

Comparative and Typological Perspectives on the Reconstruction of the Indo-European "Gutturals"

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1. Introduction

In recent decades there has been a trend in Indo-European studies to place greater weight on typological considerations than on purely comparative evidence in reconstructions. The most oft-cited study in this regard is, of course, Jakobson (1972), in which the author introduced the notion of implicational universals and lauded the "predictive power" of typological studies in reconstruction (p. 304). The present paper takes issue with the blanket application of typological considerations to problems of comparative reconstruction. The specific problem addressed is the set of "guttural" (an out-dated but still handy cover term for the palatal, velar and labio-velars) stops in Proto-Indo-European. A rigorous (some might say narrow) application of the comparative method to the data seems to yield a three-way contrast in this area. When one resorts to typology, one can argue for a two-way contrast or possibly a single velar segment. This paper will first survey several of the phonological inventories (only with respect to stops) which have been proposed for Proto-Indo-European, will then consider certain relevant theoretical and methodological issues and, finally, will examine the data and offer conclusions as to how comparative and typological approaches can be placed in perspective in this case and, perhaps, others.

2. Survey of Stop Inventories Proposed for Proto-Indo-European (PIE)

The earliest "definitive" treatment of the reconstructed phonology of PIE is seen in Brugmann ([1886] 1897). Brugmann worked, of course, in an age when the techniques of modern linguistics were unknown. He had no idea of the phoneme in the post-Saussurean structuralist sense of the term. As Lehmann correctly points out (1955:5), Brugmann frequently did not take into consideration the distribution of sounds (assuming, for example, that PIE contained two *Sprachlaute* n and ṇ, though the latter only occurred before velars) and seemed more concerned with a statement of the way PIE was spoken than with a discussion of the system of PIE phonology. Nevertheless, his proposed stop inventory must be the point of departure for this discussion. Brugmann posited a multitude of "contrasts" in a highly symmetrical set of sounds:

Labial	p	ph	b	bh
Dental	t	th	d	dh
Palatal	ṛ	ṛh	ḡ	ḡh
Velar	k	kh	g	gh
Labiovelar	k ^w	k ^w h	g ^w	g ^w h

Table 1

(Symbols used here reflect more contemporary usage and differ only superficially from those used by Brugmann.)

By the time of the publication of the second edition of his *Grundriss* (1897) Brugmann's proposed stop inventory had been subjected to serious challenge. Lehmann (1955:80-84) summarizes the arguments which led many Indo-Europeanists to reject Brugmann's claim that PIE contained a series of voiceless aspirates. Opponents of Brugmann's view were able to show that in those languages which possessed such sounds the voiceless aspirates could be shown to be secondary developments after the time of PIE unity. Thus in a single blow the stop inventory was reduced by one-fourth. For some time it remained as follows:

Labial	p	b	bh
Dental	t	d	dh
Palatal	ṛ	ḡ	ḡh
Velar	k	g	gh
Labiovelar	kʷ	gʷ	gʷh

Table 2

Brugmann's choice of symbols (and more especially his set of labels) reflect a certain reverence for Sanskrit. While his phonological system is not identical with that of Sanskrit, it does, insofar as comparative evidence from the other languages will allow, follow the Sanskrit model. This is seen especially in the case of the voiced aspirates. These sounds are never seen as voiced aspirates outside Indic. Elsewhere they show up as plain voiced stops, voiceless aspirates, fricatives and other sorts of segments. Only an obeisance to Sanskrit on the part of Brugmann and his contemporaries seems to have left us with the set of symbols **bh*, **dh*, etc. Latter-day Indo-Europeanists have proposed at least two alternate solutions to the typologically improbable voiced aspirate series. Early in this century some suggested that this series was likely to be seen as a set of voiced fricatives (**β*, **ð*, etc.) but this suggestion has not found a great deal of support. Quite recently Hopper has proposed that instead of voiced aspirates we must posit a series of murmured stops (his **d*) and, indeed, has substituted a series of glottalized voiceless stops (**t̚*, **k̚*, etc.) for the more traditional voiced stops (1973:152). Hopper's arguments are typological. His proposed modifications are also useful in that they seem to explain certain hitherto puzzling features of Indo-European root formation. Interestingly however, they do not reduce the overall number of contrasts in the phonological system with which he is operating.¹ His suggested changes (should they be generally accepted) will cause us to modify drastically our ideas as to the phonetic nature of the PIE stops, but the system itself will remain essentially intact.

