ROMAN JAKOBSON'S CONTRIBUTION TO
THE MODERN STUDY OF SPEECH SOUNDS

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Jakobson's early views on the phonic aspect of language were in their essence a reaction against the atomism that is endemic in much of the humanities, in general, and in linguistics, in particular. When Jakobson began his linguistic studies in the second decade of this century this atomism was especially striking in the then prevalent approach to the phonic side of language. Phonetics, as exemplified, for instance, by Jespersen's Lehrbuch der Phonetik (Leipzig, 1904) appeared to be concerned with developing notations for capturing the vocal tract configurations of ever finer nuances of sounds, whereas historical phonology, completely dominated by the Neo-grammarian view of sound laws, consisted primarily of a hunt for correspondences among sounds that appeared to have little rhyme or reason. A possible way out this morass had been indicated by F. de Saussure, with whose doctrines Jakobson first became acquainted in 1917 through reports of S. Karcevskij, who had just returned to Russia after studying for some years in Geneva.1 Jakobson was much impressed by Saussure's distinction between langue and parole, which provided a means for distinguishing between a restricted set of abstract phonemes (on the level of langue) and the much larger (perhaps unbounded) set of concrete sounds produced by speakers when the actualizing phonemes in concrete utterances (parole). Since many accidental factors play a significant role in the actual production of sounds – speakers differ in the speed of speaking, they are tired, they acquire peculiar mannerisms, etc. – it is the first task of the linguist to filter out the effects of these accidental factors. To achieve this, Saussure proposed that primary attention be directed to the communicative function of language. In particular, he pointed out that phonemes serve to signal differences among words and asserted that this differentiating function constitutes the essence of the phoneme: "Every language forms its words on the basis of a system of sonorous elements, each element being a clearly delimited unit and one of a fixed number of units. Phonemes are characterized not, as one might think,
their own positive quality but simply by the fact that they are distinct."³

"... language requires only that the sound be different and not, as one
one might imagine, that it have an invariable quality. I can even pronounce
the French r like the German ch in Bach, doch, etc., but in German I
could not use r instead of ch, for German gives recognition to both ele-
ments and must keep them apart."³ To have elaborated these functionalist
notions in a highly original fashion and to have applied them in the solu-
tion of a host of linguistic problems both synchronic and diachronic is one
of the great achievements with which historians of linguistics will have
to credit Roman Jakobson.

Like Saussure, Jakobson draws a sharp distinction between distinctive
features of speech sounds ("faits ... capables de différencier les significati-
ons dans la langue intellectuel")⁴ and their other phonetic properties.
For a time the latter were relegated to an almost invisible position in the
scheme of things, so that Jakobson felt justified in likening the relation-
ship between phonology, the study of distinctive features of speech sounds, and
phonetics, the study of all properties of speech sounds without regard to
their distinctive function, to the relationship holding between political
economy and the statistics of the gross national product, or between the
science of finance and numismatics.⁵ He soon became aware that this
was too radical a move, but in this early stage the fact that all sorts of
phonetic minutiae could be relegated to the background so that maximum
attention could be concentrated on a clearly limited domain of relevant
data had a tremendously liberating effect: it was possible for the first time
to discern functional patterns in language that appeared to be of great
generality and to possess obvious significance. These were primarily the
patterns constituted by the phonemes of a given language, to which the
name phonological system was then applied.

The study of phonological systems has remained throughout Jakobson's
long preoccupation with phonology at the center of his concerns. It be-
hooves us, therefore, to examine in detail what he understands by this
term. From the very beginning, Jakobson viewed the phonological system
as something much more structured than a mere list of phonemes, than
an alphabet.⁶ The phonological system always implied for him a specific
organization of the phonemes into a multi-dimensional array, where each
phoneme is distinguished from every other phoneme by one or more
"significant differences." Thus, in his "Propositions," submitted in 1927
to the First International Congress of Linguists and co-signed by S.
Karcevskij and N. Trubetzkoy, Jakobson wrote: "Every scientific descrip-
tion of the phonology of a language must above all contain a characteriza-
tion of its phonological system, that is to say, a characterization of the repertory, proper to this language, of the distinctive differences among its acoustico-motor units (des différences significatives entre les images acoustico-motrices)." And again in the introductory section of the early masterpiece, Remarques sur l'évolution phonologique du russe, written at the same time, Jakobson observes: "We call phonological system of a language, . . . the repertory of oppositions which in a given language can be associated with a differentiation of meaning (repertory of phonological oppositions). Terms of a phonological opposition that are not susceptible to being dissociated into smaller sub-oppositions are called phonemes." He is at particular pains to make clear that the phonemes are not the ultimate elements of the analysis but that they themselves are to be viewed as entities in a pattern of differential signals. Thus, he rejects the view of the phonological system as a collection of sounds, on the grounds that such a view "would involuntarily focus attention on the ideas of the acoustico-motor units themselves. The types of their mutual inter-relations would then not be subject to the desired analysis; but, it is just in these (inter-relations) that the essence of a phonological system inheres. The sign in itself is fortuitous and arbitrary." (SWL, 1971:9, emphasis supplied).

