NOSTRATIC, EURASIATIC, AND INDO-EUROPEAN

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1. *Introduction*

As the twentieth century draws to a close, it is no longer reasonable to hold to the view that Indo-European is a language isolate — thirty years have already passed since a group of Russian scholars (most notably Vladislav M. Illič-Svityč and Aaron B. Dolgopolsky) successfully demonstrated that Indo-European is related to several other language families of northern and central Eurasia and the ancient Near East. Since then, not only has this work been continued by the Russians (regrettably, Illič-Svityč was killed in an automobile accident in 1966), it has also been taken up by a number of other scholars in other countries, who have verified the initial results arrived at by the Russians, who have refined the methodology, who have greatly expanded the number of cognate sets, who have clarified issues related to phonology, who have identified additional grammatical formants and have begun to piece together the early development of morphology in each of the daughter languages, and who have made great strides in problems of subgrouping.

2. *Methodology*

At the present time, some of the work being done in distant linguistic comparison is of very high quality, adhering strictly to the methodological principles established by the founders of Indo-European comparative linguistics, while other work is quite speculative and less methodologically rigorous. Moreover, there are two main approaches being utilized: the first approach may be termed "taxonomy first", which seeks first and foremost to classify languages into valid groupings, that is, into language families and/or macrofamilies, while the second approach may be termed "reconstruction first", which, as the name implies, emphasizes reconstruction. The first approach is reminiscent of the beginnings of Indo-European comparative linguistics, where relationship was first established by the early pioneers such as Rasmus Rask, Franz Bopp, and Jacob Grimm, and it was only much later, beginning with August Schleicher, that actual reconstruction took place, though the need for reconstruction had been recognized as early as 1837 by Theodor Benfey. The two approaches are actually not mutually exclusive, but, rather, properly used, they can inform and

further one another. I, personally, would give the edge to "taxonomy first". After all, one cannot successfully reconstruct until one has first established which languages might have a reasonable chance of being genetically related, that is to say that one must know which languages to compare. (See Ruhlen 1994: 195–196 for a discussion of the difference between classification and reconstruction.)

The early founders of Indo-European comparative linguistics placed great importance on the comparison of grammatical forms, and this bias continues to the present day in Indo-European studies and has even been carried over into the study of other language phyla. However, this overemphasis on the comparison of grammatical forms is far too restrictive and was the reason that the Celtic languages, which have developed many unique features, were not immediately recognized as Indo-European. Rather, as noted some sixty ago by Holger Pedersen (1931:245):

> That agreement in the inflectional system is an especially clear and striking proof of kinship, no one denies. But it is only an anachronism in theory, which has no significance in actual practice, when such an agreement is still designated as the only valid proof. No one doubted, after the first communication about Tocharian..., that the language was Indo-European, though at that time virtually no similarities in inflection had been pointed out. Such similarities have since been shown, but even where they are almost obliterated, proof of kinship could be adduced from the vocabulary and from sound-laws. Hardly any one will assert that it would be impossible to recognize the relationship between, say, English and Italian, even without the help of other related languages or of older forms of these two languages themselves, although agreements between the inflectional systems are practically nonexistent.
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> From the modern point of view it must be said that proof for relationship between languages is adduced by a systematic comparison of languages in their entirety, vocabulary as well as grammar. The reason why earlier scholars felt they should disregard the vocabulary was that they knew of no method of systematic comparison in this field.

In Chapter III of his book *Essays in Linguistics*, Joseph Greenberg (1957:35-45) lays out a set of principles for establishing genetic relationship among languages, and these are worth repeating. Greenberg notes that the only way to establish hypotheses about genetic relationship is by comparing languages. However, the problem is in knowing which languages to compare and in knowing what to compare since not all aspects of language are equally relevant to comparison. To be meaningful, comparison must strive to eliminate chance resemblances and to separate borrowings from native elements. This is often easier said than done; however, Greenberg lays out two main techniques for detecting borrowed lexical items. First, he notes that borrowing is most

commonly confined to certain semantic spheres (for example, cultural items) and certain grammatical categories (nouns far more often than verbs). Second, borrowed words can be distinguished from native vocabulary by expanding the range of comparison to include additional languages.

The simplest way to establish genetic relationship is by identifying a large number of similar morphs (or allomorphs) — especially irregularities — in similar environments in the languages being considered. Another significant indicator of probable genetic relationship is the presence of similar rules of combinability. Unfortunately, historical processes over the passage of time bring about the gradual transformation and eventual elimination of such similarities. The longer the period of separation, the lesser the chances will be that similarities of morphological forms and rules of combinability will be found.

Fortunately, there remain other factors that can be helpful in determining possible genetic relationship. One significant factor is the semantic resemblance of lexical forms. Here, it is important to be able to establish recurrent sound-meaning correspondences for a reasonably large sample of lexical material. Lexical forms with identical or similar meanings have the greatest value. Next in value come forms that, though divergent in meaning, can convincingly be derived, through widely-attested semantic shifts, from earlier forms of identical or similar meaning. The chances that lexical resemblances indicate genetic relationship increase dramatically when additional languages are brought into the comparison and when these new languages also exhibit a very large number of recurrent sound-meaning correspondences. Greenberg has termed this method "mass comparison" (more recently, he has used the term "multilateral comparison"). He considers the comparison of basic vocabulary from a large number of languages from a specific, wide geographic area to be the quickest and most certain method to determine possible genetic relationship. To Greenberg, lexical data are of paramount importance in attempting to establish genetic relationship among languages, especially in the initial stages of comparison.

It is only after these preliminary steps have been undertaken that meaningful comparison can begin. That is to say, and to reiterate, we must first have a good sense of which languages are likely candidates for comparison.

Now let us look at the basic principles underlying the Comparative Method — they may be summarized as follows: The first step involves the arduous task of data gathering, placing special attention on gathering the oldest data available. Once a large amount of lexical material has been gathered, it must be carefully analyzed to try to separate what is ancient from what is an innovation and from what is a borrowing. After the native lexical elements have been reasonably identified in each phylum, the material can be compared across phyla to determine

potential cognates. Once a sufficient body of potential cognates has been identified, one can begin to work out the sound correspondences. Not only must the regular sound correspondences (that is, those that occur consistently and systematically) be defined, exceptions must also be explained. Here, widely-attested sound changes (palatalization, metathesis, syncope, assimilation, dissimilation, etc.) provide the key to understanding the origin of most exceptions. In other cases, the analysis of the influence that morphology has exerted provides an understanding of how particular exceptions came into being. Some exceptions, though clearly related, simply defy explanation. All of these must be noted. The final step involves the reconstruction of ancestral forms and the formulation of the sound laws leading to the forms in the descendant languages, identifying the laws that have produced the regular sound correspondences as well as the exceptions. The same principles apply to the reconstruction of grammatical forms and rules of combinability and to the identification of the historical transformations leading to the systems found in the daughter languages. Invariably, it takes the dedicated efforts of several generations of scholars to work out all of the details. Here, we may cite the case of Indo-European — as even the most casual reading of Lehmann's book (1993) on the *Theoretical Bases of Indo-European Linguistics* shows, after nearly two full centuries of investigation of what must surely be the most thoroughly-studied language family on the face of the earth, there still remain many uncertainties about the reconstruction of the Indo-European parent language.

It was necessary to discuss these issues in order to address concerns that have been raised about the applicability of traditional methods of comparison and internal reconstruction to long-range comparison. It must be made perfectly clear that the same principles are just as applicable to long-range comparison as they are to any other type of linguistic comparison. The fact is, these are the only tools we have. Moreover, they work — their efficacy has been proven over and over again. (The most thorough presentation of these methods is to be found in Anttila 1989:229–273 and Hock 1991:532–626.)

