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# Phonetic Reconstruction

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1. "Phonetic reconstruction" is a natural collocation of terms, inasmuch as the task of reconstructing a past stage of language seems to have greater affinity to the phonological than to the grammatico-lexical level of structure. Despite its origins, "comparative grammar" has largely come to be, over the generations, historical and comparative *phonology*[1] ("etymology" in earlier parlance), and the reason for this is not just – as is often thought – an all too human preference for the tidier and less exacting work in the more manageable field. The hope that a merely greater, but still analogous, effort is all that is needed to reconstruct the extra-phonological phases of language more satisfactorily may well be false, because what is reflected here is a true hierarchy. Its nature is perhaps best understood when we consider what difference there is between determining the phonemic shape of a given stem or affix in an ancestor language on the one hand, and translating a grammatical construction or a dictionary item into a reconstructed ancestor on the other hand. The first can be done even in the face of contradiction, i.e. of other than only one-to-one correspondence, among the descendant languages; the other cannot, unless recourse to quite different types of reasoning is had[2]. One of the safeguards of sound etymologizing lies in our customary reliance on identity or at least plausibility of meaning, and thus on a higher level than that (namely phonological shape) on which results are sought. As we go

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[1] In the meaning of *Lautlehre, phonétique* (in the wider sense). The equivalent to *Phonologie, phonologie* used here is "phonemics".

[2] For somewhat closer, but very restricted, morphological and semantic analogies to phonemic "comparative" reasoning, see my *Language Change and Linguistic Reconstruction* (Chicago, 1960), p. 70f.

beyond phonology with our demands for results, no analogous upward appeal is available.

2. It is useless to speak about reconstruction without first gaining a picture of the change processes to which language is subject; and this, in turn, cannot be done without reference to the role of sound in language structure quite apart from a consideration of change processes. For instance, we must remember that linguistic judgment rests on the hearer's deciding, under relevant conditions[3], whether two given speech utterances are the same or different. No segmentation is as yet introduced; we do not ask the subject to distinguish sentences, phrases, words, syllables, phones, or features; we merely want his reaction to pairs of texts (however short we may like to keep these texts in the interest of simplicity). Segmentation comes later[4]. We may find it convenient to blame the difference between utterances that are judged different on one part of these utterances rather than on the whole or on some other part. Thus in the two texts, *These are beads* and *These are beets* we may wish to regard the reported difference as lodged in the final "consonants" rather than in some larger stretch such as, perhaps, the one taking in the preceding "vowels". This is to say that, although the principle of segmentation may be considered necessary, there is nothing necessary about a given way of segmenting. We may agree to use such a way of segmenting, without claiming uniqueness for it, so long as "different" utterances are not thrown together. Moreover, we are always free to take a Saussurean view of our segments, where any one of them is defined by its pattern of occurrence with all the others. We may further choose to identify certain segments, especially short ones, in the tradition of articulatory phonetics or on the basis of some other quasi-measurement procedure. The choice has usually been guided by hopes for fruitful generalization: sound types, distinctive features, or compatability rules concerning either of these may emerge as universally recognizable or may at least serve, by their incidence or absence, to delimit typological areas on the map. However that may be, we may picture our language as a large corpus of texts, recorded in a "phonemic" notation which utilizes, in the familiar fashion, some physical segmentation of the flow of speech. Besides, we know other things about these texts: we have (though by no means necessarily in this order) located the morph boundaries within[5], recognized morphemes and constructions, and formulated certain relations which exist among the texts in the corpus and among all "possible" texts. We have a phonology, a grammar, and a dictionary; and we can, in principle, name the elements together with which a given element occurs in the texts[6].

3. Statements about linguistic change, both conventional and unconventional, typically take the form "$A[B..> M[N..$", i.e. "$A$ in the environment $B..$ is replaced by $M$ in the environment $N..$", where $A, B..$ are elements[7] in the texts of one language, and $M, N..$ elements in the texts of another language whose descent from the former has been established[8]. The two languages are termed earlier stage and later stage respectively. The implication is that many texts of the later stage may be identified as equivalents of texts of the earlier stage, on grounds furnished by a theory of translation. (At the same time other earlier-stage texts are lost without replacement, and other later-stage texts come into existence without replacing a prototype – especially texts containing morphemes with obsolete and with new meanings respectively.) Thus NHG *zwei* replaces *zween* (aside from also replacing *zwo* and *zwei*); NE *meat* replaces *flesh* in some contexts but not in, say, *flesh[-wound;* Germanic *p* replaces IE *p* after *s* but not in most other environments; in Greek, an older *s* is in certain environments replaced by *s*, in others by 0 (nothing); and so on. These replacement processes are classified as *sound changes* if and only if the environment which needs to be accorded to $A$ in order to make the statement valid does not combine with $A$ itself to produce a stretch such as to be always coextensive with a morph or morph sequence[9]. The elements which most appropriately fill the positions of $A, B.., M,$ and $N..$ are of course phonemes, phonemic components, distinctive features, and the like. We shall hereafter concentrate on phonemes, and represent a sound change by writing $a[b..> m[n..$, where $a, b..$ are the phonemes (in

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[3] As in a "pair test"; see *Chomsky, N.:* Syntactic Structures, p. 96 (s'Gravenhage, 1957).