Perhaps the clearest illustration of Jakobson's conception of the structure inherent in a phonological system can be found in the following passage from his 1930 monograph K xarakteristike evraziyskogo jazykovogo sojuza:

One must not imagine the phonological inventory of a language as a mechanical sum of phonemes. Phonemes stand in specific relations one to another; they constitute a system. Not infrequently a phoneme of one language is in itself (physically) identical with some phoneme of another language but the place that the two phonemes occupy in their respective phonological systems is different. As an illustration let us juxtapose the system of vowel phonemes belonging to three different languages:

<table>
<thead>
<tr>
<th>I</th>
<th>II</th>
<th>III</th>
</tr>
</thead>
<tbody>
<tr>
<td>a</td>
<td>o e</td>
<td>a</td>
</tr>
<tr>
<td>u i</td>
<td>o e</td>
<td>u i</td>
</tr>
</tbody>
</table>

In both the first and the second system we find the phonemes o and e, but their position within the system differs. In language II they are the corner phonemes of a triangle: o is acoustically the lowest pitched, and e the highest pitched vowel in the system; in language I, the vowels o and e are phonemes of "the middle layer," whereas the role of the acoustically lowest pitched corner phoneme is played by u and the role of the highest pitched by i. As regards their function in the system the vowels u and i in language I are closer to the vowels o and e in language II.
than are the externally identical phonemes ə and e of language I. The closest parallel to system II is system III. These two systems are phonologically identical; except that in system II the lowest pitched phoneme is realized as ə, whereas in system III as u, and correspondingly the highest pitched phoneme is realized in one case as e and in the other as i.\textsuperscript{11}

These statements call for two comments. On the one hand, it should be noted that the basis of the distinction is phonetic (auditory). In the case under discussion, the vowels are distinguished with regard to their proper pitches and in all three languages the extreme pitch values – i.e., the lowest and highest pitched vowel – occupy a special position. What differentiates the languages are the absolute values that characterize, the extrema; these may differ from language to language – as Jakobson’s example shows – without affecting the structure of the system in which maximally high- and low-pitched phonemes (those forming the two lower corners of the sound triangle) are distinguished from the rest of the vowels.\textsuperscript{12}

The second remark appropriate here is that at least in the earlier stages of his phonological investigations Jakobson believed that oppositions, not only with respect to the phonetic properties employed in their physical actualization but also with respect to their abstract structure. Thus in *Remarques* he observes that, “the phonological system presents two fundamental types of oppositions: correlative and disjoint.”\textsuperscript{13} The former, exemplified by such pairs as voiced-voiceless, palatalized-unpalatalized, stressed-stressless, long-short, etc., are the precursors of the binary features that in the later development of Jakobson’s thought became the only type of distinctive feature. The disjoint oppositions constitute all the rest. Jakobson gives\textsuperscript{14} the following table of the phonemic system of modern Russian, where “parentheses enclose the correlative phonemes.”

\[
\begin{align*}
(i, i') &\, (u, u) \\
(\ddot{a}, a) &\, (\ddot{e}, \ddot{o}) \\
(r, r') &\, (t, l') \\
(\ddot{z}, \ddot{s}) &\, (\ddot{c}, \ddot{c}) \\
(\ddot{g}, \ddot{k}) &\, (\ddot{g}', \ddot{k}') \\
(\ddot{d}, \ddot{t}) &\, (\ddot{z}, \ddot{z'}) \\
(\ddot{b}, \ddot{b'}) &\, (\ddot{v}, \ddot{v'}) \\
\end{align*}
\]
As can be seen from the table the disjoint oppositions were not necessarily nonbinary, but rather they did not characterize relationships between pairs of phonemes where one member possessed a particular feature (e.g., was voiced) and the other did not (e.g., was voiceless). Instead, disjoint oppositions characterized phonemes that differed in other ways than possession vs. nonpossession of a specific property, e.g., the contrast between the stops and fricatives is binary and disjoint.¹⁵

In Jakobson's conception, an essential component of a speaker's linguistic competence, of his knowledge of his language, is his mastery of its phonological system, of its repertory of phonemes. Sound change, therefore, is for Jakobson primarily change in the repertory of phonemes. In this Jakobson dissents sharply from Saussure, for whom change was a phenomenon of parole and hence essentially outside the purview of systematic study. In the earliest paper printed in Volume I of Jakobson's Selected Writings, a translation of a "brief extract" from "a paper delivered in the Prague Linguistic Circle, January 13, 1927," we read: "F. de Saussure and his school broke a new trail in static linguistics, but as regards the field of language history they remained in the neo-grammian rut. Saussure's teaching that sound changes are destructive factors, fortuituous, blind, limits the active role of the customary linguistic pattern as an orderly system. This antinomy between synchronic and diachronic linguistic studies should be overcome by a transformation of historical phonetics into a history of phonemic system. In other words, phonetic changes must be analyzed in relation to the phonemic system which undergoes these mutations."¹⁶

Jakobson's great monograph Remarques sur l'évolution phonologique du russe comparée à celle des autres langues slaves¹⁷ is above all an attempt to defend and illustrate these new theses by following the evolution of the successive phonological systems which ultimately gave us the system of present day literary Russian. I shall exhibit here the methodology of the book and illustrate it by reviewing a few examples cited by Jakobson.

The book begins with a discussion of the so-called First and Second (Baudouin de Courtenay) Palatalizations of the Slavic velars. According to Jakobson, the First Palatalization resulted in the replacement of the velars [k g x] by the palatals [ɛ ɛ̃ ɛ̆] in position before front vowels, whereas the Second Palatalization replaced velars by phonetically indeterminate consonants (Jakobson represents these as k₁ g₁ x₁) in the environment after long or short [i] when followed by short [o] or short [u]. These newly created sounds are, at this stage, not new phonemes, but positional variants of the velar phonemes in the specified environments. Subsequent to the
introduction of these new sounds, which are all marked by a palatal (i.e.,
front) articulation, the language is subject to a strong tendency to establish
uniformity in its syllables, so that these will consist exclusively of back
(velar) or of front (palatal) phonemes. This “syllabic synharmonism” leads
to the fronting of vowels after the newly created [k₁ ɡ₁ ɣ₁], for these were
phonetically front. The result of this change is that the two newly created
types of consonants, the [ɛ ɔ ʃ] of the First Palatalization and the [k₁ ɡ₁ ɣ₁]
of the Second Palatalization are in contrast before front vowels. Neither of
these two classes of consonants contrast with velars, however, since velars
never appear before front vowels. The question then is whether [ɛ ɔ ʃ] or
[k₁ ɡ₁ ɣ₁] are to be viewed as the positional variants of the velars. Jakobson
decides this question in the following manner: “In view of the fact that
k-k₁, ɡ-ɡ₁, x-x₁ are found in grammatical alternations more frequently
than k-ɛ, ɡ-ɔ, x-ʃ, it was ɛ ɔ ʃ that as a result of the revision of phonological
values assumed the role of independent phonemes, while k₁ ɡ₁ ɣ₁ continued
to be valued as extra-grammatical variants of k ɡ x.” 18

