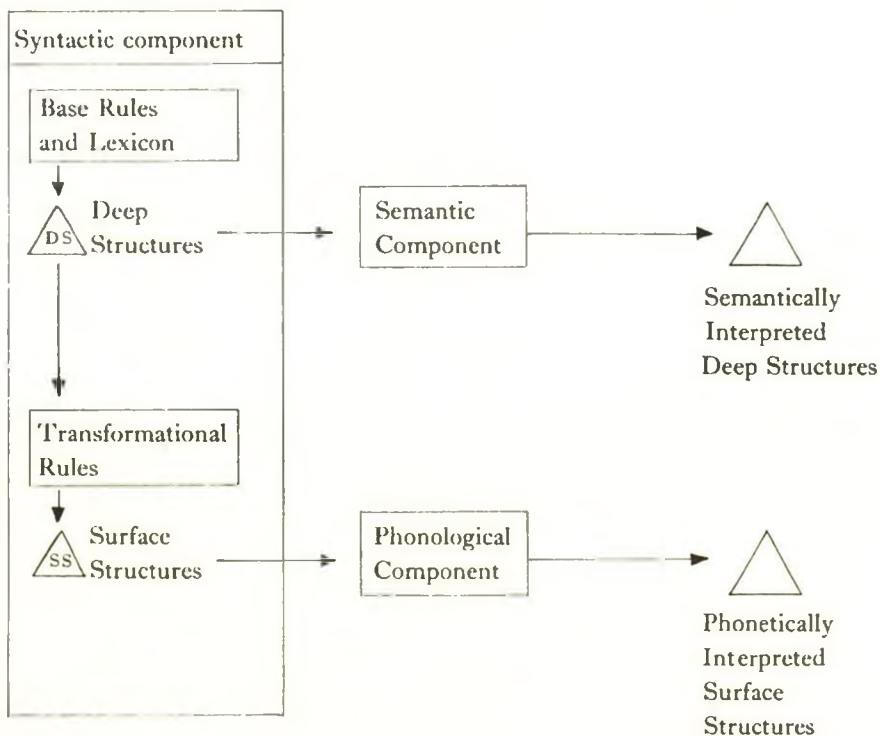
The Organization of Transformational Grammar

THE COMPONENTS. GENERAL SURVEY

9.11 As appears from the account given in 9.3, a grammar is a "device", i.e. a set of rules, which generates sentences and describes their structure. Consequently it does not consist of different and relatively independent parts – as is held in most other theories – but of a number of INTERRELATED COMPONENTS. These components are ARRANGED IN A SPECIFIC ORDER; each of them is dependent on the preceding component, and each contains a number of rules, which are also largely ordered. The linguistic description is given in the form of a procedure, and this is a very important characteristic of transformational grammar. Another characteristic is that the sentence constituents employed (noun phrase, verb phrase, etc.) are not defined, except implicitly by their place in the hierarchy, and that categories such as noun, adjective, tense, number etc. are neither defined nor systematized. The grammatical concepts with which transformational linguists operate have simply been taken over from traditional school grammar. It is the

rules which are in the focus of attention, and on this point a very precise formalization is attempted.

The division of the grammar into components has changed a good deal since "Syntactic Structures" (1957), and no final result has been reached as yet. In this description we have chosen the "Aspects" model of 1965, which differs from the previous model by the presence of a semantic component and by a considerable revision of the transformational rules. Graphic representations of this revised model are given in several books (e.g. Postal 1968, Lyons 1970, and McCawley 1968). The following diagram is used by Postal (p. 204) and seems to be most readily understandable:¹⁴



The grammar – which, it will be remembered, comprises the entire linguistic description – consists of three main parts: a syntactic component, a semantic component, and a phonological component. The semantic and phonological components are "interpretive", i.e. they map a syntactic structure onto the semantic and phonetic structures. There is thus a central syntactic part, which connects the phonetic and semantic parts.

14. Postal, however, is no longer an adherent of this system.

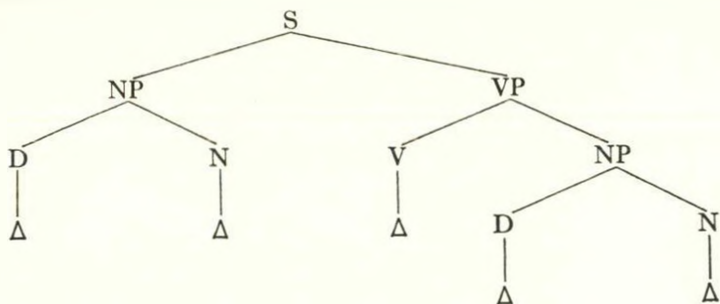
THE SYNTACTIC COMPONENT¹⁵

SUBDIVISION OF THE SYNTACTIC COMPONENT

9.12 The syntactic component is subdivided into a **BASE COMPONENT** and a **TRANSFORMATIONAL COMPONENT**. The base component contains a number of rules, by means of which sentence patterns of a relatively simple nature with their associated constituent structure are generated. It furthermore includes a **LEXICON**, from which lexical items are selected and inserted in the generated sentence patterns. Such patterns, which are called **DEEP STRUCTURES**, are converted into syntactic **SURFACE STRUCTURES** by means of **TRANSFORMATIONAL RULES**. It is the deep structures which are subjected to a **SEMANTIC INTERPRETATION** and the surface structures which are subjected to a **PHONETIC INTERPRETATION**.

THE BASE RULES

9.13 The **BASE** contains context-free **PHRASE-STRUCTURE RULES**. By means of such rules it is possible, for example, to generate the following simple English sentence pattern, which can be represented graphically as a branching **TREE DIAGRAM**.¹⁶



S symbolizes 'sentence', NP 'noun phrase', VP 'verb phrase', N 'noun', V 'verb', and D 'determiner' (definite article, for example). It is somewhat confusing that the nodes of the diagram are designated as grammatical categories and not as sentence members (subject, predicate, object, etc.). Chomsky ("Aspects", p. 68ff) argues that indications of sentence members would be redundant since they are

15. The most important works dealing with the syntactic component are "Syntactic Structures" (1957), "Aspects" (1965) and "Topics" (1966, pp. 51-75), which summarizes "Aspects". Ruwet (1967, pp. 85-360) contains a very detailed account of this component, including a discussion of the lexicon (pp. 301ff). Hovdhaugen's description (1969, pp. 18-57) is considerably shorter; Lyons (1970, pp. 47-82) gives an easily understandable account which, however, touches only on the "Aspects" model (see also Lepschy 1970, pp. 126-38). For a critical approach to transformational syntax, see, for example, L. R. Palmer (1972, pp. 137-63) and E. E. Uhlenbeck (1963 and 1967).

16. The verbal auxiliary constituent is omitted from this diagram, see below 9.15.

already represented implicitly in the tree structure. The subject can be defined as the NP immediately dominated by S and the object as the NP dominated by VP, etc. (cf. L. R. Palmer's criticism 1972, p. 137ff). Δ is a dummy symbol, which is subsequently replaced by a lexical item. The following rules will generate this structure:

$$\begin{aligned} S &\rightarrow NP + VP \\ VP &\rightarrow V + NP \\ NP &\rightarrow D + N \end{aligned}$$

Such rules are termed **REWRITE RULES** and indicate that the symbol to the left of the arrow must be replaced by the symbol(s) to the right of it. A phrase structure rule is a particular type of rewrite rule, since it is only permitted to have one symbol on the left of the arrow, whereas two or more symbols, connected by pluses indicating linear ordering, are permitted on the right. It might be said that the symbol S, for example, is analysed as consisting of NP + VP and that in the tree diagram S is represented as a "node" dominating NP + VP.

THE LEXICON

9.14 The **LEXICON** is a list of so-called lexical morphemes, or formatives.¹⁷ "Lexical entry", however, is used not only to refer to minimal units, but also to traditional "words", i.e. to derived and sometimes compounded forms (e.g. *telegraph*, "SPE", p. 12). In the lexicon each item is provided with a phonological, semantic, and syntactic description. *Man*, for example, is characterized phonologically as consisting of three segments with certain distinctive features; semantically by containing certain semantic features (e.g. "male", "human"); and syntactically, for example, by being a noun. This categorization restricts the possibilities of lexical items as regards insertion in tree diagrams. *Man*, being a noun, can only be inserted in a slot dominated by an N, *come*, being a verb, only in a slot dominated by a V, etc. Furthermore, various subcategorizations may restrict the possibilities of lexical insertion. If a verb is transitive, for example, it can be inserted only in a structure containing an object noun phrase. Finally, there are selectional restrictions, according to which an item can only be combined with constituents with certain lexical features. A verb like *admire*, for example, can only be preceded by an "animate" subject. We are here approaching the boundary between syntax and semantics; the sentence *sincerity admires John*, mentioned in 9.4, is not felt to be so obviously ungrammatical as *sincerity admires eat*.

17. In "SPE" (p. 7ff, for example) "formative" is used approximately in the same sense as "morpheme" in the Prague and Bloomfield Schools (cf. 6.35, footnote), i.e. referring to the minimal sign. Ruwet (1967, p. 207) uses "morpheme" and "formative" about minimum signs in deep structure and surface structure respectively.

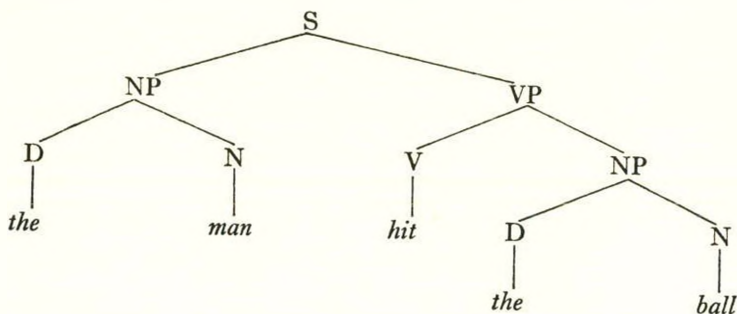
Lexical items, in short, contain all the information which cannot be expressed by means of general rules, and part of this information determines where in a tree diagram they may be inserted.

The inclusion of the lexicon in the syntactic component is somewhat odd, particularly if it is taken into consideration that lexical items are described phonologically, semantically, and syntactically. It would seem to be more consistent to establish a separate lexical component. This is done in McCawley 1968 (p. 11), but the place of the lexicon in the total model is practically the same.

DEEP STRUCTURE

9.15 Items from the lexicon may now be inserted instead of the dummy symbols in the tree diagram, and as a rule the range of possibilities is very wide. Under D a definite article (*the*) can be inserted, for example; under N, various nouns, etc.

In the structure given above, the following lexical items may be inserted:



Now this may be regarded as the generation of one of the many strings with the structure indicated. But at the same time it can be viewed as a description of a particular sentence, more precisely an "immediate constituent" analysis, by which a sentence is decomposed stepwise into successively smaller immediate constituents. In the example mentioned here *the man* and *hit the ball* are the immediate constituents of the whole sentence. At the next lower step the immediate constituents are respectively *the* and *man*, *hit* and *the ball*, and finally *the ball* can be decomposed into the immediate constituents *the* and *ball*. In principle this type of analysis is nothing new, having been used extensively in both American and European linguistics. For example, this is the approach adopted by Hjelmslev in his analytical procedure. But as regards details such an analysis may be performed in a number of different ways. It has been suggested, for example, that the object noun phrase should be regarded not as part of the verb phrase, but as a constituent directly subordinate to S in the same way as the subject noun

phrase (an analysis which has also been discussed in traditional grammar, incidentally). If the object is interpreted as a constituent of the same hierarchical status as the subject, a subject can be defined as the leftmost NP in a tree diagram. Further constituents which might be mentioned are Adv (adverb) and Aux, the latter referring to both auxiliary verbs and verbal inflexional units. Some linguists introduce Aux through VP ($VP \rightarrow Aux + V$), but others introduce it directly from S ($S \rightarrow NP + Aux + VP$), i.e. regard it as a modification of the entire sentence.

Sometimes parentheses are used as a notational variant of tree diagrams, and in such a notation the constituent structure of the sentence discussed above can be demonstrated simply in the following way: $((the\ man)\ (hit)\ (the\ ball))$. Usually, however, also the smallest constituents are enclosed in parentheses, i.e. $((the\ (man))\ ((hit)\ ((the)\ (ball))))$. In "SPE" bold-faced square brackets are used instead of parentheses, and grammatical categories are indicated with letters inside the opening and outside the closing brackets, e.g.:

$$[NP[Dthe]_D[Nman]_N]NP$$

The whole sentence may therefore be written in the following way:

$$[s[NP[Dthe]_D[Nman]_N]NP[VP[Vhit]_V[NP[Dthe]_D[Nball]_N]NP]VP]S$$

This is called a LABELLED BRACKETING. Brackets are, of course, easier to print than tree diagrams, but they are considerably more difficult to take in. As a joint designation of labelled bracketing and branching tree diagram the term PHRASE MARKER is frequently used.

The constituent structure of the sentence mentioned above, which has been borrowed from Lyons (1970, p. 60), is somewhat simplified, for even though the verbal ending is null, a constituent should be introduced (*Aux*), which in this case is turned into *past*. It is a characteristic feature of transformational grammar that whereas root morphemes are normally introduced in their phonological shape, inflexional morphemes are introduced as "past", "pres" etc., i.e. as content units, and are only subsequently given a phonological representation (at the transition from the syntactic component to the phonological component). Probably the reason for this somewhat peculiar approach is that such morphemes may bring about stem changes (*past + sing* is realized as *sang*, for example) and they may themselves have different shapes according to the nature of the stem (Latin case endings, for example). These inflexional units, consequently, are not listed in the lexicon but are introduced by means of syntactic rules.

From a structuralist point of view, and perhaps particularly from the point of view of glossematics, where content and expression are kept clearly apart, it is somewhat confusing that lexical items are inserted into deep structures in a form

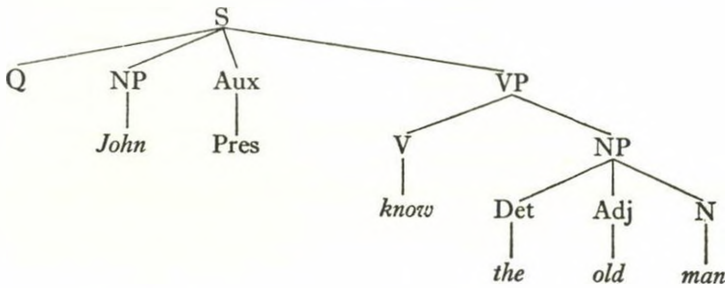
which includes their phonological shape and in a fixed order.¹⁸ This seems to be a leftover from the Bloomfield School, according to which morphemes were pure units of expression, whose combination constituted the subject-matter of syntax. In a theory which includes meaning, however, and in which syntax is regarded as an intermediary between meaning and sound, it is peculiar that phonological units appear already in the base, i.e. in the part of grammar which is closest to the semantic component. If, on the other hand, we regard grammar as a performance model and imagine that the speaker's brain contains a lexicon as well as a set of syntactic patterns into which lexical items are inserted, then it seems more plausible to insert entire lexical items, i.e. items including phonological features.

TRANSFORMATIONAL RULES

9.16 In the example mentioned above (*the man hit the ball*) the deep structure does not differ from the corresponding surface structure, but sentences of a more complex nature cannot be generated directly with phrase structure rules (PS rules). By means of PS rules it is possible to generate underlying forms, and in the TRANSFORMATIONAL COMPONENT such forms are then converted into the corresponding surface forms.¹⁹ In the original version of the theory ("SYNTACTIC STRUCTURES") underlying sentences were always simple, positive and declarative. Questions, negative sentences, imperatives, passive sentences, and constructions where one sentence (a so-called "embedded sentence") functions as a constituent of another were all produced by means of transformations. In the revised version, however, it is laid down as a principle that transformations are not allowed to change meaning, which would also be impractical, since, in the theory of "ASPECTS" deep structure forms the basis of semantic interpretation. This revision is based on Katz and Postal (1964), who attempted to show that in the case of every analysis which apparently violated this principle an alternative analysis which did not involve a meaning changing process was preferable on purely syntactic grounds. From this they concluded that meaning was in general determined exclusively by deep structure. At the underlying level questions, negations etc. should therefore be different from declarative, positive sentences, and they are consequently provided with a sort of sentence adverbial: "negation" (NEG), "question" (Q) etc. McCawley (1968, p. 29) gives an example of such a phrase marker:

18. One cannot help imagining what transformational grammar would have been like if Chomsky had been a native speaker of Latin. As regards word order see Matthews (1968) and Ruwet (1967, p. 344ff).

19. It is the introduction of such a component that has given transformational grammar its name. The phonological component also contains transformations (see 9.49), but they are not as common as in syntax, and it has become customary to use the term "generative phonology" about this part of the grammar instead of "transformational phonology".



Apart from the question marker this diagram does not differ from the one representing the declarative sentence *John knows the old man*. In the transformational component NP and Aux are permuted, and after some further changes the string *Does John know the old man?* is produced. A passive sentence is constructed like an active sentence in its deep structure, the only difference being that a passive marker has been added. In the tree diagram underlying *John hit the ball*, a branch emanating from VP and marked "passive" could be added. In the transformational component this constituent would then trigger off certain changes of word order and verb form as well as the insertion of the preposition *by*, thereby producing the string *The ball was hit by John*. It should be noticed that in deep structure *John* is the subject of the sentence (in traditional grammar it would often be called the "logical subject"). This analysis is considered necessary for the semantic interpretation. Similarly in the sentence *John persuaded Bill to leave* the semantic interpretation must be based on a deep structure of the form *John persuaded Bill, Bill leave*, since *Bill* is (logically) at the same time object of *persuade* and subject of *leave*. These underlying sentences must then be transformed into surface sentences.

If a sentence functions as a constituent of another sentence, this should be indicated at the level of deep structure by means of an "embedded" sentence. For example, a sentence like *John hit the ball which was lying on the grass* has a deep structure in which a second S, dominating the string *the ball was lying on the grass*, is embedded in the object NP of the main sentence. This embedded sentence will subsequently be converted into a relative clause by means of a transformational rule. The fact that one constituent may be contained in another constituent of the same kind is called the "recursive principle".

In "Cartesian Linguistics" (p. 33) Chomsky mentions that in the seventeenth century the Port-Royal grammarians operated with underlying structures in basically the same way. For example, they would interpret a sentence like *Dieu invisible a créé le monde visible* as consisting of three propositions: (1) *Dieu est invisible*, (2) *il a créé le monde*, (3) *le monde est visible*.

Transformations have also been employed in traditional grammar converting, for example, an active sentence into the corresponding passive sentence, and a declarative sentence into a question. In transformational grammar, however, such conversions have been formalized.

The arguments which have been adduced in favour of adding a transformational component to the phrase structure component are partly that phrase structure grammars would otherwise become extremely complex (indeed unformulable), partly that the kinship between synonymous structures, for example between active and corresponding passive sentences, would be concealed. In a grammar including a transformational component, on the other hand, they have the same phrase markers at the underlying level, and subsequently different surface structures are assigned to them by means of transformations.

Transformational rules are written with arrows like PS rules, although the arrows occurring in transformational rules are usually double shafted.

If *Peter arrived last night* is converted into *Last night Peter arrived*, the adverb-preposing transformation may be stated in the following form:

$$\begin{array}{ccccccc} \text{NP} & + & \text{VP} & + & \text{Adv} & & \\ 1 & & 2 & & 3 & \Rightarrow & 3 \quad 1 \quad 2 \end{array}$$

In contrast to PS rules, transformational rules may contain several symbols to the left of the arrow, and the arrow of transformational rules does not stand for exactly the same as that of PS rules. It is not a question of expanding a symbol into a combination of symbols by adding branches to a node in a tree, but a question of changing one tree structure into another by permuting, deleting, or adding constituents. The string to the left of the arrow symbolizes a certain structure, which is changed by the rule, and the rule only applies to a string with a certain constituent structure. Such transformations thus differ from those introduced by Harris by changing structures and not sentences. Transformational rules furthermore differ from PS rules by frequently applying in certain environments only, i.e. they are CONTEXT SENSITIVE, in contradistinction to PS rules, which are normally CONTEXT FREE.

Chomsky criticizes "taxonomic linguistics", i.e. most structuralist schools, and American structuralism in particular, for not going beyond an analysis of surface structures, since the immediate constituent analysis is applied directly to the surface structure, and transformations are not employed. On the basis of such an analysis it is not possible to distinguish between the syntactic structures of *John is easy to please* and *John is eager to please* ("Current Issues", p. 61), which are identical in terms of immediate constituents, nor to account for the ambiguity of a sentence like *flying planes may be dangerous*.²⁰ The same holds for the difference between *the growling of the lions* and *the raising of the flowers*, and for the ambiguous noun phrase *the shooting of the hunters* ("Syntactic Structures", p. 88). In transformational grammar such structures may be distinguished by being derived from different underlying phrase markers, i.e. they do not have the same deep structure and consequently also a different "transformational history". In *the shooting of*

20. For critical comments on these examples, see L. R. Palmer (1972, pp. 145-56) and Uhlenbeck (1963, p. 9ff and 1967, pp. 269ff and 295).

the hunters, for example, there is either an underlying subject-verb relation or an underlying verb-object relation. Chomsky also mentions *the wine was drunk by the guests* and *John was drunk by midnight*, which are different inasmuch as there is no active sentence (**midnight drank John*) corresponding to the latter.

On the other hand, Uhlenbeck (1963) has criticized transformational grammar for mixing up linguistic, cognitive and semantic viewpoints. *the shooting of the hunters* has, according to Uhlenbeck, only one structure linguistically, but semantically it has two different readings.

THE SEMANTIC COMPONENT

9.17 Uhlenbeck is probably right that it is not possible, as is demanded by Chomsky in "Aspects", to keep syntactic deep structures apart from the semantic component. A number of younger transformationalists, e.g. McCawley, Ross, Postal and Lakoff, have consequently abandoned this distinction and combined (deep) syntax and semantics into one component. To them semantics is not simply interpretative but occupies a central position, and it is the semantic deep structure which constitutes the starting-point in the generation of sentences.²¹ In this book the semantic component will not be discussed any further.

READJUSTMENT RULES AND MORPHOLOGY

9.18 It has been mentioned above that it is the output from the syntactic component, i.e. surface structure, which becomes input to the phonological component. First, however, it is necessary to make certain changes, which are referred to as readjustment rules in "SPE", where they are described very briefly (pp. 9ff and 371ff).

As we have already seen, certain grammatical elements, some of which are not introduced until the transformational component has been reached, have no phonological representation but appear in the shape of "past", "present", etc. Such elements are now provided with a phonological form by means of readjustment rules. For example $[v[vmend]ypast]_v$ is changed into $[v[vmend]vd]_v$, and

21. If deep syntax and semantics are fused together there will be only one single procedure by which semantic deep structures are gradually converted into phonetic surface structures. This theory thus offers an obvious parallel to performance, and to the process of communication itself, a parallel which is not really implied in the generative point of view, but which harmonizes well with it. Chafe, for example, maintains that the theory of generative semantics is supported by its parallelism to the speech event, which is also one-directional. The creative aspect of language can be referred to semantics, sounds being a means by which ideas can be communicated, and not vice versa. The listener receives something which has been created by the speaker. "Language does have a directionality" ("Lg." 44, 1968, p. 601).

$[v[vsing]vpast]_v$ into $[vs*ng]_v$, where the asterisk indicates that the form will be changed further by means of phonological rules (*sang*).

Furthermore certain nodes (or parentheses) are deleted, and very long sentences are divided into PHONOLOGICAL PHRASES, the reason for this being that some rules (e.g. stress rules) do not apply to very long and complex constructions as a whole.

Another difficulty is that intonational boundaries do not always coincide with major syntactic boundaries. Syntactically a sentence like *this is the cat that caught the rat that stole the cheese* is analysed as *this is (the cat that caught (the rat that stole (the cheese)))*, whereas a division into INTONATION GROUPS results in *this is the cat| that caught the rat| that stole the cheese*. The latter division, however, is partly dependent on the rate of delivery, and Chomsky and Halle do not know for sure how much of this should be regarded as a property of performance. In "SPE", incidentally, intonation is not dealt with, but Bierwisch has described intonational phenomena from a generative point of view in a study of German (1966; see also Stockwell 1960).

By means of readjustment rules also a number of junctural changes and insertions can be effected (cf. 9.21 below).

In a few places in "SPE" morpheme structure rules (redundancy rules) are included under readjustment rules, although somewhat hesitatingly (cf. 9.25). In "SPE" it is also discussed whether certain exceptions to rules should be handled by readjustment rules or by special diacritical marks (cf. 9.46-47 below).

A specific MORPHOLOGICAL COMPONENT is not normally set up in transformational grammar (this also applies to "SPE"). Those phenomena which are dealt with at the morphological level of traditional grammar – word classes, grammatical categories and their external forms – have been spread out over different components in transformational grammar. Word classes are given in the lexicon and also appear in syntax, inflexional categories are accounted for in the lexicon and partly enter into the phonological rules. This approach is possible with a language like English, which has a simple inflexional system, and there can hardly be any doubt that transformational grammar – in spite of its pretensions of universality – carries the stamp of originally having been worked out with the purpose of describing English. It is much more difficult with a language like German, and it is probably no mere coincidence that attempts at analysing this particular language have resulted in demands for a revision on this point. BIERWISCH (1967) suggests that morphological problems should be described together with readjustment rules in a special component, which is placed between the syntactic and the phonological components, and W. U. WURZEL (1970) has attempted to give a description of German within such a framework.

As mentioned above root morphemes are normally inserted with their phonological features already at the level of deep structure, whereas derivational and inflexional affixes at this stage appear in abstract form, i.e. without any phonological interpretation. Such a phonological interpretation cannot be included at the level

of deep structure since it is dependent on the post-transformational context. For example, it is not until certain transformational permutations have been carried out that the derivational formatives are added to the root. A sentence with the surface form *Peter recognizes John's ability* might in deep structure be something like *Peter recognize Pres. Ø_M John be able*, where M is a symbol indicating a process of derivational morphology and the phonological shape of the derivative depends on which root morpheme it is combined with (cp. *ability*, *goodness*, *likelihood*). On the other hand, derivational and inflexional endings must be inserted before the phonological component has been reached, since these morphemes are also subjected to phonological rules.

Wurzel now suggests that derivational affixes should be listed in a special division of the lexicon in the shape of phonological matrices with their syntactic-morphological and semantic features. In the morphological component there must then be rules as regards their insertion. Another possibility would be to list also derived words in the lexicon, but this would greatly complicate the lexicon. Derivational affixes should be inserted before inflexional affixes, since derived words are also inflected. Stem formation, too, should be dealt with before inflexion. Wurzel sets up a number of inflexional classes for the various word classes in German, and after that ablaut and umlaut are described. In Proto-Indo-European ablaut was probably largely a phonological process, and so was umlaut in Old High German. But in modern German this is no longer the case, and according to Wurzel the simplest solution is to treat the two as purely morphological processes. If umlaut were treated as a phonological process, the umlaut vowels *ü*, *ö* and *ä* would not appear in underlying representations, and it would be necessary to set up "historical" forms, e.g. **guti* for *Güte*, which most probably do not represent the competence of the modern German speaker. Ablaut must be dealt with before umlaut, since umlaut also applies to forms which have undergone ablaut.

It is not until derivational and inflexional affixes have been inserted that it is possible to delimit the PHONOLOGICAL WORD – the unit to which several important rules are applied (cf. 9.21). Derivation and inflexion differ from readjustment rules by introducing and changing segments. It might be added that in a language like German the morphological component will be very extensive.

The Phonological Component

THE CONNECTION OF THE PHONOLOGICAL COMPONENT WITH SYNTAX

GENERAL REMARKS

9.19 In the description of post-Bloomfieldian phoneme theory in Chapter 6, it was possible to ignore completely the type of grammatical analysis carried out

in that school. The reason for this was that the linguistic description was arranged as a discovery procedure, beginning with the establishment of the smallest unit, the phoneme, and proceeding from there via "morphs" (regarded as combinations of phonemes) to morphemes (i.e. classes of "allomorphs"), and from these to larger units. In this procedure it was a mortal sin to introduce, at any given level, units from a subsequent level (e.g. grammatical units in phonemic analysis), because this might result in circularity (cf. 6.23 above).

In transformational grammar, where this approach is rejected, and where tentative morphophonemic and syntactic structures are set up instead, whose simplicity and adequacy are subsequently tested, there is no reason why the interrelations between such structures should be disregarded, and consequently there can be no objections against "mixing of levels". Furthermore the description, which partly takes the form of a procedure (although not a discovery procedure), is carried out in the opposite direction, beginning with syntax and proceeding from there to phonology. The rules of the phonological component operate on the formatives (see 9.14 above) of the syntactic surface structure, modified by the readjustment rules mentioned in 9.18, and presuppose the syntactic analysis. The sketch of the syntactic component given in 9.12-16 is thus a necessary condition for understanding generative phonology.

GRAMMATICAL CONDITIONS FORMING PARTS OF RULES

9.20 Naturally not all phonological rules are dependent on syntactic structure, but some are. For example, certain rules are dependent on grammatical boundaries. In this particular case, there is no major difference between generative phonology and other phonological theories. It has always been customary to assume that there are special phoneme combinations, neutralizations, etc. which appear at word boundaries, and that assimilation rules apply within certain syntactic groups. On the other hand, it is a special characteristic of generative phonology to formulate stress rules, for example in English, on the basis of syntactic structure (derivations, compounds, and word groups), cf. contrasts like *black bird*/*blackbird*. Word classes are also taken into consideration in matters of stress, cf. *tórment* (noun) vs. *tormént* (verb).²² Of course it is not a new insight that the stress differences between *blackbird* and *black bird* and between *torment* (noun) and *torment* (verb) correspond with differences in syntax and word class assignment respectively. But structural linguists were mainly interested in finding out whether there was any semantic difference corresponding to the stress difference, i.e. whether the stress difference was distinctive. On the basis of examples like those mentioned above they would establish a certain number of distinctive stresses. In English,

22. Word class distinctions may also be relevant to other phonological phenomena. For example, it has been argued by Postal that in the Amerindian language Mohawk verbs and nouns have different phonological structures (1968, p. 115 ff).

for example, Trager and Smith set up four stress phonemes (cf. 6.30 above). In generative phonology, on the other hand, the syntactic differences between these examples have already been registered. In the lexicon one version of *torment* has been marked as a noun and the other as a verb derived from it, and this has been necessary for the correct insertion of these lexical items in sentences. Furthermore *blackbird* and *black bird* have been registered as noun and noun phrase respectively in the syntactic component. The stress differences may therefore be regarded as simple corollaries of the syntactic differences and can be stated in a rule, and in this way it is not necessary to regard the various degrees of stress as distinctive. (It should be remembered that syntactic differences in transformational grammar are based not only on differences in stress and word order, but are set up intuitively as a hypothesis concerning the structures leading to the most adequate description.)

It is possible to go further and maintain that the difference between e.g. *sing* and *sang* follows mechanically from the fact that one of the two forms is in the present and the other in the past, and this is actually done in generative phonology. A rule may be established according to which *sing* is changed into *sang* in the preterite, and this change from *i* to *a* may be generalized to at least a minor part of the vocabulary (*ring-rang*, *drink-drunk* etc.). If the only examples of the *i/a* opposition in English had been of the present/past type, it would not be necessary to set up different underlying representations of these two vowels.

If, however, it were attempted to go even further and to regard the difference between e.g. *s* and *t* in *sea-tea* as a mechanical consequence of the semantic difference, it would turn out that this point of view is no longer rewarding. In contradistinction to the cases mentioned above, it is no longer a question of a change which may be generalized to part of the vocabulary, but of an isolated phenomenon. It is therefore preferable, from a generative point of view also, to set up *sea* and *tea* as different morphemes, i.e. to regard *s* and *t* as distinctive segments in the underlying representation.

The central idea of this approach is that language is regarded as a whole and that the linguistic description is evaluated in relation to overall simplicity.

JUNCTURE

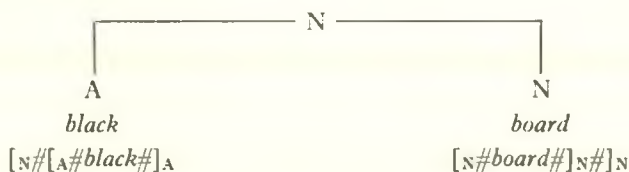
9.21 Junctures (boundaries)²³ are of great importance in phonological rules. In "SPE" three different types of juncture are established, two of which are derivable from the syntactic surface structure:

(1) a formative (or morpheme) boundary, which is symbolized by + and which occurs between the final segment of one formative and the initial segment of a following formative, e.g. *tele* + *graph*.

23. See "SPE" (pp. 12-7, 66-8, 364-71), Hovdhaugen (1969, p. 97ff; 1971, p. 166ff), McCawley (1968, p. 52ff), Dell (1973, p. 69ff) and recently an important paper by Stanley (1973).

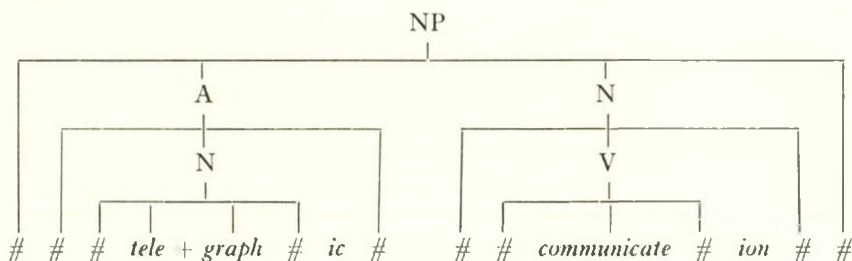
(2) a boundary symbolized by # which is inserted in the syntactic surface structure on both sides of strings dominated by a "major category" (i.e. the (so-called) lexical categories "noun", "verb", "adjective"), and by categories dominating a lexical category, like "noun phrase", "verb phrase" and "sentence" ("SPE", pp. 13 and 366).

A simple example is *blackboard* ("SPE", p. 16):



The noun phrase *black board* has the same juncture but is differently labelled. (NP in place of N at the beginning and at the end.)

Telegraphic communication is another and more complicated example ("SPE", p. 13):



It will be seen that each of the categories N, A, V and NP has one # on either side.

A definition is now given of the WORD as a unit which is bounded by two such junctures and which contains no internal # #, i.e. # # — # # ("SPE", p. 13, cf. for further precisions p. 366). In the example mentioned (*we established telegraphic communication*) such a division into words corresponds to the traditional one. However, compounds are considered to contain more than one "word" (cp. the example *blackboard*) and, on the other hand, since only the categories 'noun', 'verb', and 'adjective' are bounded by #, it follows that articles, conjunctions, auxiliary verbs, prepositions etc. are not regarded as words, but as belonging proclitically or enclitically to the adjacent words. Wurzel (1970, p. 251 ff) criticizes the fact that pronouns in "SPE" are considered independent words and points out that they are frequently proclitics or enclitics. He consequently proposes a certain revision of the word-definition.

On p. 368 of "SPE" the following example is mentioned

The book was in an unlikely place.

Since there are two or more occurrences of # only between *book* and *was* and between *unlikely* and *place*, this sentence is assumed to consist of three words. The reader should keep Chomsky and Halle's special word-definition in mind when he is told that most rules apply at the word level, i.e. within the boundaries of a word.

(3) A third type of juncture (=) is an *ad hoc* boundary, whose purpose is to prevent the application of certain rules. In a verb like *per=mit*, for example, it bars a rule which would otherwise shift the accent to the first syllable. This juncture, which is introduced at the transition from the syntactic component to the phonological component by means of readjustment rules (cf. 9.18), is somewhat questionable.

The three junctures function differently in rules. Unless the opposite is expressly pointed out, a formative boundary does not count in phonological rules, i.e. a rule which is stated as being applicable before a vowel, for example, applies both to cases with and without + before the vowel.²⁴ On the other hand, a rule which is stated as being applicable before +V only applies if the vowel is preceded by a formative boundary.

Conversely a rule which is said to be applicable before vowels does not apply before #V, and if it is meant to apply to such cases as well, this must be stated expressly. McCawley (1968, p. 52ff) is of the opinion that the convention adopted concerning formative boundaries should be extended to the other cases as well, since rules applying regardless of the presence or absence of a juncture are of greater generality and should contain fewer symbols (cf. also Wurzel 1970, p. 212).

As for the juncture =, it was mentioned above that it served to prevent the application of certain rules.

Chomsky and Halle do not operate with units smaller than the morpheme. It is true that in the chapter on stress rules (p. 15ff), they often use the term SYLLABLE, but it has no formal status in the theory. In rules it is replaced by V (vowel). Not all generative phonologists agree on this point. John Anderson (1969) asks the question whether some rules might be formulated more economically on the basis of syllables. McCawley (1969, p. 58ff) operates with syllables in stress rules, and Brown (1970) thinks that the syllable should be introduced at least at the phonetic level (see also Fudge 1969). J. Hooper (1972) argues for the introduction of the syllable as a formally defined unit within generative phonology, showing that this would simplify various rules. Although some of her rules must evidently be reformulated (see Basboll 1974), the general argument is convincing. Vennemann (1972c) demonstrates that numerous phonological processes (e.g. vowel lengthening in Icelandic, stress in Latin, etc.) cannot be formulated in a general and explanatory way without reference to syllable boundaries. At the same time Basboll (1972) shows that a considerable number of low level rules in Danish phonology can be formulated most naturally and simply with the phonological

24. However, redundancy rules (cf. 9.25 and 9.39-40) form an exception since they only apply within formative boundaries.

syllable as their domain. In a later paper (1973) he shows that nearly all order restrictions on Danish consonant combinations can be explained by reference to a very general model of maximal syllabic structure, applying at a level near the phonetic surface, and in his paper of 1974 he treats the problem from a more general point of view.

THE MORPHOPHONEMIC POINT OF VIEW

9.22 One of the most important characteristics of generative phonology is that the analysis is MORPHOPHONEMIC. This means that for each morpheme one underlying form is set up, and all other forms are derived from this basic form by means of rules. Schane mentions (1968a, p. XVIII) that his analysis can be based on alternations between inflexional forms (*meurs* – *mourons*), derivations (*fleur* – *floral*) and etymological doublets (*frêle* – *fragile*).

The morphophonemic analysis thus presupposes a division into minimal signs and a grammatical analysis of inflexion and derivation. It is much more closely connected with the lexicon, i.e. with the signs, than a traditional phonemic analysis. But in generative phonology this connection with the lexicon is established in syntax. Postal (1968) writes: "The basic function of the phonology as a whole is to describe how each sentence, that is, each Surface Syntactic Structure, generated by the syntax, is to be pronounced, i.e. to assign each such entity its phonetic representation" (p. 155), and that "phonological structure is essentially 'morphophonemic' in character, i.e. that it is concerned fundamentally with the question of how the pronunciation of whole sentences is predicted from the inherent phonological properties of individual morphemes" (p. 197). Chomsky and Halle describe the phonological component as "the system of rules that applies to a [syntactic] surface structure and assigns to it a certain phonetic representation drawn from the universal class provided by general linguistic theory" ("SPE", p. 9).

It appears from these quotations how completely different the purpose of generative phonology is, not only from American structural phonemic analysis, but also from Hjelmslev's analysis, which is largely morphophonemic. Hjelmslev wanted to establish a system of taxemes and to account for their possibilities of combination. The generative phonologists, on the other hand, are, generally, not interested in systems of units. In "Language and Mind" Chomsky writes the following on p. 65: "The structure of a phonological system is of very little interest as a formal object; there is nothing of significance to be said, from a formal point of view, about a set of forty-odd elements cross-classified in terms of eight or ten features". And it is necessary to search for some time in "SPE" before an arrangement of the underlying English vowel system is to be found (p. 236ff). It is not the system which is of interest to the generative phonologists, but the structure of morphemes and the rules converting a given base form into the various phonetic surface forms. Hjelmslev, on the other hand, passed lightly over such rules. The goal of generative phonology thus differs considerably from that

of all other phonological schools. At the end of "SPE", however, (pp. 401 ff) where the concept of marking is introduced (see 9.31 below), the question of more or less complex and more or less symmetrical systems is brought up, although rather tentatively, and in the writings of some younger generative phonologists considerations of this kind play a greater role (e.g. Brame 1972, Schane 1972 and Vennemann 1972a).

PHONOLOGICAL AND PHONETIC REPRESENTATION

TWO LEVELS

9.23 In the phonological rule complex there are normally only two levels which are considered linguistically relevant, namely the point of departure (the phonological level) and the terminal point (the phonetic level).

PHONOLOGICAL REPRESENTATION

Terminology

9.24 By means of readjustment rules (cf. 9.18), the so-called lexical representation is converted into a phonological representation.²⁵

In many early works on generative phonology the phonological level is characterized as the **SYSTEMATIC PHONEMIC LEVEL**. This designation is clearly unfortunate, partly because the phonological level is not phonemic in the ordinary sense of the word, partly because no systems are established (cf. 9.22).²⁶ It has also been described as **MORPHOPHONEMIC**, which is more appropriate, but it might suggest, as stated on p. 11 of "SPE", that there is a phonemic level besides, and this is not the case. Morphophonemics and phonemics are not kept apart. In "SPE", therefore, the more neutral term **PHONOLOGICAL** has been chosen, and this will also be used in the present description. It is also common to talk about **UNDERLYING REPRESENTATION**, as compared with the phonetic surface form.²⁷ What is involved, then, is a morphophonemic transcription with ad-

25. The word "representation" is used frequently in generative phonology. It seems to have been introduced by Chomsky, Halle and Lukoff (1966, p. 65), where the following explanation is offered: "By a 'transcription' we mean a system of symbols and an associated system of rules which assign a value to each sequence of these symbols. We call each sequence of these symbols a 'representation' of the utterances having the assigned value". It is also common practice to speak about "semantic representation".

26. In "Current Issues" (p. 68) it is stated that the term "systematic" is meant to imply "that the choice of elements at this level is deeply determined by properties of both the syntactical and the phonological component".

27. Some authors use the term "remote representation" to indicate a form which belongs to a relatively early step in the derivation, but not necessarily the earliest step. "Underlying" is also sometimes used in this relative sense.

ded junctures and syntactic constituent structure in the form of labelled bracketing (cf. 9.21 above), and the transcription is effected by means of distinctive features.

Redundancy

9.25 In the lexicon (and thus also in syntax) each formative is represented by only those phonological features which are necessary in order to distinguish it from all other formatives in the language, i.e. only the non-redundant features.²⁸ At a given stage the redundant features must be added, and this is done by means of so-called REDUNDANCY RULES. These rules are of two types: SEGMENT STRUCTURE RULES, which add features that follow mechanically from the remaining features of a given segment (e.g. voicing in the case of vowels), and SEQUENCE STRUCTURE RULES, which add features that follow mechanically from the surrounding segments (in English, for example, only *s* occurs initially before a stop, and it is therefore sufficient to write [+cons] in this position; the features distinguishing *s* from the remaining consonants are then added by means of sequence structure rules). In 9.39 below redundancy rules will be dealt with in some detail. At this point, however, it is necessary to discuss briefly where in the rule complex they should be placed, since this largely determines what the phonological representation will look like.

In his description of Russian, MORRIS HALLE (1959) introduced the term MORPHEME STRUCTURE RULES as a designation for redundancy rules (although apparently only in the restricted sense of sequence structure rules), and in "SPE" they are called "lexical redundancy rules". Halle places sequence structure rules at the beginning of the phonological component, whereas segment structure rules are not kept apart from the remaining phonological rules. This implies that the phonological representation, like the lexical representation, is non-redundant; the readjustment rules only change a few details here and there, and in practice phonological representation is identical with lexical representation. The same approach is adopted by Postal (1968, p. 61). In the greater part of "SPE" lexical and phonological representation are also considered largely the same (e.g. pp. 12 and 165-6), and on p. 166 it is stated expressly that phonological representation is non-redundant. But in other places it is mentioned that "strictly speaking" redundancy rules belong to the readjustment rules, and at the end of the book (p. 382ff) the authors endorse a proposal made by Stanley (1967 and 1968) that redundancy rules should be placed in the lexicon. Other generative phonologists as well have accepted Stanley's view, and in the following we will therefore assume that the redundancy rules have applied before the phonological representation is reached and that phonological representation is therefore fully specified. (Since, however, redundancy rules must be accounted for under phonology in a wider sense, they have been included in the examples of rules). The argument

28. At any rate this is the approach adopted in less recent works on transformational grammar.

for placing redundancy rules before the phonological component is that they are often presupposed by the phonological rules proper, and a number of difficulties could arise if phonological rules were applied to forms with non-redundant features specified only (see further 9.40).²⁹ Dell (1973) discusses redundancy on p. 100ff.

Formal versus Phonetic Characterization of the Underlying Representation

9.26 In contradistinction to the phonetic units, the units of the phonological level are often described as **ABSTRACT**. This distinction between abstract and concrete is related to the one made by Hjelmslev between form and substance. HALLE writes (1964, p. 332) that at the phonological level distinctive features are merely "abstract differential markers", and that no phonetic content is associated with them. By means of the phonological rules some values are changed, and a phonetic interpretation is added. But since the phonetic features are universal, it is permissible to use the phonetic names already at the phonological level. In this way it is indicated that at a subsequent stage the phonetic feature mentioned will be associated with the phonological feature in question. As a matter of fact this approach is similar to that of Hjelmslev, and when Halle writes that it is permissible to use the phonetic terms from the very start, this corresponds to what Hjelmslev has called "squinting at substance", i.e. it is practical already at the formal level to use the names which will be given to the various units when the form is projected on the substance. In "SPE", however, the description has been changed somewhat. Here, too, it is true, it is stated that only the phonetic features receive a physical interpretation (p. 65), and on p. 295ff phonological features are called "abstract classificatory markers", whose phonetic names are nothing but labels. But the reason adduced for using the phonetic names is that if the names for the phonological features were selected arbitrarily (as it is demanded by Fudge 1967), there would be a huge number of superfluous implementation rules, and furthermore it would be impossible to express the fact that items with similar phonetic shapes are subject to many of the same rules (p. 295).

The fact that most rules, both synchronic and diachronic, apply to a number of segments which could be characterized as a phonetically **NATURAL CLASS** (e.g. *p, t, k* or *i, y, u* in contradistinction to *p, s, e*) is, of course, a strong argument against distinguishing sharply between arbitrarily named formal items and phonetic items. The concept of **NATURALNESS** was introduced by Halle (1961); it has been developed further by Postal (1968, p. 55ff), and it is reconsidered in "SPE" (pp. 335ff and 400ff, see also "Aspects", p. 37ff and Chomsky and Halle 1965). Classes characterized by a feature configuration which is not found in items outside the class are "natural", e.g. /i, e, æ/ as opposed to /i, u, æ/. Halle (1961) gives

29. If universal marking conventions are introduced in the lexicon (see 9.41), it would be possible to restrict the number of redundancy rules considerably without affecting the degree of specification of phonological representations.

the following definition of a natural class: "We shall say that a set of speech sounds forms a *natural class* if fewer features are required to designate the class than to designate any individual sound in the class". The degree of naturalness of a class can, to a certain extent, be measured as being inversely related to the number of features needed to define it. However, it also matters what features and feature combinations are involved; for example, the class of unrounded front vowels /i, e, æ/ is, in a sense, more "natural" than the class of high vowels /i, i, u/ (see also 9.56 below).

Obviously phonetic regularities will not be revealed if by "arbitrary representation" we are to understand an arbitrary analysis of entire morphemes, as the choice of examples in "SPE" (p. 295) suggests:

[-A	-B	-C	+D]	[hɛt]
[-A	+B	-C	+D]	[əlɪps]

This, however, is not what the proponents of a purely abstract description of a sharply defined formal level (Fudge, Hjelmslev, Lamb) have in mind. Fudge, for example, describes the segments /p t k/ as consisting of the features aA, aB, aD, whereas /bdg/ consist of bA, bB, bD (this, as he points out himself, has a strong resemblance to Hjelmslev's decomposition into glossemes, the only difference being that Fudge's units are established on a completely morphophonemic basis). Such an arbitrary feature representation would still show that entities containing the same features were subject to similar rules, although it would only become apparent subsequently (when the abstract features had been changed by a set of implementation rules) that e.g. voicing, place of articulation, etc. were involved. However, it is quite obvious (as mentioned in the discussion of glossematics in 7.10) that an analysis of morphemes into abstract segments and features, which may subsequently be transferred to phonetic segments and features, is impracticable unless these segments and features are identified from the very outset on the basis of phonetic substance. It is not possible to identify either initial *p* with final *p*, or the voicing feature common to *b*, *d*, and *g* except on a phonetic basis. A purely abstract phonological level is therefore an illusion. On p. 77 of "Current Issues" this is acknowledged by Chomsky, who points out that identification has always been based on generally recognized, "natural" phonetic categories. The labels used at the phonological level are therefore not arbitrary, but phonetically determined.

If redundant features are inserted before the phonological level has been reached, it may be asked whether this level is not just as phonetic as the so-called phonetic level. To a certain extent this is true. The level is, however, considered abstract in the sense that the same underlying lexical item may have different phonetic surface realizations under different conditions, i.e. morphophonemes represent phonetically very dissimilar entities. /i/ in /divin/, for example, is realized both as [ai] and [i] (*divine-divinity*). The phonological level is called abstract because

some segments and features differ from those appearing at the phonetic level. It is abstract by virtue of being morphophonemic.

Moreover, even though redundant features are inserted, the distinctive point of view has been retained at the phonological level in so far as it is not customary to set up a larger number of different segments than necessary in order to distinguish between the morphemes of the language in question. There is no question of specifying bound variants. That is done in the so-called late rules. As a matter of fact some previous phonemic schools also considered the phoneme as fully specified, viz. those who defined the phoneme as a class or family of sounds (for instance Jones and some of the post-Bloomfieldians).

Choice of Underlying Forms

9.27 The underlying forms are not set up on the basis of surface forms according to any explicit procedure. The underlying representation is selected in such a way that the objective of the description can be reached. Harms (1968, p. 12) formulates this in the following way: "The primary aims of generative phonology are to provide a phonemic representation of morphemes and a series of ordered rules that, together with information about boundary phenomena (junctures), (1) adequately express the phonological generalizations of the language, and (2) at the same time determine the phonetic form of all utterances in the language".

In all cases it is attempted to assign the same underlying structure to the different forms of a given word and to derive the various phonetic forms from this underlying form by means of rules. The underlying representation is thus MORPHOPHONEMIC. Generally that underlying form is chosen which permits the derivation of the surface forms by the simplest rules (cf. the morphophonemic analysis in the Bloomfield School, 6.38 above). Moreover, the underlying form should not be more different from the surface forms than necessary. The analysis proceeds by working back from the surface (see Zwicky 1973, who mentions various other methodological principles used more or less implicitly by various phonologists).

There is some disagreement as to how much the underlying representation may differ from surface representation. SCHANE's book "French Phonology and Morphology" represents a rather extreme standpoint as far as the distance from surface forms is concerned, and thus it provides a good illustration of an analysis which is very far from that of traditional phonemics (but in many respects very close to Hjelmslev's analysis of French, see 7.19 above). Moreover, Schane's book is exceptional in containing a detailed argumentation for the abstract phonological representation chosen. The vowel segments set up in French are /i e ε a ɔ o u/. This means that /y ø œ/ are not included in the inventory but are generated by means of rules on the basis of alternating forms like *fleur-floral*. On the other hand, and in contradistinction to the traditional phonemic analysis, both tense and lax vowels are set up, partly because this makes it easier to account for a

number of alternations, particularly alternations involving /ə/,³⁰ partly because it makes it possible, on the basis of underlying forms, to predict stress. How strongly the word forms established differ from the actual surface forms appears from examples like /p'erd+e+r - perd+e+to/ [perdrə - perdy] and /trAv'Ali - trAv'Ali+s/ [travaj - travo] (capital letters symbolize tense vowels and + indicates morpheme boundary).

In English CHOMSKY and HALLE assume that there are six underlying lax vowels, /i, e, æ, u, o, ɔ/, and eight tense ones, viz. six corresponding to the lax vowels plus /a/ and /æ/. As examples of underlying sequences /divin - divin+i+ty/ and /serēn - serēn+i+ty/ may be mentioned.

It appears from the examples mentioned above that in the underlying phonological representation there may be segments which never occur in surface forms, e.g. lax vowels in French and tense /æ/ in English. According to "SPE" the underlying segments of English also include /x/ (e.g. in *right* /rixɪt/), as well as a final ε-glide. In Halle's paper "Phonology in generative grammar" (1962b) a frequently cited example is found: In certain Russian dialects non-high vowels which occur in pretonic syllables and which are preceded by a palatalized consonant are pronounced [i] if the vowel in the following, accented syllable is low (/a æ ɔ/), otherwise [a]. Forms which phonologically may be represented as /ʂɔlɔ́/, /ʂɔlɔ́m/ are thus pronounced [ʂa'lo], [ʂi'ləm]. Some dialects, however, have lost the opposition between /o, e/ and /ɔ, ε/, but the pretonic vowels have remained unchanged, i.e. [ʂa'lo], [ʂi'ləm]. Halle here assumes that a distinction between /o/ and /ɔ/ still exists in the underlying representation, since this permits a simple description of the vowels in the pretonic syllables. And on p. 75 of "SPE" Chomsky and Halle state expressly that "we see no reason to suppose that underlying representations will be restricted to segments that appear in phonetic representations".

Whereas McCawley (1968, p. 24) accepts Halle's interpretation, KIPARSKY (1968a, p. 10ff) has protested. According to him it is inadmissible to set up underlying segments which are never realized phonetically. It would be better to recognize exceptions to the rules. Kiparsky mentions that in Sanskrit an /e/ has sometimes been assumed to underlie phonetic [a] after palatalized consonants, but since it has only been set up because of the palatalization it explains nothing - the argument is simply circular. Entities which are never realized phonetically cannot be productive and cannot be of importance to sound change. Moreover, he requires that an underlying form differing from the surface form should only be set up if there is alternation, not in the cases where a morpheme has the same vowel in all forms (as in the Russian dialect mentioned by Halle, where [ɔ] occurs in both forms).

M. Shibatani (1971) and T. Vennemann (1972b) follow Kiparsky in the requirement of alternation as a condition for setting up a specific underlying form. Other

30. In *main* (cf. *menotte*) there is assumed to be an underlying lax /a/ and in *plain* (cf. *planer*) an underlying tense /a/.

generative phonologists have, however, argued that alternation is not the only justification for setting up underlying forms. L. Hyman (1970) mentions pattern congruity and psychological reality (inferred from the nativization of foreign words) as further arguments. On this basis he also sets up segments which do not exist on the surface (e.g. the vowels /ɛ/ and /ɔ/ in Nupe). Similarly M. Brame (1972) sets up a specific underlying segment in Maltese Arabic (ʕ), because it explains a number of regularities in the phonological rules and in morpheme structure and, further, fills a gap in the consonant system. J. E. Hoard (1972) quotes Brame with approval, but proposes a somewhat weaker constraint on underlying segments: They should only be allowed to contain features that are contrastive in the language, and they should fill a gap in the system. This would permit Brame's analysis, but not e.g. Chomsky and Halle's assumption of pharyngealization as an underlying feature in Hebrew ("SPE", p. 170). It would also rule out underlying /æ/ in English since it does not fill any gap. In contradistinction to most other generative phonologists J. Rischel (1974) sets up ambivalent (i.e. not fully specified) underlying segments in some cases (see 9.40 below). J. Crothers (1971) rejects the simplicity criteria advocated by some participants in the discussion, and requires that the existence of "imaginary segments" must be demonstrated in the behaviour of the speakers. He points out that it means a complication in language acquisition if learners have to construct abstract forms on the basis of the concrete surface forms presented to them.

Derwing (1973, p. 143ff) also finds that there must be much stronger constraints on underlying forms, and Linell (1974) gives a detailed and searching criticism of the postulated psychological reality of abstract underlying forms. This problem will be taken up again in section 9.72.

PHONETIC REPRESENTATION

9.28 Whereas the phonological level is relatively well-defined, it is not quite as easy to characterize the PHONETIC LEVEL. In "Current Issues" CHOMSKY states that by and large it corresponds to a "narrow phonetic transcription", and that it is different from "physical phonetics", which provides an exact physical and physiological description of concrete sentences by means of instruments. Now it is a wellknown fact that phonetic descriptions may have many different degrees of accuracy, and this also applies to phonetic transcription. In most other phonological schools, therefore, the phonemic level is regarded as definable on the basis of distinctive function, but no fixed and specific phonetic level is laid down. Bloomfield states expressly that the phonetic level will always be arbitrary and subjective ("Language", pp. 84-5).

The generative phonologists' distinction between the phonetic level (which has sometimes been called the systematic phonetic level) and the physical level seems to be based primarily on the hypothesis of a limited set of universal phonetic

features (cf. 9.32 below). In "Current Issues" (pp. 76-7) Chomsky maintains that as a matter of fact all phonological schools assume the existence of a universal phonetic system, but this is a psychological reality, not a physical reality ("SPE", p. 25). The phonetic representation may be interpreted as a set of instructions to the articulatory system, or as a level of perceptual representation ("SPE", p. 65): a phonetic transcription is not a direct record of the speech signal, but rather a representation of what the speaker-hearer regards as the phonetic properties of a sentence, based on a hypothesis of its syntactic surface structure and on his knowledge of the phonological rules. What is involved, then, is the speaker-hearer's interpretation, which is not necessarily in agreement with what is actually found physically. It is quite possible, for example, that the perception of several degrees of stress in English is due to a syntactic interpretation, and that the perceived degrees are not necessarily physically different. As another example the authors of "SPE" mention that we do not hear a continuous signal but a number of discrete units (segments) each of which consists of a set of features ("SPE", p. 293 ff). Postal also (1968, p. 6) points out that phonetic transcriptions are not direct descriptions of acoustic or articulatory phenomena but that they reflect instructions from the central nervous system regarding the pronunciation of sentences.

It is thus not an exact description of concrete sentences but an idealized transcription. Free variants are apparently not included in the transcription; this is, for example, stated expressly by Bierwisch (1967, p. 10). At any rate this applies to completely free variation. Whether social, dialectal and stylistic variations are included does not appear clearly from the works published so far. It is also an open question how much bound variation should be included, this being dependent on our knowledge of the instructions sent to the speech organs. POSTAL thinks (1968, p. 106 ff) that there are special instructions for certain variants, e.g. initial and final *t*. On p. 295 of "SPE" it is stated that properties which are due to universal rules, e.g. various coarticulation effects, are excluded from the phonetic transcription. LADEFOGED (1967) and KIM (1966) also discuss these problems. They distinguish between intrinsic and extrinsic variants,³¹ the former being conditioned by adjoining sounds, the latter by position, juncture, stress etc. Kim regards intrinsic variants as universal (as assumed by Wang and Fillmore and suggested in "SPE", p. 295), whereas extrinsic variants cannot be predicted universally and therefore must be taken care of by the generative rules of the individual language. Ladefoged thinks that intrinsic variants also may be language-specific; French *k*, for example, is influenced more as regards place of articulation by an adjoining vowel than English *k* is, particularly finally. Nor is lengthening of vowels before voiced consonants exactly alike in different languages. If this is true, then some intrinsic allophones must also be taken care of by rules and included in a phonetic representation (see also Ladefoged 1971). In a paper of

31. The terminology is taken over from Wang and Fillmore "Journal of Speech and Hearing Research" 4 (1961).

1972 Ladefoged describes the systematic phonetic level as "that level which specifies all the targets necessary for the description of a particular language as opposed to all other languages, but contains no information of the kind that is used simply to specify one speaker of that language as opposed to other speakers" (p. 277).

By and large McCawley (1968, p. 14ff) draws the line between the phonetic and physical levels at the same point by stating that a phonetic representation accounts for all those characteristics which are linguistically governed (i.e. not governed by extra-linguistic factors such as the speaker's mood, the shape of his vocal organs, etc.). Roughly speaking such characteristics are the ones which a speaker cannot deviate from without displaying a "foreign accent". However, very fine details of pronunciation may be linguistically governed, and McCawley therefore suggests that the phonological component should be divided into two parts: (1) the phonological rules, which account for the more important features, possibly the generally recognized universal features and (2) feature interpretation rules, which add "superficial details". He seems to draw the line between these two parts in such a way that only the feature interpretation rules operate with more than two steps in a dimension. The delimitation of the phonetic level is thus somewhat vague (cf. also Botha's criticism (1971, p. 191ff)).

If we consider the actual practice of generative phonologists, we notice that Schane hardly goes beyond an ordinary phonemic notation, and that McCawley in his description of Japanese only includes phonological rules, not feature interpretation rules. Chomsky and Halle only present selected English rules in "SPE", and on the whole they do not go any further than to an ordinary phonemic level, although bound variants are indicated in a word like *decided* (flapped *D* and vowel lengthening). On p. 65, however, they write that in principle there should also be rules of vowel fronting, degree of aspiration etc., and they refer to an article by Sledd ("Lg." 42), which deals with very detailed phonetic description, i.e. so-called "low level rules".

As appears from the above descriptions, only two levels – the phonological and the phonetic – are considered to have "linguistic status", but since we get from one to the other via a long sequence of ordered rules, there are also a number of intermediate stages with mixed phonological and phonetic representations ("SPE", p. 65). Normally segments and words quoted in the text are enclosed in diagonals // at the phonological level and in square brackets [] at the phonetic level, but at the intermediate stages the diagonal vs. square bracket convention cannot be used systematically. Distinctive features and feature complexes are, however, always placed in square brackets, e.g. in rules.

On our way from the phonological to the phonetic level we do not pass anything corresponding to a taxonomically phonemic level. Of course we can try to set up our rules in such a way that this would happen, but Halle has argued (e.g. 1962b) that this would complicate the description. This problem will be discussed in 9.69 below.

THE DISTINCTIVE FEATURES

SEGMENTS AND FEATURES

9.29 In generative phonology the description of the phonological and phonetic levels as well as of the rules connecting these levels is formulated by means of distinctive features. Evidently this is due to the influence of Roman Jakobson. However, the distinctive feature approach is carried through more radically by generative phonologists than by Jakobson himself, who also considered the phoneme (defined as a bundle of distinctive features) an important phonological unit. In generative phonology the distinctive feature is not only the minimal unit but also the only unit which is regarded as having any linguistic status. A morpheme is described by means of a matrix in which the columns are segments³² and the rows are features, e.g.

	l	ɪ	p
cons	+	—	+
voc	+	+	—
contin	+	+	—
etc.			

Such matrices can also be found in e.g. Jakobson and Halle's "Preliminaries" (pp. 44-5). The new thing, however, is that the alphabetic symbols are characterized expressly as mere practical *ad hoc* abbreviations of feature bundles (Halle 1962b, p. 336 and "SPE", p. 65). Sometimes this is expressed by saying that "segments" have no linguistic status (e.g. "Topics", p. 69, Chomsky and Halle 1965, p. 119, Chomsky and Miller 1963, pp. 308-10).