It has been claimed that these methodologies break down when one tries to apply them beyond a certain time limit, say, 5,000 to 10,000 years ago. However, these dates are really quite arbitrary. One can cite, for example, the case of the aboriginal languages of Australia. Archaeological evidence indicates that Australia has been inhabited by human beings for approximately 40,000 years. Though there remain many unsettled questions, such as exactly when Proto-Australian was spoken (probably at least 30,000 years ago), or about how the different languages should be subgrouped, and so on, all extant languages appear to belong to the same language family (cf. Ruhlen 1991:188), and

comparative work on these languages is continuing apace (cf. Dixon 1980). Another example that can be cited is the case of the Afroasiatic language family. Due to the extremely deep divisions among the six branches of Afroasiatic (Semitic, Egyptian, Berber, Omotic, Cushitic, and Chadic), which are far greater than those found, by way of comparison, among the earliest attested branches of Indo-European, the Afroasiatic parent language must be placed as far back as 10,000 BCE, or perhaps even earlier, according to some scholars. This extremely ancient date notwithstanding, the major sound correspondences have been determined with great accuracy (cf. Diakonoff 1992; Ehret 1995), excellent progress is being made in reconstructing the common lexicon (cf. Ehret 1995; Orel-Stolbova 1995), and scholars are beginning to piece together the original morphological patterning, though progress here lags behind other areas.

3. *Nostratic*

One large-scale grouping that has been proposed at various times and by various scholars is the so-called "Nostratic" macrofamily — the name "Nostratic" was first suggested by Holger Pedersen in 1903 (it is derived from Latin *nostrās* "our countryman"). Though the "Nostratic Hypothesis" has occupied the efforts of a handful of scholars from time to time, for the most part, it has been ignored by most scholars — the early work done was simply not of high quality and, therefore, was not convincing. However, beginning in the early 1960's, interest in the Nostratic Hypothesis was revived by the work of two Russian scholars, namely, Vladislav M. Illič-Svityč and Aaron B. Dolgopolsky, who first started working independently and, at a later date, through the efforts of Vladimir Dybo, cooperatively. Their work, though not without its own shortcomings (see below, §4), was the first successful demonstration that certain language phyla of northern and central Eurasia, as well as the ancient Near East, might be genetically related. Following Pedersen, they employed the name "Nostratic" to designate this grouping of languages. In particular, Illič-Svityč, in the course of several publications, culminating in his posthumous comparative dictionary, which is still in the process of publication, included Indo-European, Kartvelian, Afroasiatic, Uralic, Dravidian, and Altaic in his version of the Nostratic macrofamily. From his very earliest writings, Dolgopolsky also included Chukchi-Kamchatkan and Eskimo-Aleut.

The most important question that should be addressed is: What is the basis for setting up a Nostratic macrofamily? First and foremost, the descendant languages can be shown to share a large common vocabulary. In an article published in 1965, Illič-Svityč listed 607 possible common Nostratic roots, but only 378 have been published to date in his posthumous comparative Nostratic dictionary. It should be noted that there are differences between the etymologies

proposed in 1965 and the items included in the later dictionary: first, some of the items listed in 1965 do not appear in the dictionary; next, minor changes have been made to several of the earlier etymologies. Dolgopolsky currently claims to have over 2,000 common Nostratic roots, but only a small portion of this material has been published to date. In a joint monograph by myself and John C. Kerns, entitled *The Nostratic Macrofamily*, a great deal of lexical material is supplied from the Nostratic daughter languages to support 601 common Nostratic roots — this has now been expanded to 651 roots in my most recent book (Bomhard 1996). It should be mentioned here as well that Greenberg is currently preparing a book entitled *Indo-European and Its Closest Relatives: The Eurasiatic Language Family*, in which a large amount of lexical material will be discussed, though Greenberg's Eurasiatic is not the same as Nostratic (see below, §5). As is to be expected, the various branches of Nostratic investigated to date exhibit regular sound correspondences (see Appendix 2 for details), though, it should be mentioned, there are differences in interpretation between Illič-Svityč and Dolgopolsky on the one hand and myself on the other. Finally, a moderate number of common grammatical formants have been recovered.

Notable among the lexical items uncovered by Illič-Svityč, Dolgopolsky, and myself is a solid core of common pronominal stems (these are listed below in Appendix 1, though only the stems represented in Indo-European are given — the Proto-Nostratic reconstructions are given according to my system; for information on other pronoun stems, cf. Dolgopolsky 1984). These pronominal stems have particular importance, since, as forcefully demonstrated by John C. Kerns (1985:9–50), pronouns, being among the most stable elements of a language, are a particularly strong indicator of genetic relationship (Ruhlen 1994:92–93 makes the same point). Kerns (1985:48) concludes (the emphasis is his):

> The results are overwhelming. We are forced to conclude that the pronominal agreements between Indo-European and Uralic, between Uralic and Altaic, and between Indo-European and Altaic, did not develop independently, but instead were CAUSED by some UNIQUE historical circumstance. In short, it is extremely unlikely that the three pronominal systems could have evolved independently.

The conclusion seems inescapable that the consistent, regular correspondences that can be shown to exist among the Nostratic descendant languages as well as the agreements in vocabulary and grammatical formants that have been uncovered to date cannot be explained as due to linguistic borrowing and can only be accounted for in terms of common origin, that is, genetic relationship — it would simply be unreasonable to assume any other possibility. This does not mean that all problems have been solved. On the contrary,

Nostratic studies are still in their infancy, and there remain many issues to be investigated and many details to be worked out, but the future looks extremely exciting and extremely promising.

4. *Critique of Muscovite views on Nostratic*

In this section, I would like to make several comments about recent Muscovite research on Nostratic. Specifically, I will deal with this research as it has been codified in Illič-Svityč's comparative Nostratic dictionary. Let me begin by stating unequivocally that I have the highest admiration for what scholars of the Moscow School have achieved. Their research has opened up new and exciting possibilities and has given Nostratic studies new respectability. However, this does not mean that I agree with everything they say. I regard their work as a pioneering effort and, as such, subject to modification in light of recent advances in linguistic theory, in light of new data from the Nostratic daughter languages, and in light of findings from typological studies that give us a better understanding of the kind of patterning that is found in natural languages as well as a better understanding of what is characteristic of language in general, including language change.

We can begin by looking at phonology. In 1972 and 1973, the Georgian scholar Thomas V. Gamkrelidze and the Russian scholar Vjačeslav V. Ivanov jointly proposed a radical reinterpretation of the Proto-Indo-European stop system. According to their reinterpretation, the Proto-Indo-European stop system was characterized by the three way contrast glottalized ~ voiceless (aspirated) ~ voiced (aspirated). In this revised interpretation, aspiration is viewed as a redundant feature, and the phonemes in question could also be realized as allophonic variants without aspiration. Paul J. Hopper independently proposed a similar reinterpretation at the same time (cf. Hopper 1973).

This reinterpretation opens new possibilities for comparing Proto-Indo-European with the other Nostratic daughter languages, especially Proto-Kartvelian and Proto-Afroasiatic, each of which had a similar three-way contrast. The most natural and straightforward assumption would be that the glottalized stops posited by Gamkrelidze, Ivanov, and Hopper for Proto-Indo-European would correspond to glottalized stops in Proto-Kartvelian and Proto-Afroasiatic, while the voiceless stops would correspond to voiceless stops and voiced stops to voiced stops. That is to say that this is where one should begin when looking for potential cognates. In so doing, one finds that consistent, systematic sound correspondences can indeed be established in which the glottalized stops posited by Gamkrelidze, Ivanov, and Hopper for Proto-Indo-European correspond to glottalized stops in Proto-Kartvelian and Proto-Afroasiatic, and in which the voiceless stops correspond to voiceless stops and voiced stops to voiced stops.