The basic mechanism of sound change is thus the addition of rules such
as the First and Second Palatalization of Slavic in the example just dis-
cussed. These rules affect classes of phonemes and hence their addition
brings about change in the pronunciation not of single words but rather
of the entire stock of words known to a speaker. As a result of the addi-
tion of a rule, new patterns of contrasts may arise in the language. In the
case under discussion, [ɛ ɔ ʃ] contrasted distinctively with [k₁ ɡ₁ ɣ₁] in
position before front vowels as soon as the Second Palatalization (rule)
came into the language. Once such a new contrast appears, the language
responds by restructuring the phonological system. 19

This picture emerges with especial clarity in Jakobson’s account of the
effects that the dropping of the so-called “weak jers” had on the phono-
logical system of Slavic languages. As is well known, the “jers” – i.e., the
short high vowels [ɨ] and [u] – were dropped in certain positions, e.g.,
word-finally. According to Jakobson this phenomenon originated in rapid
speech but ultimately was generalized to all styles of speech. In those
Slavic languages where syllabic synharmonism – the tendency to limit the
composition of syllables to phonemes of a single type (front or back) – had
been carried out to the point where before front vowels there were only
front (or “soft”) consonants and where back (or “hard”) consonants were
to be found only elsewhere, the dropping of “weak” jers produced contrasts
of “hard” and “soft” consonants. Originally kladu-klad. ḭ were distinguished
by the fact that the second syllable in the former was “hard,” whereas in the
latter it was “soft.” The contrast between d and Ḫ, is nondistinctive since
the language is subject to a rule of syllabic synharmonism. The situation changes radically as soon as word final jers are deleted because the language now no longer has syllabic synharmonism as shown by such newly mono-
syllabic words as klad-klad. Once syllabic synharmonism is destroyed the
distinction between “soft” and “hard” consonants takes its place. “The
emergence of the opposition ‘soft consonants – hard consonants’ renders
valueless the opposition of soft and hard sequences taken as units.”

In his letter of 19 September 1928 Trubetzkoy wrote to Jakobson: “I
have been putting together and comparing all vowel systems that I know by
heart (34 in toto)... The results are most interesting. All systems reduce to a
small number of types and can always be represented by symmetric sche-
mata (triangles, parallel rows, etc.).” What Trubetzkoy had noticed here
(these results were later published in Trubetzkoy’s Zur allgemeinen Theorie
der phonologischen Vokalsysteme, and also incorporated in his Grundzüge
def Phylogenie, was that vowel systems of the most varied sorts not only
exhibit the same basic phonetic contrasts (essentially, front-back and tongue
height), but also that these contrasts in a very obvious fashion underlie the
internal organization of each system. This was an important insight since
at this point both Trubetzkoy and Jakobson saw the substantive content of
the opposition as being language particular, and only the structure of the
opposition (correlative, disjoint, etc.) was regarded as a linguistic
universal.

In his “Retrospect” to Selected Writings Jakobson comments that
Trubetzkoy’s paper on vowel systems “came close to reducing the vocalism
to a few binary features. It was gradually shown that each of these opposi-
tions was utilized in some of the extent species of the so-called vowel
harmony which lays bare the dichotomous structure of all vocalic attributes
and displays their operational autonomy with particular clarity.”

By the middle of the 1930’s Jakobson had come to the conclusion that
all features are essentially binary. He first expressed these ideas in the
important paper that he presented to the Third International Congress of
Phonetic Sciences in 1938, “Observations sur le classement phonologique
des consonnes.” Jakobson begins this paper by declaring that in order to
identify (= specify) the phonemes of a language it is necessary to decom-
pose them into their constitutive phonetic features. This was a great step
forward, for in effect Jakobson declared here the primacy of the feature
over the phoneme. Whereas previously phonemes had been thought of as
further undecomposed entities which could be characterized with the
help of features, much as chemical elements were once thought to be
categorized with the help of such properties as valence, atomic weight,
etc. Instead Jakobson here proposes that phonemes are nothing but complexes of features, much as chemical atoms are now seen as specific configurations of protons, electrons, etc.

Having thus placed the features at the center of phonological discussions, Jakobson proceeds one step further. He proposes that all features reflect binary oppositions between entities. He remarks first that this is almost self-evident with regard to the vowel system of a language such as Turkish which consists of eight phonemes exemplifying three binary features. These have traditionally been thought to be open-close, palatal-velar, rounded-unrounded. Jakobson believes that this is too narrowly phonetic a view of what is at issue here. Instead he invokes acoustic evidence which, in his opinion, shows that the open-close dimension is a special implementation of the property of *perceptibility*. “In contrast to the closed vowels, open vowels have, from an acoustic point of view, greater perceptibility and a clearer sound.” The differences between palatal and velar vowels, and between rounded and unrounded vowels, on the other hand, are related to a difference in pitch. Jakobson proposes that velar vs. palatal vowels should be distinguished as “grave” vs. “acute” sounds. A different type of pitch difference distinguishes rounded from unrounded vowels.

