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INTERNATIONAL ENCYCLOPEDIA
OF
LINGUISTICS
SECOND EDITION

WILLIAM J. FRAWLEY

Editor in Chief

Volume 3
Mande Languages-Selection

Библиотека
ТГПУ
инв. № 22464

OXFORD
UNIVERSITY PRESS

2003

N 7168-5

vowels intervene: *kift* 'Open!', MASC.SG.', *kifč* 'FEM.SG.', but *qifif* 'cut the edges, MASC.SG.', *q^yifif* 'FEM.SG.'.

The third type of long-distance process, dissimilation at a distance, may involve aspiration, as in Grassman's Law in Indo-European; continuancy, as in Dahl's Law in Kikuyu; labialization, as in Labial Dissimilation in Chinese; or voicing, as in Lyman's Law in Japanese. In Japanese (Itô and Mester 1986), for example, a simple or compound native word may contain only one voiced obstruent. In compounds, the first consonant of the second constituent is usually changed to a voiced equivalent: *iro-kami* → *irogami* 'colored paper'. If the second word already contains a voiced obstruent anywhere, the voicing fails to apply: *onna-kotoba* → *onnakotoba*onna gotoba* 'woman + word, i.e. feminine speech'.

The fourth type of long-distance process, in which the patterns alternate, is extremely common in stress systems, where it is usually attributed to the construction of binary feet. The pattern may begin at either end of the word: the Australian language Maranungku and the Venezuelan language Warao both have strong-weak trochaic feet, but in Maranungku they start from the left (e.g. *lángkaràteti*) whereas in Warao they start from the right (*enàhoròà-hàkutái*). Length may also alternate, probably in response to pressure to achieve alternating stress, and also to avoid heavy unstressed syllables. For example, in the Australian language Gidabal, long vowels shorten after another long vowel, resulting in alternating length across the word: */gunu:m-ba:-da:n-be:/* → *gunu:m-ba-da:n-be*.

The study of long-distance processes has had significant implications for linguistic theory. The ability of a feature or features to surface at a distance from its point of origin, and the ability of the same or other features to be realized on more than one segment, led to theories like Autosegmental Phonology (Goldsmith 1976) that separate out at least some features onto separate tiers. The ability of sets of features to spread or move as a group at a distance, often because of their affinity with particular segment types, informed the theory of feature geometry (Sagey 1986, Clements and Hume 1995). Finally, the alternating patterns of some long-distance processes, particularly stress, motivated the postulation of binary metrical constituents (Hayes 1995).

[See also Generative Phonology; Phonological Features; Autosegmental Phonology; Lexical Phonology; Tone; and Optimality Theory.]

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MOIRA YIP

PHONOLOGY. [This entry includes the following sub-entries:

- Overview
- American Structuralist Phonology
- European Structuralist Phonology
- Prosodic Phonology]

Overview

Phonology is the study of the sound structure of language. Within linguistics as a whole, it has closest con-

nections with morphology and syntax on the one hand, and with phonetics on the other. (For general reference, see Sommerstein 1977, Kenstowicz and Kisseberth 1979, Dell 1980, Van der Hulst and Smith 1982, Lass 1984, and Anderson 1985.)

1. Early history. Although the emergence of phonology as a distinct discipline is relatively recent, its practice is actually quite ancient. The discovery of alphabetic writing in the ancient Near East required significant understanding of sound structure; the *segment* and the *phoneme*, two basic results of phonological analysis, are prerequisites to the alphabet.

A concern with the proper transmission of sacred texts led to very detailed study of the phonology of Sanskrit by the grammarian Pāṇini (5th c. BCE). Pāṇini is generally credited with constructing the first generative phonology, in which explicit rules relate an abstract representation of words to their actual pronunciation. This aspect of Pāṇini's work had a considerable impact on modern linguists, particularly Leonard Bloomfield.