Generative phonologists justify their rejection of the segment as a unit with linguistic status (cf. "Topics", p. 69) by pointing out that phonological segments are cross-classified, i.e. it is not the case that each segment consists of features which only occur in this segment — the same features recur separately in other segments. It is therefore possible, for example, to establish a class *u o ɔ* sharing the feature [+back] and a class *i y u* sharing the feature [+high], and these two classes intersect since *u* occurs in both of them (cf. also Ruwet, pp. 310-1).

It is important that phonological rules apply to such classes, defined by certain features, and not to individual segments. Halle has shown (1962b) that a distinctive feature formulation of rules has the result that general rules are expressed more simply than less general rules, whereas this is not the case with a segment formula-

32. Ruwet (p. 311) and Hovdhaugen (1969, p. 81 = 1971, p. 131) simply describe a "segment" as a matrix with one column, and they do not discuss the problem of segmentation. Segmentation is probably supposed to be carried out intuitively, as something self-evident.

tion. It is generally agreed that the rule "a becomes α before i, e, α " is more general than the rule "a becomes α before i ". Nevertheless, the former rule requires more (alphabetic) symbols. In a distinctive feature notation, on the other hand, the first rule requires fewer symbols than the second, since it is sufficient to specify the features shared by i, e, α (and the number of symbols may reasonably be suggested as a measure of simplicity).

These arguments convincingly support the hypothesis that the feature is an important unit and that rules are frequently formulated better by means of features.³³ However, they are not sufficient to deny the segment any linguistic status, and this claim can therefore only be maintained with the qualification mentioned by Halle (1962b): "segments regarded as indivisible units". This is probably also the interpretation which should be put on "alphabetic symbol" ("SPE", p. 64), but in the treatises mentioned above this is not made explicit. The segment defined as a column of features is indeed an important unit, in generative phonology as well as in other theories.

Normally it is necessary to delimit segments, and this is done by enclosing them in square brackets. In redundancy rules this delimitation is absolutely necessary, since these rules express that a SEGMENT containing certain features also contains certain other features (for example, that all vowels are voiced). Rules of epenthesis, elision, metathesis, etc. also refer to whole segments (as mentioned by Householder), and this must be taken into account since it is by no means unimportant in which segment the features in question occur. Although Chomsky suggests in "Topics" that features should be regarded as properties of lexical items, he still indicates in which segment they occur. And in "SPE" (p. 64) a $+/-$ "segment" feature is even set up which distinguishes junctures (boundaries) from segmental units. The generative phonologists therefore cannot possibly mean that the segment, and thus also segmentation, has no linguistic status.³⁴ On the other hand, it is obvious that alphabetic symbols are not appropriate for all purposes; thus they do not allow the distinction between redundant and non-redundant features. In classical phonemics the alphabetic symbol s , for example, is used both for s before a consonant and before a vowel, although there are obviously more redundant features in the former case. If only non-redundant features should be accounted for, alphabetic symbols are inappropriate. Moreover, they cannot be used to designate segment classes, except by enumeration of the members (e.g. i, e and α).

33. Householder (1965) objects that rules could also be formulated by means of segment classes (in the example mentioned above "front vowels"). This seems fairly obvious and has indeed been done frequently. Generative phonologists would reply that such a classification presupposes a feature analysis and thus indirectly is a feature formulation (to say "front vowels" is really the same as saying "segments containing the features $+ \text{vocalic}, - \text{consonantal}$ and $- \text{back}$ ").

34. The importance of the segment also appears from the fact that (as mentioned above 9.26) the phonological representation is restricted to distinctive segments, whereas features may be redundant.

BINARITY

9.30 Generative phonologists distinguish more sharply than Roman Jakobson between features at the phonological level, which are characterized as CLASSIFICATORY (cf. "SPE", pp. 165 and 297), and features at the PHONETIC level, where universal phonetic scales are involved.

In generative phonology the principle of BINARITY is only maintained at the phonological level, whereas scales are permitted at the phonetic level. In the phonological matrix there will be a + or -, which indicates that the morpheme belongs to one of two opposite categories (e.g. to a morpheme category having the feature [+nasal] or [-nasal] at a given place, for example in the last segment. In the phonetic matrix a number may indicate to what extent the segment in question is characterized by the corresponding phonetic property (e.g. (1) referring to "fully nasalized", (2) to "partly nasalized", (3) to "very little nasalized", (4) to "completely non-nasal").

The restriction of the binary approach to the phonological level clearly constitutes an improvement. It is questionable, however, whether it is reasonable to consider binarity to be without exception even at this level. On p. 297 of "SPE" it is argued that the phonological features indicate whether a given lexical item belongs to a category or not (e.g. the category "begins with a voiced stop", or "ends with a strident non-back obstruent", etc.), and that this is most naturally expressed by means of binary features. This argument, however, is not self-evident, since the opposite of "begins with a voiced stop" must be "does not begin with a voiced stop", which is not the same as "begins with a voiceless stop".

HALLE (1957, 1959) justifies the binary approach by saying that we must generalize from the many evidently binary oppositions (voiced/voiceless, nasal/oral, etc.) to others, since it is difficult to compare languages and evaluate different descriptions if some oppositions are binary and others ternary (cf. also Schane (1967, p. 7)). Heny (1967, p. 92) objects that the binary approach was justified at a time when phonological description rested on arguments from information theory and when yes-no decisions were being considered, but that it is not necessary to the presentation and evaluation of phonological rules.

The problem of binarity has already been discussed in the chapter on Roman Jakobson's theory of distinctive features (8.5), where it was mentioned that degrees of aperture (or tongue height) in vowels present special difficulties. In the case of three degrees it was possible to manage with an artificial division of one dimension into two oppositions: in Jakobson's terminology +/—diffuse, +/—compact, and in the more traditional terminology of generative phonology +/—high, +/—low. This results in interpretations like the following:

	i	e	a
high	+	—	—
low	—	—	+

In the case of four degrees, however, this approach does not work, since the combination [+high, +low] is logically impossible. Exactly the same problem arises with tones, where four levels are sometimes found.

WANG (1967, 1968) has suggested that +/–high, +/–mid should be used instead of +/–high, +/–low, since this approach permits descriptions like the following:

	i	e	ɛ	a
high	+	+	–	–
mid	–	+	+	–

This is also a better solution as regards three degrees of tongue height since it is not, in the same way as +/–high, +/–low, a completely arbitrary division of one dimension into two (that *a* is –high simply follows from the fact that it is +low). In Wang's formulation there are two independent dimensions: high/low and mid/non-mid (this closely resembles Jakobson's division of *p t c k* into two oppositions which could be designated as +/–front and +/–mid).³⁵ Nevertheless, it is still a somewhat artificial solution; it is what generative phonologists call "counter-intuitive". LADEFOGED (1967) has pointed out that, in Wang's notation, number one (the highest vowel or tone) differs more from number three than from number four and that this is phonetically incorrect. Furthermore Wang's interpretation precludes an adequate description of shifts of the type in which e.g. a low tone (or vowel) becomes mid, and a mid tone (or vowel) becomes high. This is one phenomenon and should appear in the rules as such. On the basis of his features Wang is indeed able to account for phenomena like tonal shifts and vowel shifts (e.g. the great vowel shift in English), but his formulation is neither simple nor as general as it could be, and in generative phonology generality of rules is a professed aim. (Cf. also the discussion of binarity and vowel height in Kim (1966, p. 32ff), Kiparsky (1968b, p. 186ff) and Contreras (1969).) It is also likely that the different places of articulation could be described better as several points in one dimension (Kim 1966, p. 37ff). Ladefoged (1971) has established a system of features of which only some are binary (see, for more details, 12.14 below).

The problem of four degrees of vowel height is acute in Danish, where /i/, /e/, /ɛ/ and /a/ are distinguished and most variants of /a/ are front [æ]. Rischel (1969a, p. 187ff) has considered interpreting /a/ as a back vowel. This interpretation is supported by the fact that [ɣ] becomes [ʊ] after /a/ e.g. in *daglig* ('daily'), in the same way as it does after a back vowel.³⁶ The number of degrees of vowel height can then be reduced to three (*i y u – e o – ɛ æ ɔ a*). But even with only three degrees a binary description turns out to be inadequate, and Rischel therefore

35. J. E. Hoard (1972) proposes +/–high and +/–peripheral, which amounts to the same.

36. Basbøll has pointed out that the umlaut rule in Danish could also be formulated more simply if /a/ is regarded as a back vowel, since all the changes *u* → *y*, *o* → *ø* and *a* → *ɛ* would then be changes of a back vowel into a front vowel.

prefers to set up four degrees of vowel height as different steps in one dimension (1, 2, 3, 4).

CHAFE (1970) has criticized the binary system of oppositions from another angle. He proposes operating with SINGULARY FEATURES, e.g. in cases like nasalization, glottalization, rounding, etc., which may be regarded as deviations from the normal state of vocal sound production. It is then only necessary to include these features in the description when they actually occur, i.e. there is no need to mark them with either plus or minus for each segment. This simplifies the description.

MARKING

9.31 A similar endeavour underlies the proposal to operate with MARKED and UNMARKED values for the members of an opposition, and to include only marked features in lexical representations. This possibility is discussed by Chomsky and Halle in the final chapter of "SPE" (pp. 402-35) as a tentative proposal which had not been worked into the theory described in the preceding chapters; and also by Postal (1968, pp. 80-1, 153-207). Hovdhaugen (1969, pp. 161-5 = 1971, p. 163f) mentions some Norwegian examples illustrating this approach. See also Bierwisch (1967, pp. 29-30) and Halle (1970).

The concept of markedness has been taken over from the Prague phonologists. As mentioned above (see 3.7) the PRAGUE PHONOLOGISTS thought that a member of an opposition could be either "naturally marked" or "phonologically marked". The naturally marked member contains an extra property. From this point of view unrounded, oral, unaspirated, unvoiced and lenes sounds constitute naturally unmarked members, whereas rounded, nasal, aspirated, voiced and fortes sounds constitute marked members. The phonologically unmarked member of an opposition is the one which occurs in the position of neutralization, and which here represents both members: e.g., an unvoiced obstruent in final position in German. Normally natural and phonological marking go together so that the naturally unmarked occurs in the position of neutralization. In cases of conflict the phonological point of view is decisive. Hjelmslev's concept of extensive and intensive members largely corresponds to the Prague School concept of phonologically unmarked and marked members (cf. 7.18 and 7.21 above); both Hjelmslev and the Prague phonologists employed this concept also in grammatical analysis. It is also part of the stratificational theory of phonological components (10.13).

The concept of markedness was developed further by GREENBERG (1966, pp. 13-24). Greenberg quotes Zipf, who found that phonetically simple sounds are more frequent than complicated sounds, and Trubetzkoy, who stated that the unmarked member of an opposition is normally more frequent than the marked one, which, to a great extent, is due to the fact that it occurs in the positions of neutralization ("Grz.", p. 234ff). Greenberg thinks that phonetic (natural) and phonological markedness generally coincide, and thus does not make this distinc-

tion. He has investigated the frequency of phonemes in various languages based on phonetic complexity, and found that unaspirated, non-glottalized, unvoiced, oral and short phonemes are usually more frequent than the corresponding aspirated, glottalized, voiced, nasal and long phonemes. The number of phonemes possessing the unmarked property is on the whole also higher: e.g. there are normally more oral than nasal consonants in a language.³⁷ He also points out that in the case of sound changes resulting in the suspension of an opposition it is usually the unmarked member which prevails (marked members may arise again as a result of syntagmatically conditioned changes, assimilation, etc., but will remain relatively infrequent). Greenberg thus stresses the universal point of view.

Postal (1968), who by the way does not quote Greenberg, also considers markedness values to be universal. He discusses the criteria mentioned above and connects the concept of marking to Roman Jakobson's observations concerning the precedence of some features over others in language acquisition and in language typology (cf. 3.12 above). This also seems to be a question of relatively simple as opposed to relatively complex features, and these observations therefore provide further criteria for the distinction between marked and unmarked. Examples of universally marked and unmarked feature values are found in Postal (1968) and, in more detail, in "SPE".

In GENERATIVE PHONOLOGY marking is not determined on the basis of neutralizations in an individual language as in the Prague School: it is a completely UNIVERSAL CONCEPT, which primarily corresponds to "natural marking" in the Prague School, but which is based on a much larger number of criteria, including not only phonetic facts, but also others (cf. above) which may be said to be universal in the sense that they reflect universal tendencies.

Another decisive difference between the interpretation of marking in Prague phonology and in generative phonology is that, whereas the Prague phonologists establish the markedness value of a given feature independently of the context, generative phonologists operate with CONTEXT DEPENDENCY. Some features are assumed to depend on features in the adjoining segments, but more often a feature is considered dependent on other features in the same segment. As an example of the former type of context dependency, we can note that [+vocalic] is considered marked after a pause but unmarked after a consonant, i.e., CV is regarded as the most common, unmarked combination after a pause. The second type of dependency is exemplified by the fact that [+round] (in non-low vowels) is marked in front vowels, but unmarked in back vowels: i.e. the most frequently occurring vowel systems consist of unrounded front vowels and rounded back vowels, while rounded front vowels and unrounded back vowels are less frequent and must be considered marked. As regards low vowels [-round] is unmarked

37. This, however, does not always hold for vowel length, and as regards voicing it probably only applies to obstruents (i.e., the category in which voicing is usually distinctive).

(*a* is the most common low vowel). As another example we can note that voicelessness is considered unmarked in obstruents. Other marking rules are independent of the context; for example [+nasal] is always marked, nasal sounds being relatively less frequent than oral sounds.

If the marking of a given feature is regarded as dependent on other features in the same segment, the features must be arranged in some sort of hierarchy. For example, the rule of vocalic rounding mentioned above presupposes that vowels have already been assigned plus and minus values for degree of openness and place of articulation.

In "SPE" several other MARKING CONVENTIONS of this type are mentioned.³⁸ In this way it is possible to arrive at a general characterization of different speech sounds as consisting of a number of features specified as marked or unmarked, symbolized by M and U respectively. Some speech sounds contain more marked features than others. On p. 409 of "SPE" vowels are classified from this point of view; *a*, for example, consists entirely of unmarked features, whereas *ö* contains several marked features. In the consonantal category, analogously, *s* contains more marked features than *p*. The practice may now be adopted that only marked features are taken into account when the complexity of a segment is being determined. The more marked features a segment contains, the more complex it may be said to be. In this way the complexity of different speech sounds may be assessed, and thereby also the complexity of different systems: a triangular system consisting of *i*, *a* and *u* contains – according to the vowel classifications given in "SPE" – only a few marked features, whereas an *i*, *æ*, *ü* system would contain considerably more. This is consistent with the fact that *i*, *a*, *u* certainly constitute a much more common system than *i*, *æ*, *ü*.

The concept of markedness is used rather tentatively in "SPE", and it still needs clarification. Some phonologists tend to use it in a circular manner of the type: nasal vowels are marked because they are rare, and they are rare because they are marked. OHALA (see also 12.19) emphasizes that markedness is a pure labelling which does not explain anything, and R. LASS (1972) tries to demonstrate that the marking theory is empirically vacuous. Markedness is based on statistical observations, and Lass cannot see how statistical sound distributions of segments in the languages of the world should be part of the competence of a speaker in any one language. Relative frequency is bound to specific language families: Retroflex sounds are rare in Germanic languages, but common in Dravidian languages, whereas the opposite is the case for front rounded vowels. This criticism seems exaggerated. There are certainly distinctions which are universally rare, i.e. which are only found in very few languages (e.g. clicks), and others which are very common, and if universal frequency can be correlated with phonetic complexity it is certainly a highly interesting fact. But in order to avoid circularity the marking conventions must ultimately (as stressed by Schane,

38. See 9.41 concerning the place of these marking conventions in the linguistic description.

1973, p. 115) be based on the inherent complexity of the sound types, cf. Jakobson's attempt to set up universal laws for phoneme systems (3.12 above).

WURZEL (1970, p. 36ff) employs the concept of marking in morphological analysis too. For example, weak and strong feminine forms in German are considered respectively unmarked and marked, because the former are far more numerous. In this way more frequent forms are characterized by a smaller number of features. In contradistinction to the phonological marking conventions, however, which are generally considered to be universal, the morphological marking conventions are language specific. They determine the application of concrete morphological rules in the individual language.

PHONETIC DESCRIPTION OF THE DISTINCTIVE FEATURES

GENERAL PRINCIPLES OF DESCRIPTION

9.32 At first the generative phonologists simply took over the JAKOBSONIAN FEATURES (cf. 8.9-13 above) without changing them. Halle, it will be remembered, had collaborated with Jakobson in the establishment of these features, and they are used by e.g. Bach (1964), Harms (1968), Schane (1967), Hovdhaugen (1st ed., 1969, in the 2nd ed. he uses the "SPE" features) and by Chomsky and Halle in their early works (e.g. Halle 1959, 1961 and 1964).

However, these features were in many respects unsatisfactory. McCawley (1967) made several well-founded proposals for revision, and most of these have been accepted by Chomsky and Halle, who add a number of other features in "SPE" (see particularly pp. 293-329). Schane (1973) and Dell (1973) use, on the whole, the features set up in "SPE".

Except for stress, prosodic features are not dealt with in "SPE". As regards the remaining oppositions (Jakobson's inherent features) Chomsky and Halle set up a total of twenty-two, i.e. nearly twice as many as in "Fundamentals". This considerable increase must be seen in relation to the revised conception of simplicity. To Jakobson (as also to Hjelmslev) the most important objective was to reduce the number of minimum elements as much as possible, whereas the goal of generative phonology is "overall simplicity". It is no good to have a very small number of features if this complicates the rules. Furthermore, generative phonology aims at a less artificial phonetic description.

Schane (1973, pp. 33-4) sets up the following requirements for an appropriate set of distinctive features: (1) the features must have their foundation in phonetics, (2) they must be adequate for characterizing important phonetic differences between languages, (3) they must accomodate the principal allophones of a language, (4) they must accommodate all the necessary contrasts within a language system, (5) they must provide the appropriate natural classes for stating phonological changes (cf. also Ladefoged 12.14 below).

In "SPE" the features are only described from an articulatory point of view.

This is due less to the view that the articulatory aspect has top priority, than to a desire for keeping the description within reasonable bounds. However, the general characterization is also articulatory. "The phonetic features can be characterized as physical scales describing independently controllable aspects of the speech event, such as vocalicness, nasality, voicing, glottalization. There are, therefore, as many phonetic features as there are aspects under partially independent control. It is in this sense that the totality of phonetic features can be said to represent the speech-producing capabilities of the human vocal apparatus" ("SPE", p. 297). Philip Lieberman (1970) thinks that the existence of a restricted number of universal features is due to general constraints on the human articulatory, auditory and neural mechanisms. Individual languages preferably use features which are easy to produce and to perceive. K. N. Stevens³⁹ has also demonstrated that there are certain areas in the vocal tract where considerable articulatory variations result in inconsiderable acoustic changes, others where the opposite is the case. The former areas are considered "natural points of articulation". This implies that not only the dimensions, but also in some cases the number of points which are distinguished in one dimension, are conditioned by the general structure of the human speech organs and auditory mechanisms.

One of the innovations in "SPE" is the fact that features are defined on the basis of deviation from a NEUTRAL POSITION (p. 300), i.e. the position of the vocal tract immediately before speaking (which is different from the configuration of the vocal tract during quiet breathing). Chomsky and Halle think that in this position the tongue is raised approximately to the ε -level (and, it should be added, the mouth is open), the soft palate is raised, and the glottis is narrowed so that the vocal cords will vibrate in response to a normal unimpeded air flow.⁴⁰ This type of voicing is called SPONTANEOUS VOICING, and is assumed to be the type of voicing found in vowels, nasals, glides, and liquids. In the case of voiced fricatives and stops Chomsky and Halle assume that the vocal cords vibrate in a different way, with a somewhat larger glottal opening. This is quite likely, but as regards details the description is questionable, and the hypothesis that it is a readjustment of the vocal cords to this position which brings about the lengthening of vowels before voiced fricatives and stops seems especially doubtful.⁴¹

CLASSIFICATION OF FEATURES

9.33 Prosodic features are not dealt with in any detail in "SPE" (with the exception of stress in English), nor in Schane (1973). It is only mentioned that they comprise stress, pitch, and length. The inherent features are divided into

39. "The Quantal Nature of Speech: Evidence from Articulatory-Acoustic Data", *Human Communication: A Unified View*, ed. David and Denes (1972).

40. The present writer has closed glottis in "neutral position".

41. For this question, cf. M. Chen "Vowel Length as a Function of the Voicing of the Consonantal Environment", *POLA*, 9, 1969.

four groups which, however, are characterized as preliminary: (1) major class features (sonorant, vocalic, consonantal); (2) cavity features (coronal, anterior, high, low, back, rounded, distributed, covered, glottal constriction, nasal, lateral); (3) manner of articulation features (continuant, instantaneous release, tense, pressure, suction); (4) source features (heightened subglottal pressure, voiced, strident).

Table 9.1

Jakobson and Halle	Chomsky and Halle	Halle and Stevens (changes)
I. Major class features		
+/-vocalic	+/-vocalic (+/-syllabic)	
+/-consonantal	+/-consonantal	
	+/-sonorant	
II. Cavity features		
compact/diffuse	+/-anterior	added: +/-labial
grave/acute	+/-coronal	
sharp/plain	+/-high	
flat/plain	+/-low	
	+/-back	abolished:
	+/-round	+/-low for vowels
	+/-distributed	added:
	+/-lateral	+/-pharynx constriction
nasal/oral	+/-nasal	
(tense/lax)	+/-covered →	+/-advanced tongue root
III. Manner of articulation features		
discontinuous/continuant (= abrupt/continuant)	+/-continuant	abolished: +/-tense for vowels
tense/lax	+/-tense	added: +/-advanced tongue root
(strident/mellow)	+/-instantaneous release	
checked/unchecked	pressure suction	
IV. Source features		
strident/mellow	+/-strident	
voiced/voiceless	+/-voice	+/-stiff vocal cords
(tense/lax)	+/-heightened subglottal pressure	+/-slack vocal cords
		+/-spread glottis
		+/-constricted glottis
(II)	+/-glottal constriction	

The features set up in "SPE" (pp. 293-329) cannot be regarded as definitive. They have already been criticized on various points, e.g. by Ladefoged (1970 and 1971); and Halle has recently revised them in collaboration with K. N. Stevens (Halle and Stevens 1970, 1971, 1972). Some will therefore be treated relatively briefly, particularly the more exotic features. Main stress will be laid on the changes in relation to Jakobson's and Halle's features, as these are described in "Fundamentals" and in 8.9-13 above.

In the table above the features used in "SPE" are compared with the roughly corresponding features in the Jakobson and Halle system in "Fundamentals", and in the third column later changes undertaken by Halle and Stevens are listed. Chomsky and Halle's division into four types of features has been retained with the exception that $+/-$ constricted is moved to type 4.

THE INDIVIDUAL FEATURES

I. Major Class Features

9.34 One of the most unsatisfactory points in "Fundamentals" was the phonetic description of the features VOCALIC and CONSONANTAL, used to establish the principal classes: vowels (+ -), consonants (- +), liquids (+ +) and glides (- -). In "SPE" the description has been changed, but it is still unsatisfactory. In the case of "consonantal" a narrowing in the mid-sagittal region of the vocal tract is demanded. As regards "vocalic" two requirements must be met: the constriction in the vocal tract should not exceed that found in *i* and *u*, and the vocal cords must be positioned so as to allow spontaneous voicing. This implies that vocalic/non-vocalic is not an opposition within one dimension but within two, and this is clearly a drawback. The purpose of this approach is to exclude on the one hand *w* and *j* (by the first condition) and on the other hand *h* and *ʔ* (by the second condition). As in Jakobson's studies these four sounds are regarded as [-vocalic, -consonantal] and as constituting one class (glides). This peculiar class has been criticized by various phonologists, e.g. by Harms (1966, p. 24ff), who in his description of South Pajute suggests that *w* and *j* should be considered [+vocalic, +consonantal] like the liquids, and by Kim (1966, p. 58), who points out that liquids and semi-vowels often constitute one phonotactic class and that *l* is frequently shifted to *j* (and velarized *l* to *w*).⁴² For these reasons semi-vowels and liquids should not be given completely opposite feature specifications.

However, the establishment of major classes has been improved somewhat by the introduction of the feature SONORANT/NON-SONORANT (OBSTRUENT) ("SPE", p. 302). Actually this feature corresponds to McCawley's "bruisante" (1967), but in "SPE" a new definition is offered. A sonorant is produced with a vocal tract configuration which permits spontaneous voicing, i.e. there is relatively

42. Pavle Ivić, in his article on Roman Jakobson (1965, pp. 69-70), also pointed to the close relationship between *l* and *j*.

unimpeded air passage. In addition to vowels and liquids also glides and nasal consonants are included among the sonorants. *h* and *ʔ* may be included, since the condition of spontaneous voicing applies to the vocal tract configuration only, not to the vocal cords. The last point seems somewhat artificial, but the sonorant feature has the advantage of joining together the obviously related classes of liquids, nasals, and semi-vowels.

In an excursus on p. 353ff Chomsky and Halle discuss the introduction of the feature SYLLABIC instead of vocalic. They refer to Milner and Bailey, who proposed to introduce the feature syllabic in order to obtain better rules of liaison in French, but not to McCawley 1967, although the system which is set up in "SPE" p. 354 is exactly the same as the one set up by McCawley (1967, p. 119), who also advocates the introduction of "syllabic" (when comparing the two systems it should be remembered that [+sonorant] is the equivalent of [−bruisante], i.e. [−obstruent]). By introducing "syllabic" it becomes possible to distinguish between syllabic and non-syllabic nasals and liquids and to bring out the natural parallelism between this opposition and the one between vowels and *w*, *j*.

Table 9.2

	vowels	glides (w, j, h, ʔ)	syllabic liquids and nasals	non-syllabic liquids and nasals	obstruents (stops, fricatives, affricates)
sonorant	+	+	+	+	−
syllabic	+	−	+	−	−
consonantal	−	−	+	+	+

This clearly constitutes an improvement. The only revision still wanting is the transference of *h* and *ʔ* to the category of consonants (accompanied by a redefinition of "consonantal"). Postal, who also advocates the introduction of "sonorant", does not, incidentally, include *h* and *ʔ* among the sonorants (1968, p. 180-1); Schane (1968a, p. 129) is opposed to the interpretation of *h* as a glide in French and English. In 1973 (p. 27) he describes the "laryngeal glides" *h* and *ʔ* as non-sonorant.

"Syllabic" is not defined in "SPE". Fant (1969) proposes to define it as a weighted sum of the intensity of F1 and F2 compared to that in the adjoining segments. One might, perhaps, have some misgivings about the syntagmatic relativity which is implicit in the syllabicity feature and which, according to Jakobson's definition, makes it a prosodic feature like tone and stress. But since in generative phonology the latter phenomena are also considered properties of the vowel and not of the syllable (which has no status at all in the theory⁴³), the

43. McCawley (1968), Stephen Anderson (1974) and a few others form exceptions, see 9.21 above.

proposed solution must be regarded as consistent, although not satisfactory. Much can be said in favour of treating "syllabic" as a prosodic feature and basing the definition of vowels and consonants on this feature. The distinction between vowels and consonants would thus be syntagmatic (cf. Šaumjan (11.25 below) and L. R. Palmer 1972, p. 85).

II. Cavity Features

9.35 On another point also, significant changes and improvements have taken place. Jakobson's features compact/diffuse,⁴⁴ grave/acute, sharp/plain (and partly flat/plain) have been replaced by the features $+/-$ ANTERIOR, $+/-$ CORONAL, $+/-$ HIGH, $+/-$ LOW, $+/-$ BACK, and $+/-$ ROUND ("SPE", p. 304ff), and in this way a more natural classification is obtained. The phonetic description of compact/diffuse was fairly unsatisfactory, it will be remembered, because it had to be adapted to both consonants and vowels. It was confusing that compact/diffuse meant back/front when referring to consonants (kc/pt) but low/high when referring to vowels (æ/iu), and when the opposition compact/diffuse was combined with the opposition grave/acute a phonological parallelism between vowels and consonants arose which did not reflect any clear phonetic parallelism:

Table 9.3

	grave	acute	grave	acute
diffuse	p	t	u	i
compact	k	c	ɑ	æ

These features are unsuitable for describing various widespread historical developments, e.g. palatalization before *i* and *j*. When *t*, for example, becomes [tʃ] before *j* or *i*, it would be a change from diffuse to compact before a diffuse sound, which is a curious type of assimilation. This is mentioned both by Pavle Ivić (1965, p. 60), and by McCawley (1967, pp. 116-17) (see also Kim 1966, p. 31 ff). McCawley thinks that it would be better to combine high vowels with palatal and velar consonants by means of a common feature. He also mentions a Brazilian language (Maxakali), which supports this proposal. According to the description of the phonology of Maxakali by S. Gudschinsky and H. and F. Popovich ("Lg." 46, 1970, pp. 77-88) the consonants *p*, *t*, *c*, *k* have vocalic allophones before a

44. In the case of compact/diffuse an intermediate step is recognized in "Fundamentals", whereas in Cherry, Halle and Jakobson (1953) and in Halle (1959), this dimension is divided into two oppositions: $+/-$ compact and $+/-$ diffuse in order to preserve binarity (cf. 8.5 and 9.30 above).

homorganic consonant, viz. the following: \bar{e} (p), \bar{a} (t), \bar{i} (c) and \bar{i} (k), where \bar{i} indicates a high and \bar{e} a mid back unrounded vowel, and \bar{a} a central vowel which is rather variable in tongue height. In "SPE" (p. 306) reference is made to McCawley, and the criticism of Jakobson's theory is extended. For example, the connection between velarization and back vowels does not appear from Jakobson's system either, nor does the connection between palatals and palatalization.

However, these dependences become apparent upon the introduction of the features high (= the body of the tongue raised above the neutral position), low (= the body of the tongue lowered below the neutral position), and back (= the body of the tongue retracted from the neutral position), which apply to both vowels and consonants. In this way the following pattern arises:

Table 9.4

	vowels					consonants			
	i	e	u	o	a	palatal	velar	uvular	pharyngeal
high	+	—	+	—	—	+	+	—	—
low	—	—	—	—	+	—	—	—	+
back	—	—	+	+	+	—	+	+	+

It will be seen that palatal consonants receive the same feature as \bar{i} , velar consonants the same features as u , uvular consonants the same features as o , and pharyngeal consonants the same features as a , and this is in reasonably good agreement with the locations of the maximum narrowing in the vocal tract. By applying the same features to secondary articulations such as palatalization, velarization, etc. (so that e.g. a palatalized labial receives the feature value [+high] and a velarized labial receives the feature values [+high, +back]), these secondary articulations are connected with \bar{i} and u as well as with palatal and velar consonants. This use of the features high and back furthermore accounts for the fact that there are no palatalized velar consonants (sounds cannot be simultaneously + and —back).⁴⁵ When labials and dentals are palatalized by a historical change, velar consonants usually are fronted and thus become pure palatals.⁴⁶

Victoria Fromkin (1968, p. 161) has pointed out that although these features constitute an improvement they do not explain why palatalization may take place

45. According to Hans Vogt, however, palatalized velars are found in Ubykh ("Dictionnaire de la langue Oubykh", 1963, "Introduction phonologique"), but they may perhaps be distinguished by other features, e.g. +/—distributed (Stephen Anderson 1974, Appendix A).

46. It is not quite easy to tell what happens to the parallels between vowels and consonants after the latest revisions of the features. Halle and Stevens no longer use the feature low in the description of vowels. A feature of pharyngeal constriction is used instead (according to oral communication).

before *e*, which is [−high], and she therefore thinks that there should be a special feature called “palatal”.

The front consonants are kept apart in “SPE” by means of the features “coronal” (= the blade of the tongue raised from its neutral position) and “anterior” (= the obstruction is located in front of the palato-alveolar region). In this way the following pattern arises:

Table 9.5

	labial	dental	palato-alveolar
anterior	+	+	−
coronal	−	+	+

Palato-alveolar consonants are distinguished from retroflex consonants by being [+high]. Labials and dentals are [−high, −back, −low] unless they have palatal, velar, or pharyngeal secondary articulations.⁴⁷ Fant (1969) has criticized the characterization of labials as [−coronal, +anterior] and pointed out that it is hardly possible that neural encoding could take place by means of these features. A special labiality feature would be more natural (notice that Chomsky and Halle on p. 326 of “SPE” talk about “our conception of phonetic features as directly related to particular articulatory mechanisms”). Others have also argued for the introduction of a feature +/−labial, e.g. Stephen Anderson 1971, pp. 103–7), and in Halle and Stevens (1972) the feature “labial” has been introduced. +/−anterior is now only used to distinguish between dental (alveolar) and palato-alveolar consonants.

It will be seen that dentals and alveolars are not kept apart in the table above. There are, however, languages in which dental and alveolar consonants are in contrast, but according to Chomsky and Halle the distinction between them is not due to place of articulation, but to a property which they call +/−DISTRIBUTED. In distributed sounds the constriction extends for a considerable distance along the direction of the air flow, whereas it is short in non-distributed sounds.⁴⁸ Chomsky and Halle also assume that bilabials are [+distributed] and labiodentals [−distributed], but in this case other features are involved as well. This feature seems somewhat problematic.

As it appears from the above discussion pharyngeal consonants are characterized as [−high, +back, +low] and retroflex consonants as [+coronal, −anterior]. It is now possible to discard the Jakobsonian feature “flat”, which was meant to

47. On p. 307 of “SPE” there is a diagram illustrating the five new features as they occur in various consonants. Retroflex consonants, which should be [−anterior, +coronal, −high, −back, −low], have apparently been forgotten.

48. Ladefoged (1971, p. 38) mentions, however, that Malayalam distinguishes dental and alveolar stops, both of them apicals (= non-distributed).

cover all of rounding, pharyngealization and retroflexion, and to set up a more traditional **ROUNDING** feature. McCawley has pointed out that the combination of rounding and pharyngealization in one feature is unfortunate; in Arabic, for example, they clearly constitute two different features. Normally pharyngealization applies to consonants and rounding to vowels in Arabic, but vowels may also be pharyngealized by assimilation.

The feature **NASAL** is used as in "Fundamentals".

A feature **LATERAL** has been added. It is said to be restricted to coronal consonantal sounds, which is astonishing since palatal laterals are quite common, and velar laterals also occur (e.g. in Zulu and in some Arabic dialects).

Another addition is the feature **COVERED** (constriction in the pharynx accompanied by an elevation of the larynx). This feature is applied to vowels in some West African languages, which in "Fundamentals" were characterized by means of the feature **tense/lax**. It is also assumed to characterize Swedish /u/ in contrast to /y/, but Fant (1973, p. 183) rejects this analysis. Rischel (1974, p. 367f) adds the feature "sibilant".

III. Manner of Articulation Features

9.36 The features **CONTINUANT** and **TENSE** are used almost as in "Fundamentals".⁴⁹ Ordinary nasal consonants are considered non-continuant and are called stops, whereas oral stops are called plosives.

A feature **INSTANTANEOUS RELEASE VS. DELAYED RELEASE** is used to distinguish normal plosives from affricates.

IV. Source Features

9.37 The **STRIDENCY** feature has been retained with approximately the same definition as before, but its sphere of application has been narrowed down. In "Fundamentals" it referred to labiodentals, grooved sounds, affricates and uvulars. As appears from the above description uvular consonants are now characterized differently (—high, +back, —low). As mentioned by Chomsky and Halle, Ladefoged has pointed out that there are languages where both the velar and uvular consonants are [—strident]. This is now allowed for. As regards affricates, McCawley (1967 p. 114) claims that Chipewyan makes a distinction between /t^s/ and /t^h/, i.e. a stridency difference within the category of affricates. Affricates are therefore accounted for in "SPE" by means of the feature **instantaneous release/delayed release**. "Strident" is only used to keep labiodentals apart from bilabials and grooved sounds apart from slit sounds (e.g. s/θ, ʃ/ç).

These are the most important improvements compared to Jakobson's features.

49. According to Halle and Stevens (1970) [+/-tense] has been abolished at least for vowels, where it is replaced by [+/-advanced tongue root]. In Halle and Stevens (1972) "covered" is also replaced by the tongue root feature.

Finally the three features VOICE, GLOTTAL CONSTRICTION and HEIGHTENED SUBGLOTTAL PRESSURE are used (together with tenseness) to characterize various types of plosives. The authors reject Abramson and Lisker's attempt to set up voicing and aspiration as points on one scale depending on the relative timing of the start of glottal vibrations and the release of the closure (such that voiced stops have "voicing lead", voiceless aspirated stops "voicing lag" and unaspirated voiceless stops "coincidence"). Instead they set up a binary system by means of the features mentioned above. It is an improvement compared to "Fundamentals" that aspiration is not included in tenseness, since the two properties involve different articulatory mechanisms; but instead they introduce the feature "heightened subglottal pressure", which is assumed to occur in the case of aspirated voiced stops and of strongly aspirated voiceless stops. This feature is, however, not based on any experimental documentation (see Fant 1969).⁵⁰

"Glottal constriction" designates a constriction of the glottis which goes beyond the neutral position and prevents vibrations, so that the result is either creaky voice or complete closure. Such a constriction is assumed to occur in the case of certain types of unaspirated voiceless stops, at any rate in Korean.

"Voice" indicates a position of the glottis which is neither too constricted nor too open to prevent vibrations; [−voice] designates the open position. [+voice] thus seems to indicate a neutral position of the glottis (which, besides the position of "spontaneous voicing", apparently also includes the position in voiced obstruents, assumed to be slightly more open); whereas [−voice] indicates a deviation in one direction and "glottal constriction" a deviation in the other direction. This is a somewhat peculiar use of + and −. The system set up (pp. 327–8) is a good deal more complicated. It is, however, hardly worth while to give a more detailed criticism of these features since the authors themselves have given them up in the meantime. (Halle and Stevens 1971 and 1972). They have now dropped the features "voice", "tense" and "heightened subglottal pressure" and replaced them by the four oppositions +/−spread glottis, +/−constricted glottis, +/−slack vocal cords and +/−stiff vocal cords. As is clear from the terminology, only two dimensions (spread/constricted glottis and slack/stiff vocal cords) are involved, but each of them is further divided up into two binary oppositions, and thus an intermediate step, which is meant to characterize the neutral position, is provided for. By means of spread and constricted the stops are divided into three classes: plain (− −), aspirated (+ −) and glottalized (− +). By means of stiff and slack these three classes are then subdivided into three types each. Plain labial stops are e.g. divided into unaspirated *p* [+stiff, −slack], voiced *b* [−stiff, +slack] and voiceless *ɸ* [− −].

The same four features are applied to vowels, [+spread, −constricted] gives voiceless or breathy vowels; [−spread, +constricted] creaky or glottalized vowels;

50. It has been explicitly disproved since (see e.g. R. Netsell in "Phonetica" 20, 1969, pp. 68–73 and M. and J. Ohala in "Annual Bulletin of the Research Institute of Logopedics and Phoniatrics", Tokyo, 6, 1972, pp. 39–46).

	ī	ĩ	ũ	ē	ō	ǣ	ā	ǣ̃	ō̃	i	u	e	ʌ	o	æ	ɔ	y	w	ɛ
vocalic	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	-	-	-
consonantal	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
high	+	+	+	-	-	-	-	-	-	+	+	-	-	-	-	-	+	+	-
back	+	-	+	-	+	-	+	-	+	-	+	-	+	+	-	+	-	+	-
low	-	-	-	-	-	+	+	+	+	-	-	-	-	-	+	+	-	-	-
anterior	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
coronal	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
round	-	-	+	-	+	-	-	+	+	-	+	-	-	+	-	+	-	+	-
tense	+	+	+	+	+	+	+	+	+	-	-	-	-	-	-	-	-	-	-
voice																			
continuant																			
nasal																			
strident																			

	r	l	p	b	f	v	m	t	d	θ	ð	n	s	z	c	č	ǰ	š	ž	k	g	x	ɲ	h	k ^w	g ^w	x ^w
vocalic	+	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
consonantal	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	-	+	+	+
high	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+	+	+	+	+	+	+	+	-	+	+	+
back	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+	+	+	+	-	+	+	+
low	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+	+	+	+	-	+	-
anterior	-	+	+	+	+	+	+	+	+	+	+	+	+	+	+	-	-	-	-	-	-	-	-	-	-	-	-
coronal	+	+	-	-	-	-	-	+	+	+	+	+	+	+	+	+	+	+	+	-	-	-	-	-	-	-	-
round																				-	-	-			+	+	+
tense																											
voice	+	+	-	+	-	+	+	-	+	-	+	+	-	+	-	-	+	-	+	-	+	+	+	-	-	+	-
continuant	+	+	-	-	+	+	-	-	-	+	+	-	+	+	-	-	-	+	+	-	-	+	+	+	-	-	+
nasal	-	-	-	-	-	-	+	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-	+	-	-	-	-
strident	-	-	-	-	+	+	-	-	-	-	-	-	+	+	+	+	+	+	+	-	-	-	-	-	-	-	-

and [—] plain vowels. By means of the pairs +/—stiff and +/—slack vocal cords the plain vowels are characterized as having high, medium or low pitch. The same features are thus used to characterize high pitch (for vowels) and unaspirated plain stops, low pitch and voiced plain stops, and medium pitch and voiceless lenis stops, which reflects the connections found in many tone languages between voiceless consonants and high pitch and between voiced consonant and low pitch.

There is, however, no experimental documentation for the features +/—stiff and +/—slack vocal cords, and it might be possible to find other explanations of the connection between low pitch and voiced consonants (e.g. aerodynamic conditions). On the other hand the three degrees of glottal aperture are hardly sufficient (for instance voiced *b* and unaspirated *p* are assumed to have the same constriction feature (—), which is hardly correct). But this must remain very hypothetical until more detailed glottographic and electromyographic investigations have been undertaken.

As is evident from this presentation of the features, there are still many problems left both as concerns the number and the definition of the features, and the constant redefinitions make it somewhat confusing to work with them in practice.⁵¹ In the following account of rule formulation the features described in "SPE" are used throughout. Since they are only meant as examples of rules their phonetic adequacy is less essential. Table 9.6 reproduces the distinctive feature composition of English segments (including underlying segments) from "SPE", pp. 176–7.

THE MAIN TYPES OF RULES AND THEIR PLACE IN THE DESCRIPTION⁵²

INTRODUCTORY REMARKS

9.38 As mentioned above it has been common practice until recently to distinguish between two main types of rules: (1) MORPHEME STRUCTURE RULES (REDUNDANCY RULES) and (2) PHONOLOGICAL RULES PROPER. Today, however, some generative phonologists are inclined to replace a large number of redundancy rules by universal MARKING CONVENTIONS, which apply to all languages, and which may therefore be established once and for all. In this way several problems concerning the place of redundancy rules in the rule complex disappear, cf. 9.40 below.

51. Ladefoged has set up a quite different system of distinctive features (see 12.14).

52. See particularly Stanley (1967, 1968); "SPE", pp. 165–71, 380–9, 414–18; McCawley (1968, pp. 44–7), Harms (1968, p. 84ff) and Schane (1973, p. 62ff).

MORPHEME STRUCTURE RULES (REDUNDANCY RULES)

Types of Morpheme Structure Rules

9.39 In contradistinction to phonological rules proper, redundancy rules are only capable of filling in blanks in the matrices, i.e. they are unable to change the value of features or to add or delete segments. Furthermore they apply to lexical items, i.e. to separate morphemes and not to combinations of morphemes, and they are consequently independent of syntactic structure. Finally they differ from phonological rules proper by being unordered (marking conventions, on the other hand, are ordered).

The problems concerning redundancy rules and their place in the description have in particular been treated by Stanley (1967, 1968). As mentioned in 9.25 above Stanley distinguishes between two types of redundancy rules:

(1) SEGMENT STRUCTURE RULES and (2) SEQUENCE STRUCTURE RULES.⁵³

(1) Segment structure rules add features which follow mechanically from other features in the same segment. To all vowels, for example, the features [−anterior, −coronal, +continuant, −strident] may be added, as well as [−nasal] in a language like English; to an *m* the feature [−strident] may be added, to a *k* [−coronal] and [−strident]. If the only stops found in a given language are *p*, *t*, *k*, and if palatalization or velarization does not occur, the features +/−anterior and +/−coronal suffice to keep them apart, and the features [−voice], [−high], and [−back] are redundant for the stops and may be added by rules.

Segment structure rules serve the purpose of specifying redundant features, which may consequently be saved in the lexicon. Moreover they state the constraints on the feature composition of the phonological segments and thus, as a by-product, provide a definition of the set of phonological segments of the language. The number of distinctive segments is not clearly apparent from the lexical representation of single formatives (Stanley 1967, p. 400) because contextually redundant features are also left out here: e.g. *s* in *spit* is only described as [+cons]. In the fully specified phonological representation, on the other hand, it must normally be possible to count the number of different segments; since allophonic variation is not specified in the phonological representation, these different segments will be the distinctive segments of the language. (The permitted feature combinations will be identical with the actually occurring ones, since it is not common to operate with possible but non-occurring segments). Which *features* are distinctive is not directly determinable from this representation, however. This is only shown by the segment structure rules.

53. McCawley uses the terminology (1) sequential constraint rules and (2) context free redundancy rules. Harms refers to the latter as "blank filling rules", a term which seems to be more appropriate as a general characterization of redundancy rules. In "SPE" there is no special terminology for these two types, and they are not distinguished clearly. On p. 166 examples of segment structure rules are referred to as phonological rules, but on p. 171 they seem to be included among the lexical redundancy rules.

(2) Sequence structure rules add features which follow mechanically from the adjoining segments within the morpheme. It has already been mentioned above that as only *s* occurs initially before stops in English, it is sufficient to refer to it as [+cons] in this position in the lexicon, the remaining features being added by redundancy rules. Since there is no distinction between tense and lax consonants (e.g. *p* and *b*) after *s*, it is furthermore possible to omit the tenseness feature in this position and to introduce it later by means of a redundancy rule.

The function of sequence structure rules is partly to specify the redundant features, which can then be omitted from the lexicon, and partly to account for the restrictions on segment combinations in the language. They thus give information about a great deal of that which in other phonological schools is described by means of phonotactic rules (cf., however, the end of this section and 9.71 below), or by means of neutralization rules (e.g. in the Prague School).⁵⁴ Since only systematic restrictions are stated in the sequence structure rules, they also serve to keep accidental gaps and systematic restrictions apart. By means of the rules we should be able to generate the possible morphemes in a language (including those which happen to be non-existent) but none of the impossible ones. There will, for example, be a redundancy rule adding all the features characterizing *s* to the feature [+cons] found initially before stops in the lexicon, but no rule adding other feature complexes in this case. Similarly, as *l* and *r* are the only consonants occurring after *b*, it will be sufficient to characterize them as [+cons, +ant] and [+cons, -ant] in the lexicon. There will thus be redundancy rules adding the features characterizing *l* and *r* in these two cases, but, for example, no rule adding the features characterizing *n*. It will thus appear from the redundancy rules that both *brik* and *blik* are possible morphemes in English, but *bnik* is not (see above 9.4).

It should be emphasized, however, that the sequence and segment combinations resulting from the redundancy rules are those found in the underlying phonological representation. As mentioned above segments which do not occur in the surface representation are sometimes set up in the underlying representation (although Kiparsky and others have objected to this). At any rate there will be

54. The Prague School concept of neutralization and archiphonemes is closely related to the establishment in generative phonology of incompletely specified segments which become fully specified through the operation of redundancy rules. In Prague phonology, however, this type of description was only used in the case of minimal oppositions, i.e. where only a single feature is unspecified as regards +/− (e.g. *p/b* after *s*), and not if more features would be unspecified (e.g. *s* before stops). It would also have been impossible to transcribe such forms by means of an alphabetic notation; even the archiphonemes presented some notational difficulties to the Prague phonologists. In "Preliminaries" (pp. 44–5) where a feature notation is used, the possibility of a more extensive use of contextually determined redundancy is suggested.

On the other hand only some of the Prague School neutralizations are dealt with in the redundancy rules of generative phonology. In the case of an alternation like *bunde* – *bunt* in German an underlying *d* will be set up, and the change of *d* to *t* will be effected by the phonological rules.

segment combinations which do not occur in the surface structure, and conversely some combinations will be missing which do occur in the surface structure. For instance, Chomsky and Halle operate with underlying geminates in English and Schane (1968a) operates with final clusters like /tS/ and /z+s/ in French. These phenomena are therefore not the same as the ones described in the phonotactic rules of classical phonemics after all. This difference is not clearly brought out in generative studies (e.g. "SPE", p. 381 and Stanley 1967, pp. 398-401),⁵⁵ but it is discussed by Westring Christensen (1967), who points out that if both *ra:d* and *ra:t* are set up in German, then the rules of possible commutable word expressions are obscured.

It is apparently Stanley's opinion that all features must be specified in every segment by the redundancy rules, and not only those features which are present phonetically but are non-distinctive in the segment in question (e.g. +voice in vowels). Features which are never distinctive in any segment in the language (e.g. glottalized in English), as well as features which are universally irrelevant in certain segments (e.g. lateral in vowels) are specified as well. This also seems to be Chomsky and Halle's position, although they do not themselves include e.g. glottalized in English in "SPE". It is difficult to see the purpose of introducing all these features (cf. also Wilson 1966 and 8.15 above, where different types of redundancy are treated in the discussion of Roman Jakobson's distinctive features).⁵⁶

Place of Morpheme Structure Rules

9.40 As mentioned in 9.25 above the question has frequently been discussed just where in the description the redundancy rules should be placed. It has also been mentioned that "SPE" is somewhat unclear on this point. In the greater part of the book redundancy rules seem to belong to the phonological component, but in some places they are said to fall under readjustment rules. On p. 381 this problem is taken up again in a discussion of contributions made by Lightner and Stanley. Lightner (1963) and, in greater detail, Stanley (1967, 1968) have pointed out that difficulties may arise if rules are applied to unspecified matrices. If, for example, a segment is 0 voice, two possibilities may be imagined: (1) that it is neither possible to apply rules which, according to their formulation, apply to [+voice] nor to apply rules specified as applying to [-voice], or (2) that both rules applying to [+voice] and rules applying to [-voice] may be applied. But whichever of these two possibilities is selected, entities with 0 will be treated differently from entities with + or -. We are then really operating with ternary features, not binary ones, and it would therefore be wrong to consider entities

55. Cf., however, 9.56 below.

56. If marking conventions are introduced, the redundancy rules relating to universally irrelevant features can be eliminated from the grammars of individual languages together with a large number of other redundancy rules.

with zero simpler than entities with + or -, the usual approach when simplicity is being evaluated (cf. 9.56 below). Furthermore, it would be improper use of 0 if it were permitted to function in the same way as + in the application of a rule and then subsequently specified as -, or vice versa. This should be avoided.

In actual practice it is sometimes necessary to include redundant features in a rule, i.e. to let 0 function as + or - according to its phonetic value. For example, consonants are frequently voiced in voiced surroundings, particularly medially, whether the adjoining segments are redundantly or distinctively voiced.⁵⁷

Stanley now draws the conclusion that all redundancy rules must apply prior to the phonological rules, so that the phonological representation is fully specified, and that it is most reasonable to regard them as belonging to the lexicon. Rather than REDUNDANCY RULES, however, he thinks that we should speak about REDUNDANCY CONDITIONS. By means of these conditions a set of fully specified matrices is set up containing all and only the possible morphemes of the language. In the lexicon the morphemes are not fully specified but are submatrices (see note 74) of the corresponding items from the set of possible morphemes, i.e. the specified features have the same values as the fully specified forms, but the latter contain more features. In the lexicon a morpheme should have exactly as many pluses and minuses as necessary in order to identify it as a submatrix of one and only one item from the set of fully specified matrices permissible in the language.

If the redundancy rules are only used in the lexicon, i.e. are only applied to morphemes, a difficulty arises, however, since there may be rules which also apply to combinations of morphemes. If a vowel occurring before a consonant cluster is always short, for example, it is not necessary to indicate vowel length in the lexicon in this position. This is taken care of by a redundancy rule (or condition). Now if a long vowel followed by a single consonant is shortened when another consonant (e.g. in an inflexional suffix) is added, this is a process which belongs under the phonological rules, and the vowel shortening will therefore have to be described twice. The same problem arises when, for example, voicing assimilation in clusters of obstruents takes place both within the formative and across the formative boundaries. In "SPE" (pp. 171 and 381) it is suggested that such cases might be treated in the phonological rules, but this is not possible if morphemes must be fully specified before these apply. Brown (1970) therefore proposes that grammatical formatives should be inserted in the syntactic surface structure and that the morpheme boundaries separating them from the root, unless specially marked, are erased before the redundancy rules are applied. In this way cases

57. This, however, is not necessarily the case. For example, voicing assimilations caused by the initial consonant of a following word sometimes only take place before distinctively voiced consonants. This is generally considered to be the case in French, for example. The assimilation rule may, however, apply to fully specified matrices here also (as pointed out by Basbøll, personal communication), since the condition can be imposed that the initial segment of the following word (determining the assimilation) be [-sonorant]. This would prevent the rule from applying before nasals and liquids, in which voicing is non-distinctive.

of assimilation between formatives within one word, like *cats* [ts] and *dogs* [gz], might be dealt with, but not corresponding assimilations between words within sentences. Stanley suggests that the rule should be given under the redundancy rules, but that it should be permitted to remain in force during the operation of the phonological rules as well. It may also be necessary to let morphemes containing segments introduced by the phonological rules pass through the redundancy rules (or conditions) once again. It is therefore rather difficult to keep these two types of rules apart.⁵⁸

In a discussion of this problem McCawley (1968, pp. 40-3) proposes that zeros should be changed in the lexicon by means of redundancy rules if they are of consequence to later rules, but not otherwise (see also 9.69).

Another difficulty has been mentioned by Rischel (1974, p. 344 ff): 'There may be cases of alternations where no criteria permit a choice of one of the alternating forms as basic (consonant gradation in West Greenlandic seems to be a case in point). Such cases should not be concealed by an arbitrary choice of underlying form; they must be described as unspecified, as plus and minus at the same time (\pm) as a marker of alternating status. The necessity of using two rules to specify the alternants correctly depicts the lesser degree of determinacy in the system.'

MARKING CONVENTIONS

Description of Marking Conventions

9.41 In the last part of "SPE" (p. 380 ff), where Stanley's and Lightner's proposal is discussed, Chomsky and Halle acknowledge the objections against applying rules to matrices with unspecified features and actually also recognize the proposal for redundancy conditions. They believe, however, that a more radical change is called for, and this is outlined in the final chapter, p. 400 ff.

Here it is attempted to solve the problem by means of MARKING CONVENTIONS in the lexicon. The use of "marked" and "unmarked" in generative phonology, as well as the establishment of a number of marking rules, has been discussed in 9.31 above. Chomsky and Halle now propose that whenever possible the symbols "marked" and "unmarked" should be used in the lexicon instead of + and —. Since marking rules are claimed to be universal they can be given once and for all, and consequently a number of redundancy rules can be dispensed with in any individual language.⁵⁹ There will only remain a limited number of language specific redundancy rules. Since it may reasonably be claimed that unmarked values, which are the neutral and expected ones, should not be included in the

58. Stephen Anderson (1974, p. 289) prefers to keep related morpheme structure constraints and phonological rules apart, since they are not usually completely identical in formulation; there may also be different exceptions to them, etc.

59. As early as 1966 (p. 53 ff) it was pointed out by Kim that considerable saving could be gained by accepting a class of universal redundancy rules.

calculation of the complexity of a description for the purpose of evaluation, a considerable amount of saving will be gained also in the lexicon. Finally, the problem of unspecified features is avoided by this approach, since everything is fully specified from the outset, with most of the specifications being characterized either as *m* (marked) or *u* (unmarked).

In order to illustrate the saving gained in the lexicon Chomsky and Halle give an example of what a lexical item looks like if marking conventions are used ("SPE", p. 415). The English word *stun* [stan] (which has an underlying /u/) is shown in its lexical form, where "marked" is indicated by *m* and "unmarked" by no symbol, and also in its fully specified phonological form.⁶⁰ We here add the form which this word would presumably have had in the lexicon if (according to usual practice until recently) only non-redundant features are given + or -.⁶¹

Table 9.7

	fully specified				only non-redundant features				only marked features			
	s	t	u	n	s	t	u	n	s	t	u	n
segment	—	+	+	+	+	+	+	+	<i>m</i>	<i>m</i>	<i>m</i>	<i>m</i>
consonantal	+	+	—	+		+	—	+				
vocalic	—	—	+	—	—				<i>m</i>			
nasal	—	—	—	+		—		+				<i>m</i>
low	—	—	—	—								
high	—	—	+	—			+					
back	—	—	+	—			+				+	
round	—	—	+	—								
anterior	+	+	—	+								
coronal	+	+	—	+		+		+		+		
continuant	+	—	+	—								
delayed release	+	—	+	—								
strident	+	—	—	—								

It will be seen that the saving obtained in the lexicon is considerable (it should be added, though, that a word has been selected which contains a maximal number of unmarked sounds; there would be more marked features in most other words).

60. Basboll has pointed out that the feature "tense" has been forgotten. Since +tense is considered unmarked in vowels in "SPE", the vowel /u/ should be *m* tense in the matrix to the right and —tense in the middle one. "Voice" has apparently also been forgotten. It would be redundant and unmarked in all four segments.

61. Strictly speaking, the features sonorant, lateral, and possibly heightened subglottal pressure, covered, distributed, and glottal constriction should also be added in the fully specified matrix.

As regards the second segment, [*m* vocalic] and [+coronal] are sufficient to indicate that it is a dental plosive. Since CV is the normal combination in this position, *m* for "vocalic" means that it is a consonant. It is necessary to indicate that it is [+coronal] since there is no universal marking convention for this feature in anterior oral consonants (i.e. *t* is neither marked nor unmarked compared to *p*). Since it is unmarked for "nasal", it must be an oral consonant, and since it is unmarked for "continuant" and is post-initial, it must be a plosive according to the marking conventions in "SPE" (p. 404 ff) (moreover /s/ and /n/ would have had *u* for coronal, and not +, and since the segment has + it must thus be a plosive).

Since the second segment is a plosive, the first segment can only be /s/ and the third must be a vowel (had it been a liquid it would have been represented as *m* cons). The third segment is [+back] (there is no marking convention for +/-back in high vowels), and since it is otherwise unmarked it must be the back vowel /u/ (back vowels are normally rounded and oral and, if distinctively [+back], most frequently high). The final segment, which occurs after a vowel, and which is unmarked as regards vocalicness, must be a consonant, and [*m* nas] shows that it must be a nasal (nasal consonants are less frequent than oral ones and consequently marked). Since the place of articulation is furthermore unmarked this segment must be *n*, the most frequent and therefore unmarked nasal consonant. As appears from this explanation, marking conventions, like phonological rules, must be applied in a definite order.

By means of the universal marking conventions "marked" and "unmarked" may now be replaced by the correct pluses and minuses in the phonological representation.

A fully specified maximally economical lexical form has thus become possible, and there will be no problems with zeros. However, the difficulty remains that some rules must be repeated both in the lexicon and as phonological rules, and the difficulty mentioned by Rischel (arbitrary specification, cf. 9.40) also remains.

In an article in "Lg." (1969) Ch. E. Cairns has advanced some interesting suggestions about marking conventions and neutralization rules in segment sequences. He bases his views on certain empirically established universal implications, which have been pointed out by Greenberg. If, for example, a given language has the sequence A (e.g. voiceless obstruent + nasal + vowel) in initial position, it necessarily also has the sequence B (e.g. voiceless obstruent + liquid + vowel) in the same position. Cairns now establishes the rule that the presupposing sequence always has an *m* (a marked feature) in a place where the presupposed sequence has a *u* (an unmarked feature). In the example mentioned here sequence A will have an *m* for the nasality feature, whereas sequence B has a *u* for nasality. In this way a number of marking conventions for segment combinations are established, which in several respects differ from the ones set up in "SPE" by Chomsky and Halle.

Furthermore a number of so-called N-rules (neutralization rules) are established, which indicate that in certain environments only the unmarked member of an

opposition may occur. These rules are language specific, but they are arranged in a universal hierarchy (according to the universals mentioned above), so that a language which does not possess a given N-rule will lack the preceding N-rules as well. In languages which have only the combination voiceless obstruent + vowel, all the neutralization rules apply, whereas in languages possessing more complex combinations only some of them apply. These rules serve the purpose, then, of excluding the combinations which are impossible in a given language. Cairns now hypothesizes that children at the outset have all the N-rules, but that they discard them in a definite order concurrently with their acquisition of a particular language. Cairns connects these rules with articulatory and perceptual restrictions common to all humans.⁶²

Marking conventions may also be applied in combination with phonological rules in the form of "linking rules" (see 9.45).

Problems Raised by the Use of Marking Conventions

9.42 With a fully specified phonological level the idea immediately suggests itself that a large number of unnecessary features will have to be dragged through the phonological rules. This, however, is not the right way of looking at things, for the rules themselves do not have to be formulated in terms of redundant features; it is only in the items to which they apply, i.e. the morphemes, that all the redundant features are specified. Consequently the fully specified matrices are only cumbersome if a large number of examples of morphemes are cited, but in this case probably all phonologists will (like Chomsky and Halle) make use of alphabetic symbols as practical abbreviations.

The psychological reality of lexical items constitutes another problem. Which of the three forms mentioned in the example above is it likely that the speaker has internalized? It seems highly improbable that it should be the *m/u* representation, since this would imply that the speaker must pass through an enormous number of rules in order to produce the phonetic form. It may not be any of them. We simply do not know (cf. 9.72).

The markedness notation has a serious drawback, which has been pointed out both by Postal (1968, p. 177ff) and by Chomsky and Halle ("SPE", p. 416ff): it is no longer possible to distinguish between phonologically admissible and phonologically inadmissible matrices in an individual language. Formerly it was possible to compare the actually occurring lexical items with the items permitted by the redundancy rules. According to Chomsky and Halle (pp. 416-18) it is, however, an oversimplification to say that a form is either possible or impossible.

62. Stampe's "natural phonology" (1969) is based on some very similar ideas. He assumes that there are some "innate processes" determined by the human speech capacity and resulting in a very simple initial system. Gradually these processes are suppressed through influence from the language of the surroundings. He thinks that Jakobson's implicational laws result from these processes.

There are degrees of "grammaticality" depending on the generality of the rules a given form violates⁶³ (compare *bnik* and *bznk*, for example), and once the redundancy rules have been replaced by marking rules, matrices may be arranged in a hierarchy according to their distance from the set of matrices of the lexicon in question.

If universal marking conventions are used, a number of redundancy rules can be dispensed with in the descriptions of individual languages, but nevertheless some will remain, and it is not clear where these are to be placed. It would seem most natural to put them at the beginning of the phonological component. What Stanley has shown is simply that (in part) they should be prior to the phonological rules proper.

Wang (1968) has suggested that marking conventions should only be used as a sort of "price book" by means of which the complexity of lexical items can be determined, but that we should not employ a direct *m/u* notation, which is subsequently changed into a *+/-* notation by rules.