This, however, is quite different from the correspondences proposed by Illič-Svityč. He sees the glottalized stops of Proto-Kartvelian and Proto-Afroasiatic as corresponding to the traditional plain voiceless stops of Proto-Indo-European, while the voiceless stops in the former two branches are seen as corresponding to the traditional plain voiced stops of Proto-Indo-European, and, finally, the voiced stops to the traditional voiced aspirates of Proto-Indo-European. Illič-Svityč then reconstructs Proto-Nostratic on the model of Kartvelian and Afroasiatic with the three-way contrast glottalized ~ voiceless ~ voiced.

The mistake that Illič-Svityč made was in trying to equate the glottalized stops of Proto-Kartvelian and Proto-Afroasiatic with the traditional plain voiceless stops of Proto-Indo-European. His reconstruction would make the glottalized stops the least marked members of the Proto-Nostratic stop system. Illič-Svityč's reconstruction is thus in contradiction to typological evidence, according to which glottalized stops are uniformly the most highly marked members of a hierarchy (for details on phonological markedness in general and on the frequency distribution of glottalized stops in particular, cf. Gamkrelidze 1978). The reason that Illič-Svityč's reconstruction would make the glottalized stops the least marked members is as follows. Illič-Svityč posits glottalics for Proto-Nostratic on the basis of one or two seemingly solid examples in which glottalics in Proto-Afroasiatic and Proto-Kartvelian appear to correspond to the traditional plain voiceless stops in Proto-Indo-European. On the basis of these examples, he assumes that, whenever there is a voiceless stop in the Proto-Indo-European examples he cites, a glottalic is to be reconstructed for Proto-Nostratic, even when there are no glottalics in the corresponding Afroasiatic and Kartvelian forms! This means that the Proto-Nostratic glottalics have the same frequency distribution as the Proto-Indo-European traditional plain voiceless stops. Clearly, this cannot be correct. To bring the reconstruction of Proto-Nostratic into agreement with the typological evidence, the correspondences between Proto-Kartvelian and Proto-Afroasiatic on the one hand and Proto-Indo-European on the other should be modified so that the voiceless stops found in Proto-Kartvelian and Proto-Afroasiatic correspond to the traditional plain voiceless stops in Proto-Indo-European (which Gamkrelidze and Ivanov reinterpret as voiceless [aspirated] stops), so that the glottalics correspond to the traditional plain voiced stops in Proto-Indo-European (which Gamkrelidze and Ivanov reinterpret as glottalics), and so that the voiced stops correspond to the traditional voiced aspirates in Proto-Indo-European (which Gamkrelidze and Ivanov also interpret as voiced [aspirates]) (see below, §6.5, for additional remarks on the revisions proposed by Gamkrelidze and Ivanov).

What about those examples adduced by Illič-Svityč which appear to support his proposed correspondences? Some of these examples admit to alternative explanations, while others are questionable from a semantic point of view and should be abandoned. Once these examples are removed, there is an extremely small number (no more than a handful) left over that appear to support his position. However, compared to the massive counter-evidence in which glottalized stops in Kartvelian and Afroasiatic correspond to similar sounds (the traditional plain voiced stops) in Proto-Indo-European, even these residual examples become suspect.

Another major shortcoming is in the reconstruction of the Proto-Nostratic vowel system, which, according to Illič-Svityč, is essentially that of modern Finnish. It simply stretches credibility beyond reasonable bounds to assume that the Proto-Nostratic vowel system could have been preserved unchanged in Finnish, especially considering the many millennia that have passed between the dissolution of the Nostratic parent language and the emergence of Finnish. No doubt, this erroneous reconstruction came about as a result of Illič-Svityč's failure to deal with the question of subgrouping. The Uralic-Yukaghir phylum, of which Finnish is a member, belongs to the Eurasiatic branch of Nostratic. Now, Eurasiatic is several millennia younger than Afroasiatic, which appears to be the oldest branch of the Nostratic macrofamily. Therefore, Afroasiatic must play a key role in the reconstruction of the Proto-Nostratic vowel system, and the Uralic-Yukaghir vowel system must be considered as a later development that cannot possibly represent the original state of affairs.

Finally, a few remarks need to be made about Illič-Svityč's proposed cognate sets in general. In some of his proposed etymologies, the correspondences between two or three of the branches are sound from a semantic point of view, while those adduced for the other branches are questionable. Sometimes, non-existent or questionable forms are cited, and these should be removed. A number of etymologies should be abandoned altogether. These critical remarks notwithstanding, however, upwards of two-thirds of the etymologies he proposes appear to be solid from both phonological and semantic points of view or need only minor adjustments, and this, in itself, is an impressive achievement.

5. *Eurasiatic*

Illič-Svityč included Indo-European, Kartvelian, Afroasiatic, Uralic, Dravidian, and Altaic within the Nostratic macrofamily, and Dolgopolsky added Chukchi-Kamchatkan and Eskimo-Aleut as well. Greenberg includes Indo-European, Uralic-Yukaghir, Altaic (Mongolian, Chuvash-Turkic, and Manchu-Tungus), Japanese-Korean (Korean, Ainu, and Japanese-Ryukyuan), Gilyak, Chukchi-Kamchatkan, and Eskimo-Aleut in his Eurasiatic language family. Unlike Illič-

Svityč and myself, he does not include Kartvelian, Afroasiatic, nor Elamo-Dravidian — not because he believes that they are unrelated, but because he believes that these three language phyla are more distantly related to Indo-European than are the others, which, along with Indo-European, form a natural taxonomic subgrouping. My own opinion is close to that of Greenberg. As I see the situation, Nostratic includes Afroasiatic, Kartvelian, and Elamo-Dravidian as well as Eurasiatic, in other words, I view Nostratic as a higher-level taxonomic entity. Afroasiatic stands apart as an extremely ancient, independent branch — it was the first branch of Nostratic to separate from the rest of the Nostratic speech community. Younger are Kartvelian and Elamo-Dravidian. It is clear from an analysis of their vocabulary, pronominal stems, and morphological systems that Indo-European, Uralic-Yukaghir, Altaic, Gilyak, Chukchi-Kamchatkan, and Eskimo-Aleut are more closely related as a group than any one of them is to Afroasiatic, Kartvelian, and Elamo-Dravidian, and this is the reason that I follow Greenberg in setting up a distinct Eurasiatic subgroup within Nostratic. Finally, Sumerian, which I formerly considered to be a Nostratic daughter language, is to be seen as related to Nostratic instead. It must be noted here that I am still uncertain about the exact positioning of Kartvelian and Elamo-Dravidian. Clearly, the Kartvelian pronoun stems are more closely related to those found in Eurasiatic. On the other hand, it resembles Afroasiatic in its use of prefixes, for example. As for Elamo-Dravidian, its pronoun stems have about the same number of parallels with Afroasiatic as they do with Eurasiatic or Kartvelian. However, in both nominal declension and verbal conjugation, Elamo-Dravidian is closer to Eurasiatic than to Afroasiatic. My present thinking is that Kartvelian is probably closer to Eurasiatic than what I indicated in my 1994 co-authored book and that the differences are due to innovations within Kartvelian. An attempt at subgrouping is shown in Figure 1 (this is very close to the schema proposed by Ruhlen 1994:192) and a hypothesis about possible paths by which the Nostratic sub-groups dispersed across Europe, Asia, and Africa is given in Map 1.