It should be noted at once that in claiming that all features reflect binary oppositions Jakobson does not insist that all oppositions are of a single abstract structure. Instead he believes that some oppositions are *contradictories*, i.e., they contrast entities which possess the given property to those that do not, e.g., long vowels contrasting with vowels without length; while others are *contraries*, i.e., they contrast entities which, while possessing the given property, exhibit it to a maximal, respectively, to a minimal degree, e.g., acute and grave vowels (the former being maximally and the latter being minimally high pitched).

Having shown that vowel systems can be characterized by a set of binary features, Jakobson turns next to the consonants. He notes that most consonantal features such as voiced-voiceless, nasal-oral, palatalized-plain, are self-evidently binary. The major non-binary feature in the consonantal system is the point of articulation, which happens also to be central to every framework that has ever been proposed. Jakobson, therefore, attempts to show that this deeply entrenched analysis can be replaced by a more adequate one employing binary features.

Jakobson first proposes to distinguish velar and palatal consonants from labials and dentals by the fact that the former are more perceptible, louder than the latter. On the other hand, he observes that velars are lower pitched than palatals, and that the same pitch relations hold for
labials vs. dentals. This was a tremendously important move because it established not only that the major points of articulation can be characterized by means of two binary features but also that the two features involved – perceptibility and pitch – are the same as those found in the vowels. Jakobson was thus able to overcome one of the most unintuitive aspects of phonetic frameworks that were then in wide use (and continue in wide use to this day). These frameworks – cf., e.g., Bell’s system – utilize separate sets of features for vowels and consonants. For some reason, with the exception of some early Hindu grammarians, no one before Jakobson appears to have been struck by the implausibility of such an arrangement, for it implies that different mechanisms are involved in the production of vowels than in the production of consonants, and yet one set of articulators is involved in the production of both types of sound, and an analogous case for a single mechanism can also be made with regard to perception.

The four classes of consonants established by means of the two features pitch and perceptibility (later renamed gravity and compactness) do not suffice to characterize all consonantal points of articulation. Jakobson notes that additional distinctions divide each of the four major classes into two subclasses: “Thus, we distinguish the linguo-dentals from the hissing sounds, the palatals, properly speaking, from the hushing sounds, the bilabials from the labio-dentals, the velars, properly speaking, from the uvulars. Ordinarily these consonants have been ordered linearly according to the region of their articulation, although phonetic descriptions have allowed us to observe on numerous occasions that from this point of view the delimitation of the series in question is hardly possible. What is then the specific difference that determined these subdivisions?”25 (SW I 1971: 276-7).

Jakobson’s answer is that the difference is due to the feature of “stridency”: “Marked friction of the exhaled air eliciting an edge tone (the Schneidenton of Stumpf) contrasts the hissing, hushing, labio-dental and uvular sounds, in one word the strident consonants, as against their ‘partners’ listed above, which can be termed mellow consonants. A supplementary obstacle participating in this friction distinguishes the articulation of the strident constrictives from that of the mellow... The same intense friction distinguishes the strident and mellow occlusives. The former are affricates...while the latter are proper occlusives...”26

Jakobson (or perhaps more correctly Stumpf) appears to be in error in referring to edge tones here. There are no edge tones in the strident
consonants, except inadvertently produced whistles in articulating [s]. But he is entirely right in viewing the difference between strident and non-strident (mellow) sounds as being produced by the presence in the former of a special obstacle against which is directed the air stream. It is this extra obstacle that allows the speaker to create what is technically known as “turbulence at a boundary” which is a plausible acoustical correlate of strident sounds.

The system of features just outlined, with some obvious extensions as well as modifications and improvements, has remained the basis of all of Jakobson’s subsequent explorations in phonological theory. Although the Jakobsonian feature system has received extensive discussion in the literature and has affected almost all subsequent research it has been widely misunderstood in one respect: because of the prominence given by Jakobson to acoustic considerations in setting up the distinctive features and because attention to acoustic properties was rather unusual in phonological discussions, Jakobsonian features are frequently referred to in the literature as acoustic features. Jakobson never intended to limit the features in this manner, rather he consistently held to the view that all features have manifestations on all relevant levels—articulatory, acoustic, perceptual: “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 self-evident fact that we speak in order to be heard and need to be heard in order to be understood.”

Jakobson regards the distinctive features as the fundamental building blocks of which all speech sounds in all languages are constructed. He is, therefore, constantly at pains to show that the role of the features is not limited to the characterization of the phonetic attributes of speech sounds but goes well beyond it. He shows that features serve to characterize the acquisition of language by children, the loss of language in aphasia, the distribution of speech sounds in the languages of the world, the restrictions of sound sequences imposed by metrical and other conventions of poetry, and, last but not least, the effects of diachronic sound laws as well as of synchronic phonological rules. He views the above not only as direct confirmation of the correctness of the postulated features, but also as a means for gaining insight into the functioning and nature of the features themselves.

Perhaps the most extensive of Jakobson’s efforts in this direction is *Kindersprache, Aphastie und allgemeine Lautgesetze*, which, judging by
its many translations, must surely be the most popular of Jakobson's works. In this book Jakobson attempts to show that the acquisition of speech sounds by children proceeds in the reverse order of the loss of control over speech sounds by aphasics. Facts of this sort had until that time rarely been taken into account in discussion of linguistic issues. Moreover, Jakobson attempted to show that these processes are governed by certain broad principles that are best captured in terms of distinctive features, and that the same principles provide an explanation for the distribution of sounds in phonological systems of different languages.

