III LOGICAL CLASSIFICATION OF DISTINCTIVE OPPOSITIONS

1 PHONEMIC CONTENT AND PHONEMIC SYSTEM

If all the above-stated rules are applied correctly, a complete inventory of all phonemes of a given language can be established. But the *phonemic content* of each individual phoneme must be determined as well. By phonemic content we understand all phonologically distinctive properties of a phoneme, that is, those properties which are common to all variants of a phoneme and which distinguish it from all other phonemes of the same language, especially from those that are most closely related. German "*k*" cannot be defined as "velar" because only some of its variants possess this property. Before *i* and *ü*, for example, "*k*" is realized as palatal. A definition of German "*k*" as "dorsal" (a sound produced with the dorsum of the tongue), on the other hand, would also be inadequate since "*g*" as well as "*ch*" are "dorsal." The phonemic content of the German phoneme *k* can only be formulated as follows: "tense nonnasalized dorsal occlusive." In other words, only the following properties are distinctive for the German phoneme *k*: (1) complete occlusion (as opposed to "*ch*"); (2) blocking of the entrance to the nasal cavity (as opposed to "*ng*"); (3) tightening of the muscles of the tongue and simultaneous relaxation of the muscles of the larynx (as opposed to "*g*"); (4) participation of the dorsum (as opposed to "t" and "p"). *k* shares the first of these four characteristics with *t*, *p*, *tz*, *pf*, *d*, *b*, *g*, *m*, *n*, and *ng*; the second with *g*, *t*, *d*, *p*, and *h*; the

third with *p*, *t*, *ss*, and *f*; and the fourth with *g*, *ch*, and *ng*. Only the sum of all four marks is characteristic for *k* alone. From what has been said it is evident that the determination of the phonemic content of a phoneme presupposes its prior classification in the system of distinctive oppositions existing in the language in question. The definition of the content of a phoneme depends on what position this phoneme takes in the given phonemic system, that is, in final analysis, with which other phonemes it is in opposition. A phoneme can therefore sometimes be defined in purely negative terms. For example, if one considers all the optional and combinatory variants of the German phoneme *r*, the only way in which this phoneme can be defined is as a "nonlateral liquid." This is a purely negative definition since a "liquid" itself is a "nonnasal sonorant," and a "sonorant" is a "nonobstruent."

2 CLASSIFICATION OF OPPOSITIONS

A On the Basis of Their Relationship to the Entire System of Oppositions: Multilateral and Bilateral, Isolated and Proportional Oppositions; and the Structure of the Phonemic Systems Based Thereon

The phonemic inventory of a language is actually only a corollary of the system of distinctive oppositions. It should always be remembered that in phonology the major role is played, not by the phonemes, but by the distinctive oppositions. Each phoneme has a definable phonemic content only because the system of distinctive oppositions shows a definite order or

structure. In order to understand this structure, various types of distinctive oppositions must be studied.

Above all, certain notions must be introduced which are of decisive importance, not only for phonological systems of oppositions but for any other kind as well.[1]

An opposition not only presupposes those properties by which the opposition members are distinguished from each other, but also those properties that are common to both opposition members. The latter properties may be termed "the basis for comparison." Two things that have no basis for comparison, that do not have a single property in common, as, for example, an inkpot and free will, do not form an opposition. In a system of oppositions such as the phonological system of a language, two types of oppositions are to be distinguished: *bilateral* and *multilateral*. In the case of *bilateral* oppositions the basis for comparison, that is, the sum of the properties common to both opposition members, is common to these two opposition members alone. It does not recur in any other member of the same system. The basis for comparison of a multilateral opposition, on the other hand, is not limited exclusively to the two respective opposition members. It also extends to other members of the same system. The difference between bilateral and multilateral oppositions can be illustrated by examples from the Latin alphabet. The opposition of the letters *E* and *F* is bilateral because the sum of the features common to these two letters—a vertical bar and two horizontal lines extending to the right, the one extending from the upper end of the bar, the other from its middle—does not recur in any other letter of the Latin alphabet. The opposition of the letters *P* and *R*, on the other hand, is multilateral, because the sum of the features that both letters have in common, that is, a loop toward the right on the upper end of a vertical bar, in addition to its occurrence in these two letters, also occurs in the letter *B*.

The distinction between bilateral and multilateral oppositions is extremely important for the general theory of oppositions. It can be made in any system of oppositions and so, of course, also in systems of distinctive oppositions (or phoneme inventories). For example, the opposition *t-d* is bilateral in German because *t* and *d* are the only dental occlusives of the German phonemic system. The opposition *d-b*, on the other hand, is multilateral in German because the weak occlusion that the two phonemes have in common also recurs in another German phoneme, namely *g*. Consequently, every distinctive opposition can be recognized quite accurately and clearly as being bilateral or multilateral. Of course, only the phonologically distinctive properties are to be considered. However, some

nondistinctive properties may be taken into consideration as well if, on the basis of these properties, the members of the opposition in question are placed in opposition with other phonemes of the same system. For example, the opposition *d-n* (as in French) is to be considered bilateral because its members are the only voiced dental occlusives. Yet neither voicing nor occlusion is distinctive for *n*, as neither voiceless nor spirantal *n* occur as independent phonemes in the respective system.

In every system of oppositions the multilateral oppositions outnumber the bilateral ones. The consonantal system of stage German, for example, contains twenty consonant phonemes (*b*, *ch*, *d*, *f*, *g*, *h*, *k*, *l*, *m*, *n*, *ng*, *p*, *pf*, *r*, *ss*, *s*, *sch*, *t*, *w*, and *tz*)* and consequently one hundred and ninety possible oppositions. Of these, only thirteen are bilateral (*b-p*, *d-t*, *g-k*, *b-m*, *d-n*, *g-ng*, *pf-f*, *k-ch*, *tz-ss*, *f-w*, *ss-s*, *ss-sch*, and *r-l*). All the others, that is, 93 percent of the entire system, are multilateral. There are phonemes that do not take part in any bilateral oppositions: among the German consonants, *h* is such a phoneme. But every phoneme must take part in multilateral oppositions. Among the oppositions in which a specific phoneme participates, the multilateral oppositions are always more numerous than the bilateral ones. Every German consonant phoneme participates in nineteen oppositions. At the most, only two of these are bilateral. But it is precisely the bilateral oppositions that are the most important for the determination of the phonemic content of a phoneme. Consequently, despite their relatively low number, bilateral oppositions play an important role in the structure of phonological systems.

Within the multilateral oppositions *homogeneous* and *heterogeneous* oppositions are to be distinguished. *Homogeneous* oppositions are those multilateral oppositions whose members can be conceived of as the outermost points in a "chain."[2] For example, in German the opposition *u-e* is multilateral: both phonemes have only in common that they are vowels. This property is not limited to them alone, but is also shared by a whole number of other German phonemes, namely, by all vowels. The members of the opposition *u-e* are nevertheless to be conceived of as the outermost points of the chain *u-o*, *o-ö*, *ö-e*, consisting entirely of bilateral oppositions: in the German vowel system *u* and *o* are the only back rounded vowels, *o*

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* *Translator's note:* The letters of the alphabet rather than phonetic symbols are used—which is slightly confusing (*ch* = phonetic symbol "x," *ng* = "ŋ," *ss* = "s," *s* = "z," *sch* = "š," *w* = "v"). The German consonant phonemes in phonetic transcription thus are: *p*, *t*, *k*, *b*, *d*, *g*, *p̌*, *c*, *f*, *š*, *s*, *x*, *h*, *v*, *z*, (*ž*), *m*, *n*, *ŋ*, *l*, and *r*. As regards "*j*," see footnote 3. *ž*, not mentioned above, occurs in loanwords.

and *ö* the only rounded vowels with a mid-degree of aperture, and *ö* and *e* the only front vowels with a mid-degree of aperture. The opposition *u-e* is therefore homogeneous. Also homogeneous is the multilateral opposition *x-ŋ* ("ch-ng") of the German consonant system: it can be analyzed into a chain of the following bilateral oppositions: *x-k*, *k-g*, *g-ŋ*. The multilateral opposition *p-t*, on the other hand, is heterogeneous since there are no phonemes between *p* and *t* that could be conceived of as standing in a relation of bilateral opposition to these two phonemes as well as to each other. It is clear that with respect to the total phonemic system of a language, the heterogeneous multilateral oppositions must always be more numerous than the homogeneous ones. But homogeneous oppositions are very important for the determination of the phonemic content of a phoneme and consequently also for the entire structure of a given phonemic system.

Two types of homogeneous multilateral oppositions can be distinguished, depending on whether the opposition members can be related to each other by means of one or several "chains" of bilateral oppositions. These are the *linear* and the *nonlinear* oppositions. Of the two examples given above, the opposition *x-ŋ* is linear because the "chain" *x-k-g-ŋ* is the only possible one in the framework of the German phonemic system. The opposition *u-e*, on the other hand, is nonlinear because the "path" from *u* to *e* within the German phonemic system can be conceived of via several "chains" of bilateral oppositions (*u-o-ö-e*, *u-ü-ö-e*, *u-ü-i-e*, or *u-o-a-ä-e*).

Of no less importance than the distinction between bilateral and multilateral oppositions is the distinction between *proportional* and *isolated* oppositions. An opposition is proportional if the relation between its members is identical with the relation between the members of another opposition or several other oppositions of the same system. For example, the opposition *p-b* in German is proportional because the relation between *p* and *b* is identical with that between *t* and *d* or between *k* and *g*. The opposition *p-š*, on the other hand, is isolated because the German phonemic system does not have any other pair of phonemes whose members would be related to each other in the same way as *p* is related to *š*. The distinction between proportional and isolated oppositions can exist in the case of bilateral as well as multilateral oppositions: in German, for example, the opposition *p-b* is bilateral and proportional, *r-l* bilateral and isolated, *p-t* multilateral and proportional (see *b-d*, *m-n*), and *p-š* multilateral and isolated.

In every system the isolated oppositions are more numerous than the proportional ones. In the German consonant system, for example, only

40 oppositions are proportional and 150 (i.e., 80 percent) are isolated. They are distributed as follows:

bilateral proportional	11 (6%)
bilateral isolated	2 (1%)
multilateral proportional	29 (15%)
multilateral isolated	148 (78%).

This means that the bilateral oppositions are predominantly proportional, the multilateral oppositions predominantly isolated.

The absolute figures, of course, vary from language to language. In principle, however, the ratio remains the same everywhere: the largest group is formed by isolated multilateral oppositions, the smallest by isolated bilateral oppositions. The proportional oppositions are found between these extreme points, with multilateral oppositions always outnumbering the bilateral ones. What is important for the characterization of a given system is not so much the numerical ratio between the various opposition classes, as the percentage of phonemes participating in each of these classes. The German consonant phonemes include only a single phoneme, *h*, which participates exclusively in an isolated multilateral opposition; three phonemes participate only in an isolated bilateral opposition, namely, *š*, *r*, and *l*; all the rest (i.e., 80 percent of all consonant phonemes) participate simultaneously in bilateral and multilateral proportional oppositions. In Russian the consonants that take part in proportional oppositions constitute 88 percent, in Burmese as much as 97 percent. Even more important is the ratio of the number of bilateral proportional oppositions to the number of phonemes participating in these oppositions. While 16 phonemes take part in 11 bilateral proportional oppositions in the German consonant system, 30 consonant phonemes participate in 27 of these oppositions in Russian, and 60 consonant phonemes in 79 such oppositions in Burmese.* If the number of bilateral proportional oppositions is divided by the number of participant phonemes, one obtains 0.69 for the German consonant system, 0.90 for the Russian, and 1.32 for the Burmese.

These different types of oppositions determine the inner order or structure of the phonemic inventory as a system of distinctive oppositions. All proportional oppositions that show identical relations between their members can be combined into a "proportion," hence the term "proportional." For example, in German *b-d* = *p-t* = *m-n*, or *u-o* = *ü-ö* = *i-e*.

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* *Translator's note:* In "Outline of Burmese Grammar" by W. S. Cornyn, Lang. Diss. No. 38, published by the Linguistic Society of America, 1944, the total number of phonemes in Burmese is given as 29 consonants, 9 vowels, and 4 tones.

On the other hand, we have already mentioned those "chains" of bilateral oppositions which can be interpolated between the members of the homogeneous, and in particular of the linear-homogeneous, multilateral oppositions: in German, for example, *x-k-g-ŋ* or *u-ü-i*. If one of the oppositions of such a "chain" is proportional, the "chain" intersects with a "proportion." If a phoneme participates simultaneously in several proportional oppositions, several "proportions" intersect. A phonemic system can therefore be represented in the form of a series of intersecting parallels. In the German consonant system the proportions *b-d* = *p-t* = *m-n*, *b-p* = *d-t*, and *b-m* = *d-n* form an intersection that can be represented in the form of two parallel chains: *p-b-m* and *t-d-n*. The proportions *p-b* = *t-d* = *k-g* and *b-m* = *d-n* = *g-ŋ* result in the parallelism of the chains *p-b-m* and *t-d-n* with *k-g-ŋ*. However, the last chain can be augmented by an additional member. It then takes on the shape *x-k-g-ŋ*. The relation *x-k* (stricture/occlusion) is identical in essence with the relations *f-p̌* and *s-c* which themselves are only a section of the parallel chains *v-f-p̌* and *z-s-c*. Finally, *s* is simultaneously a member of the bilateral isolated opposition *s-š*. Thus the following picture emerges:

			v	*z*		
		x	*f*	*s*	*š*	
p	*t*	*k*	*p̌*	*c*		
b	*d*	*g*				
m	*n*	*ŋ*				

This comprises seventeen phonemes, that is 85 percent of the entire consonant system of German. Outside this scheme are the phonemes *r* and *l* which, as the only liquids of German, form an isolated bilateral opposition; and, too, the phoneme *h*, which stands exclusively in a relation of multilateral isolated opposition to all the other consonants.[3]

The order achieved by dividing phonemes into parallel rows does not exist only on paper and is not only a matter of graphics. It corresponds to phonological reality. Due to the fact that a specific relation between two phonemes obtains in several proportional oppositions, the relation itself can now be thought of and used phonologically independently of individual phonemes. As a result, the particular properties of the respective phonemes are recognized as such with particular clarity and the phonemes can be more readily dissolved into their phonological features.

It is a basic fact of phonology that the phonemic content of a phoneme depends on the position of this phoneme in the phonemic system and consequently on the structure of that system. Since the systems of distinctive oppositions differ from language to language and from dialect to

dialect, the phonemic content of the phonemes also varies according to language and dialect. This difference can also affect the realization of the phonemes.

The phoneme *r* in the various languages may serve as an illustration. As we have seen, German *r* stands in a relation of bilateral opposition only to *l*. Its phonemic content is very poor, actually purely negative: it is not a vowel, not a specific obstruent, not a nasal, nor an *l*. Consequently, it also varies greatly with respect to its realization. Before vowels it is a dental vibrant for some speakers of German, a uvular vibrant for others. For still others it is some sort of almost noiseless guttural spirant. In positions other than before vowels it is generally pronounced either as a nonsyllabic vowel of indeterminate quality, or as an incompletely articulated guttural, only rarely as a weak vibrant. Czech *r* has a much richer phonemic content, as it stands in a relation of bilateral opposition not only to *l* but also to a special Czech phoneme *ř*: *r* and *l* are the only liquids, *r* and *ř* the only two vibrants of Czech. *r* is distinguished from *ř* in that it is not an obstruent but a liquid; from *l* in that it is a vibrant. For this reason, Czech *r* is always, and in all positions, pronounced as a clear and energetically trilled sonorant. In contrast with the German *r*, it cannot be "slurred over." A uvular pronunciation is unpopular for Czech *r* since the opposition *r-ř* would thereby lose some of its distinctness. Czech *r* is normally dental (i.e., it is an alveolar *r*). A uvular *r* only occurs as an extremely rare individual variant and is considered incorrect.[4] The *r* phoneme of Gilyak, a language that is spoken in Eastern Siberia at the mouth of the Amur and in the northern part of Sakhalin Island, presents quite a different picture.[5] In addition to voiced *r*, this language also has a voiceless ɹ with clear friction. Since this ɹ is considered a voiceless spirant, the opposition *r*-ɹ is not only bilateral but also proportional, and forms a proportion with the oppositions *v-f*, *z-s*, *ɣ-x*, *ǰ-x̌*. Consequently *r* in this case is regarded as a voiced spirant. When the *r* in Gilyak is articulated energetically, especially when it occurs in gemination, a *ž*-type friction can clearly be heard. This can never be the case with Czech *r* since it might then be confused with *ř*. Furthermore, the oppositions *v-f*, *z-s*, *ɣ-x*, *ǰ-x̌* are linked with the chains *b-p-p'*, *ʒ́-ć-ć'*, *g-k-k'*, *ǧ-ḵ-ḵ'*. In parallel manner *r*-ɹ are also linked with *d-t-t'*. Thus, the following diagram emerges:

d	*b*	*ʒ́*	*g*	*ǧ*
t	*p*	*ć*	*k*	*ḵ*
t'	*p'*	*ć'*	*k'*	*ḵ'*
r	*v*	*z*	*ɣ*	*ǰ*
ɹ	*f*	*s*	*x*	*x̌*

A uvular pronunciation of Gilyak *r* is therefore completely out of the question. It is always realized as a dental. The phonemic content of Gilyak *r* is thus "a voiced continuant of the dental series." Since Gilyak also has an *l*, *r* must be pronounced as a distinct vibrant. Last in this series of examples, the Japanese *r* may be discussed. This is the only liquid of the Japanese phonemic system. It stands in a relation of bilateral opposition with only one phoneme, namely, palatalized *r'*. But since all Japanese consonants have palatalized equivalents, palatalization cannot be considered a specific peculiarity of *r*. Japanese *r* must therefore be defined as a "nonpalatal liquid." (The term liquid refers to a consonant phoneme that is neither an obstruent nor a nasal.) The realization of this phoneme is therefore rather indeterminate. *l* sometimes occurs as an optional variant, but even when this is not the case, *r* cannot be vigorously trilled since by so doing it would acquire too distinct a character, *r* is mostly realized as a single "flap of the tongue." A uvular articulation is impossible, as this might place in jeopardy the proportionality of the opposition *r-r'*.

The number of examples could be increased ad infinitum, and illustrations could be taken from many other languages to show the dependence of the phonemic content of the phoneme *r* on its position in the phonemic system and, therefore, on the structure of this system. And in most cases the phonetic realization of *r*, the number of its variants, etc., can be deduced from its phonemic content. Any other phoneme could be chosen instead of *r*. The result would remain unchanged. In summary, one can say that the phonemic content of a phoneme depends on the structure of the corresponding phonemic system. And since phonemic systems are structured differently in every language and even in every dialect, it is relatively rare to find a phoneme with exactly the same phonemic content in two different languages. One must not be misguided by the use of common international symbols of transcription. These symbols are only useful expedients. If the same letters should only be used for phonemes with fully equivalent phonemic content, a separate alphabet would have to be used for every language.

B Classification of Oppositions on the Basis of the Relation between Opposition Members: Privative, Gradual, and Equipollent Oppositions

The structure of a phonemic system depends on the distribution of the bilateral, multilateral, proportional, and isolated oppositions. The division of oppositions into these four classes is therefore of importance. The principles of classification then relate to the phonemic system: whether

an opposition is bilateral or multilateral depends on whether the properties shared by the opposition members in question are common to these members alone or recur in still other members of the same system. Whether an opposition is proportional or isolated depends on whether or not the same relation of opposition recurs in still other oppositions of the same system.[6] But the different types of phonological oppositions can also be classified without consideration of the respective system by establishing a principle of classification based on the purely logical relations obtaining between two opposition members. Such a classification is of no importance for the purely external structure of the phonemic inventory. It becomes very important, however, from the standpoint of the function of the phonemic systems.

In regard to the relation existing between opposition members, phonological oppositions can be divided into three types:

a. Privative oppositions are oppositions in which one member is characterized by the presence, the other by the absence, of a mark. For example: "voiced"/"voiceless," "nasalized"/"nonnasalized," "rounded"/"unrounded." The opposition member that is characterized by the presence of the mark is called "marked," the member characterized by its absence "unmarked." This type of opposition is extremely important for phonology.

b. Gradual oppositions are oppositions in which the members are characterized by various degrees or gradations of the same property. For example: the opposition between two different degrees of aperture in vowels, as in German *u-o*, *ü-ö*, *i-e*, or between various degrees of tonality. The member of a gradual opposition that possesses an extreme (either minimal or maximal) degree of the particular property is the *extreme* or *external* member, while the other member is the *mid* member. Gradual oppositions are relatively rare and not as important as privative oppositions.

c. Equipollent oppositions are oppositions in which both members are logically equivalent, that is, they are neither considered as two degrees of one property nor as the absence or presence of a property. For example: German *p-t* and *f-k*. Equipollent oppositions are the most frequent in any system.

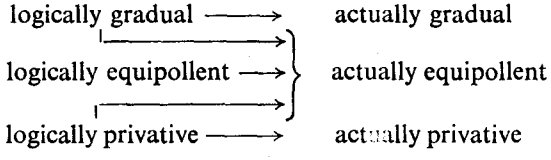
A phonic opposition, taken out of the context of the phonemic system and its functioning and considered in isolation, is always at once equipollent and gradual. As an example, let us study the opposition between voiced and voiceless obstruents. Instrumental phonetics teaches that consonants are only rarely absolutely voiced or absolutely voiceless: most cases merely involve various degrees of voice participation. Further, the voicing of

an obstruent is connected with the relaxation of the muscles of the vocal organs. Voicelessness, on the other hand, is related to their tensing. The relation between *d* and *t*, as, for example, in Russian or French, is ambiguous from a purely phonetic point of view. In order to interpret their relation as privative, it is first of all important to focus attention on a single discriminative property alone (for example, only on voice or only on tensing of the muscles of the tongue). All others must be disregarded. In the second place, the lesser degree of the particular property must be "equated with zero." For example, the relation between *u* and *o* is privative as well if one regards these two vowels as the two extreme degrees of opening or closure, and if one interprets one of the degrees of aperture or closure as "zero degree": *u* is then the "unopen," *o* the "open" vowel, or, vice versa, *u* is the "close" and *o* the "unclose" rounded (or back) vowel phoneme. But the same relation of *u-o* becomes one of gradual opposition if the same vowel system has still another vowel with a degree of aperture exceeding that of *o*: *u* is then the extreme, and *o* the mid, member of a gradual opposition.

The interpretation of a distinctive opposition as equipollent, gradual, or privative thus depends on the standpoint from which it is viewed. Yet, one should not assume that its interpretation is purely subjective and arbitrary. The structure and the functioning of the phonemic system in most cases indicates quite unequivocally and clearly how each opposition is to be evaluated. In a language that in addition to *u* and *o* has still other back, or back and rounded, vowels with a degree of opening greater than that of *o*, for example, *ɔ* or *a*, the opposition *u-o* must be evaluated as gradual. On the other hand, in a language where *u* and *o* are the only back vowels, there is no reason to regard the opposition *u-o* as gradual. The opposition *t-d*, which was given as an example above, would only have to be evaluated as gradual in the case where the respective phonemic system contains still a third "dental" occlusive with a degree of voicelessness (and tensing of the muscles of the tongue) greater and more complete than that of *t*, or, vice versa, smaller than that of *d*. In cases where this condition does not prevail, there is no reason to interpret the opposition *t-d* as gradual. If the functioning of the phonemic system points to *t* as the unmarked member of the opposition *t-d*, the opposition *t-d* must be considered privative. The tensing of the muscles of the tongue must then be considered an irrelevant side phenomenon, the degree of voicing of *t* being "zero," so that *t* is to be regarded as "voiceless" and *d* as "voiced." But if, on the other hand, in accordance with the functioning of the phonemic system, not *t* but *d* is the unmarked member, voicing becomes an irrelevant side phenomenon, and the tensing of the muscles of the tongue the discriminative mark of the

opposition. *t* must then be considered "tense" and *d* as "lax." Finally, if from the standpoint of the functioning of the phonemic system neither *d* nor *t* can be considered unmarked, the opposition *t-d* must be regarded as equipollent.[7]

The classification of concrete oppositions into gradual or privative oppositions thus depends partly on the structure and partly on the functioning of the phonemic system. But in addition, the opposition itself must contain something that makes its evaluation as either gradual or privative possible. An opposition such as *k-l* can be neither privative nor gradual under any circumstances because its members can be conceived of neither as the presence and absence, nor as two different degrees, of the same property. The opposition *u-o*, on the other hand, can be conceived of as privative ("close"/"unclose" or "open"/"unopen") as well as gradual. Whether it actually must be regarded as privative, gradual, or equipollent depends on the structure and functioning of the respective phonemic system. It is therefore possible to distinguish *potentially* or *logically* privative or gradual oppositions from oppositions that are *actually* privative or gradual, and logically equipollent oppositions from those *actually* equipollent. Logically equipollent oppositions are always actually equipollent as well. Actually equipollent oppositions, on the other hand, are not always logically equipollent but are sometimes logically privative or logically gradual. Presented in a diagram, they are as follows:



C Classification of Oppositions on the Basis of the Extent of Their Distinctive Force: Constant and Neutralizable Oppositions

By the functioning of a phonemic system we understand the combinations of phonemes permissible in a given language, as well as the rules governing the distinctive force of the individual oppositions.