The major attempts to reduce the PIE stop inventory have been centred on the "gutturals". Meillet in his *Introduction* (eighth edition, 1937) was concerned with the implausibility of setting up contrasting palatal, velar and labiovelar stop phonemes for the proto-language. He noted that each IE daughter language had no more than two of the posited series, no language possessing all three. He also pointed out that

*k̥ and *k evidenced somewhat skewed distributions, the velar occurring before *a, after *s and in some other environments which he lists (1937: 93-94) but never before *o which is one of the environments for the palatal. Other characteristic environments for *k̥ were before front vowels and elsewhere where palatality might be regarded as conditioned. He had a clever explanation for the seemingly anomalous occurrence of a frontish stop before a back round vowel (*o). He noted that in the PIE ablaut series the vowel *o was in a sense derived from *e. The vocalism *e was characteristic of present systems of verbs, while *o vocalism characterized the perfect system.² Meillet speculated that in the change from *e to *o there was a transitional vowel with palatal onset (his *i_o) which could readily have conditioned *k̥. The onglide would then have been lost leaving a palatal stop occurring before a back round vowel. One might also speculate (since we have no idea when this palatalization might have occurred) that the phonetic change k > k̥ might have taken place before the change in vocalism in the perfect. In either case loss of an overt conditioning factor in the environment would have resulted in what Hoenigswald terms secondary split (1960:93). Alternatively (and a solution preferred by some) one could see palatals before *o as having arisen via paradigmatic levelling: if the *o-containing forms were derived from *e-containing forms, then the *k̥ (conditioned in the case of the present system) might be extended to other related forms where the phonetic conditioning was not present. Meillet's proposal to simplify the PIE stop inventory is summarized below in Table 3:

Labial	p	b	bh
Dental	t	d	dh
Velar	k	g	gh
Labiovelar	k ^w	g ^w	g ^w h

Table 3

This system is probably the one most widely supported by Indo-Europeanists today. It has not been universally adopted, however.

If one examines a bit more closely the distribution of the "gutturals", one notices that things are not quite as straightforward as they appear to be in Meillet. The occurrences of the palatals are not limited to spots which might be thought to be natural environments for them. One need, in fact, look no further than the two catchword labels for the major dialectal division of the IE languages (the "centum" and "satem" languages) to find evidence for palatals. Most of the data in this regard will be treated in the fourth section of this paper. It will suffice for the present to point out merely the forms for '100' in several of the IE languages as counter-evidence for Meillet's claims.

Skt	śatám	Av	satəm	OCS	sŭto
Gk	-katón	Lat	centum	Goth	hund

Table 4

These are the correspondences used from the beginning to support the notion that PIE contained a series of palatal phonemes. The correspondences show

sibilants (generally s) in the eastern (usually termed "satem") languages and velars (Gothic h = [x]) in the western languages. The protoform for '100' is rendered *k̑ntóm. What is convincing about this (and other similar) examples is that the palatal stop does not occur in an environment in which one can point to conditions likely to cause palatalization. There is neither a front vowel nor an apophonic *o following the posited *k̑. (The possible relationship between this form and the form for '10' in PIE will be treated below.)

Kurylowicz (1935), seizing on the sort of evidence just discussed, proposed that the proto-language contained contrasts which in form and number more closely resembled those of the satem languages than those of the centum languages. His stop inventory is given below:

Labial	p	b	bh
Dental	t	d	dh
Palatal	k̑	g	gh
Velar	k	g	gh

Table 5

Instead of regarding the palatal stops as innovations in the eastern languages, he saw the western languages as having innovated in their development of labiovelars. This type of change would appear to be less likely (in terms of usual phonological probabilities) than Meillet's palatalization. There are, however, examples of labialized velars arising before round vowels in certain of the world's languages (though no such evidence appears to exist in IE).

Schwyzler (1953:161), in his discussion of the fate of Greek loanwords in various languages, notes that in Geez, a liturgical language of the Semitic group in Ethiopia, original Greek velars became labiovelars, generally before round vowels (cf. Geez q̑wastant̑nōs < Gk. Ko(n)stantinos "Constantine"). This tendency in Geez (which according to Schwyzler affected all velars in the language) was said to be due to the phonological influence of the neighboring Cushitic languages. The actual evidence for Kurylowicz's thesis (from within IE) is considerably less than that in support of Meillet. It is important, however, to show that, given the appropriate phonological environment, velars can be labialized (as well as palatalized). In IE, however, it is far more likely that the satem languages have innovated in their lack of labialization. Even some of the centum languages show a loss of labialization. A cursory look at the history of the Romance languages, for instance, shows that in the case of the interrogative pronouns (Lat. quis 'who', etc.) the labial coarticulation feature has been lost or otherwise modified (cf. French qui = [ki]). Elsewhere in the western group of languages this has also occasionally occurred. Thus it would appear that it may be more common to lose labialization of velars than to acquire it. The western languages would seem then to be more archaic in this feature than the eastern languages. This still leaves the age and provenience of the palatals undecided. Evidence of the sort seen in Table 4 places in doubt Meillet's proposed stop inventory. Kurylowicz supports the notion that the palatals are of PIE age. His view of the origin of the labiovelars does not find general support.

Some Indo-Europeanists have suggested that the segment traditionally represented by *k^w (and the other labiovelar segments as well) might perhaps be thought of as having developed from labiovelars of the sort seen in many African languages. Whatmough (1937) is cited in Hopper (1973) as having suggested a sound such as [kp] might more realistically be posited instead of *k^w. Schwyzler (1953) also draws several parallels between IE labiovelars and those of certain African languages (especially the Cushitic group). Should the Whatmough conjecture be demonstrable, it would make little difference in the overall phonological system of PIE, since the number of contrasts would not change. Additionally, in that no labiovelars of the sort here suggested are seen in any IE language and those of the type traditionally assumed are attested in more than one language, the likelihood that PIE contained segments such as [kp] and [gb] seems remote.