PHONOLOGICAL RULES

General Characteristics

9.43 In contradistinction to morpheme structure rules (or conditions), which operate on formatives, phonological rules operate on syntactic surface structure and are partly dependent on it. Phonological rules are ordered, and their function is to change feature values and to delete, insert and invert segments. They are thus similar to syntactic transformational rules, and in fact contraction and meta-thesis rules are characterized as transformational by Chomsky and Halle ("SPE", p. 360, cf. also 9.49 below). However, the term "transformational" is mainly applied to those phonological rules which are dependent on syntactic immediate constituent structure (cf. "SPE", p. 20).

The phonological rules can be divided into two main types: (1) the TRANSFORMATIONAL CYCLE and (2) the remaining phonological rules, which in "SPE" are referred to as WORD LEVEL RULES because they apply mainly within the boundaries of a word. The latter rules are also sometimes called phonetic, cf. Chomsky and Miller (1963, p. 314) and Hovdhaugen (1969, p. 90).

The Transformational Cycle

9.44 It is characteristic of the rules of the TRANSFORMATIONAL CYCLE⁶⁴ that they are dependent on the syntactic immediate constituent (IC) structure in the

63. Cf. my proposal in a paper of 1952 (Bibl. to Ch. 7), where the generality of the rules is also taken into consideration, and also Hockett (1955, p. 166).

64. See "SPE" (pp. 15-24, 26-43, 59-162), McCawley (1968, pp. 44-7), Chomsky and Miller (1963, p. 317ff) and Schane (1973, pp. 100-4).

following way: they apply in a linearly ordered sequence first within the innermost brackets; these brackets are then erased, and the cyclic rules reapply to the phrases within the next higher level of brackets, and so on until no brackets remain. In English rules of this type relate to stress and vowel reduction ("SPE"). In French the rules of liaison and elision have been described cyclically by Schane (1968a, p. 14 ff). Other phonologists, however, prefer to reserve cyclical rules for the description of stress, tone, etc. and do not wish to apply them to segmental units.⁶⁵ As regards the cyclical description of stress in English, this approach was adopted first in 1956 by Chomsky, Halle and Lukoff, but the description has been modified somewhat since then.

In compounds and syntactic constructions several stresses may be brought together, and some of these stresses are then weakened. In "SPE" Chomsky and Halle prefer to formulate this by saying that one of the stressed syllables is assigned primary stress once again and that all remaining stresses are then automatically weakened by one.

Among the cyclical rules in English the following, which are here described quite informally, may be mentioned:

- (1) The stress in simple and derived words is determined by the MAIN STRESS RULE, which is fairly complex, and which will therefore not be described here.
- (2) The COMPOUND RULE states that in compound nouns, adjectives and verbs the first primary-stressed syllable⁶⁶ receives the primary stress (e.g. *bláck board*, *Univérsty degree*).
- (3) The NUCLEAR STRESS RULE expresses that in a noun phrase primary stress is assigned to the last primary-stressed syllable (e.g. *a bláck bóard*, *a bíg Univérsty*).

The following two examples will therefore be treated differently:

- (a) [_N¹psmall [_N¹boys' school]_N]_NP ("a small school for boys").
 (b) [_N[_N¹psmall boys']_N¹school]_N ("a school for small boys").

In (a) the word *boys'* within the innermost brackets will receive primary stress according to the compound rule, and the stress on *school* will therefore be weakened to 2: [_N¹boys' ²school] (the strongest stress is indicated by 1, weaker stress by 2, 3 etc.). Then the innermost pair of brackets is erased, and by the nuclear stress rule *boys'* will now be given primary stress once again. Hereby the remaining stresses are weakened by one, and the end product will therefore be [_N¹psmall ²boys' ³school].

65. Recently Ch. W. Kisseberth has argued for a cyclic rule of segmental phonology in the Amerindian language Klamath ("Linguistic Inquiry" III, 1972, pp. 3-33).

66. I.e. the syllable that has got primary stress according to the main stress rule.

In (b) the word *boys'* gets primary stress by the nuclear stress rule and *small* is weakened by one: [²*small* ¹*boys'*]. The innermost brackets are then erased, and according to the compound rule *boys'* receives primary stress once again, while the two other words are reduced by one, i.e. [_N³*small* ¹*boys'* ²*school*] (cf. Chomsky and Miller 1963, p. 317 and McCawley 1968, p. 45).

If there are more brackets, as in

$$[_{NP} \text{John's } [_{N} \text{black board}]_{N \text{ eraser}}]_{NP},$$

the stress assignment will be carried out in a larger number of steps. Here the compound rule will first produce [¹*black* ²*board*], and when the innermost brackets have been erased, the application of the same rule will result in [¹*black* ³*board* ²*eraser*]. Then the next pair of brackets is erased, and by means of the nuclear stress rule [²*John's* ¹*black* ⁴*board* ³*eraser*] will be produced. It is possible to continue this process and to get as many as seven or eight stress degrees, but in actual practice it is necessary to have a convention by which the weakening process stops when a given point has been reached.

The stress difference between the nouns *tórrént* (without secondary stress) and *tórmént* (with secondary stress) is accounted for by regarding the latter as derived from the corresponding verb *tórmént*, i.e. by interpreting it as [_N[_V*tórmént*]_V]_N (see "SPE", pp. 36-8). According to the main stress rule the last syllable of the verb is first given primary stress (unless it consists of a lax vowel followed by a single consonant, cf. the example *edit* in 9.51 below). Then the innermost brackets are erased, and the stress is shifted to the first syllable of the noun while the second syllable is weakened by one.

According to the VOWEL REDUCTION RULE, vowels in unstressed syllables are weakened to ə, but if a vowel has primary stress at some point of the derivation, it still has a non-zero stress at the point of vowel reduction, and is therefore not weakened. Consequently, the last syllable of *tórmént* is not reduced to ə as it is in *tórrént*. A similar difference may be seen in examples like *condensation*, which is derived from *condense*, and which therefore may retain a full vowel in the second syllable, and *compensation*, which is derived from *compensate* and thus gets an ə in the second syllable ("SPE", pp. 36 ff and 96, and Chomsky and Miller 1963, p. 316).

By and large, there can hardly be any doubt that the principle underlying the transformational cycle – i.e. that a gradual weakening takes place in progressively more comprehensive syntactic structures so that the stress graduation mirrors the syntactic structure – is valid. At least this seems clear in the Germanic languages.⁶⁷ The number of distinctive stresses may therefore be reduced considerably; for example, the four distinctive degrees of stress in English proposed by Trager and Smith (cf. 6.30 above) are clearly superfluous. Whether it is possible

to reduce the number of stresses to one, i.e. to have no distinctive stress oppositions at all in the underlying form, seems a little more questionable. In "SPE" this is only brought off by means of a number of *ad hoc* rules which are not always convincing.⁶⁸ For example, special rules are set up to take care of certain derivational suffixes, and different types of junctures are inserted, (e.g. the juncture =, whose only function is to prevent the application of certain rules). In the verb *permit* (cf. 9.21 above), for example, the purpose of = is to prevent stress from falling on the first syllable (as in *edit*). In order to make the rules work Chomsky and Halle ("SPE", p. 161) even resort to the expedient of adding a final glide ε in a number of forms (how an open glide should be defined seems quite unclear), but nevertheless there are still exceptions.

Word Level Rules

9.45 Word level rules are rules which are not applied cyclically. Such rules are needed to change the underlying phonological representation into a phonetic surface representation. To do this they must be able to change features and to delete, insert and coalesce segments.⁶⁹ A few examples may be mentioned:

On the basis of alternations between [k] and [s] in forms like *electric-electricity*, *critic-criticism*, etc. underlying forms with /k/ are set up. A rule is therefore needed to change this *k* into *s* before *i* (more precisely before front, non-low vowels) under certain conditions. In German the underlying form in alternations like *Bunde-Bund* [bundə-bunt]; *Rade-Rat* [ra:də-ra:t] is supposed to contain a /d/; and the phonological component of German must consequently contain a rule changing *d* to *t* (more generally: changing voiced obstruents to voiceless obstruents) in final position.

In French there must be a rule deleting the underlying final consonant in words like *petit*, *sot* finally and before a following consonant, but not before a vowel (cp. the pronunciation of *petit garçon* and *petit ami*: [pətigarsɔ̃, pətitami] and similarly a rule deleting the final /ə/ in the feminine form *petite* before a following vowel *petite amie* [pətitami] (besides some optional deletion rules which would apply to the other examples of /ə/ in the forms mentioned).

An insertion rule will, for instance, be needed to insert an [i] before the English past ending -d in verbs, when it is added to a word ending in a dental consonant.

67. But this does not necessarily imply that the rules should take the form of a cycle. Rischel (1972) has argued that stress grading in Danish compounds (which is of the normal Germanic type) can be described from a generative point of view without reference to cyclic rule application. It can be deduced directly from the syntactic tree structure, when the location of the syllables marked [+stress] is known. Bierwisch (1968) has pointed to the influence of deeper syntactic processes.

68. This applies particularly to the main stress rule.

69. See, e.g., Schane (1973, pp. 49-73).

And according to Chomsky and Halle the first step in the diphthongization of an underlying /i/ in English (for instance in the form /diviŋ/) consists in the insertion of a glide after the *i* producing the form /diviyn/.

Sometimes two segments must be coalesced; for instance the underlying *s* + the glide *y* in *racial* must be coalesced in an *f*. In French an underlying oral vowel + nasal consonant followed by a consonant or a pause may be coalesced to a nasal vowel. In the latter case it is, however, also possible to assume two steps: first nasalization of the vowel and then deletion of the consonant.

Where these rules should be placed as against the transformational cycle is not clearly apparent from "SPE". In some places ("SPE", p. 236) it seems that they apply at one definite point within the cycle, namely when the level of the word boundary is reached, and that they should be applied only once. In other places it looks as if some of them are prior to the transformational cycle (for example, the "velar softening rule" precedes the cyclical rules), but most of them come after the cyclical rules, cf. the survey of English rules on p. 238ff. In McCawley (1968) it appears quite clearly that word level rules stand outside the framework of cyclical rules and occur partly before, partly after these (p. 45). It is important to specify where they are placed in relation to the cyclical rules, since the syntactic brackets are erased when the latter rules are applied and therefore cannot be used afterwards. However, the junctures, which also indicate syntactic boundaries, are not erased until the very end, and word class categories such as N, V, A, etc. are also retained.

It can probably not be maintained that all non-cyclical rules apply at the word level, since some assimilations (e.g. between a noun and a preposed adjective) take place across word boundaries also.

It sometimes happens that a segment affected by a rule is automatically changed further by a marking convention. For example, *k* may become [—back] by a rule, but by a marking convention it then changes into *ç* because affricated palatals are unmarked. Such a connection between a rule and a marking convention is called LINKING ("SPE", p. 419ff). Chomsky and Halle now lay down the principle that a LINKING RULE only comes into force if it applies to all segments produced by a given rule, not otherwise. If *t*, for example, turns into a spirant it becomes [+strident] (*s*) by a linking rule. But if *k* is changed into a spirant simultaneously, there is no marking convention to make it become strident, and consequently *t* does not either. For example, this is the case in the Germanic consonant shift where *k* turns into *x* and *t* into *θ*. As a result of this principle, then, an original symmetry in the system is retained. As another example umlaut in English and German may be mentioned. In English *u* and *o* turn into *ü* and *ö*, which are then changed into *i* and *e* by a linking rule, since non-low front vowels are usually unrounded. In German this additional change is prevented by the fact that *a* simultaneously turns into *ä*, which is not covered by the same marking convention because it is a low vowel. In this way the designation of the development of *u* and *o* into rounded front vowels (e.g. in German) as less natural is avoided.

WURZEL (1970) gives a detailed description of umlaut in German (pp. 105-39 and 155-67). He draws attention to the fact that many German dialects have unrounding of *ü*, *ö* to *i*, *e*. He therefore proposes a modification of Chomsky-Halle's rule so that the structure of the individual language is taken into account (p. 155ff). Vennemann (1972a) raises the same objection: The structure of the language in which the rule operates must be taken into account. If, for instance, a linking rule would lead to merger, it will probably be blocked. Bach and Harms (1972) also criticize the concept of linking rule, and Stephen Anderson (1974, p. 291) is reluctant to accept it.

DIACRITIC FEATURES AND EXCEPTIONS⁷⁰

DIACRITIC FEATURES

9.46 It has already been mentioned that syntactic categories, such as NP, N etc., may function as structural elements in phonological rules. Generative phonologists are often prepared to go to great lengths as regards the inclusion of non-phonological entities in the rules. In this way a number of phonological processes which are only partly phonologically determined or perhaps not at all and which have therefore been excluded from previous phonological descriptions, may now be included in the phonological rules and be joined together with other phonological processes in one rule complex.⁷¹

In anticipation of their use in the syntactic component, morphemes are already provided with various grammatical characteristics in the lexicon, whereby not only word class membership is indicated but also subcategories such as +/— transitive, +/— animate object, etc. In so far as they have phonological consequences these characteristics can also be used in phonological rules. Individual members of a category, such as present tense, perfect aspect, masculine etc., may also be referred to in phonological rules. Furthermore lexical items may be provided with diacritics which indicate e.g. what declension or conjugation they belong to, whether they undergo umlaut etc. Such properties may determine a number of phonological rules, but according to Bierwisch and Wurzel many of them should be brought together in a special morphological component (cf. 9.18).

A problem arises when certain rules apply to only part of the vocabulary (e.g.

70. See "SPI" (pp. 172-7, 373-80); McCawley (1968, pp. 37-9); Bierwisch (1967, pp. 17-26); Postal (1968, pp. 114-39); Schane (1968a, pp. 26ff and 1973, pp. 108-10), Hovdhaugen (1969, pp. 58 and 92) and Dell (1973, pp. 137-40).

71. According to Stephen Anderson (1974, p. 96) these morphologically conditioned processes, while intermixed with the purely phonological rules, have a different set of formal properties. For example, exchange rules (see 9.50 below) are limited to this class.

exclusively to native words, foreign words, or perhaps only certain types of foreign words). In such cases several related rules will normally apply to such a group of words. In Danish and German, for example, foreign words are characterized by special stress patterns, special consonant and vowel combinations, a larger number of qualitative differences in unstressed syllables etc. If such words are provided with a diacritic feature (+foreign) in the lexicon, this feature may play a role in a number of rules. In this way the lexicon becomes more complex, but on the other hand a large number of facts are brought together under the same rules. Several of the rules set up by Chomsky and Halle in "SPE" apply to only part of the vocabulary (particularly Romance loan words) and these words have to be specially marked in the lexicon. For example, this is the case with the so-called "velar softening rule" (*logic-logician*). Schane (1968a, e.g. p. 26) also establishes special rules applying to "learned words" in French. And in a generative description of voicing assimilation in Dutch Jacob Mey (1968) sets up some very general rules and then accounts for exceptions by means of subrules and by marking of foreign words and specific pronouns.

EXCEPTIONS

9.47 Even if diacritics are used, however, there will often be isolated words which are straightforward exceptions to a rule. In other linguistic schools phonologists have on the whole been unwilling to acknowledge exceptions. In German, for example, there is an almost absolute rule according to which only voiceless consonants occur after lax vowels, but there are a few isolated exceptions, such as *Ebbe*, *Roggen*, *Kladde* (cf. Bierwisch 1967, p. 17). In structuralist phonology, consequently, no such rule could be established. There are also cases where two sounds are almost in complementary distribution (e.g. Danish *o* - *æ*) but where there are a few minimal pairs. The usual practice has here been to set up two phonemes and then to assume that these coalesce or are defectively distributed in various environments. Generative phonologists, on the other hand, try to subsume as much as possible under general rules and to generalize whenever this is possible, even if the generalization is incomplete, their view being that exceptions should not prevent an account of actually occurring regularities. Chomsky and Halle point out ("SPE", p. 172) that the existence of e.g. *children* and a few other irregular words in English has not prevented grammarians from establishing a rule of plural formation with an *s*-suffix in English. In the German example mentioned above, generative phonologists will consequently establish the rule that only voiceless consonants occur after lax vowels and then simply regard *Roggen* etc. as exceptions.

Exceptions may be dealt with in two ways. In the first place one may attempt to explain them away by giving them another underlying form. This method is used extensively by Chomsky and Halle in their description of accent in English, where they make use of special junctures (=), consonant gemination, added vowels

and glides etc. Secondly exceptions may simply be marked in the lexicon with the feature "— rule x".

LIGHTNER (1967) is of the opinion that one should distinguish between MAJOR RULES and MINOR RULES: i.e. between rules which apply to a relatively large and to a relatively small part of the vocabulary respectively. In the former case the forms which fail to undergo the rule are indicated by a diacritic exception feature, while in the latter it is the words to which the rule applies that are marked as exceptional with a special diacritic feature in the lexicon.

KIPARSKY (1968a) takes a somewhat critical attitude to the extensive use of diacritics. According to him it is better to acknowledge exceptions of the type "— rule x", since it is then possible to avoid specific diacritics and to maintain a universal formulation. Instead of operating with +/—foreign, for example, he prefers to make a list of the exceptions to the rules and then arrange the rules in a hierarchy in such a way that e.g. "— rule 5" implies "— rule 6" etc. He also objects to the method by which vowel harmony is described by some generative phonologists (e.g. Chomsky and Halle, and Lightner) which consists in providing the root (e.g. in Finnish) with an abstract indicator on the basis of which all the vowels in the word can be specified as either front or back. Kiparsky thinks that by the use of marking conventions it is possible to specify the root vowels and to describe the affix vowels as unmarked.

RULE FORMULATION AND ORDERING

PURPOSE OF FORMALIZATION

9.48 In generative phonology great importance is attached to a consistent FORMALIZATION of rules. The purpose of this formalization is not only to make the description as precise and clear as possible, but also to permit a formulation of "true and significant generalizations" about language. The formal devices which are selected determine in part the range of generalizations which may be expressed. Already in the choice of formal devices, therefore, an important step is taken toward a definition of "linguistically significant generalization" ("SPE", p. 330).

SIMPLE RULES⁷²

9.49 In phonology as in syntax arrows are used in the rules, but they do not have exactly the same function as in syntax (cf. 9.13 above). In redundancy rules an arrow expresses the fact that segments containing the features indicated to

72. See particularly Harms (1968, pp. 42-5); McCawley (1968, pp. 27-40); "Current Issues" (p. 71 ff); "SPE" (pp. 61-4 and 330-57); Chafe (1967); Chomsky (1967), Wang (1968) and Schane (1973, pp. 62-8).

its left automatically contain the features indicated to its right as well. For example, the following rule⁷³

$$(1) \quad \begin{bmatrix} +\text{voc} \\ -\text{cons} \end{bmatrix} \rightarrow \begin{bmatrix} -\text{anterior} \\ -\text{coronal} \\ -\text{strident} \\ +\text{voice} \end{bmatrix}$$

says that all segments containing the features [+voc, -cons] (i.e. vowels) contain the features [-anterior, -coronal] etc. as well (square brackets indicate segments). In order for this rule to apply to a segment, it is a sufficient condition that the segment is [+voc, -cons], though it may contain other features as well (e.g. [-back, +round] (rounded front vowels), or [+back, +round] (rounded back vowels), etc.).⁷⁴

The above rule applies to all cases of [+voc, -cons], and as it is formulated here it is CONTEXT FREE. Most frequently, however, a rule applies in certain environments only (i.e. is CONTEXT SENSITIVE) like the following:

$$(2) \quad \begin{bmatrix} -\text{son} \\ +\text{cont} \end{bmatrix} \rightarrow [-\text{voice}] / [-\text{voice}] \text{ ——— } \#$$

This rule expresses the fact that a continuant obstruent is unvoiced finally after an unvoiced sound, the diagonal line means "in the context", and the horizontal line indicates the position of the segment affected by the rule: in this case between an unvoiced sound and #. # is a juncture (see 9.21).

It is also possible to move some of the features from the left side of the arrow to the right of the diagonal line (under the horizontal line), e.g. [+cont]. This means that the segment to the left of the arrow contains the feature [+cont]. Rule (2) could therefore also be written in the following way:

$$(2a) \quad [-\text{son}] \rightarrow [-\text{voice}] / [-\text{voice}] \overline{[+\text{cont}]} \#$$

Such a shift sometimes offers an advantage in allowing the combination of rules (cf. 9.53, rule 12). It would also be possible to retain [+cont] to the left of the arrow and move [-son] to the position under the horizontal line, or to move both of them to the right of the diagonal line with the result that only [] (i.e. "any segment") occurs to the left of the arrow. In rule (1) [+voc] could also be moved to the right, which would give:

$$(1a) \quad [-\text{cons}] \rightarrow \begin{bmatrix} -\text{anterior} \\ -\text{coronal} \\ -\text{strident} \\ +\text{voice} \end{bmatrix} / \overline{[+\text{voc}]}$$

73. In the following discussion the features from "SPE" are used, and segments are described by means of the features which are set up there for English.

74. If a matrix contains the same features, with the same values, as other matrices which contain additional features as well, it is said to be a submatrix of these matrices. For example, [+voc, -cons] is a submatrix of [+voc, -cons, +back, +round].

This shows that rule (1) is not context free in a strict sense.

A completely context free rule is the following:

$$(3) \quad [\quad] \rightarrow [-\text{glott}]$$

which states that all segments are $-\text{glottalized}$. But normally "context free" means "non-sensitive to the context outside of the segment".

What is found between the arrow and the diagonal in a rule indicates the change and is often called the **STRUCTURAL CHANGE** (abbreviated SC). What is found to the left of the arrow and to the right of the diagonal indicates the conditions which must be met in a form in order for the rule to apply (i.e. the segments which are involved plus the environment). This is called the **STRUCTURAL DESCRIPTION** (SD). Sometimes rules are formulated in a way which brings this distinction out more clearly. Rule (2) might, for example, be written in the following way:

$$(2b) \quad [-\text{voice}] \quad \begin{bmatrix} -\text{son} \\ +\text{cont} \end{bmatrix} \downarrow [-\text{voice}]$$

where the first line indicates the structural description and the second line the structural change.

In phonological rules proper, which express changes, it is possible to interpret the arrow as "turns into". At any rate this is possible if alphabetic symbols are used (e.g. $i \rightarrow j$), or if all features, or at least all those features which are non-redundant in the language in question, are stated in all rules.⁷⁵ Instead of $i \rightarrow j$ we could then write:

$$(4) \quad \begin{bmatrix} +\text{voc} \\ -\text{cons} \\ +\text{high} \\ -\text{back} \end{bmatrix} \rightarrow \begin{bmatrix} -\text{voc} \\ -\text{cons} \\ +\text{high} \\ -\text{back} \end{bmatrix}$$

Usually, however, this is abbreviated somewhat by the aid of a convention according to which the entity to the right of the arrow contains all the features contained by the entity on the left,⁷⁶ in addition to the features specified by the rule ("SPE", p. 337). The following formulation is therefore sufficient:

$$(4a) \quad \begin{bmatrix} +\text{voc} \\ -\text{cons} \\ +\text{high} \\ -\text{back} \end{bmatrix} \rightarrow [-\text{voc}]$$

75. If redundant features are included the formulation becomes somewhat more detailed, cf. "SPE" (p. 336).

76. Incompatible features, however, constitute an exception to this principle. If a segment is changed to $[\text{low}]$, for example, it is tacitly assumed that it also becomes $[-\text{high}]$.

This rule indicates that the segment to the left of the arrow is changed and that it is the feature which also occurs on the right-hand side which is involved. It would also be possible to delete [+voc] on the left-hand side of the arrow:

$$(4b) \quad \begin{bmatrix} -\text{cons} \\ +\text{high} \\ -\text{back} \end{bmatrix} \rightarrow [-\text{voc}]$$

The entity to the left now comprises both *i* and *j*, and the rule is said to apply "vacuously" to *j*.

In isolation such a formulation cannot be distinguished from a redundancy rule. It would be a redundancy rule if only *j*, but not *i*, occurs in the language in question, but a phonological rule if it is applied to an underlying form with *i*, replacing this *i* with *j*.

The phonological rules are nearly always context sensitive, in the normal sense of the word, in which "context" refers to context outside of the segment. For example, the above rule might apply before vowels, and we could then make the following addition:

$$/ \text{ --- } \begin{bmatrix} +\text{voc} \\ -\text{cons} \end{bmatrix}$$

In the preceding examples a CHANGE OF FEATURE took place.

If segments are to be INSERTED or DELETED, the symbol \emptyset (— null) is used, for example:

$$(5) \quad [-\text{son}] \rightarrow \emptyset / \text{ --- } [-\text{son}] [-\text{son}]$$

i.e. an obstruent is deleted before two obstruents, or

$$(6) \quad \emptyset \rightarrow \begin{bmatrix} +\text{voc} \\ -\text{cons} \\ +\text{high} \\ -\text{back} \end{bmatrix} / \begin{bmatrix} -\text{son} \\ -\text{cont} \\ +\text{cor} \\ +\text{ant} \end{bmatrix} \text{ --- } \begin{bmatrix} -\text{son} \\ -\text{cont} \\ +\text{cor} \\ +\text{ant} \\ +\text{voice} \end{bmatrix}$$

which states that *i* is inserted between a dental stop and *d*.

The standard notation, exemplified above in rules 1-6 (i.e. REWRITE RULES), can be applied to all cases where only *one* segment is changed. But processes in which two or more segments are simultaneously affected, for example METATHESIS and COALESCENCE, need a different format. In these cases there are two or more segments to the left of the arrow, and they must be numbered.

Metathesis can, for example, be expressed in the following way:

$$(7) \quad \begin{array}{c} \left[\begin{array}{c} + \text{voc} \\ + \text{cons} \\ + \text{cor} \\ - \text{ant} \end{array} \right] \\ \text{1} \end{array} \quad \begin{array}{c} \left[\begin{array}{c} + \text{voc} \\ - \text{cons} \end{array} \right] \\ \text{2} \end{array} \rightarrow \text{2 1} \quad / \quad - \quad \begin{array}{c} \left[\begin{array}{c} - \text{voc} \\ + \text{cons} \\ + \text{cor} \\ + \text{ant} \end{array} \right] \end{array}$$

This expresses a process in which *r* + vowel becomes vowel + *r* before a dental consonant.

This can also be written in the following way:

$$(7a) \quad \begin{array}{c} \text{SD:} \\ \begin{array}{c} \text{1} \\ \left[\begin{array}{c} + \text{voc} \\ + \text{cons} \\ + \text{cor} \\ - \text{ant} \end{array} \right] \end{array} \end{array} \quad \begin{array}{c} \text{2} \\ \left[\begin{array}{c} + \text{voc} \\ - \text{cons} \end{array} \right] \end{array} \quad \begin{array}{c} \text{3} \\ \left[\begin{array}{c} - \text{voc} \\ + \text{cons} \\ + \text{cor} \\ + \text{ant} \end{array} \right] \end{array}$$

$$\text{SC:} \quad \text{1 2 3} \rightarrow \text{2 1 3}$$

where SD is an abbreviation of "structural description" and SC stands for "structural change".

Rules with more than one segment on the lefthand side of the arrow like 7 (or 7a) constitute a kind of PHONOLOGICAL TRANSFORMATION RULES (cf. 9.16 above about syntactic transformations).

Although rules are normally formulated in terms of features, it is common practice to use V and C as informal abbreviations of vowel (+voc, -cons) and consonant (in the sense of non-vowels, i.e. including liquids and glides), cf. "SPE" (p. 68).

For reasons of ease in reading it may sometimes be practical to use alphabetic symbols informally in rules. In the following this is done occasionally.

SPECIFIC TYPES OF RULE FORMULATION

9.50 Some rules are related to each other in a specific manner and are therefore given special names.

A pair of rules may, for example, be of the type $A \rightarrow B$ and $B \rightarrow A$. Such rules have been called EXCHANGE RULES (or POLARITY RULES, or FLIP-FLOP RULES), cf. Chafe (1967, p. C18) and "SPE" (pp. 187f, 256ff, and 355ff). Wang (1967, p. 102 and 1968, pp. 696-7) has pointed out that exchange rules are frequently found in the case of tones, both synchronically and historically, so that e.g. high tones are changed into low and low into high. This is the case in several Chinese dialects. In Chaózhou, for example, the rules $[+ \text{high}] \rightarrow [- \text{high}]$ and $[- \text{high}] \rightarrow [+ \text{high}]$ may be set up.

Among the English vowel rules Chomsky and Halle include a "vowel shift rule" which operates as follows: in the examples *divine-divinity* there is assumed to be an underlying tense *i*, in *serene-serenity* an *e*, and in *profane-profanity* an *a*

in the second syllable; *divin*, *serēn* and *profæn* are first changed into *diviyn*, *serēyn* and *profæyn* by a diphthongization rule.⁷⁷ By the first part (a) of the vowel shift rule, *ē* is then replaced by *i* and *i* by *ē*, so that the forms *divēyn* and *seriyn* arise; and by the second part (b), *ē* is replaced by *æ* and *æ* by *ē*, resulting in *divæyn* and *profēyn* (subsequently *æy* is changed into *āy*) ("SPE", pp. 50ff and 183ff). Something similar happens to back vowels. Wang (1968) has proposed another solution, according to which the changes take place in one step only.

Ladefoged (1967, pp. 71-2) has criticized the formulation in terms of exchange rules, since it covers up what the changes have in common, namely that a low vowel turns into a midvowel (*æ* → *e*), and that a mid vowel becomes high (*e* → *i*), i.e., both vowels are raised. This shared property of the subparts of the vowel shift would become apparent if low, mid and high were established as three steps (1, 2, 3). Ladefoged furthermore considers an exchange unlikely as a historical process.

Other phonologists have also been sceptical about historical exchange rules, because they might result in misunderstandings between speakers who have adopted the change and speakers who have not yet done so. Chomsky and Halle ("SPE", p. 256ff) have objected to this that in running speech the risk of misunderstanding is not so great. If it were, phonetic mergers could not take place; and there can be no doubt that mergers occur quite frequently. However, they do not wish to rule out the possibility that the historical process may have been different, although they do not consider this absolutely necessary. Synchronically, at any rate, they maintain the possibility of exchange rules.⁷⁸

Another special type is constituted by so-called MIRROR IMAGE RULES, which induce the same change in symmetrical or reversed environments (e.g. $X \rightarrow Y / A \text{ — and } X \rightarrow Y / \text{ — } A$, or $X \rightarrow Y / A \text{ — } B$ and $X \rightarrow Y / B \text{ — } A$). An example of the former type is nasalization of a vowel both before and after a nasal consonant.⁷⁹

ORDERING OF RULES⁸⁰

9.51 The rules leading from the phonological representation to the phonetic representation cannot simply be applied in a random order.⁸¹ Naturally there are rules which have nothing to do with each other and whose mutual order is therefore immaterial (e.g. the rules in Russian that *ɔ* becomes *a* in pretonic

77. [y] is here used = IPA [j].

78. Stephen Anderson (1974, pp. 96-7) is of the opinion that all the examples of exchange rules given up till now are somewhat suspect and that the only valid examples are rules that are conditioned by morphological, rather than purely phonological factors.

79. Cf. Stephen Anderson (1974, p. 110-23).

80. Cf. "SPE", pp. 340-50, "Current Issues", p. 71 ff, McCawley 1968, pp. 22-3, Schane (1973, pp. 84-92), Dell (1973, pp. 85-100) and Stephen Anderson (1974, pp. 137-218).

81. According to Stanley redundancy rules are unordered, whereas marking conventions are ordered (see "SPE", p. 408).

syllables and that obstruents become devoiced finally). But many rules are inter-related and should be stated in a FIXED ORDER if they are to be formulated simply.

McCawley (1968, pp. 22-3) gives an example from Russian: in this language there is a rule (1) according to which a word final *l* in verbs is lost after velar and labial consonants and another rule (2) by which word final obstruents become voiceless. Now the preterite of verbs is formed with a suffix which is *-l* in the masculine and *-la* in the feminine. The verb *žeg-* ('burn') therefore has the underlying forms *žeg + l* and *žeg + l + a*. The surface forms are *žok* and *žgla* respectively. It is evident that in order to arrive at these surface forms the rule that *l* is lost after a velar must be applied before the rule of final devoicing of obstruents, i.e. the rule order must be (1) (2). If it had been (2) (1) we would get *žog* in the masculine. If we assume that the rules applied simultaneously, rule (2) would have to be formulated in a more complicated way, namely "an obstruent becomes voiceless if it is wordfinal or if it is grave and followed by a word final *l* in a verb". Since there are interrelated rules in nearly all known languages, a description in terms of simultaneously applying rules would become extremely complex.

In "Current Issues" (p. 71ff) Chomsky gives some simple examples from English. A rule (1) may be set up, according to which *k* and *t* turn into *s* before *i* and *y* (= IPA [j]) within a certain section of the vocabulary, cf. *democrat-democracy*, *logic-logicism*. Another rule (2) may be established, by which *s* and *z + i*, *y* are coalesced into respectively *ʃ* and *ʒ* before a vowel, cf. *race-racial*, *revise-revision*. Since rule (2) also applies to the *s* which is derived from *k* and *t* occurring before *i*, *y* (cf. *logic-logician*), it is obvious that the rule order must be (1) (2).

Another example (pp. 73-4) is the following, which has been simplified slightly here: the underlying forms which must be set up for the words *decided*, *decisive* and *delighted* are *disayd#d*, *disayd + iv*, *dilayt#d*, and the surface forms are *disa.yDid*, *disaysiv*, *dilayDid*. *D* indicates an alveolar flap. The rules which are of interest here are the following:

- (1) $d \rightarrow z / \text{ — } i, y$
- (2) $z \rightarrow s / \text{ — } + iv$
- (3) $a \rightarrow a^{\cdot} / \text{ — } (\text{glide}) [+ \text{voice}]$
- (4) $t \text{ and } d \rightarrow D / \bar{V} \text{ — } V$

According to (3) *a* is lengthened before a voiced sound whether a glide intervenes or not (see 9.54 below concerning the use of parentheses), and according to (4) *t* and *d* turn into a voiced dental flap between a stressed vowel and a following unstressed vowel. The rule order must be the one given here, for if (3) applied before (2), the *a* would be lengthened in *decisive*, and if, on the other hand, (3) applied after (4), this vowel would be lengthened in *delighted* as well, consequently rule (3) can only be placed between rules (2) and (4).

Normally rules are arranged in sequence so that each following rule is allowed

to apply to the output of the preceding rule. Such rules are said to be **CONJUNCTIVELY ORDERED**. There are, however, also types of rule sequences in which the second rule is skipped if the first applies, and where the second thus only applies in those cases where the conditions of the first rule are not met. Such rules are said to be **DISJUNCTIVELY ORDERED** (cf. Chafe 1967, "SPE", pp. 30ff and 60ff); Wang (1968, p. 696). Chomsky and Halle ("SPE", p. 30) mention the following example: simple disyllabic English words have main stress on the first syllable if the second syllable contains a short vowel plus a simple consonant (a "weak cluster"), e.g. *édit*, otherwise (i.e. if the second syllable ends in a "strong cluster") the main stress falls on the second syllable, e.g. *grotésque*, *eváde*. According to a preliminary formulation this stress distribution may be accounted for by two rules, one assigning stress to the penultimate syllable of words ending in a weak cluster, and another more general rule assigning stress to the final syllable. The latter rule must be ordered after the former rule, and furthermore the condition must be laid down that it does not apply to morphemes which have been affected by the first stress rule. Otherwise rule number one would produce *édit*, and rule number two would change this to *èdit*. If the rules were reversed we would first get *edit* and then *édit* with secondary stress on the second syllable (since there is a convention by which an assignment of main stress reduces the other stresses of the forms by one step), and this would also be incorrect. It should be possible to establish rules according to which A is changed into B under condition Y, to C under condition X and to D "otherwise". It is the rules of this type which are disjunctively ordered. According to Chomsky and Halle one should attempt to set up as many rules of this type as possible since this results in shorter derivations.

There are, however, rules which must be applied **SIMULTANEOUSLY**. For example, this is true of the exchange rules mentioned above. If they are applied successively, the second rule will neutralize the effect of the first.

Finally, it has been suggested that there are some rules, so-called **ANYWHERE RULES**, which are not restricted to any simple place in the rule sequence, but which apply whenever their conditions are fulfilled. It is not rare to find this type of rule in language history. Some rules may be valid for centuries and come into operation whenever linguistic changes create new possibilities for their application. For example, this is true of devoicing of final obstruents in German, which also applies to recent loan-words like *Job* and *Trend*. It would not be surprising to find synchronic rules of the same type. A special type of anywhere rules is what Chafe (1967) calls **PERSISTENT** rules. Chafe assumes that the rules of a grammar are organized in several sets, or **DEPTHS**. The rules within a set apply simultaneously, but the sets are ordered. He now assumes that some of the rules of the last set (or depth) may be "persistent", i.e. apply at any depth.

A special type of rule ordering is constituted by the so-called **TRANSFORMATIONAL CYCLE**. In this case a whole set of rules re-applies up to several times to increasingly larger syntactic construction (cf. for more details 9.44 above).

Different types of rules may also be distinguished according to their effect on a given linguistic material. Chafe (1967) distinguishes between ADDITIVE and SUBTRACTIVE INTERFERENCE between rules. In the case of additive interference one of the rules has an output which the other can apply to. In the example mentioned in the beginning of this section this holds true of rules (1) ($d \rightarrow z / \text{---} i, y$) and (2) ($z \rightarrow s / \text{---} +iv$) as well as of rules (4) ($t \rightarrow D$) and (3) (vowel lengthening before voiced consonant). It will be seen, however, that only in the former pair of rules the ordering is such that this possibility can be realized. Chafe calls this appropriate order, as opposed to inappropriate order (the terms "unmarked order" and "marked order" have also been used by e.g. Kiparsky 1968 b). In the case of subtractive interference a rule restricts the number of cases to which another rule applies. For example this holds true of rules (2) and (3). When z has been changed into s before $+iv$ there are fewer cases to which the lengthening rule applies. KIPARSKY (1968) makes a completely parallel distinction. Rules which interfere additively in the given order are said to be in FEEDING ORDER, whereas those which interfere subtractively are said to apply in BLEEDING ORDER (see also 9.63 below). Thus when two rules are in "feeding order", the output of the first rule increases the number of items to which the second rule can apply, whereas when they are in "bleeding order", the output of the first rule decreases the number of items to which the second rule can apply. This terminology has now been generally accepted.

STEPHEN ANDERSON (1970) has mentioned some cases where rules seem to apply in different order in different cases according to other rules with which they are combined in a given derivation. He suggests that they tend to apply in "unmarked" (i.e. "feeding") order. In his recent book Anderson (1974, p. 137 ff) attacks the generally accepted notion that rules, on the whole, are linearly ordered. Anderson assumes that only pairs of rules, not whole sets of rules, are mutually ordered, and he gives examples which demonstrate that the ordering need not be transitive: If A precedes B and B precedes C, it does not follow that A precedes C; in some cases A may follow C. It also happens in some cases that a rule applies more than once, but not anywhere, or that the ordering of two rules is governed by certain universal tendencies. In accordance with Kiparsky (1968 b) Anderson assumes that rules tend to apply in "natural" order, i.e. an order which maximizes their effect and makes their result transparent. This means that feeding order is more natural than bleeding order and neutral order (i.e. an order that is neither feeding nor bleeding), and that bleeding order is less natural than feeding order and neutral order.

If rules apply in natural order (or if the order is irrelevant), it is, according to Anderson, not necessary to indicate the order in the specific language. Only in the cases where it is not natural must the ordering be indicated explicitly. Anderson calls this theory the theory of "local ordering".

KENSTOWICZ AND KISSEBERTH (1973) have argued that some types of rules normally follow others irrespectively of the feeding or bleeding effects. Rules

which depend on surface syllable structure (for instance assimilations) will thus normally follow rules which change this structure (for instance epenthesis).

RISCHEL (1974, p. 314ff) emphasizes that a universal natural order is not so well defined that the ordering can be left unmentioned in the description of a concrete language. He prefers to talk of "priority" instead of "order" and assumes that (provided there is no prohibition in the form of disjunctively ordered rules) all rules are tested for applicability over and over again, and a potentially applicable rule is allowed to apply whenever there is no rule with a higher priority in relation to it whose structural description is also satisfied at that particular point of the derivation.

A radical criticism of the whole theory of rule ordering has been advanced recently by KOUTSOUDAS, SANDERS, and NOLL (1974). They maintain that no language specific ("extrinsic") restrictions of the relative order of application of grammatical (including phonological) rules are necessary. The order may be determined entirely by universal principles. The most general principle, which is sufficient in almost all cases, is that every obligatory rule *must* be applied to every representation to which it *can* be applied. If two rules are in feeding relation there is only one possible order in which both are able to apply. (For instance, in McCawley's example quoted in the beginning of this section, the devoicing of final *g* can only apply to *žegl* after the deletion of final *l*). Unrestricted order thus gives the same result as feeding order. In many other cases the general principle leads to simultaneous application. According to the traditional analysis of French there is, for instance, (1) a rule nasalizing vowels before nasal consonants, and another (2) deleting nasal consonants before # and C, and they are assumed to apply in the order given here. However, simultaneous application will give the same result (i.e. *grande* becomes *grād*). According to the authors it is only necessary to have a more specific (but still universal) constraint on the relative order if the two rules bleed each other.

Derwing (1973, p. 208ff) and Linell (1974, p. 78ff) also reject extrinsic rule ordering.

ABBREVIATIONS BY COMBINATION OF RULES

Conditions of Abbreviation

9.52 If two rules follow each other in the hierarchy and share certain properties, either regarding the conditions under which they apply or regarding the nature of the change, they may be combined by means of certain formal symbols. An adequate theory should allow for abbreviations where an actual generalization is to be observed and should prevent abbreviations where no true generalizations are to be found ("SPE", p. 341).

Conjunctively Ordered Rules

9.53 If rules are conjunctively ordered, and if they share certain formally specifiable material, they may be combined by means of BRACES (also called "curly brackets"). For example, the following sets of rules can be combined as indicated:

$$(9) \quad \begin{array}{l} (1) A \rightarrow B / C \text{ and } (2) A \rightarrow B / D \text{ to } (3) A \rightarrow B / \left\{ \begin{array}{c} C \\ D \end{array} \right\} \\ (1) A \rightarrow B / C \text{ and } (2) D \rightarrow B / C \text{ to } (3) \left\{ \begin{array}{c} A \\ D \end{array} \right\} \rightarrow B / C \end{array}$$

(It is also possible to have braces within each other). In 9.49 (4) above the example $i > j$ was quoted from "SPE" (p. 337ff).

$$(10) \quad \left[\begin{array}{c} - \text{cons} \\ + \text{high} \\ - \text{back} \end{array} \right] \rightarrow [- \text{voc}]$$

In "SPE" a hypothetical case is suggested in which this rule is supposed to apply before p, r, j, a , and it is furthermore assumed that w in this environment turns into u (something which is rather unlikely, incidentally):

$$(11) \quad \left[\begin{array}{c} - \text{cons} \\ + \text{high} \\ + \text{back} \end{array} \right] \rightarrow [+ \text{voc}]$$

If in these two rules "back" is moved over to the environments (cf. 9.49 above example 2a), the entity occurring to the left of the arrow will be the same:

$$\begin{array}{ll} (10a) & \left[\begin{array}{c} - \text{cons} \\ + \text{high} \end{array} \right] \rightarrow [- \text{voc}] / [\overline{- \text{back}}] \quad \left\{ \begin{array}{c} p \\ r \\ j \\ a \end{array} \right\} \\ (11a) & \left[\begin{array}{c} - \text{cons} \\ + \text{high} \end{array} \right] \rightarrow [+ \text{voc}] / [\overline{+ \text{back}}] \quad \left\{ \begin{array}{c} p \\ r \\ j \\ a \end{array} \right\} \end{array}$$

These two rules may then be abbreviated in the following way:

$$(12) \quad \begin{bmatrix} -\text{cons} \\ +\text{high} \end{bmatrix} \rightarrow \left\{ \begin{bmatrix} [-\text{voc}] / [-\text{back}] \\ [+ \text{voc}] / [+ \text{back}] \end{bmatrix} \right\} \begin{bmatrix} p \\ r \\ j \\ a \end{bmatrix}$$

In this way the formulation becomes more general and shows that the rule applies to the "natural class" $\begin{bmatrix} -\text{cons} \\ +\text{high} \end{bmatrix}$. A combination of several rules is called a **SCHEMA**, and the breaking down of a schema into separate rules is called an **EXPANSION**.

By convention the subrules of schemata are arranged in the same order as that in which they apply when taken as separate rules, and consequently they should be expanded in that order. In the example given the order of expansion would not make any difference, but in a schema like the following:

$$(13) \quad \left\{ \begin{array}{l} \check{c} \rightarrow s \\ k \rightarrow \check{c} \end{array} \right\} / \text{--- } i \quad \begin{array}{l} (a) \\ (b) \end{array}$$

it is obvious that the expansion must be carried out in the order indicated, if the results of applying the rule to k and to \check{c} are to remain distinct.

Disjunctively Ordered Rules and Simultaneously Applied Rules

9.54 Disjunctively ordered rules are abbreviated by means of normal PARENTHESES. For example, the following rules can be abbreviated as shown:

$$(14) \quad (1) A \rightarrow B / DE \text{ --- and } (2) A \rightarrow B / D \text{ --- to } (3) A \rightarrow B / D(E) \text{ ---}$$

The entity enclosed in parentheses is thus optional. When the schema is expanded, one should begin with the longest subrule.

The following example from McCawley (1968, p. 36) may be mentioned: If in a language the word stress falls on the antepenultimate syllable when there are three or more syllables, on the penultimate syllable when there are two syllables, and on the final (or rather only) syllable if there is only one syllable, this may be expressed by means of three rules (S represents "syllable"):

$$\begin{array}{ll} (15) & S \rightarrow [+ \text{stress}] / \text{--- } SS\# \\ (16) & S \rightarrow [+ \text{stress}] / \text{--- } S\# \\ (17) & S \rightarrow [+ \text{stress}] / \text{--- } \# \end{array}$$

These rules may now be abbreviated in the following way:

$$(18) \quad S \rightarrow [+ \text{stress}] / \text{--- } (S(S))\#$$

The rules must be applied in the order indicated and in such a way that subsequent rules do not apply to the output of preceding rules. When the schema (18) is expanded to the set of rules (15), (16), (17), the full form (15) (— SS#) must be selected first. In the case of trisyllabic words, for example, all three rules could potentially apply, but only if rule (15) is selected first, will the result be correct. It is not permissible, therefore, to begin with one of the two other rules, which would assign stress to the penultimate or final syllable, or to apply one of them if rule (15) has already applied, since following syllables would then be stressed as well (cf. the example with *édit* from "SPE" discussed in 9.51 above).

McCawley (1968, p. 32) also mentions the following example:

$$(19) \quad \begin{bmatrix} -\text{cons} \\ +\text{voc} \end{bmatrix} \rightarrow [+round] \quad / \quad \begin{bmatrix} -\text{cons} \\ +\text{voc} \\ +round \end{bmatrix} \quad [+cons] \text{ —}$$

$$(20) \quad \begin{bmatrix} -\text{cons} \\ +\text{voc} \end{bmatrix} \rightarrow [+round] \quad / \quad \begin{bmatrix} -\text{cons} \\ +\text{voc} \\ +round \end{bmatrix} \text{ —}$$

According to (19) a vowel is rounded after a rounded vowel followed by a consonant, and according to (20) a vowel is rounded immediately after a rounded vowel. The intervening consonant is thus optional, and the two rules may be abbreviated like this:

$$(21) \quad \begin{bmatrix} -\text{cons} \\ +\text{voc} \end{bmatrix} \rightarrow [+round] \quad / \quad \begin{bmatrix} -\text{cons} \\ +\text{voc} \\ +round \end{bmatrix} \quad ([+cons]) \text{ —}$$

By convention the schema must be expanded in such a way that rule (19), which includes the optional consonant, is expanded first. However, it would make no difference if the order was reversed, since (19) and (20) can never apply to the same form.

The same is the case with a schema like:

$$(22) \quad V \rightarrow [-\text{tense}] \quad / \text{ — } C(C) V$$

If the same type of element is repeated optionally, another method of abbreviation may also be used, according to which a numeral used as SUBSCRIPT indicates the lower limit of the number of entities involved, and a numeral as SUPERScript indicates the higher limit:

C_0^1 means: no C or one C, = (C)

C_0^2 means: no C, one C, or two Cs, = ((C)C)

C_1^2 means: one C or two Cs, = C(C)

etc.

C_0 means: no C or any number of Cs (potentially, an infinite number)

C_1 means: one C or several Cs (potentially, an infinite number).

The last two examples cannot be expressed in a parenthesis notation, since they are schemata representing an infinite set of rules. In these cases the rules must be applied simultaneously to a given entity (cf. Chomsky-Halle 1968, p. 348).

A schema like:

$$(23) \quad C \rightarrow \emptyset / \text{ — } C_0\#$$

(where \emptyset means zero) may be expanded into the rules

$$(23a) \quad \begin{array}{l} (a) \ C \rightarrow \emptyset / \text{ — } \# \\ (b) \ C \rightarrow \emptyset / \text{ — } C\# \\ (c) \ C \rightarrow \emptyset / \text{ — } CC\# \\ (d) \ C \rightarrow \emptyset / \text{ — } CCC\# \text{ etc.} \end{array}$$

If there is a morpheme $XVCCC\#$, then rule (a) will apply to the final C , rule (b) to the prefinal C etc. and the final output will be XV .

A schema like

$$(24) \quad C \rightarrow \emptyset / V \text{ — } C_0\#$$

will only delete the first C in $XVCCC\#$, thereby producing $XVCC\#$, if the rules are applied simultaneously. If they were applied successively we could first delete the first C , then the second etc., thereby arriving at the same result as in the case of rule (23) ("SPE", pp. 343-4).⁸²

Sometimes we find optional entities which are not adjacent but which go together in the sense that they are either both absent or both present. Such entities are symbolized by means of ANGLED BRACKETS. By a rule in English called "velar softening", for example, g is changed to a palatal affricate (j) and k to a dental affricate (c , IPA [ts]) before i and e : i.e. they both become [+coronal] and [+strident], but k furthermore becomes [+anterior] (and by a subsequent rule c turns into s). This may be expressed by means of two rules (25) applying to k , and (26) to both k and g :

$$(25) \quad \begin{bmatrix} -\text{cont} \\ -\text{ant} \\ -\text{voice} \end{bmatrix} \rightarrow \begin{bmatrix} +\text{cor} \\ +\text{strid} \\ +\text{ant} \end{bmatrix} / \text{ — } \begin{bmatrix} -\text{back} \\ -\text{low} \\ -\text{cons} \end{bmatrix}$$

$$(26) \quad \begin{bmatrix} -\text{cont} \\ -\text{ant} \end{bmatrix} \rightarrow \begin{bmatrix} +\text{cor} \\ +\text{strid} \end{bmatrix} / \text{ — } \begin{bmatrix} -\text{back} \\ -\text{low} \\ -\text{cons} \end{bmatrix}$$

82. Stephen Anderson (1974, p. 124 ff) cites examples where it is preferable to let the rule apply successively to its own output.

However, these two rules may also be combined into one schema:

$$(27) \quad \begin{bmatrix} -\text{cont} \\ -\text{ant} \\ \langle -\text{voice} \rangle \end{bmatrix} \rightarrow \begin{bmatrix} +\text{cor} \\ +\text{strid} \\ \langle +\text{ant} \rangle \end{bmatrix} / \text{ — } \begin{bmatrix} -\text{back} \\ -\text{low} \\ -\text{cons} \end{bmatrix}$$

The longest rule (25) should be applied first. It only applies to *k*. If (26) were applied to *k* first, \tilde{c} would be produced, and it would then be necessary to have an extra rule changing \tilde{c} to *c*; \tilde{c} should not be established as an intermediate step, however, since it would then coalesce with other instances of \tilde{c} (*chip*, *cherry*, etc.), which are not developed further to *c* and *s*. This would give incorrect results. In the case of *g* (25) does not apply and we must proceed to (26). (25) and (26) must therefore be set up as disjunctively ordered rules with (25) coming first ("SPE", p. 224).

Variables

9.55 Finally we should mention abbreviation by means of paired variables, i.e. GREEK LETTERS (α , β , γ etc.) whose function is to indicate variable feature values. Thus $[\alpha\text{vocalic}]$ is an abbreviation for the two terms $[+\text{vocalic}]$ and $[-\text{vocalic}]$.

There are always two alphas (or betas etc.) in a rule, and they are interpreted as indicating the same value, i.e. if $[\alpha\text{voc}]$ occurs twice in a rule this abbreviates two rules, one with + substituted for both alphas and one with minus substituted for both. It is not possible to substitute plus for one alpha while substituting minus for the other. But it is possible to negate an alpha symbol ($-\alpha$) so that it specifies the opposite value of an α occurring elsewhere in the same rule: i.e. $[\alpha\text{voc}]$ and $[-\alpha\text{voc}]$ in the same rule should be interpreted either as $[+\text{voc}]$ and $[-\text{voc}]$ or as $[-\text{voc}]$ and $[+\text{voc}]$.

This notation may be used in the case of exchange rules. For example, the rules $[+\text{high}] \rightarrow [-\text{high}]$ and $[-\text{high}] \rightarrow [+\text{high}]$ may be abbreviated to $[\alpha\text{high}] \rightarrow [-\alpha\text{high}]$. If an α is assigned a plus value, $-\alpha$ will have a minus value, and if an α is assigned a minus value, $-\alpha$ will have a plus value.

Variables are also very useful in assimilation and dissimilation rules. Voicing assimilation in obstruent clusters, for example, may be expressed by means of the following rule:

$$(28) \quad [-\text{son}] \rightarrow [\alpha\text{voice}] / \text{ — } \begin{bmatrix} -\text{son} \\ \alpha\text{voice} \end{bmatrix}$$

This means that an obstruent is voiced before a voiced obstruent and devoiced before a voiceless obstruent.

The first part of the vowel shift rule discussed in 9.50 above (exchange of *e* and *i* and of *u* and *o*) may be written like this:

$$(29) \quad \begin{bmatrix} \alpha \text{high} \\ -\text{low} \end{bmatrix} \rightarrow [-\alpha \text{high}] \quad / \quad \begin{bmatrix} +\text{tense} \\ +\text{stress} \end{bmatrix}$$

By this rule, then, a tense stressed non-low vowel which is [+high] becomes [-high], and a tense stressed non-low vowel which is [-high] becomes [+high] ("SPE", p. 256).

In the examples mentioned above Greek letters qualify the same feature, but they may also be used with different features. Thus, for example, the rule $[\alpha \text{back}] \rightarrow [\alpha \text{round}]$, expresses a process by which back vowels become rounded and front vowels unrounded.

Sometimes it is necessary to have several variables. For example, the rules by which the place of articulation of a nasal consonant is assimilated to that of a following consonant may be joined together in the following schema:

$$(30) \quad \begin{bmatrix} +\text{nas} \\ -\text{voc} \end{bmatrix} \rightarrow \begin{bmatrix} \alpha \text{ant} \\ \beta \text{cor} \\ \gamma \text{high} \\ \delta \text{back} \end{bmatrix} \quad / \quad \text{---} \quad \begin{bmatrix} -\text{son} \\ \alpha \text{ant} \\ \beta \text{cor} \\ \gamma \text{high} \\ \delta \text{back} \end{bmatrix}$$

As an example of one variable serving to express two changes Wang (1968, pp. 697-8) mentions Danish, where *t* and *d* in final position are changed to *d* and *ð* respectively. He assumes that *t* is defined as [+tense, -cont], *d* as [-tense, -cont], and *ð* as [-tense, +cont]⁸³ and then sets up two rules:

$$(31) \quad [+tense] \rightarrow \begin{bmatrix} -\text{tense} \\ -\text{cont} \end{bmatrix} \quad (t \rightarrow d)$$

$$(32) \quad [-tense] \rightarrow \begin{bmatrix} -\text{tense} \\ +\text{cont} \end{bmatrix} \quad (d \rightarrow \text{ð})$$

which may be combined into

$$(33) \quad [\alpha \text{tense}] \rightarrow \begin{bmatrix} -\text{tense} \\ -\alpha \text{cont} \end{bmatrix}$$

EVALUATION AND EXPLANATION OF RULES AND UNDERLYING FORMS

9.56 It is obvious that if the underlying phonological forms are not established according to any definite procedure but are set up intuitively, then the method of evaluating these forms becomes extremely important. This problem has already

83. This problem is discussed in detail in Rischel (1969 b).

been dealt with in the introduction to this chapter (9.6) and in the discussion of distinctive features (9.29).

The essential claim is that the description should attain descriptive and explanatory ADEQUACY (see 9.6 above) and this involves that the formal devices must permit the formulation of "general statements about the language which are true and significant, and must provide a basis for distinguishing these from other generalizations which are false, or which are true but not significant" ("SPE", p. 330). On p. 296 of "SPE" a LINGUISTICALLY SIGNIFICANT GENERALIZATION is described as "a 'regularity' of the sort that a child will use as a way of organizing the data he is confronted with in the course of language acquisition".⁸⁴ (See also Kiparsky 1968, pp. 170-1). Significant generalizations thus characterize the native speaker's competence. A selection among the possible generalizations must involve an evaluation procedure. Now the speaker's competence cannot be observed directly, nor by introspection (in "Aspects", p. 8 Chomsky states that generative grammar will be dealing for the most part with "mental processes that are far beyond the level of actual or even potential consciousness"). But it is assumed that the speaker operates with maximally general and natural rules. In his paper of 1961 Halle distinguished between natural and unnatural classes of sounds (see 9.26 above); *i, u, y*, for example, is a more natural class than *i, p, r, s*. Postal (1968, p. 55ff) developed this concept further. He argued that systematic phonemic and phonetic structures are connected by the NATURALNESS CONDITION. This means that the mapping between the two levels is phonetically motivated and to a certain extent universally given. The variant phonetic mappings of a single systematic segment will normally form a NATURAL CLASS, and those classes of systematic segments (morphophonemes) which must be referred to in the rules of natural languages will in general have phonetic realizations which form natural classes in terms of phonetic features (Postal 1968, pp. 73-4). Halle stated that the degree of naturalness of a class can to a certain extent be measured as being inversely related to the number of features needed to define it (see 9.26 above). This measure does not, however, always give the correct result. The class of voiced obstruents is, for example, intuitively more natural than the class of voiced segments (consonants and vowels) although the latter has a simpler definition ("SPE", p. 400). The same is true of rules. It is possible to establish rules of the same complexity, one of which is more natural than the other: e.g., $k \rightarrow \bar{k}$ as compared with $\bar{k} \rightarrow k$. It is therefore necessary to take the intrinsic content of features into account, and this leads to the theory of marking, which attempts to establish rules concerning universally normal and expected properties ("SPE", p. 400ff). The intuition about natural classes is according to Chomsky and Halle ("SPE", p. 335ff) corroborated by the fact that such classes are relevant for the formulation of phonological processes, both synchronic and diachronic.

84. Rischel (1974, p. 359) has a somewhat less specific formulation of the same idea: "I take a generalization to be significant if it is a sort of information which might be relevant to a speaker's mastery of his language".

The next step is to attempt to establish a formal system which will permit the expression of such generalizations, and as a first measure of the simplicity of a formulation the NUMBER OF SYMBOLS (apart from brackets of all sorts and arrows) was proposed (cf. some earlier papers by Halle, 1961, 1962b, 1964). But this presupposes that the symbolic system is selected in such a way that fewer symbols are actually used to account for linguistically significant generalizations, which is not a matter of course. The use of features instead of alphabetic symbols is assumed to lead to this result (see 9.29 above), and the hypothesis has therefore been advanced that a feature symbolization permits an adequate description (Chomsky and Halle 1965).⁸⁵

More precisely the evaluation measure is described in the following way ("SPE", p. 334): "The 'value' of a sequence of rules is the reciprocal of the number of symbols in its minimal representation", or "in the minimal schema that expands to this sequence". This implies that one does not count symbols in separate rules but in the schemata into which the rules may be abbreviated, i.e. in the most generalized formulation ("SPE", p. 334). It is claimed, then, that the number of symbols can be made inversely proportional to the degree of linguistically significant generalization achieved (p. 335). The notational devices and the evaluation measure jointly characterize the notion "linguistically significant generalization". Chomsky and Halle admit that this is a hypothesis, and it does not seem an easy one to verify.

As a matter of fact several specific problems have turned up in connexion with this evaluation. For example, it is frequently the case that symbols may be saved in the lexicon by making the rules more complicated, and vice versa. Which of these two considerations should now override the other? (cf. Harms 1966 and 1968, p. 88ff, McCawley 1968, p. 47ff, Zimmer 1969a). In "SPE" it is stated that a redundancy condition should result in a saving of more features in the lexical representation than the number of features required to state the condition itself (p. 389). But only a few lexical items need fall under such a condition in order to obtain such a saving. And as pointed out by Harms (1966) the lexical point of view will generally be decisive if lexicon and rules count the same. On the other hand, it would not be reasonable to disregard the lexicon completely and to reject a considerable saving in the lexicon simply because of the cost of a single additional rule. Actually, a reliable method by which these factors may be weighted against each other has not yet been devised. Postal (1968) suggests that exception features should be particularly costly. Heles Contreras (1969) discusses the issue of whether the symbols presenting variables should be less

85. In his criticism of generative phonology F. W. Householder (1965) makes some ironical remarks about the simplicity obtained by replacing three alphabetic symbols by thirty-three features. To this Chomsky and Halle replied (1965) that linguistic simplicity is not a question of saving ink. The feature notation is naturally clumsier, but that is not really the point. It is not possible to compare two theories which employ different symbolisms by counting symbols.

costly than ordinary features, since they are more general. This is taken for granted by King (1969, p. 216) who also treats this subject. The problem of the simplicity metric is thus far from being solved.

Moreover, it has been emphasized that a rule which is simpler than another may frequently be less plausible phonetically (Zimmer 1969a) and have less explanatory power (Ladefoged 1970, cf. also Wang 1968). On the whole there is an increasing scepticism as to the possibility of correlating naturalness with notational simplicity. Stephen Anderson (1974, p. 296) and Vennemann (1972a) go so far as to suggest that description and explanation should be kept apart (cf. also Wang's proposal (9.42) that marking conventions should only be used as a sort of "price book").

Several of the younger generative phonologists are therefore less interested in rule formulation and more interested in finding out which rules can in some sense be said to express linguistically significant generalizations and thus be assumed to be part of the speaker's competence, and how these rules can be explained.

SKOUSEN (1972 and 1973) has investigated a number of regularities in Finnish, and on the basis of facts of historical change and treatment of loanwords he tries to show which of the rules are PRODUCTIVE (i.e. captured by the speakers). He finds that vowel harmony is productive, whereas consonant gradation is not. This does not mean that speakers are not aware of consonant alternations, but whereas vowel harmony is introduced automatically according to rules in loan words and new compounds, this is not the case with consonant gradation. Changes in consonants take place according to surface patterns of alternation and not according to phonetically plausible rules. He concludes that consonant gradation does not represent a psychologically real rule in Finnish.