So far we have spoken of phonemes, distinctive oppositions, and systems of oppositions, without consideration of the actual distribution of the phonological units in the formation of words and forms. The role of the individual oppositions in a given language is rather varied, depending on the extent to which they actually possess distinctive force in all positions.[8] In Danish *æ* and *e* occur in all conceivable positions: they form a *constant* distinctive opposition whose members are independent phonemes. In Russian *e* occurs only before *j* and before palatalized consonants, while

ɛ occurs in all other positions: here *e* and ɛ are noninterchangeable phones that cannot be considered two independent phonemes but are two combinatory variants of a single phoneme. In French, however, *e* and ɛ occur only finally in open syllable as members of a distinctive opposition "les"/"lait," "allez"/"allait". In all other positions the occurrence of *e* and ɛ is predictable: ɛ occurs in closed syllable, *e* in open. These two vowels must thus be considered two phonemes only in final open syllable and combinatory variants of a single phoneme in all other positions. The distinctive opposition in French is thus *neutralized* in certain positions. We call such oppositions *neutralizable* oppositions, the positions in which the neutralization takes place, *positions of neutralization*, and those positions where the opposition is relevant, *positions of relevance*.

The psychological difference between constant and neutralizable distinctive oppositions is very great. Constant distinctive oppositions are perceived clearly even by those members of the speech community who have had no phonetic training. The terms of such an opposition are considered two distinct "phonic entities." In neutralizable distinctive oppositions perception fluctuates: in positions of relevance both opposition members are clearly distinguished; in positions of neutralization, on the other hand, it is often not possible to indicate which of the two had just been produced or perceived. However, even in the position of relevance, members of a neutralizable opposition are often felt only as two meaning-differentiating nuances, that is, as two distinct yet closely related phonic entities. This sense of intimate relatedness is especially characteristic of opposition members of this type. From a purely phonetic point of view, the difference between French *i* and *e* is not greater than the difference between *e* and ɛ. But the closeness of the relationship between *e* and ɛ is apparent to any Frenchman, while in the case of *i* and *e* there can be no question of any particular closeness: the reason for this phenomenon is, of course, that the opposition between ɛ and *e* is neutralizable, while the opposition between *i* and *e* is constant.

Still, it should not be assumed that the distinction between neutralizable and constant distinctive oppositions is meaningful only from a psychological point of view. This distinction is of extreme importance for the functioning of phonemic systems, as was first stressed by N. Durnovo. It must be considered one of the basic principles of the theory of phonemic systems. Neutralization and neutralizability of distinctive oppositions therefore deserve a detailed discussion.

Above all, the term itself must be clearly delineated. Not every type of distinctive opposition can be "neutralized." In those positions in which a neutralizable opposition is actually neutralized, the specific marks of an

opposition member lose their distinctive force. Only those features which are common to both opposition members, that is, which serve as the basis for comparison for the respective opposition, remain relevant. One member of the opposition thus becomes the representative of the "archiphoneme" of the respective opposition in the position of neutralization. By the term "archiphoneme" we understand the sum of distinctive properties that two phonemes have in common.[9] It follows that only bilateral oppositions can be neutralized. In effect, only those oppositions that can be contrasted with all other phonological units of a given system have archiphonemes. And it is this contrastive capacity that is the basic prerequisite for phonological existence in general. In German the bilateral opposition *d-t* is neutralized in final position. The opposition member, which occurs in the position of neutralization, from a phonological point of view is neither a voiced stop nor a voiceless stop but "the nonnasal dental occlusive in general." As such it can be placed in opposition with the dental nasal *n*, as well as with the nonnasal labial and velar stops. However, the fact that German *t* and *d* cannot occur before *l* in word-initial position, while *b* and *p* do occur in that position, cannot effect a neutralization of the oppositions *d-b* and *p-t*: in a word such as "Blatt" (leaf) *b* retains all its properties, that is, it remains a voiced labial stop. It cannot be considered the representative of the archiphoneme of the opposition *d-b* because the phonological content of such an archiphoneme could only be a "voiced stop in general." But the *b* in "Blatt" cannot be interpreted as such because the *g* in "glatt" (smooth) is also a voiced stop. Actual neutralization, by which an opposition member becomes the representative of an archiphoneme, is therefore only possible in cases of distinctive bilateral oppositions. But this by no means implies that all bilateral oppositions are in effect neutralizable: constant bilateral oppositions probably exist in almost any language. But, whenever a language has a neutralizable opposition, it is always bilateral.

How is the archiphoneme representative of a neutralizable opposition to be realized? There are four possible cases:

CASE I.—The representative of the archiphoneme of a neutralizable opposition occurring in the position of neutralization is not identical with either of the opposition members.

a. It is realized by a sound phonetically related to both opposition members but not identical with either one. In Russian the opposition between palatalized and nonpalatalized labials is neutralized before palatalized dentals. A special type of "semipalatalized" labial occurs in the position of neutralization: in English, where the opposition between voiced lenes *b, d, g,* and voiceless fortes *p, t, k,* is neutralized after *s,* a

special type of voiceless lenes consonant occurs in that position; in certain Bavaro-Austrian dialects, in which the opposition between fortes and lenes is neutralized initially, special "semifortes" or "semilenes" sounds occur in that position, and so on. The number of examples could easily be multiplied. In all these cases the archiphoneme is represented by a phone *intermediary* to the two opposition members.

b. Somewhat different are those cases in which the representative of the archiphoneme, in addition to the features that it shares with one or the other opposition member, has still other specific features proper to it alone. Features of the latter category are then a result of assimilation to the phoneme next to which the opposition is neutralized. In the Peking dialect of Chinese, for example, the opposition *k-c* is neutralized before *i* and *ü* and a palatal *č'* appears as the representative of the archiphoneme.[10] In Yami, a language spoken on Tobago Island, palatalized *l*, occurs before *i* as the archiphoneme of the opposition "dental *l*"/"retroflex *l*," etc.[11]

In all these cases, that is, in the cases discussed under (*a*) as well as (*b*), the phone that occurs in the position of neutralization is some kind of combinatory variant of the one as well as the other opposition member. Cases in which the archiphoneme is represented by a phone not fully identical with either of the opposition members are rather numerous. However, they are still less frequent than cases in which the sound occurring in the position of neutralization is more or less identical with the realization of a specific opposition member in the position of relevance.

CASE II.—The representative of the archiphoneme is identical with the realization of one of the opposition members, the choice of the archiphoneme representative being conditioned *externally*. This is possible only in cases where the neutralization of a neutralizable opposition depends on the proximity of some particular phoneme. The opposition member that "bears a closer resemblance or relation" to such a neighboring phoneme, or is even identical with it, becomes the representative of the archiphoneme. In many languages where the opposition between *voiced* and *voiceless* (or fortes and lenes) obstruents is neutralized before other obstruents of the same type of articulation, only voiced obstruents can occur before voiced (or lenes) obstruents, and only voiceless obstruents before voiceless (or fortes) obstruents. In Russian, where the opposition between palatalized and nonpalatalized consonants is neutralized before nonpalatalized dentals, only nonpalatalized consonants can occur in that position, and so on. In cases of this type which are relatively rare, the choice of an opposition member as the representative of the respective archiphoneme is conditioned purely externally by the nature of the position of neutralization.

CASE III.—The choice of an opposition member as the archiphoneme representative is conditioned *internally*.

a. In cases of this type one of the opposition members occurs in the position of neutralization, and its choice is in no way related to the nature of the position of neutralization. However, due to the fact that one of the opposition members occurs in that position as the representative of the respective archiphoneme, its specific features become nonrelevant, while the specific features of its partner receive full phonological relevance: the former opposition member is thus considered "archiphoneme + zero," while the latter is considered "archiphoneme + a specific mark." In other words, the opposition member that is permitted in the position of neutralization is *unmarked* from the standpoint of the respective phonemic system, while the opposing member is *marked*. This, of course, can only be the case where the neutralizable opposition is logically privative. However, most neutralizable distinctive oppositions belong to this category, that is, they are regarded as oppositions between unmarked and marked members, the member in the position of neutralization being regarded as unmarked.

b. If, however, the neutralizable opposition is not privative but gradual, as, for example, the opposition between the different degrees of aperture in vowels, or between the various levels of tone, it is always the *external* or *extreme* opposition member that occurs in the position of neutralization. In the dialects of Bulgarian and Modern Greek, in which the oppositions *u-o* and *i-e* are neutralized in unstressed syllables, the maximally close (actually minimally open) *u* and *i* serve as representatives of the respective archiphonemes in the position of neutralization. In Russian, where the opposition *o-a* is neutralized in unstressed syllables, the maximally open (actually minimally close) *a* represents the respective archiphoneme in the immediately pretonic syllable. In Lamba, a Bantu language of N. Rhodesia, where the opposition between low and mid tone is neutralized in final position, the position of neutralization, that is, in final syllables, permits only low tone.[12] Examples could easily be multiplied. The reason for this phenomenon is not always clear. As we have already emphasized, a gradual opposition can be regarded as gradual only if the same phonemic system contains still another element that shows a different degree of the same property. But such degree must always be higher than that of the "mid" opposition member: *i-e* forms a gradual opposition provided that the same vowel system contains still another vowel with a greater degree of aperture than *e*, etc. The "extreme" member of a gradual opposition always represents the minimal degree of the particular property, while the mid member of the same opposition exceeds this minimum, that is, it can be represented

as "minimum + something more of the same property." And since the archiphoneme can only contain that which is common to both opposition members, it can only be represented by the extreme opposition member.[13] If the neutralizable opposition is logically equipollent, an internally conditioned choice of the representative of the archiphoneme is, of course, impossible. But it should be noted that the neutralization of a logically equipollent opposition is a rare phenomenon in any event.

CASE IV.—Both opposition members represent the archiphoneme: one member in one, the other in another, environment of the position of neutralization. This case is logically opposed to the first, in which neither of the two opposition members is the representative of the archiphoneme. In its pure form it is rather rare. In most instances this fourth possibility is only a combination of the second and the third case. Thus, for example, in Japanese the opposition between palatalized (*i*- and *j*-colored) consonants and unpalatalized consonants is neutralized before *e*. It is clear that the choice of the representative of the archiphoneme before *i* was here conditioned externally, and before *e* internally. But there are cases that do not permit such interpretation. In German the opposition *s-š* is neutralized before consonants. The archiphoneme is represented root-initially by *š* root-medially and finally by *s*. Here there can be no question of an externally conditioned choice of the archiphoneme representative nor of an internally conditioned choice, particularly since an equipollent opposition is involved. In other cases the various positions of neutralization are not quite equivalent from a phonological standpoint. The two representatives of the archiphoneme cannot therefore be considered in entirely equivalent terms either. For example, in German the opposition between "sharp" *s* and "soft" *z* is neutralized root-initially as well as morpheme-finally, the archiphoneme being represented by "soft" *z* initially, and "sharp" *s* finally. However, in German, final position is also the position of the least phonemic distinction: the oppositions *p-b*, *k-g*, *t-d*, *s-z*, *f-v*, as well as the oppositions of vowel quantity, are neutralized in that position. Only eighteen out of the total of thirty-nine phonemes in the German language can occur in that position, while thirty-six phonemes can occur initially (*a*, *ah*, *äh*, *au*, *b*, *ch*, *d*, *e*, *eh*, *ei*, *eu*, *f*, *g*, *h*, *i* or *j* respectively, *ih*, *k*, *l*, *m*, *n*, *o*, *ö*, *öh*, *oh*, *p*, *pf*, *r*, *s*, *sch*, *t*, *u*, *ü*, *üh*, *uh*, *w*, *z*).* It is clear that the representative of the archiphoneme which occurs in initial position must under

* *Translator's note:* In phonetic transcription: *a*, *a:*, *æ:*, *au*, *b*, *x*, *d*, *ɛ*, *e:*, *ei*, *eu*, *f*, *g*, *h*, *I* or *j*, *i:*, *k*, *l*, *m*, *n*, *o*, *ö*, *ö:*, *o:*, *p*, *p̌*, *r*, *z*, *š*, *t*, *v*, *ü*, *ü:*, *u:*, v, *c*.

these circumstances be regarded as "the more genuine." And since the opposition "sharp" *s*/"soft" *z* is logically privative, one can probably regard it as actually privative, and the "soft" *z* as its unmarked member.

Thus there are cases in which the neutralization of a privative opposition clearly and objectively indicates which member of that opposition is unmarked and which is marked: in CASE III the unmarked member of the neutralized opposition serves as the only representative of the archiphoneme; in CASE IV it serves as the archiphoneme representative in the position of maximal phonemic differentiation.

The neutralization of an opposition sometimes points to the marked character of the member of another opposition. That is to say, a neutralizable opposition in the vicinity of the marked member of a related opposition is frequently neutralized. For example, in Artshi, an East Caucasian language, the opposition between rounded and unrounded consonants is neutralized before *o* and *u*, whereby *o* and *u* are proved to be the marked members of the opposition *o-e* and *u-i*.

Logically privative oppositions thus become actually privative by neutralization, and the distinction between unmarked and marked opposition members obtains an objective basis.

3 CORRELATIONS

Two phonemes that are in a relation of bilateral opposition to each other are by that very fact closely related to each other: what is common to both of them does not recur in any other phoneme of the same system. They are therefore *the only ones of their kind*. In placing them in opposition with each other, that which is unique to each of them is clearly brought into relief with that which links them to each other. Two phonemes that are in a relation of multilateral opposition with each other, on the other hand, appear as indivisible units. In the case of phonemes that participate in a proportional opposition, it is easy to separate the discriminative property from the other properties since the discriminative property recurs as such in several phoneme pairs of the same system. Consequently it can be easily abstracted or thought of as independent from all other properties. In contrast, in the case of phonemes that participate in an isolated opposition, the discriminative property cannot be abstracted as easily, simply because it occurs only once in such a system, namely, together with the other properties of those phonemes to which it pertains. Of all possible relations between two phonemes, it is the privative relation that most clearly shows the presence or absence of certain properties of the particular

phonemes. The analysis of the phonemic content of phonemes that are in a relation of privative opposition with each other is therefore easiest. In contrast, the phonemic content of phonemes that are in an equipollent relation to each other is the most difficult to analyze. Two phonemes that participate in a neutralizable opposition are considered as closely related even in the position of relevance. Each of them is regarded as a special variety of the archiphoneme in question, and the reality of the latter is guaranteed by means of its occurrence in the position of neutralization. The appurtenance to one archiphoneme, on the other hand, is much less evident for two phonemes that are in a relation of constant, nonneutralizable opposition.

The following conclusion can be drawn from what has been said: the participation of two phonemes in a bilateral, proportional, privative, and thus neutralizable, opposition has as a result, first that the phonemic content of such phonemes can be analyzed most clearly since the discriminative property is clearly brought into relief with what constitutes the basis for comparison; and second, that the two phonemes are considered as particularly closely related to each other. In contrast, two phonemes that are in a relation of isolated, multilateral (and consequently nonneutralizable) opposition with each other are maximally opaque with respect to their phonemic content, and maximally distant from each other in relatedness. (These features are particularly prominent in the case of a heterogeneous opposition.)

If one considers the neutralizable, privative, proportional, bilateral oppositions and the isolated, heterogeneous, multilateral oppositions as two extremes, all remaining types of opposition can be classified between these two extreme points. The more neutralizable, privative, proportional, bilateral, and homogeneous oppositions there are in a system, the greater its cohesion. On the other hand, the more logically equipollent, isolated, multilateral, and heterogeneous oppositions there are in a system, the greater the noncohesion of that system. It therefore seems appropriate to distinguish the privative, proportional, bilateral oppositions from all other oppositions by a special term. In phonemic literature the term *correlation* is used for this purpose. But the definition that is given for the term "correlation" and some other related notions in the "Projet de terminologie phonologique standardisée" (*TCLP*, IV, 1930) must be changed to some degree since it was formulated at a time when the theory of oppositions had not as yet completely developed. We now propose the following definitions.

By *correlation pair* we understand two phonemes that are in a relation of logically privative, proportional, bilateral opposition with each other.

A *correlation mark* is a phonological property whose presence or absence characterizes a series of correlation pairs, as, for example, the nasality of nasals which in French distinguishes between the correlation pairs *an-a*, *on-o*, *in-e*, *un-eu*. By *correlation* is to be understood the sum of all correlation pairs characterized by the same correlation mark. A *paired phoneme* is a phoneme that participates in a correlation pair, while an *unpaired phoneme* is one that does not participate in any correlative pair.

The notion "correlation" is certainly a very fruitful one for the development of phonology, though its importance had been somewhat overestimated during the first period after its discovery. All oppositions whose members did not form correlative pairs were thrown together and designated by the general term "disjunction," so that two types of relations were recognized between phonological units: they either formed a correlation or a disjunction. But a closer examination revealed that in fact several types of distinctive oppositions had to be distinguished, and that the term "disjunction" was unproductive in its original, too general formulation. Furthermore, the fundamental difference between neutralizable and nonneutralizable correlations had to be uncovered. A nonneutralizable correlation, incidentally, also retains its importance for the cohesion of the phonemic system. Subject to this reservation, the theory of correlations may take the place it deserves in phonology.[14]

Depending on the correlation mark, different types of correlations are distinguished: for example, the correlation of voice (French *d-t*, *b-p*, *g-k*, *z-s*, etc.) or the correlation of quantity (*ā-a*, *ī-i*, etc.). These various correlation types are related to each other in varying degrees and can be classified in related groups. The relation of the correlation mark to the other properties of the respective phonemes serves as the basis for comparison. For example, the correlation of voice (French *d-t*, *b-p*) and the correlation of aspiration (Sanskrit *t-th*, *p-ph*) belong to the same related class because their correlation marks represent different types of work performed by the larynx and different types of tensing in the oral cavity, independent of the place of articulation in the oral cavity.

The classification of correlations in related groups is not merely a theoretical artifice. It corresponds to concrete reality. Even naive linguistic consciousness "feels" quite clearly that the oppositions *u-ü* and *ö-e* in German, though different, are still on the same plane, while the opposition between long and short *a* lies on quite a different plane. The projection of distinctive oppositions (and thus also of correlations) sometimes onto the same and sometimes onto different planes is the psychological consequence of just those kin relationships between the correlation marks on which the classification of correlations into related classes is based.

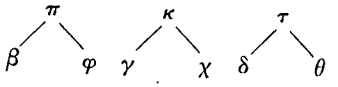
4 CORRELATION BUNDLES

In cases where a phoneme participates in several correlations of the same related class, all phonemes taking part in the same correlative pairs unite to form a multimember *correlation bundle*. The structure of such a bundle is quite varied. It depends not only on the number of participant correlations but also on their mutual relationship.

Bundles of two related correlations are the most frequent. Here two possibilities exist: both members of the one correlation may also participate in the other correlation, or both correlations have only one member in common. In the first case the result is a *four-member*, in the second a *three-member*, correlational bundle. These two cases can best be illustrated by Sanskrit and Classical Greek. In both languages stops participated simultaneously in the correlations of voice and of aspiration. In Sanskrit the result was a four-member bundle:

p-ph k-kh t-th
b-bh g-gh d-dh, etc.

In Classical Greek it was a three-member bundle:



By linking three correlations that are related in type it is theoretically possible to have bundles of four to eight members. In fact many of these types can be attested by examples from different languages. In most languages of the Caucasus the correlation of voice and the correlation based on type of expiration combine with the correlation of occlusiveness. The latter term refers to the opposition of stops or affricates with spirants. In Chechen, for example, four-member bundles result as follows:[15]

$\dot{q}$ ç č̣
γ q z c ž č
χ s š

Here the opposition of occlusiveness is relevant only in the case of voicelessness ("*z*" and "*ž*" are realized as affricates initially, and as spirants medially and finally), the opposition of expiration only in the case of occlusives (and affricates). In Georgian the same correlations yield five-member bundles because the correlation of occlusiveness extends to both members of the correlation of voice:

ç č
ʒ c ǯ č
z s ž š

Finally, in Circassian the same correlations make up a six-member bundle because in the latter case the correlation based on type of expiration extends to both members of the correlation of occlusiveness:

ʒ̂ ĉ ç̂
ẑ ŝ ṣ̂

The tie between members of a correlation bundle becomes particularly close when the entire bundle can be neutralized. Such neutralizable bundles are not rare. The above-mentioned four-member bundles of Sanskrit were neutralizable before obstruents and in final position (the unaspirated tenuis occurring as the only archiphoneme in absolutely final position). In Korean, where the occlusives form three-member bundles (lenis–fortis–aspirate), these bundles are neutralized in final position. The corresponding archiphonemes are represented by implosives. But the Korean consonants also form a three-member correlation bundle with respect to timbre (neutral–palatalized–labialized). These bundles are neutralized in final position. Their archiphonemes are represented by consonants of neutral timbre. But in addition, the correlation of palatalization is neutralized before *i*, the representative of the archiphoneme being conditioned externally; the correlation of labialization is neutralized before *u* and *y*, the representative of the archiphoneme being conditioned internally.[16] In Artshi, a language of the Eastern Caucasus group, the acute sibilants form a six-member correlation bundle (media–voiceless affricates without glottal occlusion–weak affricates without glottal occlusion–strong affricates with glottal occlusion–weak voiceless spirants–and strong voiceless spirants) which is neutralized before *t* and *d*. The archiphoneme in this case is represented by the (weak?) spirant. Examples can easily be multiplied.

As a result of the projection of all members of a correlation bundle onto the same plane, and as a result of the close interrelatedness of these members, it is sometimes rather difficult to analyze the bundle into individual correlations. For example, in cases where different prosodic correlations combine into a bundle, the members of such a bundle are sometimes conceived of as different "accents," with little attention given to differences of

quantity or differences of type of tone close. Sometimes they are conceived of as different degrees in quantity without regard to differences in tone movement. Mistakes of this type are made not only by laymen and untutored speakers. They are also made by theoreticians and sometimes even by professional phoneticians. Cases of this type are proof of the psychological reality of the classification of correlations into related groups. They are possible only where a correlation bundle is actually present, that is, where a phoneme participates in several correlations of the *same related group*.

If a phoneme participates simultaneously in several correlations of *different* related groups, such correlations do not combine into "bundles": they are not projected on the same plane but *superimposed* on one another. German stressed long *i* participates simultaneously in several correlations, namely, in the correlation of accent, the correlation of quantity, and the correlation of rounding. But while the former two form a bundle (the prosodic correlation bundle), the correlation of rounding (*i-ü, e-ö*) clearly belongs to another "plane." It can happen, of course, that two correlation bundles belonging to different "planes" are superimposed on each other and that both are neutralized in certain positions. We have already mentioned Korean, in which occlusives form a correlation bundle consisting of lenes–fortes–aspirates, and in which, further, all consonants, including the occlusives, form bundles of timbre consisting of a neutral, a palatalized, and a labialized member. Both correlation bundles are neutralized in final position. Consequently in word-final position in Korean, the guttural implosive *K* represents an archiphoneme that corresponds to nine phonemes medially—*g, k, k'; g', k', k''; g°, k°, k°'*. Still, the bundles *g-k-k'* and *g-g'-g°* obviously belong to quite different planes.

[1] In this connection cf. N. S. Trubetzkoy, "Essai d'une théorie des oppositions phonologiques," in *Journal de psychologie*, XXXIII, 5–18.

[2] The term was first used by N. Durnovo.

[3] The "phoneme *j*" is nonexistent in stage German. Stage German *j* should be regarded as a combinatory variant of the vowel *i*. Accordingly it does not belong to the consonant system.

[4] Cf. Fr. Trávníček, Správná česká výslovnost (Brno, 1935), p. 24.

[5] In this regard cf. E. A. Krejnovič, "Nivchskij (giljackij) jazyk," in *Jazyki i pis'mennost' narodov Severa*, III (1934), 188 ff.

[6] As for the division of multilateral oppositions into heterogeneous and homogeneous oppositions, and the division of homogeneous oppositions into linear and nonlinear oppositions, they are ultimately also based on the same principles.

[7] In this connection, see under *C*.

[8] On this point, cf. our essay "Die Aufhebung der phonologischen Gegensätze," in *TCLP*, VI, 29 ff., as well as A. Martinet, "Neutralisation et archiphonème," in *ibid.*, pp. 46 ff.

[9] Cf. R. Jakobson in *TCLP*, II, 8 f.

[10] Cf. Henri Frei in *Bulletin de la Maison franco-japonaise*, VIII (1936), no. 1, 130.

[11] Cf. Erin Assai, "A study of Yami Language, an Indonesian Language spoken on Botel Tobago Island" (Leiden, 1935), p. 15.

[12] Cf. Clement M. Doke, "A Study of Lamba Phonetics," in *Bantu Studies* (July 1928).

