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## Reconstructing Proto-Indo-European Phonology

by Allan Bomhard

In order to understand the reconstruction of the Proto-Indo-European stop system and the glottalic reinterpretation of Indo-European consonantism, it might be helpful to review the history of the reconstruction of that system and the reasons why the glottalic reinterpretation was proposed in the first place.

### 1. August Schleicher

Although the comparative-historical study of the Indo-European languages did not begin with [August Schleicher](#), he was the first to attempt, in the first volume (1861 [4th edition 1876]) of his (in English translation) "Compendium of the Comparative Grammar of the Indo-European Languages," to reconstruct the phonological system of the Indo-European parent language. Earlier scholars -- especially Rasmus Rask and Jacob Grimm -- had worked out the fundamental sound correspondences between the various daughter languages, and the need to reconstruct the phonological system of the parent language had been recognized as early as 1837 by Theodor Benfey, but no one prior to Schleicher had actually undertaken the task.

### 2. The Neogrammarian Period

Schleicher's reconstruction remained the accepted standard until the late 1870's, when a series of brilliant discoveries were made in rapid succession:

1. First, there was the discovery of "The Law of Palatals" (*Das Palatalsgesetz*), which established the antiquity of the vowel systems found in Greek and Latin and recognized, for the first time, that the Sanskrit vowel system was an innovation.
2. The next major discovery was that Proto-Indo-European had syllabic nasals and liquids.
3. Following these discoveries, the system of vowel gradation (Ablaut) became clear, and the original patterning was worked out in precise detail.
4. Finally, Verner's Law explained several annoying exceptions to the expected developments of the earlier voiceless stops in Proto-Germanic. First, the voiceless stops became voiceless fricatives in Proto-Germanic. Then, at a later date, these

voiceless fricatives became voiced fricatives except (A) initially and (B), in some cases, medially between vowels. The problem was that both voiceless and voiced fricatives appeared medially between vowels, and the choice between voiceless fricatives, on the one hand, and voiced fricatives, on the other hand, appeared to be entirely random. What Verner figured out was that the patterning was tied to the original position of the accent -- the voiceless fricatives appeared medially between vowels when the accent had originally fallen on the contiguous preceding syllable. If the accent had originally fallen on any other syllable, however, voiced fricatives appeared.

By the end of the nineteenth century, the phonological system reconstructed by the Neogrammarians was widely accepted as being a fairly accurate representation of what had existed in Proto-Indo-European. To this day, the Neogrammarian system, or slightly modified versions thereof, commands a great deal of respect and has many defenders.

The Neogrammarian reconstruction of the Proto-Indo-European phonological system, which was arrived at through strict adherence to the principle that sound laws admit no exceptions, was notable for its large inventory of stops and its extremely small inventory of fricatives. The stop system consists of a four-way contrast of (A) plain voiceless stops, (B) voiceless aspirated stops, (C) plain voiced stops, (D) voiced aspirated stops. This system is extremely close to the phonological system of Old Indic. Actually, there were two competing versions of the Proto-Indo-European phonological system at this time: (A) the German system (as exemplified in the works of Karl Brugmann, for example), which was phonetically based, and (B) the French system (as exemplified, in particular, in the works of Antoine Meillet), which was phonologically based. It must be pointed out that, in spite of its wide acceptance, a small group of scholars has, from time to time, questioned the validity of the Neogrammarian reconstruction, at least in part.

Brugmann, in particular, reconstructed five short vowels and five long vowels plus a reduced vowel, the so-called "schwa indogermanicum", which was written with an upside down e and which alternated with so-called "original" long vowels. A full set of diphthongs was posited as well. Finally, the system contained the semivowels \*y and \*w, a series of plain and aspirated spirants, several nasals, and the liquids \*l and \*r. The nasals and liquids were unique in their ability to function as syllabics or nonsyllabics, depending upon their environment. They were nonsyllabic (A) when between vowels or initially before vowels, (B) when preceded by a vowel and followed by a consonant, and (C) when preceded by a consonant and followed by a vowel. The syllabic forms arose in early Indo-European when the stress-conditioned loss of former contiguous vowels left them between two nonsyllabics.