RISCHEL in his analysis of West Greenlandic (1974) also claims that many conspicuous regularities are in fact non-productive, and he concentrates his description on a functional kernel of relatively simple productive rules.⁸⁶

As for the explanation of patterns and rules OHALA (1972b) argues that the naturalness of sound patterns can only be explained by the use of models which incorporate the known universal physical processes giving rise to them. SCHANE (1973) finds that the main types of natural rules are (1) assimilative rules, (2) rules that simplify syllable structure and (3) rules leading to maximum differentiation, and that there is a tendency to make segments less marked. He looks for ultimate explanation of these tendencies in articulation and perception. He finds obvious similarities between marking conventions and natural rules and assumes that natural rules have the task of reimposing universal naturalness constraints on derived structures, when these constraints have broken down because of the concatenation of morphemes to words and phrases.

Others have looked for more language specific explanations. KISSEBERTH (1970) has pointed out that a number of apparently unrelated rules can have related

86. For the distinction between productive and unproductive rules, see also Henning Andersen (1969, p. 826).

effects (a phenomenon which incidentally is familiar from diachronic phonology, cf. M. Grammont's old theories of tendencies). Both consonant deletion and vowel epenthesis rules may, for instance, bring about a reduction of consonant clusters. This common effect (which he also calls "conspiracy") cannot be expressed by collapsing of rules or by other notational simplifications. He proposes to set up a number of language specific OUTPUT CONDITIONS (or "derivational constraints") which may block the operation of rules with undesired effects.

RISCHEL (1974, p. 433 ff) also emphasizes that there is a considerable functional unity to the productive phonological rules in West Greenlandic and that a tendency towards sequential simplicity accounts for most of the rules. Both general tendencies and language specific factors seem to be at work.

KIPARSKY (1972) finds that in some cases the generative rule formulation really yields a deeper understanding of the processes, for instance by showing the relationships between rules, but he admits that many regularities cannot be captured in this way. It may therefore be necessary to set up some functional conditions pertaining to the output of the rules, thus to surface structure, and ultimately explicable by the requirements of performance. He mentions three types of conditions: (1) distinctness conditions which state that there is a tendency for semantically relevant information to be retained in surface structure. This may lead to blocking of rules in environments in which their free application would wipe out morphological distinctions on the surface (cf. Sapir, 2.12 above); various examples of such blocking are given; (2) levelling conditions, which state that allomorphy in paradigms tends to get eliminated and (3) conspiracies and derivational constraints. On this point he follows Kisseberth, but he emphasizes that phonological conspiracies always seem to avert configurations which must be characterized as complex or highly marked in terms of universal grammar. Like Schane he thus stresses the universal aspect of these tendencies.

A common feature in these recent contributions to generative phonology is the importance attached to surface constraints which have been completely neglected in generative phonology until now (see also 9.71 below).

Other critics have been still more radical. BOTHA (1971, pp. 76-115) criticizes the use of the concept of "linguistically significant generalizations" from a methodological point of view. He shows that there is no valid criterion that can be used by the linguist for distinguishing between linguistically significant and non-significant facts, and that the evaluation measure can be used only if it is known that the formal devices used in formulating the rules permit this distinction. But this has not been proved. DERWING (1973, pp. 109 ff and 130 ff) also criticizes the basis of the evaluation measure. He refers to the statement made by Chomsky ("Aspects", p. 37) that the evaluation measure is an empirical hypothesis about the nature of language. This means that the generativists have incorporated into the formal devices an *a priori* assumption about the kinds of rules which a child would prefer when learning a language (based only on the professional intuitions of the analyst himself), and that an evaluation measure is chosen which "constitutes

a *decision* as to what are "similar processes" and "natural classes" – in short, what are significant generalizations" ("Aspects", p. 42). But how, Derwing asks, can we resolve an *empirical* issue by making a "decision" or by defining the problem away? Chomsky and Halle have said (1965, p. 109) that the hypothesis can be tested on grounds of descriptive adequacy. But descriptive adequacy involves significant generalizations, so this is a circular argumentation (see also the discussion of psychological reality 9.72 below).

DIACHRONIC PHONOLOGY

MAIN CONTRIBUTIONS

9.57 The most important contributions to the description of diachronic phonology from a generative point of view have been made by HALLE (in his article "Phonology in Generative Grammar", 1962b); by KIPARSKY (in his MIT thesis of 1965 and in "Linguistic Universals and Linguistic Change", 1968b); and by POSTAL (Part II of his "Aspects of Phonological Theory", 1968). Robert D. KING's "Historical Linguistics and Generative Grammar" (1969) provides an excellent survey of the results obtained and contains a wealth of instructive examples.

GENERAL CHARACTERISTICS

9.58 The generative approach to diachronic phonology differs from that of other phonological trends at various points. The most crucial is the conception of historical phonology as a HISTORY OF THE COMPETENCE OR GRAMMARS OF SUCCESSIVE GENERATIONS OF SPEAKERS.

This means in the first place that the Bloomfieldian view of sound change is repudiated. As mentioned in 6.33 above Bloomfield accepted the neogrammarian conception of sound change as being a purely phonetically determined, mechanical process,⁸⁷ whose regularity is only affected by borrowing and analogy processes, which are of a quite different type. The principal cause of sound change was assumed to be the general variability of pronunciation which leads to "drift of allophones", i.e. to gradual sound change. As late as 1965 Hockett adopted the same view. Postal (1968) attacks this approach. He emphasizes that only the changes in the speaker's competence, not the fluctuations in his performance are important. Sound change is therefore a psychological, not a mechanical, process, and the change takes place in leaps, not gradually. He also emphasizes that grammatical and semantic conditions play a role in historical changes, just as in synchronic generative rules. There is thus no sharp distinction between sound change and analogy (cf. also King, p. 105 ff).

87. Unlike Bloomfield, however, the neogrammarians were not antimentalists. They would refer to sound change as a change in the speaker's "Bewegungsgefühl".

Moreover, since the change in the competence of successive generations is the central fact, the traditional descriptions of sound change are often found to be rather uninteresting. King says (1969, p. 104): "The listing of rules converting the sounds of proto-Indo-European into those of West Germanic may be of interest as an exercise in ingenuity and distinctive feature virtuosity, but historical linguistics it is not".

In contradistinction to the Bloomfield School the Prague phonologists were concerned with the development not of single elements, but of whole systems (see 3.16-18 above). This too the generative phonologists find to be rather irrelevant. King, for example, says (1969, p. 39): "The study of linguistic change is the study of how grammars of languages change in the course of time. We have nothing to gain from comparing phoneme inventories at two different stages of a given language and seeing what sound has changed into what other sound. Such a comparison gives as little insight into linguistic change as a comparison of before-and-after pictures of an earthquake site give into the nature of earthquakes". This disregard for phonological systems (in the sense of an arrangement of the phoneme inventory according to common distinctive features, e.g. the vowel triangle) and for their role in sound change is characteristic of generative phonology.⁸⁸ The competence of the speaker is not thought of as the mastery of a system. Later in his book, however, King quotes Martinet's theories with partial approval (see 9.66); and in the discussion of linking rules in "SPE" (see 9.45 above) the system is also taken into account.

TYPES OF CHANGE IN COMPETENCE

INTRODUCTORY REMARKS

9.59 King (1969, p. 39ff) gives a systematic survey of different types of change. He distinguishes between changes in UNDERLYING REPRESENTATION ("restructuring") and changes in the RULE COMPONENT ("primary change"). The latter type comprises four subtypes: (i) rule addition, (ii) rule loss, (iii) rule reordering, (iv) simplification. The terminology is, however, not quite fixed. Some authors use the term "restructuring" in a wider sense, including certain types of change in the rule component. And simplification is also used in a wider sense including rule loss, rule reordering and analogy. Kiparsky often uses simplification in this latter sense.

Changes in the rule component are more frequent than changes in underlying forms, since the latter are rather resistant. Changes in rules were first described as such by Halle (1962b, cf. also "SPE", p. 249ff), but as a matter of fact, this is not a completely new idea. De Groot (1941, see the Bibliography to Chapter 3), who in many matters takes up a separate attitude within the Prague School,

88. With a few exceptions, see 9.22.

proposed that a sharp distinction should be drawn between the development of phoneme systems and of word forms. According to him phonetic laws apply to word forms. "A diachronic phonetic law is nothing but the formulation of the substitution of one synchronic phonetic law for another" (p. 95). De Groot talks about changes in surface forms. In generative phonology the point of view is somewhat different, because particular interest is here attached to rules leading from underlying forms to surface forms.

RESTRUCTURING (CHANGE OF UNDERLYING FORMS)

9.60 Restructuring takes place in the language of the child. If, for example, the adult speaker has introduced a rule deleting *h* before *w* (i.e. maintaining *hw*- in his underlying representation), the child may interpret the language as having underlying forms without *h*, thereby changing the underlying form of words from that in the grammar of the adults around him. In order to illustrate this point, King (p. 92 ff) gives a detailed description of the development of German umlaut. There is no change in the underlying representations until almost all the sounds causing the umlaut have disappeared. First *j* is dropped, then *i* in closed syllables becomes *e*, and finally *i* in open syllables undergoes the same change, *i* being retained only in a few derivatives (*-lich*, *-in*). At this stage (early Middle High German) it is, according to King, no longer justified to derive all umlaut vowels from underlying *u*, *o*, *a*, and consequently *y* and *ø* must be added to the inventory of underlying vowel segments (cf. also Wurzel 1969, p. 105 ff). In traditional phonology *y* and *ø* are set up as separate phonemes as soon as the first *j* has disappeared.

CHANGES IN THE RULE COMPONENT

Rule Addition

9.61 HALLE assumes that the initial stage of a historical change normally consists in RULE ADDITION, and since the adult speaker is probably incapable of eliminating rules or of restructuring the grammar, this addition will usually be made AT THE END OF THE RULE COMPLEX, or possibly at the end of some closed subcomponent of the total system of rules (e.g. at the end of the transformational cycle). In this way the set of rules may become more complex than necessary and when the next generation takes over the language a restructuring takes place, since the child (cf. "SPE", p. 251) will construct the simplest possible grammar which accounts for the data (a rather bold assumption). Halle (1962b, p. 65) adduces the following example (cited here in a somewhat simplified form): A given language may have a rule according to which all non-low unrounded vowels are front vowels, whereas a low unrounded vowel is [+back]. In terms of features this may be expressed in the following way:

- (1) $[-\text{low}, -\text{round}] \rightarrow [-\text{back}]$

If *a* is now changed into *æ* the following rule can be added:

- (2) $[+\text{low}, -\text{round}] \rightarrow [-\text{back}]$

However, this is not an optimal formulation, and the children of the next generation will therefore simplify these two rules to one:

- (3) $[-\text{round}] \rightarrow [-\text{back}]^{89}$

KIPARSKY is also of the opinion that the typical form of a rule addition is due to rule borrowing among adults, and that simplification characteristically occurs when the next generation of children acquire the language. That borrowing is considered to take place especially among adults is somewhat surprising, since it is a well-known fact that the child in his linguistic habits largely conforms to other children of the same age, and most likely takes over rules from them. It is quite probable that both the borrowing and the simplification of rules primarily take place in childhood, and this possibility ought to be looked into.

Halle also mentions the possibility that rules may be ADDED at an EARLIER POINT in the synchronic rule complex, though this possibility was first seriously explored by Kiparsky in his 1965 thesis.

POSTAL (1968) quotes a number of examples from Mohawk. In this language, an epenthetic vowel has developed in the cluster *kw*, but not invariably. If the cluster represents what Postal treats as an underlying *p*, for instance, the epenthesis does not take place, in spite of the fact that the change of *p* to *kw* is supposedly two thousand years older than the addition of the epenthesis rule to the grammar of Mohawk.

It is naturally a necessary condition for such non-chronological rule addition that elements which have merged phonetically at an earlier stage are still to be derived from different underlying forms, on the basis of alternations or of their different effects on adjacent sounds.

A frequently quoted example is Lachmann's Law, a rule in Latin according to which a vowel is lengthened under certain conditions before consonant clusters beginning with a voiced obstruent. It now turns out that this lengthening also takes place in a word like *āktus* (**ag+tus* from the root of *agō*), as opposed to *fāktus* (from the root of *fākiō*), in spite of the fact that *āktus* has a long-established *kt* in this position. The change of voiced obstruent into voiceless before voiceless consonants dates back to Proto-Indo-European, while Lachmann's Law is clearly a Latin innovation. In generative phonology this is accounted for by saying that

89. According to the most recent version of generative phonology rule (1) is a universal marking convention, and the rules will therefore be different. However, this example illustrates Halle's hypothesis in a simple way.

the vowel lengthening rule has been added at an earlier place in the rule complex than the older assimilation rule, so that it applies to the underlying form /agtus/.⁹⁰

Rule Loss

9.62 In German a rule has been added which devoices final obstruents (cf. [bunde – bunt]). However, in certain (Swiss German) Yiddish dialects this rule has been lost again, i.e. the older form *bund* has been reintroduced.⁹¹ That these dialects really had devoicing at an earlier stage is clear from the fact that the adverb *veg*, which has not been subject to any levelling from related forms, is still pronounced [vek]. As mentioned above, Kiparsky calls this type of development a simplification.

Rule Reordering

9.63 A different type of simplification is rule reordering (or rule reversal). Halle (1962b) had already pointed out the possibility that as a result of such a reversal one dialect may have one ordering and another dialect a different ordering of the same two rules. As mentioned in 9.51 a distinction is made in certain types of American English between *ay* and *a-y* before the flap *D*, according to whether the (voiced) flap is derived from an underlying *t* or *d* (cf. *writer* [rayDir] vs. *rider* [ra-yDir]). In other American dialects, however, [ra-yDir] occurs in both cases. In the first group of dialects the lengthening rule must precede the rule changing *d* and *t* to *D*, while in the second group of dialects it must follow this rule. Kiparsky mentions an example from Finnish, where long mid vowels have been diphthongized, e.g. *vee* → *vie*. At a later stage new instances of long *e* have arisen through loss of *γ*, e.g. *teye* → *tee*, and this new *e*: is not diphthongized in the standard language. In certain dialects, however, the new *e*: is also diphthongized (e.g. *tee* → *tie*). This may be described as a reversal of rules: in these latter dialects the loss of *γ* precedes diphthongization.

Another example is taken from Moulton's description of Swiss German dialects. In some dialects *o* turns into *ɔ* before certain consonants; the mid front vowel *ø*, however, is not lowered in this environment, and we therefore find e.g. [bødə], plural [bødə]. In other dialects there is also a change of *o* to *æ*, but only in those cases where there is another form of the same word containing an *ɔ*, e.g. [bødə], plural [bædə], but [plotsli]. The change of *o* to *æ*, therefore, is not a general

90. Stephen Anderson has drawn my attention to the fact that Watkins ("Harvard Studies in Classical Philology", 74, 1972, pp. 55-74) has demonstrated that Lachmann's Law cannot be formulated in phonological terms, but is rather a morphological process. As such, its interaction with voicing assimilation is irrelevant, and the example is therefore invalid as a proof of the possibility of non-chronological rule insertion.

91. This is, however, a special case since these dialects had lost most word-final schwas through apocope (Stampe 1969), and thus got word-final voiced consonants (see also Linell 1974, p. 128 ff).

lowering, but rather umlaut of *ɔ*. This may now according to Kiparsky be described as a reversal of rules: In the former dialects the umlaut precedes the lowering of *o*, in the latter dialects the order has been reversed.

As a final example we may mention the German final devoicing rule again, seen this time in relation to the rule which lengthens vowels before voiced obstruents⁹² (cf. King, pp. 51-4). The original nominative and genitive forms of the German noun *Lob* ('praise') were *lob* - *lobes*. After the introduction of the devoicing rule for final obstruents (around A.D. 1000) we get *lop* - *lobes* (these are Middle High German forms). Then the vowel lengthening takes place (around A.D. 1400), resulting in the forms *lop* - *lo:bes*, and finally by simplification we get *lo:p* - *lo:bes*. The underlying forms are, however, still *lob* - *lobes*. Now in the synchronic description of the stage just before the lengthening of *lop*, it is evident that the rules must be placed in an order corresponding to the chronological order: (1) final devoicing (2) vowel lengthening. After the lengthening of the vowel in *lo:p*, however, the rules must be reversed: (1) vowel lengthening (2) devoicing; otherwise there will not be any lengthening in *lo:p*. According to traditional description the lengthening in *lo:p* would be considered due to analogy, but King emphasizes (p. 133) that there is no reason to believe that the change has been caused by analogical pressure from other forms in the paradigm that have long vowels. Rule reordering may be the basic event, seen as a form of simplification.

It is important to realize that reversal of rules has nothing to do with the chronological order in which changes take place. This order cannot, of course, be reversed. The reversal takes place in the synchronic order of rules leading from underlying forms to surface forms in the competence of a new generation.

KIPARSKY now lays down a general principle underlying such changes of rule order. As mentioned in 9.51 above the relation between two rules may be such that one of them increases the number of examples which the other may apply to. The former rule is then, in Kiparsky's terminology, a "feeding rule" as compared with the latter, and if it comes first in the rule complex the rules are in FEEDING ORDER. Kiparsky assumes that there is a general tendency for rules to occur in "feeding order", and this explains e.g. the reversal of rules in the Finnish example: After the change the rule of *γ*-deletion precedes diphthongization, which thereby applies to a larger number of cases. Thus *γ*-deletion comes to "feed" diphthongization.

It may also happen that one rule reduces the number of examples to which the other may apply. The former is then a "bleeding rule", and if it comes first in the rule sequence the rules are in BLEEDING ORDER. Kiparsky assumes that there is a tendency towards avoiding this ordering. In the Swiss German dialects where umlaut precedes lowering the rules apply in a bleeding order, since the umlaut of *o* to *ø* reduces the number of *o*-sounds to which the lowering rule

92. The traditional formulation of this rule is, incidentally, that vowels are lengthened in open syllables.

applies. This ordering is reversed in some dialects to avoid the bleeding relation between the rules.

These two tendencies may now be subsumed under the general principle that rules tend towards an ordering which permits their maximum utilization.

CHAFE (1967) has discussed some of the same examples as Postal and Kiparsky and offered somewhat different explanations. As regards Postal's example from Mohawk he points out that an epenthetic vowel occurs in the cluster *kɔv* only if there is a morpheme boundary, and it is therefore unnecessary to assume that the epenthesis rule does not apply to an underlying *p* etc. It is simply a conditioned rule, which applies in certain environments and which could be added anywhere.

Chafe is willing to accept that a new rule may be "pushed up", but this can only take place under certain conditions (for example, if the last rule in the existing rule complex is "persistent" according to his terminology (cf. 9.51)). Such a persistent rule will raise a new rule by one step in the hierarchy, with the result that it may itself apply to the output of this new rule.⁹³ Chafe now believes that the devoicing of obstruents before voiceless consonants is a persistent rule in Latin. The result of this is that the lengthening rule (Lachmann's Law) is raised and applies to the underlying form /*agtus*/, which subsequently turns into /*āktus*/ by the operation of the devoicing rule. It is naturally the synchronic result of the historical change which is being discussed, both here and above: i.e., it is not presumed that a surface form **agtus* existed at any time in the historical development of Latin. Chafe also assumes that the diphthongization rule has become persistent in those Finnish dialects where it also applies to *tee* derived from an earlier *teye*. To the present writer this seems to be an attractive solution.

According to Koutsoudas, Sanders, and Noll (1974), who maintain that all rule ordering is determined by universal principles (see 9.51 above), the same two rules cannot be ordered differently in different dialects, and rule reordering cannot take place. They therefore have to describe the given examples differently, by assuming addition or loss of rules in one of the dialects, or differences in the applicability of the rules. In the case of the Swiss dialects mentioned above, they assume that the dialect which has the form *bodə* possesses an extra rule excluding low front rounded vowels.

Simplification

9.64 Simplification in the narrower sense (as used, for example, by King 1969, p. 58) means GENERALIZATION. A rule may, for example, be changed so as to apply to more members of a natural class; in Old English, for instance, the final devoicing rule originally applied to fricatives only, but later came to include stops as well. This can be described as a simplification consisting in the loss of the specification [+continuant] from the environment of the rule. It may also happen

93. Persistent rules may apply at a number of levels, but they will always apply at the end of the rule complex.

that the conditions of a rule are made more general. In a wider sense rule loss and rule reordering can be included under this term.

Although King talks about "competence" changes he emphasizes that the linguist's grammar is only a model of the internalized grammar (the competence) of the speaker, and there is no reason to assume a point by point correspondence between the two. Thus, when we say that the speaker has added a rule to his grammar this is only a shorthand way of saying that the data are best accounted for in the linguist's model by the addition of a rule. "What has happened to the inside of the adult speaker's head is something we at present haven't the faintest notion of" (p. 66). On this point King is more cautious than many generative phonologists.

THE CONNECTION BETWEEN SYNCHRONIC AND DIACHRONIC RULES

9.65 It will be seen that there is a very close connection between diachrony and synchrony in generative phonology, and the interest in diachrony originates partly from the assumption that a deeper understanding of competence may be obtained through the study of diachronic phenomena. This point has particularly been emphasized by Kiparsky, who has adduced diachronic examples in support of claims about the organization of synchronic grammars. On the other hand synchronic rules may in many cases shed light on historical development.

If rules were always added at the end of the rule complex, the set of synchronic rules would be a simple reflection of historical rules. Conversely all historical rules which have left any traces in the form of alternations would remain as synchronic rules, so that the original underlying forms are retained. However, it may happen (cf. Chafe 1967) that a late rule gradually restricts, or perhaps almost neutralizes the effect of an early rule, which consequently has no motivation in the synchronic description. For example, the only trace of Verner's Law in modern English is *was-were*, and it is therefore most reasonable to assume that there is an *r* in the underlying form of *were*.

The fact that rules normally have the same order historically and synchronically forms the basis of the method of internal reconstruction, which consists in reconstructing historical forms exclusively on the basis of alternations in an individual language. On the basis of German alternations like *bunda - bunt*, for example, one may hypothesize that at an earlier stage the corresponding forms were *bunda - bund* and that *d* has then turned into *t* finally. The underlying assumption here is that the root of the word must originally have been the same in different environments (cf. the attempt to reduce the variants of a given morpheme to a single underlying form in the synchronic description).

If it is not possible to carry out a complete reconstruction of an earlier linguistic state, this may be due partly to the fact that some rules have been added at an earlier place in the rule complex, and not at the end; partly to simplifications made

by the new generation acquiring the language; and partly, also, to the fact that some historical changes take place unconditionally (e.g. $p > f$ in Germanic), and therefore leave no traces behind.

EXPLANATIONS OF SOUND CHANGE

9.66 So far generative phonologists have primarily been interested in the various types of change, and not nearly so much in the causes of sound change. According to King, however, this problem should also be investigated. He mentions Martinet's attempts at explaining sound changes with partial approval. Martinet's theory of economy fits in quite well with the generative phonologists' assumption of a tendency towards simplification, and King thinks that there is something sound in the idea of a "drag-chain" (e.g. $u \rightarrow y$ and after that $o \rightarrow u$, cf. 3.18 above), which he attempts to explain as a simplification of rules. However, he refuses to recognize "push-chains" because they presuppose the existence of gradual changes.

The increasing interest in naturalness and in explanations of phonological rules is also noticeable in historical phonology. Often synchronic and diachronic arguments are not kept clearly apart. This is, for instance, true of Kiparsky's paper of 1972 mentioned at the end of 9.56. Bach and Harms (1972) suggest that there are strong naturalness constraints on the initiation of phonetic rules, but transmission and simplification may lead to implausible rules. Lass (1972) adduces a number of facts from the history of Germanic languages in order to show that rounded front vowels are unnatural in these languages. Naturalness is language-specific. Venne-mann (1972a) discusses markedness and sound-change. Dressler (1971) finds that the difference between distinctive and redundant features is of no importance in linguistic change and suggests that phonological change is primarily phonetic change (concerning explanation of sound change, see also 12.16-21).

GENERATIVE PHONOLOGY IN RELATION TO OTHER PHONOLOGICAL SCHOOLS

INTRODUCTION

9.67 Other phonological schools are very roughly handled in generative works. In "Current Issues" (p. 75ff), for example, Chomsky attempts to demonstrate that their procedures are totally unacceptable, and in "Aspects of Phonological Theory" Postal uses a good deal of space in polemicizing fiercely against other theories, employing a number of derogatory expressions (such as "false", "wrong", "absurd", "completely senseless", "incredible errors" and "intolerable consequences"). On the other hand, Householder (1965, 1966) and Hockett (1968) have retorted in the same style. For example, Hockett writes that "the whole rule

terminology becomes a bad one: it merely is a misleading, overly cumbersome and (in some circles) dishonestly prestigious substitute for the simpler traditional terminology" (1968, p. 87).

The tone recalls that of the 1880s when the fight about the mechanical regularity of sound change was going on. The neogrammarians were very young and self-confident, and the same may be said about many of the generative phonologists.

Chomsky characterizes previous phonological approaches as "taxonomic phonemics", and this term has been widely accepted. The choice of the word "TAXONOMIC" implies an accusation that the proponents of the theories concerned were occupied only with segmentation and classification, and consequently only with "observational adequacy" (cf. 9.6 above). This is not quite fair to the post-Bloomfieldians, who also took an interest in establishing rules of phoneme combinations and in distinguishing between permitted and non-permitted combinations, and it is completely unfair to the Prague phonologists, who considered the establishment of universal laws one of the principal goals of phonology. Glossematics has not been included in the discussion (cf. 9.2 above). Evidently Chomsky did not find it worth while to devote too much time to it, and he has therefore not discovered the various points of resemblance between glossematics and generative phonology (the interest in universals, the deductive method, the morphophonemic point of view, etc.). His criticism simply does not apply to glossematics. But he would naturally be opposed to the separation of form and substance, which prevents the application of the "naturalness" principle, and he would be able to criticize rightly Hjelmslev's rules of manifestation, which are evidently unsatisfactory.

Postal, who attaches more importance to the claim made in some previous schools that phonology should be independent of grammar, uses the designation "autonomous phonemics". But this does not apply to the Prague School (cf. Vachek's explicit repudiation (1964)), nor to glossematics, which Postal does not discuss at all. Sidney Lamb (1966b (Bibl. to ch. 10), p. 539), whose "stratificational grammar" is also fiercely attacked, prefers the term "C-phonemics", an abbreviation of "conventional" or "classical" phonemics, and points out that this is not the same as Chomsky's "taxonomic phonemics" – "a system apparently created by himself to serve as the helpless victim of dramatic onslaught" (Lamb 1966b, p. 540).

CHOMSKY'S CRITICISM OF TAXONOMIC PHONEMICS

9.68 Chomsky criticizes the Bloomfield and Prague Schools for basing their phonological analyses on a discovery procedure (cf. 9.5), which he finds impracticable, and for using a number of untenable criteria in their procedures. According to his analysis of taxonomic phonemic theory it requires that phonological representations meet the following four conditions: (1) linearity, (2) invariance, (3) biuniqueness, and (4) local determinacy ("Current Issues", p. 78ff, cf. also Chomsky and Miller 1963, p. 310ff, and Postal 1968, p. 53ff).

(1) The LINEARITY CONDITION requires that each occurrence of a phoneme in a given string be associated with one (or possibly more than one) phone, such that if A follows B in the phonemic representation, then the phone(s) associated with A also follow(s) the phone(s) associated with B in the phonetic representation. This claim is rejected by Chomsky since it would preclude the most reasonable analysis in a number of cases. For example, *can't* may be realized as [kæ̃t] in American English, and if the linearity condition were maintained one would have to analyse it as /kæ̃t/, rather than as /kænt/, which everybody does. This is because there is no phonetic basis for locating the vowel nasality after the vowel itself. In *writer-rider*, furthermore, the phonetic difference lies in the diphthong, but phonologically it should be ascribed to the following consonant.

(2) The INVARIANCE CONDITION asserts that each phoneme should be associated with a certain set of defining features, which is present whenever the phoneme occurs. This claim cannot be maintained in the cases mentioned above where the linearity condition is violated, nor in cases of partial overlapping, such as occurs in the words *throw* and *Betty*. The flap [D] is the allophone of /r/ in *throw* and of /t/ in *Betty* (where it contrasts with the /r/ of *berry*).

(3) The BIUNIQUENESS CONDITION requires that each sequence of phones be represented by a unique sequence of phonemes, and vice versa: i.e., it should be possible to infer which phone corresponds to a given phoneme, and which phoneme corresponds to a given phone. This rules out a morphophonemic representation as the only phonological representation, since it is not in general related biuniquely to the phonetic representation (cf. 6.24 above); but it is, of course, not ruled out as the representation of a separate level.

(4) The LOCAL DETERMINACY CONDITION (which in Postal 1968, p. 228 is referred to as "phonetic determinacy") requires that "the unique phonemic representation corresponding to a given phonetic form can be determined by "purely phonetic" considerations, or perhaps considerations involving only "neighbouring sounds" ("Current Issues", p. 81). This is in fact a specification of the biuniqueness condition, i.e., partial overlapping, determined by the phonetic environment, is generally permitted, but grammatical conditions are rejected (see also p. 89).

Chomsky furthermore criticizes the concept of complementary distribution as neither sufficient nor necessary. [D] and [r] in the example above are, for instance, combined into one phoneme although they are not in complementary distribution (cf. the pair *Betty/berry*).

Chomsky claims ("Current Issues", p. 95) that any phonological description, whether generative or traditional, should fulfil the following condition: "If phone sequences X and Y contrast, then their phonemic representations must differ". However, he does not believe that it is possible to establish a valid procedure which will ensure this result, and at any rate the four conditions mentioned above will not do so. It is probably true that these four conditions cannot be strictly upheld, and in point of fact, such a heavily restricted theory has only been enter-

tained seriously by a fairly narrow circle of post-Bloomfieldians. Consequently, Chomsky's full criticism only applies to these linguists and not to phonologists of other schools. In glossematics, for example, nothing is said about these conditions, and they would also be incompatible with the glossematic resolution of neutralizations in ideal notation, with the assumption of latent consonants, with the interpretation of [dh] as a manifestation of /hd/ in Danish, etc. According to Vachek (1964), Chomsky's examples would be analysed in Prague phonology in the same way as in "Current Issues". However, Vachek thinks that these concrete examples reflect a fluctuation ("fuzzy points") in the system (and he asserts that in Prague phonology a language has always been looked upon as a system in motion). Apart from such areas of fluctuation Vachek apparently considers the four principles to be valid. This attitude is somewhat strange since none of the four principles have been laid down as absolute claims in the Prague School. The biuniqueness condition would preclude at least some neutralizations (i.e. those with freely variable manifestation in the same position), and phonetic determinacy would preclude taking word and morpheme boundaries into consideration when the conditions of variation are described, and this is often done in Prague phonology; the Prague School is also generally opposed to the "separation of levels" (Vachek 1964). The defense put up by Vachek therefore seems to be weaker than necessary.

Lamb (1966b, p. 539ff, see Chapter 10) declares that linearity and invariance are not accepted in stratificational grammar (and his theory is not linked up with a discovery procedure), but he maintains biuniqueness and phonetic determinacy, which he considers to be consequences of the "distinctiveness principle". Lockwood (Bibl. to chapter 10: 1972a, p. 656ff and 1972b, pp. 190ff and 235ff) argues convincingly for the view that the concept of neutralization is not in conflict with the biuniqueness principle.

Interestingly enough, it has been asserted by Chomsky elsewhere (Chomsky and Miller 1963, p. 314) that, although the linearity and invariance conditions cannot be strictly upheld, they are actually largely fulfilled in generative phonology also. As pointed out by Postal (1968, p. 55), they form part of the "naturalness condition", although in a weakened sense. There is a "cost" connected with violating invariance and linearity, and they therefore enter into the evaluation of the analysis ("SPE", pp. 166-9 and 297).

These criticisms of the post-Bloomfieldians may be justified on many points. Nevertheless, it is unfair to attack their phonemic analysis without at the same time acknowledging that they also established a special morphophonemic discipline, and that the generative phonologists themselves are greatly indebted to the Bloomfieldians in their morphophonemic analysis. Given both a phonemic and a morphophonemic description, it is evident that alternations should be excluded from the phonemic description to the greatest possible extent.

Derwing (1973, p. 187f) wonders why Chomsky compares generative underlying forms to Bloomfieldian phonemics and then rejects the latter, instead of under-

taking a comparison between generative underlying forms and Bloomfieldian morphophonemics.

THE POSSIBILITY OF A TAXONOMIC STAGE
IN THE DERIVATION OF GENERATIVE PHONOLOGY

9.69 The question has been posed whether taxonomic phonemics could not have a *raison d'être* as an intermediate stage in the derivation in a generative phonology. This is assumed by Wang (1968, p. 707), but it has generally been rejected by generative phonologists on the grounds that the establishment of such a stage would complicate the description and prevent significant generalizations. HALLE (1959, pp. 21-4) gave an example from Russian which has been quoted again and again (cf. Chomsky in "Current Issues", pp. 88-91 and "Topics", pp. 77-82; Postal 1968, pp. 39-44). In Russian there is regressive voicing assimilation between obstruents, i.e. a (basically) voiceless obstruent is voiced before a voiced obstruent, and a (basically) voiced obstruent is devoiced before a voiceless obstruent. This assimilation rule applies not only to segments with distinctive voicing, such as *p/b*, *t/d*, *s/z*, etc., but also to segments which do not take part in the voicing correlation (*c*, *č* and *x*). In "Current Issues" the following examples are given in systematic phonemic representation (I), taxonomic phonemic representation (II), and systematic phonetic representation (III):

I	II	III
dátʃi	dátʃi	dátʃi
dátʃi	dádʒi	dádʒi
žécʃi	žécʃi	žécʃi
žécʃi	žécʃi	žéjbi

According to this set-up the assimilation rule must be divided into two rules: a rule relating morphophonemic to taxonomic phonemic representation affecting all obstruents except *c*, *č* and *x*, and a similar rule relating taxonomic phonemic to phonetic representation and applying to *c*, *č* and *x*. This means that an important generalization is missed.

In "Current Issues" (p. 90) Chomsky says that similar examples are not difficult to find, but he only quotes one more: In some dialects of American English the vowels of e.g. *bomb* and *balm* have the same quality and are only distinguished by length /bam, ba:m/. As all vowels are lengthened before voiced obstruents, the vowel of e.g. *nod* [na:d] must be identified with the vowel of *balm* /a:/ from a taxonomic point of view, but from a morphophonemic point of view it should be a short /a/. Thus the lengthening of /nad/ to /na:d/ must be accounted for by

a rule relating the morphophonemic to the phonemic level, whereas the lengthening of e.g. *e* in *bed* must be accounted for by a rule relating the phonemic to the phonetic level. It is not clear, however, why it is necessary to posit a short /a/ in *nod* on the morphophonemic level since the word participates in no alternations. A clearer example can be quoted from Dutch. Dutch stop consonants are subjected to regressive voicing assimilation in much the same way as Russian obstruents. There is thus morphophonemic alternation between *p* and *b*, *t* and *d*, but the shift *k-g* is allophonic since *g* is not found as a separate phoneme in Dutch, and the voicing rule must apply at two levels just as in Russian.

However, even if it is possible to find more examples, the argument does not seem very convincing, for the following reasons: (1) The complications caused in some languages by setting up a particular taxonomic level should be weighed against the advantages, before a decision could be made. (2) In generative phonology the assimilation rule is also applied twice, since it takes place both within the morpheme and across morpheme boundaries. According to general practice the first case should be accounted for by redundancy rules, the second case by phonological rules. If the phonological representation has to be fully specified, it will hardly be possible to postpone the treatment of assimilations until the point at which the phonological rules apply, as suggested by Chomsky and Halle ("SPE", pp. 171 and 382, cf. 9.40 above).⁹⁴ (3) The taxonomic representation set up by Chomsky and Halle in the Russian example is only valid for post-Bloomfieldian phonemics. It does not apply to theories which, like Prague phonology, glossematics and stratificational grammar, operate with neutralization. In the second word in column II, Trubetzkoy would have a /T/ (with no specification for voicing) and glossematics a syncretism /t/d/, because /t/ and /d/ are neutralized in this position, and neutralization belongs to the description of the formal aspect. The fact that /T/ is pronounced [d] in the given environment is a manifestation rule just like the fact that /č/ is pronounced [j], and both these facts are treated together as a rule relating II and III, so that no generalization is missed in the description of voicing assimilation.⁹⁵

LOCKWOOD (1972a, p. 658) points out that it is not the biuniqueness claim which prevents a common treatment of the two cases of assimilation in Bloomfieldian phonemics, but the claim that oppositions cannot be suspended (the "non-suspendability"). In the Praguian version the relation between the phonemic and the phonetic level is still biunique for any given environment; it is the relation

94. If universal marking conventions are introduced, it is possible that voicing assimilations within morphemes will come under these conventions and will thus be excluded from the rules of individual languages; but it is problematic whether this is feasible, since rules of voicing assimilation operate very differently in different languages.

95. The same argument has been advanced by Johns (1969), Derwing (1973, p. 186) and Linell (1974, p. 105); cf. also Lockwood 9.68 above. But there will, of course (as pointed out to me by Basbøll), be an extra neutralization rule combining the morphophonemic and the phonemic levels.

between the morphophonemic and the phonemic level which is not biunique.⁹⁶

The argument on which the generative phonologists have concentrated almost all their efforts (that some generalizations would be missed by accepting a taxonomic phonemic level), is thus only valid for Bloomfieldian phonemics.

However, as far as Prague phonology, Roman Jakobson's later theory of distinctive features, and stratificational grammar are concerned there is a far more serious difficulty, which is due to the fact that the phonemes (or "hypophonemes" in stratificational grammar) contain only relevant features. It is precisely this character that makes the phoneme different from a phonetic unit (the glossematic expression unit does not even contain relevant phonetic features, but is fully abstract). If, in generative phonology, all features are fully specified already at the phonological level, as claimed by Stanley, and as suggested by Chomsky and Halle at the end of "SPE", it becomes impossible to fit a level of phonemics which excludes redundant features into any later stage of the derivation.⁹⁷

Schane (1971, p. 518) has argued, furthermore, that it may sometimes be appropriate to let some phonetic rules precede the morphophonemic ones in the phonological component. This situation leads to the same difficulty.

There is thus not much reason to believe that a "taxonomic" level could be fitted in somewhere in the generative derivation. W. HAAS has pointed out (in a discussion quoted in "Phonologie der Gegenwart" 1968, p. 296) that, as the results of traditional phonology are scattered throughout the generative phonological component (redundancy rules, distinctive features etc.), it is not surprising that a phonemic level cannot be inserted neatly at one particular place, but "no phonology has ever aspired to the place which is here denied to it".

Haas is certainly right in this point of view. The idea of fitting in a taxonomic phonemic representation as a step in the generative procedure was put forward, and subsequently rejected, by the generative phonologists themselves because this was the only possibility they could think of for other phonemic descriptions to have any *raison d'être*.

However, a classical phonemic description might be justified as an independent analysis of phonological structure.⁹⁸ Such a traditional analysis may prove useful for various reasons.

96. Lamb (1966b, pp. 544-7, see Chapter 10) has proposed to solve the problem of voice assimilation in Russian by positing a "devoicing element" /h/, which determines a whole cluster. [t] is thus phonemically /dh/ and [ɕ] is /ʃh/. Before voiced obstruents /h/ is dropped in both cases. But this solution has rightly been rejected by Chomsky ("Topics", p. 80ff) and Postal (1968, p. 40ff), since there is no basis for setting up a phonemic entity /ʃ/ in Russian.

97. On the other hand (as pointed out to me by Basholl), this objection does not apply to those post-Bloomfieldians who consider the phoneme to be a class of (fully specified) allophones.

98. What I have in mind is something like a (modernized) version of Prague phonology including distinctive features.

ARGUMENTS FOR CLASSICAL PHONOLOGY AS AN INDEPENDENT ANALYSIS

Contrast

9.70 The main reason why such a traditional analysis is useful is that it brings out the concept of contrast in the sense of "opposition" much more clearly than is the case in generative phonology, particularly in its more recent forms.

Contrast is mentioned as an important concept by generative as well as traditional phonologists. POSTAL (1968, p. 227) refers to it as "this fundamental notion of phonology", and he points out that the difference between free variation and contrast is about the only concept shared by autonomous phonemics and generative phonology. It has also been emphasized by various authors that it is a fundamental principle of phonological representation that contrasting words should be represented differently. In a phonological representation it should be possible to distinguish each morpheme from all the other morphemes in the language (cf. Ruwet 1967, pp. 306-7), and in CHOMSKY AND HALLE (1965 p. 128) it is stated that "if X contrasts with Y, then the phonemic representation of X differs from the phonemic representation of Y, where X and Y are utterances" (cf. also the quotation from "Current Issues" given above (9.68)).

Nevertheless the notion of contrast is not explicated very clearly in generative descriptions, and it is not always clear what type of contrast is meant. As the term is used in the preceding quotations it means contrast between surface forms. If two utterances or words contrast in this sense (i.e. if they have different communicative function) they must be represented differently, not only in the surface form but also in the underlying form (e.g. Engl. *pit/bit*), but the opposite is not true, i.e. two different underlying forms need not have corresponding contrasting surface forms: for example German *Bund* and *bunt* have different morphophonemic representations (/bund/ and /bunt/), but the same surface representation [bunt]. Consequently surface contrast cannot be inferred directly from the morphophonemic (phonological) representation (cf. also Postal 1968, p. 7ff).

This is valid for utterances and morphemes, but when we come down to segments and features the relations are much more complicated. Two contrasting morphemes need not be kept apart by means of the same segments or features at the two levels. Moreover many generative phonologists, e.g. Chomsky and Halle in "SPE" and Schane in his description of French (1968a) operate with different sets of segments, and in some cases also different features, at the phonological and at the phonetic level (the latter being largely identical with the traditional phonemic level). The consequence is that one has to operate with contrast at two levels. Postal, who on pp. 7-14 (1968) operates with only one type of contrast, makes a distinction between surface contrast and underlying contrast in other parts of his book (e.g. p. 28). The same distinction is made by Chomsky (1967, p. 113). These two types are, however, not described or differentiated explicitly.

Accordingly it is possible to have either redundancy-free or fully specified

notations both on the underlying (morphophonemic) and on the surface level. On the surface level the redundancy-free notation corresponds to the traditional phonemic notation. Contrasting features are only apparent from a redundancy-free representation. If a fully specified representation is used, the set of features which are contrastive appears only indirectly through the redundancy rules (see 9.40 above); if marking conventions are introduced, the picture is still more complex. An alternative traditional phonemic analysis would at least bring surface contrast out much more clearly.

A traditional phonemic analysis might even be useful as a basis for a generative analysis. It is evident that very often generative descriptions have taken their starting point in an existing phonemic description of the language. From this starting point the underlying forms are constructed, and very often the derivation is not continued much farther than just up to this traditional phonemic level. This is, for example, true of "SPE". One may wonder what generative phonologists would do without this starting point in the cases where the language analysed is not their mother tongue. They would probably have to undertake a preliminary analysis according to more or less traditional methods (in the form of heuristic principles) in order to find the sets of contrasting segments and features. This is not always a simple task, but in some generative descriptions it looks as if it is, because an earlier phonemic analysis is taken as given.

SCHANE (1971) takes an exceptional position among generative phonologists when he claims that the notion of surface contrast plays a significant role within phonology and that the phoneme, which is a phonological unit capturing relevant surface contrast, should be reintroduced into generative phonology. Schane does not, however, think that there should be a traditional phonemic level at some point in the phonological derivation, nor does he intend to use traditional methods starting from the phonetic representation in order to set up phonemes. He wants to deduce the phoneme from the surface representations by considering the function of the rules leading from underlying phonological representation to those representations. He makes a distinction between rules with a morphophonemic function or effect and rules with a phonetic effect. A surface contrast arising from a morphophonemic rule is "relevant" or "phonemic", whereas a contrast arising from a phonetic rule is not phonemic.

Any rule which converts one underlying segment to another where both are also found in identical environment, is a morphophonemic rule, e.g. the rule making morpheme-final voiced obstruents voiceless at the end of a word in German, or the rule converting *k* to *s* before front vowels in English in some cases (*electric-electricity*). On the other hand, the rule converting intervocalic *t* and *d* to a flap (*D*) before unstressed vowel is a phonetic rule, since *D* is not an underlying segment in English, but a phonetic variant of /t/ or /d/, and the length of the preceding vowel always indicates whether it is /t/ or /d/. As vowel lengthening before voiced obstruents is also a phonetic rule, the fact that the only difference between *writer* and *rider* may be found in the length of the diphthong is due to

an interplay between two phonetic rules; and the difference between the diphthongs cannot be considered to be phonemic.

A second type of morphophonemic effect is where a derived feature becomes contrastive on the surface because the conditioning environment has been destroyed, e.g. nasality in French vowels after the deletion of the following nasal consonant. These consonants are deleted according to an important morphophonemic process affecting consonants in general. In English [kæt], on the other hand, the rule is phonetic, and the consonant can always be recovered from the immediate environment.

Finally, morphological conditioning may be responsible for a derived feature becoming contrastive on the surface, e.g. word class differences conditioning differences of stress in English (e.g. verb-noun minimal pairs as *permit*, etc.).

The same rule may have two different effects, e.g. the assimilation rule in Russian which may change *k* to *g* (which is a morphophonemic effect) and *č* to *j* (a phonetic effect).

One may ask whether this is not a rather complicated way of arriving at the relevant surface contrasts and at the phoneme, and whether it would not be simpler to start from a more traditional phonemic analysis, e.g. from a Prague School analysis, which would give exactly the same results.

It should be mentioned in this connection that RISCHER makes a distinction between phonological and phonetic rules and sets up a "categorical surface representation" which is "a representation of the output of the phonological component without specification of phonetic variation". It is not considered to be an intermediate stage in the derivation but rather an abstraction from the phonetic representation (1974, p. 360ff).

WANG (1969, p. 707 and 1973, pp. 114-5) argues for a phonemic representation as a significant type of phonological representation reflecting the network of contrasts found in the language and acquired by the child in his first years of language learning. There would then be no need for an abstract representation of those morphemes which neither undergo nor cause alternations. They would simply have phonemic representation.

JOHNS (1969) pleads for a phonemic level based on distinctiveness. This need not be either autonomous or taxonomic, but simply a level of representation which expresses certain facts which are part of the native speaker's competence.

LINELL (1974) also emphasizes the importance of surface contrast. He makes a distinction between "concrete" and "abstract" phonology. Concrete phonology, which comprises surface contrasts and some allophonic variation, is intended to reflect "psychological reality" (see also 9.72).

Paradigmatic Systems and Syntagmatic Relations

9.71 Adherents of transformational grammar have spent an astonishing amount of energy on the discussion of derivations of individual sentences and forms and

seem to be much less interested in grammatical and phonological systems. PHONEME SYSTEMS of the type discussed in the works of the Prague phonologists and later on in the works of Roman Jakobson and others, e.g. vowel triangles and quadrangles, are very rarely found in generative descriptions (cf. Chomsky's explicit rejection of this type of systems quoted in 9.22 above). Such systems may, however, play an important role both in language typology and in language development, as suggested by Jakobson and Martinet and confirmed by Weinreich, Herzog and Labov (see 12.21). The ease with which a listener adapts himself to the vowel system of a speaker after having heard a few vowels also speaks for the psychological reality of such systems.

Generative phonologists have also, until recently, shown very little interest in establishing the range of possible segment sequences on the surface, i.e. in the description of SURFACE CONSTRAINTS (phonotactics). They have only been interested in constraints on the underlying level, and even these will be difficult to describe if marking conventions are introduced. But, as mentioned in 9.56 above, some younger adherents of generative phonology have now rediscovered the importance of surface constraints seen as the motivation for many phonological rules. SHIBATANI (1971) finds that the description of surface constraints is not only necessary for the explanation of rules, but also for the explanation of lexical borrowing and phonological change. He moreover claims that it is the surface constraints upon which a native speaker bases his judgements of nonsense syllables as structurally possible or impossible and demonstrates that the treatment of English loans in Japanese can be explained on the basis of these constraints, but not on the basis of phonological rules. This seems obvious. Probably many of the abstract underlying forms set up in generative phonology would even be considered ungrammatical by a native speaker (cf. also Linell 1974, p. 113).

These phenomena which have been neglected in generative phonology must somehow be taken care of, and this might be done in an alternative phonemic description.

The Psychological Reality of Surface Forms and Underlying Forms

9.72 Many generative phonologists would possibly find the explicit description of surface contrast, surface systems and sequences superfluous, since in their opinion there is only one correct description which mirrors the speaker's competence and which can account for the child's acquisition of language, and that is the generative description (see 9.8-10 above). But this is a mere postulate, and nobody knows yet which description comes closest to psychological reality.

As mentioned above (9.56 and 9.71) some adherents of generative phonology now think that not only underlying forms but also phonemes and at least some phonotactic constraints have psychological reality (for example Schane and partly Kiparsky). More radical critics think that only surface forms have psychological reality, and that abstract underlying forms are mere constructs made by the

analyst and that they have nothing to do with the speaker's competence. LINELL (1974) gives a detailed criticism of the assumption that the linguistic building blocks in the speaker's mental lexicon should be abstract morpheme invariants. A general and fundamental objection, which is also raised by DERWING (1973, p. 154), is that there is no reason to believe that the speaker has internalized all the paradigmatic generalizations which the linguist has stated on the basis of his knowledge of etymology. It is probably true that regular inflexional forms are not stored separately, but many derivatives may not be recognized as such, and many have to be stored anyhow because their meaning cannot be derived from the simple forms. It is also a mistake to require maximal economy of the storage of lexical information. The storage capacity of the brain is known to be very large and, on the other hand, the more economic the storage is, the more complicated is the retrieval. Very abstract underlying morphemes will have to go through a long series of rules. This may be more important. Linell therefore assumes that the building blocks are concrete word forms, and that morpheme identity is a question of relations between word forms. This also gives a simpler theory of language acquisition.

It is obvious that detailed investigations are called for on this point, but we can at least mention briefly some of the areas in which evidence must be looked for, and which are also mentioned by Linell (cf. also Zwicky 1973).

(1) *Diachrony* is one of the fields which might shed some light on the problem just mentioned. It may be possible to find examples of changes which are more readily explicable in terms either of underlying forms or of surface forms.

Traditional phonologists have attempted to explain sound change on the basis of the assumption that there is a tendency towards economy and symmetry in phoneme systems (e.g. Jakobson, Martinet, Moulton; see 3.16-18 above). KIPARSKY (1968b) has objected that these tendencies seem to apply to phonetic systems rather than to phonemic systems. In support of this claim he discusses one of Moulton's examples, which was mentioned in section 9.63 above as an example of rule reordering: In some Swiss German dialects *o* turns into *ɔ* before certain consonants, whereas *ø* (the umlaut of *o*) is not lowered. In other dialects there is a change of *ø* to *æ* in words which have *ɔ* in other forms. In some cases these new vowels have become separate phonemes. Moulton quotes the development of *ø* to *æ* as an example of the tendency to symmetry. Now Kiparsky points to the fact that the development of *ø* to *æ* takes place both in the dialects where *o* and *ɔ* are separate phonemes and in the dialects where they are variants of the same phoneme. In the first case we get the following development of the system of rounded vowel phonemes:

y	u		y	u
ø	o	→	ø	o
	ɔ		æ	ɔ

and in the second:

$$\begin{array}{ccccc} y & u & & y & u \\ o & o & \rightarrow & o & o \\ & & & & \alpha \end{array}$$

Thus, in the latter case a directly asymmetric phoneme system arises. Kiparsky now draws the conclusion that the change takes place independently of phonemic status (see also Dressler 1971), and adds that this is what one would expect if it is a rule system which is involved, and not "charts of contrasting elements moving about in a two-dimensional array". More investigations seem to be called for in this field.

Recently, however, SCHANE (1971) has found that there are series of diachronic developments in different languages that can only be explained in terms of phonemes. He examines several cases where a feature is at first phonetically determined, but subsequently becomes contrastive at the surface level due to the deletion or coalescence of the conditioning segment. In environments where there is no contrast, however, the feature is lost again (or, in terms of markedness, reverts to its unmarked value). One example is denasalization of vowels in French. According to various sources (poems, puns, spelling conventions, particular developments, etc.) the historical process of nasalization in French consisted of the following steps: first all vowels became nasalized before nasal consonants ([bɔ̃n, bɔ̃nə] became [bɔ̃n, bɔ̃nə]); second, nasal consonants were deleted before a pause or before another consonant ([bɔ̃n] became [bɔ̃]); third, nasalized vowels were denasalized before a nasal consonant ([bɔ̃nə] became [bɔ̃nə]). Denasalization takes place precisely where there is no surface contrast. A similar development is now demonstrated for depalatalization in Rumanian, labialization in Romance, palatalization and labialization in Nupe and palatalization in Japanese. Schane draws the conclusion that the native speaker's competence includes awareness not only of underlying forms and phonetic forms, but also of relevant surface contrasts.

HENNING ANDERSEN (1969) has adduced some examples from the history of Ukrainian showing that morphophonemic alternations are not produced from a very abstract systematic phonemic representation, but seem to operate on a phonological representation of a much lower degree of abstraction. This is seen as evidence for the existence of a significant level of phonological representation of a lower degree of abstraction, which is of primary importance as input for the morphophonemic component and for the phonological rules (p. 828).

SKOUSEN (1973, p. 97, see 9.56 above) also concludes that changes take place according to surface patterns of alternation and not according to phonetically plausible rules.

(2) The treatment of LOANWORDS may show whether a rule is productive or not, cf. the use made of this criterion by Skousen (9.56 above) and Shibatani (9.71); cf. also Linell's criticism of Hyman's example of Yoruba loanwords in Nupe (Linell 1974, p. 131) and Derwing, p. 150.

(3) Another area which might give useful information is CHILD LANGUAGE. As mentioned previously the establishment of underlying forms is frequently based on learned words, which are totally unknown to children. On the other hand, children quickly acquire a vocabulary which is sufficiently large for the establishment of a phoneme system. Only gradually does it become possible for the child to learn the fully elaborated underlying forms of words. That a phoneme system acquired early should then no longer have any psychological reality and should be replaced by more and more abstract underlying forms seems rather improbable (see also Linell 1974, p. 119). This is also Wang's main argument for setting up a phoneme representation: "It is a general observation that a child masters the system of contrasts of its language at some uniform age, say three or four years. Morphophonemic alternations, on the other hand, are learned according to highly individual schedules and constitute the area in which most mistakes are made" . . . A phonemic representation would reflect "the network of contrasts that is acquired uniformly in the ontogeny of phonology" (1973, p. 115).

(4) An area which deserves investigation, both in the language of children and adults, is that of RHYME AND RHYTHM, an area in which children are productive in a completely spontaneous way. The psychological reality of the syllable as a rhythmical unit seems to be quite obvious (although it is difficult to define the syllable phonetically or phonologically); many have probably had the experience that the only part that can be remembered of a given word is its number of syllables.

Rhyme does not appear to have anything to do with underlying forms. Nobody would probably have any hesitation in rhyming *petit* and *pris* in French, although the final consonants of the underlying forms differ. On the other hand, it is of course possible to claim that rhyme and rhythm belong to the phonetic level.⁹⁹ It should be possible to test this by means of bound variants and preferably with children who are not yet influenced by writing. Would a Danish child, for example, rhyme phonetically or phonemically in the following case (where [æ] is a lowered variant of /ɛ/ after /r/)?

	<i>let</i>	<i>ret</i>	<i>ladt</i>
Phonemic form	/let/	/ret/	/lat/
Phonetic form	[lɛt]	[ræt]	[læt]

99. Stephen Anderson has pointed out to me that investigations about metrics and morphophonemics by Kiparsky, Zeps and Anderson seem to indicate that there may be a certain "metric range" which may include stages that are considerably more abstract than phonemic representations as well as some that are less abstract, and that there is no evidence that the phonemic level should be exactly the appropriate one for the definition of rhyme.

(5) *APHASIA* should also provide some information, although many phenomena of this type may be due to performance blockings.¹⁰⁰ Similarly *SPEECH ERRORS* may be informative. V. Fromkin (1971) has found that speech errors provide evidence to the psychological reality of morpheme structure constraints and underlying forms. However, this does not seem to be the only possible interpretation of her material.

(6) *ORTHOGRAPHY* seems to be an area which supports the assumption that morphophonemic forms are psychologically realistic. It is hardly probable that the same base forms would be retained in different environments out of sheer conservatism (cf. also Sapir's experiences, 2.12 above). But misspellings ought to be examined from this point of view. Chomsky and Halle ("SPE", p. 49) claim that the conventional English orthography is a near optimal system for the lexical representation of English words. But *DERWING* (p. 127 ff) points out that English children have great difficulties in learning the spelling system, whereas the difficulties appear to be minimal for the Russian child learning to spell Russian. Russian spelling is also partly morphophonemic, but not by far as abstract. LINELL (pp. 136-7) quotes an experiment made by Read, who asked a group of pre-school children to construct their own orthography for English. The result was a system based mainly on phonetic similarity. It should also be mentioned that the Greenlandic orthography has recently been changed from a mainly morphophonemic to a mainly phonemic type, because the former, traditional orthography was too difficult for Greenlandic children.

(7) In the *TEACHING OF FOREIGN LANGUAGES* the phonemic point of view has for many years proved to be useful.¹⁰¹ The speaker seems to be inclined to transfer his own phonological system, inclusive of neutralizations, to the foreign language. It is not probable that only phonetic habits are involved, for it frequently appears to be more difficult to keep different sounds apart than to pronounce them individually. It should be investigated whether the errors made can be explained most satisfactorily on the basis of a classical phonological model or on the basis of a generative model.

(8) *DIRECT PSYCHOLOGICAL EXPERIMENTS* are difficult to handle, but there have been a few attempts. Ladefoged and Fromkin (1968) have made an experiment consisting in assignment of stress to nonsense words and found some of the English stress rules to be productive. K. ZIMMER (1969b) has investigated the psychological reality of morpheme structure conditions in Turkish, asking Turkish subjects to choose one of two nonsense words as more like a word that might actually occur in Turkish. The subjects answered as expected in the cases where the rules were also valid for suffixes and thus productive. But they did not make

100. If Weigl and Bierwisch (1970) are right in claiming that aphasia in most cases affects performance only, the conclusions which may be drawn are very limited, but it should be added that their views are not generally accepted.

101. Although contrastive phonology has not become quite as successful a tool as one had expected.

correct use of the rule requiring that a [+high] vowel after /a/ agrees in labiality with a preceding [+labial] consonant. Zimmer concludes that a precise statement of morpheme structure conditions does not provide a realistic analog of the knowledge internalized by the native speaker. HSIU-I HSIEH (1970) has found that native speakers of Taiwanese are not able to apply the tone sandhi rules of their language to permissible but not actually occurring morphemes presented by the tester and given a definite meaning.

J. OHALA (1972a and 1974) and M. OHALA (1974) have asked subjects to make unusual derivatives of existing words like *supreme* – *supremity*. The answers varied a good deal, but whereas M. Ohala found some evidence for the use of an abstract underlying form as a basis of schwa-insertion in Hindi words, J. Ohala found more evidence for the use of analogical rules based on existing surface forms in his experiments, which were designed to test the productivity of various of the rules for English set up by Chomsky and Halle. He also finds the use of analogical rules more plausible. He admits that they require a greater number of items to be stored plus the possibility of rapid search of the lexicon. But this does not seem to be something our brains are incapable of. The advantages, on the other hand, are obvious: no underlying forms and no long-term storage of rules are required; there is no need for ordered rules, and the computation is very simple; moreover, the acquisition of rules is much more simple. He concludes that any phonological theory which fails to treat analogical rules as one of the prime determinants of phonological creativity is seriously inadequate (see also the references to Linell and Derwing at the beginning of this section).

Intuitively these assumptions seem very convincing, but a great number of further experiments are needed to prove their validity, and it is not an easy task to set up such experiments. First, it must be made quite clear what we are looking for. "Psychological reality" and "tacit knowledge" are rather vague concepts, which must be made more precise, and they may turn out to cover rather complex structures with various layers. It is also a difficulty that we can only observe performance, but want to draw conclusions concerning competence (cf. Botha's scepticism, 1971, p. 135). It may be possible through repeated experiments in connection with studies of loanwords to find out whether a regularity is productive or not, and in the latter case it seems relatively clear that the speakers do not have abstract underlying forms and rules leading to the surface forms stored in their brains, although some sort of psychological awareness of the regularity may be possible. But if the regularity is productive, the next problem is to find out whether this productivity is due to an awareness of surface constraints¹⁰² or to analogical rules deduced from surface forms, or to rules leading from underlying abstract forms to surface forms.

Psychological experiments should not only be used to solve the problem of underlying forms. On the whole, psychological reality must be considered the

102. For instance, the vowel insertions in loanwords in Japanese certainly do not prove that Japanese words have underlying forms with consonant clusters.

most relevant criterion for the choice between alternative linguistic descriptions. The theoretical claim made in generative phonology on this point is certainly justified. It would, for instance, be an important task to devise psychological experiments showing which distinctive features are at work, for in no area is the non-uniqueness of linguistic analysis so manifest as in the analysis of distinctive features.

Conclusion

9.73 Even if investigations like the ones suggested above should demonstrate that the speaker has not internalized underlying forms and large rule complexes but rather classical phonological forms and a set of alternation rules, then this would not prove that the generative phonological description is worthless (although some generative phonologists might probably think so). A description in terms of explicit rules is of great value, irrespective of its psychological adequacy.

There is no doubt that generative phonology has greatly increased our possibilities of describing phonological phenomena precisely. And it has the merit of combining a strict formalism with consideration for phonetic reality. It is this interest in phonetic facts which has led to an improvement of the distinctive feature system (although parts of it still need revision) and to the claim of "naturalness". Only by this close combination of "form" and "substance" is it possible to reach explanations of phonological structure, phonological rules and phonological change and to see them as partly due to universal tendencies. Particularly compared to the rather mechanistic American tradition in phonology, generative phonology has had the merit of seeing new problems and opening up wider perspectives in language description.