2. Structuralism. During the first half of the 20th century, the most significant intellectual developments in the field were the emergence of American and European *structuralism* as the basis for nearly all phonological research. Particularly influential figures of this period were Bloomfield and Edward Sapir in the United States, and Roman Jakobson and Nikolai S. Trubetzkoy in Europe.

The greatest single contribution of structuralism to phonology was the recognition of the phoneme as the fundamental unit of the organization of sound systems. This unit is a contrastive element by which two words can be distinguished. The phoneme abstracts away from detailed rules of pronunciation to provide a representation of language from which the fully predictable aspects of phonological structure are absent. For example, the *p*'s of Eng. *pit* and *spit* differ in aspiration, the puff of air that immediately follows the release of the closure at the lips. If we transcribe aspirated *p* as [p^h], then we can represent these two words phonetically as [p^hit] and [spit]. From a phonological standpoint, however, the phonetically distinct *p*'s of these two words are not in contrast: whether *p* is aspirated is entirely predictable by a rule of pronunciation, i.e. "Aspirate *p* when it begins a syllable." The phoneme written as /p/ is expressed as one of its two *allophones* [p] or [p^h], by this rule of pronunciation.

The discovery of the phoneme led to a number of important results. Not only did it account for exceptionless aspects of pronunciation; it also provided a way of representing the lexicon of a language in terms of the

units by which different lexical items are distinguished. The possibility was also opened of studying the phonemic systems of languages, which revealed the systematic patterning of phonological oppositions. Thus, for each of the Eng. voiceless stop phonemes /p t k/, there is a contrasting voiced stop phoneme /b d g/. The important paper of Sapir 1933 showed that phonemes are a part of speakers' mental representation of their language, rather than a mere analytic construct.

3. Generative phonology. Contemporary phonology begins with the watershed work of Chomsky and Halle 1968, *The sound pattern of English (SPE)*. The title alludes to a paper by Sapir; the analysis contains a subtle reference to Pāṇini. This book is both a synthesis of the results of earlier research and a source of major innovations. It describes a theory of sound structure that is known as *generative phonology* and applies it to a detailed analysis of English. The most influential themes of this work are as follows:

The theory is generative in the sense that it requires explicit formulation of the rules that relate the underlying representations of the lexicon to the surface representations of actual pronunciation. This permits exact evaluation of competing analyses of the same phenomenon.

The theory must be capable of describing all and only the sound systems and rules that actually occur in languages. This requirement follows from the psychological claims made: a generative phonology is a model of the mental representation by adult native speakers of the sound structure of a language. Phonological theory provides a limited set of possible models, among which a child must choose when learning a language.

The theory of phonological processes in *SPE* is a universal theory of how to express rules in terms of a metalanguage. The metalanguage (usually called the "notational system" or "abbreviatory conventions") makes claims about what sorts of phonological rules are possible in any natural language. For example, under certain conditions, stress in Hebrew falls on the final syllable of words ending in a C[onsonant]; however, it falls on the penultimate syllable of words ending in a V[owel]. Two rules are required: a penultimate stress rule, $V \rightarrow \text{stress} / \text{---}CV\#$, and a final stress rule, $V \rightarrow \text{stress} / \text{---}C\#$. (The symbol # marks the end of a word.) The *SPE* theory requires that these two rules be collapsed or abbreviated as $V \rightarrow \text{stress} / \text{---}(CV)\#$, with parentheses demarcating the elements not common to the two rules. The theory also claims that rules abbreviated in this way are subject to a principle of *disjunctive ordering*, such that the longer rule applies first, preempting the shorter one. Thus any

word that undergoes the longer (penultimate) stress rule will fail to undergo the shorter (final) stress rule. This is correct; CVCV words have penultimate stress without final stress.

Finally, *SPE* develops in considerable detail the idea that phonological rules and representations are characterized in phonetic terms. Every speech sound is composed of a set of two-valued *distinctive features*—phonetically defined entities that classify sounds and make claims about how they pattern in phonological rules. For example, the English stops /p t k/ are distinguished from /b d g/ by the feature value [-voice] in the former, and [+voice] in the latter. A rule like the voicing assimilation process responsible for *five+th* → *fifth* refers to the feature [voice]. An adequate theory of distinctive features expresses, for all possible human languages, the contrasts in their sound systems and the categories on which their phonological rules can operate.