It should be noted here that the Proto-Indo-European vowels were subject to various alternations that were partially correlated with the positioning of the accent within a word. These vowel alternations served to indicate different types of grammatical formations. The most common alternation was the interchange between the vowels \*e and \*o in a given syllable. There was also an alternation among lengthened-grade

vowels, normal-grade vowels, and reduced-grade and/or zero-grade vowels.

Meillet's reconstruction differs from that of Brugmann in several important respects. First, Meillet reconstructs only two tectal (guttural) series, namely, palatals and labiovelars -- he does not recognize a separate pure velar series.

Brugmann posited a separate series of voiceless aspirates for Proto-Indo-European on the basis of an extremely small, and somewhat controversial, set of correspondences from Indo-Iranian, Armenian, and Greek. In the other daughter languages, the voiceless aspirates and plain voiceless stops have the same treatment, except that \*kh appears to have become x in a small number of examples in Slavic -- however, these examples are better explained as borrowings from Iranian rather than as due to regular developments in Slavic. As early as 1891, in a paper read before the Societe de Linguistique de Paris, the Swiss scholar [Ferdinand de Saussure](#) suggested that the voiceless aspirates might have had a secondary origin, arising from earlier clusters of plain voiceless stop plus a following "coefficient sonantique". This idea was taken up by Meillet, who pointed out the great rarity of the voiceless aspirates, noting in particular that the dental voiceless aspirate \*th often appears to be the result of aspiration of a plain voiceless dental by a following \*h: \*t + \*h \*th, at least in Sanskrit. Current thinking on the part of a great many linguists is that the series of voiceless aspirates reconstructed by Brugmann and other Neogrammarians for the Indo-European parent language should be removed, being secondarily derived in the individual daughter languages. The main opponent of this view has been Oswald Szemerényi, who has argued for the reinstatement of the voiceless aspirates and, consequently, for a return to the four-stop system (plain voiceless, voiceless aspirated, plain voiced, voiced aspirated) of the Neogrammarians.

Particularly noteworthy is Meillet's treatment of the resonants. Here, he considers \*i and \*u to be the syllabic allophones of \*y and \*w respectively and classes them with the resonants, thus: \*i/\*y, \*u/\*w, \*m/\*m, \*n/\*n, \*r/\*r, \*l/\*l (the first member is syllabic, the second non-syllabic), that is to say that he does not consider \*i and \*u to be independent phonemic entities. The diphthongs are analyzed by Meillet as clusters of (A) vowel plus nonsyllabic resonant and (B) nonsyllabic resonant plus vowel.

### 3. The Twentieth Century to 1970

In 1878, the young Ferdinand de Saussure attempted to show that so-called "original" long vowels were to be derived from earlier sequences of short vowel plus a following "coefficient sonantique". In 1927, Jerzy Kurylowicz demonstrated that reflexes of de Saussure's "coefficients sonantiques" were preserved in Hittite. On this basis, a series of consonantal phonemes, commonly called "laryngeals", was then posited for Proto-Indo-European. Jerzy Kurylowicz, in particular, set up four laryngeals. The overwhelming majority of scholars currently accept some form of this theory, though there is still no general agreement on the number of laryngeals to be reconstructed for Proto-Indo-European or on their probable phonetic values.

With the reduction of the gutturals to two series, the removal of the traditional voiceless aspirates, the reanalysis of the diphthongs as clusters of vowel plus nonsyllabic resonant and nonsyllabic resonant plus vowel, and the addition of laryngeals, we arrive at the system of Winfred P. Lehmann, which consists of the contrast (A) plain voiceless stops, (B) plain voiced stops, and (C) voiced aspirates.

Now, the removal of the traditional voiceless aspirates creates a problem from a typological point of view. Data collected from the study of a great number of the world's languages have failed to turn up any systems in which voiced aspirates are added to the pair plain voiceless stop / plain voiced stop unless there are also corresponding voiceless aspirated stops in the system. This is an important point, affecting the entire structure of the traditional reconstruction. In order to rectify this imbalance, several scholars have sought typological parallels with systems such as those found, for example, in Javanese. In these rare systems, there is a three-way contrast, sometimes described as (A) plain (unaspirated) voiceless, (B) voiced, (C) "voiced aspirated": /T/, /D/, /Dh/. However, this interpretation is based upon a lack of understanding of the phonetics involved. Series (C) in such systems is, in reality, voiceless with breathy release and not "voiced aspirated".