[13] What has been said applies, of course, only to those neutralizable gradual oppositions in which one member is "extreme." In cases where both members show different "mid" degrees of the same property, either the one or the other member can represent the archiphoneme. It depends on how the particular property is treated from the viewpoint of the given language. Most cases actually involve the opposition between two types of *e* or *o* vowels. In some languages close *e* and *o* are considered unmarked, in others open *e* and *o*. This can be seen from their occurrence in the position of neutralization. Accordingly the opposition in such cases ceases to be gradual from a phonological point of view.

[14] With respect to what follows, cf. (subject to the above reservation) N. S. Trubetzkoy, "Die phonologischen Systeme," in *TCLP*, IV, 96 ff. The term "correlation," proposed and defined by R. Jakobson, was used for the first time with reference to a proportional bilateral opposition in his proposal to the Congress of Linguists in The Hague, cosigned by S. Karcevskij and the present writer. See *I^er Congrès International de Linguistes* (La Haye, 1928), "Propositions," pp. 36 ff., and *Actes du I^er Congrès International de Linguistes*, pp. 36 ff., and *TCLP*, II, 6 f.

[15] Cf. N. S. Trubetzkoy, "Die Konsonantensysteme der ostkaukasischen Sprachen," in *Caucasica*, VIII (1931).

[16] Cf. A. Cholodovič, "O latinizacii korejskogo pis'ma," in *Sovetskoje jazykoznanije*, I, 144 ff.

IV PHONOLOGICAL CLASSES OF DISTINCTIVE OPPOSITIONS

1 PRELIMINARY REMARKS

So far we have considered the various types of distinctive oppositions thus: (*a*) from the point of view of their relation to other oppositions in the same system; (*b*) from the point of view of the logical relations between the opposition members themselves; and (*c*) from the point of view of the extent of their distinctive force. These three viewpoints resulted in three different classifications: (*a*) bilateral and multilateral, proportional and isolated oppositions; (*b*) privative, gradual, and equipollent oppositions; and (*c*) neutralizable and constant oppositions. All these standpoints and principles of classification are valid not only for phonological systems but for any other system of oppositions as well. They contain nothing that is specifically phonological. In order to be applied successfully in the analysis of concrete phonological opposition systems, they must still be supplemented by specifically phonological principles of classification.

The specific character of a phonological opposition consists in the latter's being a *distinctive opposition of sound*. "Distinctiveness" in the phonological sense, that is, the capacity of differentiating meaning, is something that requires no further classification. Phonological oppositions can, nevertheless, from this point of view be divided into oppositions *differentiating words* (lexical oppositions) and oppositions *differentiating sentences* (syntactic oppositions). For the meanings that can be distinguished by phonological oppositions are either the meanings of words,

including the meanings of individual grammatical word forms, or the meanings of sentences. This division is certainly of importance for the phonemic systems of the individual languages. It is less important for the general classification of distinctive oppositions, for all distinctive oppositions that appear with a syntactic function in one language may occur with a lexical function in another language. There are actually no specific phonological oppositions for differentiating sentences: an opposition that in one language serves to differentiate sentences in another serves to differentiate words.

Much more important for the general classification of phonological oppositions is the fact that these oppositions are *phonic* oppositions. Neither gesticulations with one's hands nor flag signals, but specific phonic properties, are placed in opposition with each other in phonological oppositions. It is presumed common knowledge that the purpose of contrasting sounds with each other is to differentiate meaning. The problem as to *how* phonic properties are placed in opposition with each other, that is, what types of opposition result, was discussed in Chapter III. The question now is to examine what phonic properties form phonological (distinctive) oppositions in the various languages of the world.

In Chapter III we operated with purely logical concepts. We must now combine these logical concepts with acoustic and articulatory, that is, with *phonetic*, concepts. For no other discipline except phonetics can teach us about individual sound properties. But we must not forget what has been said in the Introduction about the relationship of phonology to phonetics. Already in view of the fact that they are made part of the system of opposition categories that were discussed in Chapter III, the phonetic concepts with which the phonologist operates appear of necessity somewhat

schematized and simplified. Thus actually very little remains of phonetics in the following exposition. But this should not disappoint the phonetician. The object of the present chapter is not a classification of the sounds that can be produced by the human vocal apparatus, but a systematic survey of the phonic properties that are in effect utilized for the differentiation of meaning in the various languages of the world.

It is therefore also rather unimportant for the phonologist whether he uses acoustic or sound-physiological phonetic terminology. Important is only the unambiguous designation of phonic properties, which in phonetic literature are studied and investigated from various points of view, and which all phoneticians, despite existing differences of opinion, should be familiar with at least as *objects of study*. In modern instrumental phonetics, especially by means of sound film and X rays, it has become increasingly evident that the same sound effects can be produced by quite different movements of the vocal organs (Paul Menzerath, G. Oscar Russel). Such terms as "front vowel" or "occlusive" are therefore rejected from the standpoint of the modern methods. However, these terms have the advantage of being understood correctly by anyone familiar with traditional phonetics. Even the most accurate phonetician, provided he is not pedantic, can accept such terms, for lack of better and more accurate ones, as conventional designations for familiar objects of study. Acoustic terminology unfortunately is still very sparse. Consequently it is unavoidable in most cases to use physiological terms coined by traditional phonetics, although modern phonetics ascribes more consistency and uniformity to the acoustic effect than to the articulatory movements producing it. The phonologist, who is for the most part only interested in making reference to generally known phonetic concepts, is able to overcome these terminological difficulties.

2 CLASSIFICATION OF DISTINCTIVE PHONIC PROPERTIES

The phonic properties that form distinctive oppositions in the various languages can be divided into three classes: *vocalic*, *consonantal*, and *prosodic*. Vowel phonemes consist of distinctive vocalic properties, consonantal phonemes of distinctive consonantal properties; but there are no phonemes that consist exclusively of prosodic properties. Depending on the language, prosodic properties may combine with a single vowel phoneme, a single consonantal phoneme, or an entire sequence of phonemes.

Before defining the various classes of distinctive phonic properties, the term "vowel" and "consonant" must therefore be examined.

L. Hjelmslev attempted to define these terms without reference to any phonetic concepts: vowels are to be those phonemes, or in Hjelmslev's terminology, "cenemes" or "cenematemes," which have the faculty of forming a notional unit or a word by themselves, while all other phonemes or "cenemes" or "cenematemes" respectively are consonants.[1] Hjelmslev subsequently refined this definition which obviously restricted the application of the vowel concept too much. (For example, in German only three vowel phonemes would remain: *Oh! Au!* and *Ei!*) He added the following supplement: "Nous comprenons par voyelle un cénème susceptible de constituer à lui seul un énoncé . . . ou bien admettant à l'intérieur d'une syllabe les mêmes combinaisons qu'un tel cénème."[2] But even in this second, expanded version the definition is untenable. Again, in German, of the pure vowels only the *o* and of the diphthongs only *œ̯* and *ɑo̯* are used as interjections, only *Au* and *Ei* as words. These three vowel phonemes, among others, can also occur word-finally ("froh," "Frau," "frei" [glad, woman, free]), but they are not found before *ŋ*. Short vowels, on the other hand, cannot occur in final position, but some, namely *i*, *u*, *ü*, *a*, and *e*, occur before *ŋ*. If one regards interjections such as *Oh! Ai!* and *Au!* as independent notional units (énoncés), one must also recognize as such the interjection *ssh!* (a plea for silence). In keeping with Hjelmslev's definition, German short *u*, *ü*, *i*, *a*, and *e* would accordingly have to be regarded as consonants, while German *š* and all phonemes participating in the same combinations, that is, practically all consonants, would have to be regarded as vowels.

The untenability of the definition proposed by Hjelmslev is even more apparent in other languages. In addition to the interjection *š!* Russian also has the interjections *s!* and *c!* In certain other languages the number of isolated "syllabic consonants" used as interjections or command words for animals is even more numerous.[3] On the other hand, there are many languages in which vowels cannot occur initially, and where it is consequently impossible to have words consisting of a single vowel.

The untenability of the definition given by Hjelmslev is not an accident. "Vowel" and "consonant" are *phonic* or acoustic terms, and can only be defined as such. Any attempt to eliminate or circumvent acoustic-articulatory concepts in the definition of vowels and consonants must necessarily fail.

The process of phonation of human speech can best be illustrated by the following scheme: somebody whistles or sings a melody into the mouthpiece of a tube and alternately opens and covers the other end of that tube with his hand. It is clear that three types of elements can be distinguished acoustically in the course of this process: first, the segments between

closing and opening the orifice; second, the segments between opening and closing it; and third, the segments of the melody whistled or sung into the tube. Elements of the first type correspond to consonants, elements of the second type to vowels, and those of the third type to prosodic units.

Important for a consonant is, in the words of Paul Menzerath, "a closure–aperture movement, with an articulatory maximum between these two points," for a vowel "a movement of aperture–closure, with an articulatory minimum in the interspace."[4] In other words, what characterizes a consonant is the *production of an obstruction and the overcoming of such an obstruction.* A vowel, on the other hand, is characterized by the *absence of any obstruction.*[5]

It follows from what has been said that properties that are specifically consonantal can refer only to various types of obstructions or to the ways of overcoming these obstructions. They may therefore be called *properties based on the manner of overcoming an obstruction* (*Ueberwindungsarteigenschaften*). Properties that are specifically vocalic, on the other hand, can only refer to the various types of absence of an obstruction, that is, practically speaking, to the various degrees of aperture. They may therefore be called *properties based on degree of aperture* (*Oeffnungsgradeeigenschaften*).

In addition to these properties, which are specifically consonantal or vocalic, consonantal and vowel phonemes may have certain other properties. Let us suppose that in the presented scheme of the phonation process the length of the tube changes continually, or the position of its orifice varies continually. It follows that with respect to the consonants the different types of obstruction or the different modes of overcoming these obstructions, and with respect to the vowels, the different degrees of aperture, must be localized in different positions. As a result, special *properties of localization* are produced for the consonants as well as for the vowels. These form, so to speak, a second coordinate to consonant or vowel quality, respectively.

For some vowel and consonant phonemes still a third quality coordinate can be established. To stay with our phonation scheme, let us suppose that our tube is connected with another resonator, and during phonation this connection is alternately established and disrupted. This, of course, must affect the character of the sound produced. The specific acoustic properties that the phonation of consonants and vowels produces by means of establishing and disrupting the connection with the second resonator can be termed *properties of resonance.*

A distinctive property exists only by virtue of being a member of a distinctive opposition. German *d*, when placed in opposition with *t* ("Seide"/"Seite" [silk/side]), has the property "lenis" based on the manner of overcoming an obstruction; when placed in opposition with *b* ("dir"/"Bier" [you/beer]) or with *g* ("dir"/"Gier" [you/greed]), the property of localization "dental" or "apical"; and the property of resonance "nonnasal" when placed in opposition with *n* ("doch"/"noch" [yet/still]). Similarly, French *o* has a specific property based on degree of aperture in opposition with *u* ("dos"/"doux"), a specific property of localization in opposition with *ö* ("dos"/"deux"), and a specific property of resonance in opposition with *õ* ("dos"/"don"). In contrast, German *o* does not have any property of resonance because a distinctive opposition between nasalized and nonnasalized or between pharyngealized and nonpharyngealized vowels is alien to standard German. The "three coordinates" to vowel or consonantal quality need not, therefore, be present in every vowel or consonant phoneme. But each one of the properties that make up a vowel or a consonant phoneme must belong to one of the "three coordinates" mentioned.

As regards the prosodic units, our phonation scheme shows that they are rhythmic-melodic units—"musical" in the broadest sense of the word. Even from a purely phonetic point of view, the "syllable" is basically something quite different from a combination of vowels and consonants.[6] The phonological prosodic unit is, of course, not simply identical with the "syllable" (in the phonetic sense). However, it always relates to the syllable because, depending on the language, it is either a specific segment of the syllable or an entire sequence of syllables. It is quite clear that its properties cannot be identical with the vocalic and consonantal properties discussed above. Since the prosodic unit must be conceived of as "musical" (rhythmic-melodic), or better, as a segment of a "musical" unit, it follows that "prosodic properties" refer either to the specific marks of each constituent segment of a melody (intensity, tone) or to the type of segmentation of the melody in the phonation process of human speech. The former type of properties effectuates the rhythmic-melodic differentiation of prosodic units. The latter characterizes the contact of a given prosodic unit with an immediately adjacent unit. Prosodic properties can therefore be divided into *properties based on type of differentiation* and *properties based on type of contact.*

3 VOCALIC PROPERTIES

A Terminology

As already discussed, vocalic properties are divided into properties based on degree of aperture, properties of localization, and properties of resonance. The first two types of properties are much more closely related

to each other than to the properties of resonance, so that they may be combined into a special group or bundle.[7]

Among all speech sounds, vowels can most easily be analyzed acoustically. The degrees of aperture correspond acoustically to "degrees of saturation or sonority." In principle the more the lower jaw is lowered, that is, the wider the mouth is opened, the higher the degree of saturation. But this principle appears to be fully valid only in the case of isolated vowels when they are sung. In spontaneous connected speech the same acoustic effects can also be achieved with the articulating organs in a different position. The parallelism between degree of saturation of the vowel and degree of lowering of the lower jaw (vertical movement) is therefore not always complete.[8] Since the linguist, after all, is ultimately interested in the acoustic effect, it would perhaps be advisable to replace the term *properties based on degree of aperture*, by *properties based on degree of sonority* or *properties based on degree of saturation*. The properties of localization correspond acoustically to various gaps in the series of partial tones: the "front vowels" show an increase of the higher and a suppression of the lower partial tones; conversely the higher partial tones are the ones that are suppressed in the case of the "back vowels." In general, the stronger or higher the partial tones, the shorter the "front resonator," that is, in terms of the human vocal apparatus, the shorter is the distance between the rims of the lips and the highest point of the mass of the tongue. But since the same acoustic effect can also be achieved by other positions of the vocal organs, the parallelism between tongue and lip movement ("horizontal movement") is not always present in this case either. The term *properties of localization* with reference to the vowels may therefore be replaced by *properties of timbre*. In the following discussion the "inexact" terms "properties pertaining to degree of aperture" and "properties of localization" are used in addition to the acoustic terms.

Languages having only one vowel phoneme do not seem to exist in the world. If such a "one-vowel" language should ever have existed, it must have permitted numerous consonant combinations. For only under this condition would a single vowel phoneme be able to exist at all, since it could be placed in opposition with the absence of a vowel (zero vowel) between the members of a consonant combination or after consonants in final position. A "one-vowel" language without consonant combinations, on the other hand, would be vowelless from a phonological point of view, since the obligatory vowel after every consonant would have to be evaluated as a matter-of-fact component in the realization of the consonant and would not have any distinctive force.[9] The languages with which we are familiar have several vowel phonemes which form specific *vowel systems*.

From the point of view of degrees of aperture (degrees of sonority) and vocalic localization series (classes of timbre), three basic types of vowel system can be set up:[10] (*a*) *linear systems*, in which the vowel phonemes possess specific degrees of sonority but no distinctively relevant properties of timbre (properties of vocalic localization); (*b*) *quadrangular systems*, in which all vowel phonemes not only possess distinctive properties based on degree of sonority but also distinctive properties of timbre; and (*c*) *triangular systems*, in which all vowel phonemes possess distinctive properties based on degree of sonority. Distinctive properties of timbre are found with all vowels except the maximally open vowel phoneme. The latter phoneme is outside the oppositions of localization. Within these basic types, subtypes can be set up depending on how many degrees of sonority and classes of localization there are, and depending on the relations of logical opposition between the individual types of distinctive property.

B Properties of Localization or Timbre

There are languages in which these vowel properties are not distinctive, because they are automatically conditioned by the phonic environment. This is the case in Adyghe, where three vowel phonemes are distinguished: the maximally close "ə" which is realized as *u* in the neighborhood of labialized velars, as *ü* between two labials and after labialized sibilants, as *ы* after nonlabialized back velars, as *i* after palatals, and in all other positions as a close indeterminate vowel *ə*; mid open "*e*" which is realized after labialized velars as *o*, after labialized sibilants and between labials as *ö*, after laryngeals and nonlabialized back velars as *a*, in the remaining positions as *e* or as indeterminate open vowel *ë*; and the maximally open "a" which is realized between two labials as slightly rounded, between two palatals as *ä*, and elsewhere as a long *ā*. The duration of these vowels is in accord with their sonority: "*a*" is the long [illegible], "*e*" somewhat shorter (after laryngeals and nonlabialized back velars this difference in quantity is clearly noticeable), "*ə*" the shortest, with a tendency to be reduced. Long, *ū*, *ō*, *ē*, and *ī* do occur, but only as optional variants of diphthongs ("*ew*," "*əw*," "*ej*," "*əj*"). Similar conditions hold true for Abkhas, but there the realization of the mid-open vowel is more uniform: it occurs as an *e* only in the vicinity of *j*, as an *o* only before a *w* in closed syllable, elsewhere always as *a* which is distinguished from the maximally sonorous vowel mainly by its shorter duration. The vowel system of Ubyk is in all probability based on the same principle. Vowel phonemes with a phonologically specific degree of sonority and phonologically irrelevant timbre would thus appear to be a peculiarity of the [illegible] Caucasian languages. Whether such "linear" vowel systems also occur elsewhere is hard to say

at the present state of phonological studies in the world. As far as we know, linear systems do occur in certain languages as partial systems, in particular in certain Finno-Ugric and Turkic languages, in which the vocalism of the first syllable is richer than the vocalism of all other syllables. (On this point see further below.)

In the overwhelming majority of languages, the properties of timbre of the vowel phonemes are distinctive. The only difference between triangular systems and quadrangular systems is that in the former distinctive oppositions of timbre exist only with respect to the vowels of nonmaximal degree of aperture, while in the latter type they are found in vowel phonemes of all degrees of aperture. Actually there are only two oppositions of timbre: one opposition between rounded and unrounded vowels (opposition of lip rounding), and another between back and front vowels (opposition of tongue position).[11] These oppositions can occur with distinctive force either independently or in combination, thus producing different *classes of timbre*. The following eight classes of timbre are conceivable: rounded, unrounded, front, back, front rounded, back rounded, front unrounded, back unrounded. All eight of these classes do in fact occur in different languages. But in a single system only four classes of timbre can exist at the most. The triangular and quadrangular systems can accordingly be divided into *two-class*, *three-class*, and *four-class* systems. Acoustically, the rounded vowels are darker than the unrounded, and the front vowels clearer than the back vowels. Every multiclass vowel system must therefore have a *maximally dark* and a *maximally clear* class of timbre, which may be designated as *extreme* classes since there may be one or two *medial* classes between them.

Three possibilities exist for *two-class systems*: either the opposition of tongue position alone is distinctive, or the opposition of lip rounding alone is distinctive, or both oppositions occur in combination. In the first case the back and front vowels are placed in opposition with each other, and lip participation is phonologically irrelevant. In the second case rounded and unrounded vowels are opposed to each other, and the position of the tongue is phonologically irrelevant. Finally, the third case involves a distinctive opposition between back rounded and front unrounded vowels. In this case the properties of timbre of the vowel phonemes cannot be divided. Thus one should actually not speak of back rounded and front unrounded vowels, but only of maximally dark and maximally clear vowels. It is evident that the first and second cases involve logically privative oppositions, while the third case involves a logically equipollent opposition.

In quadrangular two-class systems, cases one and two are the ones usually found, that is, the correlation of tongue position or the correlation

of lip rounding is found in its pure form. It all depends here on the makeup of the two vowel phonemes with the maximal degree of aperture. If both are unrounded, one must be a back vowel, the other a front vowel. As a result, the opposition of tongue position also becomes a bilateral proportional opposition in the other vowel pairs of the same system. On the other hand, the fact that back vowels of nonmaximal degree of aperture are rounded is nonsignificant from the point of view of the total system. As an example of such a two-class quadrangular system, the vowel system of those archaic Montenegran dialects may be cited in which the Proto-Slavic "semivowels" did not develop into an *a*, as they did in Serbo-Croatian, but into a particularly open *æ* sound (a "sound intermediary between *a* and *e*"):[12]

a *æ*

o *e*

u *i*

If, however, the "dark" vowel of maximal degree of aperture is rounded, and its "partner" is an unrounded nonfront vowel, the lip position alone is phonologically relevant for such a vowel pair. As a result, the opposition of lip rounding becomes exclusively distinctive for all other vowels of the same system as well, while the frontal character of the unrounded vowels is considered merely an insignificant secondary phenomenon. The vowel system of the Plaza dialect of Polish (in Western Little Poland) will serve as an example of such a quadrangular system:

å *a*

o *e*

ů *y*

u *i*[13]

Quadrangular two-class systems, in which the maximally open vowel pair is represented by a back rounded vowel and a front unrounded vowel phoneme, are extremely rare. In systems of this kind individual properties of localization cannot be isolated: the vowels are divided into two classes of timbre, a maximally dark and a maximally clear class. These stand in a relationship of logically equipollent opposition to each other. The vowel system of the Uzbek dialect of Tashkent may serve as an example:[14]

ɔ *æ*

o *e*

u *i*

This relation of logically equipollent opposition between the two classes of timbre, which as indicated is extremely rare in quadrangular systems, predominates in triangular two-class systems. In systems of the latter type back rounded (maximally dark) vowels are contrasted with front unrounded (maximally clear) vowels as "polar" members of an equipollent opposition; and the maximally open vowel phoneme *a*, which stands outside this opposition, is a back unrounded vowel, that is, it belongs to neither of the two classes of timbre as the remaining phonemes of the respective vowel system. The well-known vowel system of Latin may serve as a classical example:

a

o *e*

u *i*

Similar triangular systems, only sometimes with a different number of degrees of aperture, occur in the most diverse languages in all parts of the world.

Only rarely does it happen that the correlation of lip rounding or the correlation of tongue position alone has distinctive force in a two-class triangular system, so that the relation between the two classes of timbre would be logically privative. This may be deduced either from the realization of the vowel phonemes or from the circumstances surrounding the neutralization of the various oppositions. The vowel systems of Russian, Artshi, and Ostyak may be cited as examples of such triangular two-class systems in which only the correlation of lip rounding is distinctive. In Russian the front or back position of the tongue is contextually conditioned in the realization of the vowel phonemes: between two palatalized consonants "*ü*," "*ä*," "*e*," and "*i*" are pronounced as front vowels (*ɔ*, *ü*, *ė*, and *i*). *u* is also fronted in that position, though not as much as the other vowels. On the other hand, after nonpalatalized (phonetically velarized) consonants "*u*," "*o*," and "*a*" are realized as vowels of the back series, "*ï*" as a vowel of the back-central series (*ui*). "*e*," too, is pronounced by some Russians as a vowel of the central series in this position. Back or front position of the tongue is therefore phonologically irrelevant for Russian vowels: the correlation of lip rounding of the vowel phonemes alone has distinctive force.[15] Artshi, an East Caucasian language of Central Daghestan, has a "correlation of consonantal rounding," that is, certain consonants are divided into a rounded and an unrounded variety. This correlation is neutralized before and after the rounded vowels *u* and *o*.[16] As a result, these vowels are placed in opposition with the remaining vowels

of the Artshi system, namely, with unrounded *a*, *e*, and *i*. This means that all vowels are divided into rounded and unrounded vowels, while the back or front position of the tongue proves irrelevant for the classification of vowel phonemes, and consequently also for the phonemic content of these phonemes.[17]

Ostyak, or more precisely, the Kasym dialect of Northern Ostyak, now elevated to the rank of a standard written language, has a two-class triangular system in word-initial syllables:

a

ɔ *ɛ*

o *e*

u *i*

Only unrounded vowels (*i*, *e*, *ɛ*, and *a*) occur in all other syllables.[18] In other words, the *correlation of timbre* is here neutralized in noninitial syllables, the unrounded vowels representing the archiphonemes of the corresponding oppositions (*u-i*, *o-e*, *ɔ-ɛ*). Since the choice of the representative of the archiphoneme in this case is obviously internally conditioned, unrounded *i*, *e*, and *ɛ* in the pairs *u-i*, *o-e*, and *ɔ-ɛ* must be considered the unmarked opposition members. Lip rounding must therefore be regarded as the phonologically relevant correlation mark.

As an example of such two-class triangular systems, in which only the correlation of tongue position is distinctive, the Japanese vowel system may be cited. In this system, the correlation of palatalization of consonants, that is, the opposition between palatalized and nonpalatalized consonants, is neutralized before the front vowels *e* and *i*, but retained before the back vowels *u*, *o*, and *a*. As a result, *i* and *e* are put in opposition with the remaining vowels, that is, all vowels are divided into front and back vowels, lip rounding being irrelevant for the classification of the vowel phonemes, and hence for their phonemic content.[19] The vowel system of Japanese and that of Artshi (*u*, *o*, *a*, *e*, *i*), already referred to, are therefore quite different phonologically, despite their apparent similarity. The correlation of tongue position alone is the phonological basis of the one, the correlation of lip rounding of the other.