3. Methodological and Theoretical Considerations

In the course of examining the nature of the oppositions among the "gutturals" in IE one is confronted with three modes of enquiry into linguistic change: the comparative method, internal reconstruction and notions of typological probability. Brugmann and contemporaries worked with the comparative method but their application of this technique lacked the insights of structural linguistics (notions of distribution, the phoneme, etc.). Their comparisons generally were between the inventories of speech sounds of pairs of languages. Some of these sounds would have been phonemes but many others (as pointed out above) might have been nothing more than positional variants of phonemes. The results of such efforts were occasionally somewhat uneven. An additional complication for Brugmann was the special position of certain of the oldest IE languages, especially Sanskrit and Greek. Early on in the nineteenth century Sanskrit was thought to be virtually synonymous with PIE. Although this view had been largely abandoned by the time Brugmann began his *Grundriss*, it still had its effect on his ideas as to the number of entities to be assumed, for example, for the stops in PIE. Two defects in his use of the method lay, then, in an imprecise idea of what to compare and an inability to compare the languages in a way which did not assign a special role to any of them.

The most comprehensive treatment of the comparative method is found in Hoenigswald (1960). The author discusses at one point the reality of reconstructions arrived at by use of this method. He says (p. 134) that in an application of the comparative method one can hope to arrive at "a number of contrasting entities in the proto-language" and information as to their sequencing (in forms) and phonetic character. The particular indications as to phonetic detail will depend both on "the physical consensus between the daughter languages" and "on certain considerations of phonetic and typological plausibility" (1960:135). The notion of physical consensus among daughter languages relates in general to the time-depth involved or the tendencies of specific languages to be innovative or conservative in their phonologies. Consider only the differences between Danish (innovative) and Icelandic (conservative) in the Scandinavian languages or French (innovative) and Sardinian (conservative) among the Romance languages. In each case the more conservative member shows a

closer correspondance to the reconstructed proto-phonology for its respective group than does its more innovative counterpart. One arrives at this particular insight by different routes for Scandinavian and Romance, however. In the case of the former group we have an unbroken literary tradition from Old Norse to the present, the time-depth is not so great and the changes in the modern language (Icelandic) have not been so great. In the Romance languages the time-depth is several hundred years greater, there has not been an unbroken literary tradition (in all the Romance languages down from the time of Latin) and the sound changes to be observed are more remarkable than is the case in Scandinavia. We conclude that Sardinian is more conservative than French as the result of comparison of the various languages. In the case of Scandinavian we more or less know the position of Icelandic going into the comparison. Typological considerations seem to play the greatest role when one arrives at a reconstruction which bears little resemblance to any of the languages being compared. Previously extant "exotic" phonemes may have been lost in all daughter languages through mergers. If it is possible to reconstruct a phoneme which is unlike any particular entity in the phonology of any daughter language one may still be able to demonstrate its typological plausibility by showing that it fills a phonological "slot" or in some other way fits the phonological pattern of the proto-language.

To illustrate how relative time-depth and the availability of data can affect a reconstruction we will examine an example each from the Germanic and Romance languages. If we compare dental obstruents in certain of the Germanic languages (omitting Icelandic and English for the present), we arrive at a proto-phonology which contains two entities: **t* and **d*. A look at the data (here illustrated with forms from Swedish, Dutch and German), however, will show certain anomalies:

	Sw	Du	G	
(a)	döda dröma duk	doden dromen doek	töten träumen tuch	'kill' 'dream' 'cloth'
(b)	tid två tunga	tijd twee tong	zeit zwei zunge	'time' 'two' 'tongue'
(c)	du det där	du dat daar	du das dort	'thou' 'that' 'there'
(d)	tri tänka tunn tak	drie denken dun dak	drei denken dünn dach	'three' 'think' 'thin' 'roof'
(e)	te stol	thee [te] stoel	tee stuhl	'tea' 'chair'

Table 6

The data in Table 6 are grouped to show similarities and differences between the distribution of assumed *t and *d in the three languages. In general (and for a substantial number of lexical items) there are two important correspondences: in group (a) d:d:t and in group (b) t:t:z. In another group of forms (group (d)) Dutch and German contrast with Swedish, the correspondence being t:d:d. In a quite small set of forms (group (c)) all three languages exhibit d. Clearly if we are to assume PGmc *t and *d as ancestor phonemes for all the forms cited, we have to demonstrate how, in what directions and in which languages mergers occurred, since the languages do not exhibit the same distribution of these phonemes. One apparent anomaly is seen when we compare Dutch and German forms of groups (a) and (c)-(d).³ German shows a greater variety of phonological shapes (t and d as against Dutch d). If no evidence can be cited to demonstrate a phonemic split in German (and none can), then we must assume a merger in Dutch. If then the identity of initial segments in the Dutch forms in (a) and (c)-(d) is due to merger, we must assume one entity in the proto-phonology to underlie (a) and another to underlie (c)-(d). If we now examine the Swedish data in (c) and (d), we will note another anomaly. For a fair number of forms there is a correspondence t:d:d (group (d)) among the languages. However for a very small set of forms (group (c)) Swedish exhibits the same initial d seen in Dutch and German. The forms in (c) can be easily specified in terms of the word classes to which they belong: pronouns (personal and demonstrative), articles and an adverbial demonstrative ('there'). No other Swedish forms exhibit a d answering to Dutch and German d.