[4] In the logical sequence (though not necessarily in actual procedure).

[5] Morphs are smallest meaningful phoneme stretches, not necessarily continuous. Morphemes are classes formed from morphs and defined by the pattern in which they contrast with each other or (which may amount to the same) by their grammatical or lexical meanings.

[6] The formulation must in many cases be in terms of a generative grammar.

[7] Including "0", or absence of any element. "Environments" must be mutually exclusive in order for such a notation as ours not to lead to any contradictions.

[8] On descent, see footnote 25.

[9] "Sound change operates without exceptions" is, of course, a definitional statement.

some valid phonemicization) of the earlier stage, and $m, n..$ are the phonemes of the later stage[10].

It should be noted that $a$ and $m$ are defined separately, each with purely synchronic reference to all the other phonemes with which it contrasts. Thus, IE $p$ is "$p$" inasmuch as it contrasts with IE $t, bh, g^w, e..$, while Germanic $p$ is "$p$" as distinct from Germanic $t, f, h...$ The replacement relation between the two is an independent finding. This does not mean, however, that additional relations may not exist between the replaced and the replacing phoneme, nor that certain further observations cannot be made about the replacement process.

One possible kind of observation concerns the connection of a replacement with other replacements. Some replacements are *one-to-one* in the sense that there is only one source, namely $a[b..$, for $m[n...$ All instances of Arabic $f$ come from Proto-Semitic $p$; so do all instances of Hebrew $p$. All instances of Germanic $p$ in position after $s$ replace an IE $p$. Other replacements are parties to *mergers* of original contrasts, where both $a[b..$ and $c[b..$ go to $m[n...$ An Italian $\varrho$ replaces both Latin $i$ and $\acute{e}$. A Germanic $t$ when preceded by $s$ and followed by $r$ may go back to an IE $t$ preceded by $s$ and followed by $r$, but also to "0 preceded by $s$ and followed by $r$". With this dichotomy between one-to-one processes and mergers there intersects another, according as $a$ goes to $m$ in all environments ($a[b..>m[n..$; $a[d..>m[n..$ or $>m[o..$) or only in some environments ($a[b..>m[n..$; but $a[d..>p[n..$ or $>p[o..$). To illustrate such a *conditioned* sound change, or *split:* English $\theta>$ later $\theta$ in one set of environments but $>\delta$ in another, with the difference between the environments themselves partly lost (hence *wreath: wreathe*); IE $p$ after $s>$ Germanic $p$, but $>f$ and $>b$ in two other environment classes; IE $s>$ Greek 0 between vowels, but $>s$ in certain other environments. The second dichotomy is, however, far less incisive than the first since it often depends on the notation chosen. If, say, $sb$ were written instead of IE $sp$ (a possible, though for various reasons less elegant alternative[11]) there would be no split, since IE $b$ in general $>$ Germanic $p$.

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[10] The phones or properties of $/b../$ and $/n../$ may occur before, simultaneously with, and after the phones of $/a/$ and $/m/$ (in contact or discontinuously) in the speech stream.

[11] Chiefly because of the parallel "$sd$" which is a better notation for *Brugmann's* "$zd$" in items like *nisdos* 'nest'.

We may also wish to take a more systemic view of sound changes. There may be grounds for asserting that a descriptive parallelism exists, in part or in toto, between the two phonemic systems; $a, b, c..$ together with their privileges of mutual occurrence on the one hand, and $m, n, o..$, likewise, on the other hand. In this sense we may in particular make some assertion such as that $a$ is homologous to $m$, or perhaps even (by some extension of whatever principle underlies here) that $a$ is homologous to the union of $m$ and $n$ or that the union of $a$ and $b$ is homologous to $m$. It then becomes a matter of interest to state the extent to which phonemes are replaced by their homologs. Suppose, for instance, that the sequences $ab, ac$ and $cb$ occur but $bc, ba, ca$ do not; that $nm, om$ and $on$ occur but $mn, mo, no$ do not; and suppose moreover that the notion of parallelism from system to system is in this case based, by agreement, on such clustering behavior. This makes $a, b, c$ homologous with $o, m, n$ respectively. The question is now whether or not it is also true that $a>o, b>m, c>n$. The stop subsystems of IE and of Germanic may well be judged parallel, in which case IE $b, p$, and $bh$ and Germanic $b, p$, and $f$, in this order, would be plausible homologs; yet $bh$ is not replaced by $f$.