In addition to the two "extreme" classes of timbre, three-class vowel systems further contain a "medial" class which is phonetically realized either by unrounded back or central vowels, or by rounded front or central vowels. The medial class of timbre is most frequently represented by front rounded vowels. The relationship of the medial class of timbre to the

extreme classes is not identical in all languages. The presence of the medial class of timbre partly facilitates and partly complicates the analysis of complexes of properties that occur in the extreme classes.

In a three-class vowel system a medial class of timbre that consists of front rounded vowels may be related more closely to the one or the other extreme class of timbre of the same vowel system, depending on the language involved. The closeness of the relationship is primarily expressed in the neutralization of the corresponding oppositions. Thus, for example, the oppositions *y*(= *ü*)-*u*, *ö*-*o*, and *ä*-*a* are neutralizable in Finnish. *y*, *ö*, and *ä* cannot occur after a syllable containing *u*, *o*, or *a*. Conversely *u*, *o*, and *a* cannot occur after a syllable containing *y*, *ö*, and *ä*. The oppositions *u*-*i*, *y*-*i*, *o*-*e*, and *ö*-*e*, on the other hand, cannot be neutralized. In other words, only oppositions between front and back vowels (of the same degree of aperture) are neutralizable, while oppositions between rounded and unrounded vowels (of the same degree of aperture) are constant. After a syllable containing *u*, *y*, *o*, *ö*, *a*, or *ä*, therefore, only five vowels are possible in each case; that is, after *u*, *o*, and *a*, the vowels

a

o *e*

u *i*

and after *y*, *ö*, and *ä*, the vowels

ä

ö *e*

y *i*

Quite a different distribution of classes of timbre is seen in a three-class vowel system, such as that of Polabian.[20] In Polabian the correlation of palatalization was present in consonants. However, it was neutralized before all front vowels and before the maximally open vowel *a* which stood outside the classes of timbre. As a result, the back vowels *u*, *o*, and *a* acquired a special position in the system. The oppositions between the back and front vowels of the same degree of aperture were constant (non-neutralizable), while the oppositions between rounded and unrounded vowels of the same degree of aperture (*ü*-*i*, *ö*-*e*) were neutralizable after *v* and *j*, the archiphoneme being represented by unrounded *i* and *e*. As a result, the medial class of timbre was more closely linked to the front class.

A certain hierarchy existed with respect to the correlation of tongue position and the correlation of lip rounding:

back vowels—front vowels { rounded / unrounded

The properties of lip participation were phonologically irrelevant for the back vowels.[21] Graphically this may be represented as follows:

a

α *e*

o *ö*, *ê*

u *ü*, *i*

It seems that three-class vowel systems are comparatively rare, such as those of Finnish and Polabian, in which the medial class of timbre is more closely related to one of the extreme classes, thereby creating a certain hierarchy between the correlations of tongue positions and lip rounding. In most three-class systems that have front rounded vowels in the medial class of timbre, it is not possible to establish a closer relationship between that class of timbre and one of the extreme classes. For example, in standard German, Dutch, French, Norwegian, Swedish, and Danish the three classes of timbre are opposed to each other as equidistant opposition members. As far as we know, there is also no reason to assume a closer relationship between the medial class of timbre and one of the extreme classes in Northern Albanian, Estonian, Ziryene,[22] and Annamese.[23] In K'üri, now Lezghian, in which the oppositions *a*-*e* and *u*-*i* are not neutralizable, while both the oppositions *ü*-*u* and *ü*-*i* are neutralized in certain positions (stressed *ü* cannot occur in a syllable after *u* or *i*, and stressed *u* and *i* in turn cannot occur in a syllable containing *ü*), the medial class of timbre is also equally closely related to both extreme classes.[24]

In the three-class vowel systems discussed so far, the medial class of timbre was represented by front rounded vowels. Systems in which the medial class of timbre contains back (or central) unrounded vowels are found much more rarely. As examples Romanian, Siamese,[25] and Votyak ("Udmurt")[26] may be mentioned. In systems of this type, too, there is sometimes a closer relationship between the medial class and one of the extreme classes of timbre. For example, in the East Sorbian (East Lusatian-Wendic) dialect of Muskau,[27] described by Ščerba, the opposition between vowels of the medial and front class of timbre is neutralized after non-guttural lingual consonants, that is, after dentals, palatals, sibilants, and

r and *l* sounds: the unrounded central vowels *ï* (Ščerba's *ë*) and *ë* (Ščerba's *æ*) occur after *d*, *t*, *n*, *l*, *r*, *s*, *z*, *c*; the front vowels *i* and *ɛ*, on the other hand, occur after *ɜ'*, *c'*, *z'*, *s'*, *n*, *l*, *r*, and *j* (while, for example, after labials, *i* and *e* as well as *ï* and *ë* may occur with distinctive function). The vowels of the medial class of timbre in this case are therefore more closely related to the vowels of the front (maximally clear) class.

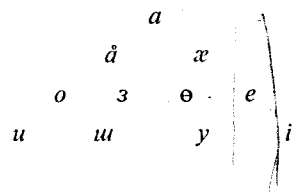
As for *four-class* vowel systems, they are found much more rarely than three-class systems. The vowel system found in many Turkic languages may be cited as an example:

o a ö ä
u ɯ ü i

In those Turkic languages in which the so-called vowel harmony is carried through consistently, the vowel system cited exists only in word-initial syllable in the above form, that is, with full phonological validity. In all other syllables the oppositions of timbre are neutralized. The realization of the vocalic properties of timbre in noninitial syllables is conditioned by the vowel of the preceding syllable. In the four-class vowel systems such a system as that of Eastern Cheremis[28] must also be counted, in which the vowels with the minimal degree of aperture have four, with the mid-degree of aperture three, and with the maximal degree of aperture two, classes of timbre, so that the entire system contains nine vowel phonemes. The correlation of tongue position is neutralizable in all vowel pairs, while the correlation of lip rounding is neutralizable only in the vowels with the minimal degree of aperture.[29] The particular vowel system could therefore be represented in about the following diagram (using the transcription as it appeared in *Anthropos*):

a ä
o ö e
u ü ə i

But there are also those four-class vowel systems in which the oppositions of timbre cannot be neutralized at all, so that all four classes of timbre coexist fully autonomously and with full equality. The vowel system of Ostyak-Samoyed (now Selkup),[30] in which not a single opposition is neutralizable, appears to belong to this type:



C Properties Based on Degree of Aperture or Sonority

Above we discussed the so-called linear vowel systems whose members only possessed properties based on degree of aperture but no properties of localization or timbre. The question now is whether there are also vowel systems whose members, conversely, possess only properties of timbre but no properties based on degree of aperture. J. van Ginneken believes that he can answer this question in the affirmative. As an example he cites the vowel systems of Lak, an East Caucasian language of Central Daghestan, and of "Assyro-Babylonian[31] of the Achaemenid inscriptions." With respect to the latter, no opinion can be ventured at all since it is an extinct language. With respect to Lak, it can be positively shown that the vowel phonemes of this language contain not only properties of timbre but also properties based on degree of aperture. It is true, of course, that the three vowels of Lak are realized as *u*, *a*, and *i* in most phonic positions. It is this circumstance that leads van Ginneken to assume that the *u* involved a "back rounded vowel in general," the *i* a "front unrounded vowel in general," and the *a* a "back unrounded vowel in general," so that the degree of aperture of these three vowels was phonologically irrelevant. However, in the neighborhood of strongly palatalized consonants the realization of all three Lak vowel phonemes changes: "*u*" in this position is realized as *ö*, "*i*" as *e*, and "*a*" as *ä*.[32] Thus no opposition of timbre, but an opposition of degree of aperture, exists in this position between "*i*" and "*a*." A comparison of the two variants of each vowel phoneme of Lak shows that with respect to "*a*" the maximal degree of aperture alone is important, while for "*u*" and "*i*," first, the minimal degree of aperture, and, second, a specific property of timbre, that is, for "*u*" the property of being rounded, for "*i*" the property of being unrounded, are phonologically relevant. Lak can therefore by no means be used as proof for the existence of vowel systems without properties based on degrees of aperture. The same is also true of other languages with three-member vowel systems of the type "*u*," "*a*," "*i*."[33] In Arabic a clear opposition based on degree of aperture exists between "*i*" and "*a*" since "*a*" is mostly realized as a front vowel (unless it occurs in the vicinity of "emphatic consonants"). But after emphatic consonants the "*a*" sounds "dark," so that in that position it rather stands in opposition to "*u*" with respect to degree of aperture. Arabic "*a*" before "emphatic consonants" is realized as a back or back-central vowel (like the "*a*" in English "father"). But short "*i*" in this position is also pronounced as back-central *ï*. Therefore, in this case too, an opposition based on degree of aperture is found between "*a*" and "*i*."[34] The same phonological properties as for the three vowel phonemes

of Lak discussed above must therefore also be assumed for Arabic "*u*," "*a*," and "*i*." In Modern Persian long "*a*" is normally pronounced with rounding, while short "*a*" has changed to "*ä*." Long *a* in this case thus stands in an opposition based on degree of aperture with the corresponding maximally dark vowel (*u*), and short *ä* with the corresponding maximally clear vowel (*e*).[35] In other languages with only one "maximally dark," one "maximally clear," and, with respect to timbre, one "neutral," vowel phoneme the "neutral" vowel phoneme is also much more open than the other two. While there actually exists only an opposition of timbre between the "maximally dark" and the "maximally clear" vowel, both vowels stand in an opposition based on degree of aperture with the "neutral" vowel phoneme. In certain phonic positions this is particularly apparent.

Accordingly there are no vowel systems without distinctive oppositions based on degree of aperture. This is of course only true with respect to "total systems": in "partial systems," that is, in those systems that exist only in a specific phonic position in a given language, it happens that oppositions based on degree of aperture are excluded. For example, in Russian only two vowel phonemes, that is, *ĭ* and *ŭ*, occur in pretonic syllables after palatalized consonants as well as after *č*, *š*, and *ž*. The phonemic content of these vowel phonemes in this particular position consists only of their properties of timbre (*ĭ* unrounded, *ŭ* rounded). But this partial system does not have an independent existence. It exists only in connection with the partial system of the remaining unaccented syllables (*ŭ*, *ă*, and *ĭ*) and with the partial system of the accented syllables (*u*, *o*, *a*, *e*, and *i*) which have oppositions based not only on classes of timbre but also on degrees of aperture.

Every language has thus a vowel system with oppositions based on degrees of aperture. And just as all vowel phonemes with the same property of timbre form a "class of timbre" within a given vowel system, all vowel phonemes with the same degree of aperture (= degree of sonority) can be comprised under one "degree of sonority" within the same system. Vowel systems can accordingly be divided not only into "one-class" (= linear), "two-class," "three-class," and "four-class" systems, but also into "two-degree," "three-degree," "four-degree" systems, etc.

Two-degree vowel systems are not rare. The systems of Lak, Arabic, and Modern Persian have already been cited above. These are two-degree (and two-class) triangular systems. Schematically:

a

u *i*

Certain other vowel systems also belong to the same type, for example, the system of Tlingit and Haida (in North America)[36] and Old Persian. But there are also two-degree *quadrangular* systems, for example, the vowel system of Tonkawa, in Texas,[37] which has a back and a front class of timbre, the vowels of the back class being realized more openly than the corresponding front vowels. Thus there is no symmetry from a phonetic point of view:

a *e*

o *i*

A two-degree, three-class quadrangular system, for example, is present in K'üri (Lezghian):[38]

a *e*

u *ü* *i*

As an example of a four-class, two-degree quadrangular system, the aforementioned vowel system of many Turkic languages can be cited:

o *a* *ö* *ä*

u *ɯ* *ü* *i*

It is clear that in all two-degree vowel systems the opposition based on degree of aperture can be conceived of as a logically privative opposition—"low"/"nonlow" or "high"/"nonhigh." But since, as far as we know, the opposition based on degree of aperture does not seem to be neutralizable, it has not become an actually privative opposition anywhere.[39]

By far the majority of languages has *three-degree* vowel systems. A two-class, three-degree *triangular* system is found with varying realization in numerous languages in all parts of the world: for Europe, let us mention Modern Greek, Serbo-Croatian, Czech, (standard) Polish; for the Soviet Union, (standard) Russian, Erza-Mordvin, Georgian, Avar, Andi, Artshi, Tavgy-Samoyed ("Ngasan"); for Asia, Japanese and Tamil; for Africa, Lamba, Shona, Zulu, Ganda, and Chichewa; for America, Maya, etc.:

a

o *e*

u *i*

But three-class, three-degree triangular systems are not rare. Of the three-degree *quadrangular systems* the already-mentioned vowel system of the Montenegran dialects may be cited:

a *ä*

o *e*

u *i*

In all three-degree vowel systems the individual degrees of sonority stand in a relation of gradual opposition with each other. The neutralizability of a phonic opposition within such a system conforms to the rules that govern the neutralization of gradual oppositions, that is, either the "extreme" opposition member functions as the representative of the archiphoneme or its choice is conditioned externally.

Considerably rarer than three-degree vowel systems are *four-degree* systems. Still, they do occur in quite a number of languages in various parts of the world. As examples, the triangular system of Italian:

a

ǫ *ę*

o *e*

u *i*

and the above-mentioned quadrangular system of many Polish dialects may be cited:

å *a*

o *e*

ů *y*

u *i*

(in the traditional transcription of Polish dialectologists). Here, as in all vowel systems of more than two degrees, the individual oppositions based on degree of aperture are gradual oppositions. Special relations result where some of these oppositions are neutralizable. For, if the opposition between the two medial degrees of sonority is neutralizable, this opposition loses its gradual character and becomes a privative opposition. The opposition "mark" is then either the "closeness" or "openness," depending on which opposition member represents the archiphoneme. For example, in the Scottish dialect of Barra Island (Hebrides)[40] a four-degree vowel

system exists, but only in word-initial syllable. The medial oppositions *o-ɔ* and *e-æ* are neutralized in the remaining syllables, so that in that position there occur only the open vowels *ɔ* and *æ*. These vowels may thus be considered the unmarked opposition members. The correlation *o-ɔ*, *e-æ* must then be designated as a "correlation of closeness." However, where the neutralizable opposition of sonority contains one of the "extreme" degrees of sonority, that is, either the maximal or minimal degree, the gradual character of the opposition is not changed. In Danish the oppositions *u-o*, *y-ø*, and *i-e* are neutralized before a preconsonantal nasal (and before *ŋ*). There is also a clear tendency to neutralize the same oppositions before *r*.[41] Nevertheless, Danish *o*, *ö*, and *e* cannot be considered open *u*, *y*, *i*. The situation is somewhat different where this type of neutralization affects the entire vowel system. This is the case in Ibo, Southern Nigeria.[42] This language has a two-class, four-degree vowel system, in which, on the one hand, the oppositions based on degree of aperture between the vowels of the first and second degree of sonority are neutralizable. On the other hand, the vowels of the third and fourth degree of sonority are neutralizable in such a way that there exists a proportion "1:2 = 3:4." A word can only contain vowels of the first and third degree or of the second and fourth degree of aperture. All affixes (prefixes and suffixes) follow the vocalism of the stem in this regard. Accordingly all oppositions based on the degree of aperture are equipollent in this system:[43]

low	open	*ɔ-a*	4th degree of aperture
	close	*o-ɛ*	3rd degree of aperture
high	open	ʊ-*e*	2nd degree of aperture
	close	*u-i*	1st degree of aperture

One can divide the words, or stems, or roots of this language into an "open vowel" category and a "close vowel" category, and the affixes into a "low vowel" category and a "high vowel" category. But none of these classes can be considered unmarked or marked.

As already mentioned, four-degree vowel systems are much rarer than three-degree systems. Five-degree vowel systems may be considered special rarities. In Europe such systems exist in Switzerland, for example, in the Kerenz dialect of the Canton Glarus.[44] In Africa, Fante on the Gold Coast seems to have a five-degree (two-class) triangular system: *u*, ʊ, *o*, *ɔ*, *a*, *ɛ*, *e*, ɪ, *i*.[45] Gweabo, in Liberia, seems to have a *six-degree* (two-class) triangular system, if the opposition between "bright" and "muffled" vowels of this system can be evaluated as an opposition based on the degree of sonority.[46] In Gweabo there exists a type of "vowel harmony"

that presupposes the neutralizability of the oppositions between the first and second, the third and fourth, and the fifth and sixth, degrees of sonority. The rules for vowel harmony are here much more complicated than in Ibo. In any event they presuppose the following division of the entire system (we leave E. Sapir's transcription unchanged):

low	"bright"	*a*	6th degree of aperture
	"muffled"	*O* – *E*	5th degree of aperture
mid	"bright"	*ɔ* – *ɛ*	4th degree of aperture
	"muffled"	*o* – *e*	3rd degree of aperture
high	"bright"	*o̱* – *e̱*	2nd degree of aperture
	"muffled"	*u* – *i*	1st degree of aperture

In every vowel system the maximally dark and the maximally clear class of timbre always contains the same number of degrees of sonority. This is valid without reservation for quadrangular systems. In triangular systems the vowel with the maximal degree of sonority, which is outside the classes of timbre, is to be added. A four-degree quadrangular system, for example, must therefore contain four vowels of the maximally dark, and four vowels of the maximally clear, class of timbre, while a four-degree triangular system contains only three dark and three clear vowels and in addition a maximally open vowel. In quadrangular systems individual oppositions based on degree of aperture are usually neutralized in both the maximally dark and the maximally clear class of timbre. The result of such neutralization is then always another "quadrangular" partial system (with fewer degrees of sonority). In triangular systems the neutralization of a particular degree of aperture may take place in the two "extreme" classes of timbre, which again creates a "triangular" partial system; or it may take place only in one of the two extreme classes of timbre, in which case the partial system is quadrangular. For example, in certain dialects of Modern Greek the opposition between the first and second degree of sonority of a three-degree, two-class triangular system is neutralized in unstressed syllables,[47] resulting in a two-degree triangular system in that position:

		a				*ă*
stressed	*o*		*e*	unstressed		
					ŭ	*ĭ*
	u		*i*			

In the North Great Russian dialects, on the other hand, where stressed syllables also possess a three-degree, two-class triangular system, the opposition *a*-*e* is neutralized in unstressed syllables. The representative of

the archiphoneme is conditioned externally (*e* after palatalized consonants, *a* after nonpalatalized consonants). This gives rise to a two-degree quadrangular system:[48]

		a				*ŏ* *ă*
stressed	*o*		*e*	unstressed		
					ŭ	*ĭ*
	u		*i*			

Examples can easily be multiplied.

In three-class vowel systems the medial class of timbre cannot contain more vowel phonemes than either of the extreme classes. An equal number of vowels in all three classes is found primarily in triangular systems, for example, in the Mongolian system:[49]

	a	
o	*ö*	*e*
u	*ü*	*i*

In three-class quadrangular systems, on the other hand, the medial class of timbre almost always contains fewer vowel phonemes than either of the extreme classes. (See, for example, the above-cited vowel systems of Finnish and K'üri or Lezghian.) The same relation is not rare for triangular systems either. See, for example, the Norwegian vowel system:[50]

		a	
	å		*æ*
o		*ø*	*e*
u		*y*	*i*

as well as the analogously structured, but differently realized, vowel systems of Polabian, Annamese, the Scottish dialect of Barra Island, and (with an unrounded central series) the East Sorbian dialect of Muskau, referred to above and described by Ščerba. When the medial class of timbre contains fewer degrees of sonority than either of the extreme classes, it usually lacks the equivalent to the most sonorous vowels of the extreme classes of timbre. At any rate, the minimal degree of sonority always appears to be fully represented in three-class systems, that is, by three vowel phonemes.

It follows from what has just been said that the medial class of timbre of a three-class system can sometimes also be represented by a single vowel phoneme. In this case such a phoneme must have the same degree of aperture

as the minimally sonorous vowels of the extreme classes of timbre. Examples of this type are indeed not lacking. The vowel system of K'üri (Lezghian), which was already mentioned, may be cited:

a *e*

u *ü* *i*

Middle Greek had a three-degree triangular system, in which the medial series was represented by *ü* alone:

a

o *e*

u *ü* *i*

In Tübatulabal, an Indian language of the Shoshonean group of the Uto-Aztecan family, an analogous system still exists today, with the difference that an unrounded *ï* occurs instead of an *ü*.[51] These are by no means the only examples of this type.

Neutralization of individual oppositions based on degree of aperture in the three-class vowel systems follows the same rules as in the two-class systems, but the medial class of timbre may not contain any more phonemes in the partial system than in either of the extreme classes of timbre. Since oppositions of timbre are sometimes also neutralizable, it often happens that a two-class (or even a linear), two-degree partial system exists besides a three-class, multidegree total system. For example, the already-cited three-class, three-degree vowel system of Mongolian occurs only as such in first syllables:

a

o *ö* *e*

u *ü* *i*

In noninitial syllables following a syllable containing an *i*, the opposition *ü-ö* is neutralized, and the following partial system results:

a

o *e*

u *ü* *i*

Finally, after a syllable with any other vowel (except *i*) the oppositions of timbre *u-ü*, *o-ö*, *ö-e*, and *o-e*, on the one hand, and the oppositions based

on degree of aperture *o-a*, *ö-a*, *e-a*, on the other, are neutralized. As a result, the following partial system arises:

A

U I[52]

All this is valid only for the long vowels of Mongolian. In short vowels all oppositions of timbre are neutralized after a syllable containing an *i*, so that a three-degree linear system results:

a

e

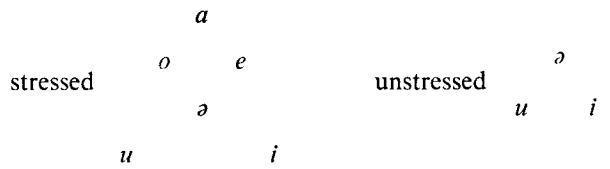
i

After a syllable containing any other vowel the system shrinks even more, and only two short vowels, "*i*" and "*e*," remain. The latter takes on the quality of the vowel of the preceding syllable.

The statement was made above that where the medial class of timbre of a three-class vowel system was represented by a single vowel phoneme, this phoneme had the minimal degree of sonority, and in this respect formed a group with the minimally sonorous vowels of the extreme series of timbre *u* and *i*. This rule applies without exception where a rounded front vowel is involved: if the vowel system contains only one such phoneme, it is always *ü*, never *ö*. But there are cases where in addition to the vowels of the extreme classes of timbre a multidegree vowel system contains still another, unrounded vowel phoneme which does not belong to any of these classes of timbre, and which has neither the maximal nor the minimal degree of sonority. Since such a vowel phoneme can therefore be characterized only negatively, it may be designated as an "indeterminate vowel."[53] This phoneme must not be confused with the sole representative of the (unrounded) medial class of timbre: the latter stands in a relation of pure (isolated bilateral) opposition of timbre with *u* and *i*, while the "indeterminate vowel" does not stand in a bilateral opposition relation with any other phoneme of the vowel system. In any event, it does not participate in any pure opposition of timbre.

Many languages in various parts of the world have an indeterminate vowel in the above-defined sense in stressed as well as in unstressed syllables. The vowel may be long or short: the vowel in the English word *bird* (in standard Southern English) may be regarded as a long indeterminate vowel. But in many languages the indeterminate vowel only appears in partial systems in those phonic positions where several oppositions based on degree of aperture and oppositions of timbre are neutralized.

It follows from what has been said that the indeterminate vowel must be considered not as the sole representative of a specific medial class of timbre but as a vowel phoneme that lies outside any class of timbre. As a result thereof the indeterminate vowel may enter into a special relation to that vowel of maximal degree of sonority which characterizes triangular systems and which also lies outside any class of timbre. Under certain circumstances an "indeterminate" vowel in a triangular system can thus become a "specific" vowel by entering into a relation of bilateral opposition with "*a*." Such a case is present, for example, in Bulgarian. The Bulgarian indeterminate vowel has approximately the same degree of aperture as *o* and *e*, but it is neither rounded nor palatal. It would hardly be possible to assume a pure opposition of timbre between Bulgarian *ə* and *o*, or between Bulgarian *ə* and *e*. But the proportions $o:a = u:ə$, $e:a = i:ə$, and the proportion $u:o = i:e = ə:a$ deduced therefrom may well be established. The conditions in unstressed syllables (at least in a part of the local types of pronunciation) are proof that this proportion corresponds to a reality. For in these syllables *o*, *e*, and *a* are not permitted, only *u*, *i*, and *ə* are. In other words, the oppositions based on degree of aperture *u-o*, *i-e*, and *ə-a* are neutralized, while the triangular character of the vowel system is preserved. Graphically, this may be represented as follows:



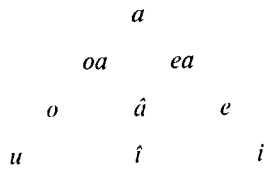
The Bulgarian vocalism is thus a three-class triangular system, in which the medial class of timbre is characterized by its neutral character and by an increase in the degree of aperture of its members.[54]

The Bulgarian vowel system appears to be a rather rare case. In the other languages with which we are familiar no special bilateral relation can be ascertained between this vowel and the "*a*." There is accordingly no reason to include the indeterminate vowel and the "*a*" in a special medial class of timbre.