Examination of the totality of Swedish forms which could be listed in group (d) will show that the only word classes not represented are those seen in the rather limited group (c). Obviously then, a great variety of word classes are included in (d); the four forms in Table 6 show numeral, verb, adjective and noun classes. Given the variety of word classes and the sheer number of forms represented, we assume the correspondence in (d) to be the norm and that in (c) to be some deviation from this norm. The forms in (c) are a clearly identifiable lexical (or morphological) set, which, on the basis of comparison with Dutch and German, seem to have deviated from the phonological developments seen in the rest of the larger set to which they once belonged. They have experienced what we can label a morphologically (or perhaps lexically) conditioned sound change.⁴ We assume then that (c) and (d) are really one set (as they appear to be in Dutch and German) and that in groups (a) through (d) we have to deal with three proto-phonemes: one underlying (a); one, (b); and one, (c)-(d).⁵

Based upon a comparison of Swedish, Dutch and German, we have concluded that there must have been some phoneme in PGmc which underwent various mergers in the former two languages but which is not directly (in some obvious phonetic way) attested in any one of the daughter languages. A reconstructed partial proto-phonology (together with an indication of the sound changes which result in the daughter languages compared) is seen in Table 7:

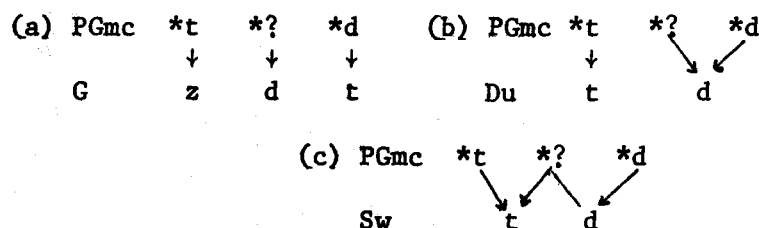


Table 7

The comparative distributions of the phonemes in question in all three languages allow us to formulate the speculative statement seen above. If all three languages had undergone the same merger, no such reconstruction would have been possible. No more than two entities could have been posited for the proto-language. We can now add English and Icelandic to the problem (no further forms will be listed, however) and discover the phonological shape of the entity symbolized by *? above: it is *θ, more usually represented as *þ by Germanists. This rather extended example illustrates the power of the comparative method when it is applied to data exhibiting distributional anomalies. It allowed us to reconstruct a "slot" in the proto-phonology which found no single direct counterpart in most of the daughter languages but which could be inferred by comparison.

Hoenigswald (1960:136-137) cites a similar example from the Romance languages. In that group of languages if one compares the vowel systems one can reconstruct a proto-system containing nine vowels. The reconstructed system contains four front and four back vowels, each exhibiting contrasting long and short forms, and a single low central vowel of indeterminate length. The irregularity of the low vowel tempts one to speculate that an earlier system might have possessed contrasting long and short forms. Any such system has succumbed to merger in the daughter languages, however, and thus cannot with certainty be reconstructed. This is somewhat different from the Germanic example previously discussed in that, while we were unable to state (without English or Icelandic) the nature of the posited proto-phoneme, we could state with a great measure of confidence its development. Here we can speculate with greater certainty on the nature of the proto-phonemes (presumably *a and *ā) and assume that they underwent unconditional merger. The reason for our greater certainty in the case of Romance is due to the closer similarity of segments in the languages compared and the lesser time-depth. The Romance problem is resolved relatively simply if appeal is made to internal reconstruction within Latin and to Latin metrics. One easily arrives at a posited contrast between *a and *ā.

In the problem which is the principal topic of this paper (the reconstruction of the PIE "gutturals") the technique of internal reconstruction and associated considerations of typological plausibility might be seen as ancillary at best. After all, the main concern here will be with comparative data from a variety of IE languages and internal reconstruction would hardly seem to be especially relevant. It is of interest, however, in that it, as a technique of reconstructing diachronic processes in a language, has been applied to the problem at hand. Both Meillet and Kurylowicz used it in order to arrive at their reduced inventories of

posited PIE stops. It has a rather chequered history however, as it has been used in attempts to reconstruct various components of PIE. One of the most celebrated instances of its use in the history of linguistics was Saussure's *Mémoire* (1879). In this study Saussure addressed the problem of the so-called long-vowel series in IE. These series were aberrant from the usual sort of ablaut seen in IE (see section 2 above) in that, instead of having **e* as their basic vocalism, they had a long vowel (**ē*, **ā* or **ō*). Using what might best be characterized as a typological insight, namely that a small number of forms exhibited a pattern that deviated from the norm, he posited certain segments (his *coéfficients sonantiques*) the loss of which might have resulted in "compensatory" lengthening of the vowels. The segments he posited (later identified with "laryngeal" consonants of Semitic and discovered to exist in Hittite) were only minimally specified in terms of their phonetic character. Their existence, while in 1879 only posited, did not seem to violate any typological generalizations which could be made about PIE phonology; indeed, they helped clarify an otherwise unexplained deviation from the productive ablaut pattern in PIE.