Jakobson first establishes the fact that phonetic contrasts are acquired in the same order by children of the most varied linguistic background: "Regardless of whether it deals with French or Scandinavian children... every careful description confirms for us the remarkable fact that for a series of sound acquisitions the relative time sequence remains everywhere and always the same."39 (SW I, 1971:356). In aphasics the loss of speech sounds shows that the reverse order of the process of acquisition in children: "The dismantlement of the linguistic sound repertory in the case of aphasics provides an exact mirror image of the process of construction of child language. Thus, for example, the acquisition of the liquids r and l is a fairly late acquisition of child language and... one of the earlist and most frequent losses in aphasis disturbances,"30 (SW I, 1971:368). This, however, is not all. The same principles appear to govern the distribution of particular phonetic contrasts in the languages of the world: "Contrasts, which appear rarely in the languages of the world, belong among the latest phonetic acquisitions of the child."31 "The number of languages with a single liquid (be it l or r) is inordinately large, and in this connection Benveniste points out quite rightly that the child is satisfied with a single liquid for quite a long time and acquires the other liquid only as one of the last speech sounds" (in its repertory - M.H.).32

Maximally contrasting entities are first in the order of acquisition of speech sounds, which in Jakobson's view proceeds from simple unarticulated structures to complexly differentiated ones. Jakobson believes that the maximal contrast among speech sounds is represented by that of the open vowel a and the labial occlusive p: "The earliest stage of child language begins with a clear differentiation and delimitation of vowel and consonant... From the motor point of view these two classes of speech sound contrast as blockage vs. opening. The optimal opening is attained in the wide [a] -vowel. The extreme contrast to the [a] vowel is provided by the occlusives, and among the occlusives it is the labials that block off the entire oral cavity."33
Once this maximal contrast is acquired by the child, the process of articulation and differentiation can begin. The first development appears in the consonant system; the new variety that appears is the nasal consonant, a structure which combines the characteristic oral cavity closure of the consonants with a simultaneous (vowel-like) opening of the vocal tract via the velum. Thus, from a contrast between open and shut vocal tract there develops a more refined contrast between a totally unobstructed passage from the glottis to the ambient air vs. one that is partially or fully obstructed; i.e., a simple gross contrast evolves into a more complicated and refined one.

To explain the next step in the universal order of sound acquisition Jakobson reviews certain findings of such German psychologists as Köhler and especially Stumpf, whose psychoacoustic investigations of the speech sounds, Die Sprachlaute (Berlin, 1926), exercised a profound influence on Jakobson’s thought. These researchers believed that there were essential parallels between the perception of colors and that of speech sounds. They proposed that certain attributes of speech sounds corresponded to the color attributes of saturation (Farbigkeit) and lightness (Helligkeit). In particular, they identified saturation with sonority (Schallfuelle) and lightness with subjective pitch (Tonhoehe). They noted that these two dimensions of the color space are not totally orthogonal. Highly saturated colors admit of no (or only very limited) distinctions in lightness, and the same limitation appears to hold for speech sounds: maximally open sounds such as the low vowels allow only for limited distinction in lightness (pitch), whereas minimally open sounds such as the occlusives readily allow for pitch distinction, e.g., distinctions between labial (dark) and dental (light) consonants are found in all consonantal systems: “Much like visual sensations speech sounds are, on the one hand, light or dark, and, on the other hand, saturated and unsaturated. With decreasing saturation (sonority) the contrast of lightness and darkness gains in importance. The wider the vowels, the more saturated they are and the greater is their distance from the lightness contrast. Of all vowels, a possesses the greatest saturation and is least affected by the contrast light/dark, while the narrowest vowels, which are particularly subject to this contrast, exhibit minimal saturation.”

Since at this stage of the child’s acquisition of speech the system is composed of only one vowel whose primary distinctive property is that of being maximally saturated, we do not expect lightness distinctions to develop among the vowels; we rather expect to see these developing in the consonant system, since consonants are minimally saturated and hence
maximally susceptible to distinctions in lightness. The light counterpart to
the labial occlusive is the dental. Thus, at this early stage of speech
development we find a system that contains a single vowel $a$ and four
types of consonants distinguished by the features nasal-nonnasal and light
dental)-dark (labial).

Since this path of development is blocked for the vowels, these evolve
first by attenuating the openness dimension. In contrast to the maximally
open and saturated $a$ there evolves a relatively closed and somewhat less
saturated variety of vowel, the so-called high vowel. But since the vowels of
the latter kind are less saturated than $a$, they are also less resistant to the
development of lightness contrasts. As a result we find quite commonly
three-vowel systems of the a-i-u variety.

Following Stumpf, Jakobson identifies sonority (Schallfölle) as the
psychoacoustic correlate of saturation. Since $a$ is normally louder, more
audible than either $i$ or $u$, sonority is ultimately equated with sound intensity
and loudness. Given this definition the consonantal counterpart of the
saturated $a$ is the velar $k$ because according to the best available psy-
choacoustic data (cf. Fletcher, Speech and Hearing [1928]), $k$ is more
intense, louder than $p$ or $t$. The development of this (relatively) saturated
consonant is the next stage in the process of language acquisition. Once
this is completed the vowel system consisting of i-u-a and the consonant
system consisting of dentals, labials and velars exhibit identical structure:

$$
\begin{array}{c}
\text{k, a} \\
\text{p, u} \\
\text{dark} \\
\text{ti} \\
\text{light} \\
\text{unsaturated}
\end{array}
$$

Although one cannot fail to admire the ingenuity and daring of Jakobson's
constrictions and of his theoretical imagination, it is not obvious – at least
to this reviewer – that this account of speech sound acquisition is well-
founded. It is to be noted that the order of acquisition of phonemes
concerns exclusively their production and specifically does not affect their
perception. Jakobson recounts a whole series of anecdotes whose central
point is that children who are unable to produce phonetic contrast are
perfectly capable of distinguishing the contrasting sounds in speech of
others.34 (see SW I, 1971:336-7). If the acquisition of phonology concerns
primarily the production of sounds and not their perception, it is puzzling
what relevance should be attributed to the cited parallels with color per-
ception. One might expect a parallelism between the perception of colors
and the perception of sounds, but it is hardly likely that the perception of
color will shed any light on the order in which a child learns to manipulate various muscle groups in order to produce the different phonetic contrasts. It might be worth emphasizing that Jakobson adduces the parallelism between speech sounds and colors in order to buttress his suggestion that both vowel and consonant systems are organized in the fashion illustrated by the graph on the preceding page. Hence, by questioning the relevance of this parallelism between colors and speech sounds we are questioning this particular organization of the speech sounds, and we are leaving unaffected the more fundamental proposal that the same set of features underlies both vowels and consonants.