Most of these points were generally accepted after 1968, but some aspects of the *SPE* program engendered considerable controversy in the years following its publication. The three most important ones involved abstractness of underlying representations, conspiracies among rules, and rule naturalness.

The *abstractness* controversy was initiated by Kiparsky 1968; he observed that the *SPE* theory places no limits on the remoteness of the relation between underlying and surface representation. Kiparsky pointed out that certain kinds of abstract analyses, although they account for patterning of data in the language itself, are not supported by external evidence, such as the progress of historical change. The efforts to grapple with this and related questions subsequently led to the development of the theory of *Lexical Phonology*.

A *conspiracy* consists of two or more rules that are functionally similar but formally distinct. This phenomenon was discovered by Kisseberth 1970; his premier example came from the phonology of Yawelmani Yokuts, which has several rules that actively eliminate or passively avoid creating sequences of three consonants. The problem with conspiracies, from the *SPE* perspective, is that formal and functional relatedness ought to go together. This is *SPE*'s central claim, following from its universal rule-writing metalanguage. In a conspiracy, rules that cannot be collapsed or abbreviated nonetheless function together in support of the same surface outcome, avoidance of a marked configuration (e.g. a triconsonant cluster).

Another area of debate which ultimately led to a greater understanding of phonological structure was the problem

of *naturalness*. Within the *SPE* theory, the naturalness or likelihood of a system of rules was determined by maximally abbreviating the rules by use of the notational conventions, and then measuring the simplicity of the resulting grammar by counting the distinctive features using an *evaluation metric*.

In chap. 9 of *SPE*, Chomsky and Halle concede that this formalist approach to naturalness was not successful. In response, the theory of Natural Phonology proposed a repertoire of universal natural rules, called *processes*, in place of *SPE*'s rule-writing principles. A typical process is devoicing of final obstruents, as in German *Hund* [hunt] 'dog'. All learners start out with this process actively present, so the developing phonologies of young children are expected to show the effects of this process, as in fact they do. Children exposed to English hear final voiced obstruents in the ambient language, and this leads them to suppress the natural process. Children exposed to German simply retain the natural process unaltered from its original state. The phonology of a specific language, then, consists of all those natural processes that were not suppressed by learners in the course of acquiring that language.

From the mid-1970s through the 1990s, research on these and other issues moved away from *SPE*'s focus on rule-writing and toward a greater concern with aspects of phonological representation. This change of emphasis was initially driven by the desire to analyze phenomena, especially tone and stress, that had not been addressed satisfactorily in *SPE*, but the scope of this research program, sometimes known as "nonlinear phonology," quickly expanded, eventually having a transformative effect on phonological theory as a whole.

The study of stress led to the development of the theory of Metrical Phonology. Here stress is seen as a relation between syllables, rather than an intrinsic property of them. This syntagmatic view of stress has yielded a nearly comprehensive cross-linguistic typology of stress systems, as well as an excellent understanding of how rhythmic factors contribute to lexical and sentential stress. Relatedly, there has been significant progress in understanding other aspects of prosodic structure, particularly syllables.

Investigations of *tone* were the basis of the development of the theory of Autosegmental Phonology, in which the distinctive features that make up speech sounds are decomposed into separate levels of representation, called *tiers*. Principles of the theory provide a kind of orchestration of the gestures on the different tiers, with a single unit of one tier possibly corresponding to several units

of another. Autosegmental phonology has also been applied with success to non-concatenative morphology, to vowel and consonant harmony, and assimilatory phenomena in general.