Not much can be said about the number of degrees of sonority in four-class vowel systems since vowel systems of this type are in general extremely rare. According to our knowledge, in such systems none of the medial classes of timbre can contain more degrees of sonority than either of the extreme classes. (The total number of vowel phonemes of the two medial

classes of timbre cannot therefore exceed the total number of vowel phonemes of the two extreme classes.) In the above-cited vowel system of Eastern Cheremis the lowest degree of sonority is represented in all four classes of timbre. This system is proof that the two medial classes of timbre of a four-class system need not necessarily contain the same number of degrees of sonority.

Also very closely related to the study of the properties based on degree of aperture is the difficult problem of the position in the vowel system of monophonematically evaluated diphthongs. The situation is simplest in such cases as the vowel systems of the archaic Great Russian and North Ukrainian dialects, where the phonemes that are represented by *ω* and *ĕ* in Russian dialectology are realized as diphthongs of movement with an increasing degree of aperture (approximately like *u͡o*, *ie*). These diphthongs begin somewhat lower than the maximally high vowels of the same system, but they do not end with as great a degree of aperture as that found in undiphthongized *o* and *e* of the same system. The position of these phonemes in the vowel system can therefore evoke no doubts: such vowel systems are four-degree triangular systems in which "*ω*" and "*ĕ*" represent the second degree of sonority (*u*, *ω*, *o*, *a*, *e*, *ĕ*, and *i*). The oppositions *ω-o* and *ĕ-e* are neutralizable in the dialects in question. In unstressed syllables where these oppositions are neutralized, the respective archiphonemes are represented by *o* and *e*. (This is true, at least, of the North Great Russian and the North Ukrainian dialects which have an "*ω*" and an "*ĕ*".) It follows that in this case diphthongization or, more precisely, the decrease in vowel height must be regarded as the correlation mark. Equally clear is the position of the diphthongs "*oa*" and "*ea*" in Daco-Romanian, where they obviously stand between *o* and *e*, on the one hand, and *a*, on the other:[55]



In the Slovenian dialect of Carinthia, north of the Drau (in the dialect of the so-called Drauci), the diphthongs *u͡ə* and *i͡ə*, which end less high than they start, are obviously to be classed between *u* and *i*, and *o* and *e*, whereas *oa* and *ea* evidently lie between *o*, *e*, and the maximally open *â*, and *a*. Accordingly there exists a five-degree quadrangular system:[56]

å	*a*
oa	*ea*
o	*e*
uə	*iə*
u	*i*

More difficult is the classification of those monophonematically evaluated diphthongs in which one part is more open and the other higher than the neighboring vowels of mid-degree of aperture. German and Dutch present a case of this type. The three German diphthongs "*au*," "*eu*," and "*ei*" can be grouped into the three classes of timbre of the German vowel system, but it is impossible to accommodate them within the system constituted by degrees of sonority. The fluctuation and indeterminacy of the degree of aperture of these phonemes, which is due to flexibility in articulation, may well be considered their specific mark. It distinguishes them from all other long (i.e., unchecked) vowel phonemes of the German language. The long vowel phonemes must therefore first be divided into two categories: those with a "stable" and those with a "movable" degree of aperture. Further classification according to the three classes of timbre can then be carried out in both categories. Classification according to the three degrees of sonority, on the other hand, can only be carried out in the category of vowels with a stable degree of aperture.[57]

The diphthongs of English present particularly complicated problems, even if one limits oneself to the form of the modern language as codified by Daniel Jones.[58]

Recently several attempts have been made to interpret the vowel system of this form of English phonemically; in chronological sequence these were by Josef Vachek (1933),[59] Bohumil Trnka (1935),[60] A. C. Lawrenson (1935),[61] and Kemp Malone (1936).[62] The so-called short vowels appear to offer no difficulties: all four investigators agree that in technical terminology these vowels form "a two-class, three-degree quadrangular system." In English the opposition mark seems to be tongue position rather than lip rounding. Difficulties appear in regard to the so-called long vowels and diphthongs (or triphthongs). However, these difficulties seem to have arisen primarily because the English vowel system had been treated without considering the peculiarities of the English prosodic system. In English "quantity" is a *prosodic opposition based on type of contact*. A vowel is "short" if its pronunciation is *interrupted* by the beginning of the following consonant, "long" if its pronunciation is undisturbed and displays its full

extent. The description by Daniel Jones indicates that of the "unchecked" vowel phonemes in English only *a*: and *ə*: have no diphthongal variants. All remaining unchecked vowel phonemes have diphthongal variants, in other words, they have variants that are characterized by a movable degree of aperture. Such variants are only optional for *ɛ*: and *ɔ*:, and they are used much more rarely than in the case of *i*: and *u*:. Still, they do exist, and this is sufficient. In the variety of modern English described by Jones no fundamental difference can be recognized between the "true" diphthongs and the "long monophthongs" (with the exception of *a*: and *ə*:). Both are *unchecked vowel phonemes with a movable degree of aperture*. The only *unchecked vowel phonemes with a stable degree of aperture* are maximally open *a*: and indeterminate *ə*:, that is, those unchecked vowel phonemes that stand outside the classes of timbre. The flexibility in degree of aperture in the variety of English studied is thus related to "uncheckedness" as well as to membership in a specific class of timbre.

On the basis of the preceding, a principle of classification can be established for the vowel phonemes with a movable degree of aperture, namely, the *direction of articulatory movement* (*Ablaufsrichtung*). Some unchecked vowels have a centripetal, others a centrifugal, direction of articulatory movement. I.e., some move back to a (neutral) center position[63] from a point characterized by the marks of a specific class of timbre, while others move in the direction of the extreme representative of the specific class of timbre. In German we can designate the former as vowels with an articulatory movement toward the center (*hineinablaufende Vokale*), the latter as vowels with an articulatory movement away from the center (*hinausablaufende Vokale*). It is significant that *a*: and *ə*:, which stand outside the system of timbre, in the center so to speak, have an immovable degree of aperture. In the remaining unchecked phonemes in English it is possible to determine the relative degree of aperture of the starting point. Both classes of timbre[64] have three degrees of sonority. In the case of the vowel phonemes with an articulatory movement away from the center, these are *uw* (= u:), *ou*, and *au* in the dark class of timbre, and *ij* (= *i*:), *ei*, and *ai* in the clear class of timbre. In the case of the vowel phonemes with an articulatory movement toward the center, the first degree of sonority is evidently represented by *və* and *iə*. To the second we assign *ə*: and *ɛ*:, which actually also have the optional variants *ɔə* and *ɛə* and which, on the basis of their phonological content, should rather be considered the realization of the vowels moving toward a neutral center ("*ə*"). The phonemes that Jones designates as triphthongs *auə* and *aiə*, and for which he lists the optional variants *aə*, a*ə* and *a*:, a: respectively, should probably be considered as having the third degree of sonority.[65] Since the maximally open *a* stands

outside the classes of timbre, the entire English system of unchecked vowel phonemes must be regarded as a "four-degree, two-class triangular system containing an indeterminate vowel." However, due to the fact that the two directions of articulatory movement are distinguished in every class of timbre, the total number of unchecked vowel phonemes is not eight but fourteen:

a:

au *auɔ* *aiə* *ai*

ou *ɔə* *εə* *ei*

ə:

u: *uə* *iə* *i*:

As to the diphthong *oi*, it is considered a phoneme combination by all the above investigators, except A. C. Lawrenson. But the positive arguments Lawrenson raises in favor of his monophonematic interpretation do not seem to carry much weight (see Kemp Malone, *op. cit.*, p. 160, no. 4).[66]

While in standard German and Dutch there are only few unchecked vowels that have a movable degree of aperture and are always "articulated away from the center," most unchecked vowel phonemes in English are characterized by the movability of their degree of aperture and, in addition, present an opposition based on the direction of articulatory movement. It is possible that similar conditions also exist in certain other languages or dialects, in particular in those languages that have a prosodic structure based on the same principle as that of English. In any event, all languages that have a large number of diphthongs of movement must always be examined as to the question whether differences in direction of articulatory movement similar to those found in English are not significant for them.

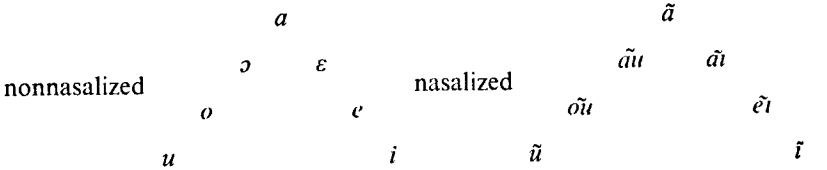
D Resonance Properties

While the properties of localization and the properties based on degree of aperture of the vowels are so closely linked with each other as to form a kind of "bundle," the resonance properties belong on quite a different plane. By the term "oppositions of resonance" we understand all "distinctive oppositions" between "pure" vowels and vowels that are somehow "impure."

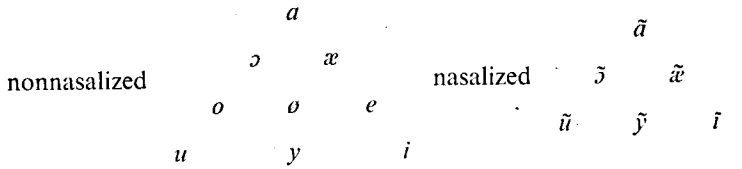
a. The correlation of nasalization

The *correlation of nasalization* is the most common.[67] In many languages it exists for all vowels. The nasalized vowels, of course, need not be fully

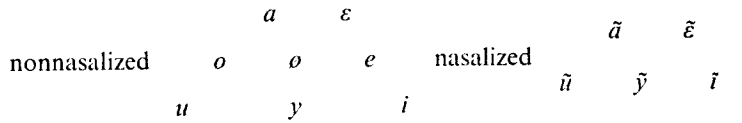
identical with the corresponding nonnasalized vowels with respect to tongue, lip, and jaw positions. Only sameness of position in the system is important. For example, in Burmese the long nasalized vowel phonemes with the second and third degree of sonority are realized as diphthongs, while the corresponding nonnasalized vowels are realized as monophthongs:[68]



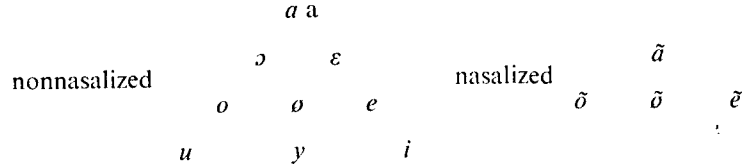
In many languages the correlation of nasalization extends only to part of the vowel system. Often one of the mid degrees of sonority remains unaffected by this correlation. This is true, for example, of the variety of Scottish spoken on Barra Island:[69]



or of Northern Albanian:[70]



Sometimes not the mid, but the maximally high, vowels are exempted from nasalization, as, for example, in French:



In all of these cases all classes of timbre are represented in the nasalized vowels. There are languages with two-class vowel systems which have only two nasalized vowels. This is the case, for example, in the Jauntal dialect of Slovenian spoken in Carinthia (nasalized vowels $\tilde{o}$ and $\tilde{a}$),[71] and in the

Kashub dialects ($\tilde{o}$ and $\tilde{a}$).[72] In other languages no specific degrees of aperture, but certain classes of timbre, are excluded from nasalization.

In the Central Chinese dialect of Siang-tang (Honan Province) only unrounded vowels are nasalized:

			a				$\tilde{a}$	
nonnasalized		*o*		*e*		nasalized	$\tilde{e}$	
	u		*ɤ*		*i*		$\tilde{i}$[73]	

In the dialect of Marchfeld the vowels of the medial class of timbre as well as the vowels of the second mid degree of aperture are exempted from nasalization:[74]

				a					$\tilde{a}$		
			au	*äü*	*äi*						
									$\tilde{a}u$	$\tilde{a}ı$	
nonnasalized			*ǫ*	*ǫ̈*	*ę*		nasalized				
									$\tilde{o}$		$\tilde{e}$
		o		*ö*		*e*					
									$\tilde{u}$		$\tilde{ı}$
	u			*ü*		*i*					

The number of nasalized vowels is thus never greater than the number of nonnasalized vowels.

It may happen that a language contains only a single "nasalized vowel." For such a vowel neither a particular class of timbre nor a particular degree of aperture is relevant. These could only become relevant in contrast with other nasalized vowels. The coloration of such a single nasalized vowel is therefore determined by its consonantal environment alone. Its aperture is not present at all. In other words, such an "indeterminate" nasal vowel is nothing but a syllabic nasal that is assimilated to the following consonant. In sketches on African languages where such phonemes occur, they are usually represented by the letters *m*, *n*, *ŋ*, etc. But it is very questionable whether this phoneme can really be identified with *m*, *n*, etc. It must be kept in mind that in most such languages consonant combinations do not occur at all (or that only the combinations "obstruent + liquid" are permitted). The phonemes in question can therefore only form distinctive oppositions with the vowel phonemes, while *m*, *n*, etc., stand in a relation of direct, distinctive opposition only to the other consonants. Furthermore, the "syllabic nasal" in the particular African languages shows the same distinctive differences of tone (differences of tonal register) as the vowels. All this favors the view that in cases such as Ibo "mbɛ" (bisyllabic, high-tone *m*, low-tone *ɛ* [turtle]) the "syllabic nasal" may be considered an "indeterminate nasalized vowel."

However, even with this interpretation certain difficulties remain. For in languages such as Ibo, Efik, Lamba, Ganda, etc., which do not have any nasalized vowels nor a nonnasalized indeterminate vowel, the "syllabic nasal" stands in a relation of distinctive opposition to the vowels only, but this relation is always multilateral. In such a case, the "syllabic nasal" can probably be regarded as an "indeterminate vowel in general." Its nasalization, however, is a purely phonetic, phonologically irrelevant property. In languages such as Ewe, Yoruba, Fante, etc., on the other hand, where the correlation of nasalization comprises the entire vowel system, this "syllabic nasal" would have to be grouped with the category of nasalized vowels. A curious situation would result: the system of nasalized vowels would then contain one phoneme more than the system of nonnasalized vowels, which would contradict everything we know about the correlation of nasalization.

b. The correlation of muffling

The correlation of nasalization is probably the most common, but by no means the only, correlation of resonance. Whether there exists only one or several other additional types of oppositions of resonance is very difficult to say at the present stage of investigation. The languages in which distinctive oppositions between "pure" and somewhat "muffled" vowels exist are "exotic" languages. The notations that one finds about them by observers, usually better trained and more interested in ethnology than in linguistics, are, for the most part, rather unclear.[75] Subject to this reservation, we continue to use the term "correlation of muffling" (or opposition of muffling), without taking up the question of whether this always involves the same or different correlations in the various languages.

Recently the phonetic aspect of the problem has been considerably advanced, at least for Africa. Dr. A. N. Tucker, who had studied and mastered the pronunciation of the "pure" and "muffled" vowels in the Nilotic languages, was himself subjected to an instrumental phonetic study by Panconcelli-Calzia in Hamburg. The results showed that in the case of the "squeezed" vowels the faucal pillars are compressed and the velum is lowered, without, however, enabling the flow of air to escape through the nose. In the case of the "breathy" vowels the velum is raised, the fauces retracted, and the larynx clearly lowered, so that quite a large cavity is formed behind the oral cavity proper. The glottis appears to be in the position of whispering.[76] Dr. Ida C. Ward made the same observations for the Abua language of Southern Nigeria: this language also involves the opposition of vowels with a compressed pharynx and vowels with a wide-open pharynx, resulting in a "flat" sound.[77] It seems that in certain

dialects of Modern Indic the same phonetic basis for the "correlation of muffling" can be determined. In any event, J. R. Firth here also speaks of an opposition between "tight" and "breathy phonation."[78] The phonetic nature of vowel muffling in certain East Caucasian languages, on the other hand, remains unclear from the description by A. Dirr. Of the corresponding vowels of Tabarasan it is claimed that they have laryngeal friction and that, in comparison with other vowels, they have an energetic expiration.[79] Of the corresponding vowels of Aghul it is said that the larynx is compressed in their articulation. This produces a slight noise of laryngeal friction.[80]

The "correlation of muffling," like the correlation of nasalization, also extends either to the entire vowel system or only to a specific part thereof. The former seems to be the case in Nuer, a Nilotic language of the Egyptian Sudan,[81] possibly also in other Nilotic languages, while in Abua, according to Ida C. Ward, the correlation of muffling is present only in the vowels *e* and *o*; in Tabarasan, according to A. Dirr, only in *u* and *a*, and probably also in Aghul, where "muffled" *u* is realized as a type of *o*. (Unmuffled *o* does not occur as an independent phoneme in words of native origin.) The above-mentioned languages with two nasalized vowels can be compared with these cases.

In all types of "oppositions of resonance" the rules for monophonematic and polyphonematic interpretation must be observed with particular stringency. Phonetically nasalized vowels are very often only the realization of the phoneme sequence "vowel + nasal," and the vowels accompanied by a noise of laryngeal friction are only the realization of a combination of a vowel phoneme with a laryngeal consonantal phoneme.

4 CONSONANTAL PROPERTIES

A Properties of Localization (*Lokalisierungseigenschaften*)

There is no language in which the properties of localization of the consonantal phonemes would be phonologically irrelevant. There are, of course, individual consonantal phonemes without distinctive properties of localization in every language. But these always take some special position in the system because they deviate from the "norm." Several consonantal phonemes of a given language may be equivalent to each other with regard to the distinctive properties of localization (and distinguish themselves from each other only by the properties based on the manner of overcoming an obstruction or the properties of resonance). By *series of localization* is meant the sum of all consonants with the same distinctive properties of localization, regardless of whether such a series consists of several consonants or only of a single one. Within a system of consonants

the individual classes of localization stand in various relations of opposition to each other.

a. The basic series. Those consonantal series of localization that stand in a relation of heterogeneous multilateral opposition to each other, we call "basic series." Some of these basic series occur in almost all languages of the world. They are the gutturals ("dorsals"), the apicals ("dentals"), and the labials. We do not know of any languages that do not have apicals. Gutturals do not occur, for example, in some Slovenian dialects of Carinthia. Labials are absent in Tlingit (Alaska). But these are extremely rare cases. Except for these, the three mentioned series of localization occur in all languages of the world. This certainly cannot be an accident. It must have some basis in the makeup of these three series. It is probably easiest to seek an explanation in the fact that the lips, the tip of the tongue, and dorsum of the tongue are movable organs that are best suited for obstructing the oral cavity. Thus for the labial series the bringing together of the lips is relevant; for the apical series the participation of the tip of the tongue, the tongue itself being extended, and a frontal position of articulation; and, finally, for the guttural series the participation of the back of the tongue, the tongue being contracted, and a back position of articulation.[82] These three positions of the vocal organs may be considered the "most natural," but by no means in the sense of being "innate." It is well known that children must first acquire these positions laboriously. The sounds that are spontaneously produced by children in the babbling stage for the most part only remotely resemble labials, apicals, and gutturals. The three types of consonants mentioned are "natural" only in the sense that they solve most easily and naturally, with the aid of the movable parts of the oral cavity, the task of producing different sounds that have their own individual character and that are clearly discriminated from each other. This may also explain their universal (or near universal) presence in the world.

Just as universal as the labials, apicals, and gutturals are the sibilants. The only language known to this author in which an "s" is almost completely absent is Eastern Nuer in the Egyptian Sudan. The grooved shape of the tongue surface distinguishes sibilants from the apicals which are produced with the tongue flatly extended, and from the gutturals which are produced with the tongue arched and contracted. The grooved shape of the tongue surface gives special direction to the airstream, creating a specific acoustic effect. But since the upper and back portion of the resonating cavity is approximately the same for sibilants and apicals, these two series of localization show a certain relatedness, and in some languages they unite into a single series under certain circumstances.

In addition to the four series of localization commonly found and referred to above, there are some languages that have still other basic series. One of these is particularly the *lateral* series, which occurs as a special series of localization in many North American and some African languages (Zulu, Pedi, Herero, Sandawe, etc.).[83] A type of intermediary series of localization between the guttural and the labial series is represented by the series of localization that is usually called "labiovelar." As far as we know, it exists in the above form only in the so-called Sudan languages, and, it seems, in certain Japanese dialects. This series is characterized by simultaneous labial and guttural occlusion. We would prefer to call it "gutturolabial." A type of intermediary series between the guttural and the apical is represented by the *palatal* series of localization, which occurs in very many languages in all parts of the world. In many languages it can be considered a basic series, but in some languages it enters into a bilateral relation with the guttural or the apical series. The phonetic realization of the palatal series, too, differs from language to language.[84] Lastly, the *laryngeal* series of localization must be regarded as a basic series on a par with the others, at least for a part of the many languages in which it occurs. In addition to the four universal (or near-universal) basic series, that is, the labial, guttural, apical, and sibilant, there thus exist four less common series, namely, the lateral, the gutturolabial (= labiovelar), the palatal, and the laryngeal.

However, the phonological concept of series of localization must not be confused with the phonetic one of position of articulation. For example, in Czech a relation of neutralizable opposition exists between voiced laryngeal *h* and voiceless guttural *x* ("ch"), which is fully analogous to the relation "voiced"/"voiceless." *x* and *k*, however, stand in a bilateral proportional relation to each other ($x:k = s:c = š:č$). The *h* in Czech thus does not belong to a special laryngeal series, which does not even exist in that language. It belongs to the guttural series, for which, from the standpoint of the Czech phonological system, only the fact that lips and tip of tongue do not participate is relevant.[85] In Greenlandic Eskimo[86] all spirants have occlusives as "partners." These belong to the same series of localization: *s-c*, *x-k*, *š-q*, *f-p*. The lateral spirant λ alone has no "occlusive partner." Since, however, there is no closer spirantal equivalent of the apical occlusive *t*, the *t* is evaluated as the "occlusive partner" of λ, that is, the lateral egress of air in λ is irrelevant for Greenlandic. Its apical articulation alone is relevant. Examples of this type can easily be multiplied. One can speak of a particular lateral, palatal, or laryngeal series in the phonological sense only if the phonemes in question do not stand in a relation of proportional bilateral opposition to any phoneme of another

localization series. In cases where, as in the examples cited above, there exists a bilateral opposition between consonants of different positions of articulation, and that opposition is proportional to analogous relations between phonemes of the same series of localization (Czech and Slovak $h\text{-}x = z\text{-}s = ž\text{-}š$, Greenlandic $t\text{-}λ = p\text{-}f = k\text{-}x = q\text{-}χ = c\text{-}s$), both members of the opposition in question must be assigned to one series of localization. Cases in which two series of localization stand in a relation of bilateral opposition to each other are not to be confused with the above.

b. Equipollent related series. Each of the above basic series stands in a relation of multilateral opposition to the other basic series. In certain languages, however, two series occur for some of these basic series, and these stand in a relation of *bilateral equipollent* opposition to each other. Instead of a single labial series, characterized by the participation of the lower lip, a labial and a labiodental series may occur. Both are labial, but at the same time they remain distinct from each other. This is the case, for example, in standard German, where the labial series is represented by *b*, *p*, and *m*, the labiodental series by *v*, *f*, and *p̌*. It is even more pronounced in Shona, a language spoken in Rhodesia, where the occlusives *p* and *b* are contrasted with the spirant *β* in the bilabial series, and the occlusives (affricates) *p̌* and *b̌* with the spirant *v* in the labiodental series.[87] Many languages have two apical series, one characterized by the tip of the tongue pointed upward, the other by the tip of the tongue pointed downward, instead of a single series characterized by the participation of the tip of the tongue. Depending on the language, this relation can be expressed as opposition between "retroflex" and "plain" apicals,[88] or as opposition between "alveolars" and "interdentals,"[89] or, finally, as opposition between "dentals" and "prepalatals."[90] The relation itself remains identical in all cases: the tip of the tongue is always relatively higher in the realization of the one series than in the realization of the other. Instead of a single "guttural" series, characterized by participation of the dorsum, many languages have two distinct dorsal series: a postdorsal series and a predorsal series. This is the case in many North American languages, for example, in Kwakiutl, Tlingit, and Haida; in Eskimo and Aleut; also in the so-called Paleo-Asiatic languages (Chukchi, Koryak, Kamchadal, Gilyak, Kettic); and in all Caucasian idioms. Or rounded and unrounded gutturals stand in opposition to each other, as in Tigre, in Ethiopia.[91] Instead of a single sibilant series, an *s* and an *š* series occur. Such a "split" in the sibilant series is very common among European languages: English, French, German, Italian, Hungarian, Albanian, Romanian, all Slavic languages, and Lithuanian and Latvian. This phenomenon is rather common in other parts of the world also. Finally, the laryngeal series, which is

characterized by the passivity of all mouth organs, may also be replaced by two series: a purely laryngeal series and a pharyngeal series, as found, for example, in Somali, in the Semitic languages, and in some North Caucasian languages.