As we have seen from the preceding discussion, Lehmann's reconstruction is problematical from a typological point of view. However, from a structural point of view, it presents an accurate analysis of Proto-Indo-European phonological patterning.

Several scholars have proposed various solutions in an attempt to eliminate the problems caused by the removal of the traditional voiceless aspirates. For example, in 1964, Kurylowicz tried to show that the voiced aspirates were not phonemically voiced. However, this interpretation seems unlikely in view of the fact that the daughter languages are nearly unanimous in pointing to some sort of voicing in this series in the Indo-European parent language. The main exceptions are Tocharian and possibly Hittite (at least according to some scholars). In each case, however, it is known that the voicing contrast was eliminated and that the reflexes found in these daughter languages do not represent the original state. The Greek and Italic developments are a little more complicated: in these daughter languages, the traditional voiced aspirates were devoiced, thus becoming voiceless aspirates. Then, in Italic, the resulting voiceless aspirates became voiceless fricatives.

According to Eduard Prokosch (in 1938), on the other hand, the voiced aspirates of traditional grammar were really voiceless fricatives. This interpretation seems unlikely for two reasons: (A) as noted above, the daughter languages point to voicing in this series in Proto-Indo-European, and (B) the daughter languages point to stops as the original mode of articulation and not fricatives. This latter objection may also be raised against the theory -- advocated by Alois Walde (in 1897) and Johann Knobloch (in 1965) -- that the voiced aspirates may have been voiced fricatives.

Next, there is the theory put forth by Louis Hammerich (in 1967) that the voiced aspirates may have been emphatics. Hammerich does not define what he means by

the term "emphatics" but implies that they are to be equated with the emphatics of Semitic grammar. Now, in Arabic, the emphatics have been described as either uvularized or pharyngealized. Such sounds are always accompanied by backing of adjacent vowels. In Proto-Indo-European, all vowels were found in the neighborhood of the voiced aspirates, and there is no indication that any of these sounds had different allophones here than when contiguous with other sounds. Had the voiced aspirates been emphatics such as those found in Arabic, they would have caused backing of contiguous vowels, and this would be reflected in the daughter languages in some manner. However, this is not the case. If, on the other hand, the emphatics had been ejectives such as those found in the Modern South Arabian languages, the Semitic languages of Ethiopia, and several Eastern Neo-Aramaic dialects (such as, for instance, Urmian Nestorian Neo-Aramaic and Kurdistan Jewish Neo-Aramaic), the question arises as to how these sounds could have developed into the voiced aspirates needed to explain the developments in Indo-Iranian, Greek, Italic, and Armenian.

Oswald Szemerényi was one of the first (in 1967) to bring typological data to bear on the problem of reconstructing the Proto-Indo-European phonological system. Taking note of Roman Jakobson's famous remark that "...no language adds to the pair /t/ ~ /d/ a voiced aspirate /dh/ without having its voiceless counterpart /th/," Szemerényi reasoned that since Proto-Indo-European had voiced aspirates, it must also have had voiceless aspirates. Though on the surface this reasoning appears sound, it puts too much emphasis on the typological data and too little on the data from the Indo-European daughter languages. As mentioned above, there are very cogent reasons for removing the traditional voiceless aspirates from Proto-Indo-European, and these reasons are not easily dismissed. Szemerényi also tried to show that Proto-Indo-European had only one laryngeal, namely, the voiceless glottal fricative /h/. Szemerényi does not include diphthongs in his reconstruction since their "phonemic status is disputed".