Metrical and Autosegmental Phonology shift much of the burden of description and explanation in phonology from *SPE*'s rules to constraints on representations. The idea that all of phonology may be reducible to the interaction of constraints is pursued in Optimality Theory, which attributes linguistic generalizations to the interplay among ranked, violable constraints. Conspiracies, which had been so problematic in the rule-based model, emerge as the expected result of this interaction. Under the assumption that the constraints are universal and that languages differ only in their ranking, Optimality Theory also offers a solution to the naturalness problem. Language acquisition consists of learning a constraint ranking, with effects that hark back to process suppression in Natural Phonology.

Finally, we turn to the place of phonology in linguistics as a whole. Although the proper relation between phonology and syntax seems secure, the connections between phonology and the closely adjoining fields of morphology and phonetics are not. Work on Lexical Phonology and on non-concatenative morphology has established firm correlations between phonological and morphological structure; at the same time, it is unclear in the limiting case whether a particular phenomenon is to be analyzed phonologically or morphologically. The trade-off between phonetics and phonology is similarly unclear, although it continues to be a topic of lively debate.

[See also Acquisition of Language, *article on* Phonology; Autosegmental Phonology; Bloomfield, Leonard; Borrowing, *article on* Loanword Phonology; Generative Phonology; History of Linguistics, *articles on* American Structuralism, Ancient India, Prague School; Intonation; Jakobson, Roman; Language Change, *article on* Phonological Change; Learnability; Lexical Phonology; Markedness, *article on* Markedness in Phonology; Metrical Phonology; Morphology, *article on* Morphology and Phonology; Natural Phonology; Optimality Theory; Phoneme; Phonemic Systems; Phonetics; Phonological Derivations; Phonological Features; Phonological Processes; Sapir, Edward; Segments; Sentence Phonology; Syllables; and Tone.]

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JOHN J. MCCARTHY

American Structuralist Phonology

American structuralist phonology was concerned primarily with formalizing the notion of the *phoneme*, and with elaborating a framework for the phonemic analysis of languages. By the early 20th century, phonetic science had revealed that languages often had more sounds in their phonetic inventories than had originally been suspected. For example, Eng. *p[ɥ]ease* has the voiceless liquid also found in Welsh; the final sound in *ma[tʰ]* resembles the glottalized stop of many Amerindian languages. While phonetically accurate, these transcriptions are linguistically misleading: [ɥ] and [tʰ] are of quite different status in English than in these other languages. Understanding the nature of this difference was taken to define the field of phonology.

In the 1920s, Edward Sapir and Leonard Bloomfield initiated two different approaches to the problem. For

Sapir, a language's phonetic inventory is but a distorted manifestation of its inner system of phonemes. The phonemic structure is a conceptual system—an inventory of "ideal sounds," in terms of which the phonetic segments of speech are perceived and articulated. Sapir 1925 shows how the same phonetic sound can have a quite different status in languages with different phonemic systems. For example, in some languages voiced and voiceless laterals, or plain and glottalized stops, constitute separate phonemes. However, English has only one lateral [l], and only one [t], in its phonemic system; [l] and [tʰ] are "inorganic variants" of the phonemes /l/ and /t/, which arise from largely unconscious, mechanical phonetic processes. The phonemic/phonetic disparity may also go in the opposite direction: two languages may have the same phonemic system, but differing phonetic realizations, depending on the presence or absence of particular phonetic processes. This is a principal source of dialect differences: e.g., intervocalic /t/ is realized as a flap in American dialects, but not in British English. Sapir believed that a language's inner phonemic system can often be intuited by the native speaker. In another famous paper, Sapir 1933 discusses how his Amerindian consultants could transcribe sounds which were objectively absent in their speech; he draws an analogy with *r*-less English dialects, and the average Englishman's feeling for the phonetically absent [r] of *soared* [sɔ:d]. Here the phoneme /r/ in /sɔ:r-d/ has zero realization—a true phonetic "illusion" (cf. *soaring* [sɔ:riŋ]). Thus, for Sapir, the phonemic system is a mental reality: something that exists in the mind of the speaker, independently of the act of speaking.