A less successful instance of the use of internal reconstruction is seen in Benveniste's theory of the PIE root (1935) and the associated view (briefly popular with some Indo-Europeanists in the 1940's and 1950's) that earliest PIE contained only one vowel (**e*). Benveniste assumed, mainly as a result of his interpretation of the laryngeal hypothesis, that the PIE root was of the form CVC, where V = **e* and C might represent classes of stops, nasals, the fricative *s*, semivowels *y* and *w* or the laryngeals. He posited that the "colour" of vowels in the various daughter languages was due to the loss of a preceding laryngeal and that (with Saussure) length was the result of the loss of following laryngeal. Two problems became immediately obvious. Benveniste's theory did not (and does not) account for all the data. Many forms in IE languages cannot be subsumed under it. Additionally, and more importantly in the view of proponents of the use of typology in reconstruction (cf. Jakobson 1972:304), no human language exhibits a phonological system containing a single vowel. Benveniste's theory continues to fascinate Indo-Europeanists in that it is, considered by itself, logically satisfying and internally consistent. It falls because it fails adequately to describe the data and because it violates what appears to be a typological universal: no language has a one-vowel phonology. The root theory and the one-vowel phonology together illustrate what is perhaps an inherent weakness in the technique of internal reconstruction (especially as it is applied to data themselves the result of previous reconstruction): while it may lead to impressive, appealing theories, if not subjected to some sort of constraint, its results may be highly improbable.

The relative reliability of internal reconstruction (depending on what data are handled by this method) will be dealt with below in Section 4 of this paper. Suffice it here to point out that if we choose to reconstruct internally a single morpheme underlying historically the three allomorphs of the past tense in contemporary English, we can do so with little trouble. The data consist of three forms (/əd/, /d/ and /t/) which occur in phonologically natural environments. We can easily assume one of the extant forms to be in some sense historically older (/əd/) and write a diachronic rule showing the developments which result in the

modern situation. The notion that this reconstruction is "correct" is reinforced when we see that metrical exigencies sometimes require us to produce archaized versions of past tense forms (cf. /lukəd/ for more usual /lukt/ 'looked' in a poem). English orthography provides further support for the reconstruction, spelling the past tense morpheme -ed. Internal reconstruction in this case and in similar instances where living languages (or well attested dead ones) are involved can frequently be relied upon. Problems seem to arise when the technique is applied to a language (such as PIE) which is itself the product of reconstruction. The farther one is removed from the real primary data, the more one should rely on typological constraints in order to insure the validity of one's reconstruction. The typological constraints alluded to here are of two (complementary) types: (1) reconstructions should conform to our idea of the way languages in general behave (universals) and (2) the systems proposed for the proto-language should not differ radically from the set of systems being compared. If these two constraints ever seem to conflict (as they may in the following section), my own view would be that, short of committing a ghastly violation of typological universals, one should tailor the reconstruction to fit the data compared. Typological plausibility, while a very useful tool, has occasionally been invoked in order to justify preconceived notions. Universals (implicational or absolute) have great "predictive power" but the tendency to overuse them, in my opinion, can lead to an intellectually satisfying simple and elegant system which may obscure the more complex, but possibly more interesting actual situation.

4. Reconstructing the PIE "Gutturals"

Having briefly surveyed the major proposals with respect to the "gutturals" and discussed relevant methodological and theoretical issues, it is time now to turn to the problem of reconstructing the PIE "gutturals". The systems being compared here will be those illustrated above in Tables 2, 3 and 5. The least controversial set of data is that given below:⁶

- (a) Skt rukṣá 'shining', ručitá 'shone'; OCS lučī 'light';
Lat lūx, lūcis 'light'; Gk leukós 'bright';
Goth liuhap 'light'
- (b) Skt ayuṣá 'not paired'; OCS igo 'yoke'; Lat jugum 'yoke'
Gk zygón 'yoke'; Goth juk 'yoke'
- (c) OCS gostī 'guest'; Goth gasts 'guest'; Lat hostis 'enemy';
Skt stighnotī '(he) walks'; Gk steíkhō '(I) walk';
Goth steigan 'walk, stride'

Table 8

The set of forms in (a) generally show a voiceless velar segment. The apparently deviant Sanskrit and Old Church Slavonic forms show an affricate before front vowel. One Sanskrit form shows the "normal" k and, had another set of cognates been chosen, one would have been able to show a Slavic example with a stop as well. The Gothic form (where h = [X]) shows the regular Germanic change of posited PIE voiceless stop to corresponding voiceless fricative. The PIE sound underlying the set of cognates in (a)

is then *k. In (b) most languages exhibit a voiced velar stop, exceptions being Sanskrit and Gothic. One can cite other Sanskrit forms from this same root (given in Sanskrit grammars as yuj- 'yoke') in which both k and g occur. One form of the verb 'yoke' (third sg., pres, ind. act.) yunákti exhibits k while the instrumental plural of an adjective rtayugbhís 'joined by truth' shows g. Using comparative data, it is possible to show that assumed PIE *k and *g have split in Sanskrit. One finds both k and č and g and ǵ occurring before the vowel a. Evidence from outside Sanskrit shows that some of these instances of a are historically *e, while others reflect PIE *o or *a. Velar stops were palatalized before front vowels in Indic. Subsequently all non-high vowels merged with a, thus resulting in the secondary split of č from k (and ǵ from g). The voiceless segment in Gothic (and in the other Germanic languages) shows a regular correspondence with the other IE languages.