As for the palatal series, in some systems it stands in a relationship of bilateral opposition to the apical or the dorsal series and must then be evaluated either as "a series with the tip of the tongue lowered," or as a "predorsal series." The bilateral nature of an opposition is proved objectively by its neutralizability. In Czech, Slovak, Hungarian, and Serbo-Croatian, where the opposition between dentals and palatals is neutralizable, these two series of phonemes can be considered "a split" in the apical series. In the Central Chinese dialect of Siang-tang (Honan Province), where the opposition between velar and palatal consonants is neutralizable in certain positions (before *u*, *a*, *i*, *ã*, and *ĩ*),[92] these two series must be considered "splits" in the dorsal series.

All cases discussed above thus involve a "split" of a basic series into two "related series" which stand in a relation of bilateral opposition to each other, but in a relation of multilateral opposition to all other series of localization in the same system. It must be stressed, however, that there can be a question of such a split in a basic series only if the context of the entire system requires it. Spirants frequently do not have the same position of articulation as occlusives. For example, in Modern Greek there exist, on the one hand, bilabial, postdental, dorsal, and sibilant occlusives (π, τ, κ, $\tau\sigma$), on the other, labiodental, interdental, dorsal, and rill spirants (φ, θ, χ, σ or β, δ, γ, ζ respectively). Occlusives and spirants thus agree in position of articulation with respect to the dorsal and the sibilant series only. However, since the relation $\kappa:\chi$ and $\tau\sigma:\sigma$ is parallel to the relation $\pi:\varphi$ and $\tau:\theta$, the fact that the position of articulation of the spirants φ, θ is not in complete agreement with the position of articulation of the corresponding occlusives π, τ is considered phonologically irrelevant. This case does not involve the "split of a series." The concept of localization is merely slightly extended: instead of "bilabial" and "labiodental" it is here simply "labial," that is, it is "characterized by participation of the lower lip." Instead of "postdental" and "interdental" it is simply "apical," that is, it is "characterized by participation of the tip of the tongue." In French, however, where the labiodental spirants *f* and *v* and the bilabial occlusives *p* and *b* are pronounced from a purely phonetic point of view approximately like Modern Greek φ, β, π, $\mu\pi$, it is nevertheless not possible to speak of a single labial series. For in the entire French consonant system there is not a single phoneme pair in which the relation "spirant: occlusive" would occur in its pure form (as, for example, in Modern

Greek $\chi:\kappa$, $\sigma:\tau\sigma$). Two separate series of localization, bilabial and labiodental, will therefore have to be posited here. Though these series stand in a relation of bilateral opposition to each other, they still remain distinct from each other.[93]

According to what principle does the split of the basic series into related series take place? Is there one articulatory or acoustic mark that in such cases serves to distinguish between two related series, or does each pair of related series involve a different discriminative mark? According to the classification by Jakobson, several such series involve a split into a "strident" and a "mellow" series. This opposition is especially evident for the spirants of the particular series. The strident spirants are at the same time also more audible than the corresponding mellow spirants. For example, the labiodental *f* is strident and more audible than the mellow bilabial φ. The strident pharyngeal $\underline{h}$ is more audible than the mellow laryngeal *h*. The strident postvelar $\check{x}$ (as it occurs in snoring) is more audible than the mellow prevelar *x*, and strident $\check{s}$ is more audible than mellow *s* (although the latter is itself much more audible than the remaining mellow spirants mentioned above).[94] However, not all splits of basic series into related series can be explained by this principle. The differentiation within the apicals is a result of the modification in the volume and shape of the two resonating cavities, the one located in front, the other in back of the position of articulation. The split of the guttural series into velar and palatal is based on the difference in length of the anterior resonator, as is the split of the guttural series into simple velar and labiovelar. Insofar as the elongation of a resonating cavity can acoustically be converted into a lowering in timbre, and its reduction into a rise in timbre, one might be inclined to consider the relative height of timbre as the discriminative mark. But this would hold true only for the splits in the guttural series which we have just mentioned. In the case of the apicals the matter is not quite so simple since these involve two resonating cavities, anterior and posterior. In these, elongation or reduction does not take place in a parallel manner. Further, in addition to the relative volume, the shape of the resonating cavities plays a role here acoustically. Perhaps one comes closest to a solution by looking at the extreme case of the so-called retroflexes, also called "cerebrals" and "cacuminals," with respect to their relation to the alveolars or postdentals. The acoustic impression left by the retroflexes can best be designated as "flat timbre" (*hohler Klang*), in contrast with the "plain timbre" (*flacher Klang*) of ordinary "dentals."* The same

* *Translator's note:* Trubetzkoy's opposition flat plain is for the most part identical with Jakobson's dichotomy flat nonflat (now flat nonflat). Trubetzkoy does not make the distinction, however, as does Jakobson, between flat plain and plain–sharp. Instead he

relation between "flat" and "plain" timbre exists also between labiovelar and simple velar consonants (in addition to the above-mentioned height of timbre). The opposition between velars and palatals ("back palatals"), and between "dentals" and "dentopalatals," can also be attributed to this discriminative mark, although not as clearly. The same could perhaps also be said of the opposition between alveolars and interdentals.

It thus seems that in all cases where a basic series is split into two related series, the discriminative mark of these two related series is either the opposition "strident"/"mellow," or the opposition "flat"/"plain." Both oppositions are equipollent.

The relationship between the labial, apical, dorsal, sibilant, laryngeal, lateral, palatal, and labiovelar series represents a relationship of multilateral (and heterogeneous) opposition. The "split" of these basic series, discussed above, produces two series each, which form a bilateral opposition: labiodental/bilabial, postdorsal/predorsal, etc. But there are cases in which a basic series is not split into two but three series, and these series stand in a relation of *gradual* opposition to each other. Cases of this type are extremely rare. We know only of the following examples: (*a*) three guttural series are found in three North American Indian languages, in Tsimshian (Nass dialect), Chinook, and Hupa: a postvelar series, a prevelar series, and a (back) palatal series;[95] (*b*) three sibilant series occur in two North Caucasian languages, Kabardian[96] and Udi:[97] an *s* series, an *š* series, and an *ŝ* series, the latter being phonetically intermediary between the *s* and *š* sounds. Low Sorbian (Low Lusatian-Wendic) probably also belongs to this type, where in addition to *s* and *š* sounds special *ŝ* sounds occur which take an intermediary position.[98] The slight *i* coloring of the intermediary sibilant series in Kabardian and Low Sorbian can probably be considered a phonologically irrelevant secondary phenomenon. Accordingly Tabarasan[99] (in Daghestan in the Eastern Caucasus) and Shona (in Rhodesia, South Africa)[100] may also be considered as belonging to the same class, although the intermediary sibilant series here shows a *u* or *ü* coloring.[101] The number of examples is thus very small. The picture would of course change completely if yet another third group of languages should be included, namely, the languages with a gradual split into three of the apical series. Many languages that have the phonological opposition between retroflex and plain apicals, or between alveolar and interdental apicals, also have a palatal series. Considering the ambiguous character of

considers these two binary oppositions, where simultaneously present, as belonging to the opposition flat–plain, which then takes on a gradual character.

Trubetzkoy's opposition further does not extend to include the vowels. (Cf. Jakobson–Fant–Halle, *Preliminaries to Speech Analysis* [Cambridge, Mass., 1952], pp. 31–36; Jakobson–Halle, *Fundamentals of Language*, pp. 31, 32.)

the palatals, it is not impossible that the three series (retroflex, plain, and palatal, or alveolar, interdental, and palatal respectively) may be interpreted as three different degrees of rising or lowering the tip of the tongue. This could be proven objectively only in those cases where the opposition between the palatals and one of the apical series is neutralizable and would therefore be bilateral. However, this seems to be the case neither in the particular African languages (Herero, Nuer, and Dinka) nor in the modern Indian or Dravidian languages. With respect to Old Indic (Sanskrit), where the opposition between "palatals," "dentals," and "cerebrals" was neutralizable, it must be noted that this opposition existed not only in the case of the apicals but also in that of the sibilant phonemes. It should thus be interpreted rather as a bundle of correlations of timbre (see p. 132). The domain of gradual splits may therefore be considered very limited.

c. The secondary series (*Nebenarbeitsreihen*). Finally, in many languages the basic and the related series are split into two series each, which stand in a relation of privative opposition. Insofar as such oppositive relation is not only privative but also proportional, it gives rise to correlations. From an articulatory point of view, this always means that in the one, namely, the unmarked series of localization, the vocal organs are always in a position considered normal for the corresponding basic or related series, whereas in the other (marked) series the same position of the vocal organs is associated with still another specific *secondary task* to be performed by the vocal organs (or any part thereof) not involved directly in the basic task. The acoustic result is either a specific coloration, that is, a kind of vocalic timbre, or a click sound. Correlations that arise out of placing the *secondary series* in opposition with their corresponding pure basic or related series may therefore be grouped into "correlations of timbre" and "click correlations."

α) From an acoustic point of view, the *correlations of consonantal timbre* involve the combining of a series of localization, which may be either a basic or a related series, with two opposed "colorations." One of these is evaluated as "neutral" (i.e., as unmarked). Insofar as this combination takes place in several, sometimes even in all, series of localization, the corresponding "colorations" are abstracted from the individual series of localization and conceived of as independent thereof. Various types of correlations of timbre are distinguished, depending on which colorations serve as correlation marks.

The *correlation of palatalization*, that is, the opposition between neutral and *i*- (or *j*-) colored consonants, is probably the most common. For example, it occurs as the only correlation of timbre in Gaelic, Polish, Lithuanian, Russian, Ukrainian, the Moldavian dialect of Romanian,

Mordvin, and Japanese.[102] But its scope within the consonantal system is not the same everywhere: in Japanese and Lithuanian it comprises all series of localization, whereas in Ukrainian and Mordvin it only comprises the apical and the *s*-sibilant series. Individual languages that have this correlation also differ rather strongly with respect to the phonetic realization of the palatalized consonants. Still, the principle remains the same everywhere: the "palatalized" consonant has an *i*- or *j*-like coloration which combines with its other phonetic properties, while the corresponding "nonpalatalized" consonant does not have any *i* or *j* coloring. The *i* coloring of palatalized consonants is the result of raising the central part of the tongue against the hard palate. In order to stress this opposition even more, the back part of the tongue is often raised toward the soft palate in the case of the nonpalatalized consonants.[103]

These shifts in tongue position very often bring about secondary modifications of articulation as well. In some cases palatalized consonants are thus not only distinguished from nonpalatalized consonants by their "coloration" but also by specific articulatory marks. But from the point of view of the phonemic system of the particular language, such secondary articulatory differences are irrelevant, though frequently these marks are the ones most noticed by a foreign observer. The opposition between palatalized and nonpalatalized consonants also strongly influences the realization of the neighboring vowels. A foreign observer will sometimes notice only the combinatory variants of the vowels without being aware of the differences in timbre in the consonants. But this is an acoustic deception, which is frequently also found with regard to other correlations of consonantal timbre. In a language with a correlation of palatalization the "coloration" ("timbre") of the consonant is always the most important. Of all other articulatory properties, only those properties are observed which are shared by the particular consonant and its "partner." One of the conclusions to be drawn is that in a language of this type the palatal series is hardly possible as an autonomous series of localization: it is always interpreted as a "palatalized apical" or "palatalized guttural" series. In *Polabische Studien* we posited for Polabian a correlation of palatalization as well as an autonomous palatal series. This was an error: the opposition between the gutturals *k*, *g* and the palatals *ћ*, *ђ* was neutralizable in Polabian (*k* and *g* did not occur before front vowels, and "*ћ*" and "*ђ*" were not permitted before consonants or in final position). Since the correlation of palatalization was found in the other series of localization, the Polabian palatals might also be considered "palatalized gutturals." (Phonemically, the Polabian word for *guns* should therefore be transcribed as "g'uNsna," for *work* as "g'olü," for *dough* as "k'ostü," for *darkness* as "k'ɑmă," for *man* as "k'arl," for *where* as "k'edə̆," for *mountain* as "g'öra," for *horse* as "k'ün," etc.)

The *correlation of emphatic palatalization*, which is found in certain languages of the Eastern Caucasus, namely, in Chechen, Ingush, Bats, Lak, and Udi, must be distinguished from the correlation of simple palatalization.[104] It seems that in emphatic palatalization a reduction of the resonator orifice is produced mainly by an upward shift of the larynx by which the mass of the tongue also moves toward the front. The special position of the larynx in the production of emphatic-palatalized consonants produces a specific "hoarse" fricative noise which extends to the neighboring vowels as well. Due to the particular shift of the tongue, the neighboring vowels also receive a clearer coloration and seem to be pronounced more openly: *i* tends toward *e*, *a* toward *æ*, and *u* toward *ö*. A foreign observer tends to notice these concomitant phenomena only: he hears the hoarse laryngeal glide after the consonant as well as the hoarse, clearer, and more open pronunciation of the surrounding vowels. But these concomitant phenomena are irrelevant for the phonemic system of the particular language. Only the specific consonantal coloring is important, which a foreign observer learns to notice only after prolonged practice.

Just as the palatal series cannot exist as an autonomous series of localization in languages with simple palatalization, because it is inevitably interpreted as a "palatalized apical" or "palatalized guttural" series, so the "glottal" (or "pharyngeal") series must be interpreted as a "palatalized laryngeal" series in languages with a correlation of emphatic palatalization.

From the correlation of emphatic palatalization it is necessary to distinguish the *correlation of emphatic velarization* that plays an important role in the Semitic languages, especially in Arabic. The Arabic "emphatic" consonants are characterized by a thickening of the root of the tongue, which at the same time causes a shift of the larynx. The opposition between "emphatic" and "nonemphatic" consonants is found in the apical, guttural, sibilant, and laryngeal series. It is accompanied in all series by specific shifts in the position of articulation: the "emphatic" apicals are not only velarized (in the above-defined sense), but are also alveolar in contrast with the postdental nonemphatic apicals. Likewise in the case of the emphatic sibilants, the tip of the tongue is raised higher than in their nonemphatic equivalents. The emphatic gutturals are postdorsal or even uvular, while nonemphatic *k* is predorsal or palatal. In certain dialects of the Egyptian Sudan the voiced equivalent of nonemphatic *k* is almost marginally palatal. Finally, the emphatic laryngeals are closer to being pharyngeal, while the nonemphatic laryngeals are pure laryngeal sounds.[105] However, these concomitant differences in the position of articulation

must be ignored. For in the phonemic system of Arabic the emphatic velarized consonants form a closed category, which is placed in opposition to the category of the nonemphatic consonants. What makes the correlation of emphatic velarization in Arabic somewhat opaque is the fact that it does not comprise all consonants of the respective series, and further that it cannot be neutralized:

nonemphatic

t d θ δ n k g - s z š ž ʔ h - b f m r l

emphatic

t^{α} d^{α} - δ^{α} - *q γ x* s^{α} z^{α} - - - *ħ ḥ* - - - - -.

Consequently, whether the phonemes *q*, *γ*, and *x* are to be interpreted as "emphatic gutturals" or as a special postvelar (uvular) series, and whether *ħ* and *ḥ* are "emphatic laryngeals" or whether they form a special pharyngeal series, is subject to debate. But since similar questions do not arise with regard to the apicals and sibilants, one may probably assume the correlation of emphatic velarization in the case of the gutturals and laryngeals as well, and accordingly designate *x*, *q*, *γ*, *ħ*, *ḥ*, as x^{α}, k^{α}, g^{α}, h^{α}, and $ḥ^{\alpha}$. In languages that have a correlation of consonantal timbre, all bilateral oppositions between series of localization which permit such an interpretation are considered privative with respect to the particular correlation of timbre.

The case is much simpler and clearer for the *correlation of rounding* or *labialization*. It occurs as the sole correlation of timbre in some languages of the Northern Caucasus (Kabardian, Ch'ak'ur, Rutulian, Lezghian, Aghul, Artshi, and Kubachi), in Kwakiutl (North America),[106] and possibly also in some African (in particular Bantu) languages. In Kwakiutl this correlation extends only to the two guttural series. In the languages of the Northern Caucasus, in which this correlation is found, it occurs also mainly with respect to front and back gutturals but is not limited to this series. In Kabardian and Lezghian it includes also the apical series; in Ch'ak'ur, Rutulian, and Aghul, the apical series and both sibilant series; and in Artshi the lateral series as well.

The various correlations of timbre tend to combine into *bundles*. We are only familiar with bundles that are produced by the combination of the correlation of palatalization with the correlation of rounding. They are found in Circassian, Ubyk, Abkhas, Dungan Chinese, Korean, and Burmese. The bundles do not occur in all series. For example, in Adyghe, the *s* series alone has three types of timbre (*s*, *s′*, *s°*), the *š* series has only the

correlation of palatalization, the two guttural series and the apical series only the correlation of rounding. (The labial, lateral, and laryngeal series do not have any differences of timbre.)[107] In standard Abkhas three types of timbre occur in both guttural series and in the *š* series, while the *s* series occurs only with the correlation of palatalization, the apical and the laryngeal series only with the correlation of labialization, and the labial series with no differences of timbre at all.[108] In Burmese the labial series alone has three series of timbre (*p*, *p′*, and *p°*), while the remaining series, that is, the two apical, the guttural, the sibilant, and the palatal ones, have only the correlation of labialization.[109] But in Korean all series of localization appear to participate in both correlations of timbre. The transparency of the system is increased here by the fact that the entire correlation bundle can be neutralized.[110] In all cases discussed so far, the combination of the correlation of palatalization and labialization results at the most in three-member bundles. In the Bsyb dialect of Abkhas, however, the *š* sounds indicate four classes of timbre (neutral, simple-palatalized, simple-labialized, and "*ü*-colored" palatalized-rounded). A similar case seems to be on hand in Kinyarwanda, a Bantu language described by P. P. Schumacher (*Anthropos*, XXVI): four classes of timbre are distinguished in the bilabial series and, it seems, also in the *š* series (only three in the apical and in the *s* series; only two, i.e., *f-f°* and *v-v°* in the labiodental series).[111]

A different type of correlational bundle of timbre should probably be posited for Sanskrit. Since any reduction in the front resonator results acoustically in a reinforcement of the higher partial tones, and consequently in a clearer timbre, it is evident that the timbre of the "dental" occlusives and sibilants of Sanskrit must have been higher than that of the "cerebrals" and lower than that of the "palatals." However, not only the opposition between "dentals" and "palatals" but also the opposition between "dentals" and "cerebrals" was neutralizable and consequently bilateral. It is therefore possible that in this case a correlation bundle existed. The opposition between "dental" and "palatal" occlusives (*t-c*, *th-ch*, *d-j*, *dh-jh*) and between *s* and *ç* could then be interpreted as a correlation of palatalization (similarly as in Ukrainian or Mordvin, for example). The opposition between "dental" and "cerebral" occlusives (*t-ṭ*, *th-ṭh*, *d-ḍ*, *dh-ḍh*), nasals (*n-ṇ*), and *s-ṣ*, on the other hand, would have to be considered a special "correlation of retroflexion." The characteristic feature of the "cerebral" phonemes would then consist of the elongation of the front resonator of the mouth (i.e., of the space between the highest point of the tongue and the orifice of the mouth), resulting from the retraction and retroflexion of the tongue, and the corresponding lowering of timbre of the respective consonants. The entire bundle has, of course,

a certain gradual character. The question as to what extent the bundle of timbre which existed in Sanskrit can also be posited for other languages, must remain unanswered for the present. Much depends on whether the opposition between "dentals" and "palatals" is bilateral in the language in question. This can be proven objectively only by its neutralizability.

β) The *click correlation* is geographically much more limited in scope. Even in those areas where it is found it extends only to a few languages. It occurs only in a few Southern Bantu languages. Of these, Zulu is the most important. It is found further in the genetically isolated Hottentot and Bushman languages, which are also spoken in South Africa; and, finally, it occurs in Sandawe in the Kilimatinde district of East Africa, which again is geographically and genetically isolated.

The phonetic aspect of click sounds is well studied at the present. Good instrumental phonetic recordings and detailed descriptions are available. Recently a whole monograph appeared in which the "click problem" was discussed from various points of view.[112] Roman Stopa, the author, discusses the phonetic nature of the click sounds in detail. He develops hypotheses as to the origin of these sounds and the origin of language in general. But he does not even raise the question of the position of the click phonemes in the phonemic system of the respective languages. The small essay by P. de V. Pienaar is very valuable.[113] Although it does not clarify the phonemic problem, it at least contributes new reliable and essential phonetic material. A recently published study by D. M. Beach,[114] in which the phonetic, and in part also the phonemic, character of the clicks is placed in a new light, is very commendable. Thanks to this excellent study, we now have at our disposal an absolutely reliable description of Hottentot, that is, of all its main dialects: Nama, Damara, Griqua, and Korana. Of the other languages concerned, Zulu has been studied most completely from the point of view of phonetics. The basic work on the sounds of this language by Clement M. Doke,[115] though itself not phonological in our sense, nevertheless makes it possible to work out the phonemic system without great difficulties. For Sandawe, too, the phonemic system can be worked out in its general outline (at least with respect to the consonants).[116] The same may also be said for the description by A. N. Tucker of the phonetics of the Suto-Chuana group.[117] The situation is somewhat more difficult with respect to Bushman, which is generally regarded as "the click language par excellence." The copious notations by Wilhelm Heinrich Bleek[118] are an extremely important source for the study of Bushman. But the fluctuating and inconsistent transcription of the sounds of the Bushman language makes it extremely difficult, if not impossible, to infer its phonemic system, at least without the commentary of the collaborator

of this deserving Bushman scholar. Although P. Meriggi succeeded in bringing a certain order to this confusion,[119] complete clarity has by no means been achieved.

The problem the phonologist encounters with regard to the click sounds of the African languages is the following: Is the opposition between click phonemes and nonclick phonemes in these languages an opposition of localization or an opposition based on the manner of overcoming an obstruction? Phoneticians who studied the physiological nature of click sounds have interpreted and treated the specific properties of these sounds as properties based on type of articulation. The "clicking" (avulsive) type of articulation of these sounds was compared with other types of articulation (ingressive, implosive, ejective, etc.). The comparison was a general one, without regard to the consonantal system of a particular language. The phonologist, however, must study the position of the click phonemes in the consonantal system of individual languages. Such a study leads to the following results. In Zulu, which has apical, palatal, and lateral clicks, there also exist nonclick apicals, palatals, and laterals. Disregarding the clicks for a moment, one will find that in every series of localization, including the apical, palatal, and lateral, there exists a voiced consonant, a recursive occlusive, a voiceless aspirated occlusive, and a nasal.[120] *Mutatis mutandis*, the same oppositions also exist with respect to the three "click" series: each of these has a click with a voiced (soft) vowel onset, another in which the vowel has a "hard" onset (glottal plosion), a third in which the vowel has an aspirated onset, and, finally, a nasalized click. All oppositions between these various types of clicks are distinctive. Accordingly the apical clicks, the palatal clicks, and the lateral clicks in Zulu form a special series, which represents a parallel with the respective nonclick series. In Bushman, where the same four types of clicks occur (i.e., with a voiced soft, a voiceless hard onset, an aspirated vowel onset, and nasalization), the same four types of articulation are found for the corresponding nonclick consonants as well. Accordingly here too a relation of parallel series exists between the apical and palatal clicks and nonclicks. A similar relationship can also be shown for Sandawe, as will be demonstrated further below. The relation of the "click series" to the "nonclick series," which was noted for Zulu, therefore seems to be characteristic also for "click" languages in general. If the distinction between "click" and "nonclick" articulation would consist only in the relation between ingress and egress of air, it would, of course, be impossible to classify this distinction according to oppositions of localization. But more recent phonetic studies have shown that "click sounds" always require a specific shape of the tongue. In addition to the basic closure that is formed either

by the lips or by the anterior parts of the tongue, and which produces the various types of clicks (labials, dentals, retroflexes, palatals, and laterals), each click has still another, so-called supplemental closure which is always velar (i.e., it is produced by raising the posterior part of the dorsum against the soft palate). The presence of two closures, of which one must be velar and the other somewhere in the anterior part of the oral cavity, is part of the nature of click sounds. A suction act rarefies the air in the space between these two closures. Upon release of the anterior closure, outside air rushes into this air-starved space. But immediately thereafter the posterior velar closure is released. From a phonetic point of view, all these properties of the click sounds are equally important. However, from a phonological point of view, the presence of the velar occlusion, in addition to another closure (labial, apical, palatal, etc.), and the resultant specific modification of the shape of the tongue, and hence the configuration of the entire oral resonating cavity, are most important. This circumstance makes it possible to interpret the difference between click and nonclick articulation as an opposition of localization, more specifically, as an opposition between basic and secondary series. Since this opposition is logically privative and occurs in several series of localization of the same system, it may be designated as "click correlation."