Chapter 10

STRATIFICATIONAL THEORY

INTRODUCTION

BIBLIOGRAPHIC REMARKS

10.1 Stratificational theory is a recent trend in American linguistics, developed by SYDNEY LAMB in the course of the sixties. Similar ideas were developed by H. A. GLEASON independently of Lamb. Later these two influenced each other, and Gleason has taken over a good deal of Lamb's terminology. He has, however, published very little in this field. His paper "The Organization of Language" (1964) gives a clear and relatively easily understandable description of the stratificational model. Lamb has published a good deal more, and the present description of stratificational theory will be based mainly on Lamb's views. Lamb's paper "The Sememic Approach to Structural Semantics" (1964a) gives a good introduction to the theory as it was at that time. Some of his later works: "Outline of Stratificational Grammar" (1966c) and especially "Prolegomena to a Theory of Phonology" (1966b) contain more information about his views on phonology, but they are very hard to understand and cannot be recommended as a first introduction to the theory. His paper "The Crooked Path of Progress in Cognitive Linguistics" (1971) gives an account of the history of the theory and a brief sketch of its latest stage. G. Sampson's "Stratificational Grammar" (1970) does not give what the title seems to promise. Apart from a very brief introduction it contains a discussion of the formal definitions which presupposes knowledge of Lamb's "Outline", and an application to the English numeral system. Much more easily understandable is Sullivan (1972a), but it is very brief. On the other hand, D. LOCKWOOD's "Introduction to Stratificational Linguistics" (1972b) is rather long (363 pages), but it is by far the best introduction if one wants to know more than the most general features. It contains a detailed description of the theoretical views and the graphical notations, accompanied by examples and exercises. It is not very easy either, but this does not seem to be Lockwood's fault. What makes the details of stratificational theory so exasperatingly difficult to understand and to remember is partly the complicated terminology (which is hard even to a reader who has been exposed to glossematics) and the complicated graphs, but still more the fact that both terminology and theory shift from one article to the other (as indicated in the title of Lamb's paper on "The Crooked Path . . .").

BACKGROUND

10.2 Stratificational theory has two main sources of inspiration: (1) The BLOOMFIELD SCHOOL particularly some papers by Ch. F. Hockett, and (2) GLOSSEMATICS. As further predecessors Lamb (1971) mentions NIDA and CHOMSKY.

In Lamb's earlier works (e.g. 1964a) the influence of HOCKETT is much more obvious than the influence of glossematics. Three papers in particular by Hockett ("Problems of Morphemic Analysis" (1947), "Two Models of Grammatical Description" (1954), and "Linguistic Elements and their Relations" (1961)) have been of importance to Lamb.

In the first two articles Hockett sets up various types of morpheme alternants or morphs (zero morphs, portmanteau morphs, etc.), which are taken over by Lamb as different forms of realization. In the paper of 1954 Hockett for the first time mentions the relation between morphemes and morphs as one of "representation", and in the last article (1961) he makes a clear distinction between REPRESENTATION and COMPOSITION. Elements related by representation are by definition elements of roughly the same "size level", though belonging to different STRATA (morphemes are thus represented by morphs, and morphophonemes by phonemes), whereas elements related by composition are of different size level, but belong to the same stratum of the language (e.g. morphemes and morphophonemes, which belong to the grammatical stratum, and morphs and phonemes, which belong to the phonological stratum). At the end of the article he maintains the two strata, but rejects morphs and morphophonemes as artifacts of the analysis, and he also rejects the relation of representation (see the end of 6.39 for more details). Lamb, however, takes the first part of this article as the starting point of his theory. He keeps the morphophonemes and morphs (although with new names) as units in his system and extends the application of the relation of representation (later called realization), which results in a larger number of strata (see 10.5 below).

There is a certain resemblance between stratificational theory and Pike's theory of TAGMEMICS (see 6.9). Pike sets up three hierarchies of linguistic structure roughly comparable to strata: the phonological, the lexical and the grammatical. But the interrelation between the tagmemic hierarchies is different. They are not ordered by a relation of representation, but constitute three relatively independent aspects of linguistic structure, and there has not been much direct influence from tagmemics on Lamb's thinking (see Lockwood 1972b, p. 254ff).¹

1. The fact that stratificational theory, but not tagmemics, has a separate chapter in this book does not reflect the relative importance of the two theories in American structuralism. Tagmemics has many more adherents and has been applied to a much larger number of languages. But the phonological theory of tagmemics is not sufficiently different from the phonemics of the Bloomfield School to motivate a separate treatment. The differences are more obvious in grammar; but the grammatical theories of the Bloomfield School and of tagmemics have not been dealt with in this work since for these schools

The influence of GLOSSEMATICS is less pronounced in Lamb's earlier writings, although already in the paper on Sememics (1964a, pp. 67-8) he quotes Hjelmslev's distinctions between content and expression and between form and substance, and he compares the phonetic and semantic strata, which according to his view are outside language proper, to Hjelmslev's expression substance and content substance respectively.

In 1966 Lamb published a very detailed and, on the whole, very positive review of Hjelmslev's "Prolegomena" (1966a). He criticizes a number of Hjelmslev's principles and definitions and his system of functions, but subscribes to the basic dichotomies of CONTENT : EXPRESSION, FORM : SUBSTANCE, to the BOTH-AND and EITHER-OR relationships, and to the view of language as a network of relations. "The statement that "a totality does not consist of things but of relationships" (23) conveys a vitally important thought which must surely be accepted by any who would hope to construct successful linguistic theory in the future" (1966a, p. 560). The view of language as a system of relationships is also emphasized by Lockwood, who considers it the most basic principle of stratificational grammar.

There are also some points of contact between stratificational theory and the PROSODIC SCHOOL (see Chapter 5). Both operate with different levels of description; and prosodic principles in the description of phonology are taken over by stratificational theory, e.g. in the description of vowel harmony. According to Lockwood (1972b, p. 263) "the step from allowing prosodic analyses for stress, tone, and intonation to permitting them for other similarly distributed phenomena is a small one within a theory which recognizes that it is dealing with form rather than substance".

The influence from TRANSFORMATIONAL THEORY appears in the structure of syntactic trees. The two theories also agree on the view that discovery procedures should not be part of the theory, and moreover, they share the hope that their respective descriptions should reflect what goes on in the human brain. In Lamb's last paper the name of the theory is changed to COGNITIVE LINGUISTICS because it "aims at characterizing the speaker's internal information system that makes it possible for him to speak his language and to understand utterances received by others" (1971, p. 101). It aims at an account of language that can be used as a basis for a performance model. Lockwood (1972b, p. 282) formulates this idea in terms of neurophysiology: "The correspondence of the stratificational model of language to the neurophysiologists' model of the brain should be an ultimate goal for cognitive linguistics" (1972b, p. 282). The basic principles of transformational theory and cognitive linguistics are, however, quite different. Hockett (1954) characterized post-Bloomfieldian linguistics as based on an "item and arrangement model". On the other hand, Boas and Sapir represent an "item

it was found possible to treat phonemics without entering into details about the other parts of linguistic description. This would be difficult in the case of stratificational grammar, as also in the case of glossematics and transformational grammar.

and process" model, in which one item is derived from another. Transformational grammar also represents an item and process model, whereas stratificational grammar, at least since 1966, differs from both these models by not recognizing any items at all, but only relationships. Lamb criticizes the transformational model for confusing strata and intermingling rules of different nature; he finds that the formulation of morphophonemic and transformational rules as processes within one and the same level is cognitively unrealistic (1971, p. 105). They should be described as realizational connections between different strata. Transformational theory is also criticized for introducing substance into the formal description and for introducing orderings of rules which are only artifacts of the description (Gleason 1964, Lamb 1964b, Lockwood 1972b, p. 263ff).

GENERAL VIEWS

10.3 Stratificational linguistics sees language as a code relating concepts to sounds through a series of systems, each constituting a linguistic stratum, e.g. the sememic, lexemic, morphemic and phonemic strata. A stratum is also called a stratal system because it contains various subparts. The reason why there must be SEVERAL STRATAL SYSTEMS is that sounds and meanings are very differently patterned. The phonemic system must be adapted to the articulatory and auditory organs and to the linear nature of speech, whereas the sememic system must be adapted to the patterns of thought, which are nonlinear and multidimensional. A close correspondence between sememic and phonemic systems would thus be impossible. There must be intervening strata providing transitional stages between the strata at the two extremes.

It is emphasized that linguistic structures consist entirely of relationships, which connect to objects only at the two peripheries (Lamb 1966c, pp. 1-2, Lockwood 1972b, pp. 3-11 and 287). The entities posited in the description (e.g. morphemes, phonemes, etc.) are only points in a network, and the labels assigned to them have no status whatsoever in the theory (Lockwood 1972b, p. 26; Sullivan 1972, p. 28).

THE STRATA

GENERAL CONFIGURATION

10.4 In the graphic representation which makes up a linguistic description, the strata are ordered vertically between the area of concepts (on the top) and sounds (at the bottom). A "higher" stratum is thus closer to the concepts, and a "lower" stratum is closer to sounds. On each stratum a distinction is made between two kinds of units, designated by the endings -EME and -ON. An -eme unit may consist of one or more -on units; -eme units have upward connections to the

adjacent higher stratum, -on units downward connections to the adjacent lower stratum. These connections are realizations. Thus an -eme unit of a given stratum is a realization of an -on unit on the higher stratum. A morpheme, for instance, is composed of one or more morphons, and morphons are realized by phonemes on the stratum below. As -emes normally are composed of -ons, this means that the units, on the whole, gradually become smaller as we move from the higher to the lower strata. Phonemes are, for instance, generally of smaller size than morphemes. This is not, however, the essential difference between the strata; and there are also units of different size within the same stratum.

Each stratum (or stratal system) comprises a TACTIC PATTERN (a pattern of relationships specifying the possibilities of combination between the elements of the stratum) and a REALIZATIONAL PORTION comprising ALTERNATION PATTERNS and SIGN PATTERNS. Whereas the tactic pattern generates new combinations of elements, the sign pattern contains "the fixed or prefabricated items that through repeated use have come to be treated as units" (1971, p. 116) (e.g. compounds at the lexemic level) and analyses them into components. "Tactics" is a term borrowed from Hockett (who later dropped it), and the distinction between combination and realization corresponds to Hockett's distinction (1961) between composition and representation. In 1964a Lamb still uses the term representation, characterized as a relationship taking place between adjacent strata; from 1966 it is called realization, and realization may now take place also within a stratum.

NUMBER OF STRATA

10.5 In 1964 Lamb sets up four different strata: the sememic, the lexemic, the morphemic and the phonemic. The same four strata are found in Gleason's paper of 1964. In 1966 the number has been increased to six. The two new strata are the hypersememic (or gnostemic), and the hypophonemic, which are placed above and below the sememic and phonemic strata respectively. Lockwood (1972b, pp. 165 and 227ff) criticizes the hypersememic and the hypophonemic strata, which he finds superfluous. In his paper of 1971 Lamb has returned to the four strata of the 1964 model, the hypersememic (gnostemic) level being relegated from linguistics proper as a "conceptual system", and the phonemic and hypophonemic strata being coalesced into a single stratal system.

THE LINGUISTIC PHENOMENA TREATED BY THE DIFFERENT STRATA

10.6 The HYPERSEMEMIC stratum was described in 1966 as providing the classificatory interrelations of objects and other phenomena which a speaker assimilates from his culture, and dealing with units larger than the sentence:

i.e., with texts and their parts (Lockwood 1972b, p. 165ff). In its new status as a conceptual system it is said to contain everything the individual knows, save the language itself (Lamb 1971, pp. 99).

The SEMEMIC STRATUM comprises the sememic units and their combinations, described in the semotactics. Hjelmslev's content figures (e.g. "she" and "ox" as components of "cow" (see 7.5)) would be sememic units (Lamb 1964a, p. 68). Lamb also mentions (1964a, p. 74) that there are different sememic units corresponding to the lexeme *big*, e.g. $S/big_1/$, $S/big_2/$, and $S/big_3/$, as in "a big house", "a big sister", "a big fool". They differ in possibilities of combination (you cannot say "my sister is big", "the fool is big" in the sense of $S/big_2/$ and $S/big_3/$). Moreover, they differ by the fact that $S/big_1/$ can also be realized by the lexeme $L/large/$, which is not the case with the two others (cf. also Lockwood 1972b, pp. 23-4).

The semotactics describes the combination of sememes within the sentence, and corresponds more or less to deep (semantic) structure in transformational syntax. It comprises such units as "agent", "goal", "focus", "predication", etc. If the agent is at the same time the focus of the sentence, the lexemic construction will be active, if the goal is the focus, it will be passive.

The LEXEMIC STRATUM deals with lexemes and their combinations. Lexemes correspond more or less to "words", i.e. both compound and simple words. The lexeme $L/understand/$ is, for instance, composed of the lexons $L^N/under/$ and $L^N/stand/$ (lexons are = morphemes in the Bloomfield School). A lexon may be realized by two different morphemes (= morphs in the Bloomfield School) under different conditions, e.g. $L^N/good/$ which may be realized as $M/gud/$ and $M/bet-/$. The lexotactics corresponds roughly to traditional syntax, and to the surface syntax of transformational grammar. It accounts for, e.g., government, concord and clause structure.

The MORPHEMIC STRATUM comprises "morphemes" and their combinations within the word. Morphemes are composed of morphons, which correspond to what are generally called morphophonemes. Morphotactics corresponds roughly to traditional morphology, i.e., it deals with the combination of morphemes into words, and thus mainly with inflexion and derivation.

The PHONEMIC STRATUM has the phoneme (the realization of a morphon) as its basic unit. A phoneme is composed of phonons (i.e. features like "voiced", "nasal", etc.). Phonotactics treats the combination of phonemes in syllables.

The HYPOPHONEMIC STRATUM (when such a stratum is posited) comprises hypophonemes (realizations of phonons) and their combination in segments and clusters.

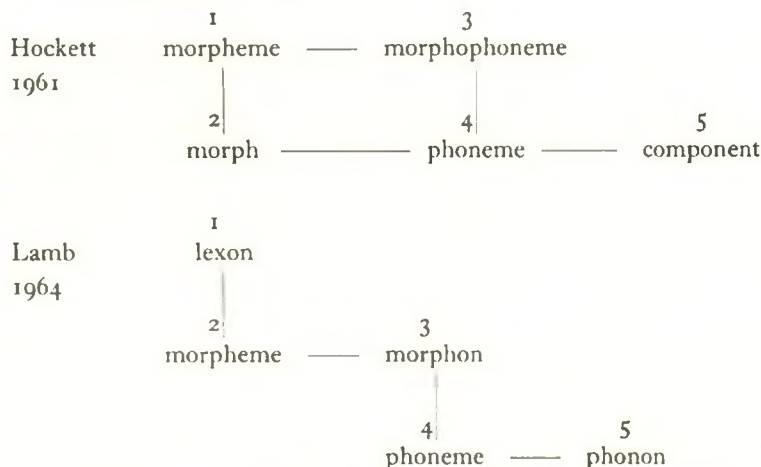
We shall return to these two lower strata in 10.12-10.14.

In 1971 (pp. 120-1) Lamb divides the four strata into two main portions: phonology, consisting of a single stratal system, and grammar, consisting of three

2. The units of the different strata are indicated by slashes preceded by an abbreviation of the name, i.e. S, L, M, P for sememes, lexemes, morphemes and phonemes, and SN, LN, MN, PN for the corresponding -ons.

partially independent stratal systems, the morphemic, lexemic and sememic systems, concerned with morphology, surface syntax, and deep structure respectively. This sounds, however, simpler than it is.

It may be useful at this point to compare Lamb's terms placed in a simplified stratificational diagram (see, however, for a later complication 10.10) with those used in Hockett's figure of 1961. This has been done in the diagram below where the numbers indicate corresponding units in the two systems:



The vertical dimension is "representation" (realization), the horizontal dimension is "composition". It will be seen that Lamb's morpheme corresponds to Hockett's morph, and his lexon to Hockett's morpheme, and that the leftmost part has been moved one step up, so that the morpheme (Hockett's morph) is not composed of phonemes. The reason is that Lamb wants to distinguish between morphologically (or lexically) conditioned alternations (like *go-went*, or pl. *-z*, *-en*, i.e. two morphemes realizing one lexon) and phonemically conditioned alternations (like *-z*, *-s* in *dogs*, *cats*, two phonemes realizing one morphon) as belonging to two different levels (see below 10.9).

THE STRATA COMPARED TO THE GLOSSEMACIC DISTINCTION BETWEEN CONTENT AND EXPRESSION

10.7 Lamb accepts Hjelmslev's distinction between content and expression, but in stratificational grammar the distinction is only clear as far as substance is concerned. As there are four formal strata corresponding to Hjelmslev's two (content form and expression form), it is not quite clear how these strata should be distributed between content and expression. Sullivan (1972a) thinks that the phonemic stratum belongs to expression and the higher strata to content, whereas Lamb (1966c, p. 34) and Lockwood (1972b, p. 258) realize that in Hjelmslev's ideal notation (with resolved syncretisms) the expression taxeme corresponds to

the morphon of stratificational grammar (the traditional morphophoneme) and thus impinges on the morphemic stratum. As for the content, they compare Hjelmslev's actualized content form with the morphemic stratum and his ideal content form with the lexemic and sememic strata. This comparison is, however, somewhat dubious. Hjelmslev did not consider "ideal" and "actualized" to belong to different strata. He only speaks of "notations". It is, moreover, dubious whether the stratificational morphemic and lexemic strata can be considered as pure content strata. It should be remembered of course, that the units have no theoretical status and that e.g. $M/gud/$ is only a label; but various phenomena dealt with in the morphemic stratum evidently include facts of expression, e.g. the alternation between different inflexional endings combined with different noun stems (Lockwood 1972b, p. 75ff) and the "zero morpheme" in *sheep*. Moreover, it appears from the various graphs that whereas there is no linear ordering in the sememic stratum, there is linear ordering of lexemes on the lexemic stratum, and of morphemes on the morphemic stratum. But linear ordering belongs to expression. It would probably be more correct to say that whereas the sememic stratum deals with pure content units, the lexemic and morphemic strata deal with signs, and not only with sign content. This is at any rate obvious for the morphemic stratum. In his review of Hjelmslev's "Prolegomena" (1966a, p. 569) Lamb states that the two strata deal with sign contents, but on p. 571 he says that the sememic stratum is the only one for which it is really appropriate to speak of content.

TACTIC PATTERNS

10.8 It appears from what was said in 10.6 that the basic element of the tactics on each stratum is the -eme unit, not the smaller -on unit. As the -on is realized by an -eme on the lower stratum, its tactics will be treated there. If there is only one phonemic stratum, however, the phonotactics will have to deal both with the combination of phonemes in syllables and of phonons (features) in segments.

REALIZATION PATTERNS

THE 1964 VERSION

10.9 In 1964 realization (representation) is described as a relation taking place between two adjacent strata. It may be a simple one-to-one relation between two units on different strata, or the relations may be more complicated. The description of the various possibilities is based on Hockett's description (1947) of relations between morphemes and morphs (corresponding approximately to lexons and morphemes in stratificational theory), but these relations are generalized to be valid for all pairs of adjacent strata. The graphic symbolizations used in the paper on sememics (1964a) can be combined as in the following figure (10.1):

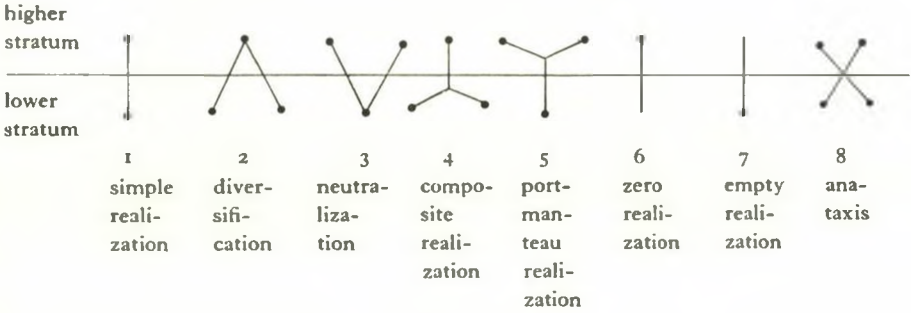


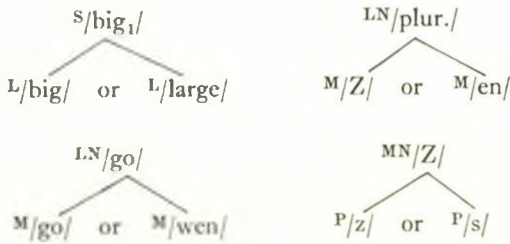
Fig. 10.1
Types of realization

Examples of types 1-8:

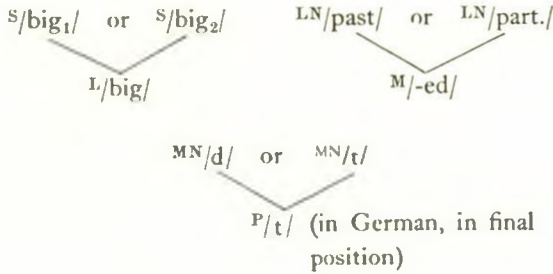
1. *Simple Realization:*



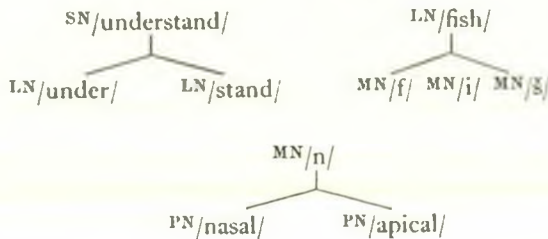
2. *Diversification:*



3. *Neutralization:*

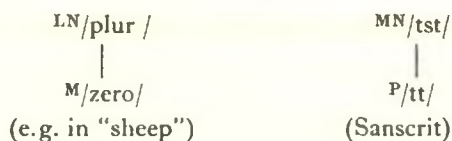


4. *Composite Realization:*



5. *Portmanteau Realization*: $S/\text{male}/$ $S/\text{sheep}/$ $L/\text{two}/$ $L/\text{ordinal}/$
- $L/\text{ram}/$ $M/\text{second}/$
- $M/\text{à}/$ $M/\text{le}/$ (French)
- $P/\text{o}/$

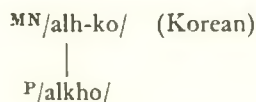
6. *Zero Realization*:



7. *Empty Realization*:



8. *Anataxis* (Metathesis):



It should be noticed that morpheme alternations which are morphemically conditioned are treated as diversifications between the lexemic and morphemic strata, whereas alternations which are phonemically conditioned are treated as diversifications between the morphemic and phonemic strata, which seems quite convincing.³

LATER DEVELOPMENTS

10.10 In the subsequent development of the theory the description becomes more complicated. Many of the realizations described above are now seen as taking place not between strata, but within the same stratum, and more intermediate entities are set up. In the case of composite realization it is obvious that the composition takes place within the same stratum. This appears also from the graph and from the fact that in the examples of composite realization the units of the lower stratum are -ons and not -emes. It is the morpheme $M/\text{fi}\check{s}/$ (realizing

3. The examples have mostly been taken from Lamb (1964a) and Lockwood (1972b, pp. 27ff). There are a few doubtful cases. The verb /do/ used in questions is, for instance, described as an empty lexeme by Lamb, but an empty morpheme by Lockwood. It will be seen that realization is seen as taking place not only between -ons and -emes, but also between -emes and -emes (or -ons and -ons) in two different strata. See, however, 10.10.

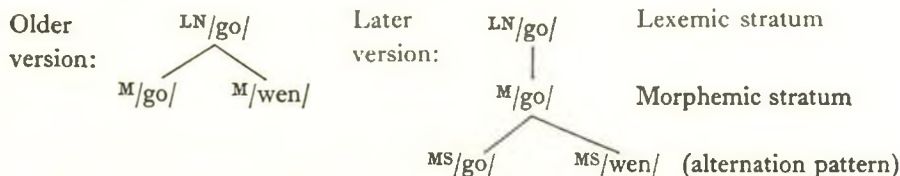
the lexon $^{LN}/fish/$) which is composed of the morphons $^{MN}/f/$, $^{MN}/i/$ and $^{MN}/\xi/$, and the phoneme $^P/n/$ (realizing the morphon $^{MN}/n/$) which is composed of the phonons $^{PN}/nasal/$ and $^{PN}/apical/$. What is confusing, however, is that composition is now treated as a type of "realization" within a stratum, forming a special SIGN PATTERN. In this way the distinction between representation and composition, which was considered crucial in 1964, and which was at the basis of the whole theory of strata, has been given up (cf. also F. R. Palmer's criticism 1968).

In "Outline" (1966c) portmanteau realization is also moved to the sign pattern, e.g. in French the morphemes $^M/\grave{a}/$ and $^M/le/$ are combined in a morphon $^{MN}/o/$, realized by the phoneme $^P/o/$. Similarly Lockwood (1972b, p. 55) designated $^S/sheep/$ and $^S/male/$ as two sememes combined in the semon $^{SN}/ram/$, and this realization must be placed in the sememic sign pattern. The semon $/ram/$ is thus realized by the lexeme $/ram/$ on the lexemic stratum.⁴

The other complex realization phenomena, e.g. diversification, neutralization, etc. are placed in an ALTERNATION PATTERN, which is placed above the sign pattern (see Lamb 1966c, p. 16). The placement of alternations within the stratum now makes it necessary to distinguish between two kinds of -eme units, (1) one type of indivisible unit (called -emes) realizing the -on of the higher stratum and entering into the tactics, and (2) a type of lower units (called emic signs) related to the unit of the first type by diversification, neutralization, etc. and composed of -ons of the stratum in question.

The emic sign is indicated by an S after the S, L, M or P, thus $^{MS}/go/$ indicates a morphemic sign $/go/$ (see Lockwood 1972b, p. 86).

In the earlier version of the theory the smaller unit of the lexemic stratum, the lexon, e.g. $^{LN}/go/$, was, as mentioned above, related directly by diversification etc. to the eme-units of the next stratum, the morphemes, e.g. $^M/go/$ and $^M/wen-/$. In the later version the lexon $^{LN}/go/$ is realized by a morpheme $^M/go/$, which is again realized by the morphemic signs $^{MS}/go/$ and $^{MS}/wen-/$. This takes place in the alternation pattern of the morphemic stratum. The morphemic signs are then (within the sign pattern of the morphemic stratum) spelt out in morphons.⁵

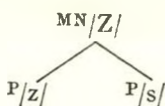


4. However, on p. 123 Lockwood says that in the most recent version of the theory portmanteau phenomena have been moved to an alternation pattern.

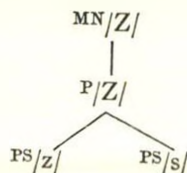
5. In the earlier version of the theory the lexons correspond to Hockett's morphemes, and the morphemes to his morphs. In the 1966 version the lexons and the morphemes realizing them correspond to Hockett's morphemes and the morphemic signs to his morphs.

Similarly the phoneme /Z/ realizing the morphon /Z/ is realized in the alternation pattern by the phonemic signs $^{PS}/z/$ and $^{PS}/s/$.

Older
version:



Later
version:



Composition and diversification will thus both take place within one stratum and will not be distinguished graphically as they are in fig. 10.1, but they are treated within the sign pattern and the alternation pattern respectively.

The realization portion is combined with the tactics through what Lamb (1966c) called a KNOT PATTERN. This is later called "DIAMONDS", because the connections are symbolized by diamond shaped figures in the graphic representation (Lockwood 1972b, p. 55-8). The diamond can, according to Lockwood (1972b, p. 56), be thought of as representing the -eme.

A stratum thus comprises a tactic pattern, a knot pattern ("diamonds"), an alternation pattern, and a sign pattern. The alternation pattern and the tactic pattern are placed above the sign pattern. They must be mutually connected because the tactic rules determine the alternations, specifying all and only the permissible structures. But their mutual placement shifts from one article to the next. In the latest version (Lockwood 1972b, p. 120f), there are two alternation patterns: one above and one below the tactic pattern; the latter deals mainly with alternation between free variants which are not determined by the tactic pattern. We thus get the order: higher alternation pattern, tactic pattern, lower alternation pattern, sign pattern; and some alternations are now again treated as taking place between a higher stratum and the following stratum.

RELATION TYPES AND GRAPHIC SYMBOLIZATION

10.11 Lamb uses a very simple set of relation types, namely AND-relations, and OR-relations, which may both be ORDERED or UNORDERED and have either an UPWARD or a DOWNWARD orientation. The relationship of a combination to its components is called an AND-relation. If the order of the constituents is significant it is an ordered AND-relation. If the order is insignificant (as in semology) or if the constituents are simultaneous (as constituents of a phoneme) it is an unordered AND-relation. The relationship which a class bears to its members is called an OR-relationship. Ordering in an OR-relation means precedence or priority of choice (i.e., if both choices are possible, the first is chosen).

The relations are symbolized graphically in the following way:

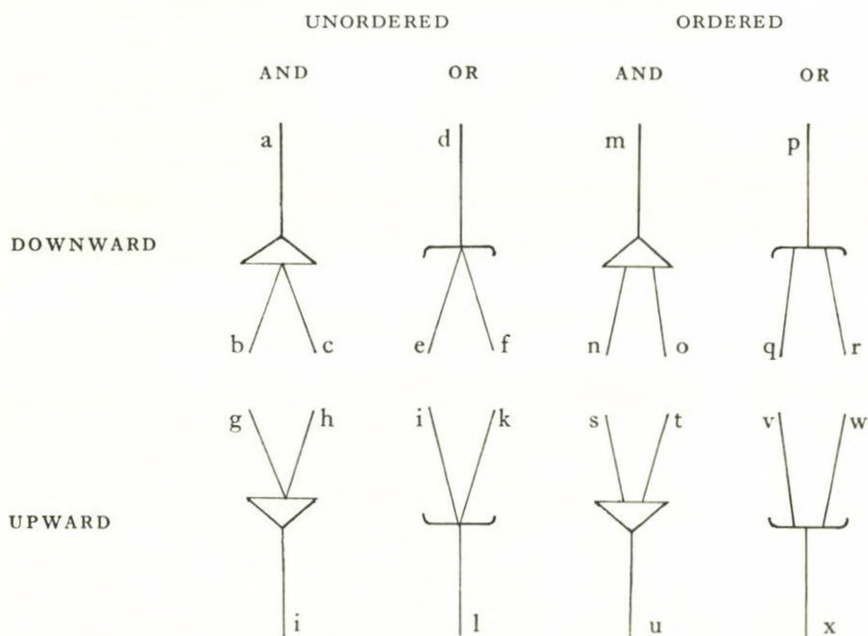


Fig. 10.2

The basic graphic symbols (Lamb 1966c, p. 9)

In accordance with the general orientation of the system, "upward" means upward towards meaning, and "downward" means downward towards sounds (see Lamb 1966c, p. 8ff, and Lockwood 1972b, p. 30ff).

Applied to the tactical pattern, the meaning of ANDs and ORs is very clear and directly comparable to Hjelmslev's terms both-and and either-or. ANDs are used for syntagmatic relationships, and ORs for paradigmatic relationships. The only difference is that Lamb does not speak of the relations between the constituents of a construction or between the members of a class, but of the relations between the construction (or the class) and its parts.

A simple phonotactic pattern can, for instance, have the following appearance:

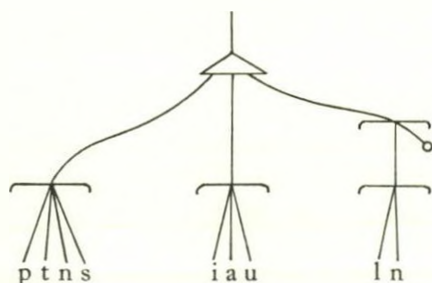


Fig. 10.3

Simple tactical pattern

This means that the syllable of the language in question has an onset (consisting either of *p*, *t*, *n* or *s*), a peak (containing *i*, *a* or *u*) and a coda (consisting of *l* or *n*). The higher OR node with a line ending in a zero means that the coda is optional.

The same relations are applied to the realizational portion of the strata. Figs. 10.4 and 10.5 present two examples of sign patterns, a morphemic and a phonemic sign pattern (from Lamb 1966c, p. 13). The entire morphemic sign-patterns of a language are generally too complex to be presented in a graph.

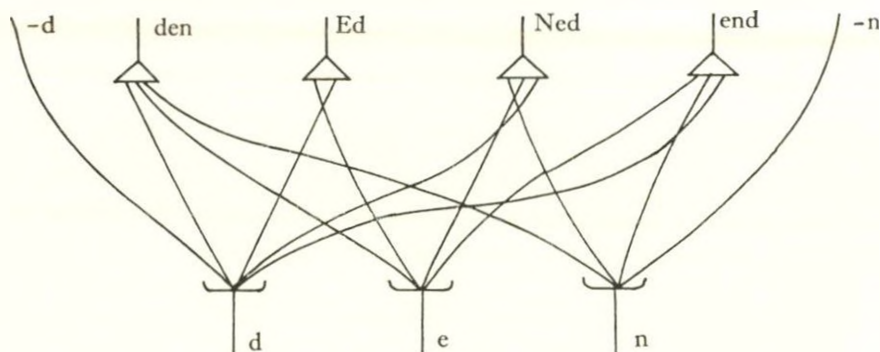


Fig. 10.4

Morphemic sign pattern (Lamb 1966c, p. 13)

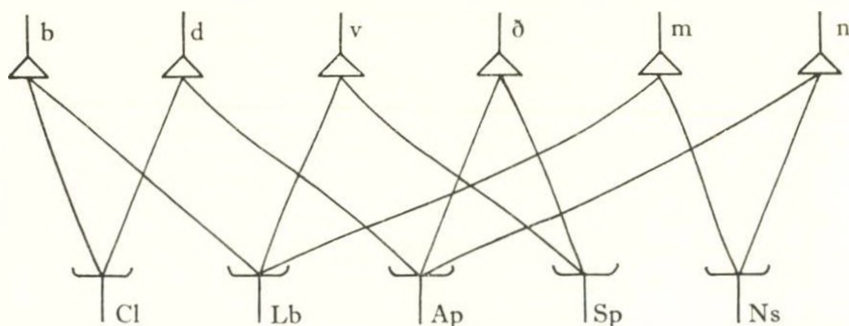


Fig. 10.5

Phonemic sign pattern (Lamb 1966c, p. 13)

The letters at the bottom of the phonemic sign pattern in Fig. 10.5 are abbreviations for phonons (Cl = closed, Lb = labial, Ap = apical, Sp = spirant and Ns = nasal).

In alternation patterns a downward unordered OR is used for diversification, and an upward unordered OR for neutralization. An upward AND is used for portmanteau realization. In the example French /à le/ realized as /o/ the AND will be ordered, because *a* and *le* are ordered; while in the example /ram/ realizing /male/ and /sheep/ the AND will be unordered, because the sememes are unordered.

DIAMONDS are used to combine the tactic pattern with the realizational part of the network.

A special graphic device, a so-called ENABLER, consisting in a broken line starting from the tactic pattern and ending in a filled circle in the alternation pattern, is sometimes used to show which alternant should be used under given tactical conditions.

The relations can also be symbolized in algebraic form, but Lamb considers the graphic patterns to be more important, and they form the basis for evaluations of the simplicity of the description.

When the relations are very simple, the graphs are easy to read. But as soon as they get a little more complicated, the only advantage of the graphs seems to be that they are decorative. A simple prose statement is in most cases much easier to understand. Two illustrations of this fact are given in Figs. 10.6 and 10.7 (from Lockwood 1972b, pp. 231 and 215).

Fig. 10.6 is a graphical representation of the simple fact that Belorussian has five vowels *i*, *u*, *a*, *e*, *o* in stressed position but only *a*, *i*, *u* in unstressed position,

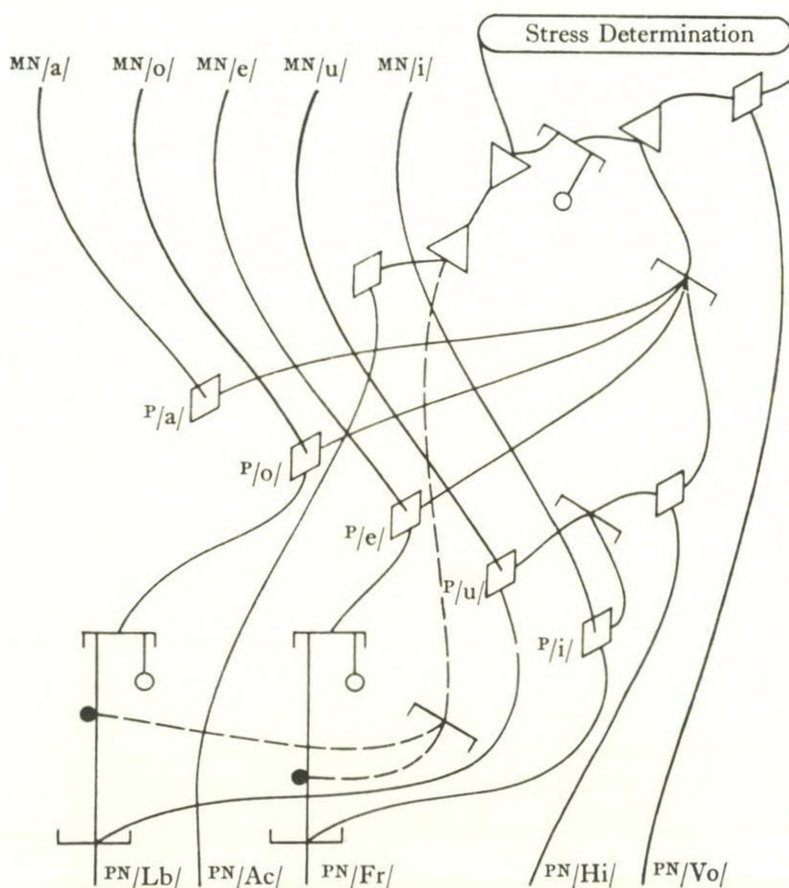


Fig. 10.6

Belorussian vowel alternation (Lockwood 1972b, p. 231)

e and *o* being neutralized with *a*. This graph represents a simplification of the much more complicated one which must be used if two phonological strata are posited (Lockwood 1972b, p. 229).

Fig. 10.7 is a graphical representation of a subset of the phonologically possible syllable onsets in English, namely: /pl, bl, kl, gl, pr, br, tr, dr, kr, gr, sl, sm, sn, spl, skl, spr, str, skr, sp, st, sk/ and any single consonant of the above, namely /p, t, k, b, d, g, s, l, r, m, n/. The full set would have been considerably more complicated.

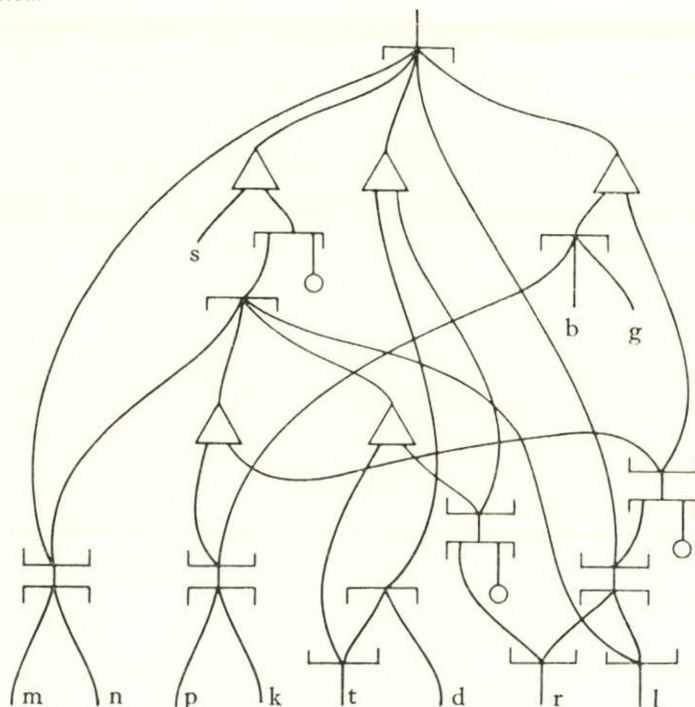


Fig. 10.7

Tactical pattern of some English onsets (Lockwood 1972b, p. 215)

It would probably be easier to read the list given above or the following statement: "All consonants *p, t, k, b, d, g, s, l, r, m, n* occur alone. Clusters of two consonants consist of either (1) *s* + any nasal or *l* or any voiceless stop, or (2) any stop + *r*, or (3) any labial or any velar stop + *l*. Clusters of three consonants consist of *s* + any of the two-consonant clusters starting with a voiceless stop".

It would also be possible to represent the same facts graphically in a much simpler way, e.g. as in Fig. 10.8 (which has been inspired by Bengt Sigurd's phonotactic diagrams).

It appears from the description of the stratificational graphs that the nodes represent relations and the lines units. This may be somewhat disturbing. It is, however, still more confusing that Lockwood (1972b, p. 33) says that labels like noun, verb etc. may be applied to the lines, or, alternatively, to the nodes.

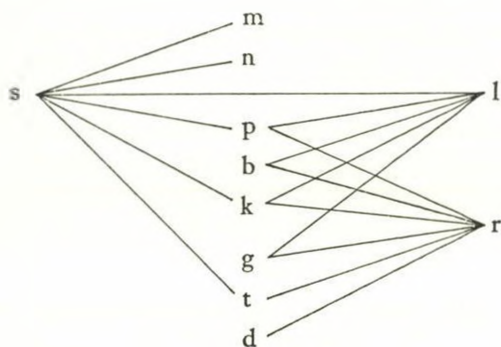


Fig. 10.8

THE PHONOLOGICAL PARTS OF THE STRATIFICATIONAL SYSTEM

THE PHONOLOGICAL STRATA

10.12 In the preceding description of the general structure of stratificational grammar, phonological phenomena have already been mentioned and used as examples at various points. There are, however, a few specific problems connected with the phonological description which will be taken up in this and the following sections.

In those of Lamb's publications that deal in more detail with phonology (1966c and particularly 1966b), he sets up two phonological strata, the phonemic and the hypophonemic. In his paper of 1971 he proposes to unite these two strata into one single stratum, but he does not give any explicit reasons for this change, nor does he give any details on the new system. The following description is therefore based on his earlier 1966 version with two phonological strata. Lamb's argument for positing two stratal systems in 1966 was that some combinations and some alternations are best described in terms of segments (for instance the alternation between *m* and *mn* in *damn* – *damnation*, *autumn* – *autumnal* (*n* is lost between *m* and juncture), whereas other combinations and alternations are best described in terms of components (features like "labial", "voiced", etc.), for instance combinations of obstruents which are either all voiced or all voiceless as in Russian, and the corresponding alternations between voiced and voiceless obstruents. It is therefore necessary to have two distinct tactical patterns and two distinct alternation patterns describing these two types; moreover, the lower tactical pattern must describe the combination of components in segments. These arguments seem convincing. Lockwood prefers, however, the new version with one stratum, and his argument is that according to the latest version of the theory there are two alternation patterns both in the lexemic and the morphemic strata, consequently there would be four phonological alternation patterns, and that

would complicate the description unnecessarily. As an example he gives two graphs of the Belorussian vowel phonemes mentioned above, one based on a monostratal phonology (see fig. 10.6), and the other, much more complicated, based on a bistratal phonology. One might, however, have chosen the solution to leave out the superfluous alternation patterns and keep the bistratal system.

On p. 226 Lockwood gives the following diagram of Lamb's 1966 model:

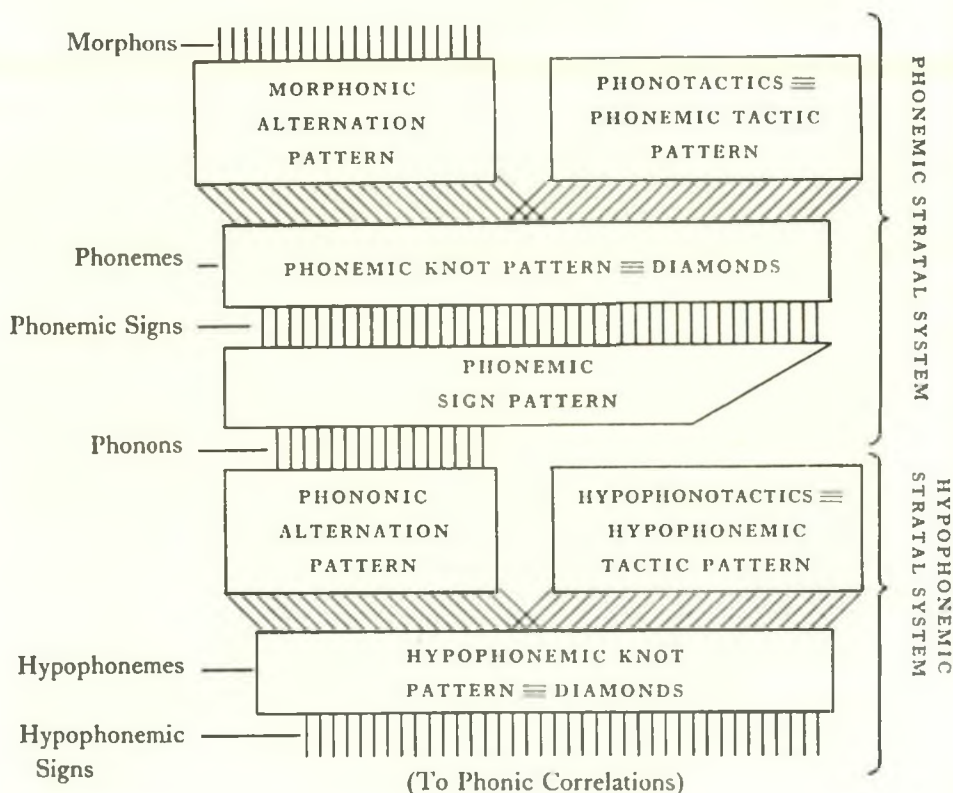


Fig. 10.9

Bistratal Model of Phonology (Lockwood 1972b, p. 226)

The morphonic⁶ alternation pattern deals with alternations which are best treated in terms of whole segments, with environments statable in terms of syllable structure.

The phonotactics describe the syllable structure in terms of units the size of the classical phoneme, but on a level of abstraction intermediate between the morphophonemic and the classical phonemic levels.

The phonemic knot patterns (or "diamonds") connect the alternation pattern and the phonotactic pattern.

6. The higher alternation pattern of a stratum is named according to the units involved in its alternations, which will be the -ons of the stratum above.

The phoneme is the basic unit of the phonotactic pattern. It realizes a morphon and is realized by one or more phonemic signs. In the sign pattern the phonemic signs are broken down into phonons. For instance the morphon $^{MN}/Z/$ is realized by the phoneme $/Z/$, which is realized in the alternation pattern by the phonemic signs $/s/$ and $/z/$. In the sign pattern they are broken down into the components "apical", "spirant", etc. (see fig. 10.5).

The phononic alternation pattern, which is part of the hypophonemic stratal system, accounts for the remaining morphophonemic alternations, those which are better handled in terms of components; they are independent of the syllable boundary.

The hypophonotactics specifies the structure of segments and clusters (in so far as they are best accounted for in terms of components). Fig. 10.11 gives an example of a hypophonotactic diagram (for the labels of the components see 10.13).

The hypophoneme is the realization of a phonon and is realized by hypophonemic signs. There is no hypophonemic sign pattern, since this is the lowest level (see, for this description, Lockwood, pp. 226-7).

On p. 233 Lockwood gives a diagram of the simplified phonological stratal system (see fig. 10.10).

The morphonic and phonemic alternation patterns correspond to the morphonic and phononic alternation patterns of Fig. 10.9 and have the same functions (the

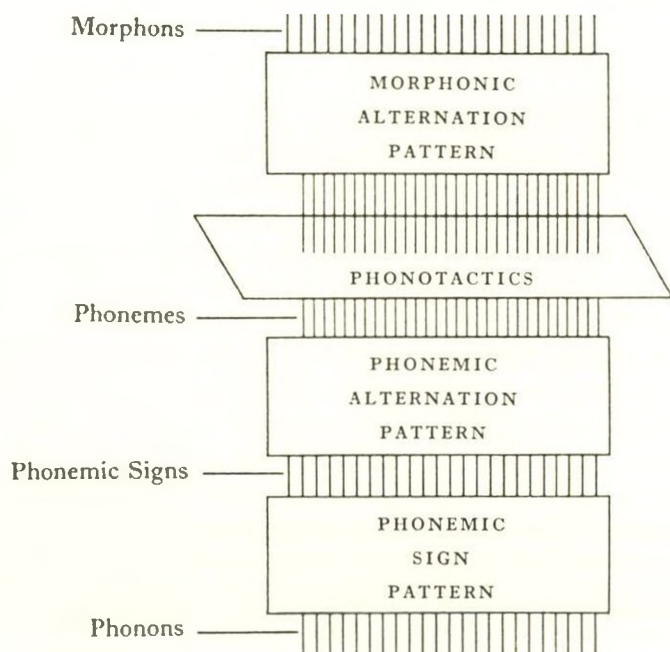


Fig. 10.10

Revised Phonemic Stratal System (Lockwood 1972b, p. 233)

final decision as to where a particular alternation is treated will depend on the relative simplicity of the possibilities). The two tactic patterns have, however, been combined into one, which must deal with both the combination of segments and of components.

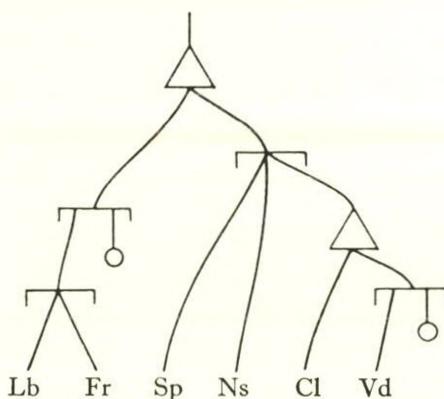


Fig. 10.11

A hypophonotactic diagram (Lockwood 1972b, p. 340)

COMPONENTS, MARKING, AND NEUTRALIZATION

10.13 The COMPONENTS (phonons realized by hypophonemes) used in stratificational phonology are indicated by two-letter abbreviations (Cl = closed, Sp = spirant, Ns = nasal, Rz = retracted (sometimes used for *s* and *r*), Lt = lateral, Lb = labial, Ap = apical, Fr = front, Do = dorsal, Hi = high, Lo = low, Vl = voiceless, Vd = voiced) (Lockwood 1972b, pp. 209ff and 242ff).

The components are not set up in binary pairs but designated as "singulary". There may be three members in one dimension (e.g. labial, apical, dorsal), and the attention is focused on the individual properties taking part in a contrast rather than on the contrast as such. One contrasting property of a dimension is considered UNMARKED; /Vl/ may, for instance, be considered unmarked in obstruents, and /Do/ may be considered unmarked compared to /Lb/ and /Ap/. In vowels mid vowels are considered unmarked, and if there are only two degrees of aperture either /Hi/ or /Lo/ may be considered unmarked. The use of marking differs from the way it was used in the Prague School (see 3.6-3.7) in that it is also applied to ternary oppositions, and moreover by the fact that the unmarked members may be left out completely in the description. Voiced obstruents are thus designated as /Vd/, but the voiceless ones are neither indicated as /Vd/ nor as /Vl/. In this way the number of components for each phoneme is restricted. This is reminiscent of the way marking conventions are used in generative

phonology (see 9.31), but in contradistinction to generative phonology the marking conventions are not considered universal. The simplest description is chosen for each individual language.

The hypophonotactic diagram fig. 10.11 (Lockwood 1972b, p. 340) indicates the combinatory possibilities of the components of the system:

	Lb	Fr	
Cl	{ p	t	k
	{ b	d	g
Sp	f	s	x
Ns	m	n	ŋ

It could also be displayed in a different way (with the unmarked components in parentheses):

p	b	f	m	t	d	s	n	k	g	x	ŋ
Lb	Lb	Lb	Lb	Ap	Ap	Ap	Ap	(Do)	(Do)	(Do)	(Do)
Cl	Cl	Sp	Ns	Cl	Cl	Sp	Ns	Cl	Cl	Sp	Ns
(Vl)	Vd			(Vl)	Vd			(Vl)	Vd		

Stratificational phonology follows the Prague School and glossematics in positing NEUTRALIZATIONS, and the Bloomfield School is attacked for not accepting this concept (cf. Lockwood 1972b, pp. 193 and 236ff, Lockwood 1972a, Sullivan 1972b).

Neutralizations take place between a higher and a lower level. There must be a contrast on the higher level, which means that only resolvable neutralizations are recognized. There is therefore no neutralization in the stratificational sense in *sp-*, *st-*, *sk-*. On this point Lamb is in agreement with glossematics,⁷ but in disagreement with the Prague School.

A neutralization of the type found in Russian obstruent clusters in which the voicing of the last consonant determines that of the whole cluster would, according to Lockwood (1972b, p. 236ff), be described in the following way: in morphonic forms there is a difference between /kb/ and /gb/, but in the phonemic signs there is neutralization and both have the same components /Cl Cl/. This means that

Lb
Vd

k and *g* consist of the same hypophoneme /Cl/ in this position. In the hypophonemic sign /Vd/ is inserted from the tactics in both cases.

7. It is true, though, that Hjelmslev recognized the existence of irresolvable syncretisms, but only in positions where resolvable syncretisms also occurred (e.g. German *ab*).

THE STRATIFICATIONAL AND THE "CLASSICAL" PHONEME

10.14 The stratificational phoneme is not identical with the classical phoneme. It is of the same size, but it is partly morphophonemic in character, since it realizes a morphon. The phonemic sign is considered to correspond approximately to the classical phonemic representation.⁸ The phonemic sign is a unit composed of phonons, and contains only distinctive phonons. The level of distinctiveness is thus below the stratificational phonemic level. The hypophonemic level is characterized by distinctiveness and has a biunique relation to the phonetic stratum like the classical phoneme. Biuniqueness is also maintained in the case of neutralization. In the Russian example mentioned above both the phonetic and the phononic features can be predicted, given the surroundings. In *kb* and *gb* the first consonant will be phonetically voiced, in *kp* and *gp* voiceless, but in no case is there distinctive voicing. Biuniqueness is not, however, maintained between the hypophonemic level and the morphonic level (Lamb 1966b, p. 57of, Lockwood 1972b, p. 235ff and 1972a, p. 657ff).

CONCLUSION

10.15 Lamb has not had many followers. This may be due partly to his bad luck in propounding a new theory simultaneously with Chomsky. The enormous success of transformational grammar did not give a basically different theory much of a chance. Moreover, Lamb has been criticized by Chomsky and violently attacked by Postal, who uses much space in his book "Aspects of Phonological Theory" to prove that Lamb is wrong. Even Hockett, whose articles have been one of the main sources of inspiration for stratificational grammar, was completely negative in his review of "Outline" (1968). On p. 153 of this review he writes: "So, in the end, how many strata do we need? Not Lamb's current eleven or six. Not my two of 1961. Not even just one. None at all. The stratificational view was an error from the outset". – But Lamb's position is due not only to bad luck. Lamb's theoretical apparatus (and his graphs in particular) are unnecessarily complicated. Four strata, furthermore, may give an enormous redundancy in cases of simple realization. We may, for instance, have to set up a semon /house/, a lexeme /house/, a lexemic sign /house/, a lexon /house/, a morpheme /house/, etc. (cf. also the reviews by Chafe 1968 and F. R. Palmer 1968).⁹

Nevertheless, in a more moderate form the stratificational view seems promising in the light of its emphasis on relations. Language should also be described from this point of view. As for the psychological reality of the description it is certainly

8. Most closely to the phoneme of the Bloomfield School.

9. In the last version of the theory (Lamb 1971), however, direct connections between the conceptual level and the separate strata are introduced in order to avoid some of these repetitions.

very optimistic to think that the lines in the graphs should be interpretable in terms of dendrites and axons and the nodes in terms of nuclei and synapses in the human brain (!) (cp. Sullivan 1972a, p. 26); on the other hand, nobody knows yet whether Lamb's network or Chomsky's rules give a better picture of what is going on.

Chapter 11

PHONOLOGICAL THEORY IN THE SOVIET UNION

Introduction

BIBLIOGRAPHIC REMARKS

11.1 The knowledge of Soviet phonology in Western countries is very modest, and Russian authors are very rarely quoted. This is mainly due to the fact that almost all contributions are written in Russian, and, unfortunately, most Western linguists – apart from Slavonic philologists – are unable to read Russian fluently.¹

A very restricted number of articles, almost exclusively by S. K. Šaumjan, have been written in English or German, and very little has been translated. The periodical “Langages” (vol. 15, 1969), edited by R. L'Hermite, contains a selection of Russian papers on linguistics, but nothing dealing particularly with phonology. English translations of Revzin's “Models of Language” (which contains a chapter on phonology) and of Šaumjan's book “Problems of Theoretical Phonology” were published in 1966 and 1968 respectively, and O. S. Axmanova, “Phonology, Morphonology, Morphology” was published in 1971, but this is about all.

There exist, however, a few introductions to Russian phonology, written in English. “Current Trends in Linguistics 1, Soviet and East European linguistics” (1963) contains a chapter on “Phonemics” (p. 5–21), written by MORRIS HALLE. He gives an account of the main characteristics of the Moscow and the Leningrad Schools and of R. I. Avanesov's attempt at a compromise. D. D. MILIVOJEVIČ gives a detailed summary of Šaumjan's theory in his book “Current Russian Phonemic Theory 1952–62” (1970), and F. H. H. KORTLANDT's book “Modelling

1. This has also been a handicap to the present author, who is only able to read Russian very slowly. As I had only limited time at my disposal, I had to restrict my readings. This chapter is therefore based on the co-operation of Peter Molbæk Hansen, who made detailed Danish summaries of a great number of the Russian papers quoted; as Mr. Molbæk Hansen has an excellent knowledge both of Russian and of phonology, I could rely on his summaries and restrict my reading to the crucial parts of the papers. Nevertheless, we were not able to go through all of the relevant literature, which has become rather abundant during the last decade, but had to make a choice. We are grateful to Dr. A. S. Liberman, Leningrad, for help in this choice, and for procuring some very important books. However, not all the works that he advised us to read were available. The account given here is therefore based on a relatively restricted choice of papers. Only works read by Peter Molbæk Hansen and/or me have been listed in the bibliography. More extensive bibliographies are found in Zinder 1968 and Kortlandt 1972.

the Phoneme" (1972) contains a succinct summary of Russian phonemic theory before 1962 (pp. 19-27), a detailed critical review of Šaumjan's theory (pp. 28-45), and a discussion of more recent mathematical models by Revzin, Uspenskij, Beloozerov and others (pp. 46-110). This book should be read by everybody interested in modern Russian phonological theory.² The last chapter of F. HÄUSLER's book "Das Problem Phonetik und Phonologie bei Baudouin de Courtenay und in seiner Nachfolge" (1968, pp. 106-25) contains much information on the phonological theory of L. V. Ščerba. Finally it should be mentioned that R. L'Hermite, in his introduction to the above-mentioned number of "Langages" gives a brief survey of the development of Russian linguistics in general (pp. 3-13); his regular reviews of the leading Russian linguistic periodical "Voprosy jazykoznanija" in "Bulletin de la Société de linguistique de Paris" constitute also a good source of information about this development.

The most important surveys written in Russian are those by M. V. Panov (1967), L. R. Zinder (1968) and A. A. Reformatskij (1970). PANOV gives in chapter 4 of his textbook of Russian phonetics (p. 350-414) a survey of the development of Russian phonetics and phonology from its very beginnings in the eighteenth century, with special emphasis on Baudouin de Courtenay. ZINDER's paper "Fonologija i fonetika" (1968, 39 pp.) is concentrated on the development since the 1920s and contains a wealth of references. REFORMATSKIJ has published a very useful collection of papers on phonology written in the period 1928 to 1963 ("Iz istorii otečestvennoj fonologii" 'Selections from the history of phonology in our country'), and in the introduction to this work (pp. 1-120) he gives a detailed and vivid description of the discussions between the different schools as seen by the most prominent representative of the Moscow School. This introduction has been one of the main sources of information used in this chapter.

THE GENERAL CONDITIONS FOR THE DEVELOPMENT OF RUSSIAN PHONOLOGY AND ITS RELATION TO WESTERN STRUCTURALISM

II.2 All trends in Russian phonology until the beginning of the fifties (including the two dominating schools, the Leningrad and the Moscow Schools) go back to the ideas of the Polish linguist J. Baudouin de Courtenay (see 2.4 above), who taught at various Russian universities (1871-75 in St. Petersburg, 1875-83 in Kazan', 1910-18 again in St. Petersburg) and who was also a source of inspiration for Western phonology (see section 2.4 above). In this early period, until the end of the first World War, there were many contacts between linguists in the eastern and western parts of Europe. Baudouin de Courtenay met Saussure in Paris in

2. Cp. now also J. Krámský, "The Phoneme" (1974, pp. 126-48).

1881 (see Roman Jakobson 1965, p. 20), and from about 1900 on he also corresponded with P. Passy. Baudouin's St. Petersburg student L. V. Ščerba studied with Passy in Paris during 1908–09 and published a short description of Russian sounds in a supplement to "Le maître phonétique" in 1911, in which he used the term "phoneme" for sounds having a distinctive function. According to Roman Jakobson (1971, p. 425) it was under the influence of Passy that Ščerba introduced the distinctive function in his definition of the phoneme. On the other hand, it was through Ščerba's paper that Daniel Jones got acquainted with the term "phoneme", and it was through discussions with another student of Baudouin de Courtenay, Titus Benni, that the importance of the phoneme theory became clear to Jones (see 4.1 above). Finally, it should not be forgotten that the most prominent members of the Prague School, Trubetzkoy and Roman Jakobson, were Russians and had grown up in the Russian linguistic tradition. They had both studied in Moscow where linguistic studies were dominated by the Fortunatov School (the "formalist" school, which also influenced Hjelmslev), and they were acquainted with the Leningrad School of phonology, which continued Baudouin de Courtenay's teaching. L. V. Zinder (1968, p. 194) writes that at that time almost every first-year student of philology knew the concept of the phoneme (and as early as 1902 a Russian encyclopedia contained a long article on the phoneme). Roman Jakobson and Trubetzkoy brought this tradition to Prague. But at that time Roman Jakobson had already been influenced by Saussure through the Russian linguist S. J. Karcevskij, who in 1917 returned to Moscow after years of study in Geneva (see Roman Jakobson 1962, p. 631). The contact between East and West was thus close, and Russian linguistics had a decisive influence on the start of Western structuralism.

After the Russian Revolution, however, the connections were broken, and until the middle of the fifties there was hardly any contact. Russian papers were rarely read in the West, and the rapidly growing Western structuralism – although not unknown in the USSR – had little influence because it was not politically acceptable. In this period the development of Russian linguistics was seriously hampered by the dominance of Marrism (see e.g. L'Hermite 1969, p. 5ff). N. J. MARR (1864–1934) was a Russian linguist, a specialist of note in Caucasian languages, who developed some extravagant ideas in the field of comparative philology and general linguistics, and who somehow succeeded in convincing the political authorities that these views represented the true and real Marxist linguistic theory. He thought that all languages had originated from a common source; he even claimed to know the first four elements from which all languages had developed, namely the syllables *sal*, *ber*, *jon* and *roš*. Linguistic evolution was assumed to take place in leaps through definite stages dependent on the structure of the society. Language was considered to be a superstructure like philosophy, art, literature, religion, etc., reflecting the economic base structure. It was therefore also connected with social classes. These theories, which every linguist had to accept, were, of course, disastrous both for comparative and for general linguistics.

After Marr's death in 1934, his theories were further developed by his followers, particularly by I. I. Meščaninov. Some of the most absurd of Marr's ideas were pushed into the background, and for a time there was a certain relaxation, but at the end of the forties the position of Marrism was strengthened again, and in 1949 a number of linguists, among them most of the members of the Moscow phonological School, were accused of having cherished idealistic ideas in contravention of the Marxist linguistic theory.