Bloomfield was suspicious of such "mentalism" (see Bloomfield 1933, Hockett 1970). He felt it more prudent to approach the phoneme exclusively through objectively observable data. For Bloomfield, the phoneme was not an "ideal sound" or "mental image," but rather a bundle of distinctive features which are present in the overt, physical manifestation of speech. The task of phonemic analysis is to isolate these distinctive features—principally through the discovery of minimal pairs—and to state the distribution of redundant, non-distinctive features. For example, the existence of Eng. *sue* vs. *zoo* shows that voicing is distinctive for fricatives; no such minimal pair can be found for Eng. [l] vs. [ɫ], which suggests that voicing is not distinctive for the lateral. When viewed from this perspective, the phonemic analysis of a language becomes a matter of grouping phonetically distinct sounds ("phones") into phonemes.

Because of the positivistic climate of the 1930s, Bloomfield's approach attracted much more attention than did that of Sapir. At the theoretical level, American Structuralist Phonology in the next two decades occupied itself principally with elaborating Bloomfield's surface-oriented, inductive view of the phoneme; explicit criteria were developed to justify given phonemic groupings. The phenomenon of phoneme "intersection" (assignment of the same sound to different phonemes), uncovered by Bloch 1941, posed one of the most serious challenges to the Bloomfieldian view. For example, in most American English dialects, the /t/ phoneme of *betting*, *butter* is realized as a flap [D]; in some of these dialects, the /t/ phoneme is also realized as [D] after the interdentals of *three*, *throw*. On this analysis, there is no invariant bundle of features that distinguishes among all occurrences of /t/ and /r/. To maintain the invariance condition, [D] would have to be set up as a separate phoneme—despite its limited distribution and redundant status. The standard response to this problem gives up the invariance requirement; it defines the phoneme as a class of segments or *allophones* which are in complementary distribution. However, it became clear that this definition was both too broad and too narrow. Requiring a certain degree of phonetic similarity among the allophones helps to constrain the number of possible analyses (e.g. forcing the [p] of *spin* to group with the [p^h] of *pin*, rather than with the [t^h] of *tin*). Phonetic similarity also sets an upper bound on the grouping of allophones. For example, English [h] and [ŋ] are in complementary distribution; but most analysts were reluctant to identify them phonemically, thereby betraying a strong intuitive conception of what a natural phonemicization should be like. From a later, generative perspective, this question could be posed in terms of the naturalness of a rule that relates [h] and [ŋ]. However, the Bloomfieldians failed to develop any explicit notion of phonological rule, and thus neglected the idea of a natural distribution of allophones.

The problem of complete overlap, and the solutions suggested, best illustrate the surface orientation of Bloomfieldian phonology, and what sets it apart from the Sapirian and later generative approaches. Bloch 1941 noted that the well-known short vs. long vowel difference in such pairs as *bit*, *bid*, *bat*, *bad* is contextually determined by the voicing of the following consonant. The low vowel [a] of *pot*, *pod* also participates in this correlation. But in Bloch's dialect, not all occurrences of [a] and [a:] correlate with the voicing of the following consonant: *bomb* and *bother* have [a], while *balm*, *father*,

and *Pa* have [a:]. In this case, we must phonemicize the latter with /a:/. The problem here is that, in the utterance *Pa'd go (if he could)*, the phonetic sequence [pa:d] has been phonemicized as /p:d/. But in *The pod grows*, the same sound sequence has been phonemicized /pad/, with the short vowel. The result is a complete intersection of phonemes: the phone [a:] realizes two different phonemes in the same local phonetic context. Bloch considered this phonemicization inadmissible; given the phonetics, there is no way to tell whether [a:] realizes the /a/ or the /a:/ phoneme. The requirement appealed to here was later called *biuniqueness* by Harris 1951: in a valid analysis, it should be possible not only to transform the phonemic representation to the phonetic, but also the reverse. To satisfy biuniqueness, *pod* must be phonemicized /pa:d/—with the regrettable consequence that the low vowel must be exempted from the long-short correlation of *bit/bid*, *bat/bad*, etc. The biuniqueness requirement seems strange from a Sapirian or generative standpoint, but it makes sense from the strong empiricist view that phonemic structure is computed exclusively from directly observable phonetic structure.