It has become increasingly clear that the systemic properties which are here considered have typological importance, in the sense that they tend to be characteristic of languages, related or unrelated, spoken in parts of the same (often large) area during a given (often long) period. This means that throughout such periods of stability the processes of sound change may be expected to keep moving within a framework of more or less readily identifiable structure points. It also means that when important alterations do appear in the structural complexion of a language, these alterations are likely to have a specific, area-wide direction of some sort. In the absence of detailed knowledge of the machinery that is at work here, it has proved most fruitful to treat language as if it were subject to typological pressure toward a goal, be it in the nature of preserving a prevalent, stable type or of working along with some readily recognizable trend toward a new type. But it must be stressed again that these pressures had better be thought of as specific factors in history, in spite of their broad and slow way of operating; there is no reason to acknowledge as circumscribing agents only such allegedly "universal" features as the general symmetry of linguistic (particularly, phonemic) systems (possibly modified by anatomic asym-

metries), the finite character of possible distinctive features, certain constants having to do with functional load and with redundancy, and generally the minimal requirement that a language remain "a language"[12].

After this digression, let us return to the classification of our artificially isolated individual replacements. We have considered their possible concatenation through merger and split, and we have considered their relation to structural stability and instability. There remains a third criterion: that of the phonetic properties of our replacements. This criterion looms so large in the existing literature that we need not concern ourselves with it in detail. The textbooks of general linguistics and the introductory chapters to our great historical and comparative grammars are full of enumerations of varieties of phonetic change: assimilation, simplification of clusters, loss, emergence of glides, diphthongization, dissimilation, metathesis, and many others. What interests us more deeply is the relationship between this criterion and the other two points of view introduced above. It is for instance a fact that the examples of loss and cluster simplification are frequently also examples of merger with "0" (as when $hr-$ is replaced by $r-$ in most Germanic languages and thereby produces homonymy with earlier $r-$, i.e. "$0r-$"). But this is not necessarily true: suppose that a language in which all utterances end in consonant $+$ vowel drops its final vowels ($..CV\#$ $> ..C\#$). This will constitute a case of $C]V[\# > 0$, but not a merger, since there is no previous "0" between $C$ and pause. On the other hand, it contributes to, and may be the principal tool of, a striking change in the structure of the language. Or consider the frequently used and even more frequently implied notion of a sound "remaining unchanged". As a mere physical description this notion is apt to be meaningless and unverifiable, but this is irrelevant in any case, since statements of this kind usually turn out not to be intended as mere physical description. At the very least, the intention may be to describe the phonic substance of an $m$ as *more* similar to that of the $a$ which it replaces than to that of the $b$'s and $c$'s replaced by $n$'s and $o$'s, under criteria of similarity taken either from an universalistic framework like traditional articulatory phonetics, or from an array of distinctive features. But the intention may also be typological and refer to homologs in a stable area. Only on grounds like these might

[12] *Martinet, A.:* Eléments de linguistique générale, p. 215ff. (Paris 1960).

one justify saying that IE $p$ "remains" $p$ in Germanic after $s$, but "changes to" $f$ or $b$ in other environments – a distinction which cannot meaningfully refer to phonic identity or near-identity in any absolute sense. It is of course common practice to regard certain types of phonetic change (such as assimilation) as more plausible to postulate than certain other types (say, unvoicing of consonants between vowels). But there are enough counter-instances to such things to suggest that the ease or difficulty with which the many physical varieties of change operate is itself somewhat subject to typological restriction in space and time, hence less universal than is thought. We sum up some of our argument by recommending that in weighing the merits of a given reconstruction these two factors be taken into account: the leeway that exists for language structure in terms of the area and the period insofar as these are known; and the available replacement machinery, also in terms of areal plausibility.

4. There are three contexts in which we might speak of phonetic reconstruction. First, we may be asked to make pronouncements about the phonetic properties of a language extant in the form of written records. Secondly, our task might be that of reconstructing such properties from a known later state of the 'same' language. The third task is the most elaborate of all, namely that of retrieving detail from material which is linked with the language in question by the hypothesis of common descent. Like many distinctions, this threefold division is somewhat impure; in particular, it does not neatly partition the processes of history to which the three procedures are applied, since each procedure may be used in conjunction with the other two. Still, as procedures, they are, to an extent, separate and remain separable.