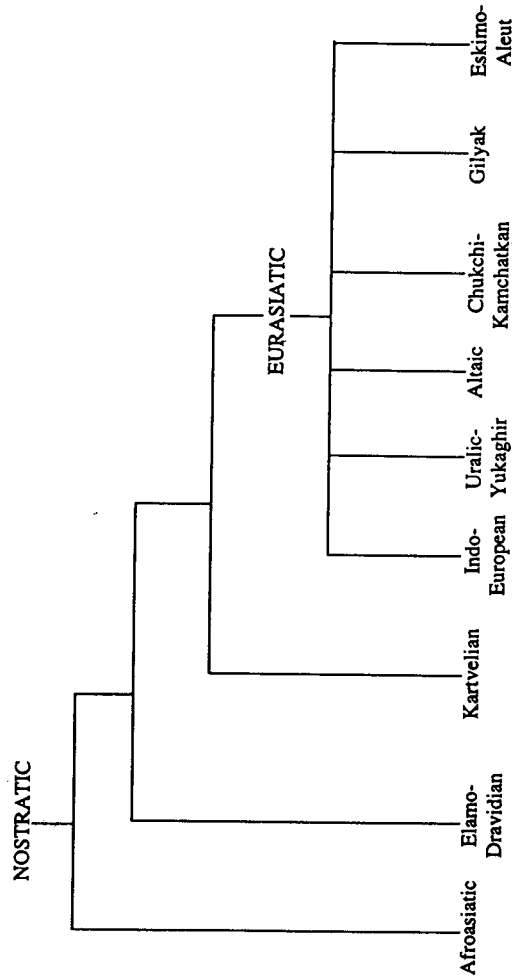
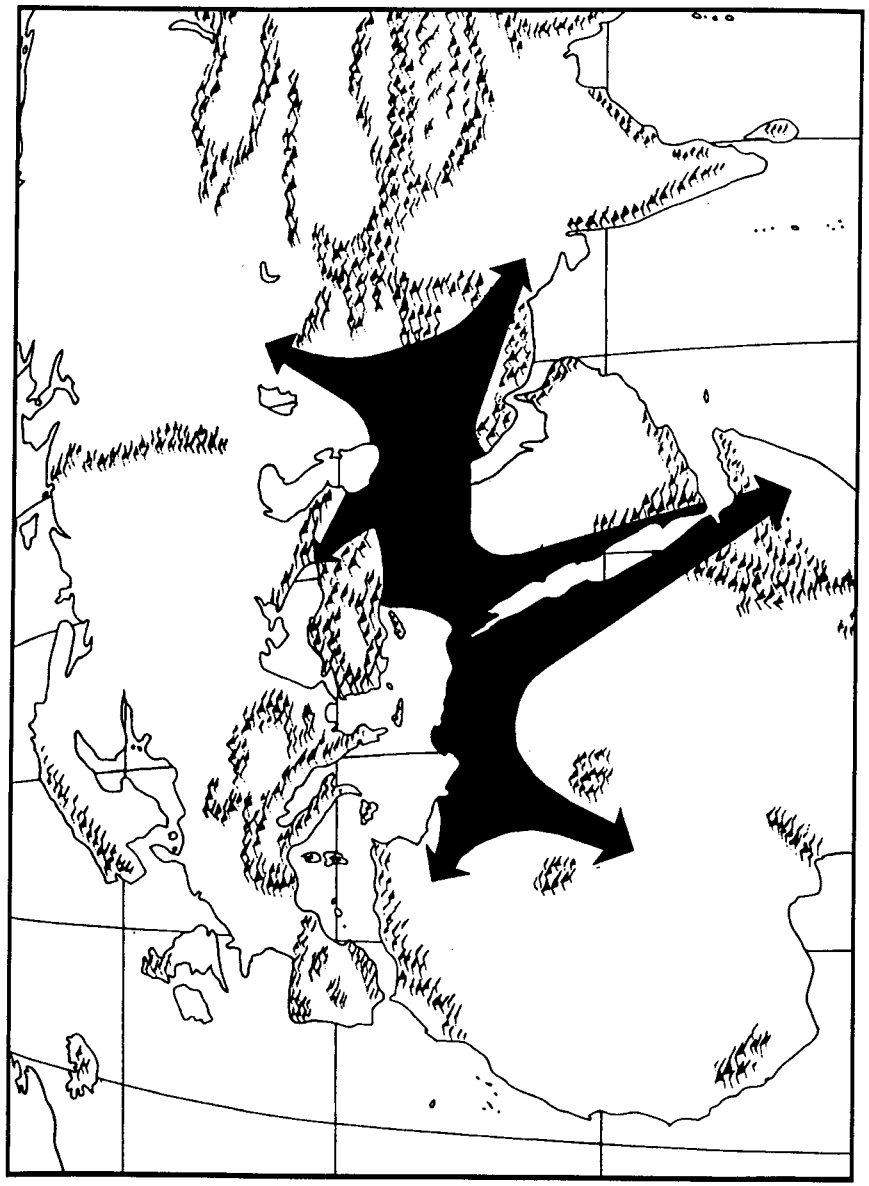


Figure 1: The Nostratic Languages



Map 1: The Dispersal of the Nostratic Languages

6. *Indo-European*

Let us now look at Indo-European and discuss some of what is to be gained by comparing Indo-European with the other Nostratic languages. The following gains may be mentioned as being among the most important: (A) a better understanding of the laryngeals, (B) a better understanding of root structure patterning, (C) a better understanding of the origin of verb morphology, (D) a better understanding of the origin and development of vowel gradation, and (E) support for the Gamkrelidze, Ivanov, and Hopper reinterpretation of Indo-European consonantism. We may now look at each one of these in more detail.

6.1 *Laryngeals*

According to Kuryłowicz and those who follow his theories (such as Sturtevant and Lehmann, among others), Indo-European is assumed to have had four laryngeals, which may be symbolized as $*H_1$, $*H_2$, $*H_3$, and $*H_4$ (Kuryłowicz writes $*\underline{\partial}_1$, $*\underline{\partial}_2$, $*\underline{\partial}_3$, and $*\underline{\partial}_4$). Other scholars posit only three laryngeals, denying the existence of $*H_4$, and, still others posit as few as one laryngeal or as many as twelve. For the sake of argument, we will stick with the four laryngeals posited by Kuryłowicz. Now, of the other Nostratic branches, only Afroasiatic has a full set of laryngeals. Though Semitic is traditionally assumed to have had six laryngeals, the Afroasiatic parent language most likely had only four, namely, a glottal stop /ʔ/, a voiceless laryngeal (or glottal) fricative /h/, and voiceless and voiced pharyngeal fricatives /ħ/ and /ʕ/. Extremely good correspondences can be established between Afroasiatic and Indo-European, and, as a result, it is now possible to establish the probable phonetic values of the laryngeals: we can confirm that $*H_1$ was a glottal stop /ʔ/ and $*H_4$ was a voiceless laryngeal fricative /h/ as originally suggested by Sapir, Sturtevant, and Lehmann, while $*H_2$ was probably the voiceless and voiced multiply-articulated pharyngeal/laryngeal fricatives /ħh/ and /ʕ͡ɦ/, and $*H_3$ was probably originally identical to $*H_2$. That is to say that there is no evidence from the other Nostratic languages to support positing $*H_3$ distinct from $*H_2$ in Indo-European. Note that both of these two laryngeals have the same reflex in Hittite, namely, *ḫ-* (initially) and *-ḫ(ḫ)-* (medially). The only reason that two separate laryngeals were set up in Indo-European by Kuryłowicz in the first place was to account for several cases of nonapophonic *o. However, these examples can be accounted for much better by assuming that this single, combined $*H_2$ and $*H_3$ changed a contiguous original *u to *o along the lines of what is found in modern Arabic dialects. (It should be noted here that /ħh/ and /ʕ͡ɦ/ are to be derived from earlier voiceless and voiced pharyngeal fricatives /ħ/ and /ʕ/ respectively — for details on the

development of the laryngeals in Indo-European, cf. Bomhard-Kerns 1994: 47–56; for a good introduction to the Laryngeal Theory, see Lindeman 1987.)