Jakobson has continued to develop and refine his ideas on the distinctive features down to the present. Since I had the good fortune of collaborating closely with Jakobson on much of this research, I feel that it would be inappropriate for me to review it here. I omit, therefore, this aspect of Jakobson’s work from consideration and turn to other matters.

In the preceding, attention has been focussed almost exclusively on the phonological system: its structure, the changes that it undergoes, the manner in which command over it is acquired by a child and lost by an aphasic. These have been the main topics of discussion. A fluent speaker’s command over the phonology of his language, however, crucially involves yet another component: the rules that govern the distribution and actualization of a given phoneme in different contexts. The fact that English voiceless stops are aspirated in pretonic position unless preceded by [s] or that in Slovak long vowels are shortened after syllables with a long vowel in conformity with the so-called “rhythmic law” is information that a fluent speaker of these languages must have and that therefore must be explicitly included in a phonological description of these languages.

Up to this point in our discussion we have encountered rules primarily as agents of sound change (see pp. 00-00 above). It hardly needs pointing out that this is not their only role in language. In fact, they can affect change only because they are an integral component of the synchronic functioning of the language. In view of this, phonological descriptions always include extensive discussions of various rules, and Jakobson’s studies of extensive discussions of various rules, and Jakobson’s studies are no exception: they devote considerable space to various phonological rules among which one can find some of the most significant and lasting results obtained by Jakobson. To mention but a few these include the “dissimilation rule” characteristic of an important group of Southern Russian dialects, the treatment of vowel length and its relationship to diphthongization in standard Slovak, the principles of word accentuation in classical
Greek,\textsuperscript{38} consonantal alternations in Gilyak,\textsuperscript{39} and the rules of the Russian conjugation.\textsuperscript{40}

It should be remarked at once that Jakobson’s conception of the rules differs in many respects from that prevalent in present day generative phonology. For instance, Jakobson draws a distinction between phonology (or phonemics) proper and morphophonemics, and views most of the rules cited immediately above as belonging to morphophonemics rather than to phonology, on the grounds that they result in the replacement of one phoneme by another, whereas phonology proper should be restricted to a consideration of the sub-phonemic (positional) variants of the phonemes.\textsuperscript{41} However, there is good reason to suppose that for Jakobson this distinction is considerably less basic than it was for many other phonologists, especially on this side of the Atlantic. In an article published in 1932 Jakobson writes that “Word phonology inventories the phonemes peculiar to a given language, their interrelations and possible combination . . . A special branch of word phonology is morphological phonology or mor(phon)ology, which analyzes the phonological structure of the various morphological components of the word.”\textsuperscript{42} The impression that the distinction between morphophonemics and phonology is quite peripheral in Jakobson’s scheme of things is further supported by his observation of 1948 that “any . . . comprehensive study of a phonemic pattern inevitably runs into the problem of partial patterns mutually distinguishing and specifying the diverse grammatical categories of a given language. The limit between phonemics proper and the so-called mor(phon)emics is more labile. We glue from one to the other imperceptibly.”\textsuperscript{43} Moreover, it should be noted that Jakobson did not take an active part in the debates of the 1960’s that raged around the separateness of morphophonemics from the rest of phonology. Although we knew that Jakobson did not fully share our views, those of us who argued against the separation of levels found in Jakobson’s practice some of the most striking examples to support our position. I conclude from the preceding that the distinction that Jakobson makes between morphophonemics and phonology proper should be regarded as an expository device and does not reflect the view that morphophonemics is a special level of representation, distinct and separate from phonology, having its own primitive entities and its own principles of organization. Instead, in Jakobson’s practice, morphophonemics and phonology both make use of the same set of primitives (the distinctive features) and the same type of rules.

For my discussion of Jakobson’s phonological rules I have tried to choose instances where rules serve not only to characterize an interesting
body of linguistic data but where they also support theoretical proposals made by Jakobson. The abstract structure of these arguments is usually of the following form: given a particular theoretical proposal the configuration of facts under discussion is highly probable, whereas in the absence of the theoretical proposal that observed configuration of facts would have to be regarded as a mere accident. Since it is *prima facie* implausible that the configuration is accidental, its existence provides in support of the theoretical proposal. This form of argumentation, though standard in most science, was long regarded as questionable by linguists, many of whom felt that theoretical proposals and constructs could be justified only if it were shown that they were discoverable in the data by following certain procedures laid down in advance. In using the type of circumstantial argument just outlined, Jakobson was thus going against a very powerful current in the field. He had the good fortune to see the current reverse direction and his own practice fully vindicated.

One instance where Jakobson made use of the type of argument just sketched has already been mentioned. It was noted above that to support his proposal that gravity is a binary feature in vowels Jakobson adduced the vowel harmony rule of Turkish. As is well known, in this language the vowels in a word must all be either grave or acute; a mixture of grave and acute vowels in a word is forbidden. The language thus treats all vowels as if they belonged to one of two mutually exclusive classes. This is precisely what one would expect to find if features are binary. If gravity were a multi-faced feature the binary treatment of the vowels by the language would have to be regarded as purely accidental. Since vowel harmony of the Turkish type is wide spread among the Uralic-Altaic languages, it could not plausibly be regarded as an accident. Hence the facts just discussed must be viewed as evidence supporting the proposition that the feature grave-acute is binary.