Suddenly, however, everything was changed. In May 1950 the linguist A. Čikobava attacked Marrism publicly, and in June 1950 Stalin himself published an article in *Pravda* on the situation in linguistics, in which he characterized Marr's doctrines as absurd and in no sense representative of Marxist theory. He emphasized that language is not a superstructure dependent on the economic base structure, but an independent structure which must be investigated by a specific method, that it is not intimately connected with social classes, but a means of communication common to all members of the society and that it does not change in leaps dependent on social revolutions. A free discussion of the principles of linguistics must be opened, and a new Soviet linguistics based on true Marxist ideas must be founded.

This intervention opened new possibilities for Soviet linguistics. Comparative studies could again be based on sound principles, and general linguistics was given more rope, though still a rather short one, since Western structuralism was, as before, considered bourgeois, idealistic, subjective, and degenerate.

In 1952 "*Izvestija Akademii Nauk*" started a discussion on the principles of phonology (see Reformatskij 1970, pp. 35-46, Milivojevič 1970, pp. 16-23, and Kortlandt 1972, pp. 25-7). They asked S. K. Šaumjan who was relatively independent of the two competing schools, the Moscow and the Leningrad, to open the discussion. Šaumjan, however, turned out to be *too* independent. He rejected the theory of the Leningrad School as purely phonetic, and the principles of the Moscow School (in a few lines) as erroneous. The article was mainly built on Trubetzkoy's views, particularly his theoretical claim of a strict separation of phonetics and phonology, and the phoneme was characterized as an abstraction. He thus managed to offend everybody, and no less than fifteen articles, which were all against him, were published in the course of 1952-53. Moreover, his views were considered politically unacceptable. Although he had quoted both Stalin, Lenin, and Engels and had argued that his view of the double nature of the speech sound was representative of dialectical materialism, and although he had accused Hjelmslev of idealism, his own dependence on Western structuralism was obvious and he was in turn accused of idealism, particularly by Bernštejn (see Bernštejn 1952).

In the same period (1952-53) structuralism, and particularly glossematics, was violently attacked in various articles in "*Voprosy jazykoznanija*". But, in 1953 Stalin died, and in the following years a steadily increasing influence from Western theories was noticeable, starting with mathematical linguistics which was accepted

because of its practical applications, but soon followed by structural linguistics of various types. In 1960 a department for structural linguistics was established at the Academy in Moscow, and in the years 1960–62 works by Trubetzkoy, Jakobson, Martinet, Hjelmslev, Uldall, Harris, and Chomsky were translated into Russian, and various positive papers on structuralism were published. There was also, however, a certain resistance. In 1965 V. I. Abaev published a vehement attack on modern linguistics which he accused of “dehumanizing” linguistic studies (extracts of this article have been published in French translation in “Langages”, see also Kortlandt 1972, pp. 113–19). Practically nobody agreed with him, except F. P. Filin, who at the same time wrote a more moderate article with a similar content. The victory of structuralism was almost complete. Recently, however, there have been signs of a certain reaction. In 1971 Filin was appointed chief editor of “Voprosy jazykoznanija”, and more traditional views seem to gain ground. This reaction, by the way, is not a special feature of Russian linguistics: adherents of transformational grammar have for some time considered structuralism to be completely out of date.

The Leningrad School

L. V. ŠČERBA

BACKGROUND AND GENERAL VIEWS

11.3 The Leningrad School of phonology has its origin in Baudouin de Courtenay's teaching at the University of this city (at that time St. Petersburg) from 1910 to 1918. Among his pupils were L. V. Ščerba, E. D. Polivanov and S. I. Bernštejn.

L. V. Ščerba (1880–1944) was Baudouin's most prominent pupil in the field of phonology and the actual founder of the Leningrad School. Ščerba had studied at various European universities during 1906–09. From 1908 to 1909 he studied with Rousselot and Passy in Paris, and in 1909, shortly before the arrival of Baudouin in St. Petersburg, he was appointed leader of the laboratory of experimental phonetics. At the same time he worked on his thesis, a phonetic description of Russian vowels which appeared in 1912 under the title “Russkie glasnye v kačestvennom i količestvennom otnošenii” (‘Russian vowels from a qualitative and quantitative point of view’). Ščerba had, of course, already known Baudouin de Courtenay's works before he came to St. Petersburg. In the first paragraph of his thesis he mentions that Baudouin de Courtenay's “Versuch einer Theorie phonetischer Alternationen” had been the starting point of his work. But the influence from Baudouin was reinforced by their personal contact in St. Petersburg. What Ščerba took over from Baudouin was not, however, his theory of alternations, but his interest in the study of living languages and his psychological

approach. Already in a paper of 1909 on the subjective and objective methods in phonetics he had emphasized that the synthesis of acoustic and physiological facts and their utilization for linguistic communication takes place in the mind, and that the main object of phonetic studies must be the psychological sound images. It is necessary to ask the speaker which phonetic differences are used for communication, and the method must thus be subjective. The different modifications of sounds in different surroundings are not noticed by the speaker (see Häusler, p. 106ff). We see that, already here, both the **PSYCHOLOGICAL REALITY** and the **COMMUNICATIVE FUNCTION** of speech sounds are emphasized.

In the short article in "Le maître phonétique" (1911) Ščerba uses the term "phoneme" (with reference to Baudouin de Courtenay) and characterizes phonemes as "sons qui ont une valeur significative". As mentioned above, this formulation may have been influenced by Passy. In his book on Russian vowels (1912) Ščerba gives a more detailed account of his views. Phonemes are described as general sound images; but the basis for these images or notions is found to be the distinctive function. On p. 14 he gives the following definition of the phoneme: "The phoneme is the shortest general phonetic notion in a given language which is capable of being associated with notions of meaning and of differentiating words". The formulation "association with notions of meaning" and "differentiation of words" is not as pleonastic as it may seem at first look. By "association with notions of meaning" Ščerba understood the faculty of single phonemes to make up a morpheme, i.e. in English the article *a*, or the plural suffix *s*, or the adverbial ending *y* (in Russian there are more examples). In this way the phoneme acquires a certain degree of independence (see Häusler, pp. 112-14). It is a potential bearer of meaning. In the "differentiation of words" the phoneme only functions as a diacritic, and the connection with meaning is indirect.

The psychological approach was emphasized by Ščerba on many occasions, even more than by Baudouin de Courtenay. But in the twenties both he and Baudouin were severely criticized by the Marrists for employing subjective and idealistic methods in linguistics, and Ščerba then dropped the psychological definitions and instead emphasized the social function. In his book on French phonetics from 1937 he defines the phoneme as a "sound type capable of differentiating words and their forms, i.e. capable of serving the purpose of human communication" (1937, p. 17).

PROCEDURES FOR ESTABLISHING THE PHONEME INVENTORY

II.4 Ščerba's procedure of segmentation is based on the cases of monophonemic morphemes. In Russian all vowels and various consonants appear as separate expressions of morphemes, and when for instance *a* has been isolated as a case ending, it may also be isolated in other cases. In this way also consonants which

are combined with *a* in a biphonematic morpheme may be segregated (Zinder 1960, § 21). Morpheme boundaries thus play an important role in the segmentation procedure.

In order to find the number of distinctions in a given environment minimal pairs are used. If an exchange of one sound for another produces a new meaning or spoils the word, the two sounds cannot be united into one phoneme. But Ščerba is well aware of the fact that the crucial problem is to localize the relevant, independent difference, for instance when both the consonant and the adjoining vowel are palatalized (cp. Zinder 1960, § 49).

As for the problem of uniting sounds in different positions as members of one phoneme, Ščerba could in part rely on the speaker's intuition as long as he defined the phoneme as a psychological entity. After having given up this definition he had to rely on complementary distribution and phonetic similarity as it is done in most other phonological schools.³ The phoneme is, according to the later definition, not only a functional unit, it is also a sound type, and it is assumed that it contains some stable phonetic features which are present in all its variants. A phoneme can therefore be recognized and distinguished from others, even in words which have no corresponding minimally different counterpart; e.g. in the word *mak* ('poppy') the vowel can be identified as an /a/, although there is no word *mek*. And this identification can also be made in positions where no contrast is possible. This means that the concept of NEUTRALIZATION is not accepted, and no archiphonemes are set up (as in the Prague School), nor are alternations taken into account in the identification of phonemes (as Baudouin de Courtenay had done in most of his writings, and as it is done in the Moscow School). In a word like Russian [xot] ('motion'), Ščerba thus identifies the final consonant as a /t/, although no [d] is possible in this position, and although the word has /d/ in medial position [xoda] (see e.g. Zinder 1960, § 44). On these points Ščerba is in accordance with the approach of the Bloomfield School and with Daniel Jones.

PHONEME AND VARIANT

II.5 Another characteristic feature of Ščerba's theory is the description of variants. Ščerba distinguishes three types of variants: (1) obligatory variants (which are conditioned by the environment), (2) individual variants (characteristic of different speakers), and (3) facultative variants (which may be socially or dialectally conditioned). Not all obligatory variants are considered to have the same importance. One of the variants, viz. the variant which is most independent of the surroundings and which expresses the common phonetic features "to the

3. But he found the identification supported by cases where the sounds in question were found in different forms of the same morpheme, e.g. [ɛ] and [e] in ['etɔt] 'this' ['etɨ] 'these'.

highest degree", is called the typical or BASIC (FUNDAMENTAL) VARIANT ("osnovnoj ottenok"). When pronounced in isolation a phoneme will always be realized by its basic variant. But this criterion can only be applied to syllabic phonemes, and for consonants it is thus often impossible to set up a basic variant (Zinder 1960, § 29ff).⁴

The idea of the basic (or fundamental) variant seems to be partially responsible for Ščerba's interpretation of the Russian vowels [i] and [i̯]. These two vowels are in complementary distribution in Russian, [i̯] being found initially and after a palatalized consonant, and [i] in other positions. Already Baudouin de Courtenay had therefore considered them to be variants of the same phoneme. Ščerba, however, considers them to be two separate phonemes, although with a very low functional load. His motivation is that a Russian speaker is able to pronounce both vowels in isolation without difficulty and that, in analogy with the verbs *akat'*, *okat'*, *ekat'* and *ikat'* ('to pronounce the sounds [a, o, e, i]'), we can produce the verb *ykat'*⁵ ('to pronounce the sound [i]') (cit. from Halle 1963, p. 9). Zinder (1960, § 52) adds the argument that [i̯] and [i] form a minimal pair as names for the letters *и* and *й*, which can be regarded as inflexible nouns in the neuter gender.

PHONETICS AND PHONOLOGY

II.6 On the whole Ščerba was moving rather far away from the ideas of his teacher, Baudouin de Courtenay. What is left is the idea of the phoneme in one of the senses in which it was used by Baudouin, but differently defined, and the conviction that the functional and the physical aspect of speech sounds should not be separated by setting up phonology as a specific discipline distinguished from phonetics. On this point also, Ščerba and Jones are in agreement. S. K. Šaumjan (1952, p. 340, and 1968, p. 16) and others have designated Ščerba's phonological theory as purely physical. It is true that physical facts play a greater role for Ščerba than e.g. in the Prague School and the Moscow School, but, on the other hand, the differentiating function of the phoneme has such a prominent place in his definitions and procedures that this characterization cannot be upheld. It has also been repudiated by Zinder and Reformatskij (see e.g. Reformatskij 1970, p. 102).

4. 'The concept "basic variant" also plays a role in Daniel Jones' phonological theory (e.g. "The Phoneme" 1950, p. 8 ("principal member of a phoneme")), and it is found in the "Projet d'une terminologie phonologique standardisée" which the members of the Prague School agreed upon in 1931 (see "TCLP" 4, 1931, p. 320, "variante fondamentale"), but it was not much utilized in Prague phonology, except in some of Jakobson's earlier writings. J. Greenberg ("Language Universals" 1966, p. 22f) also speaks of "basic allophones" which are relatively independent of the phonetic environment.

5. ' after a consonant in transliterations and phonemic notation of Russian words indicates that the consonant is palatalized.

CONTRIBUTIONS FROM OTHER MEMBERS OF THE LENINGRAD SCHOOL

II.7 E. D. POLIVANOV (1891–1938) and S. I. BERNŠTEJN (1892–1970) were students of both Baudouin de Courtenay and Ščerba. Polivanov adopted the psychological definition of the phoneme and stuck to it also in his latest writings, but at the same time he stressed the communicative aspect of language. He applied phonological principles of description to a number of Eastern languages (for instance, Japanese) and was particularly interested in prosodic features, and in the phonological role of the syllable (see Ivanov 1957).

Polivanov was one of the first to describe sound change from a phonological point of view (1928). He set up two main types of phonological change, viz. merger and split, and stressed the fact that splits are normally conditioned by mergers (cp. Roman Jakobson 3.16 above). He also mentioned cases of chain reaction of the type $\varepsilon > e$, $e > i$ as conditioned by the system, a point of view which was taken up later by Martinet (see 3.18 above).

In 1929 he was sent to Central Asia because he protested against Marr's theories. In 1937 he was arrested, and he died in prison in 1938.

Bernštejn went from Leningrad to Moscow in the thirties. The confrontation with the Moscow phonological School made him try to unite the two approaches into one theory (see 11.14 below). In two articles of 1936 and 1937 (see Zinder 1968, p. 196) and again in 1952 (p. 545) he criticized the Prague School for attaching too much weight to the differentiating function of the phoneme and too little weight to the positive function of identification and word recognition.⁶ Word differentiation is only a means of word recognition, and the description of redundant features should not be neglected since they may play an important role in speech recognition (see Zinder 1968, pp. 196 and 198, and Bernštejn 1952). This point of view was accepted later both in the Leningrad and in the Moscow Schools (see Zinder 1967 and 1968, and Reformatskij 1970, p. 55ff). Bernštejn also emphasizes the necessity of maintaining the close connection between phonology and phonetics, i.e. to maintain phonetics as a linguistic discipline (1952).

Since Ščerba's death in 1944 L. R. ZINDER has become the most prominent member of the Leningrad School. In one of his early articles (1948) he attacks the Moscow School for causing confusion in phonological theory by their morphological approach, and maintains that the same sound cannot be a realization of two different phonemes. Neutralization is nothing but a case of defective distribution. Twenty years later, in the article "Fonologija i fonetika" (1968), he gives a more balanced account of the differences between the two schools, without giving up his own position.

In his textbook of general phonetics ("Obščaja fonetika" 1960, pp. 33–76) he

6. Within the Prague School A. W. de Groot maintained the same view, see e.g. "TCLP" IV, 1931, p. 295; cp. also H. Mol and E. M. Uhlenbeck, "Hearing and the concept of the phoneme" ("Lingua" VIII, 1955), cf. 3.3.

has given a detailed exposition of the Leningrad approach to phonology. Zinder is a faithful advocate of Ščerba's theory, which he has taken over with very few modifications, and Ščerba is quoted on almost every page of his chapter on phonology. In the first paragraph (§ 21) he defines the phoneme as the smallest linearly indivisible sound unit in la langue; but in § 25 it is characterized as a sound unit which is capable of differentiating meanings.

Ščerba's methods for establishing the phoneme inventory are quoted and accepted. In this connection Zinder stresses the fact that for the identification of variants only the distinctive features are used, so that for instance *s* and *h* may well be variants of the same phoneme, provided they are the only spirants of the language in question. It is not a simple question of phonetic similarity (§ 39). The distinctive features are assumed to be present in all variants of a phoneme, but they may be of a relative kind like the degree of openness in vowels; [a] in [sat] and [æ] in [sæt] are variants of the same phoneme since both represent the most open unrounded vowel in the given environment.

Like Ščerba, Zinder rejects the concepts of neutralization and the archiphoneme. The archiphoneme, he says, is only a relation between phonemes, it has no substance and cannot appear in speech (§ 47). Ščerba's description of variants (including the fundamental variant) is also accepted.

Zinder is, however, obviously influenced by Trubetzkoy in his system of opposition types, and he uses the term "correlation" in the same way as Trubetzkoy (§ 57).

A certain influence from other trends can also be found in §§ 57-58, where it is mentioned that phonemes can be classified on the basis of their possibilities of entering into (phonetically and morphologically conditioned) alternations and their possibilities of appearing in certain positions under certain conditions of stress and in certain combinations with other phonemes.

In later articles, partly in co-operation with L. V. BONDARKO, Zinder points out that the acoustic characteristics of distinctive features may vary considerably according to the environment and according to the other features of the given phoneme. Only by taking the syllable into account as the elementary unit within which distinctive features are realized is it possible to speak of the invariance of phonological features (see Bondarko and Zinder 1968 and also Bondarko 1967).

Another prominent member of the Leningrad School is A. N. GVOZDEV. The characterization which Halle (1963) gives of the Leningrad School is mainly based on Gvozdev's writings, particularly a book of 1949 on the phonological means used in the Russian Standard language.⁷

Halle (1963, p. 8) quotes the following passage from Gvozdev's book (p. 11): "One may regard as an indication that a given concrete sound is a contextual variant of a phoneme the fact that it is not pronounced in isolation but is replaced by a different sound in isolated pronunciation. The sound pronounced in its stead

7. This book has not been available to me.

(in isolation – M. H.) is then the fundamental variant of (the phoneme – M. H.); at the same time this (procedure – M. H.) also shows to which phoneme the given contextual variant belongs". Halle draws the conclusion that the doctrine of the fundamental (or basic) variant in Ščerba's theory replaces the requirement of phonetic similarity used in other phonemic schools. One may wonder whether this procedure is not a particular feature in Gvozdev's approach.

Other members of the Leningrad School are G. I. MATUSEVIČ, who has mainly been occupied with phonetic problems, and M. V. GORDINA, who has published an interesting paper on various functional sound units in language (1966). Like Ščerba, she wants to base segmentation primarily on morphological boundaries. In an example like Russian *póta* (genitive of *pot*, 'sweat') there is a morphological boundary between *t* and *a*, and *a* can consequently be recognized as a separate segment. The morphological boundary does not, however, coincide with the syllable boundary (which is a phonetic phenomenon), i.e., *t* is explosive in *póta*, but implosive in *pot*. Explosive *t*- and implosive *-t* can, however, be identified as variants of the same phoneme because they alternate in the same morpheme; and once explosive and implosive consonants have been identified, this identification can be generalized to e.g. *t* in *tok* and *pot*.⁸ Similarly, different vowel shades which depend on the palatalization of the following consonant can be identified on the basis of alternations in the same morphemes. The presence or absence of a morphological boundary is also considered the primary criterion in the analysis of diphthongs as mono- or biphonematic. Languages in which syllable boundary and morphological boundary coincide (e.g. Chinese and Vietnamese) do not permit the application of the same criterion, but in these languages the initial consonant has a certain degree of autonomy because it does not take part in the tonal characteristic of the syllable, whereas vowel and final consonant are intimately connected and also show compensation of length.

S. D. KACNEL'SON and M. I. STEBLIN-KAMENSKIJ are students of Ščerba, but not closely connected with the Leningrad School. Kacnel'son has particularly studied non-segmental phenomena (cp. his paper on "Phonemes, Syndemes and Intermediate Structures" 1971). Steblin-Kamenskij has published a series of interesting papers within Scandinavian phonology, particularly treating diachronical problems, for instance the Scandinavian umlaut.

A. S. LIBERMAN belongs to the young generation of Russian linguists who are well informed about European and American theories. His proposals for discovery procedures in phonological analysis (cp. his paper 1971 b) represent, however, a direct continuation and further development of the procedures used by Ščerba and M. V. Gordina. He presupposes that speakers are able to decide whether two linguistic forms have the same or different meanings, and to distinguish homonyms from non-homonyms. The procedure is described as taking

8. It should be noticed that this method works very well for Russian, and also for French, but not for Danish, in which medial consonants (which are practically only found before [ə] in native words) behave like final consonants, so that the syllable boundary is dubious.

place in three steps: (1) segmentation of phonemes, (2) description of phonemes in terms of distinctive features, and (3) identification of phonemes. (1) In the segmentation procedure he utilizes morpheme- and syllable-boundaries in much the same way as Gordina. In the words *pol* [pɔl] ('floor') and *Pol'* [pɔ̌l] (a name), the relevant difference might lie either in the vowels or in the consonants, but the genitive forms *póla* ['pɔlə] and *Pólja* ['pɔ̌jə] (with syllabic boundary before *l*) show that the difference is in the consonants and not in the first vowel. (2) The distinctive features are found on the basis of alternations. Before *-e* the distinction between */l/* and */l'/* is neutralized: *pole* ['pɔ̌lɪ] may be the locative of both *pol* and *Pol'*, and *[l]* represents an archiphoneme. The semantic ambiguity of *póle* at the same time shows the relevance of the feature "palatalization" in *pol* and *Pol'*. In the same way alternations between *t* and *d*, *p* and *b* permit the isolation of the distinctive feature 'voice'. But not all phonetic distinctions can be set up as phonological features in this way (for instance neither nasality nor laterality). The phonological system thus contains a nucleus of phonemes which can be dissolved into distinctive features on the basis of alternations and peripheral phonemes not dissolvable in this way. (3) Once a phoneme has been described as a bundle of distinctive features, it may be identified by means of these features.

The Moscow School

BACKGROUND AND START OF THE MOSCOW SCHOOL

II.8 Until the end of the thirties the Leningrad School was dominant in Russian phonology, but in the course of the twenties and the thirties a group of young Muscovite linguists developed a new phonological theory in explicit opposition to the Leningrad School. The most important members of this group were R. I. AVANESOV (born 1902), V. N. SIDOROV (1903-68), A. A. REFORMATSKIJ (born 1901), and (from about 1931) P. S. KUZNECOV (1899-1968). Avanesov and Sidorov came from dialectology, Reformat-skij from studies of literature, music and sign structures. In 1920 Reformat-skij had attended the lectures of Roman Jakobson on the Russian language, and he was also a member of the linguistic circle of Moscow which had been started on Jakobson's initiative. In the start the Moscow group was strongly influenced by the works of N. F. JAKOVLEV (born 1892) who had developed a purely functional phoneme concept for the purpose of transcribing Caucasian dialects, and described this concept in articles published in 1923 and 1928. Jakovlev was influenced by Baudouin de Courtenay, but rejected the psychological approach. The group of young Moscow linguists was also influenced by Baudouin de Courtenay, particularly by his early writings

when he based his phonological theory on alternations, but they included only the phonetically conditioned alternations in their theory. They were also open to influence from abroad, from the Prague School and from American linguistics, particularly Sapir, whose theories Reformatskij reviewed very positively in an article on American linguistics in 1941.

Around the middle of the thirties their theory had reached a final form, but their possibilities of publication were hampered by the dominance of Marrism. At the end of the thirties Avanesov and Sidorov wrote a grammar of the Russian language comprising a chapter on phonology in which their theory is described and applied to the Russian language, but the book was not published until 1945. In 1941 Kuznecov applied the theory to an analysis of the phonological system of the French language. In 1947 Reformatskij published his book "Vvedenije v jazykovedenie" ('Introduction to Linguistics') which also contains a chapter on phonology.

In the following years a number of articles by Avanesov, Reformatskij and Kuznecov were published, dealing partly with theoretical problems, partly with the application of the theory to concrete language problems. Around 1950 the Moscow and the Leningrad Schools were rather strongly opposed to each other, but in 1952, when Šaumjan published his article on phonology (see 11.2 above), they were united in a common repudiation of his deprecatory judgement of Ščerba, and in the middle of the fifties Avanesov revised the Moscow theory in an attempt to bridge the gap between the two schools (see 11.15 below). However, Reformatskij and Sidorov did not approve of this attempt. In the fifties a number of other linguists joined the group, among them S. S. VYSOTSKIJ, M. V. PANOVA, VJAČ. V. IVANOV, V. A. VINOGRADOV, B. K. ŽURAVLEV, and E. L. GINZBURG (see Reformatskij 1970, pp. 14-34).

THE MAIN DIFFERENCES BETWEEN THE MOSCOW AND THE LENINGRAD SCHOOLS

11.9 It is a common feature of the Leningrad and the Moscow Schools that they do not want to separate phonetics and phonology completely as two different disciplines. They generally use the term phonetics to cover both. Another common feature is the role played by the "fundamental variant". But apart from this their approach is very different.

In the Leningrad School the phoneme, and phonetics as a whole, is considered to have a certain autonomy. The Moscow School, on the other hand, regards grammar and phonetics as an integrated whole. The phoneme is not considered to have any independent existence, but is seen as an element of morphemes.

The difference manifests itself very clearly in their attitude to the concept of NEUTRALIZATION. In the Leningrad School this concept is rejected, and the sounds appearing in positions of neutralization are identified phonetically. In the

Moscow School, on the other hand, neutralization is a central concept, and the Leningrad School is criticized for neglecting the fact that the number of oppositions is different in different positions and for disregarding the relation between alternating sounds.

POSITION, VARIATION, VARIANTS, AND HYPERPHONEMES

II.10 POSITION ("pozicija") is an important concept in the Moscow theory (see Reformatskij (1947) 1960, p. 172ff; 1970, pp. 55ff and p. 115ff, and Avanesov and Sidorov 1945). Positions may be STRONG or WEAK, and they may be strong or weak in two respects, namely in respect to the "SIGNIFICATIVE" (or differentiating) and the "PERCEPTUAL" (or identifying) function of the phoneme (cf. Bernštejn's distinction mentioned above 11.7).

A position is strong in regard to the perceptual function if the phoneme appears in this position in its basic shape (or aspect) ("osnovnoj vid"), i.e. if it is minimally influenced by the surroundings and easily recognizable, e.g. /a/, /o/ and /u/ spoken in isolation or between unpalatalized consonants, or /i/ spoken in isolation or between palatalized consonants.⁹ A position is weak in regard to the perceptual function if the phoneme is strongly modified by the surroundings, e.g. /a/, /o/ and /u/ between palatalized consonants, or /i/ between unpalatalized consonants. The modified sounds found in the weak position are called VARIATIONS ("variácii"). They can always be referred to one definite phoneme. The variations together with the basic form (osnovnoj vid) correspond to the combinatory variants of Prague phonology.

A position is strong in regard to the significative function if a given opposition is maximally distinct, whereas a position is weak in regard to the significative function if there is neutralization. For Russian vowels the stressed position is strong, because in this position all five vowel phonemes are distinguished, whereas the unstressed positions are weak because various oppositions between vowels are neutralized in this position. The number of phonemes is decided on the basis of the number of distinctions in the strong position. The sounds found in the positions which are weak in regard to the significative function are called VARIANTS ("varianty"). The same sound may be a variant of different phonemes; an [a] in pretonic position may be a variant of /a/ as in *sadú* [sa'du] (locative of *sad* 'garden') or of /o/ as in *vodú* [va'du] ('water', nominative, cp. the accusative *vódu*).¹⁰

The positions are not relevant for the phonemes as such, but for the distinctive

9. This concept comes very close to the basic (or fundamental) variant of the Leningrad School ("osnovnoj ottenok").

10. Besides the terminology "variations" and "variants", Avanesov and Sidorov use the terminology sound synonyms and sound homonyms for variations and variants respectively.

features. For the opposition voiced-voiceless the final position is weak because the opposition of voicing is neutralized in this position, but for the opposition palatalized-unpalatalized the final position is strong.

It is not always possible to decide to which phoneme a sound found in a weak position in a given word belongs. In the word *barán* ('ram') the first vowel does not enter into any alternations, because the syllable can never be stressed, and no decision can be made.

According to Reformatskij 1970, p. 63ff, the distinctive units in the weak position are called **HYPERPHONEMES**. Thus in unstressed position after unpalatalized consonants Russian has only three vowel hyperphonemes: *a-o*, *e-i* and *u* (Reformatskij 1970, p. 64, see also p. 117 and 1957, and Kuznecov 1941, p. 172).¹¹ This concept, which was introduced by Sidorov, comes close to the archiphoneme as used by Martinet in 1936 (who, in contradistinction to Trubetzkoy, applied the term only to cases of neutralization, see 3.7 above). According to Reformatskij (1970, p. 64) the hyperphoneme is, however, not identical with the archiphoneme since it does not necessarily include a neutralization. In the example given above (vowels in unstressed position), *u* is also a hyperphoneme, although no fusion has taken place in this case. Hyperphonemes and phonemes belong to different levels.¹²

The phoneme of the Moscow School is thus of a double nature. Seen in relation to its variations it corresponds to the phoneme of the Leningrad and Prague Schools and most other phonological schools; seen in relation to its variants it corresponds to some extent to the morphophoneme of the Bloomfield School and of the Prague School, but only to some extent, since the Moscow School takes only the phonetically conditioned alternations into account, whereas morphologically conditioned alternations (like /k-č/ in Russian or /f-v/ in English) are excluded from phonology. In a sense the Moscow phoneme which includes an essential part of what has been called a morphophoneme, is closer to the systematic phoneme of generative phonology than to the phoneme of any other school. Like the systematic phoneme it is the basic (underlying) form in an alternation.

In his "Introduction to Linguistics" (1947 (1960), p. 175) Reformatskij defines phonemes as "the minimal sound units of a linguistic system serving to construct and differentiate the meaningful linguistic units: morphemes, words and sentences".

11. For articles reprinted in Reformatskij (1970), the page numbers refer to this book.

12. This is how the hyperphoneme is described by Reformatskij and by Kuznecov (1941). But the term may also be applied in a more restricted sense, viz. to cases where it cannot be decided to which phoneme the variant belongs (e.g. *barán*). It is used in this restricted sense by Kuznecov (1959, p. 479) ; see also Zinder (1968, p. 197) and Kortlandt (1972, pp. 23-4).

MORPHONOLOGY

II.11 In a paper on the relation between phonetics and grammar (1955, p. 415), Reformatskij distinguishes the following five possibilities of relations between morphemes (his Russian examples are here replaced by English ones): (1) different unrelated morphemes (*house/pen, tie/die*), (2) different morphemes connected because of suppletivism (*am/was*), (3) same morphemes with internal inflexion (*man/men*), (4) same morphemes with morphologically conditioned (historical) alternation (*wife/wives*), (5) same morphemes with phonetically conditioned alternation ("var'irovanije") (German [*ta:k/ta:g-ə*]).

(1-3) belong to morphology, (5) to phonetics, whereas (4) (the morphologically conditioned alternations) belong to an intermediate zone: morphonology. But Reformatskij sees no reason for setting up morphophonemes (1970, pp. 114 and 56ff).

THE STRATIFICATIONAL VIEW

II.12 Reformatskij considers language as structured in layers or STRATA (1966). Sentence, syntagm, word, morpheme and phoneme belong to different layers. Within each stratum there may be different levels. In the phonological stratum there are three levels: the subphonemic level (= the phonetic level), the phonemic level, and the supraphonemic level comprising rhythm groups, stress, etc. Vowel harmony (e.g. in regard to front/back) may in some languages belong to the supraphonemic level as a sort of "long component", which permits a reduction of the number of vowel phonemes on the phonemic level. Within the phonemic level there may be sublevels (e.g. the level of phonemes and of hyperphonemes).

Kuznecov also sees language as stratified (see Kuznecov 1941, and Reformatskij 1970, p. 60ff).

DISTINCTIVE FEATURES

II.13 The theory of distinctive features is accepted by Reformatskij but with many reservations: (1) distinctive oppositions need not be binary. He proposes himself a system of different types of oppositions including both binary and multilateral oppositions (1947 (1960), p. 181); (2) Roman Jakobson's phonetic definitions of the concrete features are criticized (see Milivojević, p. 50ff); (3) redundant features should not be neglected, since they are important both in speech perception and in diachronic phonology. Kuznecov has discussed Roman Jakobson's theory in a paper of 1958. He prefers to start the analysis at the phoneme level and then proceed to distinctive features and, like Reformatskij, he does not consider the binary interpretation as necessary.

Modifications of the Moscow and the Leningrad Schools

S. I. BERNŠTEJN

II.14 Already in 1936, shortly after Bernštejn had moved to Moscow, he worked out a set of theses meant to unite the Moscow and the Leningrad theories. They were intended for a lecture, which was, however, never given, and he did not publish them until 1962 (see also Reformatskij 1970, p. 75 ff). Such an attempt might seem quite promising. The Moscow phoneme was a rather complex concept, and by splitting it up one might identify one of its aspects with the Leningrad phoneme. This was also what Bernštejn tried to do.

In his article of 1962 he distinguishes three levels with **THREE DIFFERENT TYPES OF ALTERNATIONS AND UNITS**.

Alternations of the first and second degree are called **DIVERGENCES** (a term coined by Kruszewski). They are phonetically conditioned, i.e. they depend on synchronic phonetic laws of the language.

(1) Alternations (or divergences) of the **FIRST** degree are such whose alternants (divergents) are in complementary distribution and have no semasiological function, for instance the shift between different vowel shades depending on the surrounding consonants, or differences of place of articulation in *k* and *g* before front and back vowels. (2) Alternations (divergences) of the **SECOND** degree are such whose alternants (divergents) are distinctive in some positions, but not in others, i.e. there is neutralization, for instance the alternation between voiced and voiceless obstruents in German and Russian, or between the different vowels in Russian in stressed and unstressed positions. Divergences of the second degree are also called **SUBSTITUTIONS**. (3) Alternations of the **THIRD** degree are such which are not dependent on synchronic conditions, but are results of earlier phonetic processes. From a synchronic point of view they are morphologically conditioned. Bernštejn calls them **TRANSFORMATIONS**. Examples are *f/v* in English, *wife/wives*, and alternations between the vowels *e* and *o* in Russian, e.g. *žénskij* 'female' and *žóny* 'wives', or between *g* and *ž*, for instance in *mogu* ('I can') *móžeš'* ('you can').

A totality ('sovokupnost') of alternants of the first degree constitutes a **PHONEME OF THE FIRST DEGREE**. It corresponds to the Leningrad, Prague, and Bloomfield phoneme and to one aspect of the Moscow phoneme (i.e. the phoneme seen in relation to its variations). Its alternants correspond to the combinatory variants of the Leningrad and most other phonological schools and, partly, to the "variations" of the Moscow School.

A totality of alternants of the second degree constitutes a **PHONEME OF THE SECOND DEGREE**. It corresponds to the mor(pho)phoneme of the Prague and Bloomfield Schools (in so far as its alternants are phonetically conditioned) and to the other aspect of the Moscow phoneme, i.e. to the phoneme seen in relation

spondences somewhat. This is indicated in the table above¹⁴ by means of an example from Russian: [g^l] and [g^u] as combinatory variants of the phoneme of the first degree /g/, which may alternate with /k/ in final position, e.g. [luk] ('meadow' nom. sing.) – [lu'ga] (gen. sing.), and thus produce a phoneme of the second degree. Moreover, /g/ may alternate with /ž/ as in *mogu-možes'*, thus forming a phoneme of the third degree.

The HYPERPHONEME (as used by Reformatiskij) does not enter into the steps based on alternations. It is seen from another angle, namely from the point of view of oppositions. It is a unit belonging to the positions of neutralization. In the present example the *k* of the third row, e.g. in [luk] would represent the hyperphoneme g/k since there is no opposition between /g/ and /k/ in final position. It corresponds approximately to the archiphoneme in Prague phonology (see, however, 11.10 above). The *k* in the third row can thus be seen either as an alternant (in relation to /g/), or as a hyperphoneme g/k, according to the point of view.

Bernštejn's system is quite clear, but it was not generally accepted. One reason may be that his exposition is complicated by the introduction of various other units (morphemes and lexemes) of different degrees. Reformatiskij also rejected his analysis because it cannot be used for practical purposes. For the purpose of setting up alphabets and for solving other problems of applied linguistics, it is necessary to have only one set of phonemes in a given language.

R. I. AVANESOV

II.15 Avanesov was one of the founders of the Moscow phonological School, but in the middle of the fifties he undertook a revision of the theory. He found that in the original form of the theory the phoneme concept was too complex and not sufficiently delimited and that the distinctive function of the "variants" was not sufficiently stressed. On the other hand, he wanted to maintain the close connection with morphology. As a remedy he proposed to split up the phoneme concept in much the same way as did Bernštejn. But he used a different terminology and a somewhat different approach. He has given a detailed account of his proposals in a paper of 1955, which was reprinted in an abbreviated form in his textbook of Russian phonetics (Avanesov 1956a, pp. 13–40). He also devised a transcription for the different levels of analysis, published in an article of 1956, which was also included in his textbook (pp. 213–37 (= Avanesov 1956b)). Avanesov proposes to split up the Moscow phoneme in two concepts which he calls PHONEME and PHONEME SERIES ("fonemnyj rjad"). The first corresponds to Bernštejn's

14. The table also contains the terms used by Avanesov – see the following section. A similar table has been set up by G. A. Klimov in his book "Fonema i morfema" (1967, p. 90) and is reproduced by Reformatiskij (1970, p. 106). Klimov's book has not been available to me.

phoneme of the first degree (and to the phoneme of most other phonological schools), the second to Bernštejn's phoneme of the second degree. Avanesov excludes the morphologically conditioned alternations from phonology (see the table at the end of section 11.14). He defines the phoneme as the shortest sound unit (based on a linear segmentation) which is qualitatively independent [of the surroundings] and thus in itself sufficient for the differentiating of the sound envelope ("oboločka") of word forms (1956a, p. 21). By a word form is meant a concrete word in one of its concrete forms (e.g. [got] 'year' (nominative), or ['goda] 'year' (genitive)). One and the same word form consists of the same phonemes, and different word forms show a difference in phonemes of the same order, i.e. strong or weak (but cp. Gvozdev's criticism below).

In some languages the same distinctions may be found in all positions, and the phonemes show parallel modifications in all positions without any fusion between phonemes. That is the case with stressed Russian vowels in different surroundings. But generally some positions show neutralizations, i.e. a smaller number of distinctions between related phonemes. There are thus strong and weak positions (cp. 11.10 above); the phonemes occurring in these positions are called strong and weak phonemes respectively (but only the strong phonemes are included in the phoneme inventory); there will be alternations between strong and weak phonemes, so that each of the weak phonemes alternates with one or more strong phonemes. Such a set of alternating sounds is given the name a "phoneme series", for instance [o ʌ ə] in [vot] ('water' gen. pl.), [vʌ'da] ('water' nom. sing.), and [vəɖʌ'vos] 'water-carrier', or [k-g] in [luk]-[lu'ga]. The phoneme series is an important structural element. It connects phoneme and morpheme and is the basis for the identification of the morpheme. One and the same morpheme will normally consist of the same (sequence of) phoneme series, and different morphemes will consist of different (sequences of) phoneme series. The morpheme 'water' will thus have the form $v \begin{Bmatrix} o & d \\ \text{ʌ} & d' \\ ə & t \end{Bmatrix}$ (covering e.g. ['vodu, vot, vʌ'da, vʌ'de, vəɖʌ'vos]).

This would, of course, be a rather clumsy transcription, and Avanesov therefore proposes to use the symbols representing the strong phonemes, e.g. /vod-/. He distinguishes three different types of transcription (Avanesov 1956b): (1) a purely PHONETIC TRANSCRIPTION, which indicates contextual variants, (2) a WORD-PHONEMATIC TRANSCRIPTION, which abstracts from everything which is positionally conditioned and functionally unessential in the word form, i.e., only the phonemes are indicated, and (3) a MORPHOPHONEMATIC TRANSCRIPTION, which abstracts from everything which is positionally conditioned and functionally unessential in the morpheme, i.e. only the "phoneme series" are indicated.

(1) In phonetic transcription *vod-vodá* will be written [vot]-[vʌdʌ].

(2) In the word-phonematic transcription different symbols are used for the strong and weak phonemes; the symbol /a/ is, for instance, used to indicate the

product of neutralization between /o/ and /a/ and for consonants a system of index numbers is applied (1 for neutralization of palatalization, 2 for the neutralization of voicing, and 3 for the neutralization of both). *vod* is thus written /vot₁/, and *vodá* /vadá/. This means that Avanesov indicates archiphonemes, probably under the influence of Prague phonology.

(3) In the morphophonematic transcription the symbol for the strong phoneme is used, thus /vod/-/vodá/.

Avanesov's three types of transcription have much in common with Hjelmslev's (1) phonetic, (2) actualized, and (3) ideal notation. In Hjelmslev's actualized notation syncretisms were indicated, in the ideal notation they were resolved (see 7.18 above). Russian *vod-vodá* would be transcribed exactly as done by Avanesov, only Hjelmslev used /o/a/ and /t/d/ to indicate the syncretisms in the actualized transcription. Avanesov's morphophonematic transcription (and the normal transcription of the Moscow School) recalls the base forms in American morphophonemic transcription and the underlying forms of generative phonology.

Halle finds the word-phonematic transcription superfluous, since it can be deduced by rules from the morphophonematic transcription (1963, p. 15).

GVOZDEV has discussed Avanesov's system of transcriptions in an article of 1958. He criticizes Avanesov for not having indicated the principles (and not seen the problems) of his phonetic transcription, and for not giving a sufficiently exact definition of "word form" and "morpheme". He also finds his definition of "different word forms" inexact, since they need not differ in phonemes of the same order; /volk/ and /vosk/, for instance, differ in /l/ and /s/, but /l/ is a strong phoneme, and /s/ is a weak phoneme since voicing is neutralized before /k/. (Probably Avanesov only had cases in mind where the difference between strong and weak was relevant in both members of the pair).

KUZNECOV (1959) criticizes Avanesov from the point of view of the original Moscow theory, which he finds simpler. He points out the inconsistency in talking of strong and weak phonemes, but excluding the latter from the phoneme inventory. In the same article Kuznecov tries to give more precise definitions of phonemes, variants and variations.

Reformatskij also rejects Avanesov's approach (1970, p. 82ff), but it has been influential as part of Avanesov's textbook of phonetics.

M. V. PANOV

II.16 Panov makes a distinction between paradigmatic phonemes and syntagmatic phonemes (1967, see also Reformatskij 1970, pp. 86-90). It should, however, be noticed that he uses "paradigma" in a sense which is quite different from the normal use of the term.

According to Hjelmslev and many others a paradigm is a class of entities which can occur alternatively in the same position, e.g. the vowels in *bit*, *bet*, *bat*, *but*, whereas a syntagm is a sequence (or combination) of entities in the same speech-

chain, e.g. *b-i-t*, cf. Saussure's distinction between associative and syntagmatic. Now Panov argues that in this sense the paradigm is a superfluous term, for it is only a different way of stating a syntagmatic law. If *bit*, *bet*, *bat*, *but* are possible syntagms in the language in question, then *i e a u* enter into the same paradigmatic class (1967, p. 6). This is, of course, true, but it may nevertheless be useful to have two terms for the two different points of view.

Panov uses the term paradigm to designate a class of linguistic units, whose difference is due to their position, i.e. sounds belonging to the same paradigm cannot occur in the same position (1967, p. 5); cf. that some "paradigms" of traditional grammar may be interpreted in this way, e.g. a "paradigm" of nouns (*mensa, mensam*, etc.) comprising members which occur in different syntactic positions (cp. also 11.18). A PARADIGMA-PHONEME is a unit including sounds belonging to the same paradigm, e.g. in Russian /o/, including the alternants [o ö ö a ə] (1967, p. 217), thus both combinatory variants (ö ö) and vowels which are distinguished in other positions. This is thus the same as the Moscow phoneme, but hardly the same as Avanesov's "phoneme series".¹⁵

The SYNTAGMA-PHONEME, on the other hand, is a member of a class of sounds occurring in the same positions and containing the same number of features. There are thus different "groups" of syntagma-phonemes. In stressed position there are, for instance, five vocalic syntagma-phonemes in Russian; in unstressed syllables after palatalized consonants there are only two. The consonants enter into many different positions with a different number of distinctions, and we get in this way seventy-three Russian syntagma-phonemes (!). Panov admits that this is not practical, and he proposes to restrict the number of units by analysing the syntagma-phonemes into "subsyntagma-phonemes", i.e. distinctive features.

The syntagma-phoneme is reminiscent of Twaddell's "macro-phoneme" (cp. 6.12 above). Twaddell also sets up different independent (macro-)phonemes in positions presenting a different number of distinctions.

Šaumjan's Two-Level Theory of Phonology

INTRODUCTION

11.17 The phonological theory of S. K. Šaumjan (born 1916 and Professor of Linguistics in Moscow) represents a complete break with the Russian phonological tradition. The only specific Russian feature in his theory is the selection of a fundamental or standard variant. Šaumjan does not even discuss the former Russian theories (apart from the controversy in 1952, mentioned above), and it is rare that he quotes Soviet Russian authors.

15. As O. Axmanova suggests (1971, p. 34).

The background of Šaumjan's theory is to be found almost exclusively in Western structuralism, particularly Trubetzkoy, Saussure, Hjelmslev, Kuryłowicz, Jakobson and Martinet. In the answer to his critics, Šaumjan declares that as far as the sound aspect of language is concerned he regards Trubetzkoy as his direct teacher. What he took over from Trubetzkoy was, above all, the sharp distinction between phonology and phonetics as two separate disciplines belonging to the humanities and to the physical sciences respectively. But as Trubetzkoy's actual practice was not in accordance with this definition (see above 3.2), it is not astonishing that Šaumjan reacted strongly against many of Trubetzkoy's definitions and rules, and Šaumjan's own theory is rather different from Prague phonology. He was confirmed in the distinction between phonology and phonetics by Saussure's description of *la langue* as a network of relations, as pure form, and by Hjelmslev's sharp distinction between form and substance and his idea of an immanent linguistic science. He was also confirmed in this view by J. Kuryłowicz (see 12.4 and 12.18) and, he is also influenced by Kuryłowicz in other respects. The idea of a structural isomorphism between content and expression was advanced by Hjelmslev, but Šaumjan has taken it over in the specific form given to that idea by Kuryłowicz (see 11.26 below). The same is true of the idea of marked and unmarked, first advanced by Trubetzkoy. He is also influenced by Kuryłowicz's ideas on diachronic phonology. From R. Jakobson he has taken over the theory of distinctive features, adapting the general definition to his own theory, but accepting most of the concrete features. Martinet has particularly influenced his treatment of prosodic features. Šaumjan has given a general survey of structural linguistics in the paper "O suščnosti strukturnoj lingvistiki" ('the Essence of Structural Linguistics' 1956). Finally, his whole way of reasoning is strongly influenced by modern logic (Carnap, Reichenbach, Tarski, and others) and by cybernetics.

The main idea in Šaumjan's theory of phonology is the sharp distinction between phonology and phonetics, which he emphasized already in his article of 1952. In a later article (1958a) this distinction is seen in an epistemological context as the distinction between the level of observation and the level of constructs. In the following years he worked out the theory in detail, and in 1962 he published the result in the book "Problemy teoretičeskoj fonologii", in which he gives a full account of the theory. In the same year he published a short summary of the main points in English: "Two-Level Theory of Phonology" (1962b). His book was translated into English in 1968¹⁶ under the title "Problems of Theoretical Phonology" (in the following abbreviated as "Problems"). In 1965 and 1967 other papers were published in English. A paper of 1966, "Sovremennoje sostojanije

16. Unfortunately, although the translation has been revised by the author and the proofs read by several people, the English version contains a long series of mistakes and inaccuracies, of which some are so obvious that they do not give much trouble, whereas others are very disturbing. For the benefit of readers who do not have the Russian original at hand, I will give a list of the mistakes I have found (i.e. the places I looked

dvuxstupenčatoj teorii fonologii" ('The present state of the two-level theory of phonology') contains some modifications and elaborations of the theory.¹⁷

ŠAUMJAN'S CRITICISM OF EARLIER PHONOLOGICAL THEORIES

THE PRAGUE SCHOOL

II.18 In order to demonstrate the necessity of establishing a new theory of phonology Šaumjan discusses the deficiencies of earlier theories.

The PRAGUE SCHOOL is subjected to a detailed criticism, obviously because it is considered the main representative of what Šaumjan calls the "relational-physical theory", and because he has come to his own theory in an attempt to overcome the difficulties of this theory.

Šaumjan takes as his starting point Trubetzkoy's definitions of phonological opposition and of the phoneme (see 3.3 above). However, he finds it more correct to characterize the phonological opposition as a sound opposition which can differentiate signifiers¹⁸ (sign expressions) rather than meanings, since sounds have

up in the Russian original because I found the English text enigmatic, – there may be more):

23,5 signifiants for signifiés

25,13 significations for signifiants

59,32 and 60,3 connective for connected (Russ. svjazannyj. On p. 54 "connective" is correct (Russ. konnektivnyj))

66,29 vowels for consonants

99,19 morphology for morphonology

99,35 words for syllables

109,3 demarcative for differential

117,25 relevant for connected

129,1 eliminable for ineliminable, and ineliminable for eliminable

146,24 velar for alveolar

155,15 those distinctive features which . . . for: these distinctive features, which

164,31 which embodies it, for: which it embodies

171 (table) labial for oral

207, Matrix no. 1, last row: C_3^1 for C_1^3

207, Matrix no. 2, C for Č

209,21, 209,28 and 209,29 absolutely dominant for: absolutely dominated

215,18 ' for l

Two mistakes (81,23: non-acoustic for non-accentual, and 164,24: differentoids for differentors) are already found in the Russian original. There exists an excellent Italian translation by E. Rigotti, "Linguistica dinamica", Bari 1970 (personal communication by G. C. Lepschy).

17. See also Milivojevič (1970, pp. 24–42 and 60–79), Kortlandt (1972, pp. 28–45), and Kohler's review of "Problems" (1970).

18. In "Problems" the French terms "signifiant" ('signifier') and "signifié" ('signified') are used as translations of "označajuščij" and "označemyj".

only an indirect connection to meaning via the sign expression (cp. Avanesov 11.15 above).

From the definitions of the Prague School in this slightly altered form Šaumjan deduces the following two statements:

- (1) Phonemes are elements whose function is to differentiate between "signifiants".
- (2) Phonemes are acoustic elements.

He finds that these statements lead to three antinomies: (1) the antinomy of transposition, (2) the antinomy of the paradigmatic identification of phonemes, and (3) the antinomy of the syntagmatic identification of phonemes. Šaumjan's exposition of these three antinomies is not very convincing and has been criticized severely both by Kohler (1970, pp. 298-300) and by Kortlandt (1972, p. 29-33) along the same lines. They will therefore only be mentioned briefly.

The first antinomy (THE ANTIMONY OF TRANSPOSITION) arises, according to Šaumjan, from the fact that the first statement (about the differentiating function of the phoneme) must imply the possibility of transposition to other types of substance (e.g. graphic substance), whereas this is excluded by the second statement (about the acoustic nature of the phoneme). As Kortlandt remarks, this antinomy is due to an elementary logical error, since Šaumjan's deductions would only be true if the first statement were reversible (i.e.: elements whose function is to differentiate between "signifiants" are phonemes). Nothing prevents phonologists from defining phonemes as acoustic elements whose function it is to differentiate between signifiers.

The second antinomy (THE ANTIMONY OF THE PARADIGMATIC IDENTIFICATION OF PHONEMES) is somewhat difficult to understand, one of the reasons being that he uses the term "paradigmatic" in two different senses, (1) in the usual sense, (2) in the sense in which it is used by Panov (sec 11.16 above). According to the example given the problem is that of overlapping manifestation, e.g. A, B, C in position 1, and B, C, D in position 2 (cf. also "Problems", p. 64, and 1962b, p. 757).

The third antinomy (THE ANTIMONY OF THE SYNTAGMATIC IDENTIFICATION OF PHONEMES) concerns the possibility of interpreting a sound sequence (e.g. *st*) as one phoneme if the elements are mutually inseparable. According to function the group may constitute one phoneme, but from the acknowledgement of the acoustic nature of the phoneme it follows that it cannot constitute one phoneme. As Kohler remarks (p. 299), this conclusion is only valid if the statement "phonemes are acoustic elements" is read as "phonemes are elementary acoustic units", which is by no means necessary.

Šaumjan's reasoning can thus be refuted, but what remains is the fact that there may be discrepancy between functional and phonetic facts, and if both are used as arguments in phonological analysis as is, in fact, the case in Prague phonology (for instance in the decision about the mono- or biphonematic status of groups), then antinomies may arise.

OTHER SCHOOLS

11.19 The **PSYCHOLOGICAL THEORY** of the phoneme (Baudouin de Courtenay and Sapir) and the **"PHYSICAL" THEORY** of the phoneme (Ščerba and Jones) are discarded as being of historical interest only ("Problems", p. 16). **AMERICAN DESCRIPTIVE PHONOLOGY** is discarded already in the preface since Šaumjan does not regard it as a theory, but rather as a method of investigation, a technique with practical aims. Kohler (in his review of Šaumjan's "Problems" (1970, pp. 288-90)) rightly objects that this characteristic does not apply to Z. Harris, who described the linguistic elements as purely logical symbols upon which various operations of mathematical logic can be performed (see 6.14 above). It is true that at least Pike had a more practical aim in view, but, as mentioned above (6.9, footnote 6), he nevertheless made a distinction between the "emic" and the "etic" level. Šaumjan mentions this in a later publication (1966, p. 22), but he adds that Pike does not keep the two apart since he considers the phoneme as a class of allophones.

The theories left as worth criticizing are, then – apart from Prague phonology – glossematics and Twaddell's theory of micro- and macrophonemes.

GLOSSEMATICS is treated very briefly. Šaumjan recognizes that "the fundamental statement of the glossematic concept of the phoneme, according to which the phoneme comprises no inherent physical substance, but appears to be an element of pure relation manifested in sounds, constitutes an important achievement of linguistic science and should be regarded as the cornerstone of modern phonology" ("Problems", p. 73). But he finds that it is a serious mistake that Hjelmslev does not recognize distinctive features as formal entities and thinks that this is because the glossematic theory lacks an explicit demarcation of the two abstraction levels, the level of constructs and the level of observation. However, this can hardly be the right explanation, since these two levels correspond approximately to form and substance (as Šaumjan rightly remarks, p. 74), and since glossematics makes a very clear demarcation between form and substance (see further section 11.21 below).

In an earlier article (1957, pp. 198-9) he suggests that Hjelmslev's attitude towards distinctive features should be due to his exclusively syntagmatic approach: as the analysis of distinctive features belongs to the paradigmatic analysis, they are not recognized by glossematics. But this suggestion cannot be right either. In the first place it is not correct to characterize glossematics as exclusively syntagmatic. Commutation, which plays an important role in glossematics, is a paradigmatic function; moreover, the setting up of paradigmatic categories is part of the glossematic procedure. Secondly, distinctive features are no more paradigmatic than phonemes. The opposition between oral and nasal is a paradigmatic function, but the combination between nasality, acuteness, interruptedness and voicing (in Jakobson's terminology) in a *d* is a both-and function, and thus syntagmatic, although it is not a linear combination (cf. Jakobson's "On the

identification of phonemic entities", "TCLC" V, 1949, p. 206-7, and the end of 12.3 below).

Hjelmslev gave various reasons for not accepting distinctive features (see 7.21 above), none of them very convincing. I think that at the time when the distinctive feature theory came up, Hjelmslev simply was no longer able to change his theory.

TWADDELL's theory of MICROPHONEMES and MACROPHONEMES (see 6.12 above) is mentioned with approval ("Problems", pp. 68-72) and seems to have been one of the sources for Šaumjan's distinction between concrete and abstract phonemes (see below), but Šaumjan criticizes Twaddell for regarding the macrophoneme as a sum of microphonemes, although the former belongs to the level of constructs and the latter to the level of observation. This criticism is hardly tenable, since the microphonemes are defined by Twaddell as terms of phonological differences, i.e., they seem to belong to the level of constructs.

THE TWO LEVELS

11.20 In order to avoid the antinomies mentioned in the preceding section Šaumjan requires a strict demarcation of two abstraction levels: the LEVEL OF CONSTRUCTS and the LEVEL OF OBSERVATION, which are connected by means of correspondence rules.

From this point of view phonemes are hypothetical units belonging to the level of constructs. They are not directly observable and not assumed to have any inherent physical substance. Sounds, on the other hand, are directly observable elements which function as substrata of phonemes. The relation between phonemes and their substrata is called embodiment. The sounds which are in relation of embodiment ("voploščenie") to phonemes are not simply physical elements, but relational-physical elements and are called phonemic substrata. It is thus necessary to distinguish (1) sounds (physical elements), (2) phonemic substrata (relational-physical elements), and (3) phonemes (purely relational elements, i.e. constructs) ("Problems", pp. 48-51).

Šaumjan now introduces a distinction which reminds one of Twaddell's microphonemes and macrophonemes, viz. a distinction between CONCRETE (or INDIVIDUAL) PHONEMES which are bound to definite positions, and ABSTRACT PHONEMES which are classes of concrete phonemes. Concrete phonemes which are members of the same abstract phoneme differ only in regard to their position. The corresponding relational-physical substrata are now called phonemoids, and we get CONCRETE and ABSTRACT PHONEMOIDS as embodiments of concrete and abstract phonemes.

This fourfold terminology should also help to clarify the relation between phoneme and what is often called allophone or variant. The allophone corresponds to Šaumjan's concrete phonemoid, and the phoneme to his abstract phoneme, and he argues that as a class and its members must, according to modern logic,

be homogeneous, i.e. belong to the same level, the phoneme cannot be a class of allophones (phonemoids), but must be a class of concrete phonemes which are embodied in concrete phonemoids or allophones. As Trubetzkoy's "phonetic variants" must be concrete phonemoids, they cannot be class members of the phoneme.¹⁹

Šaumjan emphasizes that in the two-level theory there is no place for the concept of combinatory variants of the phoneme since individual phonemes are constructs and as constructs cannot be subject to positional changes ("Problems", pp. 119–20). Here Šaumjan seems to consider a "variant" as something that varies physically. In a later article (1966, p. 22) he uses the term "variant" for both levels, but emphasizes that the variants of a phoneme are also phonemes. In the same article he makes a distinction between INVARIANT (in the sense of "basic" variant) and VARIANT. The variant is regarded as derived in relation to the invariant, but he considers it very important that the distribution of variants and invariants need not be the same on the two levels, i.e., an invariant on the level of constructs may be embodied by a variant on the level of observation and vice versa (since they are determined in different ways: on a functional and on a physical basis respectively). This is called the principle of heteroinvariantness ("geteroi invariantnost").²⁰

The strict terminological demarcation of the two levels is carried through for all units, not only for the phoneme. Thus corresponding to Jakobson's distinctive features Šaumjan makes a distinction between DIFFERENTORS (on the level of constructs) and DIFFERENTOIDS (on the level of observation) and between concrete and abstract differentors and differentoids ("Problems", p. 61 ff). Differentors are constructs and have no inherent physical substance, and concrete differentors belonging to the same abstract differentor may be embodied by different acoustic qualities. Some may, for instance, be embodied by tenseness and others by aspiration. The corresponding differentor may then be called "tenseness", but this designation is arbitrary (see also 1962b and 1962d). A similar distinction has been proposed by others (see 8.14 above).

19. Šaumjan seems to assume (p. 52) that Trubetzkoy considered variants to be class members of the phoneme. This is hardly correct. Trubetzkoy characterized variants as realizations of phonemes, which is something different.

20. It should be mentioned in this connection that in glossematics variants are formal units; "bound variants" in glossematic terminology thus correspond to Šaumjan's concrete phonemes, and like these they differ only by their position, but may be manifested by different sounds. The difference between the two theories is thus purely terminological on this point. It may also be practical to draw attention to the fact that in glossematics an "invariant" is a class of variants, for instance a taxeme (= Šaumjan's phoneme); it never means "basic variant".

We thus get the following system ("Problems", p. 109):

LEVEL OF CONSTRUCTS	constructs	<i>concrete differentor</i>	<i>abstract differentor</i>	<i>concrete phoneme</i>	<i>abstract phoneme</i>
LEVEL OF OBSERVATION	relational physical concepts	<i>concrete differentoid</i>	<i>abstract differentoid</i>	<i>concrete phonemoid</i>	<i>abstract phonemoid</i>
	purely physical concepts	<i>concrete acoustic property</i>	<i>abstract acoustic property</i>	<i>concrete sound</i>	<i>abstract sound (sound type)</i>

The terms "phoneme" and "differentor" without determining adjectives indicate abstract phonemes and differentors.

A corresponding distinction is made for prosodemes.

Kohler (1970, p. 301) finds the term abstract phonemoid (as well as abstract differentoid) superfluous. It does not embody the abstract phoneme directly, but is an abstraction from the concrete phonemoids, and not itself an observable unit.

This may be true, but apart from this the clear and consistent terminological distinction between the level of constructs and the level of observation seems very useful, and particularly in the area of distinctive features it might clear up some controversies (see also above, 8.14).

It is also a terminological advantage that the word differentor is used exclusively for a component of a phoneme entering into an opposition, not for the opposition itself. In accordance with Jakobson's original use of "distinctive feature", "voiced" and "voiceless" are thus two differentors which make up a "pair of differentors". "Distinctive feature" in the English version of the book is a translation of "differencial'nyj element" (as distinguished from "d. para" or "d. oppozicie"). Šaumjan thus avoids the confusion between opposition and term of an opposition, found in most of the more recent literature on distinctive features.

THE TWO LEVELS COMPARED TO SAUSSURE'S AND HJELMSLEV'S "FORM" AND "SUBSTANCE"

II.21 There is no doubt that Šaumjan has been influenced by Saussure and, partly, by Hjelmslev. In his paper "Strukturnaja lingvistika kak immanentnaja teorija jazyka" (1958a) he calls Saussure the Copernicus of linguistics (1958a, pp. 7-8, cp. also 1957), and at the start he seems to have identified his own distinction between the level of constructs and the level of observation with Saussure's and Hjelmslev's form and substance. This latter distinction, as well

as the idea of the primacy of form, is quoted with approval. On pp. 23-4 of the above mentioned paper (1958a), it is emphasized that whereas traditional linguistics regarded language as a given physical and semantic substance, structural linguistics sees it as an immanent object consisting of abstractions and relations which are represented by substance. By the method of abstractions language is freed from substance, and the study of substance is only an auxiliary discipline. Also in "Problems" this view is found at different places. On p. 106 he writes: "The structural point of view requires us to regard any element solely as a point of intersection of known relations, all other characteristics of the elements being unessential". Here he might perhaps think of relations belonging to the level of observation, but on p. 107 we read: "From our point of view a correct description of phonological reality should comprise only a systematic description of abstract operations which utilize symbols", and on p. 108: "In his time F. de Saussure had characterized the essence of linguistic reality in the statement "Language is form, not substance". We believe that a consistent deduction of all essential consequences from this revolutionary statement would lead to the formulation of a two-level theory of structural linguistics". Hjelmslev is criticized for not accepting the distinctive features and (though not rightly) for restricting his description to syntagmatic relations. But his distinction between form and substance is accepted, and there is an obvious parallelism between Šaumjan's constructs, relational-physical concepts, and purely physical concepts, and Hjelmslev's form, substance, and purport; similarly, Šaumjan's relation of embodiment clearly corresponds to Hjelmslev's "manifestation". It is not even unusual for Šaumjan to use the terms "form" and "substance" as being synonymous with his "level of constructs" and his "level of observation", also in "Problems" (e.g. p. 74).