Szemerényi's reconstruction is in fact typologically natural, and he defended it strongly right up to his dying day (1996). His system -- as well as that of the Neogrammarians, it may be added -- is merely a projection backward in time of the Old Indic phonological system. In certain dialects of "Disintegrating Indo-European" (specifically, in the early development of Pre-Indo-Iranian, Pre-Greek, and Pre-Italic), such a system no doubt existed in point of fact. Next, there are the proposals put forth by Joseph Emonds (in 1972). According to Emonds, the plain voiced stops of traditional Proto-Indo-European are to be reinterpreted as plain lax voiceless stops, while the traditional plain voiceless stops are taken to have been tense and aspirated. Emonds regards the voicing of the lax stops as common to a Central innovating area and the appearance of voiceless stops in Germanic, Armenian, and Hittite as relics.

Similar proposals were put forth by Toby D. Griffen (in 1988). According to Griffen, Proto-Indo-European had a three-member stop system, which he represents as (using the dentals for illustration) \*[d], \*[t], \*[th] (media, tenuis, aspirata). While this

system was maintained in Germanic with only minor changes, a series of sound-shifts in the other Indo-European daughter languages completely restructured the inherited system. Thus, Germanic emerges as the most conservative daughter language in its treatment of the Indo-European stop system.

There are other problems with the traditional reconstruction besides the typological difficulties caused by the removal of the voiceless aspirates. Another problem, noted in most of the standard handbooks, is the statistically low frequency of occurrence -- perhaps total absence -- of the traditional voiced labial stop \*b.

The marginal status of \*b is difficult to understand from a typological viewpoint and is totally unexplainable within the traditional framework. This problem was investigated by the Danish scholar Holger Pedersen (in 1951). Pedersen noted that, in natural languages having a voicing contrast in stops, if there is a missing member in the labial series, it is /p/ that is missing and not /b/. This observation led Pedersen to suggest that the traditional plain voiced stops might originally have been plain voiceless stops, while the traditional plain voiceless stops might have been plain voiced stops. Later shifts would have changed the earlier plain voiced stops into the traditional plain voiceless stops and the earlier plain voiceless stops into the traditional plain voiced stops. In a footnote in his 1953 BSL article entitled "Remarques sur le consonantisme semitique", Andre Martinet objected to this "musical chairs" rearrangement.

"Since there are extremely few examples of the Common Indo-European phoneme reconstructed 'analogically' as \*b, it is tempting to diagnose a gap there as well, as did the late Holger Pedersen... But, instead of assuming, as did Pedersen, the loss of a Pre-Indo-European \*p followed by a musical-chairs [rearrangement] of mediae and tenues, one should be able to see in the series \*d, \*g, \*gw the result of evolution from an earlier series of glottalics, without labial representative."

This appears to be the first time that anyone had proposed reinterpreting the plain voiced stops of traditional Proto-Indo-European as glottalics. Martinet's observation, however, seems to have influenced neither Gamkrelidze and Ivanov nor Hopper, each of whom arrived at the same conclusion independently of Martinet as well as independently of each other.

In the preceding discussion, only the more well-known counterproposals were mentioned, and only the briefest of explanations were given. More details could easily have been given. Insights gained from typological studies, for example, could have been used to strengthen the arguments: no phoneme stands alone; it is, rather, an integral part of the total system. Each and every phoneme is tied to the other phonemes in the system by discrete interrelationships -- to disturb one phoneme is to disturb (at least potentially) the entire system. This is basically the message that Jakobson and Martinet were trying to bring home. All too often, this message is ignored. Moreover, the interrelationships are not only synchronic, they are diachronic as well.

#### 4. The Glottalic Theory

Discovery -- perhaps "rediscovery" would be a better term since Martinet's insightful remarks first appeared in 1953 -- of what has come to be known as the "Glottalic Theory" came from two separate sources, each working independently. On the one-hand, the British-born American Germanist Paul J. Hopper hit upon the notion that Proto-Indo-European may have had a series of glottalized stops while he was a student at the University of Texas and taking a course in Kabardian from Aert Kuipers. Hopper went on about other business after graduation, waiting five years before putting his ideas into writing. On the other hand, the Georgian Indo-Europeanist Thomas V. Gamkrelidze, a native speaker of a language containing glottalics (Georgian), had been investigating the typological similarities between Proto-Kartvelian and Proto- Indo-European. It did not take Gamkrelidze long to realize the possibility that Proto-Indo-European might also have had glottalized stops. Gamkrelidze, in a joint article with the now-immigrated Russian Indo-Europeanist Vjacheslav V. Ivanov, was the first to make it into print (in 1972). Hopper might have beat them into print had his paper on the subject not been rejected by the journal *Language*. He was then obliged to search for another journal willing to publish his views, which finally happened in 1973. Then, in 1973, Gamkrelidze and Ivanov published a German language version of their 1972 paper.