This view is also reflected in the attitude toward the role of grammatical information in phonemic analysis. Bloomfield considered the notion "word" to be a primitive, and so he allowed reference to word boundaries. This permits him to identify German [x] and [ç] phonemically, despite such minimal pairs as *Kuchen* [ku:xən] 'to cook' and *Kuhchen* [ku:çən] 'little cow'. The latter has the structure of a compound, with the diminutive suffix *-chen* treated as a separate word. Later writers tried to dispense with this reference to grammatical information, in favor of the dubious notion of "juncture phonemes." However, this move was vigorously disputed by others (notably Kenneth Pike).

Another much-discussed problem is the minimal pair *writer* [rayDər] vs. *rider* [ra:yDər]. The surface contrast is in the length of the vowel. But most analysts felt that the correct phonemicization registers the contrast in the consonant as [t] vs. [d]. Chomsky 1964 seized on this example from Harris in a devastating critique of Bloomfieldian phonology. Comparison with the morphologically related *write* and *ride*, as well as the restricted distribution of the flap, justifies locating the contrast in the consonant. The phonetic forms can be derived by ordered application of the independently needed rules of vowel-length assignment and flapping. But if we proceed simply on the basis of minimal pairs, then we must phonemicize the vowel length—even though this contrast

only appears before the flap, and correlates elsewhere with voicing of the following consonant.

In the 1950s, Chomsky and his collaborator Morris Halle concluded that the best solution to such problems was simply to abandon the strong behaviorist stance of the Bloomfieldians, and to explore instead the mentalist approach to phonology advocated by Sapir. In the resultant generative model, the only constraint on underlying (systematic phonemic) representations was their effectiveness in maximizing the overall simplicity of the grammar. The focus of phonological research shifted to rules—their discovery, formulation, and ordering. However, generative phonology also carried over several features of American Structuralism. These included the conception of phonological representation as a linear string of segments; the assumption that the chief problem in phonological analysis is the specification of the distribution of predictable features—and, perhaps most importantly, the belief that the best methodology is the explicit formulation of general principles, and a rigorous pursuit of their empirical implications. (For general reference, see Joos 1957, Makkai 1972, Hymes and Fought 1981, Anderson 1985.)

[See also History of Linguistics, *article on American Structuralism*; and Phonological Features.]

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MICHAEL KENSTOWICZ

European Structuralist Phonology

European structuralist phonology is the work of the Prague Linguistic Circle. For the Prague School, language is conceived of as a functional whole, composed of structural components or elements which together form a unified system. Thus it combines a functional (means-ends) approach with a structuralist one. Moreover, it searches constantly for the universal, general laws by which specific systems can be explained.

The hallmark of Prague work undoubtedly remains its contribution to the development of phonology. (For a general discussion of Prague phonology, see Malmberg 1964:74-97, Vachek 1966:40-78, M. Ivić 1965:134-147, Fischer-Jørgensen 1975:19-48, 144-173, Anderson 1985:83-139.) It had precursors in the work of Baudouin de Courtenay, Mikolai Kruszewski, Lev Ščerba, and Ferdinand de Saussure; and there were other Prague phonologists (e.g. Bohumil Trnka and Josef Vachek). However, the two linguists who were most instrumental in developing the basic tenets of Prague phonology during the interwar period were the Russian émigré scholars Prince Nikolai Trubetzkoy (1890-1938) and Roman Jakobson (1896-1982). The general program of Prague phonology is given in Prague 1929, 1931; the most representative work of Trubetzkoy is 1939 (see also Trubetzkoy 2001). For Jakobson, one should refer to his co-authored works (Jakobson, Fant and Halle 1952, Jakobson and Halle 1956, Jakobson and Waugh 1979/1987), and the collection of his phonological writings (Jakobson 1962; see also Jakobson and Pomorska 1983, Jakobson 1990, Waugh and Monville-Burston 1990).