The forms cited in (c) show velarity in all languages except Latin (early Greek kh, later = [x]). Voicing is shared by a majority of languages. the entity in the proto-phonology is traditionally represented by *gh. As pointed out above (p. 2), this symbol has not met with universal approval by Indo-Europeanists. It will be retained, however, since the issue of its precise phonetic value in the proto-language is not under discussion here.

The set of forms usually cited in support of the reconstructed labio-velars are given below:

- (a) Skt ča 'and'; Gk tè 'and'; Lat -que 'and'; Goth -uh 'and'
Skt kas 'who'; Gk tís 'who'; Lat quis 'who'; Goth hwas 'who'
Skt kutás 'whence'; Gk póthen 'whence'; Lat quō 'whither'
- (b) Skt gáččhati '(he) goes'; Gk baínō '(I) go'; Lat veniō
'(I) come'; Goth kwiman 'come'
Skt jiváti '(he) lives'; Gk biō '(I) live'; Lat vīvō '(I)
live'; Goth kwius 'alive'
- (c) Skt gharmás 'heat'; Gk thermós 'warm'; Lat formus 'warm';
Goth warms 'warm'; Lith virti 'cook'
Av snaēžati '(it) snows'; Gk nípha 'snow'; Lat ninguit
'(it) snows'; Goth snaiws 'snow'

Table 9

The segments in (a) generally show that the ancestor phoneme must have been at least voiceless and a stop. Velarity is also apparent from Sanskrit, Latin and Gothic. Labiality appears as well -- always in Latin, frequently in Gothic and in Greek only before round vowels. In Latin qu and Gothic hw labiality appears as a coarticulated feature; these segments are true labiovelars. In Greek (corresponding to the two segments just mentioned) we have a bilabial voiceless stop before round vowels. Before non-round vowels there is t. Kurylowicz (1935) would like to explain the traditionally posited labiovelars as secondary developments in the centum languages. The feature of labialization is, however, an integral part of the segments in Latin and Gothic; it does not arise from anything in the

environment of these sounds. One cannot demonstrate that the labiovelars have their labialization as a result of assimilation to anything in their surroundings. If this is the case, we must assume that, for late Indo-European at least, a series of labiovelar phonemes is to be reconstructed. Underlying the forms in (a) we posit then the proto-phoneme *k^w. The forms in (b) generally exhibit voicing, velarity and labiality; the historically underlying phoneme is traditionally rendered *g^w. In addition to voicing, velarity and labiality we see in (c) evidence for aspiration. This set of correspondences is said to reconstruct as *g^wh.

The most contentious of the phonemes to be discussed here are the palatals. Brugmann, Kurylowicz and many others claim that there existed in PIE a series of palatal stops analogous to the velars seen earlier. Meillet, Lehmann and possibly a majority of current Indo-Europeanists hold that the palatals arose from the velars as a result of palatalization (discussed in Section 2 above) in particular environments. In addition to the data already cited in Table 4, the following can be used as evidence for palatals:

- (a) Skt *dāśa* 'ten'; OCS *desęti* 'ten'; Lith *dėšimtis* 'ten';
Gk *déka* 'ten'; Lat *decem* 'ten'; Goth *taihun* 'ten';
Skt *śvā* 'dog'; Lith *šuō* 'dog'; Gk *kýōn* 'dog';
Lat *canis* 'dog'; Goth *hunds* 'dog';
Skt *śrṇóti* '(he) hears'; OCS *slutī* 'be named';
Gk *klēwos* 'fame'; Lat *clueō* '(I) hear'; OHG *hlūt* 'loud'
- (b) Skt *jānāti* '(he) knows'; Av *zanaⁱti* '(he) knows';
Gk *gignōskō* '(I) know'; Lat *(g)nōscō* '(I) know'; Goth *kunnan* 'know'; OCS *znatī* 'know'; Lith *žinoti* 'know';
Skt *yájate* '(he) worships'; Av *yazaēša* 'you (sg) would venerate'; Gk *hāgos* 'worship' (noun), *hāgios* 'holy';
Av *varəzayaⁱti* '(he) works'; Gk *érgon* 'work'; Goth *waurkjan* 'work'
- (c) Skt *lihāti* '(he) licks'; OCS *lizā* '(I) lick'; Gk *leíkhō* '(I) lick'; Lat *lingō* '(I) lick'; Goth *bilaigon* 'lick';
Skt *sáhati* '(he) conquers'; Av *hazō* 'power'; Gk *ékhō* '(I) have'; Goth *sigis* 'victory';
Skt *hāmsa* 'goose'; Lith *žąsis* 'goose'; Gk *khēn* 'goose';
Lat *(h)anser* 'goose'; Goth *gans* 'goose'