The simplest observations of sound change, and consequently the simplest reconstructions of sound are made upon written records. In the favorable case a descendant form of the language is known, preferably from scientific present-day observation. Since this is not the place to discuss the problems of decipherment, we may limit ourselves to phonemic, and especially to alphabetic scripts, that is, to those scripts which are designed to render minimum sound. The way in which this is done is rather well known and requires no great elaboration. Alphabets are, ideally, (morpho-)phonemic writings, in which there is a letter to each phoneme as well as a phoneme to each letter. Once a script is recognized as alphabetic, two kinds

of question arise: In what respects does it fall short of the ideal of phonemic consistency?; and: What can we know in the way of phonetic fact that goes beyond the matter of phonemic consistency? On the whole, the two questions are approached in quite separate ways.

A script may fail to render certain contrasts in any way. This is often fatal, especially where whole phonemic subsystems are affected. The classical instance are the intonations and many of the stress and "juncture" traits of practically all languages known from alphabetically written records but not fully analyzed from spoken texts; the near-neglect of these features is of course part of the alphabetic tradition. But even where the area of neglect is more capricious it is difficult or impossible to infer the existence of particular contrasts that are never represented in writing. It takes additional information to suspect or discover it: it is of course well known how a knowledge of alliteration, riming, quantitative prosody, etc., can help reveal the presence of unwritten distinctions. Vowel length could be reconstructed for Latin, and correctly assigned to a large number of particular Latin words, in this way, even if this reconstruction could not, as is actually the case, be checked against the same result obtained in other ways. If we suspect that a contrast has been left unexpressed, a knowledge of the history of the script itself may tell us that, short of invention, no means of expression existed, thus making the neglect plausible. The opposite kind of inconsistency is easier to see. Both promiscuous and regulated uses of more than one letter for a phoneme can obviously be detected; if the mutual distribution of Q and C in Latin were not in turn complicated by the two (phonemically different?) uses of V for either *u* or *v* we should have no trouble deducing that QV represents a phonemic *cv*[13]. It is perhaps unnecessary to remind ourselves that this does not mean that the writers recognized, and intended to write, positional variants of phonemes (in this case, the rounded variety of *c* before *v*). In all known instances the complementary use of letters is no more than an analog to the way in which allophones complement each other; its origin lies in the vagaries of writing itself, and it is often an episode in the gradual and mechanical reduction of a superabundance of letters over phonemes[14]. Only by accident may it be ex-

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[13] There is no good reason to see a "unit phoneme" in "qu", if importance were accorded to this very secondary question. See *Transactions of the American Philological Association 80*: 274[18] (1949).

[14] As in the case of the Greek qoppa.

pected to correspond to some major allophonic division within a phoneme. Deviations from phonemic writing which attach consistantly to dictionary items may be given away by even small numbers of informal and semi-literate writings where the irregularity tends to be removed.

A knowledge of descendant states of the same language introduces considerations which will occupy us later. It contributes most to the interpretation of written records where a finding of existing contrast needs to be confirmed, or where the absence of such a finding leaves us in much ignorance. If metrical [and other] evidence were not available to establish the unwritten contrast between short and long vowels in Latin, it would nevertheless have to be inferred from the contrast which most "descendants" [e.g. Italian] exhibit in the relevant places.

Within the limitations indicated, then, the internal evidence of alphabetically written texts furnishes information on the number of phonemic contrasts, and on the incidence and distribution of contrast. It provides us with the means for a phonemic reconstruction in one very narrow sense of the word. To give body to such a skeleton of phonemic structure points, other evidence and additional considerations are needed. Some of the evidence comes to us along with alphabet lore itself; we know of the use of the same alphabet (alphabetic writing is, after all, historically connected throughout) for other languages, and if part of that knowledge is granted, all kinds of presumptions concerning the phonetic content of the phonemic entities that are represented may be obtained. Familiarity with Greek alphabetic practice would go a long way toward establishing facts about Latin phonemics *and* phonetics even if Latin had to be deciphered without any other outside aid. It is further well known that decipherers make crucial use of notions which they regard as self-evident and which are indeed either linguistic universals or at least solid characteristics of the typology which happens to be involved. Here belong, in particular, certain assumptions on syllable structure, on the relative frequency of phonemes with vocalic and with consonantal phones, on the special properties of utterance-initial and utterance-final phoneme sequences, on the expected frequency of "word" boundaries and its relation to signs (including spaces and punctuations) suspected or known to be word or phrase dividers, and so on. There is, moreover, the evidence (if its availability be granted) of borrowings from and into other known languages with its many intricate phonetic and phonemic aspects[15].

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[15] *Sturtevant, E. H.*: Pronunciation of Greek and Latin[2] (Philadelphia 1940), passim.