6.2 *Root structure patterning*

Comparison of Indo-European with the other Nostratic branches, especially Kartvelian and Afroasiatic, allows us to refine the theories of Benveniste (1935:147–173) and, in so doing, to trace the development of root structure patterning from the earliest times down to the appearance of the individual daughter languages. The most ancient patterning may be assumed to have been as follows:

1. There were no initial vowels in the earliest form of pre-Indo-European. Therefore, every root began with a consonant.

2. Originally, there were no initial consonant clusters either. Consequently, every root began with one and only one consonant.

3. Two basic syllable types existed: (A) *CV and (B) *CVC, where C = any non-syllabic and V = any vowel. Permissible root forms coincided exactly with these two syllable types.

4. A verbal stem could either be identical with a root or it could consist of a root plus a single derivational morpheme added as a suffix to the root: *CVC-VC-. Any consonant could serve as a suffix.

5. Nominal stems, on the other hand, could be further extended by additional suffixes.

In the earliest form of Indo-European, there were three fundamental stem types: (A) verbal stems, (B) nominal and adjectival stems, and (C) pronominal and indeclinable stems.

The phonemicization of a strong stress accent disrupted the patterning outlined above. The positioning of the stress was morphologically distinctive, serving as a means to differentiate grammatical categories. All vowels were retained when stressed but were either weakened (= "reduced-grade") or totally eliminated (= "zero-grade") when unstressed: the choice between the reduced-grade versus the zero-grade depended upon the position of the unstressed syllable relative to the stressed syllable as well as upon the laws of syllabicity in effect at

that time. Finally, it was at this stage of development that the syllabic allophones of the resonants came into being.

The stress-conditioned ablaut alternations gave rise to two distinct forms of extended stems:

Type 1: Root in full-grade and accented, suffix in zero-grade: *CVCC-.

Type 2: Root in zero-grade, suffix in full-grade and accented: *CCVC-.

When used as a verbal stem, Type 1 could undergo no further extension. However, Type 2 could be further extended by means of a "determinative". Further addition of a determinative or suffixes pointed to a nominal stem. According to Benveniste, a "suffix" was characterized by two alternating forms (*-et-/*-t-, *-en-/*-n-, *-ek-/*-k-, etc.), while a "determinative" was characterized by a fixed consonantal form (*-t-, *-n-, *-k-, etc.).

In its beginnings, ablaut was merely a phonological alternation. During the course of its prehistorical development, however, Indo-European gradually grammaticalized these ablaut alternations.

Indo-European had constraints on permissible root structure sequences. In terms of the radical revision of the Indo-European consonant system proposed by Gamkrelidze, Ivanov, and Hopper, these constraint laws may be stated as follows:

1. Each root contained at least one non-glottalic consonant.

2. When both obstruents were non-glottalic, they had to agree in voicing.

The Indo-European root structure constraint laws thus become merely a voicing agreement rule with the corollary that two glottalics cannot co-occur in a root. Comparison of Indo-European with the other Nostratic branches indicates, however, that the forbidden root types must have once existed. Two rules may be formulated to account for the elimination of the forbidden types:

1. A rule of progressive voicing assimilation may be set up to account for the elimination of roots whose consonantal elements originally did not agree in voicing: *T ~ *B > *T ~ *P, *B ~ *T > *B ~ *D, etc.

2. A rule of regressive deglottalization may be set up to account for the elimination of roots containing two glottalics: *T' ~ *K' > *T ~ *K', etc. This rule finds a close parallel in Geers' Law in Akkadian.

According to Gamkrelidze, Bartholomae's Law is a later manifestation of the progressive voicing assimilation rule, applied to contact sequences.

6.3 *Verb morphology*

Comparison of Indo-European with Uralic reveals many striking similarities in verb morphology and allows us to ascertain the ultimate origin of the athematic verb endings: they can be nothing else but earlier possessive suffixes, similar to what is found in Uralic and Altaic. The earliest forms of the athematic endings were most likely as follows (for details, cf. Bomhard 1988; see also Villar 1991:244–252):

Person	Singular	Plural
1	*-m	*-me
2	*-t	*-te
3	*-s, *-Ø	*-en

This earlier system may be partially preserved in Tocharian A.

Now compare the following system of personal endings, which are assumed to have existed in Proto-Uralic (cf. Hajdú 1972:40 and 43–45):

Person	Singular	Plural
1	*-me	*-me (+ Plural)
2	*-te	*-te (+ Plural)
3	*-se	*-se (+ Plural)

These endings survive in Elamite as well, especially in the 2nd and 3rd persons (by the way, the 1st singular ending, *-h*, is, of course, related to the 1st singular perfect ending *-Ae of traditional Indo-European, which is found, for example, in Luwian in the 1st singular preterite ending *-ḫa*, in Hittite in the 1st singular ending *-ḫi*, and in Greek in the 1st singular perfect ending -α; this ending may also be related to the Kartvelian 1st person personal prefix of the subject series, *xw- [Gamkrelidze-Mačavariani 1982:85 reconstruct *w-, however], as suggested by Ivanov and Palmaitis) — compare, for example, the conjugation of *hutta-* "to do, to make" from Middle Elamite (cf. Reiner 1969:76; Grillot-Susini 1987:33):

Person	Singular	Plural
1	*hutta-h*	*hutta-hu* (< *h* + *h*)
2	*hutta-t*	*hutta-ht* (< *h* + *t*)
3	*hutta-š*	*hutta-hš* (< *h* + *š*)

Traces of the 2nd singular ending are also found in Dravidian — McAlpin (1981:120) reconstructs Proto-Elamo-Dravidian 2nd person ending *-ti (> Proto-Elamite *-tə, Proto-Dravidian *-ti). This is a significant archaism, since it bears no apparent resemblance to the common Elamo-Dravidian 2nd person personal pronoun stem, which may be reconstructed as *ni.

Traces of these endings can be found in the Altaic languages too, as in the Turkish agreement markers *-(I)m* (1st singular) and *-Ø* (3rd singular verbal) or *-(s)I(n)* (3rd singular nominal). In Proto-Turkic, the 1st singular possessive suffix was *-m, while the 3rd singular was *-s. The 1st singular possessive suffix was also *-m in Proto-Tungus, and the 2nd singular was *-t — the 3rd singular possessive suffix, on the other hand, was *-n, which mirrors what is found in Sumerian. Finally, we may note that a 3rd singular in *-s* is also found in Kartvelian (cf. Old Georgian *c'er-s* "writes").

The 2nd singular ending *-t is preserved in Hittite and Tocharian. This was later replaced by what had been the 3rd singular, namely, *-s. Watkins (1962) has discussed the extensive evidence from the Indo-European daughter languages for an original 3rd singular ending in *-s. It was Watkins who also showed that the 3rd singular indicative was originally characterized by the fundamental ending *zero*.