Table 10

The correspondences are summarized below:

(a)	Skt	OCS	Lith	Gk	Lat	Goth	
	š	s	š	k	k	h (= [x])	
(b)	Skt	Av	OCS	Gk	Lat	Goth	
	ṣ	z	z	g	g	k	
(c)	Skt	Av	OCS	Lith	Gk	Lat	Goth
	h	z	z	ž	kh	g/h	g

Table 11

Phonological environments seen in the data are:

- (a) (e) m as in 'ten' and 'hundred'; u, u as in 'dog'; l as in 'hear, etc.'
- (b) n, V as in 'know'; V, y as in 'worship, holy' and 'work'
- (c) V in all cases (though both initial and medial occurrences are seen)

Table 12

Of the phonological environments listed in Table 12 only the pre-vocalic ones are ambiguous with respect to possible palatalization. The pre-y position in (b) clearly is an environment which might condition palatalization. The remaining positions generally would not be classed as palatalizing environments. The IE forms for the numerals 'ten' and 'hundred' (reconstructed as **dékm* and **kmtóm*, respectively) are said to be related. There are real problems in trying to state in a precise way how these two numerals are related. The attempts generally centre on deriving 'hundred' from 'ten' by means of some unique process (involving seemingly ad hoc instances of dissimilation, loss, etc., cf. Szemerényi 1970:208). For those who hold that this sort of relation existed, the palatal stop in these forms can be explained as being phonologically conditioned in the case of 'ten' (after **e*) and analogically levelled in the case of 'hundred'. If one doesn't accept this explanation, one must posit another instance of historically underlying **k*. Meillet (1935:93) in his attempt to treat the palatal stops as variants of the velars tries to show that assumed **k* and **k̑* exhibit virtually complementary distributions. One of the positions listed for **k* is root-final. There are then, presumably, no root-final instances of **k̑*. Since his discussion is couched entirely in terms of the voiceless palatal and velar stops (no examples are given for assumed **g̑* or **gh̑*), one must conclude that his statements made with respect to **k̑* are also valid for the other stops of the series. We cannot cite here any examples of root-final voiceless palatal stop. We can, however, point to three examples (in the small set of data examined here) of root-final voiced (both plain and aspirated) stops, those seen in the roots 'worship', 'conquer' and 'lick'. This must be taken as counter-evidence to Meillet's claim. It seems then that an assumed palatal stop can occur in several environments which clearly do not condition palatalization (including the morphological root-final one). One can only conclude, based upon an examination of the evidence, that PIE must have contained a three-way contrast among the stops in the "guttural" area.

A closer examination of Sanskrit data tends to support the statement just made. As mentioned above, Sanskrit phonemes /k/ and /č/ contrast before /a/. This is due to the fact that at some point in the development of Indic the reflexes of PIE **e* and **o* fell together with that of **a*, but not before the front vowel had conditioned palatalization of /k/. If Meillet's contention were correct, that an original velar split in the satem languages to give us sometimes a velar stop and sometimes a more fronted fricative and that this fricative arose in "palatalizing" environments, why are not many of the instances of Sanskrit /č/ in fact realized as /š/? Some examples of /č/ are, of course, easily explainable as palatalizations of PIE **k̑* (compare the forms for 'and' or 'who' above). One can imagine that a first palatalization (k > š) might have taken place

while the labiovelars were still labialized and that 'and' (etc.) might then have lost its labial coarticulation and succumbed to another sort of palatalization ($k > \check{c}$). There are, however, instances of Sanskrit / \check{c} / which are traceable to PIE $*k$ (cf. in Table 8 the form ručítá). It is clear from an examination of the history of Sanskrit and the other satem languages that the palatalization that characterizes these languages must have arisen before the break-up of the PIE speech community. It is not unexpected then that, if a "tendency" to palatalize remained in these languages, it might manifest itself in different ways at later periods. This explains the instances of / \check{c} / which reflect PIE $*k^w$. It does not explain those instances of / \check{c} / which reflect PIE $*k$, unless the environments in which these affricates occur arose subsequent to the first palatalization. It is not clear that this is the case. We must conclude for the moment that, in those languages exhibiting the sort of palatalization under discussion here, the underlying cause of this sound change lay in a particular set of PIE phonemes (the palatals).