5. We are now ready to turn to internal reconstruction – a subject which has been treated extensively in recent years[16]. Internal reconstruction is based on the grammatical alternations between phonemes (on the morphophonemics) of a language state. It aims at the recovery of the processes which have resulted in the alternations. In a manner quite similar to what is true of the interpretation of alphabetically written records, it yields primarily the phonemic shapes, or approximations to the phonemic shapes, of morphs and morph sequences as they must have existed before the operation of the processes in question. Only incidentally and secondarily does it provide more strictly phonetic information. In addition, it has other limitations.

The principles of internal reconstruction may be derived rather simply from the theory of sound change as outlined earlier, as well as from a handful of simple assumptions governing morphs and morphemes. There is a superficial, partly valid and partly deceptive analogy between the allomorphic structure of morphemes and the allophonic structure of phonemes. Thus, there are positional allomorphs which are non-contrastive (e.g. NHG *gut: bes–* [in *besser, best*]; NHG */vált/:/véld–/* [*Wald:Wäld(er)*]) in the sense that neither of the two[17] forms in partnership ever occurs surrounded by the same morphs. Sets of allomorphs are of two kinds: suppletive or morphophonemic. The latter are distinguished from the former by the fact that the phonemic differences between the co-allomorphs recur in other sets of allomorphs; /a/ alternates with /e/ in *arg: Ärger, alt: Eltern*, /t/ with /d/ in *Feld: Felder, lud: laden*, whereas no comparable statement could be made about *gut: best*. It may be taken as axiomatic that suppletion is the effect of some grammatical process (often against a background of syncretism where formerly contrasting morphs develop a complementary and hence allomorphic distribution[18]) or else the last remnant of a sound change which then, in its very isolation, is already at the point at which it ceases to be useful as a datum from which to reconstruct[19]. Morphophonemically related allomorphs, on the other hand, are the typical remnants of sound change.

[16] *Chafe:* Language *35:* 477–495 (1959); my note in Language *36:* 191–192 (1960); and *Kurylowicz* in the Proceedings of the Ninth International Congress of Linguists (ed. *Horace G. Lunt*), p. 9–36, give the most recent treatment.

[17] Or more.

[18] *LCLR*, p. 48 f.

[19] Ibd., p. 49.

In order to recover the change process it is necessary to examine the terms of the phoneme alternation as it recurs in the relevant sets of allomorphs. Some alternations are *irregular*, in the sense that the environments which determine the choice of one allomorph over the other (or rather: of the allomorphs with one of the two alternating phonemes rather than those with other) require the naming of specific morphs. The alternation of NHG /a/ with /e/, where it occurs at all, can only be stated in terms of the grammar of inflections and derivations. Other alternations between phonemes are *regular* in the sense that where they occur at all, their distribution can be described in terms of (often very small) phonemic stretches in the environment which are not coextensive with morphs. Thus, where a Latin *r* does alternate with *s*, we find *r* between vowels and *s* otherwise[20] *(gerō: gestus, corporis: corpus)*; in *Wald: Wälder* and in all the other instances of *t: d, d* occurs before vowels, *t* before pause, etc.[20]. But between the Latin and the German example there is a further significant difference. The phonemic system of Latin allows both *s* and *r* in either kind of environment, intervocalic and otherwise *(gerō nisi misī; gestus certus)*, whereas the rules of German phonemics exclude *d* precisely from those surroundings in which the allomorphs with *t* appear instead of those with *d*. In other words the alternation *t: d* is not only regular, that is, conditioned; we may say that the phonemic system imposes it (provided that we designate *d* as the "basic" partner). The alternation is a *compulsory* one. The play of *r* and *s* is not compulsory; it is, so far as it is stated here, merely regular.

There are good reasons why it is not always feasible to classify an alternation unambiguously along these lines; one of the limitations of our work lies here[21]. But under reasonably favorable conditions the classification can be valuable. This is so because compulsory alternations are the typical results of certain sound changes; because certain additional sound changes will transform a compulsory into a non-compulsory alternation; and finally because it is also possible to name the type of sound change which produces irregular alternations.

What is fundamental in all these cases is the simple circumstance that a split will lead to an alternation if some of the instances

[20] Simplified.