In general, Trubetzkoy and Jakobson defined phonology as that part of linguistics which examines sounds and sound differences in terms of their function within linguistic systems. In early work, this was sharply distinguished from phonetics, which was viewed as the study of sounds as non-functional physical units of language. Later, however, this strict dichotomy was rejected, with emphasis on the mutual interdependence of the two. The central phonological unit is the *phoneme*, whose function is to distinguish words that differ in meaning ("distinctive

function," e.g. Eng. *p* in *pin* vs. *b* in *bin*). A phoneme may be realized as different speech sounds ("variants") which share an invariant base (a common denominator). Combinatory variants are those which do not occur in the same environments (e.g. *p^h* of *pin* vs. *p* of *spin*); optional variants do (e.g. released vs. unreleased *t* in *pit*).

1. The phoneme. Trubetzkoy defined the phoneme as the smallest distinctive unit which cannot be broken down into smaller successive units. For Jakobson, however, the phoneme is the sum of those properties which serve to distinguish it from all other phonemes in a given language; this leads to his definition of the phoneme as a bundle of *distinctive features*. This concept is considered by many to be the most significant step forward, after the discovery of the phoneme, in the development of modern phonology (P. Ivić 1965, Halle 1983).

In addition to the distinctive function of phonemes and their properties, other functions of sound were defined:

- (a) *Delimitative*, e.g. Czech fixed stress, which serves to locate word-boundaries.
- (b) *Culminative*, e.g. Russian free stress, which signals the number of word units in a given string.
- (c) *Expressive*, e.g. English vowel length, which shows the emotional attitude of the speaker.

Moreover, it was recognized that there may be diverse functional varieties of language: different styles and registers, loan vs. native phonemes, male vs. female styles of speech, etc. Thus a phonological system may encompass a variety of subsystems.

The paradigmatic relationships among the distinctive phonemes in a given language, and the nature of phonemic differences in general, were of primary interest to Prague phonology. Various attempts were made to define the distinctive properties of segmental and prosodic (suprasegmental) elements in acoustic terms. Prosodic properties were defined in various languages with respect to either the *syllable* or the *mora*.

2. Phonological opposition. The fundamental underlying principle of Prague phonology is the notion of phonological opposition. A detailed schema of types of oppositions is presented by Trubetzkoy 1939:66-227; the most important are the three types of relations between the members of an opposition:

- (a) In a *privative* opposition, one member is considered to have a specific property—to be *marked*. The other does not have it, and is *unmarked*. An example is the

property of voicing in voiced vs. voiceless consonants.

- (b) A *gradual* opposition involves different gradations of a given property, e.g. vowel aperture in *i e ε a*.
- (c) In an *equipollent* opposition, one property occurs in one member of a set, and another property in the other(s), e.g. place of articulation in *p t k*.

Moreover, an opposition can be either *constant*, when both members can potentially occur in the same environment; or *neutralizable*, when some environment requires one of the members and not the other. In the latter case, the opposition between two phonemes is suspended. The neutralization of an opposition may either be context-determined, i.e. dependent upon properties of the surrounding phonemes (e.g. voicing assimilation in consonant clusters); or it may be structure-determined, i.e. resulting from position in a word or a syllable (e.g. neutralization of the voicing opposition in word-final position in Russian). In the latter case, the resulting sound, sometimes called the *archiphoneme*, is usually phonetically equivalent to the unmarked member of a privative opposition.