The same type of circumstantial argument is used by Jakobson in support of his suggestion that the features gravity and compactness characterize not only the vowels, but also the consonants. He cites the fact that in Rumanian [k] became [p] before [s,t] and observes that with the help of the two features the process can be shown to be an instance of partial assimilation; i.e., a type of process that is well attested in many languages. In feature terms the process would be described as one where compact stop sounds become diffuse (noncompact) “sans perdre sa gravité” if they precede diffuse acute obstruents.44

As an additional bit of evidence in favor of the features gravity and compactness, Jakobson cites the case of certain Czech dialects, where
[p b m] changed to [t d n] before [i], or, in the new feature terminology, diffuse consonants become acute if followed by an acute diffuse vowel. What is of special interest here is that acuteness is, as it were, transmitted from vowel to consonant, a fact that would tend to support Jakobson's suggestion that grave-acute is a feature of both vowels and consonants.

The last example I have chosen to discuss are the rules of the "Russian Conjugation." This is among most widely quoted works because it deals with a very crucial phenomenon in a widely studied language. For our purposes the important point is that the paper attempts to establish a clear distinction between what in more recent studies would be described as surface and underlying representations and to relate the two by means of a set of explicit rules of considerable complexity. This point is brought out clearly, though somewhat obliquely, in the epigraph which appears in the version printed in the second volume of Jakobson's Selected Writings (it does not appear in the original version of the paper in the 1948 volume of the journal *Word*, but is referred to in a footnote). The epigraph reproduces the following passage from Bloomfield's *Language*:

We have seen that when forms are partially similar, there may be a question as to which we had better take as the underlying form, and that the structure of the language may decide this question for us, since, taking it one way, we get an unduly complicated description, and taking it the other way, a relatively simple one.

The major problem of the Russian conjugation, and indeed of the conjugation in all Slavic languages, stems from the fact that for many verbs there are two distinct stems, one for the infinitive and past tense forms, the other for the present tense and imperative forms. The difficulty is to decide which of the two stems, if any, is basic. What all approaches prior to Jakobson have in common is the supposition that if a single stem is to be postulated as basic it must be the same stem – i.e., infinitive or present stem – for all verbs. As a rereading of the passage quoted above shows, this is not the procedure recommended by Bloomfield, nor is it followed by Jakobson. Instead, in line with Bloomfield's recommendation, Jakobson chooses as basic the stem that ensures the simplest description in each case without regard to the fact that for one verb – e.g., *stoja* 'to stand' – this is the infinitive stem, whereas for another verb – e.g., *citaj* 'to read' – this is the present tense stem. It turns out that when the two stems differ in length, the longer must be chosen as basic, or as full-stem, to use Jakobson's terminology. Moreover, "if certain phonemic constituents of the given full-stem as compared with cognate forms appear in different alternants, we take as basic the alternant which appears in a position where the other
alternant too would be admissible." Once the proper choice of the basic full-stem has been made with the help of these principles, a number of simple rules permit us to derive the correct actualization of each verbal form.

The rules that constitute the heart of Jakobson’s description are the following two truncation rules:

“Open full-stems (i.e., stems ending with a vowel – M.H.) remain intact before a consonantal desinence and lose their final phoneme before a vocalic desinence.”

“Full-stems in je n m drop their terminal phoneme before a consonantal desinence.” (SW II, 1971:124)

The effects of these rules are illustrated below:

Open stems before consonantal desinence: stoj + a + t’ ‘to stand’
Open stem before vocalic desinence: stoj + a + u → stoj + u ‘I stand’
Stem in j before consonantal desinence: čit + aj + t’ → čit + a + t’ ‘to read’
Stem in j before vocalic desinence: čit + aj + u ‘I read’

The two truncation rules clearly are part of a fluent Russian speaker’s knowledge of his language; he uses them to produce the appropriate conjugational forms of newly coined verbs. It is necessary, therefore, to include these rules in a complete scientific description of the language. For some reason this discovery has yet to be incorporated in all standard text books of Russian; e.g., the most recent large-scale grammar of the Russian language, Grammatika sovremennogo russkogo literaturnogo jazyka, does not utilize Jakobson’s epoch-making discovery in its treatment of the verbal conjugation. It is conceivable that one of the causes for this neglect is the feeling of disbelief on the part of many linguists that any psychological reality hides behind a solution such as Jakobson’s which implicitly assumes that the production or analysis of a given form involves an abstract underlying string as well as a process of calculation utilizing the rules given above. I can testify that when I first read “Russian Conjugation” in the summer of 1949 this aspect of its description was a major stumbling block for me. I overcame it by suspending disbelief long enough to work out part of the conjugation of other Slavic languages and discovered that with some straightforward modifications Jakobson’s approach held there, too. This discovery convinced me, and I strongly recommend the same procedure to anyone who has doubts about the approach on theoretical
grounds. In an empirical science, results like those just mentioned cannot be rejected on theoretical grounds; rather they provide the strongest argument possible for a re-examination of the theoretical grounds that appeared to exclude them. In my own case this re-examination ultimately led to what has since become known as generative phonology. But this, as Jakobson would say, is an interesting autobiographical remark which has only indirect bearing on the subject under discussion.

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NOTES

*This chapter was originally written for Sound, Sign and Meaning: Quinquagenary of the Prague Linguistic Circle, ed. Ladislav Matejka (Ann Arbor: Michigan Slavic Publications, 1976). It is reprinted here with the editor's permission. This work was supported in part by Grant 2P01MH13390-09 from the National Institutes of Mental Health. Except where specifically indicated otherwise, translations of texts in languages other than English are my own.