The *-n- found in the 3rd plural was a relic of the 3rd person ending found in Tungus, Kartvelian (cf. Old Georgian *c'er-en* "they write"), and Sumerian. The development of the 3rd singular ending *-t was a later change, though this still occurred fairly early since it is found in Hittite and the other Anatolian daughter languages — this *-t was added to the 3rd plural ending *-n- at the same time, yielding the new ending *-nt-. The most recent change must have been the development of the so-called "primary" endings, which were built upon the so-called "secondary" endings by the addition of the deictic particle *-i meaning "here and now". It may be mentioned that this deictic particle has a Nostratic origin, coming from a widely-represented proximate demonstrative stem meaning "this one here".

Proto-Uralic is assumed to have had two conjugational types (cf. Hajdú 1972:43–44): (A) a determinative (objective) conjugation, which was characterized by the 3rd singular in *-s and which was used with transitive verbs, and (B) an indeterminative (subjective) conjugation, which was characterized by the 3rd singular in *zero* and which was used with intransitive verbs. The same

two conjugational types were found in Proto-Indo-European, except that they were used to contrast active versus stative. Indeed, the active-stative contrast appears to be the more ancient in both Uralic and Indo-European.

After all of the changes described above had taken place, the resulting Proto-Indo-European athematic endings were as follows:

	I. Primary		II. Secondary	
Person	Singular	Plural	Singular	Plural
1	*-mi	*-me	*-m	*-me
2	*-si	*-te	*-s	*-te
3	*-ti	*-nti	*-t	*-nt

Note: The 1st person plural endings have different extensions in the various daughter languages: *-mes(i), *-mos(i), *-men(i), *-mon(i).

In volume 1 (draft version 3, dated 9 March 1995), *Grammar*, of his forthcoming book *Indo-European and Its Closest Relatives: The Eurasiatic Language Family*, Greenberg discusses the evidence for a Eurasiatic first-person singular pronoun stem *k.

Now, the perfect had its own set of endings, one of which has hitherto defied explanation, namely, the first person perfect endings in *-k- found, for example, in Tocharian A *tākā* "I was", Latin *fēcī* "I made", Greek ἔθηκα "I placed", etc. In Greek, a separate stem type developed, the so-called "κα-perfect", based upon the *-k-* endings. This development took place in the early prehistory of Greek itself and is not representative of the Indo-European state of affairs. All indications are that the *-k- endings belonged exclusively to the first person singular in Proto-Indo-European. Thus, both in function and form, the *-k- endings clearly belong with the Eurasiatic first person singular pronoun stem *k reconstructed by Greenberg.

Recently, several scholars have tried to show that Indo-European is to be reconstructed as an active-stative language. Indeed, such an interpretation seems to clarify many problems in the early dialects. According to this interpretation, the so-called "perfect" of traditional Indo-European is seen as originally stative (cf. Lehmann 1993:218). Comparison with other Nostratic languages allows us to confirm this view.

6.4 *Vowel gradation*

The development of vowel gradation is extremely complicated and would require far more space to discuss than is allotted for this paper. Therefore, I will only deal with several key points. Ever since Hirt, it has been assumed by many scholars that early Indo-European went through a stage of development characterized by phonemic stress and that this stress caused the weakening and/or loss of the vowels of unaccented syllables, that is to say that the stress was responsible for the development of the quantitative ablaut alternations. Furthermore, according to this theory, it is assumed that, at a later date, stress became phonemically non-distinctive and was replaced by an accent system characterized by phonemic pitch and that this pitch accent was responsible for the development of the qualitative ablaut alternations. Kuryłowicz, however, argued that the qualitative ablaut alternations were ancient and preceded the changes brought about by the phonemicization of a strong stress accent. Comparison with the other Nostratic languages, especially Kartvelian, indicates that Kuryłowicz was correct. Indo-European inherited the qualitative ablaut alternations from Nostratic. In a recent paper entitled "The Prehistory of the Indo-European Vowel System in Comparative and Typological Perspective", Greenberg (1990) supplies convincing evidence in support of this view. The phonemicization of a strong stress accent in early Indo-European brought about a complete restructuring of the inherited vowel system. The same thing happened in Kartvelian, by the way. Another important point concerns the early prehistory of the *e ~ *o ablaut gradation. In an article published in 1965, Pulleyblank tried to show that this gradation series should be reinterpreted as a *ə (*schwa*) ~ *a gradation. It looks as though Pulleyblank came pretty close to the truth, though only for the oldest period of development. We may note that this older system is partially preserved in Hittite, where *ə appears as *e* (or *i*) and *a is preserved as such. The development of *ə to *e is fairly easy to explain: *e may be assumed to have been the normal allophone of *ə under stress. A typological parallel may be observed in the Northwest Caucasian languages Ubykh and Circassian, where ə becomes *e* under stress. For the latest period of development, namely, the period directly before the emergence of the non-Anatolian daughter languages, the traditional system of five long and short vowels is surely correct. Finally, there is little indication that Nostratic had phonemic long vowels. Therefore, long vowels may be assumed to have arisen solely in Indo-European proper.

6.5 *Indo-European consonantism*

There are internal inconsistencies in the traditional reconstruction of the Indo-European stop system that make that system highly improbable from a typological point of view. In order to address these problems, Thomas Gamkrelidze and Vjačeslav Ivanov, on the one hand, and Paul Hopper, on the other, independently proposed, in 1972 and 1973 respectively, a radical

reinterpretation of the Indo-European stop system. According to Gamkrelidze, Ivanov, and Hopper, the traditional plain voiced stops are to be reinterpreted as glottalized stops (that is, ejectives). Furthermore, according to the version of the theory proposed by Gamkrelidze and Ivanov, the traditional plain voiceless stops are to be reinterpreted as voiceless aspirates, while the traditional voiced aspirates are to remain unchanged. In this revised interpretation, aspiration is viewed as a phonemically redundant feature, and the phonemes in question could also be realized as allophonic variants without aspiration. Strong support for this theory is provided by comparison of Indo-European with Kartvelian and Afroasiatic, both of which have a three-way contrast, in the series of stops and affricates, of voiceless (aspirated) ~ glottalized ~ voiced. According to my views on Nostratic, though not according to the views of Illič-Svityč and Dolgopolsky, the Indo-European glottalized stops (the traditional plain voiced stops) correspond exactly to glottalized stops in Kartvelian and Afroasiatic, while the voiceless (aspirated) stops in Indo-European correspond to identical sounds in Kartvelian and Afroasiatic, and the voiced (aspirated) stops of Indo-European correspond to voiced stops in Kartvelian and Afroasiatic. It should be noted that the voiced aspirates were probably a late development in Indo-European, and this series may be assumed to have originally been characterized by plain voicing, without aspiration. (For an excellent survey of the Glottalic Theory, cf. Salmons 1993.)

Traditional Indo-European			Gamkrelidze-Ivanov		
p	b	bh	p[h]	p'	b[h]
t	d	dh	t[h]	t'	d[h]
k	g	gh	k[h]	k'	g[h]
k^w	g^w	g^wh	k^w[h]	k'^w	g^w[h]

Not only have we barely scratched the surface in this short survey, there are whole areas that have not even been touched upon — noun morphology and the question of homelands, for example (both of these are discussed in my most recent book [Bomhard 1996]). Yet, enough has been given to show that comparison of Proto-Indo-European with other Nostratic languages can add a new dimension to our understanding of Indo-European prehistory.