This still leaves the problem of how to characterize the assumed palatals. It seems counter-intuitive to some to propose that a language might contain, in addition to / k /, / k^w /, / g /, / g^w /, / gh / and / g^wh /, an analogous series of palatals. Palatals are frequently regarded as conditioned variants of velars. There are languages in which this apparently is not the case. Sherzer (1976:60) reports that several neighboring languages of the British Columbia coast (Kwakiutl, Comox and Bella Coola) all exhibit "a fronted pronunciation of 'k' sounds." If a language can possess "fronted 'k' sounds" to the exclusion of velars, is it not possible for a language to possess both series? This logical possibility taken together with the evidence from the satem languages seems to militate in favor of a posited system containing palatal phonemes. Evidence which might throw light on the exact phonological shape of the entities here posited is inconclusive. All the eastern languages point to a fricative, while the western languages only suggest a velar stop. There is, however, evidence from outside IE which may be helpful. It is probably the case that the Finnish words for 'eight' and 'nine' (kahdeksan and yhdeksän, respectively) were borrowed from IE, very possibly before the break-up of the PIE speech community. The forms themselves seem to show prefixes related to the Finnish forms 'one' (yksi) and 'two' (kaksi). If this is the case, then kahdeksan might be etymologized as 'ten less two' and yhdeksän as 'ten less one'. This leaves -deksan/-deksän (the second variant is the result of internal Finnish rules of vowel harmony) to be explained. These forms have been identified with PIE $*dek_m$ 'ten' (Hakulinen 1960:44). Assuming this identification is correct, we have direct evidence that at a time well back in the history of the IE languages the form for 'ten' evidenced a segment which showed both velar stop and pre-palatal fricative articulation. It is not reasonable to assume from this that the proto-phoneme was $*ks$. There is no evidence to show that such an affricate (?) exists in any language. Affricates sometimes arise from aspirated stops. One might be tempted to posit such entities here. This, however, will conflict with some of the aspirated stops already posited. Since the only affricated "reflex" of the stop in question appears in a non-IE language, it is unreasonable to assign this sort of change any major position in a putative sequence of events resulting in the split of satem languages from centum languages. Suffice it to say that the loanwords in Finnish contribute to the view that PIE contained a series of palatals contrasting with the velars

and labiovelars.

Finally and somewhat more speculatively, it is still possible to conceive that the palatals (and, less likely, the labiovelars) may have split from the velars. It is not possible to prove this based upon comparative evidence. We can make this conjecture based upon notions of phonological universals, namely that the palatals and labiovelars may in some sense presuppose velars. While we cannot demonstrate this concretely, it is plausible. To allow for this possibility I would propose that we look at IE in terms which thus far seem restricted to various daughter families (Germanic, Slavic, etc.) and speak of Common Indo-European as well as Proto-Indo-European. The former term should be reserved for that language which can be reconstructed from the evidence available in the daughter languages. Its stop inventory would then be like that given in Table 2. If after subjecting these data to internal reconstruction, one could posit a simpler (or otherwise different) inventory, that might be labelled Proto-Indo-European. The label PIE would then characterize the ultimate stage which could be reconstructed for the IE languages.

5. Conclusion

We have surveyed proposed PIE stop inventories and relevant methodological and theoretical considerations and have suggested a possible solution to the problem of the PIE "gutturals". We have tried to demonstrate that one's principal reliance in any comparative problem should in the first instance be on the data afforded by the languages themselves. Typological considerations should at the most be used in ways ancillary to the comparative method. In the present problem, for example, assumptions about how velars and palatals are distributed in language seem to have predetermined some Indo-Europeanists' discovery that the palatals were nothing more than variants of the velars. A far more interesting speculation might be based on the notion of variation and how the existence of sibilant and stop reflexes of a single underlying phoneme ($*\bar{k}$, etc.) in a characteristic geographic distribution might tell us something about the structure of the original speech community. Our knowledge of the social context in which the Indo-Europeans lived and spoke is, however, minimal. The existence of these phonological differences does, nevertheless, point in the direction of some sort of social differentiation of speech. To assume (for "typological reasons") the simpler phonological inventory is to impose an extraneous logic on the system and to obscure interesting "irregularities" which are an intimate and inevitable part of language.

Footnotes

¹Hopper's article (written in 1973) reflects the view of PIE phonology seen in Lehmann and Meillet as far as the palatals are concerned. He is discussed here somewhat out of his chronological position because his concern is not with the palatals but with the phonology of the other segments.

²Many Indo-Europeanists feel that the perfect system (or at least the radical vocalism which it exhibits) was historically derived from the *e vocalism of the present as a result of shifts in the location of PIE stress and pitch. It is true that the present system shows stress on the root vowel, while the perfect evidences desinential stress.

³The data in Table 6 have been arranged from the "point of view" of Swedish. Considered from the vantage point of Dutch and German, there is no reason to assume a group (c) distinct from group (d).

⁴The conditions under which group (c) split from group (d) in Swedish (and in Danish and Norwegian) are well known. The problem has been somewhat obscured here so as to allow the maximal use of the comparative method. Since Swedish is well-attested from before the time of this particular change, we can show that the change ($\theta > d$) occurred in unstressed positions (Haugen 1976:266).

⁵Forms in group (e) were included in the table to show a further complication: 'tea' represents a class of loanwords from outside Germanic which have been taken into the individual languages independently and 'chair' represents a class of forms which show t in the phonologically conditioned environment after a sibilant. They will not be further discussed here.

⁶Forms cited here have been simplified with respect to translation, and grammatical information usually given in such contexts has been omitted. The Sanskrit transcriptions are also modified to make them more comprehensible to the uninitiated. More usual c, j, and s have been rendered č, ǰ, and š here.

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