3 Ibid.
4 Selected Writings I, p. 21n.
6 It is worth mentioning that Jakobson's concept of phonological system shows many resemblances to the concept of sound pattern developed somewhat earlier by Edward Sapir (see Sapir's celebrated "Sound Patterns in Language," Language 1 [1925], 37-51).
7 Selected Writings I, p. 3.
8 Selected Writings I, p. 8.
9 Selected Writings I, p. 9; emphasis supplied.
10 Selected Writings I, pp. 144-201.
11 Selected Writings I, pp. 151-52.
12 This relativistic character of the differentiating signals plays a central role in Jakobson's conception of the phoneme and permits him to avoid certain, though not all, problems posed by what in the American linguistic literature was to become known as "total overlap." Thus, in a rejoinder to one of his American critics, Jakobson notes that Danish pretonic ɒ and posttonic ɒ "which both are phonetically similar...nevertheless represent two different phonemes" (Selected Writings I, p. 436) because in pretonic position ɒ contrasts with the more energetically articulated ɾ, while in posttonic position ɒ contrasts with the less energetically articulated ɻ; thus the relation ɾ:ɻ in pretonic position is paralleled by the relative ɒ:ɻ in posttonic position (see R. Jakobson, G. Fant, M. Halle, Preliminaries to Speech Analysis [10th printing, Cambridge, Mass.: M.I.T. Press, 1952], pp. 5 ff.). This move was not available to anyone who viewed phonemes as sets of sounds sharing particular absolute physical properties, rather than as physical actualizations of entities in an abstract pattern of oppositions.
13 Selected Writings I, p. 9.
14 Selected Writings I, p. 13.
15 It is significant in the light of later developments in Jakobson's thought that in his
very first writings on the subject he tended to lay maximal stress on correlative oppositions. Referring to the "Propositions au Premier Congrès International des Linguistes," of which he was a co-signer, N. Trubetzkoy in a letter to Jakobson notes that Jakobson "discusses, as a matter of fact, only the simplest case: the opposition of two correlative distinctions. But the matter is considerably more complicated when what is opposed to one another is not two, but rather three or more of such distinctions" (N. S. Trubetzkoy's Letters and Notes, prepared for publication by Roman Jakobson [The Hague: Mouton, 1975], letter of 24/X/27, p. 110). The issue of binary vs. multi-valued features that Trubetzkoy and Jakobson continued to debate to the very end of the former's life thus had roots going back to a very early stage in their collaboration.

10 Selected Writings I, pp. 1-2.
11 =Travaux du Cercle Linguistique de Prague II (1929).
12 Selected Writings I, p. 28.
13 I have been unable to find an explicit statement in Jakobson's writings indicating whether he believes that the phoneme system of an adult speaker can undergo change or that such change can be observed only between phoneme systems of successive generations of speakers.
14 Selected Writings I, p. 57.
16 P. 635.
17 Jakobson had already expressed the view that the feature rather than the phoneme is the basic constituent of phonology in two earlier papers; cf. "Notes on Standard Slovak" (Selected Writings I, pp. 222-226) published in 1931, and in his contribution to the Czech encyclopedia (Selected Writings I, pp. 232-35) published in 1932. It was, however, only in the paper under discussion here that he succeeded in showing how the consonant system could be analyzed in terms of binary features as well as in drawing significant consequences from this analysis.
18 P. 272.
19 Selected Writings I, pp. 276-77.
20 Selected Writings I, p. 277.
21 Selected Writings I, p. 489.
22 Uppsala Universitets Arsskrift, 1942/9; reprinted Uppsala, 1941, and in Selected Writings I, pp. 328-401.
23 Selected Writings I, p. 356.
24 Selected Writings I, p. 368.
25 Selected Writings I, p. 365.
26 Selected Writings I, p. 366.
27 Selected Writings I, p. 375.
28 Selected Writings I, p. 379.
30 Selected Writings I, pp. 96-98.
31 Selected Writings I, pp. 222-26.
32 Selected Writings I, pp. 262-71.
34 Selected Writings II, pp. 119-29.
35 Recall that for Jakobson the phoneme is a "set of concurrent sound properties which are used in a given language to distinguish words of unlike meanings. In speech diverse sounds can implement one and the same phoneme. This variety depends on the style of speech and/or the phonetic environment in which that phoneme occurs. The difference between such sounds is determined by external factors, and hence cannot serve to distinguish word meanings. Such sounds are labelled variants of the given phoneme" (Selected Writings I, p. 231).
Selected Writings I, p. 232.
Selected Writings II, p. 169.
Selected Writings I, p. 275.
The reprinted text unfortunately includes also the only serious misprint to be found in the original; on p. 127, line 8 (bottom) the word “narrowly” appears in place of the correct “broadly,” as is made clear by the illustrative examples quoted directly below the rule.
Selected Writings II, p. 120.
Selected Writings II, p. 124.
Ibid.
See Selected Writings II, p. 128, for some examples.
Truncation rules that affect entire morphemes rather than just single phonemes have been proposed by A. V. Isačenko (“Rol’ ušećenja v russkom slovoobrazovanii,” International Journal of Slavic Linguistics and Poetics, 15 [1972], 95-125), following a suggestion of D. S. Worth. Needless to say, such truncation rules are distinct from those under discussion here. Cf. also the interesting response to Isačenko by V. V. Lopati and I. S. Ulutanov (“Neskol’ko spornyx voprosov russkoj slovoobrazovatel’noj morfonologii,” Voprosy jazykозnanija 3 [1974], 57-69).
Edited by N. Ju. Švedova (Moscow, 1970).