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Appendix 1: The Distribution of Nostratic Pronoun Stems

A. Personal Pronoun Stems

Proto-Nostratic	Proto IE	Proto-Kartvelian	Proto-Afrasian	Proto-Uralic	Proto-Dravidian	Proto-Altaic	Sumerian
**mi-/*me-* (1st sg.)	**me-/ *mo-*	**me-, *men-*	**m[i]-*	**me*		**mi* (> **bi*)	*ma(-e), me-a, me-e*
**ma-/*mə-* (1st pl. incl.)	**-me-/ *-mo-*		**ma-*	**me*		**ma-* (> **ba-*)	*-me*
**wa-/*wə-* (1st pl.)	**we-/ *wo-; *wey-*		**wa-*				
**na-/*nə-* (1st pl.)	**ne-/ *no-; *n̥-s-*		**na-*		**năm-*		
**tʰi-/ *tʰe-* (2nd sg.)	**tʰŭ, *tʰe-*		**ti-*	**te*		**ti, *ta*	*za-e, -zu*

NOTES:

1. Indo-European: The 1st sg. stem **mi-/*me-* is used in the oblique cases (except in the Celtic branch, where it has spread into the nominative as well); the 1st pl. inclusive stem **ma-/*mə-* is preserved in 1st person plural verb endings; the 1st pl. stem **wa-/*wə-* is preserved as an independent 1st person plural pronoun stem and in 1st person dual and/or plural verb endings; the 2nd sg. reconstructions **tʰŭ*, **tʰe-* represent later, Post-Anatolian forms.
2. Kartvelian: The 1st pl. stem **na-/*nə-* is found in Svan *näj* 'we'.
3. Afrasian: The 1st sg. stem **mi-/*me-* and 1st pl. inclusive stem **ma-/*mə-* are found only in Chadic as independent pronouns; the 1st sg. stem **mi-/*me-* serves as the basis of the 1st sg. verbal suffix in Highland East Cushitic; the 1st pl. stem **wa-/*wə-* is found in Egyptian and Chadic (in Egyptian, *wy* means 'I, me').

4. Elamo-Dravidian: The 2nd sg. stem **tʰi-/*tʰe-* is found in Elamite in the 2nd sg. and pl. verb ending *-t* and in Dravidian in the Parji appositional marker *-t* of the 2nd sg. in pronominalized nouns and as a verb suffix of the 2nd sg.
5. Altaic: The 1st sg. stem **mi-* has become *bi* 'I' in the Altaic daughter languages, while the 1st pl. stem **ma-* has become *ba* in Mongolian (= 1st pl. exclusive); the initial **m-* is preserved in the oblique cases, however; the 2nd sg. stem **tʰi-* has become *či* 'you' in Mongolian.
6. Sumerian: *ma(-e), me-a, me-e* 'I' are Emesal forms; *-me* is a 1st pl. possessive suffix, 'our'; *-zu* is a 2nd sg. possessive suffix, 'your'.
7. Etruscan: The 1st sg. stem **mi-/*me-* is preserved in (nominative) *mi* 'I', (accusative) *mini* 'me'; the 2nd sg. stem may be preserved in the pronoun stem *θi*, but this is uncertain since the meaning of the Etruscan form is unknown — however, the 2nd sg. stem **tʰi-/*tʰe-* is clearly reflected in the Etruscan verbal imperative endings *-ti*, *-θ*, *-θi*.
8. Chukchi-Kamchatkan: The pronouns of the 1st and 2nd persons sg. and pl. are as follows in Chukchi:

	Singular	Plural
1	**γə-m**	**mu-***ri*
2	**γə-t**	**tu-***ri*

9. Gilyak: The 1st pl. inclusive stem **ma-/*mə-* is preserved in the 1st pl. inclusive pronoun *me-r* 'we' (note also 1st dual *mẹ-gi*); the 2nd sg. stem **tʰi-/*tʰe-* is preserved in the 2nd sg. pronoun *či* 'you'.
10. Eskimo-Aleut: The 1st sg. stem **mi-/*me-* is preserved in the West Greenlandic 1st sg. relative possessive suffix *-ma*, while the 2nd sg. stem **tʰi-/*tʰe-* is preserved in the 2nd sg. absolutive possessive suffix *-(i)t*. The plural forms are *-ma* and *-tit* respectively.

B. Demonstrative Pronoun Stems

Proto-Nostratic	Proto IE	Proto-Kartvelian	Proto-Afrasian	Proto-Uralic	Proto-Dravidian	Proto-Altaic	Sumerian
**sa-/*sə-*	**so-*	**s$_1$-*		**sä*			
**tʰa-/ *tʰə-* (proximate)	**tʰo-*		**ta-*	**ta; *tä*	**tă̈n-*	**te-*	
**tʰu-/ *tʰo-* (distant)	**tʰo-*		**tu-*	**to*			
**kʰa-/ *kʰə-*	**kʰe-, *kʰo-, *kʰi-*	**-k-*	**ka-*				
**dʸi-/*dʸe-*	**-dʰe*		**dʸi-*	**tʸi-/*tʸe-*			
**ʔi-/*ʔe-*	**ʔe-/*ʔo-; *ʔey-/ *ʔoy-/ *ʔi-*	**i-, *e-* (distant)		**e*	**ǐ-* (proximate)	**i-, *e-* (proximate)	
**ʔa-/*ʔə-*	**ʔe-/*ʔo-*	**a-, *e-* (proximate)			**ă-* (distant)	**a-* (distant)	
**na-/*nə-, *ni-/*ne-, *nu-/*no-*	**ne-/*no-*		**na-*	**na, *nä* **no*			*ne-en, ne(-e)*

NOTES:

1. Indo-European: The stem **dʸi-/*dʸe-* is only preserved as a suffixed particle **-dʰe*; the stem **ne-/*no-* has a derivative **ʔe-no-/*ʔo-no-*.
2. Altaic: The stem **tʰa-/*tʰə-* is used as the distant demonstrative in Altaic: Mongolian (nom. sg.) *tere* (< **te-r-e*) 'that', (nom. pl.) *tede* 'those'; Tungus (Solon) *tari* 'that'; Manchu *tere* 'that'.

3. Sumerian: The demonstrative stem **ʔi-/*ʔe-* is found in *e* 'hither, here'.
4. Etruscan: The proximate stem **tʰa-/*tʰə-* is preserved in *ita, ta* 'this'; the stem **kʰa-/*kʰə-* is preserved in *eca* (archaic *ika*), *ca* 'this'.
5. Gilyak: The proximate stem **tʰa-/*tʰə-* is preserved in (proximate) *tıd* 'this'; the stem **kʰa-/*kʰə-* is preserved in *kud* 'that'.
6. Eskimo-Aleut: The stem **tʰa-/*tʰə-* is preserved in the Inuit (also called Inupiaq) prefix *ta-*, which may be added to any demonstrative form whose coreferent has already been focused.

C. Relative and Interrogative Stems

Proto-Nostratic	Proto-IE	Proto-Kartvelian	Proto-Afrasian	Proto-Uralic	Proto-Dravidian	Proto-Altaic	Sumerian
**kʷʰi-/* **kʷʰe-* (relative)	**kʷʰe-/* **kʷʰo-/* **kʷʰi-*			**ki*, **ke*		**ki-*, **ke-*	
**kʷʰa-/* **kʷʰə-* (inter.)	**kʷʰe-/* **kʷʰo-/* **kʷʰi-*		**kʷa-*	**ku*, **ko*		(**ki-*, **ke-*)	
**mi-/*me-* (inter.)	**me-/*mo-*	**mi-*, **min-*	**mi-*	**mi*			
**ma-/*mə-* (relative)	**me-/*mo-*	**ma-*	**ma-*	(**mi*)			
**ʔay-*, **ʔya-* (relative and inter.)	**ʔyo-*		**ʔay(y)-*	**yo*	**yā-*	**yā-*	

NOTES:

1. Kartvelian: The relative / interrogative stem **ʔya-* is found in Svan (interrogative) *jär* 'who?', (relative) *jerwäj* 'who', (indefinite) *jer* 'somebody, something'.
2. Altaic: The interrogative stem **mi-/*me-* is found in the Turkish interrogative particles *mi*, *mı*, *mu*, *mü*.
3. Sumerian: The interrogative stem **mi-/*me-* occurs in *me-na-àm* 'when?', *me-a* 'where?', *me-šè* 'where to?'. The relative / interrogative stem **ʔay-*, **ʔya-* may be preserved in the interrogative stems *a-ba* 'who?' (animate) and *a-na* 'what?' (inanimate), if *a-* represents original **ya-*.
4. Chukchi-Kamchatkan: The interrogative stem **mi-/*me-* is preserved in *meŋin* 'who?'.
5. Eskimo-Aleut: The interrogative stem **kʷʰa-/*kʷʰə-* is preserved in the Proto-Eskimo interrogative pronoun **ki(na)* 'who?' and in **qaŋa* 'when?', **qavcit* 'how many?', **qaku* 'when (in future)?'. The interrogative stem **mi-/*me-* is preserved in the Proto-Eskimo enclitic particle **mi* 'what about?'.