The presence of a velar "supplemental closure" quite naturally produces a shift in the position of articulation of the front part of the tongue. It is therefore at times very difficult to pair a click series with a particular nonclick series. In Bushman nonclick consonants have a labial, an apical, a dorsal, a palatal, a sibilant, and a laryngeal series. The click consonants, on the other hand, have a plain-apical, a "cerebral," a palatal, and a lateral series. A click correlation can therefore be determined here at first glance only for the apical and the palatal series. However, what has been said by D. M. Beach (*op. cit.*, pp. 81 ff.) about the corresponding phonemes of Hottentot, namely, that retroflexion of the tip of the tongue is optional and not essential, can probably be repeated for the "cerebral" clicks of Bushman. Important for cerebral clicks is solely that in comparison with the "dentals" and "palatals" they are shifted further backward, so that a comparatively large "empty" space, that is, a space not filled by the tongue, is formed in the front part of the mouth. The relationship that thus exists between "dental" and "cerebral" clicks may be compared with the relationship between apical and guttural nonclicks. The "cerebral" clicks may be considered a secondary series of the guttural series. The system of clicks in Hottentot, as described by Beach, pages 75 to 82, can be summarized as follows: There are two series of plosive clicks. In one, which is the "dentialveolar series," according to Beach, and the "palatal series," according to earlier observers, the tongue fills the anterior part of the oral cavity up to the teeth. In the other, which is the "alveolar series," according to Beach, and the "cerebral series," according to earlier observers, an empty cavity remains in the anterior part of the mouth. In addition to these two "plosive" series, two "affricate" series are found which stand in exactly the same relationship to each other as the "plosives." In other words, in the one, namely, the "dental" series, the front part of the oral cavity is filled by the tongue, while in the other, namely, the lateral series, it is not. In releasing the anterior closure in the case of the "plosive" series, the tongue is simply torn away from the palate, while in the case of the "affricate" series it permits the air to penetrate gradually: from the front in the "dental" series, from the sides in the lateral series. It is clear that the opposition between "affricate" and "plosive" series is not an opposition of localization. Accordingly there are actually only two click series of localization in Hottentot, one characterized by a completely filled-out anterior part of the mouth (by the tongue), the other by an empty anterior part of the mouth. The nonclick consonants of Hottentot are divided into labials, apicals (including sibilants), gutturals, and laryngeals. The labials and laryngeals obviously stand outside the click correlation. In the remaining series the apical nonclicks correspond to the "clicks with a filled-out anterior cavity," and the guttural nonclicks to the "clicks with an empty anterior cavity." Thus there exists in Hottentot a correlative relation between the click and nonclick series of localization as well.

In connection with the click correlation, a type of secondary series must still be discussed, namely, the "correlation of full gutturalization"* and the "correlation of labiovelarization." These correlations are found in certain Bantu languages, namely, in the Shona group, and in the neighboring Venda.[121] A correlation of full or pure gutturalization exists in the opposition between nonvelarized consonants and consonants in which, in addition to the basic articulation, a secondary guttural articulation takes place, which consists of raising the dorsum of the tongue against the soft palate. The tongue can be raised high enough so as to practically form a velar closure. (This is usually the case in the Zezuru dialect of Central Shona.) Or it may be raised somewhat lower so that it results only in a velar stricture. (This is characteristic for the other dialects of Eastern and Central Shona, especially for the Karanga subgroup.) In the Zezuru dialect this correlation is found in the bilabials and palatals. The correlation of

* *Translator's note:* The term gutturalization instead of velarization is used here in view of N. S. Trubetzkoy's apparent preference for this term.

labiovelarization is a combination of the correlation of full gutturalization and the correlation of labialization. It occurs independently of the correlation of full gutturalization in all dialects of Eastern and Central Shona, in the apicals, palatals, and the two sibilant series. The acoustic impression of the fully gutturalized and labiovelarized consonants on a foreign observer is that of combinations of consonants (*pk*, *ck*, *tkw*, *ckw*, or *px*, *cx*, *txw*, *cxw* respectively). They must nevertheless be evaluated as monophonematic since the languages in which they occur do not permit any other consonantal clusters. If one compares the clicks and the fully gutturalized (or labiovelarized) consonants, one arrives at the conclusion that the difference is only phonetic, not phonological. The suction element, which, at first glance, seems to be characteristic of clicks, is only a special way of releasing the anterior oral closure. For the position of the click sounds in the phonemic system it is much less important than the presence of the velar "supplemental closure." But the latter is also present in the pure gutturalized and labiovelarized consonants of Zezuru and the other dialects of Eastern and Central Shona, though perhaps not in quite as energetic a form.

In summary, it can be said that the localization properties may form rather complicated systems of oppositions. The basic series stand in a relation of multilateral (heterogeneous) opposition. But in many languages some of these basic series are split into two related series each. These stand in a relation of bilateral equipollent opposition to each other, and in a relation of multilateral opposition to the other (basic or related) series of the same system. Finally, each series of localization can be split into series that stand in a relation of (actually or logically) privative opposition to each other. If such a split comprises several series of localization in the same consonantal system, it represents a correlation, which may be either a correlation of consonantal timbre or a click correlation.

d Consonantal phonemes outside the series of localization. In many, and possibly in most, languages there are consonantal phonemes that stand outside the localization series (or at least outside the noncorrelative series of localization). The "liquids" and "*h*" are *usually* among these consonantal phonemes. But one should not generalize this statement. The liquids and the *h* can sometimes also be incorporated into the series of localization. Above we have already mentioned Gilyak, where the *r* must be considered a voiced continuant of the apical series.[122] In Eskimo, where the *r* is always realized as a uvular and without a trill, it takes the same position in the postdorsal series as the *w* takes in the labial series and the *y* in the predorsal series. In the apical series this position is taken by *l*, which has a voiceless spirant *λ* as its counterpart, so that the following system results:[123]

p	*t*	*k*	*q*	*c*
φ	*λ*	*x*	*χ*	*s*
w	*l*	*y*	*r*	
(*m*)	(*n*)	(*ŋ*)	(*ň*)	

In languages that have only one liquid and that have a palatal series of localization, the *w* can be interpreted as the labial, the *y* as the palatal, and the sole liquid as the apical sonorant. But whether such an interpretation is correct can be established only where it is substantiated by the way the system functions or by grammatical alternation. For example, in Mende (Sierra Leone), where the *l* is the only liquid, *t* and *l* are in grammatical alternation. This alternation takes place under the same conditions as the alternation *p* – *w*. Accordingly a proportion *t*:*l* = *p*:*w* may be set up.[124] In Chichewa, where the only liquid is realized sometimes as an *r* and sometimes as an *l*, it becomes *d* following the prefix *m* or *n*. Under the same conditions *y* is replaced by *j* and *w* by *b*.[125] In these instances there exists objective proof that the "sole liquid" belongs to the apical series. But in cases where similar proof does not exist the classification of single liquids into a particular localization series is always subject to doubt. In languages that have more than two liquids, it is not uncommon that at least one or two liquids belong to specific series of localization. For example, in Serbo-Croatian (Štokavian) the relationship between *l* and *ļ* is obviously analogous to the relationship between *n*:*ń*, *t*:*ć*, and *d*:*đ*. This justifies grouping *l* with the "dental," and *ļ* with the "palatal" series. Thus only the *r* remains outside the series of localization. The case of Tamil will be discussed later (pp. 141 f.).

Most languages of the world have only two liquids. Only in extremely rare cases can these be grouped with any localization series.[126] They generally stand outside these series. They form a bilateral opposition which can be interpreted as logically privative. The relation *r*-*l* can then be considered either "trilled"/ "untrilled" or "nonlateral"/ "lateral." In a language such as Italian, where the *r* is always a trilled vibrant, the first interpretation is probably the more suitable one, while in German, where the "untrilled" varieties of the *r* sound are very frequently realizations of the *r* phoneme, the second interpretation would be the only one possible. But insofar as the opposition *r*-*l* cannot be neutralized in a given language, it remains only logically privative. The opposition between *r* and *l* is then at any rate not an opposition of localization but an opposition based on the manner of overcoming an obstruction. This is true even for languages such as German, where *r* is the "nonlateral" and *l* the "lateral" liquid. From a phonological point of view, the lateral articulation can be

considered a localization property only if it is shared by several phonemes whose remaining distinctive marks are the same as the properties based on the manner of overcoming an obstruction of the phonemes of other basic (or related) series of the same system (as is the case, for example, in Pedi, Sandawe, Tlingit, Chinook, Adyghe, Avar, etc.). However, in languages that have only a single lateral phoneme, and in which that phoneme stands in a relation of bilateral opposition to the *r* that lies outside the localization series, the lateral articulation (i.e., the unimpeded frictionless passage of egressing air between the side of the tongue and the "side wall" of the oral cavity) must be considered a special manner of overcoming an obstruction. The ambiguous character of lateral articulation, which causes such difficulties in *phonetic* systemization, is something that can quite easily be resolved in *phonological* systemization, the more so since the important thing here is only to establish to which other phoneme the particular "lateral" phoneme stands in a relation of opposition, and to determine the nature of such an oppositive relationship.

As for *h*, in many languages it is the "indeterminate consonantal phoneme in general." In many others, however, it is grouped with a particular series of localization. This may be either the "guttural series," which in such a case is characterized by the fact that the tip of the tongue and the lips are not involved in articulation, or it may be a particular laryngeal series. The latter is the case primarily where the same system contains a laryngeal plosive (glottal stop) that stands in a relation of bilateral opposition to *h*. In Danish, where *h* occurs only in those phonic positions in which (voiceless) unaspirated lenes *b*, *d*, and *g* are in opposition with the aspirated fortes *p*, *t*, and *k*, *h* obviously stands in the same oppositive relationship to the unaspirated vowel onset as *p*, *t*, and *k* stand to *b*, *d*, and *g*.[127] A laryngeal series could, therefore, be posited here, in which *h* would be the "aspirate" (or "fortis"). In German, on the other hand, where the relationship between *h* and unaspirated vowel onset is not paralleled by the relationship between *p*, *t*, *k* and *b*, *d*, *g*, *h* must be considered an "indeterminate" phoneme which stands outside any series of localization (*h* is voiced intervocalically, while *p*, *t*, and *k* are voiceless in that position; *h* does not occur in final position, while *p*, *t*, and *k* in that position represent the archiphonemes of the neutralized oppositions *p-b*, *t-d*, *k-g*, etc.). The same is also true of many other languages.

B Properties Based on the Manner of Overcoming an Obstruction (*Überwindungsarteigenschaften*)

a. Degrees of obstruction and the correlations based on the manner of overcoming an obstruction of the first degree. It has been stated above (p. 94)

that the creation of an obstruction and the overcoming of such an obstruction constituted the nature of a consonant. Considered from this point of view, the traditional classification of consonants into occlusives, fricatives (or spirants), and sonorants must be considered a classification based on *degrees of obstruction.* The *occlusives* have the highest degree of obstruction, the *fricatives* a medial degree, and the *sonorants* the lowest degree (which may already come close to an "absence of any obstruction" characteristic of vowels, without, however, wholly reaching that point). Occlusives are *momentary sounds* (*Momentanlaute*), while the fricatives and sonorants are *continuants.* But the occlusives and the fricatives may also be designated as *obstruents* in contrast to the sonorants. Accordingly five bilateral oppositions can exist between the three degrees of obstruction: (*a*) sonorant/obstruent, (*b*) momentary sound*/continuant, (*c*) occlusive/fricative, (*d*) fricative/sonorant, (*e*) occlusive/sonorant. All five of these are logically privative. If, in a given system, they are proportional, that is, if they occur in several localization series, each of these oppositions produces a special correlation. Such a correlation may be designated *correlation based on the manner of overcoming an obstruction of the first degree* (*Überwindungsartkorrelation ersten Grades*).

The *correlation of sonants,* that is, a bilateral and proportional opposition between sonorants and obstruents, is, of course, only possible in those languages in which the opposition between occlusives and fricatives is phonologically irrelevant. A very clear case of this type exists in Tamil,[128] which has five obstruent phonemes. These are realized differently, depending on their environment: they occur as aspirate occlusives (p^h, t^h, $\underset{.}{t}^h$, k^h, and $\hat{c}^h$) initially. Medially after vowels they occur as spirants (i.e., β, δ, $\underset{.}{\delta}$ as voiced, x and $\hat{s}$ mainly as unvoiced). After nasals they are realized as voiced occlusives (b, d, $\underset{.}{d}$, g, $\hat{3}$), and after *r* as voiceless unaspirated occlusives (p, t, $\underset{.}{t}$, k, $\hat{c}$). The oppositions between voiced and voiceless aspirated and unaspirated obstruents, as well as between occlusives and spirants, are therefore here determined by their phonic environment, and are phonologically irrelevant. The phonological nature of the above-mentioned five phonemes of Tamil consists, on the one hand, in their membership in specific localization series, on the other, in their being obstruents. These

* *Translator's note:* The term *Momentanlaut* (momentary sound) will henceforth be rendered by the familiar term "stop." The author uses this term only to distinguish between *Momentanlaut* and *Dauerlaut* (continuant). Momentanlaut becomes "occlusive" in relation to the fricative/sonorant division within continuants.

It seems that Trubetzkoy's division cannot be completely equated with Jakobson's interrupted/continuant opposition (cf. *Preliminaries*, p. 21). In Trubetzkoy's terminology both *r* and *l* are included in the sonorants and hence, according to his classification, in the continuants, while Jakobson contrasts them as being interrupted and continuant respectively. Cf. Jakobson–Fant–Halle, *Preliminaries to Speech Analysis*, pp. 19, 21, 22.

five obstruents in Tamil are opposed to five sonorants: the labial *P* phoneme is opposed to a *w*, plain-apical *T* to an *l*, retroflex apical *Ṭ* to a retroflex *ḷ*, and palatal sibilant *Ć* to a *y*. The guttural *K* phoneme in Tamil seems to correspond to the sonorant *R* (transcribed as "ɹ" by J. Firth). Firth describes its realization as follows: "It is a frictionless continuant with an indeterminate back vowel coloring. It is produced by retracting the entire body of the tongue toward the back, spreading the seam of the tongue toward both sides so that the tongue so to speak becomes short, thick, and blunt, and approaches the center of the hard palate" (XVI). Only Tamil *r* lies completely outside any localization series and does not stand in a relation of bilateral opposition to any other phoneme.[129] A *correlation of sonants* is thus present in Tamil (or a *correlation of liquids*, if one makes the decision to consider *w* and *y* as liquids as well). This correlation comprises the entire consonantal system (with the exception of *r*). We do not know of any other examples of this type. Sonorants generally either stand outside all localization series and form a phoneme class by themselves. In this case they stand in a relation of bilateral opposition to each other, but in a relation of multilateral opposition to all other phonemes. Or only a few, but not all, sonorant phonemes are incorporated into the system of localization series and enter into a relation of bilateral opposition to a particular class of obstruents.

The bilateral opposition between stops and continuants presupposes that the opposition between fricatives and sonorants is phonologically irrelevant. In its pure form it seems to occur very rarely. At least we do not know of any consonantal system that is structured in accordance with this principle. There are languages, however, in which the (oral) sonorants together with the spirants form a class of continuant phonemes, which is opposed to the class of stop phonemes in all or in several series of localization. But this correlation does not occur by itself, at least not in the cases known to us. It occurs only in connection with other correlations, and in such a way that either the stops or the continuants, or both categories, are divided into voiceless and voiced lenes and fortes. Compare, for example, the consonantal systems of Eskimo (p. 138) and Gilyak (pp. 73 ff.) cited above. This correlation (which may be termed *correlation of stops* or *correlation of continuants*) is therefore always only a member of a correlation bundle.

The correlation of sonorants and the correlation of stops are rare phenomena in general. More often, the three degrees of obstruction (occlusives, spirants, and sonorants) are put into opposition with each other in pairs. In most cases oppositions of this type extend only to part of the consonantal system.

We use the term *correlation of constriction* or *correlation of occlusiveness* for the opposition between occlusives and spirants simultaneously existing in several localization series. In German this correlation is found in the dorsal, labiodental, and *s*-sibilant series (*k-x, p̆-f, c-s*). In Polish, Czech, Slovak, and Ukrainian this correlation comprises the guttural and all sibilant series. In Serbo-Croatian and Hungarian it is limited to the two sibilant series (Serbo-Croatian *c-s, ǧ-ž, č-š*; Hungarian *cs-s, dzs-zs, c-sz, dz-z*). In Albanian, in addition to the two sibilant series (*c-s*, "*x*"-*z*, "*ç*"-"*sh*," "*xh*"-"*zh*"), it also comprises the labial (*p-f, b-v*) and apical series (*t*-"*th*," *d*-"*dh*"). In Modern Greek it includes all series of localization (*π-φ, τ-θ, κ-χ, τσ-σ*). In English the opposition between occlusive and constrictive quite evidently exists in the case of the *š* sounds (*č-š, ǯ-ž*). However, in the case of the English apicals and labials the matter is not quite clear: English *t* and *d* are realized with the tip of the tongue raised rather high. In the case of energetic, affricated aspiration of initial *t* an *š*-like "off-glide" is audible, while the plain-apical spirants *θ* and *δ* in English are realized with the tip of the tongue in a rather low position ("interdental"). Likewise *p* and *b* are "bilabial," while *f* and *v* are "labiodental." It is true, of course, that in Modern Greek and Albanian the labial and dental spirants do not correspond exactly to the respective occlusives with regard to position of articulation either. But such an exact correspondence is found here in two other localization series (the Albanian *s* and *š* series, and the Modern Greek *χ* and *σ* series), thus creating a "systemic constraint." Further, the oppositions *p-f, t-θ*; and *k-x* are neutralizable in Modern Greek, and a grammatical alternation exists between its members. Since these conditions are absent in English (and the affricated aspiration of initial *t* and *p* clearly underlines the phonetic difference of localization which exists between these sounds and *θ* and *f*), it is doubtful whether the oppositions *t, d—θ, δ* and *p, b—f, v* should be interpreted as "oppositions of constriction" in English.[130] Similar doubts also arise with respect to certain other languages. It can nevertheless be said that in most cases the situation is quite clear, and that the correlation of constriction, though it is only rarely found in all localization series, is one of the most common correlations in the languages of all parts of the world.

A bilateral relation of opposition between a sonorant and a fricative, on the other hand, is a rather rare phonological phenomenon. In Czech such a relation is found between *r* and *ř*, in Zulu and in the language of the Pueblo Indians of Taos (New Mexico)[131] between l and *ɬ*. In several languages a similar relation seems to exist between *w* and *β* (or *v*), but in each of these cases one must check out whether the *w* is actually a consonant and not rather a combinatory variant of the vowel *u*. Discounting such

doubtful cases, there remain only very few languages that have the opposition "labial sonorant"/"voiced labial spirant." (Examples are K'üri, Pedi, Chichewa, and a few others.) Relative to the opposition between a palatal sonorant and a voiced palatal spirant, we do not know of a single example.[132] Cases in which two consonantal phonemes are actually distinguished only by the presence or absence of friction are thus extremely rare. This opposition does not seem to form a correlation that extends over several series of localization in any language.

As regards the opposition between sonorants and occlusives, it occurs particularly in those languages that do not have any spirants, for example, in the Eastern dialect of Nuer in the Egyptian Sudan. In this language all five voiced occlusives *b*, *d*, interdental *ḍ*, *g*, and *j* are in contrast with an equal number of sonorants, *w*, *l*, *r*, *γ*, and *y*.[133] Of the latter, *w*, *γ*, and *y* obviously stand in a relation of bilateral opposition with *b*, *g*, and *j*. *r* and *l* should perhaps also be grouped with the two apical related series. Bilateral oppositions between sonorants and occlusives are also found in other languages. In Serbo-Croatian (Štokavian) we find the proportion $b:v = d:l = d:\text{ĺ}$ (*lj*). In those Montenegran dialects where Proto-Slavic *x* has become a voiced velar continuant without any perceptible friction,[134] the same proportion appears to have been expanded to include the pair $g:\check{\gamma}$. In Danish, in particular in the standard language, a proportional opposition occurs between lenis *b*, *d*, and *g*, on the one hand, and the continuants *v*, δ, and *γ*, on the other. Since in Danish *v*, δ, and *γ* are realized almost without friction, and since their combination with a preceding vowel is prosodically equivalent to a long syllabic nucleus (as is the combination vowel + *r* or *l*, or vowel + *m* or *n*), they may be considered sonorants from the point of view of the Danish phonemic system.[135] Accordingly here too a correlation is present which includes all lenis occlusives and part of the sonorants. Since from an acoustic and articulatory point of view occlusives and sonorants involve maximally different types of articulation, this correlation might well be termed the (consonantal) *correlation of contrast*. It is to be noted that in all cases discussed above the (phonetic) intermediary degrees between occlusives and sonorants, namely, the voiced or lenis spirants, are absent: Eastern Nuer does not have any spirants at all. In Serbo-Croatian and Danish spirants are absent, at least in those series of localization which participate in the "correlation of contrast." This is quite understandable, of course, since only under this condition can the opposition between occlusive and sonorant be bilateral.

b. Correlations based on the manner of overcoming an obstruction of the second degree (*Überwindungsartkorrelationen zweiten Grades*). From the

above survey it should be apparent that the correlations that arise from bilateral oppositions between the different degrees of obstruction comprise the entire consonantal system only relatively seldom. Usually a few consonantal phonemes remain unaffected by such correlations; but these enter into specific relations of bilateral opposition to other phonemes of the same degree of obstruction. Bilateral oppositions between phonemes having the same degree of obstruction (and belonging to the same series of localization) give rise to a specific set of correlations which may be termed *correlations based on the manner of overcoming an obstruction of the second degree*, in contrast with the primary correlations which are the result of the opposition between three degrees of obstruction.

In each correlative pair of a correlation based on the manner of overcoming an obstruction of the second degree, both members of the opposition must belong to the same degree of obstruction. But a correlation based on the manner of overcoming an obstruction of the second degree is theoretically not bound by any specific degree of obstruction. It can occur in different degrees of obstruction, depending on the language.

We distinguish the following six typical correlations based on the manner of overcoming an obstruction of the second degree:

The *correlation of tension*, or the opposition between "fortes" and "lenes"—an opposition in which the size of the obstruction and that of the means of overcoming the obstruction (air pressure) are adapted to each other: if the obstruction is reinforced by a tensing of the buccal muscles, the air pressure increases accordingly. On the other hand, if there is a slackening of the muscles of the buccal organs, the air pressure decreases as well.

The *correlation of intensity* (*or pressure*), which shows a somewhat different type of relation between resistance and air pressure: when the muscles of the buccal organs are being relaxed, the air pressure is too strong. Hence the short duration and possible aspiration of the "weak" opposition members. When the buccal muscles are being tensed, the air pressure seems just about able to accomplish its task. Hence the relative length, the lack of aspiration, and the fact that the obstruction is overcome with great effort in the case of the "strong" opposition members.

The *correlation of voice*, or the opposition between voiced and voiceless consonants.

The *correlation of aspiration*, or the opposition between aspirated and unaspirated consonants (insofar as only aspiration and no other articulatory properties are phonologically relevant).

The *correlation of recursion*, or the opposition between consonants produced by air flowing from the lungs and consonants that are only

produced by the air accumulated above the closed glottis and expelled by means of a pistonlike thrust of the closed glottis.[136]

The *correlation of release*, the opposition between occlusives in which the oral closure is released with plosion and those in which it is released normally.[137]

The *correlation of preaspiration* could, perhaps, be mentioned as a seventh correlation based on the manner of overcoming an obstruction of the second degree, that is, the opposition between consonants with aspirated implosion and those without such implosion. This opposition is found in some American languages, for example, in Fox and Hopi. But it is not clear whether the "preaspirated" consonants in these languages should be considered monophonematic or polyphonematic (i.e., as h + consonant).[138]

All correlations based on the manner of overcoming an obstruction of the second degree involve the opposition between a "stronger" and a "weaker" consonant.

Correlation	*Strong Opposition Member*	*Weak Opposition Member*
Correlation of Tension	fortis	lenis
Correlation of Intensity	heavy	light
Correlation of Voice	voiceless	voiced
Correlation of Aspiration	aspirated	unaspirated
Correlation of Recursion	infraglottal	recursive
Correlation of Release	explosive	injective

The question whether the "strong" or the "weak" opposition member of a correlation based on the manner of overcoming an obstruction of the second degree is unmarked can, in the final analysis, be determined objectively only from the functioning of the particular phonemic system. However, in any correlation based on the manner of overcoming an obstruction a "natural" absence of marking is attributable to that opposition member whose production requires the least deviation from normal breathing. The opposing member is then of course the marked member. From this general or "natural" point of view the marked member in the correlation of tension is the fortis consonant, in the correlation of intensity the heavy consonant, in the correlation of aspiration the aspirated member, in the correlation of recursion the recursive member, and in the correlation of release the injective member. By looking at it in this way it is possible to determine the phonological nature of a correlation based on the manner of overcoming an obstruction of the second degree in some

doubtful cases. In a language in which voiced lenis consonants form a neutralizable opposition with voiceless fortis consonants, and in which the archiphoneme in the positions of neutralization is represented by a voiceless fortis consonant, the correlation of voice is present. This means that in this case the opposition between voiced and voiceless consonants alone is phonologically relevant, while the difference in the tension or relaxation of the buccal muscles is a secondary phenomenon which is phonologically irrelevant. In a language where a recursive lenis is opposed to an aspirated fortis consonant, the correlation of recursion is present, provided that the archiphoneme is represented by an aspirated fortis consonant in the position of neutralization. Only in those cases where the given phonemic system contains direct proof for another ("unnatural") distribution of markedness or unmarkedness of the opposition members can this "natural" way of evaluation be ignored.