[21] On this and on the effects of "analogic change", see *LCLR*, pp. 99–111. In connection with the mainly negative implication of the term "compulsory", see *Wells*, Language *25:* 99–116 (1949).

of $a[b..$ and $a[d..$ on p. 28 above involve a given morph contain-
ing $a$ so that a morph boundary passes between $a$ and its significant
environment, whichever it happens to be. If the split satisfies the
description $a[b.. > m[n..; a[d.. > p[n..$ (that is, if $b$ has merged
with $d$), the result will be an irregular alternation between $m$ and $p$;
the voiceless and the voiced "th" in *wreath* and *wreathe* alternate ir-
regularly inasmuch as the statement can only be given in grammati-
cal terms ("noun:verb", or "underlying noun:verb derived with
zero-suffix"); this has come to pass because the differences in the
original conditioning environment (the presence vs. absence of a
following vowel in the verb ending) have been merged into "0". If,
contrariwise, the split is of the type $a[b.. > m[n; a[d.. > p[o..,$
$m$ will alternate with $p$ in such a way that $m$ occurs in the environ-
ment $n$, and $p$ in the environment $o$ – that is, in regular form. That
this regular alternation is moreover likely to be compulsory follows
from a corollary of the split process. There must be, outside the area
in which the alternations arise, instances of $m$ in some environment
in which $p$ also occurs; or else $m$ and $p$ are not in contrast, hence not
separate phonemes. This will in particular happen if there are other
sources for one of the two, say for $m$, in all or in part of the environ-
ment $o$. At this stage, then, we shall have $m$ rather than $p$ in those
environments in which $m$ is permitted but $p$ is not (namely, in the
environment $n$), while the converse is not true.

For the reason sketched here it is possible to infer that some $p$'s
in the environment $o$ (itself reconstructable as $d$) replace $a$, while $a$
in environment $b$ has gone to $m$. If other replacement processes
create instances of $m$ in environment $o$ as well, they will there con-
trast with $p$ and thus contribute to eliminating the compulsory
character of the alternation created by the earlier process but they
will not thereby make it useless for the purpose of recovering it.
Thus, pre-Greek $s$ between vowels goes to 0 (thereby merging with
other ø's [e.g. from $y$]); between vowel and word-end it becomes $s$,
a phoneme which for a while does not occur between vowels. As a
result, *génos* 'family' alternates with *gene0*– (in, say, *genéōn* g. pl.) in
a regular and compulsory manner which permits us to infer that a
phonemic entity of some sort split into $s$ and 0 under statable con-
ditions. When later *tw*, which occurs between vowels, is replaced by
$s$, the earlier alternations become in part non-compulsory but lose
nothing of their indicative value [22]. The principle, in brief, must be

[22] See footnote 21.

to give chronological precedence to alternations from phoneme to
phoneme over the later bonds which only hold the constituent
phones of a phoneme together [23].

It is a weakness of internal reconstruction that it is silent on
pure (unconditioned) merger processes and that it has sometimes
contributed, by its selectivity, to giving the wrong impression that
all language becomes more complicated morphophonemically as
time goes on [24]. It shares a further weakness with our procedures for
the interpretation of written records: namely that of providing, in
principle, proto-forms in their phonemic makeup but without physi-
cal detail; it gives us information about the incidence of contrast but
none about the nature of the contrasting phones. We have been
careful to stress this at the cost of adhering to a complex, abstract
formulation in which no unwarranted identification between the
phonemes of the extant stage and those of the inferred stage is sur-
reptitiously introduced. This is necessary because, as we know from
our earlier discussion, a study of the relation between the two must
be independent of the replacement formula.

Suppose that we have two stages with a trivially simple replace-
ment relation obtaining between the two: all $a > m$, all $b > n$, ....
It is normal to expect the physical characteristics of $a$ and of $m$
to be in some sense "the same", and likewise for all other pairs.
It is, however, also clear that this is not necessarily the case; there
may be a "shift". Thus, in the popular simplified version of the
Germanic consonant shift, Germanic $p$, $t$, $d$ replace IE $t$, $d$, $dh$ one-
to-one, and yet with a difference which has importance both as a
collection of isolated physical fact and also with reference to a more
or less stably continuing typological framework. It is an open ques-
tion to what extent such a displacement could be inferred simply
from a later stage. On the other hand it is also doubtful that major
shifts ever go on in complete purity; just because some of the proper-
ties of the framework within which the shift occurs are best thought
of as deep-seated areal (or general) characteristics, the shifting of, say,
a stop (in all its environments) to a spirant location in the frame-
work may lead to a situation where all the occurrences of the stop
cannot be accommodated precisely because some of them are
characteristic of stops rather of spirants under the prevailing areal

[23] But involve (at least prior to analogical action) different lexical material in each
partition.
[24] *Chafe*, p. 495.