3. Relationships among languages. Trubetzkoy and Jakobson were also concerned with defining the ways in which languages may be grouped together. In addition to the well-known genetic/historical affiliations (language families), they proposed two other approaches to language relations. The first pertains to language alliances or *Sprachbünde*, and is based on the sharing of structural properties among geographically contiguous languages; e.g., the languages in the Eurasian association (Russian, Baltic languages, Finnic languages) all have palatalized consonants (see Trubetzkoy 1931, 2001). The second approach, that of phonological typology, concerns the classification of possible and frequently occurring types of systems, e.g. two vs. three degrees of aperture in vowels. Trubetzkoy and Jakobson also arrived at general laws concerning the structure of such systems: thus degree of aperture is always relevant in vowels (a phonological universal). Again, front/back in low vowels always entails front/back in high vowels, but not vice versa (an implicational law). The most ambitious of these formulations is contained in Jakobson 1941 and Jakobson and Halle 1956; here it was claimed that the order of acquisition by children reflected such facts—children start with maximal and fundamental differences, and acquire secondary ones only later. Jakobson linked these

observations to typological issues: e.g., the implicational laws dictate the order of acquisition of specific sounds in child language, and also in the evolution of linguistic systems.

4. Sound change. The conception of language as a system was also extended to the study of phonological change. Jakobson proposed two general principles of change:

- (a) All synchronic systems are dynamic—encompassing, among other things, change in progress.
- (b) Change is goal-directed (teleological), and is to be studied in terms of both the earlier and the resulting systems.

Thus Jakobson was able to distinguish different types of phonological changes, e.g. creation or loss of a phonological opposition. In later work, Martinet 1955 constructed a “therapeutic” theory of sound change, which combined such structural principles with other, sometimes conflicting, properties—such as the drive for symmetry/harmony (“economy”) in systems, and the importance of the functional yield or load of an opposition (i.e. the degree of its utilization).

Questions of the phonological structure of morphemes also came under scrutiny in morpho(pho)nology (Trubetzkoy 1931, 2001), which was differentiated from phonology on the grounds that morphemes have inherent meaning, whereas phonemes and their components do not. Jakobson later explored these “sense-determinative” uses in terms of iconic, i.e. non-arbitrary, connections between sound and meaning (Jakobson and Waugh 1979: 57–59, 181–234, Jakobson 1990:407–447).

While Jakobson’s later work on phonology bears the stamp of his Prague heritage, various new ideas can be found (see in particular Jakobson and Waugh 1979). For Jakobson, there is a universal, limited set of distinctive features, unified for consonants and vowels; e.g., vocalic front/back and consonantal place of articulation are acoustically similar. All these features are *binary* (Trubetzkoy’s gradual and equipollent relations were thus redefined as privative), and they are characterized by contextually determined markedness relations. Contextual variation was redefined in terms of *redundant* features, which serve to enhance the perception of distinctive features. Indeed, the claim was made that everything in the speech sound is functional (i.e. phonological): there is nothing in sound which does not serve some communicative purpose. The phonetic/phonemic dichotomy thus

becomes outmoded. Finally, a new dichotomy was put forth: *mediacy*, or indirect relation between sound and meaning, vs. *immediacy*, i.e. direct relation, as in sound symbolism and synesthesia. This was used for Jakobson's work on the relationship between language and the brain (see Jakobson and Waugh 1979:32–39, Jakobson 1980).

During the 1920s and 1930s, the Prague approach to phonology (synchronic and diachronic, structural, areal, and sociolinguistic) was embraced by many linguists in Europe. By the late 1980s, it was still being carried on by scholars worldwide, most notably in Western and Eastern Europe, the Soviet Union, and North America. Moreover, because of Jakobson's work on base forms and systems of ordered (morphological) rules for Russian conjugation (1948), he is also credited with being the founding father of generative phonology. (See also Halle 1983, Anderson 1985:139.) Finally, widely used concepts such as (distinctive) features, binary opposition, markedness, redundancy, universals, and typology have become the intellectual property of most linguists—without conscious realization that they originated in, or were fostered by, Prague work in phonology.

[See also Generative Phonology; History of Linguistics, articles on Structuralism and The Prague School; Jakobson, Roman; Language Change, article on Phonological Change; Markedness, article on Markedness in Phonology; Phonological Features; and Syllables.]

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