In his 1973 paper, Hopper proposed reinterpreting the plain voiced stops of traditional Proto-Indo-European (\*b, \*d, \*g, \*gw) as glottalized stops (ejectives), that is, (\*p'), \*t', \*k', \*k'w respectively, because the traditional plain voiced stops "show many of the typological characteristics of glottalized stops (ejectives), e.g. they are excluded from inflectional affixes, they may not cooccur with another in the same root, etc." Hopper also reinterpreted the traditional voiced aspirates as murmured stops.

Gamkrelidze and Ivanov also reinterpret the traditional plain voiced stops as ejectives, but, unlike Hopper, they reinterpret the traditional plain voiceless stops as voiceless aspirates. They make no changes to the traditional voiced aspirates. They point out, however, that the feature of aspiration is phonemically irrelevant in a system of this type. In an article published in 1981, Gamkrelidze claims that such a system exists in several modern Eastern Armenian dialects (however, this is challenged by the Armenian scholar Gevork B. Jahukyan in a 1990 rebuttal).

Many of the points discussed above by Gamkrelidze were also noted by Hopper, in particular the root structure constraint laws. Hopper also discusses possible trajectories of the new system in various Indo-European daughter languages.

The system of Gamkrelidze, Hopper, and Ivanov has several clear advantages over the traditional reconstruction of the Proto-Indo-European stop system:

1. Their reinterpretation of the traditional plain voiced stops as glottalics (ejectives) makes it easy to account for the fact that the phoneme traditionally reconstructed as \*b was highly marked in the system, being characterized by an extremely low

frequency of occurrence (if it even existed at all). Such a low frequency distribution is not characteristic of the patterning of the voiced labial stop /b/ in natural languages having a voicing contrast in stops, but it is fully characteristic of the patterning of the labial ejective /p'.

2. Not only does the reinterpretation of the traditional voiced stops as ejectives easily account for the frequency distribution of these sounds, it also explains the fact that they were used only very infrequently in inflectional affixes and pronouns, since this type of patterning is characteristic of the way ejectives behave in natural languages having such sounds.

3. For the first time, the root structure constraint laws can be credibly explained. These constraints turn out to be a simple voicing agreement rule with the corollary that two glottalics cannot cooccur in a root. Hopper cites Hausa, Yucatec Mayan, and Quechua as examples of natural languages exhibiting a similar constraint against the cooccurrence of two glottalics. Akkadian may be added to this list as well if we take Geers' Law to be a manifestation of such a constraint.

4. The so-called Germanic and Armenian "consonant shifts" (in German, "Lautverschiebungen"), which can only be accounted for very awkwardly within the traditional framework, turn out to be mirages. Under the revised reconstruction, these branches (along with the poorly-attested Phrygian as well) turn out to be relic areas.

In 1984, Gamkrelidze and Ivanov published their monumental joint monograph (an English translation of this work has since been published by Mouton de Gruyter [in 1995]). As is to be expected, this massive work (2 volumes, 1,328 pages) contains the most detailed discussion of the Glottalic Theory that has yet appeared.

Gamkrelidze and Ivanov's book also contains trajectories of the revised Proto-Indo-European phonological system in the various Indo-European daughter languages, original proposals concerning the morphological structure of the Indo-European parent language, an exhaustive treatment of the Proto- Indo-European lexicon, and a new theory about the homeland of the Indo- Europeans (they argue that the Indo-European homeland was located in eastern Anatolia in the vicinity of Lake Van).

One of the most novel proposals put forth in the book is that Proto-Indo-European may have had labialized dentals and a labialized sibilant. Gamkrelidze and Ivanov also posit postvelars for Proto-Indo-European.

The Glottalic Theory has attracted a good deal of attention over the past two decades and has gained widespread -- though not universal -- acceptance.

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