The parallelism is, however, not complete.

Šaumjan's two levels are closely connected with his HYPOTHETICO-DEDUCTIVE method taken over from physics and other theoretical sciences. This method comprises four steps ("Problems", p. 28ff): (1) establishment of data, (2) advancement of hypotheses for the explanation of the given data, (3) deduction from the hypotheses including predictions of new facts not found in the initial data, (4) verification of the predictions.

The observational level belongs to the first step in this method. It is called "the sum total of initial facts subjected to theoretical treatment" (1964, p. 155). The level of constructs belongs to the later steps: constructs are defined as "concepts which deal with unobservable entities that are postulated for the explanation of facts given through direct observation" ("Problems", p. 7). Phonemes, differentors etc. are thus hypothetical units belonging to the level of constructs. They are part of the descriptive model. "Structural description should clarify facts and phenomena which are obtained through direct observation. Otherwise structural description would lack any cognitive value" ("Problems", p. 108).

These quotations show that Šaumjan's levels of constructs and of observation, although in many respects corresponding to Saussure's and Hjelmslev's form and

substance, cannot be identified with these concepts. Šaumjan's level of constructs is in some respects related to what Hjelmslev calls the "theory". Hjelmslev sets up a linguistic theory including certain premises which are based on experience but consisting mainly of a deductive system of definitions and a general calculus of possible linguistic systems destined for describing languages (see 7.3 above). The premises are, however, very general and the theory is meant as a universal linguistic theory. The form of a concrete language, seen as a network of (syntagmatic and paradigmatic) dependencies, is not part of the theory, but constitutes the object of the analysis, whereas substance is derived from form, and only definable through form. It is generally not regarded as an "observable"²¹ (see 7.10 above and the reservations made there concerning the unilateral dependency between form and substance). Šaumjan, on the other hand, starts from substance as an observable in the individual language and proceeds to construct abstractions corresponding to the observable facts with the purpose of explaining these facts, which thus seem to be the real object of the description. The nature of the observable facts used as raw data is, however, not quite clear. As mentioned in the preceding section the level of observation comprises purely physical as well as relational-physical concepts. Sometimes Šaumjan seems to take his starting point in the physical facts. The physical segmentation of speech into separate sounds is, for instance, taken as given, and "the phonologist's task is, taking this phonetic fact as a starting point, to discover the chain of phonemes on the syntagmatic axis of the language" ("Problems", p. 42). But on pp. 26-8 in "Problems" it is said that the phonological constructs have the purpose of explaining the protocol data about contrast which have been found with the help of an informant. And a distinction is made between "contrast", belonging to the level of observation, and "opposition", belonging to the level of constructs. In this case the primary observable data consist of "linguistic behaviour", which can hardly be identified with Saussure's substance. Šaumjan also distinguishes distributional relations operating between phonemic substrata (which belong to the level of observation), and distributional relations between constructs (p. 74), and he obviously assumes all kinds of relations both for the level of constructs and for the level of observation, the latter constituting the basis for setting up corresponding relations on the level of constructs. But distributional relations would not be part of what Hjelmslev calls substance. The level of observation thus includes somewhat more than Saussure's and Hjelmslev's substance.

In later articles (particularly 1966) Šaumjan stresses the difference. His book of 1962 seems to belong to a transitional phase in the development of his attitude to Saussure and Hjelmslev and is therefore unclear at some points.

In 1966 he criticizes Saussure and Hjelmslev for excluding substance from the concept of language since acoustic substance is one of the most important characteristics distinguishing natural languages from other semiotic systems. On the

21. Though in OSG (p. 86), it is described as directly observable.

other hand, he criticizes Trubetzkoy and Martinet for considering language to be an undissolvable whole of form and substance since this view leads to the antinomies mentioned above. Šaumjan characterizes both these approaches as one-level theories. A solution of the problems involved in these two theories can only be found by splitting up the concepts of phoneme, distinctive feature, etc. into mutually exclusive, but complementary concepts belonging to two distinct levels. This should make it possible to investigate language as a purely semiotic object, but at the same time connect this object with physical substance. In the last chapter of "Problems" Šaumjan compares his approach to linguistic theory with Niels Bohr's principle of complementarity.

This conception of language brings Šaumjan closer to Trubetzkoy than to Hjelmslev. The question now is how the theoretical difference between Šaumjan and Trubetzkoy is reflected in Šaumjan's practical procedures for linguistic analysis.

ŠAUMJAN'S DISCOVERY PROCEDURES²²

CONTRAST

II.22 Šaumjan rejects the use of semantic criteria in the establishment of phonological oppositions, and consequently he rejects the commutation test. One of his arguments is that most languages contain lexical doublets, like Russian *škaf* and *škap* (which both mean 'cupboard'). On the basis of semantic criteria these two signifiers must be considered identical, and "we have to admit with logical inevitability that in Russian the phonological opposition /f/-/p/ does not differentiate between different significations [read: signifiants] and, as a result, that /f/ and /p/ are not different phonemes in the Russian language" (p. 25).

The inevitable logic of this argument is not very obvious, since a phonological opposition is defined as a sound opposition which *can* differentiate signifiers, not as one which always *does* differentiate signifiers, and examples like *fára/pára*, *fas/pas* suffice for the purpose of demonstrating /f/ and /p/ as different phonemes in Russian.²³

Šaumjan's main argument is, however, that if we want to remain on a strictly linguistic ground, identity and difference of meaning can be defined only on the basis of difference between signifiers, and the semantic criterion is thus a vicious circle. This is true in the sense that the commutation test serves to find corre-

22. Šaumjan's procedures for the establishment of phonemes and distinctive features are described in "Problems" (pp. 22ff, 51ff and 113ff).

23. The English version is here more evidently illogical than the Russian text, since "can differentiate" is a translation of "služaščije dlja različenija" ('serving to differentiate'); but this Russian formulation only serves to conceal the lack of logic, for one page earlier (1962a, p. 23), where the definition is given explicitly, the text is "mogut differencirovat'" ('can differentiate') which is in agreement with the formulations used in Prague phonology and in glossematics.

spondences between sound and meaning, and through this correspondence both the two sound sequences and the two meanings involved are constituted as linguistically different sound sequences and meanings (i.e. as signifiers and signified). This may be a circle, but hardly a vicious one.

And in practice the difficulties are reduced by the fact that there is no conformity between content and expression, and consequently it is very rare that dubious sound differences correspond to dubious differences of meaning; normally one of the two is obvious (cp. *cow/steer* and, on the other hand, *tie/die*).

Šaumjan proposes to replace the semantic criteria by criteria of linguistic behaviour. The standard procedure should be the presentation of various types of tests to adult native informants. The linguist should accept those identities or differences between the segments of signifiers which can be fixed on the basis of the intuitive deposition of the informant, and use them as material (as "protocol data") for theoretical constructions ("Problems", p. 27). But nothing more is said about these tests, and it is therefore impossible to have any opinion of their usefulness.

The formulation "segments of signifiers" ("signifiant segments") seems to indicate that the tests are used not only for establishing different sign expressions, but also for the segmentation of these expressions – or perhaps this segmentation is taken for granted. On p. 42 it is said that "physical segmentation of the speech flow into separate sounds, i.e. into separate acoustic segments, is an objectively ascertained fact".

Contrast is now defined as "the difference between signifiant segments fixed on the basis of the deposition on the part of the informant" (p. 27), and if a sound a_1 is in contrast to another sound, we can conclude that the individual sound a_1 is a substratum of the individual phoneme " a_1 " (p. 51).

IDENTIFICATION OF SOUNDS IN DIFFERENT POSITIONS

11.23 On the basis of the tests a limited number of contrasting sounds embodying individual phonemes is found in each position. The next question is how these individual (concrete) phonemes are united into classes of individual phonemes (= abstract phonemes).

Šaumjan rejects the criterion of complementary distribution ("Problems", p. 121ff) because different phonemes can also be in complementary distribution. But nobody has ever thought of considering complementary distribution as a sufficient criterion; it has always been combined with the criterion of phonetic similarity or of common distinctive features. And as a matter of fact, Šaumjan's own method is very similar to the method of complementary distribution. The characteristic feature is rather that he does not use the criterion of phonetic similarity nor of common distinctive features. He mentions that he has earlier regarded the definition of phonological identity as being contingent upon distinctive

features; i.e. sounds are considered as phonologically identical if they consist of identical distinctive features. But this is no solution since it only transfers the problem of identity to the distinctive features. The identification of phonemes should therefore be carried out independently of the analysis into distinctive features ("Problems", pp. 124-7).

Šaumjan calls his own method the OPERATOR METHOD ("Problems", pp. 51 ff and 113 ff). As an example he uses the Russian vowels in stressed syllables. On the basis of the tests with informants various sets have been established in different positions, each consisting of five contrasting vowels. He now chooses as a standard set the set which may be considered maximally independent of the surroundings (cp. the Russian tradition of choosing a basic variant), in this example the vowels between unpalatalized consonants; the phonetic shades found in other sets are seen as alternations due to position. The acting factor in a change (viz. the position) is called the OPERATOR, and the element acted upon (e.g. a vowel of the standard set) is called the OPERAND. The vowels of the standard set (*a, o, u, ε, i*) may be paired with the vowels in one of the other sets (e.g. *ä, ö, ü, e, ɨ*) as a_1 - a_2 , o_1 - o_2 , etc., since the difference between *a* and *ä* and between *o* and *ö* etc. can be attributed solely to the position (the operator), whereas the difference between e.g. *a* and *ö* can only partly be attributed to the position. Now the action of the operators can be removed by a "mental experiment"; in this way we obtain pairs of sounds which constitute substrata of identical individual (concrete) phonemes, and since the identity is obtained by means of a mental experiment, it belongs to the level of constructs.

This procedure is set up in four distinct steps (which are not very convincing logically, see Kortlandt 1972, p. 37). In spite of the mathematical formulas the procedure is hardly more exact than Trubetzkoy's. It is also disappointing that units and relations on the level of constructs seem to be simple reflections of units and relations on the level of observation, i.e., the whole procedure is based on phonetic facts and "mental experiments".

Šaumjan's procedure is a rather complicated way of saying that instead of using phonetic similarity as a criterion of identification, it is required that the phonetic difference can be explained as an influence from the environment. Incidentally, this criterion has also been mentioned by Martinet (see 3.5 above) and by Pike (6.20 above); it has been most explicitly required by Hockett (6.20 above). It is not a bad criterion. It has the advantage that it permits the formulation of manifestation rules which have a high degree of "naturalness". It may, however, sometimes be difficult to apply.

The establishment of paired sounds is based on a so-called law of reduction: "If a given set of sounds M_i is taken as a standard, then for every sound a_i of this set one can find a corresponding sound a_j of the set M_j , whose difference from the sound a_i can be attributed solely to the action of the positional operator P_j " (p. 118). It is evident that this law does not hold in the frequent cases of defective distribution and neutralization. These cases are not mentioned explicitly, but it

appears from p. 103 that in cases of neutralization Šaumjan sets up ARCHIPHONEMES²⁴ which contain a smaller number of differentors than the corresponding phonemes.

MONO- OR POLYPHONEMATIC INTERPRETATION OF SOUND SEQUENCES

11.24 According to Šaumjan ("Problems", p. 127ff), the sound sequence AB can be considered as a sequence of two phonemes only if both sounds are eliminable (i.e. if each can occur alone). This is very close to Martinet's formulation (3.5 above). The biphonematic interpretation is, however, only considered obligatory if the order of the two sounds can be reversed. If not, the interpretation depends on the system of the language. English *tf* is, for instance, interpreted as one phoneme because this is a necessary interpretation of the corresponding voiced group *dʒ* (in which *d* cannot be eliminated initially). It is, conversely, possible to interpret one sound, e.g. a palatalized *b*, as two phonemes, but since the parts here are simultaneous, it is not possible to reverse the order, and the biphonematic interpretation is therefore not obligatory (p. 137).

The requirement of a possible permutation seems to set very narrow limits to the obligatory polyphonematic interpretation, but the example *klad-palka* (p. 138) shows that AB and BA need not be in the same position. One may, however, ask how Šaumjan would treat consonant + vowel in languages which have only CV-syllables. In this case neither permutation nor elimination would be possible.

The criterion of commutation or substitution seems preferable. Šaumjan rejects, however, this criterion, one reason being that he thinks it might lead to the recognition of too many phonemes in the cases of interdependent elements. If, for instance, palatalized consonants are only found before front vowels and unpalatalized consonants before back vowels (as in Proto-Slavic at a definite time), it would nevertheless be possible to replace both elements (e.g. *ra/ta*, *ra/ro* and *r'ä/t'ä*, *r'ä/r'e*) ("Problems", p. 134ff). Šaumjan forgets, however, here that *r'* and *r* are not commutable before the same vowels, nor are *a* and *ä* commutable after the same consonants, and traditional phonemics would therefore not draw the conclusion assumed by Šaumjan, but either, arbitrarily, treat palatalization as relevant in either consonants or vowels, or choose the solution of long components which Šaumjan seems to prefer. The criterion of commutation is also rejected by Šaumjan because he thinks that it does not permit the distinction between phonological and phonetic simultaneity (or linearity). However, all phonological schools recognize interpretations involving a discrepancy between the phonetic and the phonological levels on this point (e.g. [tʃ] as one phoneme and [æ] in e.g. *can't* as two).

24. In 1952 he called them mixed phonemes ("smešannye fonemy").

DISTINCTIVE FEATURES

11.25 As mentioned above (11.20) Šaumjan recognizes the analysis of segments into distinctive features and uses the terminology "DIFFERENTORS" for the level of constructs and "DIFFERENTOIDS" for the level of observation. The distinctive features are treated in detail in "Problems", pp. 61ff and 143ff, and 1958b (see particularly pp. 30-47). The BINARY INTERPRETATION is preferred because it is simpler and because it admits phonology into the sphere of applied cybernetics, but it is not considered obligatory. The use of an intermediate step \pm , which is found in some of Jakobson's publications, especially for compact/diffuse (see 8.5 above), and used by Šaumjan (1958b), is rejected in "Problems" (pp. 187-8) as being in conflict with the principle of binary oppositions. On the level of constructs nothing prevents the dissolution of a ternary contrast into two oppositions (e.g. compact/non-compact and diffuse/non-diffuse).

The use of zeros becomes clearer when the two levels are distinguished; zero on the level of constructs means that the opposition is not applicable, on the level of observation it may mean both-and or either-or, etc. (see also above, 8.15). The oppositions should be set up in a hierarchy. Only those which establish one-one correspondences between the constituent phonemes (i.e. correlations like *p-b*, *t-d*, *k-g*) can be neutralized.

Jakobson's list of distinctive features is taken over by Šaumjan, although with some revisions. The most important change is that he combines the oppositions vocalic/non-vocalic and consonantal/non-consonantal into one: vocalic/consonantal, which is then removed from the system of differentors and considered as prosodic ("Problems", pp. 83ff and p. 187). Šaumjan sets up as "a registration law" that every independent chain of phonemoids must contain at least one phonemoid which serves as substratum of a vowel. It has been maintained that vowels and consonants can occur in the same position, but this is true only for the level of observation. It is necessary to distinguish between environment on the two levels. On the level of constructs the vowel is described as central, the consonants as marginal, and syllables as *um* and *da* must be set up as

P ₁	P ₂	P ₃		P ₁	P ₂
Ø	u	m	and not as	u	m
d	a	Ø		d	a

French *pays* [peɪ] and *payes* [peɪ] are thus distinguished as *peØi* and *pejØ* (1958b, pp. 36-38) (cf. 12.10).

It can now be maintained that VOWELS and CONSONANTS cannot be mutually substituted,²⁵ and vocality has merely a culminative function, signalling the number of phonological syllables. In order not to change the meaning of the term "proso-

25. See also L. R. Palmer (1972, p. 85).

deme", Šaumjan proposes to set up a class of "CULMINATORS", comprising prosodemes and vocality. As in the other cases he makes, of course, a distinction between culminators and culminatoids. Later he also includes boundary signals and vowel harmony in the class of culminators (1967b, pp. 132-3).

It is now necessary to introduce two new differentors: "liquid" and "glide" for the description of *l*, *r*, *h*, *w*, *j*. On the other hand, quantity is carried over from the prosodemes to the differentors. This revision is a clear improvement. The definition of the features vocalic and consonantal has always been unsatisfactory. As mentioned in 9.34, some generative phonologists have also replaced "vocality" by "syllabicity", but they have not gone so far as to regard it as a prosodic feature.

Šaumjan proposes to restrict prosodic features in the narrower sense of the word to those which have a culminative function, i.e. stress ("Problems", p. 74ff). Stress has the function of signalling a phonological unit, in German the lexeme, in Russian the word, in French the word group. Non-culminative tone differences (which can characterize more than one syllable in a word) are considered to be distinctive features of the vowels. Šaumjan also tries to get rid of the differentiating function of stress by positing a number of zeros on the level of constructs; if *dúšu* and *dušú* are written *00dúšu* and *dušú00*, the stress will be in the same place, and the difference is reduced to a different distribution of zeros ("Problems", p. 83). In contradistinction to the use of zeros for positions in the syllable, this seems to be a very arbitrary description.

SYLLABLE AND PHONEME COMBINATIONS

11.26 The chapter on syllable patterning ("Problems", pp. 192-217) differs from the other chapters by a relatively extensive use of generative terminology, but in contradistinction to most generative phonologists Šaumjan regards the syllable as an important unit. Whereas phonemes, differentors etc. were related directly to the level of observation by correspondence rules, the SYLLABLE is set up as a pure construct derived from other units on the level of constructs. It is defined as "an elementary quantum of phonemic chain within whose framework there exist definite rules of phoneme combinations" (p. 216). This definition reminds one very much of those given by Pike and by Haugen (see 6.26 above). This is probably the most adequate type of definition that can be given of the syllable.

The internal structure of the syllable is described in two steps within the level of constructs, viz. first on a "descriptive plane" and then on an "immanent plane". On the descriptive plane the external relationships between phonemes are described by means of a finite state model which can only generate linear sequences of phonemes. On the next plane an explanatory model, which is a fusion of a phrase structure and a transformation model, is used to disclose the deeper inherent relations. This model, which is capable of distinguishing between different degrees

of cohesive strength and between basic and derived structures, generates the syllable as a hierarchical structure. The syllable is first set up in a branching diagram according to an immediate constituent analysis, where the first cut is between initial consonant group and vowel, and the following cut within the initial group can be made at different places according to the degree of cohesion found in a given language.

In the chain $C_3C_2C_1V$, V is considered obligatory, whereas C_1 is facultative in relation to V , but obligatory in relation to C_2 , etc. and on this basis a relation of DOMINANCE is set up (V dominates C_1 , and C_1 dominates C_2 , etc.). Phonemes are now classified according to their mutual domination, but as most consonants can be found in different positions, one position is selected as decisive for the definition, viz. the position in which the given phoneme is subject to minimal limitations from the context and thus has maximal probability of appearance compared to other positions. It is called "the basic dominating parameter" of the phoneme. This is reminiscent of the concept of a basic variant and is a characteristic feature of the theory. For instance, in Czech the consonantal function of l and r is considered the basic dominating parameter of these phonemes.

Other dominating parameters are generated by derivations, for instance consonants in the final parts of the syllable are generated by "mirror reflection", and elements can be added to the basic strings. This is a new and original contribution to the description of syllabic structure.

In his paper of 1966 Šaumjan describes syntagmatic phonological structure by analogy to the structure of the sentence. According to this analogy (which seems to have been inspired by Kuryłowicz, see 12.4 below), a monosyllabic phonological word corresponds to a simple sentence, a polysyllabic phonological word to a compound sentence, the vowel corresponds to the sentence verb, and culminators characterizing larger units (word accents and word group accents) to various types of sentence "connectors". The prevocalic sonorant consonants are compared to the subject, and voiceless consonant clusters before the sonorant consonants to the determinations of the subject.

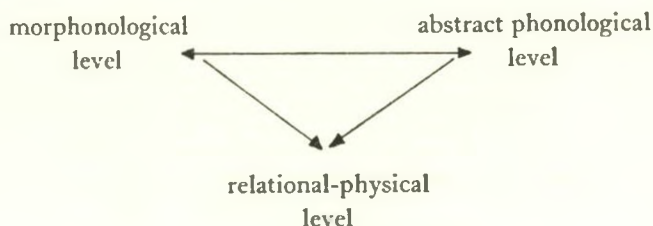
PHONOLOGY AND MORPHONOLOGY

II.27 Morphology is treated very briefly in "Problems" (pp. 100-5). It is considered to constitute a higher plane of abstraction compared to phonology. In morphonology there exists "a summarizing identity of phonemes which are substrata of one and the same morphophoneme". This is distinguished from the "generalizing identity" uniting concrete phonemes in different positions as members of the same class. In morphonology the phoneme "g" in *lugā* ('meadow', gen.) is combined with the archiphoneme K in *luK* ('meadow', nom.) to the morphophoneme [g], and the phoneme "k" in *lúka* ('bow', gen.) is combined with the archiphoneme K in *luK* ('bow', nom.) to the morphophoneme [k].²⁶

26. Šaumjan uses " " to indicate phonemes and [] to indicate morphophonemes.

Corresponding to phonemoids, phonemes and morphophonemes it is possible to set up three different types of transcriptions which may be called phonemoidal, phonemic and morphophonemic. Here Šaumjan refers to Avanesov, and to Smirnickij, who has stressed the necessity of a strict separation of the phonological and morphonological levels. In a later paper (1967b, p. 133ff) he proposes to consider neutralization as taking place on the level of observation only, i.e. among phonemoids. Thus on the ideal phonological level *g* and *k* should be distinguished also finally. This brings his phonological level closer to morphonology.

At the same time, however (1966 and 1967a), Šaumjan criticizes the generative phonologists for not keeping the phonological and the morphonological levels apart. "The subject matter of phonology is the potentialities of phonological means with respect to their diacritical (differentiating) function. Morphonology investigates the realization of the diacritic potentialities of phonological means for grammatical purposes" (1967a, p. 217). Phonology is not an intermediate stage between morphonology and phonetics. It is possible to go directly from both morphonology and phonology to the relational physical level. The mutual relation of these disciplines is illustrated by a triangle with arrows:



He has thus changed his views somewhat since he wrote "Problems", where morphonology was placed at a higher abstraction level than phonology. In the later articles it is maintained that in some respects phonology is rather more abstract than morphonology. Šaumjan emphasizes that phonologically and morphologically conditioned rules should also be kept apart. Finally he stresses the importance of an investigation of the empirical correlates of the abstract phonological system. This is called "experimental phonology".

DIACHRONIC METHODS

11.28 Šaumjan has also made interesting contributions to diachronic phonology. In 1958 he published a book on the history of the distinctive feature system in Polish (1958b): "Istorija sistemy differencial'nyx elementov v pol'skom jazyke", and in the same year a shorter article (1958c) on the same problem.

The history of the phonological system is described basically as the HISTORY OF THE DISTINCTIVE FEATURES. The description is given in the form of a

comparison between three synchronic states (twelfth century, sixteenth century and the present time). For each of the synchronic stages an account is given of (1) the number of distinctive features, (2) the inventory of phonemes, seen as bundles of distinctive features, and (3) the number of pairs of phonemes distinguished by each distinctive opposition. The historical development of the systems is described as changes on the three points mentioned above.

Sounds found at different stages of the development are considered as diachronic variants of the same phoneme if they are characterized by the same bundles of distinctive features. At that time (1958) Šaumjan also defined the phonemes at each synchronic stage on the basis of their distinctive features, and he thus applies the same method of identification in synchronic and in diachronic description. As an example we may mention the phonemes *p* and *v*. In the twelfth century the inventory of labial (i.e. grave and diffuse) consonants was constituted by *m*, *m'*, *p*, *p'*, *b*, *b'*, *v*, *v'*. In the sixteenth century the system also comprised *f* and *f'*. There was thus an increase in the number of phonemes, but the change did not involve any new features; it did, however, involve new combinations of features, not only in the new phonemes, but also in already existing phonemes, *p*, *p'*, and *v*, *v'* because they entered into new oppositions. The feature "interrupted" had to be added to *p* and *p'*, and the feature "voiced" to *v* and *v'*. Thus, the phonemes *p*, *p'*, *v*, *v'* from the sixteenth century cannot be identified with those from the twelfth century. The former are therefore written *p*₁, *p'*₁, *v*₁ and *v'*₁ and, although the sounds [p] and [v] have not changed, they are manifestations of different phonemes in the twelfth and in the sixteenth centuries.

The features used in this description are Jakobson's with the revisions mentioned above.

Šaumjan's papers on structural linguistics (1956 and 1958a) contain rather detailed accounts of Kuryłowicz's theory of marking applied to historical linguistics, but these ideas have not been directly used in his own description of the development of Polish.

ŠAUMJAN'S GENERAL LINGUISTIC THEORY

II.29 Šaumjan's phonological theory has later been incorporated in a general linguistic theory which he calls the "APPLICATIONAL GENERATIVE MODEL", and which he describes in his book "Principles of Structural Linguistics" (1971), a revised edition of a book "Strukturnaja lingvistika" of 1965 (see also Šaumjan's articles of 1965 and 1969, and H. Mørk (1971)).

Šaumjan's general linguistic theory is mainly influenced by Chomsky, by Bar-Hillel and by the mathematical-logical principles of H. G. Curry. Šaumjan uses the term "structural linguistics" to indicate the science of what he calls the "DYNAMIC ASPECT OF SYNCHRONY". Structural linguistics is opposed to "taxonomic linguistics" which deals with the static aspect of synchrony and is

merely classificatory. Only by dealing with the dynamic aspect can structural linguistics become a genuinely abstract theoretical science capable of explaining and predicting observable linguistic facts (1971, p. 5).

Šaumjan's model differs from Chomsky's in various respects; but above all by being a two-level model. Šaumjan's generative model does not generate linguistic objects of actual languages directly; it first generates idealized linguistic objects, words and sentences, which together form an idealized GENOTYPE LANGUAGE. By a number of restricting operations this universal language is transformed into the genotype of a given natural language, and the natural language itself, the PHENOTYPE LANGUAGE, is derived from the genotype language by means of correspondence rules. "Genotype" and "phenotype" correspond to "level of constructs" and "level of observation" respectively as used in phonology. The genotype language is an abstract alinear system. Linearity is a characteristic of the phenotype language only. This is an important difference from Chomsky's model. Moreover, Šaumjan does not consider words to exist in a lexicon. Both words and sentences are generated by the model.

Language is considered to be a two-strata structure comprising a STRATUM of signs as global symbols and a stratum of diacritic elements where the global symbols are phonologically coded (cp. Martinet's "double articulation", 3.3). In each of these strata two LEVELS must be distinguished: (1) the semiotic level itself, i.e., the level of idealized semiotic objects, (2) the physical level, i.e., the level of the physical substrata of the idealized semiotic objects. The diacritic (phonological) stratum is a secondary semiotic system overlying the primary semiotic system of linguistic signs, but it must be included in a complete description. The phonological code can be universal, but it is not applied to the universal global symbols, but only to a concrete natural language. There may be several equivalent phonological codings; it is, for instance, possible to leave out the phoneme and operate with differentors only (Šaumjan 1971, pp. 69-84).

Further Development of Soviet Russian Phonology

11.30 Šaumjan's work has been treated in some detail because he was the first to introduce Western structural ideas and because he has modified these ideas in his own way and built up an original theory of language, which has been of importance, not only for the further development of Soviet linguistics but also in the West, since almost all his works are accessible in English translation. Among the Soviet linguists whose phonological views have been most obviously influenced by Šaumjan are, for instance, P. A. Soboleva, E. L. Ginzburg, T. P. Lomtev, V. A. Vinogradov and V. K. Žuravlev.

However, Šaumjan is by no means the only one who deserves to be mentioned. On the whole, Western linguistics has been increasingly discussed and utilized during the sixties. As mentioned above (11.2), the main works of modern Western linguistics were translated and published in the years 1960–62, for instance in the series "Novoe v lingvistike", and in the second volume of A. ZVEGINCEV's book on the history of linguistics (1960). In 1966 JU. D. APRESJAN published a book on ideas and methods in modern structural linguistics with positive evaluations of the Prague School, the Bloomfield School and glossematics. In 1966 O. AXMANOVA published a book "Fonologija, morfonologija, morfologija" (translated into English in 1971), which gives a survey of modern theories based on both Russian and Western contributions. She defines phonology as the science of the semiological relevance of speech sounds, morphology as the science of the discrete meaningful linguistic entities, and morphonology as the science concerned with the ways and means by which the 'series' of phonological entities are transposed into the morphological ones (p. 8). In accordance with A. I. Smirnitskij she stresses the fact that the term "phoneme" implies a comparison. "Two or more sounds are mutually 'phonemes' if the difference between them cannot be accounted for by position alone" (p. 11). The syllable is characterized as "a frame unit, a specific means of encoding phonemes and other linguistic units" (p. 60). She is somewhat sceptical with regard to the purely formal approaches.

Books on general phonological theory have also been written by G. A. KLIMOV and G. P. TORSUEV.²⁷

Specific phonological subjects have been discussed in a great number of articles, and conferences on phonological problems with a great number of participants and contributions were held in 1962, 1968, and 1970 (see the reports by Vinogradov and Ginzburg in "Voprosy jazykoznanija").

Roman Jakobson's theory of DISTINCTIVE FEATURES has been discussed very often, particularly since 1962. In that year the most important articles by Jakobson and Halle were published in Russian in "Novoe v lingvistike", preceded by a long introductory article by VJAČ. V. IVANOV, who traced the history of the concept and its relations to recent results in acoustic research. Ivanov stressed particularly its importance for the description of neutralization and for diachronic phonology. Jakobson's concept of distinctive features has been criticized by KUZNECOV, STEBLIN-KAMENSKIJ, REVZIN, and others. Revzin (1970) criticizes dogmatic binarism and prefers tree structures to matrices because they reflect the hierarchic structure of features. A. M. Šur (conference on phonology 1962) criticizes the lack of a clear definition of relevance which leads to ambiguities in the placement of zeros in the identification matrices. But on the whole Jakobson's theory seems to have been adopted by most Soviet phonologists.

As mentioned above (11.28), Šaumjan applied the distinctive feature approach to diachronic phonology as early as 1958. In two interesting articles of 1966 and

27. G. A. Klimov "Fonema i morfema" (1967) and G. P. Torsuev "Problemy teoretičeskoj fonetiki i fonologii" (1969). These books have not been available to me.

1971 V. K. ŽURAVLEV has continued this line. He aims at setting up a diachronic model which should be capable of predicting sound changes in a given language, for instance on the basis of the stability and homogeneity of the phonological system. On this point he also utilized the ideas of Martinet (Žuravlev 1966). He emphasizes that arguments concerning holes in the pattern presuppose the acceptance of redundant features as potentially distinctive: there is only a hole in the pattern in the system $\begin{array}{c} p \ t \ k \\ b \ d \end{array}$ if k is regarded as voiceless. In the article of

1971 he operates with the concept "relative force of an opposition" which is considered to be directly proportional to the number of positions of differentiation and inversely proportional to the number of neutralizations.

Problems of juncture have been treated by Gvozdev, S. A. Sokolova, Panov, and others. Panov (1961) uses the term 'diaeremes' and describes their relations to segmental and suprasegmental phenomena.

Prosodic phenomena and morphonological problems have also been discussed by many linguists.

Generative phonology does not seem to have had much influence. In a paper of 1972 Liberman has given an account of the ideas and procedures of generative phonology. He recognizes that there are many interesting points in generative phonology, but on the whole he is rather sceptical. In particular he criticizes the assumption of a psychological reality behind the rules. He also emphasizes that the establishment of underlying forms presupposes a phonological analysis along traditional lines.

The most characteristic feature of Soviet phonology and of Soviet linguistics in general is, however, the great interest in MATHEMATICAL MODELS and FORMALIZED DESCRIPTIONS. This may seem very abstract, but as a matter of fact this interest is closely connected with the interest in cybernetics and information theory and their possible practical applications in machine translation, automatic teaching systems etc. Mathematical linguistics was the first branch of structural linguistics to be admitted in the Soviet Union, obviously because of its practical applications. At the same time, however, the formalist approach was in good agreement with a traditional tendency in Russian linguistics, found in the works of Baudouin de Courtenay, Fortunatov, Ščerba and others (see Revzin 1969).

I. I. REVZIN has set up models for linguistic description based on set theory, for instance in his book "Models of Language" (1966; published in Russian 1962). His phonological model (pp. 15-48) is based on a distributional definition of the phoneme (he quotes Daniel Jones), which presupposes that free variation has been eliminated. Segmentation is taken as given, and phonemes are assumed to possess constant distinctive features. (For a criticism of Revzin's definitions, see Kortlandt 1972, pp. 48-50). Revzin sets up a paradigmatic and a syntagmatic model, both of which are very simple. The paradigmatic model consists of sets of phonemes having a common archiphoneme, and the problem of holes in the

pattern is discussed. This paradigmatic model is strongly influenced by ideas of Prague phonology, particularly by Trubetzkoy and Martinet. The syntagmatic model is based on combinations of neighbouring phonemes, apparently without regard to syllable boundaries. Revzin does not seem to be fully acquainted with the Western linguistic literature on phonotactics.

In this model the most difficult problems of phonological analysis, the identification and delimitation of the units, are presupposed as solved. Other types of models have been set up for the identification procedure itself. Such models have been constructed by USPENSKIJ (1964) and V. N. BELOOZEROV.²⁸ Uspenskij takes only the segmentation as given, and gives rules for the identification based on minimal pairs and phonetic similarity. His rules do not in all cases lead to a unique result. Beloozerov tries to avoid the non-uniqueness by introducing the concept of distance between sounds.

Soviet phonology has thus developed a variety of methods and viewpoints during the sixties. It is time that these achievements were taken into account by Western phonologists.

28. They are only mentioned briefly here because, as mentioned in the preface, mathematical linguistics is beyond the present writer's competence. The reader is advised to consult Kortlandt (1972, pp. 76-87) on this subject.

Chapter 12

CONTRIBUTIONS FROM OUTSIDE THE SCHOOLS

General Remarks

12.1 The preceding chapters have dealt with the theories of different phonological schools. However, valuable contributions to phonological theory have also been given by linguists who cannot be said to belong to any definite school. Some of these are mentioned in this chapter.¹ The contributions are arranged according to subjects, and it has been attempted to relate them to the treatment of these subjects in the preceding chapters.

The Saussurean Dichotomies

INTRODUCTION

12.2 F. de Saussure has had a deep influence, particularly on linguistics in Western Europe, and the well-known dichotomies set up in his "Cours de linguistique générale" (see 2.7-11 above), viz. langue/parole, form/substance, signifié/signifiant, associative (later called paradigmatic) vs. syntagmatic relations, synchrony/diachrony, have been amply discussed. The vast literature on these subjects will not be quoted here (some titles have been given in 2.6 above), but a few contributions will be picked out which are of specific interest to phonology or closely connected with the discussions in the preceding chapters.

LANGUE/PAROLE, FORM/SUBSTANCE, AND ASSOCIATIVE/SYNTAGMATIC

12.3 The most debated of these dichotomies has been the distinction between **LANGUE** and **PAROLE**. As mentioned above (2.7) Saussure characterized *la langue* as a social system and *la parole* as the individual application of the system. This

1. The choice is not based on any systematic bibliographic investigations and may be somewhat accidental and biased in favour of Scandinavian scholars and in favour of the problems I have considered interesting, but I hope that nothing *very* important has been left out.

distinction was taken over by the Prague School and used in their early writings as the theoretical foundation of the distinction between phonology and phonetics (see 3.2 above). In generative phonology a corresponding distinction is made between competence and performance (with emphasis on the difference system/application; see 9.9 above).

Saussure's *langue*/*parole* dichotomy has a certain relationship to the distinction between FORM and SUBSTANCE (2.9), since *la langue* was described as a purely formal system; and in the theoretical definitions of Prague phonology the distinction phonology/phonetics was also paralleled with the distinction form/substance (although in practice substance was not excluded from phonology (see 3.2 above)). Hjelmslev criticized the equation of Saussure's *langue* with form, and divided it up into schema (pure form), norm, and usage (see 7.9 above).

In connection with the discussion of Hjelmslev's distinction between form and substance reference was made to EUGENIO COSERIU's monograph "*Forma y sustancia en los sonidos del lenguaje*" (1954); but it should be mentioned here again since it is the most thorough and penetrating study existing on this subject. Coseriu also criticizes the dichotomy *parole*/*langue* and instead sets up three steps: *parole*, norm, and system. Within the expression these three steps are represented by (1) "allophonetics", dealing with the innumerable variants in the individual speech act, (2) "normophonetics", comprising the normal obligatory but not functional variants, and (3) phonology (or functional phonetics). Coseriu's "norm" and "system" correspond approximately to Hjelmslev's "usage" and "norm". In a later article (1968) he sets up a third step: the type. The norm comprises the traditional linguistic realizations, the system the rules corresponding to the realizations, and the type the principles corresponding to the rules of the system. Coseriu considers Hjelmslev's "schema" as a further step of formalization where form is independent of any particular substance and only has the general attribute "substantiality". But this is, according to Coseriu, no longer linguistics, considered as the study of concrete natural languages, but a science dealing with semiotic possibilities, a perfectly legitimate science, but one which should not be confused with linguistics. It can only describe what is common to natural languages and other semiotic systems, but not what is characteristic of human language. The formal system of language is not independent of the substance in which it is manifested.

BERTIL MALMBERG, who has been mentioned several times in the preceding chapters for his excellent introductions to various linguistic theories, particularly his book "*New Trends in Linguistics*" (1964), is strongly influenced by Saussure and, in his view of phonology, both by the Prague School and by glossematics. However, from his very first papers (e.g. 1941, pp. 271-2) he has stressed the close connection between phonetics and phonology, thus agreeing with Martinet, but in opposition to Hjelmslev and the theoretical doctrines of the early Prague School. Even in his most glossematic paper (1963b, p. 8) he states that substance is not independent of form, and that language is form *and* substance (1963b,

p. 23; see also 1969a, pp. 14–15). Conversely, he often insists on the linguistic basis of phonetics (e.g. 1963b, p. 12).

In some papers, however, Malmberg has advocated the idea that form and substance do not constitute an opposition between just two extremes but cover a whole series of levels of increasing abstraction (1962, 1963a, pp. 96–117, 1969a, p. 17). As an example he analyses (1962) the two Swedish word tones (accent 1 and accent 2) on four levels of abstraction, comprising (1) a phonetic description of all measurable differences, (2) a simplified description of the perceptually relevant features, (3) a quantified description as “high/low”, (4) a purely linguistic description, where the two accents are designated by + and –, i.e., positive or marked vs. negative or unmarked (Malmberg does not distinguish between positive/negative and marked/unmarked).

The differences between the levels of abstraction get, however, somewhat blurred because Malmberg equates the difference between levels 2–3 and level 4 with the difference between distinctive features and phonemes. This does not appear clearly from the accent example because the status of the two accents as features or independent phonemic entities is problematic. But levels 2 and 3 are called the distinctive levels, and level 4 the level of opposition, and the concepts of distinction and opposition are defined in the following way: “By *distinction* I mean a linguistically valid sound difference, by *opposition* a linguistic function with regard to the paradigm. There is *opposition* between phonemes, *distinction* between relevant sound features” (1962, pp. 223–4). A similar definition is given in a later work (1963a, p. 81), and it is added that opposition belongs to the form domain, distinction to the substance domain.

However, in a later paper (1969b) it is stated, with reference to Šaumjan (cf. 11.20 above), that the distinctive feature can be regarded as the minimal linguistic unit and that for this unit, just as for the phoneme, it is possible to distinguish between form and substance. This is also in closer agreement with Roman Jakobson’s concept of distinctive features as components, not properties, of phonemes (cf. 8.2 and 8.14 and the discussion of Hjelmslev’s characterization of distinctive features as substance units in 7.21 above).

GUNNAR FANT has in various papers emphasized the necessity of distinguishing between the distinctive features as linguistic units on the message level and the physical cues belonging to the signal level (e.g. 1967a, p. 2), but at the same time he stresses the necessity of setting up rules predicting the speech event given the output of the phonological component of the grammar (1969, p. 3).

There is also a certain relationship between the distinction langue/parole and another of Saussure’s dichotomies, viz. the distinction between SYNTAGMATIC and ASSOCIATIVE (paradigmatic) phenomena (see 2.10 above). La langue is primarily viewed as an inventory of signs, which may be combined in la parole. However, Saussure does not equate these two distinctions; on p. 173 of “Cours” (3rd ed.) he states that all types of syntagms constructed on the basis of regular

forms should be attributed to *la langue*, and not to *la parole*,² and on p. 180 he mentions the rules of phoneme combination as belonging to *la langue*. But on p. 173 he adds that within syntagmatics there is no clear-cut limit between *langue* seen as collective usage and *parole* as individual freedom. He seems to assume that a certain number of normally constructed phrases are stored in the brain and that the speaker uses these as models. A clearer distinction would have been obtained by the formulation that the syntactic patterns belong to *la langue*, whereas the actual utterances belong to *la parole*. Some linguists have, however, confused the two dichotomies *langue/parole* and associative/syntagmatic.

The Danish linguist VIGGO BRØNDAL (1887-1942) has constructed an original theory of grammar,³ the main divisions of which are based on two dichotomies: the inner vs. the outer, and system vs. rhythm (see e.g. 1943). This gives four basic disciplines:

	inner	outer
system	morphology	phonology
rhythm	syntax	prosody

Phonology deals with systems of phonemes and phoneme classes, prosody (in earlier papers also called phonetics) with the syllable and its parts.

Brøndal identifies the division system/rhythm with Saussure's *langue/parole* dichotomy (with emphasis on the difference social/individual). But evidently the distinction has a much closer relationship to the distinction between paradigmatics and syntagmatics.

HENRIK BIRNBAUM has dealt with the problem: paradigmatic and syntagmatic phonology in a paper of 1967 containing many references to the relevant literature. He also seems to identify the dichotomy paradigmatic/syntagmatic more or less with Saussure's *langue/parole*, but he rightly emphasizes that this identification does not hold for the competence/performance distinction of transformational grammar, since syntactic and phonetic patterns evidently belong to competence.

The distinctive features present a special problem in this connection. Saussure described the syntagmatic relation as taking place between terms *in praesentia* (i.e. both terms are present in the speech chain, for instance *p* and *a* in *pa*), whereas the associative relation takes place between terms *in absentia* (i.e. the terms alternate in the same position, for instance *p* and *b* in *pa/ba*). Moreover, he gave the further characterization of the terms of a syntagmatic relation that they are linearly ordered. This double characterization is adequate as long as the phoneme is not divided into distinctive features conceived as phoneme com-

2. "Il faut attribuer à la langue, non à la parole, tous les types de syntagmes construits sur des formes régulières".

3. Brøndal is often mentioned together with Hjelmslev as one of the founders of the "Copenhagen School". They had, however, very little in common except that both were structuralists and influenced, in different ways, by de Saussure.

ponents. But the distinctive features make difficulties. For instance, the features "labial" and "closure" are both present in a *b*, but they are not linearly ordered. This has led to some terminological confusion. Jakobson rejects Saussure's characterization of the signifiant as linear (cf. 8.2 above) and thus maintains the distinction *in praesentia* and *in absentia* (cf. Hjelmslev's definition of paradigmatics and syntagmatics by means of the concepts both-and and either-or in 7.4 above). The relation between features in a phoneme must therefore, according to Roman Jakobson, be a syntagmatic relation. Birnbaum, on the other hand (1967, p. 318), describes the analysis of phonemes into features as a paradigmatic operation because the features are not linearly ordered. Also Šaumjan considers the distinctive features to belong exclusively to paradigmatics for the same reason.⁴ Jakobson's solution seems more adequate.

SIGNIFIANT/SIGNIFIÉ

12.4 The distinction between signifiant and signifié (Hjelmslev's expression and content) has been much less debated and is accepted by most linguists, although some post-Bloomfieldians described morphemes as a mere combination of phonemes and wanted to keep meaning out of linguistics. But very few have accepted Hjelmslev's assumption of a complete parallelism between content and expression as far as the definition of categories is concerned (cf. 7.20 above).

The well-known Polish linguist JERZY KURYŁOWICZ forms an exception. He is strongly influenced by de Saussure and also somewhat by glossematics. Like Hjelmslev he assumes a parallelism between categories in the two planes, but, whereas Hjelmslev equates syllable and noun, Kuryłowicz finds a parallelism (isomorphism) between syllable and sentence (1948a, p. 106, and 1949). A sentence may be analysed as subject + (verb + determinations), whereby the determinations are accessory in relation to the verb, and the subject accessory in relation to the group consisting of verb + determinations; in the same way the syllable is analysed as initial consonant cluster + (vowel + final consonant cluster). Moreover, just as a complex subject like "un soldat + (blessé + d'un coup de baionette)" can be decomposed into its members, the initial consonant group *str-* in Greek or Latin can be decomposed into (*s* + *t*) + *r*, where *s* is accessory in relation to *t*, and (*s* + *t*) in relation to *r*, since the clusters *st* and *tr*, but not *sr*, are possible. (Šaumjan is influenced by Kuryłowicz on this point – see 11.26 above). Kuryłowicz has also discussed the problem of syllable division (1948a).

In a paper of 1972 MALMBERG applies a hierarchic principle to both phonological and grammatical phenomena in a similar way. He does not, however, in this connection make a sharp distinction between content and expression but talks about a series of levels from the feature to the sentence.

4. Moreover, both Šaumjan and Panov use the term "paradigmatic" in a different sense (see above 11.16 and 11.18).

The British linguist WILLIAM HAAS differs from most other European linguists by not recognizing content and expression as two separate planes of language, one of his arguments being that using the commutation test for content would mean starting from disembodied notions (1954, p. 79ff and 1972). Haas does not, of course, deny that linguistic units may have a physical shape and a meaning, but his approach to this dichotomy is different. It is connected with what he calls "functional" relations and shows some affinity with a Firthian approach to meanings.

A linguistic unit can, according to Haas, be determined by a twofold relationship: (1) its part-part-relations to other units of the same level (distributional relations), and (2) its part-whole-relations to units of higher or lower levels (1954, p. 56). From the point of view of its part-whole-relations a unit can thus either be defined as a constituent of a higher level unit (this is called its synthetic or (later) functional definition), or as a function of its constituents (this is called its analytic or componential definition). Now the only way of describing meaning scientifically is to deduce it from the function of the given unit in higher level units. The semantic value of a linguistic unit thus appears in the synthetic (or functional) definition of it, the phonetic value in the analytic definition. Only units of the intermediate levels of the hierarchy admit both definitions. Any attempt to give an analytic description of the units of the lowest level (the phonological features) or to give a functional description of the units of the highest level (sentences) would carry us beyond the boundaries of linguistic analysis, i.e. to the physiology or acoustics of sounds and the social context of utterances, respectively. Haas wants to set up a hierarchical framework of a one plane description and considers the assumption of a content plane as metaphysical.

SYNCHRONY/DIACHRONY

12.5 Saussure required that synchrony and diachrony should be kept strictly apart, and he thought that linguistic change had no relation to the system (see 2.11 above). Bloomfield also restricted the structural approach to the synchronic aspect of language and kept to the neogrammarian concept of sound change as purely phonetically conditioned, mechanical processes (see 6.33). The Prague School, on the other hand, viewed the diachronic description as a comparison between systems at different points in time; but at the same time they did not consider the system as something completely static (see 3.16 above). In generative phonology the point of view is shifted again. Generative phonologists are not interested in comparing systems, but in studying the process of sound change, or rather, changes in the speaker's competence. Moreover, the limits between synchrony and diachrony get blurred, because the derivations from underlying forms are often more or less identical with historical developments (see 9.65). COSERIU (1958) emphasizes that the strict distinction between synchrony and

diachrony belongs to the description, not to the object. In accordance with Humboldt and Croce he sees language as *energeia*, as activity.

The problem of the explanation of sound changes will be treated in 12.16–21 below together with the problem of tendencies in phonological systems because the two problems are very closely connected.

Establishment of Phoneme Inventories

GENERAL REMARKS

12.6 In spite of the different criteria used in different phonological schools and the different weight attached to the common criteria, it is astonishing how similar the results of their actual phonological analyses are (except for the Firthian School and generative phonology). They have obviously all aimed at the same intuitively recognized units. Nevertheless, the discussion of the validity of the criteria is of methodological interest.

THE COMMUTATION TEST

12.7 The commutation test has been accepted by almost all European linguists (see 3.4 and 7.6) and (more or less implicitly) also by many American linguists, although for instance Bloch tried to get rid of it (cf. 6.19), and Chomsky has criticized it severely (e.g. in "Current Issues", p. 83, see 9.5). But the problem of the most adequate form of the test has often been discussed (see e.g. 6.19).

HAAS (1959) accepts the use of the commutation test in phonological analysis, but interprets it in his own way in accordance with his specific view of content and expression. In his view the commutation test implies in the first place distributional statements of the paradigmatic relations among the contrasting items, and of the syntagmatic relations between them and their environments (the paradigmatic relation is said to be distributional in the sense that e.g. *p* and *b* are substituted in the same environment). But moreover commutation implies a functional relation of the contrasting items to any whole sign-unit in which they occur, "and it is by taking account of this *part-whole* relation that the operation of contrastive substitution serves as a test of relevance" (1959, p. 17). The exchange of *p* and *b* is correlated with the exchange of *pet* and *bet*, which belong to a higher level. "To widen the scope of linguistic inquiry to ever more comprehensive functions, and generally ever wider contexts, is something very different from trying to slip away to another plane outside (above or below) the plane of expression. And to examine various capacities for 'filling positions' in higher-level functions is very different from seeking to match perceptive sound entities with another kind of imperceptible ones" (i.e. meaning) (1972).

Substitution, if linguistically relevant, takes place within a unit of higher level, not within a chain cut out by chance, i.e. not within *tall*, cut out of *not at all*. For the substitution of phonological elements, grammatical units are recognized as determining relevant environments; but this is not tantamount to including all sorts of grammatical information in phonological analysis. The explanatory morphophonemics of generative grammar presupposes, according to Haas, a phonological (as well as a grammatical) analysis (1967, pp. 239-40).

Substitution, in phonological analysis, is described as taking place minimally between features. Phonemes are "bundles" of features which characterize segments of sound. In some cases the phonetic range of a feature is determined by the environment. This is normally the case for tone levels or, e.g., for the degree of aperture in Danish vowels after *r* and after other consonants. Roman Jakobson thinks that in such cases we recognize the same substitutional relations (oppositions), but Haas maintains that we recognize the same relative features, they are only measured on a different scale in different environments (much as a small mouse and a small elephant may both be appropriately described as small). What distinguishes relative features from others is simply that we cannot identify them without identifying the environment (1957, p. 139ff). An "overlap" appears only when an absolute frame of reference is applied.

In a paper of 1956 on the commutation test the PRESENT WRITER concludes that the test can only be applied to meaningful units, preferably minimal utterances. "Commutation" of sound segments is only a short-cut expression for a procedure by means of which commutable signs are analysed into components in such a way that the difference between them is accounted for in the most simple and adequate manner.

The Norwegian phonetician MARTIN KLOSTER JENSEN has investigated the presence or absence of phonological tone differences in an extensive dialect area around Bergen by means of an interesting type of pair test described in his book "Tonemicity" (1961).

A recording was made of 612 Norwegian informants from various parts of the area. Each informant was presented with a list of six short sentences containing each a specially marked test word at the end. The test words constituted three minimal pairs, and the meaning of each word was evident from the context. The subjects were asked to read the sentences silently and only read the test word aloud. The test words were randomized by throwing a die: the informant had to read the test number corresponding to the number shown up on the die. Fifty-eight items were recorded by each subject. After the recording the test tape was played back to the speaker four times, and he had to indicate the number of the sentence from which the word was taken. Each subject thus made 232 identifications in all.

As might be expected, most of the subjects could be placed in two distinct groups. One group had about 50 per cent correct answers (with a certain dispersion) and thus no tonemic distinction, and another group had almost 100 per cent

correct answers and thus a clear tonemic distinction. But about one sixth of the subjects (108) had recognition scores in between, i.e. 65–85 per cent. Kloster Jensen rejects the hypothesis that these informants might be bilingual and have vacillated between two coexisting systems. Most of the informants with percentages below 65 originated from a coherent central geographical area, and there was no reason to believe that they would be less influenced by the standard language than the others, whereas most of the informants with intermediate scores came from the borders of this area, more or less intermingled with the third category. Kloster Jensen assumes that the physical correlates of the toneme realizations are less easily distinguished in a transition area than in a typically tonemic district and states that there are degrees of relevance in tonemics, and that the difference seems to lose its phonemic status gradually. This is in contradiction to the absolute phonological boundaries and abrupt phonological changes assumed by Trubetzkoy and Roman Jakobson, but it is very probable that similar distributions might be found in other cases. In standard Danish there are quite a number of examples of indeterminate phonological distinctions which might be investigated by means of similar methods.

The test type used by Kloster Jensen (which is similar to the one recommended by Harris (6.19)) is certainly the best method. If speakers are asked directly whether two words are the same or different, they will often be influenced, for instance, by orthographic differences and think they make a difference in pronunciation which in fact they do not make.

On the other hand, LABOV (1972b) has recently made a more unexpected observation. In a good number of cases he found that the informants were unable to distinguish minimal pairs which differed in their own pronunciation. The difference could often be perceived by the phonetically trained observer and appeared clearly in spectrograms, although in most cases it was relatively subtle. These results were not limited to tests with old people, who might be hard of hearing. Labov draws the conclusion that the role of contrastive function is not as powerful as we have been led to believe by structural theory. The phonemic principle is important, but we must be prepared to identify marginal cases which are not fully distinct – “a marginal phoneme not distinct enough to be easily recognized by the native speaker, but distinct enough for the rule system to maintain its integrity and evolve as a separate element” (p. 1133).⁵

It is perhaps not so astonishing that small differences cannot be consciously perceived by the native speaker. But it is a puzzling problem how he can acquire and maintain a distinction he cannot hear. PANOV (1967, pp. 245–9, see Bibl. to Ch. 11) quotes similar observations from Russian: Many speakers have complete neutralization between *i* and *e* in pretonic syllables after palatalized consonants

5. C. L. Ebeling (1967) uses the term “marginal” in a different sense. He makes a distinction between “marginal” phonemes, which are characterized by the fact that they occur only in marginal words (borrowings, interjections, etc.) and “heavy phonemes” (a better name would be “optional phonemes”), characterized by optional distinctive features.

(e.g. *milá/melá*), but some make a small difference between the two. They are, however, not able to identify the words when these are played back to them on tape. Panov gives the following explanation: if many, or most speakers of a speech community do not make a given distinction, it loses its importance, and people stop paying notice to a variation which has in most cases no function, although they may have a stable difference in their own speech.

CONVERGENCE OF CRITERIA

12.8 The British linguist CHARLES E. BAZELL has made various stimulating contributions to phonological theory, but they are scattered over a number of articles, some of which, according to the titles, deal with other subjects. Bazell criticizes everybody, but at the same time he accepts almost all of the criteria used in different schools. One of his basic ideas is precisely that linguistic units and categories should be defined by a convergence of different criteria (cf. e.g. 1952 and 1953, p. 93 ff).

In setting up the phonemes of a language, for instance, both phonetic and various other criteria (including morphological) may be used. "The "linguistic reality" of the phoneme, or of any other linguistic unit, is merely the fact that different criteria converge on one point. The marginality of a unit is their failure to converge" (1952, p. 35).

There is thus a central area where all criteria converge and peripheral areas where only some apply. Those phonemes which would be dubious without the support of morphological criteria are, for instance, peripheral. This point of view also implies the recognition of the non-uniqueness of solutions to various problems. One may choose to leave out some criteria for some purposes. "The question "One phoneme or two?" (like all other such questions) is always worth asking, but is not always worth answering" (1952, p. 33).

Communicative relevance is, of course, one of the criteria used, but Bazell also stresses the "principle of motivation" which implies that allophonic variants must be explicable in terms of environment (cp. Martinet 3.5 above and Hockett 6.20 above); it is not enough that they should be predictable in such terms. The aim is to reach a system whereby intrinsic features and distribution are mutually explanatory (1954, pp. 134-5, cp. also 1953, p. 42). The phonemes are, in a sense, the arbitrary residues left after the deduction of whatever is to be regarded as motivated.

The question of formal and substantial *criteria* is, according to Bazell, a pseudo-problem, which arises because the distinction between form and substance is mixed up with other distinctions, for instance with the distinction between composition and distribution (1954). A phoneme may, for instance, be described by means of the features of which it is composed or by means of the relations into which it enters with other units, but one is no more substantial or more

formal than the other. There is nothing uniquely formal about distribution (cp. Šaumjan 11.21 above). It is possible, however, to distinguish between substantial and formal *definitions*. When comparing a graphemic and a phonemic system the definitions must necessarily be formal.

NEUTRALIZATION

12.9 There has been much debate and much disagreement among different phonological trends about the concept of neutralization. If much weight is attached to the concept of opposition, neutralization (i.e. suspension of opposition) will also be a crucial concept.⁶ This means that neutralization is an important concept in the Prague School and in glossematics (see 3.7 and 7.18) and, in a somewhat different form, in the Moscow School (11.10), whereas it does not play any role in the Bloomfield School (6.24), the Leningrad School (11.4) or in Jones's phoneme theory (4.5).

BAZELL has treated the problem in various papers (e.g. 1953 and 1956). Also in this case he argues for convergence of criteria, so that there may be more or less evident cases of neutralization. In his book of 1953, p. 20, he states that the typical instances of neutralization must fulfil the following conditions: (1) inclusive distribution, (2) a single feature shared by the including and the inclusive member,⁷ (3) the distributional positions from which one member is excluded allow that member which from other standpoints may also be regarded as unmarked, (4) morphological emergence of the excluded member in allowable positions. In English *sp, st, sk* condition (4) is not fulfilled. Such cases are less central.

HAAS (1957) accepts the concept of neutralization, but the delimitation between neutralization and defective distribution is not made in quite the same way as in the Prague School. Cases like German [ta:k] may, according to Haas, be described either as defective distribution or as neutralization, i.e., we may either recognize a neutralization of contrast without implying a neutralization of the features themselves and thus still identify the final consonant as a voiceless /k/, or we may interpret it as an archiphoneme k/g with neutralization of the feature of voicing. We decide for one description or the other mainly on morphological grounds. In the cases of multidimensional oppositions, to which Trubetzkoy did not apply the concept of neutralization, Haas admits a description operating with partial loss of contrast. In English, for instance, only *p* and *k*, but not *t*, are found before *l* (but initial *kl* may in Northern English vary freely with *tl*). If the opposition

6. Provided one does not take one further step and sets up a different inventory of phonemes for different positions (cf. Twaddell 3.4 above and the Prosodic School 5.4).

7. He probably means "at least a single feature . . .", but this claim seems too weak. It would allow neutralization between all consonants, cf. Trubetzkoy's much stronger claim (3.7 above).

p-t-k is considered as one of more grades (front-mid-back), it may now be said that before *l* the grades are reduced to two (front and back).

In volume II of "Travaux de l'institut de linguistique de l'université de Paris" (1957) Martinet has published the answers to a questionnaire concerning neutralization in morphology and lexicon. Some of the answers also touch upon neutralization in phonology.

Phoneme Combination and Phoneme Classification

12.10 Except for some early papers by Mathesius and Trnka (cf. 3.13 above), Prague phonologists have not made many contributions to the description of phoneme combinations. The same is true of Russian phonology. The Bloomfield School attached more importance to this aspect of phonology (cf. 6.25-26). A relatively great number of contributions in this field have, however, been made by phonologists outside the current trends.

The British phoneticians J. O'CONNOR and J. L. M. TRIM (1953) have tried to define vowel, consonant and syllable based on a distributional analysis of English words. Only mutual relations between initial and post-initial and between final and pre-final phonemes were considered. The number of contexts occupied in common by every pair of phonemes in each of the four places was determined, e.g. *p* and *ɔ* are said to have a common context in *pray* and *oral*. The frequency of the individual phonemes was also taken into account. In this way it was possible to separate two classes of phonemes showing a large number of mutual combinations whereas there were few combinations within each of the two classes. These two classes correspond to the traditional vowel/consonant dichotomy, and there was some basis for describing vowels as central since they were found relatively more often in post-initial and in pre-final position than the consonants and were able to stand alone. The authors then define the syllable as a minimal pattern of phoneme combination with a vowel unit as nucleus preceded and followed by a consonant unit or permitted consonant combination.

GORDON ARNOLD has applied the same method to French with a special discussion of the problem of semi-vowels.

Whereas O'Connor and Trim base the definition of the syllable on the definition of vowel and consonant, the German linguist HERBERT PILCH (1966) proposes to start a phonological description by an immediate constituent analysis separating the syllabic nucleus and the margins on the basis of free combination between these groups. Opposition is seen as a relation between phonemically different members of a given class of constituents (e.g. margin or nucleus). There is thus no opposition between *a* and *s* in *appear/spear*, nor between *i* and *j* in French

paye/pays [pej/pe-i].⁸ Vowel and consonant are defined on the basis of the concepts peak and margin.

A relatively large number of papers on these problems are written by Scandinavian linguists who, generally, have been influenced by both Prague phonology, American phonemics and glossematics.

In a paper of 1952 the PRESENT AUTHOR has discussed the possibility of establishing distributional categories of phonemes which can be used for comparisons between languages. It is proposed to use positions within the syllable as the basic criterion. The paper further contains a discussion of the relation between syllable and minimum utterance and a discussion of structural law versus accidental gaps. It is argued that the placement of an exact borderline between structural law and accidental gap is arbitrary, since the rules determining the syllabic structure of a language form a hierarchy from the most specific to the most general laws. The more general the rule with which a given cluster would come into conflict, the safer is the statement that its absence is due to a structural law. Moreover, the frequency of the phonemes in question and perhaps the possibility of formulating the rule in terms of distinctive features should be taken into account. Some empirical observations concerning accident or law in the combination of different parts of the syllable are also mentioned.⁹

The Norwegian linguist HANS VOGT has given an interesting description of the structure of Norwegian monosyllables (1942), in which phoneme classes are defined on the basis of possibilities of position and combination, and in which the problem of the distinction between structural rules and accidental gaps is raised. This problem is discussed in more detail in a later paper (1954) with Georgian as an interesting example. Georgian initial consonant clusters have up to six members, and although more than 700 different clusters are found, there is a very high number of non-exploited possibilities. It is, however, not possible to set up structural rules for consonant combinations and thus to predict the permitted clusters without taking both the occurring clusters and the phonetic classification of the phonemes into account.¹⁰ In a structural rule at least one of the terms must be a class of phonemes; the statement that labial stops do not occur before *v* is therefore a true structural statement, but the statement that *p*, *p̣*, *l*, *r*, *ʒ* and *ʒ* do not occur before *n*, is not. On this basis Vogt distinguishes

8. This view is in agreement with that of Šaumjan (11.25 above); cp. the somewhat different approach taken by Martinet (e.g. 1964 (Bibl. to Chapter 3), p. 72).