type. Therefore, we may use the occasionally observable (and internally reconstructable) minor conditioned sound changes on the fringes of seemingly simple replacement processes as phonetic indications. In fact, the Germanic change does not just shift $t$ to $\not p$ and $d$ to $t$; it also lets $st$ go to $st$.
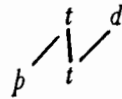
In this situation it is possible to argue in reverse, with a great deal of typological concreteness, that the "$a$" which split up into $\not p$ and $t$ had [t]-like rather than [$\theta$]-like phones, because it is less likely, from what we know about the languages of the family, area, and period, that [s$\theta$] existed or if it existed should have become [st], than that $t$ should have been spirantized except when it followed $s$. Another possibility, namely that "$a$" had always had two clearly different positional variants, $t$ after $s$ and $\not p$ otherwise, runs into another typological objection: the other phoneme, viz. the one which ends up as Germanic $t$ is also known to have occurred after $s$, in contrast with "$a$", as in the words NHG *Nest, Ast*, from IE *sd*. Such is the nature of the argument against a phonetic interpretation like this:
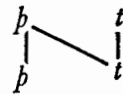
It seems, in general, that it is fruitful to distinguish those split-cum-merger processes in which the splitting and the merging phoneme are homologous (as they are in the case of IE and Germanic $t$) from those which are not (as in the case of the unvoicing of German $d$ to $t$, in *Wälder*, above).

The irregular alternations pose a different phonetic problem. These alternations exist between sounds which may have remained substantially unchanged but which used to be allophonically different until the alternative conditioning factors in the environment became merged ($a[b.. > m[n..; a[d.. > \not p[n..$). We may wish to know where these factors were located in the flow of speech and what their physical characteristics were. Satisfactory answers to these questions are often possible, since there seems to be great uniformity in the assimilatory (and otherwise conditioning) action from segment to segment. In the light of our accumulated experience it is reasonable to suspect that the voicing of *wreathe* has to do with an

intervocalic environment, or that Germanic umlaut points to front vowels in the final part of the word.

There are situations in which internal reconstruction is the only available avenue to the past. This is true when all we possess is either one synchronic corpus or a reconstructed ancestor language in the antecedents of which we are interested. Considering the limitations of the method the results will be uneven, and more rewarding for languages with elaborate morphophonemic alternations and with histories of extensive conditioned sound than for languages of a different build. Fuller use of internal reconstruction may be made where it supplements the comparative method.

6. The "comparative" method of reconstruction utilizes the circumstance that when separate and different replacements operate on one and the same language (thereby breaking up an original community of speech), the recurrent phoneme correspondences which result among the descendant languages must in a majority of cases behave like allophones of a phoneme in being complementarily distributed and "similar". Suppose that $a > m$, $c > n$ in one descendant, (I), while $a > t$ as well as $c > t$ in the other descendant language, (II)[25]. The effect will be that two correspondences are recorded, $m/t$ and $n/t$. These are "similar" in sharing their language II component (namely, $t$) but they contrast in the sense that they can be preceded and followed, in the morphs in which they occur, by the same correspondences. Thus, Low German $d$ corresponds to both High German $t$ and $d$, but both correspondences occur in initial antevocalic position (as in the words for *du* and *tun*), thus testifying to two separate entities in the common (West-Germanic) ancestor and to the merger of these in LG. This amounts to saying that no condition can be named under which an alternatively reconstructed single entity would have split up in HG. On the other hand, a LG $t$ corresponds both to HG "$z$" *(zehn)* and to HG $t$ *(treu, stehen, Stroh)* so that the two correspondences are once again "similar". They are, however, not in contrast, since $t/t$ occurs after $s/\check{s}$ or before $r/r$ or under both conditions combined, where $t/"z"$ is missing. Consequently, a single phonemic source may be posited, along with a conditioned sound change in HG. This method of

[25] Note that, contrary to appearance, the notion of descent is derived from the comparative method itself: if two related languages, III and IV are subjected to the comparative method, and the result is "identical" with III, III is itself the ancestor of IV (*LCLR*, p. 145f.).

inference is far more powerful than internal reconstruction: it is not dependent on the special nature of the morphological structure of the language, nor does it break down before the task of retrieving a merger process. Its two principal drawbacks are these: it will naturally miss the independent duplication of a merger (or of one portion of a merger) on the part of both descendant languages ($a > m, c > m$ in I, and $a > t, c > t$ in II; or similarly for conditioned changes); and there will be difficulties when the same correspondence arises in two unconnected ways. (IE $p$ > Germanic $f$ but > Germanic $b$ after unaccented vowel, IE $bh$ > Germanic $b$; IE $p$ > Greek $p$, IE $bh$ > Greek $ph$ but > Greek $p$ if an aspirate begins the following syllable. The result is that the distribution of the correspondence Germanic $b$/Greek $p$ is not, as a whole, complementary with that of either $f/p$ or of $b/ph$.) Both these difficulties are diminished as more than two languages, or pairs formed from a collection of more than two languages, are examined.