On the basis of these general considerations it may be concluded, for example, that the correlation of voice is present in Russian, Polish, Lithuanian, Czech, Slovak, etc., where the voiceless fortis consonant functions as the archiphoneme in the position of neutralization. In Lapp, on the other hand, where the archiphonemes of the neutralized correlation based on the manner of overcoming an obstruction of the second degree are represented by lenis consonants initially, the correlation of tension is obviously present. This correlation is also present in High German, where obstruents are neither voiced nor aspirated, and where tensing of the buccal organs is the only means of differentiation. But in cases where several principles of differentiation combine, and where the particular correlation cannot be neutralized, or where the way in which it is neutralized does not contain any indication as to the markedness or unmarkedness of the opposition members, it is actually impossible to determine precisely the nature of a correlation based on the manner of overcoming an obstruction of the second degree. English *t*, *p*, and *k* are aspirated voiceless fortes before stressed vowels, but unaspirated voiceless fortes elsewhere; *b*, *d*, and *g*, on the other hand, are always voiced lenes. The correlation is neutralized, on the one hand, before obstruents, the representative of the archiphoneme being conditioned externally, and on the other, after *s*, the archiphonemes being represented by voiceless lenes, that is, by sounds that are phonetically intermediary between the two opposition members. Consequently it is impossible to say whether in English a correlation of tension or a correlation of voice is present. *Mutatis mutandis*, the same is also true for standard German, French, Hungarian, Serbo-Croatian, etc., where voiceless fortes are found in opposition to voiced lenes. The type of neutralization of this opposition does not give any clues to its nature. In

Danish the situation is equally unclear, though here the correlation of voice is not involved. All obstruents are voiceless in Danish. But since aspirated fortes in Danish are in opposition to unaspirated lenes, and the latter represent the archiphonemes in the positions of neutralization, it is not clear whether a correlation of aspiration or a correlation of tension is here to be posited. According to H. J. Uldall (*International Journal of American Linguistics*, VIII [1933], 74), two classes of occlusives are presumably in opposition to each other in Achumawi. One of these is realized by aspirated voiceless consonants, while the other is realized optionally by voiced or voiceless lenes or by recursive consonants. A similar situation is found in many languages. In cases of this type it seems advisable to designate the correlation simply as a correlation based on the manner of overcoming an obstruction of the second degree, and the opposition members simply as "strong" and "weak." The situation is usually much clearer in those cases where more than two manners of overcoming an obstruction are differentiated phonologically within one degree of obstruction. However, even those cases do not preclude a certain indeterminacy, at least with regard to one component of the correlation bundle. In principle the differentiation of the phonemes within one degree of obstruction by second degree correlations based on the manner of overcoming an obstruction is the greater the higher the degree of obstruction. This means that the occlusives usually show more classes based on the manner of overcoming an obstruction than the fricatives, and the fricatives more classes than the sonorants. However, this is no law, only a general tendency.

α) In a two-degree consonantal system such as, for example, the abovementioned system of Eastern Nuer, the occlusives are divided into two classes by means of a correlation based on the manner of overcoming an obstruction of the second degree (*b-p, d-t, ḍ-ṭ, g-k, j-c*), whereas the sonorants form only one such class (*w, r, l, γ, y,* and *m, n, ŋ, ɲ* respectively). In many languages in which three degrees of obstructions are represented, the occlusives are divided into two classes with respect to the manner of overcoming an obstruction, whereas the fricatives and the sonorants form only one class each. This is the case, for example, in Danish (occlusives *b-p, d-t, g-k,* fricatives *f, s,* sonorants *r, l, j, v, ð, γ,* and *m, n, ŋ* respectively); in the language of the Mayas of Yucatan (occlusives *p-p', t-t', c-c', č-č', k-k', ḳ',* fricatives *s, š, h,* sonorants *m, n, w, l, j*);[139] in Yurak-Samoyed (occlusives *b-p, d-t, g-k, c, ḳ',* fricatives *s, h,* sonorants *m, n, ŋ, ɲ, w, l, r, j*);[140] and in Lamba (occlusives *b-p, d-t, g-k, ḍ-ṭ,* fricatives *f, s, ʂ,* and sonorants *m, n, ŋ, ɲ, r, l, v*).[141] In other languages fricatives are divided into the same two classes as the occlusives with regard to the manner of overcoming an obstruction, while the sonorants are not differentiated in this

way. This probably represents the most common type of consonantal system: in Europe it is found in English, French, Dutch, Russian, German, Lithuanian, Latvian, Polish, White Russian, Ukrainian, Slovak, Czech, Hungarian, Romanian, Serbo-Croatian, Bulgarian, Italian, etc.[142] In other parts of the world it is by no means rare either. On the other hand, it is difficult to find a language in which not only the occlusives and fricatives but also the sonorants are differentiated by *the same* correlation based on the manner of overcoming an obstruction of the second degree. In those languages in which each of the three degrees of obstruction is divided into two classes, each relative to overcoming an obstruction, we find either a different correlation based on the manner of overcoming an obstruction of the second degree for each degree of obstruction (as, for example, in the Scottish-Gaelic dialect of Barra Island where, with respect to manner of overcoming an obstruction, the occlusives are divided into two classes by the correlation of aspiration, the fricatives by the correlation of voice, and the sonorants by the correlation of intensity),[143] or at least the sonorants do not involve the same correlation as the occlusives and the fricatives. (This is the case, for example, in the North Albanian dialect of Skutari, where occlusives and fricatives are differentiated by the correlation of voice, and sonorants by the correlation of intensity.)[144] Of all the languages with which we are familiar only Irish has a single correlation based on the manner of overcoming an obstruction, namely, that of voice, in all three degrees of obstruction. In addition, it is peculiar in that its sonorants participate not only in this correlation but also in the correlation of intensity. Thus a greater number of classes based on the manner of overcoming an obstruction is found here for the sonorants than for the obstruents.[145]

Consonantal systems in which the occlusives and fricatives are divided into two classes each with regard to the manner of overcoming an obstruction should theoretically have four obstruents in each series of localization containing both occlusives and fricatives. In some languages this is actually the case, as, for example, in the North Albanian dialect of Skutari, mentioned above. However, series of localization which involve the correlation of constriction frequently do not have four but only three obstruent phonemes. This is the case, for example, in Czech, where *dz, dž,* and *g* occur only in loanwords: *p-b, t-d, t'-d', f-v, k-ch-h, c-s-z, č-š-ž*.[146] The same relations are found in the Čakavian dialect of Serbo-Croatian (*p-b, t-d, ṭ-ḍ, f-v, k-x-γ, c-s-z, č-š-ž*), in Erza-Mordvin (*p-b, t-d, t'-d', k-g, c-s-z, c'-s'-z', č-š-ž*), in Upper Sorbian (*p-b, t-d, ć-dź, k-x-h, c-s-z, č-š-ž*), and in Kinyarwanda (*p-b, t-d, k-g, c-s-z, č-š-ž, p̌-f-v*).[147] This, then, is a phenomenon that repeats itself in several genetically unrelated languages and must

consequently have a deeper reason. Also to be mentioned here is Dutch, where the only series of localization that involves the correlation of constriction, namely, the dorsal series, is also the only series in which a weak occlusive is absent.[148] It may well be assumed that in all these cases, the correlation of constriction combines with a correlation based on the manner of overcoming an obstruction of the second degree to form a "three-member bundle." The strong fricative is then the phoneme that so to speak "keeps" the entire bundle "together." But there are also bundles of a different type which consist of the correlation of constriction and a correlation based on the manner of overcoming an obstruction of the second degree. A correlation of constriction clearly existed in Late Avestan: *p-f*, *t-θ*, *k-x*, *č-š*. However, Avestan also had a correlation based on the manner of overcoming an obstruction of the second degree, which cannot be determined more closely. It probably was the correlation of voice. Be that as it may, the formation of an occlusion or constriction was phonologically irrelevant for the weak opposition members of this correlation since they were realized as occlusives in initial position, but as fricatives intervocalically. Accordingly they could be considered the "weak" partners of *p*, *t*, *k*, and *č* as well as of *f*, *θ*, *x*, and *š*, and therefore had to "keep together" the bundle. (The relation *s-z* was unambiguous only in the *s* series since in that series no corresponding strong occlusive occurred.) In Cheremis, three-member bundles (*c-s-z*, *ć-ś-ź*, and *č-š-ž*) are found in the sibilant series of localization. In the other series pairs of phonemes are found, consisting of a strong occlusive and a weak fricative (*p-β*, *t-δ*, *k-γ*). After nasals, all of these oppositions are neutralized in all series. Weak occlusives function as the archiphoneme representatives in this position. In initial position the opposition *p-β* is maintained, while the oppositions *t-δ* and *k-γ* are neutralized and represented by the archiphonemes *t* and *k*. However, the sibilant series are represented initially by strong occlusives and strong fricatives (*c-s*, *ć-ś*, *č-š*). Thus it seems that an actual correlation of constriction is present only in the sibilant series of localization, while in the remaining series the occlusiveness of the strong and the constrictiveness of the weak opposition member must be considered secondary; these series of localization, that is, the labial, apical, and dorsal series, would thus involve "obstruents in general," which are differentiated by a single correlation based on the manner of overcoming an obstruction of the second degree. In addition to the three-member bundles *c-s-z*, *č-š-ž*, and *k-x-γ*, certain Slovenian dialects have phoneme pairs consisting of a voiceless occlusive and a voiced fricative (*p-β*, *t-δ*) in the remaining series of localization. Here voiced fricatives are replaced by voiceless fricatives in final position. The correlation of constriction thus appears in all series in its pure form: *p-f*, *t-θ*, *k-x*, *c-s*, *č-š*. Accordingly only the correlation of constriction is here phonologically relevant for the labial and dental obstruents, the correlation of voice, on the other hand, only for the fricatives of the two sibilant series and the dorsal series of localization. This means that we would have here the rare case in which the fricatives have more classes with regard to the manner of overcoming an obstruction than the occlusives.

All these phenomena point toward the conclusion that, although the correlation of constriction is a correlation based on the manner of overcoming an obstruction of the first degree, in many languages it is related especially closely to the correlations based on the manner of overcoming an obstruction of the second degree. The necessary prerequisite for the "formation of a bundle" thus appears to be provided.

Consonantal systems in which the individual degrees of obstruction are differentiated by several correlations based on the manner of overcoming an obstruction are not a rare phenomenon in the world. It is true, of course, that the European languages, with the exception of a few dialects, in principle have at the most only one correlation based on the manner of overcoming an obstruction of the second degree for each degree of obstruction. Often it is difficult to determine what should be regarded as the correlation mark. But in many languages in other parts of the world, as well as in some European dialects, an additional correlation based on the manner of overcoming an obstruction of the second degree is found. But here, too, the tendency toward greater differentiation with respect to the "higher degrees of obstruction" is maintained.

β) Languages that have two correlations based on the manner of overcoming an obstruction of the second degree in the case of the occlusives and no such correlations in the case of the fricatives and sonorants are represented in all parts of the world. Mentioned here are, for example, the Chinese dialect of Siang-tang (Honan Province) (occlusives *b-p-p*^{h}, *d-t-t*^{h}, *g-k-k*^{h}, *ĝ-ḳ-ḳ*^{h}, *ʒ-c-c*^{h}, fricatives *x*, *x̣*, *s*, sonorants *m*, *n*, *ŋ*, *ŋ̣*)[149] and Haida (occlusives *b-p*, *d-t-t'*, *g-k-k'*, *ğ-ḳ-ḳ'*, *ʒ-c-c'*, *ƛ-λ-λ'*, fricatives *x*, *x̌*, *s*, *l*, *h*, sonorants *m*, *n*, *ŋ*, *w*, *l*, *j*).[150] Classical Greek also belonged to this type (*π-β-φ*, *τ-δ-θ*, *κ-γ-χ* on the one hand, and *σ*, *ρ*, *λ*, *μ*, *ν* on the other). In another series of languages the occlusives have two correlations, the fricatives only one, based on the manner of overcoming an obstruction, while the sonorants are not differentiated by any such correlation. As examples of this type the Tsaconian dialect of Modern Greek, in which geminated occlusives have become aspirates, may be mentioned here. Thus the following systems resulted: *b-p-p*^{h}, *d-t-t*^{h}, *g-k-k*^{h}, *ʒ-c*; *v-f*, *δ-θ*, *γ-x*, *z-s*, *ž-š*; *r*, *l*, *ṛ*, *l̥*, *m*, *n*, *ŋ*;[151] Georgian (*b-p-p'*, *d-t-t'*, *g-k-k'*, *ʒ-c-c'*, *ǯ-č-č'*, *ḳ*; *γ-x*, *z-s*, *ž-š*; *v*, *r*, *l*, *m*, *n*); Tibetan (*b-p-p*^{h}, *d-t-t*^{h}, *g-k-k*^{h}, *ʒ-c-c*^{h}, *ǯ-č-č*^{h}, *ɔ-h*, *z-s*,

ẑ-ŝ; *m, n, ŋ, ɲ, v, j, r, l*);[152] Amharic (*b-p-p'*, *d-t-t'*, *g-k-k'*, *ǧ-ǩ-ǩ'*, *ǯ-č-č'*; *z-s*, *ž-š*; *m, n, ɲ, r, l, w, y*);[153] Chichewa in Northeast Rhodesia (*b-p-p^h*, *d-t-t^h*, *g-k-k^h*, *ǯ-č-š^h*, *ʒ-c*, *ḇ-p̌*; *z-s*, *v-f*; *m, n, ŋ, ɲ, w, l, γ*), etc.[154]

Still other languages involve two correlations based on the manner of overcoming an obstruction of the second degree for occlusives and fricatives, while the sonorants do not participate in any such correlation: Kabardian, for example, belongs to this type: *b-p-p'*, *d-t-t'*, *g-k-k'*, *ʒ-c-c'*, *ǩ-ǩ'*, *ɓ-h*; *ẑ-ŝ-ŝ'*, *v-f-f'*, *l-l-l'* (+ *γ-x*, *γ̌-x̌*, *z-s*, *ž-š*, *ḫ*).[155] In Burmese both the occlusives and the fricatives show two correlations based on the manner of overcoming an obstruction of the second degree. The sonorants, on the other hand, have only one such correlation: *b-p-p^h*, *d-t-t^h*, *g-k-k^h*, *j-ǩ-ǩ^h*; *z-s-s^h* (+ *δ-θ*); *m-m^ʿ*, *n-n^ʿ*, *ŋ-ŋ^ʿ*, *l-l^ʿ*, *y-y^ʿ* (+ *w*).[156] All these cases confirm the rule according to which higher degrees of obstruction tend toward greater differentiation by means of secondary correlations. However, an exception to this rule is found in Tsimshian, where the same two correlations based on the manner of overcoming an obstruction as are present in the occlusives also occur in the sonorants, while the fricatives are not differentiated by any such correlation: *b-p-p'*, *d-t-t'*, *g-k-k'*, *ǧ-ǩ-ǩ'*, *ǧ̌-ǩ̌-ǩ'*, *ʒ-c-c'*; *x*, *x̊*, *x̌*, *s*, *h*; *l-l'-l'*, *w-w'*, *y-y'*, *m-m'*, *n-n'*, *r*.[157]

The above examples, which can easily be multiplied in number, seem to point to the conclusion that in those systems in which the occlusives (or the obstruents) are differentiated by two correlations based on the manner of overcoming an obstruction of the second degree, one of these correlations is either the correlation of aspiration or the correlation of recursion. The other, on the other hand, is either the correlation of tension in its pure form or a "merger" of the correlation of tension with the correlation of voice ("voiceless fortis"/"voiced lenis"). If one considers that the unmarked members of the correlation of recursion are usually realized as aspirates (in order to bring out more clearly the contrast to the recursives, which are produced with a closed glottis and hence with very little air), one must become aware of the close relation between the correlation of aspiration and the correlation of recursion: they are distinguished from each other only in that in the one the "strong," in the other the "weak," member of the opposition is marked. Phonetically this is expressed by an exaggeration of its "strength" (through energetic air pressure, that is, aspiration) or of its "weakness" (through lessening of the air pressure by means of glottal closure). By combining with the correlation of tension (or the correlation of voice), a three-member bundle is produced whose members form a gradational series. If one component of this correlational bundle is the correlation of aspiration, the "[illegible]member of the gradational series is an unaspirated voiceless fortis consonant (*d-t-t^h*). If, on the other hand, the correlation of recursion is one component of the correlation bundle, the "mid" member of the gradational series is a (voiced or voiceless) lenis with infraglottal expiration (*t-d-t'*). In all languages in which such three-member bundles are only common to occlusives, and in which the other degrees of obstruction are differentiated only by a second-degree correlation, the latter (generally the correlation of voice merged with the correlation of tension) is one of those correlations that occur in the occlusives as well.[158]

γ) Languages with more than two second-degree correlations based on the manner of overcoming an obstruction within one degree of obstruction are very rare. The East Caucasian languages of Daghestan, on the one hand, and the Western dialects of Circassian, on the other, present a combination of the correlation of tension and voice respectively with the correlation of recursion and with the correlation of intensity. All three correlations occur with respect to the occlusives and, depending on the language, produce different "bundles": in Avar five-member bundles are produced (although not in all series, for example: *g-k-K-k'-K'*, but *d-t-t'*), in Lak four-member bundles (*d-t-T-t'*), and so on. The correlation of intensity with respect to the fricatives occurs in all languages of Daghestan, with the exception of K'üri and Rutulian. As far as the correlation of voice is concerned, the opposition between occlusives and fricatives is here usually irrelevant, and the correlation of recursion is completely alien to fricatives.[159] A four-member bundle (*d-t-t'-T*) is present with respect to the occlusives in the Western dialects of Adyghe. In the case of the fricatives the correlation of voice as well as the correlation of recursion (and in the sibilant series, it seems, also the correlation of intensity) are phonologically relevant.[160] What characterizes all these languages is the fact that the sonorants do not participate in any of the three mentioned correlations based on the manner of overcoming an obstruction of the second degree.[161] The languages of the Northern Caucasus thus show the tendency, referred to above, to gradate the number of classes with respect to the manner of overcoming an obstruction in accordance with degrees of obstruction. A combination between the correlation of voice (or tension) and the correlation of aspiration presumably exists in Dakota (of the Sioux language family in North America).[162] In the case of the occlusives these three correlations form a four-member bundle (*b-p-p^h-p'*, *d-t-t^h-t'*, *g-k-k^h-k'*, and the defective bundle *č-č^h-č'* = *ʒ-č-č^h-č*, in the Ponka dialect). However, the correlation of aspiration is foreign to the spirants (*z-s-s'*, *ž-š-š'*, *γ-x*), and the sonorants (*m, n, w, y, l*) do not participate in any correlation based on the manner of overcoming an obstruction at all. In Sindhi the correlations of voice, aspiration, and release are combined to form a five-member

bundle with regard to the occlusives (*p-p^h-b-b^h-b'*, *t-t^h-d-d^h-d'*, *k-k^h-g-g^h-g'*, *c-c^h-j-j^h-j'*, and the defective *ṭ-ṭ^h-ḍ-ḍ^h*). The spirants show only the correlation of voice (*f-v*, *s-z*, and defective *s*, *h*, *x*), and the sonorants do not present any correlation based on the manner of overcoming an obstruction of the second degree.[163] The number of examples for combinations of three (or even four) correlations based on the manner of overcoming an obstruction of the second degree within a single degree of obstruction can probably be increased considerably. There is, however, no doubt that such cases are extremely rare.

In order to conclude the section about correlations based on the manner of overcoming an obstruction of the second degree, we are going to give some interesting examples which will show that the nature of a correlation can sometimes be altered to such a degree by the context of the system to which it belongs that completely new correlations are produced.

In East Bengali the correlation of voice, the correlation of aspiration, and the correlation of recursion are found (at least word-initially). The correlation of aspiration is limited to occlusives only, and the correlation of voice to obstruents only, while the correlation of recursion is present in all degrees of obstruction: *p-b-p'-b'-p^h*, *t-d-t'-d'-t^h*, *ṭ-ḍ-ṭ'-ḍ'-ṭ^h*, *k-g-k'-g'-k^h*, defective *c-ɜ-c'-ɜ'*; *f-v-f'*, *x-γ*, *š-ž'*, *s*; *m-m'*, *n-n'*, *r-r'*, *l-l'*.[164] In this case the sibilant series of localization is thus the only one in which an aspirated occlusive is absent. If one considers that *s* (in contrast with *f* and *š*) does not have a "recursive partner," one may well assume that *s* is the aspirated phoneme of the sibilant series. Accordingly, as far as the sibilant series of localization is concerned, the correlation of aspiration in East Bengali is replaced by the correlation of constriction (which, incidentally, is in fact the case from a diachronic point of view).

While in the case of East Bengali one can only speak of a possible interpretation, there are other languages in which the parallelism between the opposition of aspirated and unaspirated consonants and the opposition between spirants and occlusives is clearly apparent. For example, the Tiva language of the Pueblo Indians of Taos (N.M.) belongs among these.[165] Tiva has the correlation of voice (*b-p*, *d-t*, *g-k*, *l-l'*) and the correlation of recursion (but only for occlusives, *p-p'*, *t-t'*, *k-k'*, *c-c'*), and in addition the correlation of constriction and the correlation of aspiration. The last two, however, are mutually exclusive, so that the opposition of aspiration is found only in the labial and apical series (*p-p'*, *t-t'*), while the opposition of constriction is present only in the guttural, the labiovelar, and the sibilant series (*k-x*, *k̲-x̲*, *c-s*). It may probably be assumed that cases of this type involve not two distinct but one single correlation. The one member of such a correlation is characterized by an

energetic occlusion followed by a plosive release that requires all the egressive air, while the other member presents only a light obstruction to the egressive airstream. Depending on the series of localization, it may be either a loose occlusion or a stricture. This correlation could therefore be most readily identified with the correlation of intensity, and it could then be assumed that the language of the Pueblo of Taos probably contains a correlation of voice, a correlation of recursion, and a correlation of intensity.

The consonantal system of Sandawe in East Africa provides a very peculiar and instructive illustration. Otto Dempfwolff, to whom we owe the description of this language,[166] lists the following consonants: (*a*) voiced lenes *b*, *d*, *g*, *ɜ*, *λ̂* (lateral affricate); (*b*) "semivoiced lenes," which presumably are identical with "'*b*", "'*d*," etc., of Ful, and must consequently be considered injectives (*b$^\cup$*, *d$^\cup$*, *g$^\cup$*); (*c*) unaspirated fortes *p*, *t*, *k*, *c*, *λ* (lateral affricates); (*d*) aspirated fortes *p^h*, *t^h*, *k^h* (the latter only in a single word); (*e*) recursive fortes *k'*, *c'*, *λ'*; (*f*) recursive fortes with a "squeezed" offset *k^ɜ*, *λ^ɜ* (which, incidentally, may only be variants of *k'* and *λ'*); (*g*) voiceless spirants *f*, *x*, *s*, *l*, *h*; (*h*) nasals *m*, *n*, *ŋ*; and (*i*) liquids *r*, *l*, *w*, *y*. In addition, Sandawe has clicks which need not be considered here. An examination of this list reveals that the opposition between the fortes consonants of types (*c*) and (*d*) occurs only in the labial and dental series, while the opposition between types (*e*) and (*c*) is found only in the sibilant and lateral series. It is not difficult to see that both oppositions are analogous. In both cases a sound with a lesser amount of egressive air is opposed to a sound with a greater amount: in the case of the pairs *p-p^h* and *t-t^h* this is accomplished by only a slight opening of the glottis for one opposition member, but by opening it wide for the other; in the case of the pairs *c-c'* and *λ-λ'* it is accomplished by keeping the glottis completely closed with respect to one member, but not with respect to the other. In the guttural series the opposition *k-k'* belongs to the same correlation. If *k^h* and *k^ɜ* are really independent phonemes, which is by no means evident from Dempfwolff's material, *k^h* is an intensification of *k*, *k^ɜ* an intensification of *k'*. As for *λ^ɜ*, it must obviously be interpreted in the same way as *k^ɜ*. Turning to the lenis sounds, we see that *b*, *d*, and *g* are produced by an egress of air, while *b$^\cup$*, *d$^\cup$*, and *g$^\cup$* are not. This opposition may again be attributed to the same rule as the oppositions *t-t^h*, *p-p^h*, and *k-k'*, *c-c'*, *λ-λ'*: complete, unrestricted egress of air on the one hand, restriction of egress or *absence of complete egress* on the other. Accordingly a special correlation exists in Sandawe with regard to lenis and fortis consonants. Its nature resides in the opposition of occlusives with complete (unrestricted) egress of air and occlusives with incomplete (restricted) egress.