9. I should like to add a personal note here: Krámský (1974, see Bibl. to Chapter 3) mentions me as a "firm adherent of glossematics". It would be more correct to say that as a member of the Copenhagen Linguistic Circle and of the Linguistic Institute, which was directed by Hjelmslev, I have felt an obligation to try to understand glossematic theory and to communicate the understanding I gained to others; but I have never felt inclined to apply glossematic theory myself. The paper mentioned above is the most positively glossematic I have written, and Hjelmslev's comment on it was that I had been "completely Americanized".

10. He thus found the purely positional criteria proposed in my paper of 1952 insufficient.

between four classes of clusters: "the class of clusters which do not occur and which do not conform to any structural patterns in the language, called inadmissible clusters; the class of clusters which occur but do not conform to any structural patterns, called marginal clusters; the class of clusters which do not occur, but conform to the structural patterns of the language, called virtual clusters; and, finally, the class of clusters which occur and conform to certain patterns, called actual clusters" (p. 33). Marginal clusters arise through conflicts between phonemic tendencies and morphophonemic rules.

In a paper of 1963 KLOSTER JENSEN has given a very useful survey of the definitions of the syllable.

The Swedish linguist BENGT SIGURD has published various articles and a book on phonotactics, mainly based on Swedish material (e.g. 1955, 1965 and 1968). He sets up classes of consonants in a definite rank order based on their relative "vowel adherence", i.e. their tendency to occur close to the vowel. The result is shown in the form of a simple generative order diagram which shows the allowable sequential combinations. In the article of 1955 a number of exceptions are mentioned; in the later form (e.g. 1968, p. 456), the diagram (which is of the type shown in section 10.11 (fig. 10.8) above) has been extended by a "filter" which includes the exceptions. The fit of the order diagram to the data is shown by the size of the filter. This method gives clear results for Germanic languages, but it could hardly be applied to Georgian.

MALMBERG (1965) has pointed to a possible connection between the universal tendency towards open syllables and the more restricted amount of information conveyed by the final part of the syllable.

A particularly important contribution to this field has been made by the Danish linguist HENNING SPANG-HANSEN in his book "Probability and Structural Classification in Language Description" (1959). The most characteristic feature of the book is the strong emphasis on the prognostic character of linguistic description. The observed material is taken as a sample drawn at random from an assumed larger text, which constitutes an open material. The aims of a linguistic description of texts is to set up a prediction on the occurrence of certain phenomena in texts not yet examined, in particular in all texts in a certain language. This description will always be in the nature of a hypothesis, and rules can only mean "rules by hypothesis" (not by definition). When formulating a rule, exceptions can be set up explicitly. Different from exceptions are counter-cases, i.e. a case contradictory to the hypothesis. It is the number of counter-cases which determine the prognostic value. But a small number of counter-cases do not prevent the formulation of rules. Similar ideas came to play a role later in generative grammar; but typical of Spang-Hansen's approach is the probabilistic point of view: structure is seen as deviation from randomness. Not only empty places, but also places showing a number considerably smaller than other places may represent deviations from chance.

The glossematic functions selection, solidarity, and combination (see 7.12 above)

are now described from this point of view. The functions solidarity and selection can be seen as hypotheses about occurrences. Combination (which Spang-Hanssen prefers to call "free combination") does not allow of structural classification, because no empirical event can ever form a counter-case to it, but it may be useful to apply it in the form of a postulate on possible occurrence in such cases in which a particular non-trivial motivation can be given for setting up certain unobserved combinations as equivalent to observed combinations (p. 111). This is called generalization. These points of view are applied to phonemics and graphemics, in particular to a description of the graphemic system of Danish.

Syllables are defined as the class of minimum parts of expression, each of which is potentially a text expression and combinations of which form the observed repertory of text expressions. Phonemes (graphemes) are defined as the class of the largest possible mutually irreducible and structurally classifiable parts of expression by means of which a generalized inventory of syllables can be set up (p. 126). "Mutually irreducible" means that no element of the class can be described as a combination of other elements all belonging to the same class.

If the structural relation found between the classes of phonemes is of the selection type, the two classes are called vowels and consonants. In practice these two classes can be found by means of a combination diagram based on utterances (syllables) consisting of only two phonemes. This will (for instance for Danish) make it possible to set up one class of phonemes which cannot combine mutually to form a higher unit (consonants), and one class which can combine with members of the other class and of its own class (vowels). The occurrence of a single phoneme is interpreted as a combination of identical elements. The order of the phonemes in the diagram may be rearranged to give an empty crossfield for the consonants. The larger the empty crossfield, the less reasonable will it be to consider it as an outcome of random distribution.

The procedure is demonstrated in the diagram below (fig. 12.1) which contains part of the Danish consonant and vowel graphemes. All observed combinations

	b	d	f	g	h	a	e	i
f						fa	fe	
h						ha		hi
g						ga	ge	gi
b						ba	be	bi
d						da	de	di
a	ab	ad	af	ag	ah	aa		
e	eb	ed	ef	eg				
i	ib	id		ig	ih			i

Fig. 12.1

Combination diagram for some Danish graphemes
(Spang-Hanssen 1959, p. 44)

are entered regardless of the order of their constituent elements. Syllables in bold face are not found as words in the given order of the graphemes.

In an article of 1949 Spang-Hanssen has discussed the concept of simplicity, and in a congress report of 1957 he has treated some of the points mentioned above and also criticized the term "complementary distribution".

Distinctive Features

THE GENERAL APPROACH

12.11 The analysis of phonemes into distinctive features, as proposed by Roman Jakobson (Chapter 8) has been accepted by practically all phonologists apart from Hjelmslev and Uldall. H. Spang-Hanssen takes up a novel position concerning this problem. He draws an interesting consequence of the prognostic point of view, namely that a hypothesis on an exhaustive inventory is incompatible with the analysis of the elements in question into smaller structural elements since structural analysis can only be applied to an open material (1959, p. 109). This means that phonemes cannot normally be analysed into smaller structural elements because an analysis of this kind logically presupposes the recognition of phonemes that have accidentally not occurred, but which nevertheless are equivalent to those found in the material examined. The exhaustive character of the phoneme inventory may well have been the motivation for alphabetic writing. A further division of phonemes into features belongs to usage, not to structure (p. 127). However, it may be possible to set up a potential inventory of phonemes if phonemes in different languages can be mutually identified on an objective basis (p. 110).

One may add that this must also be possible from Spang-Hanssen's point of view if a language is considered as one of more diachronic stages. The distinctive feature analysis is obviously relevant for diachronic predictions. The fact that features, within one synchronic stage, may be relevant for setting up rules of phoneme combination and alternation since they allow of more general statements (cf. generative phonology), does not seem to be foreseen in the theory.

H. PILCH (1964) makes an unusual distinction between "relevant" and "distinctive". If a language has the stops *ptk* and *bd*, the feature "voiceless" will be relevant for *k*, but not distinctive. The feature "voiced" is relevant for English *r*, *l*, *m*, *n*, but not distinctive. A combination of relevant features characterize one phoneme compared to other phonemes of the same language, but the distinctive features are the minimal number of features necessary to distinguish a phoneme from others. The relevant features may be of importance in sound change.

NUMBER AND PHONETIC DEFINITION OF DISTINCTIVE FEATURES

BERTIL MALMBERG

12.12 MALMBERG accepts on the whole the concrete features set up by Roman Jakobson, but he proposes that three steps of rounding should be admitted (in order to account for the differences between the Swedish vowels /i-y-u-u/ (1956, p. 319, 1963a, p. 50)). Later (1969a, p. 9) he suggests a different solution, viz. the description of /u/ as a labial vowel.

GUNNAR FANT

12.13 GUNNAR FANT is primarily a renowned specialist of speech acoustics, and the phonetic definitions of distinctive features in the famous booklet by Jakobson, Fant and Halle, "Preliminaries to Speech Analysis", carry the stamp of his insight. These definitions were, however, only meant as provisional sketches, and in the following years Fant published various articles containing improvements of the acoustic definitions and discussions of fundamental problems of the whole theory of distinctive features.¹¹ In one of these articles (1969) he discusses the proposals of Chomsky and Halle. On the whole he regards their system of distinctive features as an improvement compared to the feature system of "Preliminaries". Some of his critical remarks have been mentioned in 9.34 and 9.35.

Fant regards it as rather improbable that we will ever reach a language-universal finite and unique set of distinctive features since there are many possibilities of alternative descriptions. There is, in the first place, a constant conflict between the endeavour to obtain a minimum number of features, for instance by using the same features for vowels and consonants, and the endeavour to give realistic phonetic descriptions. It may be very difficult to find a common denominator for the cues in all contexts, and "there is a potential danger that this demand for generality dilutes the discriminatory power of the formulation in any specific context" (1967a, p. 12). In more phonetically orientated investigations (e.g. for studies of speech recognition or comparative phonetics) it may be useful to increase the number of features (1967b, p. 5). If we are in search of the psychological reality behind speech production and perception, we must probably also operate with more redundancy (1967b, p. 12).

There may, further, be a complex relation between the distinctive feature and its physical cues (see also 12.3 above). A natural linguistic class like the class of all *r*-phonemes may have very complicated phonetic correlates, and on the other

11. These articles have been published together in part II of Fant 1973.

hand a natural phonetic dimension like voicing may have to be combined with various others (tenseness, duration, etc.) to form the correlate of a distinctive feature (1969, p. 3).

Moreover, the concept of distinctive features requires an integrated view of speech patterns at each stage of the speech-communication chain, but the parameters at these different stages may be different.

Finally, there are many dependencies between features both at the phonemic and at the phonetic level, and not all combinations are allowed. This also makes alternative solutions possible (1969, p. 5).

Fant has often discussed these problems in connection with attempts to set up the distinctive features for Swedish. Particularly the Swedish vowel system makes difficulties because it is rather rich and not quite regular. Besides /i, e, ε, u, o, ɑ/ and /y, ʊ/ it contains a vowel /u/ which, when long, is a front vowel having a tongue height intermediate between /y/ and /o/ but with a different type and degree of rounding (and consequently a lower F₂).

Fant has suggested many different solutions of this problem. In a paper of 1960 he proposed to use a binary feature of gravity and two ternary features: compactness and flatness (following Malmberg 1956), besides tenseness for the short-long opposition.

In 1967a he proposed to add a feature "sharpness" (with /y, ʊ, i/ and possibly *e* as [+sharp]) in order to obtain a system with exclusively binary features. He considers this requirement to be a practical convenience. In 1969 "high" is split up into +/−high and +/−low, and he proposes to replace the sharpness feature by the feature [+palatal] for /i/ and /y/; moreover, /u/ and /ʊ/ are described as "labial". It is, however, not necessary to use all of these new features unless two combinatory variants [æ] and [œ] are included in the inventory. In the paper of 1971, where the various solutions are summarized, these variants are left out and only the feature "labial" is retained since it is also useful for the description of consonants. The possibility of using +/−mid instead of +/−low (as proposed by Wang) is also mentioned. As another solution he again considers the possibility of having more than two steps for "high" and "round", thus restricting the features to back, high, and round (1969, p. 15).

On the acoustic level, however, he proposes a quite different solution with only two features and five steps in each. It is possible to place the vowels in a two-dimensional diagram with the frequency of F₁ as one dimension, and the frequency of F₂' (i.e. a weighted average of F₂ and F₃) as the other, and to rotate this figure 45 degrees so that one dimension is constituted by the difference between F₁ and F₂' and the other by the sum of F₁ and F₂'. These two dimensions are called +/−spread (i.e. spectral spread) and +/−flat, respectively. Back and front vowels are distinguished on the "spread"-dimension and rounded and unrounded on the "flat"-dimension (see Fig. 12.2). But the relation between this configuration, which Fant assumes to be a subset of a language-universal system of maximal perceptual contrast, and the physiological dimensions is very compli-

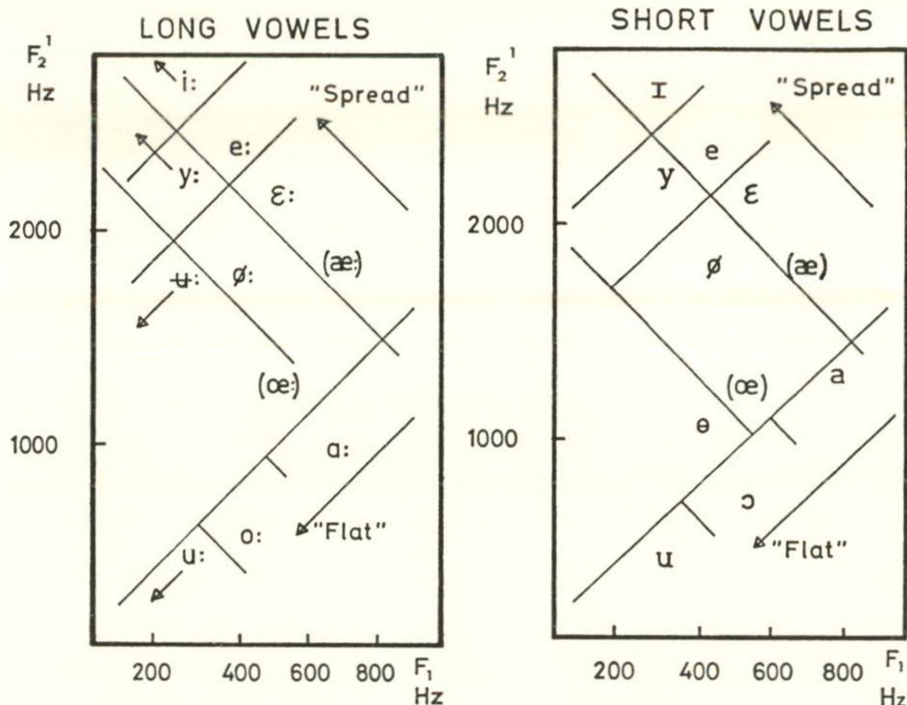


Fig. 12.2

Two-dimensional (F_1 and F'_2) representation of Swedish long and short vowels. F'_2 is an estimated perceptual mean of F_2 and higher formants (Fant 1971, p. 262)

cated and shows the difficulty mentioned above of combining the different stages of the speech communication chain in the same feature set.

As for the consonantal features, Fant has argued convincingly for the feature "labial" (see 9.35 above). He has furthermore proposed the introduction of the feature "mid-closure", which allows him to dispense with both "consonantal" and "continuous".

PETER LADEFOGED

12.14 Ladefoged has discussed the problems of distinctive feature analysis in various articles and particularly in his book "Preliminaries to Linguistic Phonetics" (1971b). His criticism of some of the features used by Roman Jakobson and by Chomsky and Halle has been mentioned in 8.11 and 9.35.

In the above mentioned book, however, he has also set up a new system of general phonetic features. His proposals are based on a first-hand knowledge of a vast variety of languages and on his general phonetic insight (he has made a number of valuable contributions, particularly to physiological phonetics).

Ladefoged agrees with Roman Jakobson and with Chomsky and Halle on the

view that the description of the phonological oppositions in the individual languages must be based on a general phonetic framework containing a limited number of phonetic dimensions, but, in contradistinction to Jakobson, he emphasizes that this general framework must also include the dimensions which are necessary for describing the characteristic differences among languages (1971a, p. 54; 1971b, p. 45; 1972, p. 273 ff), and the description of the features must not be phonetically arbitrary. The number of dimensions must, therefore, be considerably greater than that proposed by Roman Jakobson. There may even be some which are never used independently for phonological oppositions. This seems, for instance, to be true of the difference apical/laminal, which must be set up in the general framework because it may happen that one language uses apical dentals and laminal alveolars, whereas another is characteristically different from the first by using apical alveolars and laminal dentals (1971b, pp. 39 and 44).

The number is, however, limited to what is required on the systematic phonetic level, i.e. "that level which specifies all the targets necessary for the description of a particular language as opposed to all other languages, but contains no information of the kind that is used simply to specify one speaker of that language as opposed to other speakers" (1972, p. 277). The description of the actual utterances by individual speakers belong to physical phonetics. Ladefoged thus draws the boundary between systematic phonetics and physical phonetics approximately in the same way as McCawley (see above 9.28). The term "target" is used in the definition of systematic phonetics because most coarticulation phenomena are considered to be mechanical and universal (cp. 9.28).

Like Chomsky and Halle, Ladefoged assumes that the dimensions may be multivalued on the phonetic level, but he differs from both Roman Jakobson and Chomsky and Halle in that he does not require oppositions to be binary on the systematic phonemic level either, although he finds that this is very often the case. Of his twenty-six phonetic dimensions twenty are used as binary oppositions on the systematic phonemic level. Non-binary oppositions are assumed for glottal stricture, voice onset, articulatory place, vowel height, tone and "rate". In these cases three or more steps out of a larger number of phonetically definable steps may be used phonemically in a single language. These steps are characterized relatively by numbers, e.g. 0, 1, 2 on the systematic phonemic level. The concrete feature specification is not given until the systematic phonetic level, by means of phonological rules leading from the phonemic to the phonetic level. This means that two languages which both utilize three steps (but not the same) along a given dimension will be characterized in the same way phonologically (by the steps 0, 1, 2, i.e. the intermediate step will always have number 1, the peripheral steps numbers 0 and 2), but the three steps will be described differently phonetically. Thus phonological systems and actual sounds may be compared separately. This differs from Chomsky and Halle's system in which phonetically similar sounds in different languages will normally also get the same feature specification on the phonemic level.

Another difference is the assumption that not all oppositions can be defined as points on a physical scale, but that some features should be considered as higher relations between those other features which can be defined in terms of scalar quantities (1971a, p. 51 ff, 1971b, p. 109). These features will be those which are "required for defining major natural classes such as vowels, consonants, sonorants, liquids and glides" (1971a, p. 51). The features will thus form a hierarchy in which some features are "cover terms" denoting groups of other features. The feature list set up in "Preliminaries to Linguistic Phonetics" contains only one cover feature (consonantal), but it is mentioned that more might be necessary. Most of the other features are characterized in physiological terms, but a few (e.g. sonorant, grave, fricative) are described in acoustic or auditory terms. Syllabicity is also a feature of a particular type, i.e., it is not a scalar quantity, but an organizing principle concerned with the co-ordination and timing of speech movements (1971a, p. 52).

The list (1971b, pp. 92-4) includes the following features (the number in parentheses indicates the maximum number of steps utilized in phonemic oppositions, and the phonetic labels indicate a more or less arbitrary number of steps for use at the systematic phonetic level):

- o. Consonantal (2) (not applicable at the phonetic level).
1. Glottal stricture (3): glottal stop, creak, creaky voice, tense (stiff) voice, voice, lax (slack) voice, murmur, breathy voice, voiceless.
2. Voice onset (3): voicing throughout articulation, voicing during part of articulation, voicing starts immediately after, voicing starts shortly after, voicing starts considerably later.
3. Fortis/lenis (2): normal respiratory activity, heightened subglottal pressure.
4. Glottalicness (3): ejective (glottis moving air upward), pulmonic, implosive (glottis moving air downward).
5. Velaric suction (2): no click, click (ingressive velaric airstream).
6. Nasality (2): oral (velic closure), nasal (velic opening).
7. Prenasality (2): not prenasalized, prenasalized.
8. Articulatory place (6): bilabial, labiodental, dental, alveolar, postalveolar, palatal, velar, uvular, pharyngeal, glottal, labial-velar, labial-alveolar.
9. Gravity (2): higher pitch spectral energy, lower pitch spectral energy.
10. Apicality (2): tip of tongue, blade of tongue.
11. Stop (2): no complete articulatory closure, stop closure.
12. Fricative (2): no turbulence, maximum turbulence.
13. Vibration (2): no vibration, vibration (trilled).
14. Rate (3): rapid, normal, long, extra long.
15. Laterality (2): central, lateral.
16. Sibilance (2): no high pitch turbulence, high pitch turbulence.
17. Sonorant (2): less intensity in the formants, greater acoustic energy in the formants.

18. Rounding (2): lips spread, lips neutral, lips closely rounded.
19. Height (4): low, mid-low, mid-high, high.
20. Backness (2): no tongue retraction, body of tongue retracted.
21. Tension (2): tongue hollowed, no intrinsic tongue contraction, tongue bunched.
22. Syllabicity (2): nonsyllabic, syllabic (correlates undefined).
23. Accent (2): not stressed, maximal stress pulse.
24. Tone (as in Wang 1967): contour, high, central, mid, rising, falling, convex.
25. Cadence (2): no intonation change, falling intonation.
26. Endglide (2): no intonation change, final rising intonation.

On pp. 94-111 Ladefoged gives an account of the main differences between this system and the system used by Chomsky and Halle in "SPE". It is obvious that the two systems differ on a number of points; only some of them will be mentioned here.

Numbers 1-3 are phonation features. No. 3 (fortis/lenis) is defined in the same way as the feature "heightened subglottic pressure" in "SPE", but it is only used for the description of a few very specific oppositions in Luganda and Korean. All other oppositions in respect of phonation (for which "SPE" uses voicing, tenseness, glottal constriction and heightened subglottal pressure) are characterized by means of the two dimensions "glottal stricture" and "voice onset". Of particular interest is Ladefoged's description of the sounds normally called voiced aspirates. They are described as murmured, i.e. as having a specific degree of glottal stricture (in between voicelessness and voice) during the closure phase and the so-called aspiration phase (in the transcription they are indicated by two dots, thus [b̥] instead of [bh]).

Hindi *ph*, *p*, *bh*, *b* will thus be characterized in the following way:

	ph	p	b̥	b
glottal stricture	0	0	1	2
voice onset	2	1	2	0

It is probably correct that the vocal chords are not in the same position in *bh* and *b*, but, as demonstrated by Halle in his review of Ladefoged's book (Halle 1973, p. 927), this feature specification is very inadequate for the formulation of Grassmann's Law, which states that stops in Greek and Sanscrit are unaspirated if followed in the same stem by an aspirated stop. This law is valid both for voiceless and for voiced aspirates in Sanscrit, e.g. *ph* and *bh*, which thus seem to contain the same feature. The conception of *ph* and *bh* as containing two different features is in conflict with Ladefoged's own aims, viz. that the feature specification should fit with natural classes required by phonological rules.

Another point where the two systems differ radically is the description of articulatory place. Ladefoged treats articulatory place as one dimension with a

large number of steps, whereas it is split up in a number of binary oppositions both in Roman Jakobson's system and in "SPE". Much can be said in favour of Ladefoged's proposal (it explains alternations and variations between neighbouring steps) but, as emphasized by Jakobson, there is also a relationship between labial and velar, and Ladefoged therefore adds the auditory feature "grave".¹² But as vowels are only characterized as back and front (and possibly central), Ladefoged has difficulties in describing the assimilations between vowels and consonants in a simple manner (this was achieved in the "SPE" system by means of the common features high, back and low, see 9.35 above). Ladefoged therefore proposes a double description, so that consonants also have values for backness, and vowels for place of articulation. But this is a rather clumsy solution (cf. also Halle's objections 1973, p. 929).

On the other hand, Halle's objections to Ladefoged's four features of vowel height are not convincing. One of the best examples of four vowel heights is the often quoted Danish system: *i e ε a*. Halle proposes to consider *i e* as tense, and *ε a* as lax (1973, p. 930). It is true that on the whole low vowels are less tense than higher vowels, but it is arbitrary to use this concomitant feature independently and make an ad hoc division between *i*, *e* and *ε a* (see also 9.30 above). By the way, Ladefoged does not consider "vowel height" to be a correct physiological designation of this dimension. It is rather a perceptual dimension based on the height of F₁.

Feature number 14 (rate) requires some comments: "rapid vs. normal rate" is used to characterize flap vs. stop, and tap vs. trill, whereas long vs. normal are used for usual length differences.

It is a definite improvement that *h* and *ʔ* are not defined as sonorants, and thus not as glides.

We are still far from having reached any definitive solution of the problems connected with the analysis into distinctive features, but Ladefoged's proposals constitute an important contribution to the discussion.

SUPRASEGMENTAL (PROSODIC) FEATURES

12.15 In his list of features Ladefoged simply refers to WANG for the features of tone. Wang (1967) has tried to set up a universal system of tone features, comprising seven binary oppositions. The features *+/-high*, *+/-central*, and *+/-mid* can be combined to give five pitch levels. Moreover, tones may be characterized by the opposition *+/-contour*, and if [*+contour*], they may be [*+rising*], [*+falling*], or both. In the latter case they may be *+/-convex*. Wang thinks that thirteen combinations of these features are sufficient for describing the tones of known languages (it is thus not a very economical system).

ILSE LEHISTE has written a very useful and informative book on suprasegmentals describing length, tone, intonation and stress both from a phonetic
12. Cf. Hyman's arguments for the feature "grave" (1973).

and (to a more restricted extent) from a phonological point of view. It contains a wealth of references and also summaries of the results of her own research in the field. Both the domain of the different units and their functional role in languages are treated. She has found that in Finnish and Estonian the rules for the occurrence of quantity contrasts are most economically formulated in terms of disyllabic sequences.

Explanation in Phonology

GENERAL CONSIDERATIONS

12.16 Linguists, like all scientists, are generally not satisfied with simply describing things; they also want somehow to explain them. In phonology this means explaining phonological structures and their development. But explanations can be of many kinds. When a phenomenon or process can be described not as an isolated case, but as an example of a more general phenomenon or process, it is considered as better understood. The possibility of generalization is to some extent an explanation. If, for instance, *u* has developed to *y*, not only in a single word, but in all words containing *u* in a given language, the development of the single word is to some extent explained; and if this is found to be a common development also in other languages, it is still better understood in the sense that it is an expected development, not an unexpected one. Linguists are therefore interested in finding universal tendencies. A deeper understanding is achieved if the single phenomenon can be seen as part of a structure or pattern, and if the observed change is part of a change of the pattern (if, for instance, not only *u*, but also *o* is fronted); a still higher degree of understanding is reached if the development of the pattern can be seen to conform to some tendency of the language in question or to some generally observed tendency, and it is a further advance if the tendency can be seen to have some rationale from the point of view of economy or of better adaptation to communicative needs, for instance a better distinction of phonemes (the change of *u* to *y* may be connected with a change of *o* to *u*). But it is also necessary to look for explanations outside of the phonological system itself. A change may, for instance, be found to be phonetically plausible, that is, not only easily describable in phonetic terms, but also understandable as promoting ease of articulation (for instance, if *u* becomes *y* before *i*); or it may be psychologically plausible, for instance understandable as a well-known psychological process like anticipation and perseveration, or socially plausible, for instance as an imitation of the pronunciation of a prestige group.

The different phonological schools have generally preferred specific types of

explanations, often rejecting others as irrelevant in a rather intolerant way instead of trying to explain language systems and language development by an interplay of many different factors. In the Bloomfield School any explanation was regarded with some suspicion (cf. the extreme position taken by Martin Joos, mentioned in 6.40 above), because all explanation must be more or less hypothetical, and the main endeavour of this school was to make linguistics an exact science. The same endeavour characterized glossematics. Hjelmslev was, however, at least interested in formal universals, but insisted on keeping form and substance strictly apart. In Prague phonology, on the other hand, there was from the start a keen interest in finding general laws for phonological systems and in finding phonetically based structural explanations for language development (see particularly the theories of Roman Jakobson and of Martinet, 3.12 and 3.18 above).

Generative phonology attaches much importance to the explanatory power of the theory, but the bases of explanation are the formal constraints given by the notational conventions and the evaluation measure. The naturalness of phonological processes should be reflected in the formalism of the description, natural processes being described by simpler rules (see 9.56 above). In "Language and Mind" (1968, p. 12) Chomsky says that for the present it is advisable to concentrate on developing the abstract theoretical apparatus without attempting to relate the postulated mental structures and processes to any physiological mechanism or to interpret mental function in terms of 'physical cause'. In "SPE" Chomsky and Halle admit, however, that their rules do not always reflect the naturalness of given sound patterns (cf. also the examples given by Chen 1971). They have tried to remedy this by introducing marking conventions and linking rules (see 9.41-42 and 9.45). This remedy has been criticized as insufficient, also by younger adherents of generative phonology, and they have tried to go beyond the purely formal considerations (see 9.56 and 9.66 above).

Many linguists outside the current phonological trends have also been interested in explanations, but from many different points of view.

In his very interesting book, "Sincronía, diacronía e historia" 1958 (mentioned in 12.5), COSERIU emphasizes the necessity of distinguishing three problems in connection with language change: (1) First there is the rational problem of the changeability of language; why do languages change? In his answer to this question Coseriu maintains that change belongs to the essence of language; language is dynamic because linguistic activity does not consist in speaking and understanding a language but in saying and understanding something new by means of a language. (2) Next there is the general problem: under what conditions do changes in language usually occur? Cultural and social instability favours change. But this is an external, indirect factor which only permits variation and individual innovation, and linguistic change does not consist in accidental innovations, but in the adoption of some innovations by the speech community. Only those innovations are adopted which correspond with the functionality of the system. Language changes as a system, and weak points in the system may be conditions of change.

(3) Finally there is the historical problem concerning a concrete change in a concrete language. Coseriu rejects physiological explanations as absurd. Only an individual innovation in *la parole* may be explained physiologically. The adoption of innovations is a historical phenomenon which may have only a historical explanation in cultural and functional terms. Cultural phenomena cannot be explained physically. Coseriu stresses repeatedly that the explanation of linguistic change is not a question of causality but one of finality. Weak points in the system are not causes of change but problems to be solved by the speakers, and two phonemes on the verge of coalescing are not modified because they are close to coalescing but in order to keep them apart.

HENNING ANDERSEN, who has made various original contributions to the typology and explanation of sound change (1972 and 1973), stresses, like Jakobson and Coseriu, the importance of teleological explanations, but he does not follow Coseriu in regarding the spread (or codification) of an innovation as constituting the main fact to be explained. He also wants to explain the innovation and distinguishes various types of innovations, of which only some should be explained in teleological terms.

The different explanations and arguments mentioned in the following sections belong mostly to Coseriu's problem No. 2. However, the general conditions for language structure dealt with in 12.17 are not conditions for language change as such but conditions for the direction a possible change may take.

UNIVERSALS

12.17 The Danish linguist VIGGO BRØNDAL concentrated most of his efforts on the problem of universal categories. His ideas on phonology are on many points close to Prague phonology, but his approach is more abstract and speculative. What he aims at is a definition of universal linguistic categories of different degrees of complexity, united in groups by mutual solidarity. This solidarity determines which categories must occur together in individual languages. Thus, for vowels his aim is (1) to find the minimum number of fundamental concepts necessary to define any vowel, (2) to deduce from these definitions the relations of solidarity or independence between given vowels, and (3) on this basis to set up a system of possible vowels and the conditions for the structure of concrete vowel systems. The phoneme is thus conceived as an ideal abstract sound type. For the definition of the vowels he uses the four concepts: front (F), back (B), high (H), and low (L), where the first two and the last two are mutually complementary concepts and define groups of vowels with mutual solidarity. These terms, which sound rather concrete, should be regarded as merely provisional indications, outer signs of a deep symbolism constituting the true essence of the vowels (1936a, p. 65).

The vowels are ordered in five levels of increasing complexity containing from 0 to 4 elements, and on each of the intermediate levels the vowels are divided

into groups (a, b, c) with solidarity between the members within each group (the phonetic symbols are, of course, approximate).

level 0 the neutral vowel		(ə)	
level 1 (one element)	(a) F	(ε), B	(ɔ)
	(b) H	(ɑ), L	(ʊ)
level 2 (2 elements)	(a) FB	(o)	
	(b) HF	(i), HB	(u), LF (e), LB (o)
	(c) HL	(a)	
level 3 (3 elements)	(a) HLF	(e), HLB	(o)
	(b) FBH	(ü), FBL	(ö)
level 4 (4 elements)	HLFB	(ɪ)	

These are considered the basic sixteen vowel types. Secondary shades can be obtained by stressing one of the elements entering into the vowel. The vowels are set up in a graphic quadrangle with *a* in the middle and *i*, *u*, *e*, *o* in the four corners.

The vowel system of a concrete language can now be characterized by the number, the degree of complexity, and the homogeneity of the vowel groups it contains (homogeneous vowel groups are groups of the same level).

The characteristic feature of Brøndal's theory is the concept of complexity. This has certain affinities to Roman Jakobson's early views as expounded in his book "Kindersprache" (see 3.12), where some sounds are considered as universally more complex than others and therefore more rarely found in phoneme systems. Brøndal, however, does not assume that more complex phonemes presuppose the more simple ones in concrete vowel systems. Instead he assumes that there is solidarity between certain vowel categories of the same degree of complexity and with opposite feature values.

In a later paper, however (1940), he sets up the general law that complex categories (like front rounded vowels or affricates) tend to have fewer members, an assumption which is in close agreement with Jakobson's ideas.

The concept of complexity is also an important aspect of the ideas on universals propounded by some American linguists and anthropologists, also outside the group of transformationalists, in the beginning of the sixties. But in contradistinction to Brøndal's deductive method their approach is inductive. Their generalizations are based on frequency counts of phonemes in many languages.

As early as 1935 G. K. ZIPF found that phonetically complex phonemes are more rare than phonetically more simple ones (e.g. aspirated vs. unaspirated, voiced vs. unvoiced).

JOSEPH GREENBERG, whose ideas on marked and unmarked were mentioned in 9.41 above, got similar results (1966), and he has drawn some interesting conclusions for diachronic phonology. He finds that the overall tendency in unconditioned change (particularly mergers) is for the marked or phonetically

complex series to give way to the unmarked or simpler. However, a number of conditioned changes, like assimilation, may lead to a new increase of marked features (e.g. nasalization of vowels before nasal consonants). As these changes take place in restricted environments, the increase will, however, always be modest. The widely assumed explanation "ease of articulation" can now be interpreted as comprising two kinds of "ease": (1) paradigmatic ease which favours simplification by loss of additional articulatory features regardless of context, and (2) syntagmatic ease, which favours the genesis of new assimilatory modifications conditioned by the phonetic environment and so may give rise to articulations which taken in isolation are more complex (1966, p. 64).

Attention should also be drawn to the volume "Universals in Language" (1963) edited by Greenberg and containing contributions by Greenberg, Ferguson, Osgood, Hockett and others.

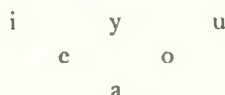
STRUCTURAL LANGUAGE-SPECIFIC EXPLANATIONS

12.18 J. KURYŁOWICZ is relatively close to Hjelmslev in his view of linguistic change. Like Hjelmslev he rejects extralinguistic (physiological or social) explanations of phonological change and requires that explanations must be found in the linguistic system itself. It is, however, a specific characteristic of his approach that he takes his starting point in the facts of neutralization and marking, for instance in his paper on the Germanic and Armenian consonant shifts (1948b, cp. also 1958a). In the position of neutralization only one member of a privative opposition may be found, and it will thus have a larger sphere of application than the other member of the opposition, and as there is an inverse relation between content and sphere of application, its content will be poorer, i.e., it will be unmarked, whereas the other member is marked and possesses an additional feature. In the stage just before the Germanic and the High German consonant shifts the position after *s* did not show any opposition between *ptk* and *bdg*. Only *ptk* were found, and they therefore formed the unmarked members of the opposition, whereas *bdg* had the additional feature of voicing. The correlation between *ptk* and *bdg* was thus one of voicing. Now, according to Kuryłowicz, the decisive phonological change consisted in a shift of marking. The consonants *ptk* after *s* were no longer identified with *ptk* in other positions, but with *bdg*; consequently *bdg* became unmarked, and the correlation changed into a correlation of force or aspiration. The devoicing of *bdg* and the affrication or spirantization of *ptk* are only consequences of the phonological shift (1948b, p. 81). Buysens (1958) has objected that the identification can not have taken place until after the mutation. To this Kuryłowicz replied (1958a) that this point of view is due to a confusion between phonology and phonetics. Irrespectively of possible phonetic changes there is no phonological change until the identification of the archiphoneme has shifted. This may be true, but it is difficult to find any other reason for the shift

of identification than a devoicing of *bdg* or an aspiration of *ptk*, and these phenomena should therefore not be described as consequences of the phonological shift, but perhaps (if they are not accepted as causes) rather as phonetic manifestations of the shift (a formulation which is also used by Šaumjan in his report of Kuryłowicz's theory (1956), see 11.28). But even if the explanation can hardly be purely linguistic, the description of the phonological shift as a shift of marking is interesting (see also Šaumjan's account (1958a, p. 12ff) of Kuryłowicz's theories).

As described above (3.18), Martinet's theory of phonological change operates with the factors economy of features, maximal distance between phonemes, influence of functional load and (interfering with these tendencies) influence of the asymmetry of the speech organs. His views have been very influential and widely adopted,¹³ although particularly the concept of functional load (or functional yield) has given rise to a good deal of discussion. Among the contributions to this discussion attention should be drawn to the papers by Rischel (1962), Avram (1964) and the monograph by Meyerstein (1970), containing a survey of the different points of view; cf. also King (1967), who considers functional load to be of very little importance in sound change.

ANDREI AVRAM (1971) adopts Martinet's theories on economy and holes in the pattern and adds a principle of continuity, pointing out that it is rare for the direction of an evolution to be changed. If, for instance, a language has the vowel system



a greater economy and regularity might be attained by eliminating *y*, or a hole might be filled (without loss of economy) by adding an *ø*. The probability of one or the other development will depend on the former history of the system. If *y* has been added at the preceding stage, it is more probable that the next change will be the addition of an *ø*. If an *ø* was lost at the preceding change, the loss of *y* will be more probable.

There is some connection between this idea and the views propounded by MALMBERG, who is influenced both by Martinet's theory and by the French linguistics current in the beginning of this century, in which the idea of phonological tendency played a great role (e.g. Grammont and Meillet). Malmberg tries to find internal linguistic explanations by describing a number of phonetic and phonological changes within the same language (and at different stages of the same language) as results of the same more general tendency, for instance

13. See also 12.21 below.

in Spanish the tendency to open syllables.¹⁴ These tendencies are not considered to be biologically conditioned (as it was assumed by some scholars in earlier times, e.g. by J. v. Ginneken), but regarded as due to a linguistic tradition. They assert themselves particularly when the norm is relaxed in periods of social instability. In this way Malmberg has succeeded in reducing the necessity of setting up substratum languages as explanations for the development of the Romance languages in many cases. Malmberg does not deny the existence of substrata (he has found evidence for a Guarani substratum as a factor of the development of Spanish spoken in Paraguay), but he tries to reduce this kind of (usually very hypothetical) explanation as much as possible (see e.g. 1947-8 and 1961).

KNUD TOGEBY, on the other hand, rejects categorically all internal explanations (tendency to symmetry and tendency to avoid mergers of phonemes) because they do not explain why the development has taken place in some dialects and not in others presenting the same conditions (1960). Instead he evokes the external factors which Malmberg tries to minimize, for instance influence from a substratum language. (It is, however, difficult to see why one type of explanation should exclude the other.) Togeby thinks that phonological mergers as such can always be accepted, but admits the possibility of reaction against the coalescence of words or forms.

PHONETIC EXPLANATION IN PHONOLOGY

12.19 The necessity of phonetic explanation in phonology has recently been emphasized by various scholars, particularly by a group of Berkeley linguists (WILLIAM S.-Y. WANG, JOHN OHALA and MATTHEW CHEN (now in San Diego)), and by the Swedish phonetician BJÖRN LINDBLOM. This emphasis can be seen as a reaction against generative phonology in its classical form (e.g. as described in "SPE") with its very formal and abstract concept of explanation. They find the addition of marking conventions and linking rules quite insufficient, and they are thus in line with some of the younger adherents of the theory (see above 9.56), but they are more radical. Ohala (1972) states that marking is simply a labelling of processes as expected and unexpected. It does not explain anything.

Instead it is proposed to utilize physiological and acoustic explanations in phonology (e.g. Wang 1969 and 1972; Ohala 1970, 1971 and 1972; Chen 1971; Lindblom 1972). As examples of sound changes which are found in many unrelated languages and which can be explained by phonetically based universal tendencies they mention (1) the nasalization of vowels before nasal consonants and the tendency for lower vowels to be more easily nasalized (Ohala 1971, 1972 and 1974a;

14. This view has been taken up again by Kisseberth and other young generative phonologists (see 9.56 above).

Chen 1971), (2) fronting and affrication of *k* before front vowels (Ohala 1972; Wang 1972), (3) lowering of tone after voiced consonants (Ohala 1970 and 1974a; Wang 1972), (4) the development of *ph* to *pf* to *f* to *h* (Ohala 1970), etc. But whereas Chen (1971) attempts to integrate a number of phonetically based meta-rules and universal constraints into the generative rule complex,¹⁵ the other critics (Ohala, Wang (in his later writings) and Lindblom) think that a completely different approach is necessary. Ohala (1972) refers to Sven Öhman's model for coarticulation and to Lindblom's works. Phonetic considerations are of particular importance for explaining the directionality of sound change and children's acquisition of phonological patterns (Ohala 1974b).

The most important and original contribution to the discussion of these problems was made by Björn Lindblom in his report to the international congress of phonetics in 1971 (Lindblom 1972, cp. also Liljencrants and Lindblom 1972). Lindblom bases his approach on the following requirements (1972, p. 66): (1) the primacy of linguistic form must be questioned; (2) once it has been rejected, an approach to the study of sound structure that makes a more predictive than interpretative use of the knowledge embodied in phonetic theory should become possible; (3) ultimately, a more comprehensive substance-based theory formalizing the phonetic as well as the sociological mechanisms of language use might be developed to predict and explain the nature and historical development of "sound patterns".

Lindblom is, of course, well aware of the fact that the demand for a phonetic explanation of sound patterns and their development is not completely a new one. He quotes Passy's and Jespersen's principles of least effort and maximal perceptual contrast and (within structural linguistics) Jakobson's and Martinet's principles of maximal contrast (he might also have mentioned Martinet's reference to the asymmetric nature of the speech organs). What is new is the attempt to construct quantitative models with a predictive power. Lindblom and Sundberg (1969) have constructed a model defining a procedure for deriving formant frequencies from articulatory configurations. It differs from earlier models by Fant and by Stevens and House, mainly by recognizing the jaw movement as a separate parameter, by particular definitions of the tongue tip and the tongue body parameters and by positing a neutral position of the tongue. When only the jaw opening is varied and other parameters kept constant in a neutral position, a strongly lowered jaw will produce the vowel [æ], whereas mid and high central vowels are produced when the jaw is gradually raised. When the jaw is closed the lips will close, and there will be a narrow apico-alveolar constriction. This position will produce a *p* and (if the velum is lowered) an *m*, and with opening of the lips we will get *t* and *n*, thus the minimum consonant system assumed by Roman Jakobson (see 3.12 above).

By means of this model the acoustic space universally available for vowels can

15. He might therefore have been mentioned in ch. 9 (generative phonology), but he belongs to the group of Californian linguists influenced by Wang and Ohala.

be constructed; and it is possible to calculate the location of vowels in this space for systems from three to twelve vowels on the assumption that the distance between all vowels should be maximal, measured in mels (Liljencrants and Lindblom 1972). The vowel systems containing from three to eight vowels generated in this way are in good agreement with vowel systems found in real languages, and Lindblom concludes that there is a universal tendency to perceptual contrast between vowels. For more than eight vowels the model generates too many high central vowels, and no [ə]. Lindblom stresses that the approach selected is simplified and that various other constraints might be included, for instance K. Stevens's observation that certain configurations give more stable acoustic results than others in spite of articulatory imprecision. In the discussion Ladefoged suggested the use of other acoustic dimensions (e.g. the difference between F_1 and F_2 , as proposed by Fant (see 12.13 above)). One might also take account of the fact that many languages seem to prefer very definite steps in F_1 values, e.g. from *iyu* to *eo* to *eaɛ*, perhaps in connection with steps in jaw opening. This might perhaps be explained by means of Martinet's economy principle. But this would mean introducing the feature concept, which Lindblom avoids. Anyhow, even if the model may be improved, the attempt is very interesting and promising.

Lindblom emphasizes that he wants to start from substance, not from form, and that this means a break with the Saussurean tradition in the study of linguistic form. This caused some misgivings on the part of the participants in the discussion at the congress. But evidently Lindblom does not leave form out of consideration. The experiments with the location of vowels could also be described as follows: given a definite number of contrasting vowel phonemes (which is a purely formal condition), what will be the most probable manifestation of these vowels if maximal contrast should be maintained? What is explained here is the interplay between form and substance. Similarly what may be explained in sound change are in the first place phonetic processes (nasalization of vowels before nasal consonants, lowering of tone after voiced consonants), these changes may, however, entail later formal changes. Communicative aspects (e.g. contrast) are thus part of Lindblom's theory, and he is evidently on linguistic ground. Much like Roman Jakobson and Martinet he is interested in the interplay between form and substance; but his approach is much more firmly based on phonetic theory. And it certainly constitutes a sound reaction against some extremely formal tendencies in generative phonology and in glossematics.

SOCIOLOGICAL EXPLANATIONS IN PHONOLOGY

SYNCHRONIC COMPLEXITY

12.20 Saussure described "la langue" as a social phenomenon, but since each member of the speech community was supposed to possess an (almost) exact replica of the linguistic system, there was no need to include social considerations

in the description of *la langue*. On the other hand, "*la parole*" was characterized as individual, but since speech communication normally includes a hearer, the study of speech entails a social aspect. This is what Labov calls the "Saussurean paradox" (1972b, p. 1111).

Structural linguistics followed Saussure in considering *la langue* as the object of linguistic description and in describing the linguistic system as a homogeneous structure common to the speech community.¹⁶ The emphasis on *la langue* as pure form and the endeavour to establish linguistics as an autonomous branch of science contributed to keeping extralinguistic aspects out of linguistics proper. Transformational grammar (including generative phonology) does not differ from structural linguistics in this respect although it does not attach much importance to the structuredness of language in the Saussurean sense. Relations to social facts have simply no place in their formal rule complex.

It is the merit of a group of younger American linguists to have reacted against this narrowing down of the perspective and to have emphasized the necessity of seeing language in its social setting and in its real complexity.

This is, of course, not a completely new insight. Pike and Fries described the possibility of coexisting systems (see 6.17 above), and Haugen has devoted most of his efforts to a description of bilingualism and its consequences (see 6.9). Jakobson stressed the importance of stylistic variation for phonological change. Vachek described peripheral phonological elements (see 3.18), and Martinet, though emphasizing internal factors in phonological change (see 3.18), also recognized the role of external factors, e.g. in his explanation of the development of Spanish *f* to *h* (Bibl. to ch. 3, 1955, p. 304 ff; cf. also 1955, p. 20-21 and 1952). Still closer to the new points of view is IVÁN FÓNAGY, who has studied cases of phonetic change in progress (1956) and found competing variants due to age, social group, emotional style and different classes of words. However, structural linguistics usually ignored these complications and concentrated on describing an idealized system, and Chomsky stated that linguistic theory is concerned with an ideal speaker-hearer in a completely homogeneous speech community.

It is therefore important that some linguists now emphasize that heterogeneity is normal, even in the system of one individual, and give ample documentation for this view.

In 1953 URIEL WEINREICH (1926-67) published a book, "Languages in Contact", based on abundant material, taken partly from published literature, partly from his own extensive research in the field, comprising particularly studies of contact between different languages in Switzerland and between Yiddish and various other languages.

16. Some linguists, who found this assumption too unrealistic (e.g. Daniel Jones (see 4.3 above) and Bernhard Bloch (6.16 above)), proposed to limit the object of description to a single individual speaking in a definite style, but if this delimitation were taken seriously, the description would be of very restricted interest.

Two or more languages (or dialects) are said to be in contact if they are used alternately by the same person. This means that the object of Weinreich's study is bilingualism and the interference phenomena occurring in the speech of bilinguals, among these the phonetic and phonological interferences which arise when a bilingual identifies a phoneme of one language in terms of the phonemic system of another. The ultimate goal of interference studies is said to be the prediction of typical forms of interference based on the sociolinguistic description of a bilingual community and a structural description of its language. In the structural description Weinreich is, as a student of Martinet, closer to Prague phonology than to the Bloomfield School. He compares the whole configuration of the systems in question and tries to explain the interference phenomena not only on the basis of phonetic similarity, but also on the basis of the place of the phoneme in the system and the existence of "holes in the pattern" of the recipient language. He advances the hypothesis that the acceptance of changes in the phonemic system will depend largely on structural conditions, whereas the spread of changes in phonetic manifestations may depend on social conditions only, although they may entail phonemic alterations at a later time.

In a paper of 1954 "Is a structural dialectology possible?" he emphasizes the necessity of comparing the structure of different dialects and gives various examples of such a comparison.

LINGUISTIC CHANGE

12.21 Weinreich's book of 1953 concentrated on synchronic studies of interference phenomena, but it is evident that such studies may also contribute to a better understanding of sound change.

This problem is taken up in an important paper by URIEL WEINREICH, WILLIAM LABOV and MARVIN I. HERZOG of 1968, "Empirical Foundations for a Theory of Language Change" and in various studies by Labov (e.g. 1965, 1972a and 1972b), based on extensive field studies of changes in progress.

The first-mentioned paper contains a critical evaluation of earlier theories of sound change. The authors emphasize that the difficulty of combining the concept of a homogeneous structure with the concept of change was one of the reasons why Saussure and Bloomfield limited the structural point of view to synchronic linguistics and remained neogrammarians as far as the conception of linguistic change is concerned. They consider it a progress that European post-Saussurean structuralists applied the structural approach to diachronic linguistics as well; the extreme formalism of Kuryłowicz is, however, rejected (Labov 1972b, pp. 1110-11), whereas Martinet's theories are mentioned as a positive contribution (1968, p. 133, see also Labov 1972b, p. 1133). In a great number of cases the authors have found chain shifts under functional pressure and evidence of a tendency to preserve a margin of security as assumed by Martinet. The need to

distinguish words is always there and may occasionally gain the victory. However, these are weak forces, and they are very often overridden; mergers abound in language history.

The generative model of language change is characterized as unnecessarily unrealistic. In the first place the assumption that children's grammars are formed upon the data provided by their parents' speech cannot be upheld. Current studies show that the child normally acquires his particular dialect pattern, including recent changes, from children only slightly older than himself. Linguistic change is transmitted within the community as a whole, not confined to discrete steps within the family (1968, p. 144 ff).¹⁷

Moreover, the isolation of specific historical developments from their social context has the result that relevant data are excluded. Finally, the description in terms of distinctive features is not always appropriate. The authors have, for instance, found several cases of a close covariation between the front-back movement of low vowels and the high-low movements of mid vowels, e.g. fronting of *a* combined with raising of *e*, and backing of *a* combined with raising of *ɔ* (their examples could be multiplied from other languages). These covariations can only be explained as movements in a two-dimensional vowel space, not on the basis of two independent dimensions. The subdivision of vowel height in +/–low and +/–high is also inappropriate since vowel height functions as one single dimension in phonological change (see Labov 1972a, p. 153).

In order to understand sound change it is, according to the authors, in the first place necessary to break down the identification between structuredness and homogeneity. "The key to a rational conception of language change – indeed of language itself – is the possibility of describing orderly differentiation in a language serving a community. We will argue that nativelike command of heterogeneous structures is not a matter of multidialectalism or "mere" performance, but is part of unilingual linguistic competence" (1968, p. 101). It is not only so that there may be co-existing systems available to the same speaker, who may switch between them; there are also linguistic variables within the same system, ultimately defined by the function of other linguistic or non-linguistic, e.g. social, variables.

Moreover, it must be recognized that linguistic and social factors are closely interrelated and must be described in their mutual interplay.

Finally the attempt to distinguish between the origin and the propagation of a change should be given up. Change in an idiolect is not change in language. "The spread of a linguistic feature *is* the linguistic change, as a new social convention enters the language" (Labov 1972b, p. 1114).

17. The authors mention children of first generation immigrants as a particularly clear case. Here the social factors are evident. It is also true that nowadays, at least within our culture, children speak like their playmates, not like their parents. I wonder, however, whether this was true to the same extent at a time when the older generation enjoyed greater esteem.

It is important to study the transition, the embedding and the evaluation of a change.

The **TRANSITION** problems can be studied in real time, i.e. by means of recordings from the same community at relatively long intervals. This has been done in some cases, but a more feasible method is to study it in apparent time, that is, along the dimension formed by the age groups of the present population. All the cases studied by the authors show continuous development through the successive age levels, in some cases ending in mergers with other phonemes. They have not found "lexical diffusion" in the strict sense of the word (the term was coined by W. S.-Y. Wang (1969)), i.e. in the sense that the change applies to words rather than to sounds. This was found by Wang to be valid for Chinese, and it has been maintained earlier by German and Dutch dialect geographers that each word has its own history. Weinreich et al. found that the words changed in groups often determined by the phonetic surroundings, but also by grammatical conditions (grammatically important endings are sometimes retained), or by frequency (common words are changed first). Generally the development starts in a smaller subgroup of the community and then spreads to other subgroups. The conditions may apply in a given order, so that the change passes as an ordered wave through the population. Different forms of the same word may thus co-vary for a longer period within the same community, and even in the speech of the same person. At the end the older forms become obsolete and disappear, and the final result is often a regular change, perhaps with a small residue of unchanged words.

By **EMBEDDING** the authors understand the correlations between a linguistic change and other linguistic or non-linguistic phenomena. It has very often been found that vowels of the same height undergo parallel changes, but not necessarily simultaneously; often one of them may lead the way. The covariation of low vowels in the front-back direction and mid vowels in the high-low direction was mentioned above. Very often the choice of a definite variable is dependent on non-linguistic factors, particularly on age, socio-economic class and style; and the interactions between these conditions may be very regular. If a limited number of phonetic steps, e.g. from low to high vowels, and a limited number of socio-economic classes and of styles (from the most casual style to the most deliberate pronunciation of isolated words) are indicated by numbers, it is possible to describe the interactions in a quantitative way (see e.g. Labov 1965 and 1972b).

By **EVALUATION** is meant the attitude of the speakers to the change in the cases where they are consciously aware of them. A change will often start in one of the middle social classes, and it may be stigmatized by members of the upper class. This may entail reversals and hypercorrections. Hypercorrection is found to be an important mechanism in linguistic change.

On the basis of investigations of a great number of concrete changes in progress, it may be possible to find some universal **CONSTRAINTS** on linguistic change, e.g. that in cases of contact between a system with two phonemes and another

system where these two phonemes are merged, the direction of change will be in favour of the merger. (Examples of phonetically conditioned constraints have been given by Wang, Ohala and Chen, see the preceding section).

The most difficult problem is the ACTUATION problem, i.e., why does a change occur at a given time in a given language? This problem is too complex to allow of predictions.¹⁸

A formalized description of the type of change normally found in these studies requires a new type of rule. Normal generative rules are invariant (categorical). What is needed is a type of variable rule indicating that a change is more common in one environment than in another, although optional in both. Labov (1972a, p. 112ff) proposes the use of angled brackets to indicate optionality. The formula $[+tense] \rightarrow \langle +high \rangle / [\overline{-back}] \langle +nasal \rangle$ will thus indicate that a front vowel is (optionally) raised, preferably before nasals, cf. the different use of angled brackets mentioned in section 9.54 above.

The studies mentioned in this section have contributed in an essential way to the widening of perspectives in phonological description and explanation.

18. Henning Andersen (1972 and 1973) adduces cases from Slavic sound history showing the complexity of phonetic and social factors resulting in a gradual change. But he attaches more importance to the explanation of innovations as conditioned by the internal phonological structure.

Chapter 13

CONCLUDING REMARKS

13 In the introductory chapter (1.2) it was stated that the development of phonological theory has not taken the form of a straight line, but rather that of a spiral, because each new trend tends to set up a theory which is as different as possible from that of the immediately preceding stage and instead to take up ideas from older theories. This is particularly obvious in the attitude of generative phonology to the Bloomfield School. Chomsky was a pupil of Harris, but he reacted strongly against the Bloomfield School in all respects, and nothing is considered so outdated by the adherents of transformational grammar as "taxonomic" analysis. Instead they have taken up ideas from traditional grammar and, in phonology, Roman Jakobson's theory of distinctive features and early Prague School marking theory. But they rejected the basic concepts which the Prague School had in common with the Bloomfield School, which means that the concept of opposition (contrast) was neglected and the phoneme abolished.

The reaction against generative phonology has, however, already started, even among the younger adherents of the theory itself. The importance of contrast is stressed, paradigmatic and syntagmatic surface structure are taken into account, and some have even found that generative phonology had been too rash in throwing the phoneme out with the taxonomic bathwater. So both the traditional phonological level and the phoneme seem to be on their way to being restored to their former position as honourable phonological concepts.

On this background one may ask whether there has been any progress at all in phonological theory, or whether it is only a question of changing fashions. This latter view would, however, be too pessimistic. There is no doubt that each new trend in phonology has led to valuable new insights and opened up new perspectives, and language is a complicated and manysided structure which can be, and should be, described from various complementary points of view. It is, of course, deplorable that the new insight is generally rejected as uninteresting by the following generation; but that does not mean that it is lost: it is there, laid down in books and articles, to be taken up again by subsequent generations. Personally I think that the basic concepts of Prague phonology (the concept of opposition, of relevant properties (or distinctive features), of phonological systems and universal tendencies, as laid down in the works of Roman Jakobson and Trubetzkoy and continued by Martinet) will be taken up again and again, and that they are not incompatible with the description of (morphophonemic) under-

lying forms and the derivation of surface forms by rules as proposed in generative phonology. Nor does this prevent alternative "prosodic" analyses in cases where this type of analysis gives new information.

There also seems to be a growing tolerance in many quarters and an increasing contact between different trends, a development which has been obvious for some decades in the Scandinavian countries. There is, finally, an increasing contact between phonology and phonetics and between these disciplines and psychology, neurology and sociology. Linguistics is giving up the isolation which some scholars insisted on in the first period of structuralism in order to build up linguistics as an autonomous science. This isolation was perhaps necessary at that time, but it was becoming an obstacle to progress; transformational grammar has made a very positive contribution to breaking down this isolation. There is thus hope that real progress will be achieved in the future by means of unrestricted and open-minded co-operation.

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* indicates particular important works or easily understandable introductions.

Books in parentheses have only been partly utilized.

ABBREVIATIONS:

- Actes Congr. int. ling.:* *Actes du . . . congrès international des linguistes*
- AL (H):* *Acta Linguistica* (Hafniensia)
- ARIPUC:* *Annual Report of the Institute of Phonetics, University of Copenhagen*
- BCLC:* *Bulletin du Cercle linguistique de Copenhague*
- BSL:* *Bulletin de la Société de linguistique de Paris*
- CFS:* *Cahiers Ferdinand de Saussure*
- CLS:* *Papers from the . . . Regional Meeting, Chicago Linguistic Society*
- FRJ:* *For Roman Jakobson. Essays on the Occasion of his Sixtieth Birthday* (The Hague) 1956
- IJAL:* *International Journal of American Linguistics*
- JASA:* *Journal of the Acoustical Society of America*
- JL:* *Journal of Linguistics*
- Lg.:* *Language*
- MIT QPR:* *Massachusetts Institute of Technology. Quarterly Reports*
- Phon. Th.:* *Phonological Theory, Evolution and Current Practice*, ed. Makkai, 1972 (New York)
- POLA:* *Project on Linguistic Analysis. Reports. Phonological Laboratory, Department of Linguistics, University of California, Berkeley*
- PSR:* *A Prague School Reader in Linguistics*, compiled by Josef Vachek (Bloomington) 1964, 3rd ed. 1967
- Proc. int. Congr. phon.:* *Proceedings of the . . . International Congress of Phonetic Sciences*
- Proc. int. Congr. ling.:* *Proceedings of the . . . International Congress of Linguists*
- RL:* *Readings in Linguistics* I, ed. M. Joos (New York) 1958, and II, ed. E. P. Hamp, F. W. Householder, R. Austerlitz (Chicago) 1966
- RML:* *Readings in Modern Linguistics*, ed. Malmberg 1972
- STL-QPSR:* *Speech Transmission Laboratory. Quarterly Progress and Status Report. Dept. of Speech Communication, Royal Institute of Technology, Stockholm*

<i>Studia ling.:</i>	<i>Studia Linguistica</i>
<i>SWr.:</i>	Roman Jakobson, <i>Selected Writings</i> I (1962, 2nd ed. 1971) and II (1971) (The Hague)
<i>TCLC:</i>	<i>Travaux du Cercle Linguistique de Copenhague</i>
<i>TCLP:</i>	<i>Travaux du Cercle Linguistique de Prague</i>
<i>TLP:</i>	<i>Travaux Linguistiques de Prague</i> (1964ff)
<i>UCLA Working Papers:</i>	<i>Working Papers in Phonetics, University of California, Los Angeles</i>
<i>VJa:</i>	<i>Voprosy jazykoznanija</i>
<i>Zs. f. Phon.:</i>	<i>Zeitschrift für Phonetik</i>

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Chapter 8.

Roman Jakobson's Theory of Distinctive Features

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Addition:

Important papers by, among others, Labov, Lightner, Kiparsky and Dingwall have been published in *A Survey of Linguistic Science*, ed. W. O. Dingwall 1971. This publication was not available to me until after the present book was printed.



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Note that the cipher (or ciphers) before the first point indicates the chapter and thus the phonological school involved, viz.: 2 Forerunners, 3 Prague, 4 Jones, 5 Firth, 6 Bloomfield School, 7 Glossematics, 8 Roman Jakobson's distinctive features, 9 Generative Phonology, 10 Stratificational Theory, 11 Soviet Russian phonology, 12 Others.

Names of specific schools or authors have therefore only been added in a few cases where it was found useful because the same term is used in a quite different sense by different authors (e.g. invariant, paradigm, schema), or because an everyday word is used in a quite specific sense (e.g. direction (gloss.)).

For names of authors and schools, see the index of names.

o (in matrices) 8.16
 Ø (in rules) 9.49
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MINOR CORRECTIONS AND ADDITIONS

- Page 8, l. 23: Baudouin de Courtenay may also have taken the term "anthropophonics" from C.E. Merkel, who used it in 1857.
- Page 67, l. 17: The Bloomfield paper referred to by Hockett is "Meaning" in "Monatshefte für den deutschen Unterricht" 1943, p. 400-405. Here Bloomfield defines "meaning" as "the features of situation and action which are common to all utterances of a speech form."
- Page 68, l. 4 f.b.: Bloomfield's secondary phonemes are not equivalent to stress and tone, since he considers, e.g. Chinese tones to be primary phonemes.
- Page 74, l. 15: Pike 1959 is not listed in the bibliography. It is "Language as Particle, Wave, and Field", The Texas Quarterly II, p. 37-54.
- Page 167: Table 8.1 showing the distinctive features of English was reproduced from the original edition of "Preliminaries". In all later editions the feature strident (+) is left out for *f* and *ʒ*, and the feature mellow (-) for *t* and *d*. This is an evident improvement, whereas my proposal to leave out mellow for *k* and *g* was inappropriate.
- Page 225, l. 26: The number of features in SPE is mentioned as 22, but I had overlooked that Chomsky and Halle mention two suction and two pressure features. The correct number is thus 24.





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