Once again, the immediate result is what some scholars feel a disembodied system of contrasts endowed with but little substance, and once again we must look for the considerations, concealed or explicit, which lend concreteness to a proto-language[26]. In part these considerations have already been taken up in connection with our other methods. The same subtle balance between a belief in universals and a recognition of areal type plays a role in assessing plausibility. Where requirements are made explicit they have occasionally been overly severe. Authors who insist that the ancestor structure must resemble that of the descendant forget that we are often faced with a history in which all or most descendants are also members of an area and thus subject to parallel pressures away from the type represented by the proto-language. If they have responded to these pressures with somewhat varied mechanisms, we are lucky, because this is what keeps the original structure within our reach. The simplest examples are those in which the areal trend is toward a smaller phonemic system or subsystem. Almost all the Semitic languages have reduced their sibilant contrasts. The fact that they have done so in different ways has brought it about that the number of contrasting correspondences for the lot exceeds the number of sibilant phonemes in each separate descendant. The requisite reconstruction is then different, in this small respect, from the type

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[26] Language 35: 410 (1959); *Allen*, TPS 52–108 (1953); *Pike, K. L.*: Axioms and procedures (Revised Edition, Glendale 1957), passim.

which prevails in the family, and, being different, has been suspect to some critics. The suspicion is allayed when South Arabic, situated at the margin of the Semitic world, turns up with the same aberrantly high number of sibilants. Similar experiences are frequent enough.

The old question whether asterisked proto-words are "only formulae for observed correspondences" – an alternative which has never been taken quite seriously – or have some "reality" turns, not perhaps entirely but still to a large extent, on the phonic content of the reconstructed phonemes. Having a broader basis, the "comparative" approach is a little better off than the more elementary forms of guessing at the linguistic past. Rightly or wrongly there is an inevitable inclination to believe that a phonetic consensus among the daughter languages establishes a phone as ancestral. On this basis, nobody would doubt that proto-Romance had a voiceless fortis unaspirated bilabial stop for its *$p$, and what we know about Latin from other sources confirms this. In cases of discrepancy there is sometimes a tendency, other things (like intrinsic phonetic plausibility) being equal, to abide simply by some kind of majority count, where what should also be considered is not only the size but the relative geographic position of the aberrant phenomenon. This presupposes, of course, that the descendants have not already been shown, by the comparative method itself, to be related through some kind of definite sub-ancestry. If this *is* the case, an innovation, even just a suspected phonetic (sub-phonemic) one which would not by itself contribute much to the task of establishing sub-ancestry in the first place, must of course be counted as having occurred only once (in the sub-ancestor), regardless of how many descendants from it are extant.

The breadth of a "comparative" foundation may support a fair knowledge of positional variety within the phonemes or distinctive components in the proto-language. After all, the lines along which the daughter languages let the phonemes break up under conditioned sound change must correspond to earlier allophonic groupings within the phonemes. They may of course be of different age, and it would be poor method to project all of them back into the ideally uniform ancestor. Yet some of them must be ancient. IE aspirates, if followed by another aspirate in the next syllable, lost their aspiration both in Greek and in Indic (i.e. in those two languages in which aspiration is an active distinctive feature). While each descendant accomplished this by an entirely separate merger, it is easy

to believe that aspirates had untypical allophones when occurring before a syllable with another aspirate. Another extremely instructive example is furnished by "Sievers' Law" (including the doctrine of the so-called schwa secundum) as it now appears to some Indo-europeanists. Its essence is that an automatic, non-phonemic element of syllabicity would crop up in sequences of more than two consonants after every two consonants (*ere epre*, but /*erpre*/[erp$_v$re]). These predictable, hence non-distinctive supports had a way of merging with otherwise existing, non-predictable phonemes in the individual IE languages (though not with the same ones in all each languages). Thus, *erpre* [erp$_v$re] appears as *arpura* in Sanskrit as does an IE *erpwre;* in Attic Greek *erpre* merges with IE *erpHere* (or something of the sort) into *erpare*. A correspondance *u/a* is established; as it is found to occur predictably in consonant settings it must be classified as a non-phonemic feature in the ancestor.

7. To return to the topic of this congress, we must admit that reconstruction does more for "The Phoneme" than for "Its Realization" as it existed in the dim past. But nobody will say, these days, that it is possible to keep the two apart. Even in a historical context we cannot possibly deny our constructions and reconstructions their physical, phonetic substance.

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### Discussion

*Martinet* (Paris): Le texte de la communication de M. *Hœnigswald* pourrait faire croire que la conception de changements phonétiques dirigés vers un but (*goal*) fait partie des principes explicatifs qu'il m'attribue à juste titre. Je voudrais rappeler que la conception de l'économie des changements phonétiques que je préconise n'implique aucune téléologie, mais une succession de causes et d'effets.