Appendix 2: Nostratic Sound Correspondences

Proto-Nostratic	Proto-IE	Proto-Kartvelian	Proto-Afrasian	Proto-Uralic	Proto-Dravidian	Proto-Altaic	Proto-Eskimo
b- -b- pʰ- -pʰ- p'- -p'-	bʰ- -bʰ- pʰ- -pʰ- (p'-) (-p'-)	b- -b- p- -p- p'- -p'-	b- -b- p-, f- -p-, -f- p'- -p'-	p- -w- p- -p-	p- -pp-/-vv- p- -pp-/-v-	b- -b- pʰ- -pʰ- p- -b-	p- -v- p- -p-
d- -d- tʰ- -tʰ- t'- -t'-	dʰ- -dʰ- tʰ- -tʰ- t'- -t'-	d- -d- t- -t- t'- -t'-	d- -d- t- -t- t'- -t'-	t- -t- t- -t(t)- t- -t-	t- -ṭ (ṭ)- t- -t(t)- t- -t(t)-	d- -d- tʰ- -tʰ- t- -d-	t- -ð- t- -t- t- -t-
dʸ- -dʸ- tʸʰ- -tʸʰ- t'ʸ- -t'ʸ- sʸ- -sʸ-	dʰ- -dʰ- tʰ- -tʰ- t'- -t'- s- -s-	ǯg- -ǯg- čk- -čk- č'k'- -č'k'- šk- -šk-	dʸ- -dʸ- tʸ- -tʸ- t'ʸ- -t'ʸ- sʸ- -sʸ-	tʸ- -tʸ- tʸ- -tʸ- tʸ- -tʸtʸ- sʸ- -sʸ-	c- -c(c)- c- -c(c)- c- -c(c)- c- -c(c)-/-y-	ǯ- -ǯ-/-d- čʰ- -čʰ- č- -ǯ- s- -s-	c- -c- c- -c- c- -c-
ʒ- -ʒ- cʰ- -cʰ- c'- -c'- s- -s- z- -z-	dʰ- -dʰ- tʰ- -tʰ- t'- -t'- s- -s- s- -s-	ʒ- -ʒ- c- -c- c'- -c'- s- -s- z- -z-	ʒ- -ʒ- c- -c- c'- -c'- s- -s- z-' -z-	č- -č- č- -č- č- -č- s- -s- s- -s-	c- -c(c)- c- -c(c)- c- -c(c)- c- -c(c)-	ǯ- -ǯ-/-d- čʰ- -čʰ- č- -ǯ- s- -s- z- (?) -z- (?)	c- -c- c- -c- c- -c-

Proto-Nostratic	Proto-IE	Proto-Kartvelian	Proto-Afrasian	Proto-Uralic	Proto-Dravidian	Proto-Altaic	Proto-Eskimo
ǯ-	d^h-	ǯ-	ʒ-	č-	c-	ǯ-	c-
-ǯ-	-d^h-	-ǯ-	-ʒ-	-č-	-c(c)-	-ǯ-/-d-	-c-
$č^h$-	t^h-	č-	c-	č-	c-	$č^h$-	c-
-$č^h$-	-t^h-	-č-	-c-	-č-	-c(c)-	-$č^h$-	-c-
č'-	t'-	č'-	c'-	č-	c-	č-	c-
-č'-	-t'-	-č'-	-c'-	-č-	-c(c)-	-ǯ-	-c-
š-	s-	š-	s-	š-	c-	s-	
-š-	-s-	-š-	-s-	-š-	-c(c)-	-s-	
g-	g^h-	g-	g-	k-	k-	g-	k-, q-
-g-	-g^h-	-g-	-g-	-γ-	-k-	-g-	-γ-
k^h-	k^h-	k-	k-	k-	k-	k^h-	k-, q-
-k^h-	-k^h-	-k-	-k-	-k(k)-	-k(k)-	-k^h-/-g-	-k-, -q-
k'-	k'-	k'-	k'-	k-	k-	k-	k-, q-
-k'-	-k'-	-k'-	-k'-	-k-	-k(k)-	-g-	-k-, -q-
g^w-	g^{wh}-	gw/u-	g^w-	k-	k-	g-	k-, q-
-g^w-	-g^{wh}-	-gw/u-	-g^w-	-γ-	-k-	-g-	-γ-
k^{wh}-	k^{wh}-	kw/u-	k^w-	k-	k-	k^h-	k-, q-
-k^{wh}-	-k^{wh}-	-kw/u-	-k^w-	-k(k)-	-k(k)-	-k^h-/-g-	-k-, -q-
k'^w-	k'^w-	k'w/u-	k'^w-	k-	k-	k-	k-, q-
-k'^w-	-k'^w-	-k'w/u-	-k'^w-	-k-	-k(k)-	-g-	-k-, -q-
G-	g^h-	G-	G-	k-	k-	g-	k-, q-
-G-	-g^h-	-G-	-G-	-γ-	-k-	-g-	-γ-
q^h-	k^h-	q-	q-	k-	k-	k^h-	k-, q-
-q^h-	-k^h-	-q-	-q-	-k(k)-	-k(k)-	-k^h-/-g-	-k-, -q-
q'-	k'-	q'-	q'-	k-	k-	k-	k-, q-
-q'-	-k'-	-q'-	-q'-	-k-	-k(k)-	-g-	-k-, -q-
q'^w-	k'^w-	q'w/u-	q'^w-	k-	k-	k-	k-, q-
-q'^w-	-k'^w-	-q'w/u-	-q'^w-	-k-	-k(k)-	-g-	-k-, -q-
t͡ɬ^h-	k^h-	x-	t͡ɬ-	s^y-	c-	k^h-	ɬ-
-t͡ɬ^h-	-k^h-	-x-	-t͡ɬ-	-δ-	-k-	-k^h-/-g-	-ɬ-
t͡ɬ'-	k'-		t͡ɬ'-	$δ^y$-	t-	k-	
-t͡ɬ'-	-k'-		-t͡ɬ'-	-$δ^y$-	-t(t)-	-g-	

Proto-Nostratic	Proto-IE	Proto-Kartvelian	Proto-Afrasian	Proto-Uralic	Proto-Dravidian	Proto-Altaic	Proto-Eskimo
ʕ-	ʕfi-	Ø-	ʕ-	Ø-	Ø-	Ø-	Ø-
-ʕ-	-ʕfi-	-Ø-	-ʕ-	-Ø-	-Ø-	-Ø-	-Ø-
ħ-	ħh-	x-	ħ-	Ø-	Ø-	Ø-	Ø-
-ħ-	-ħh-	-x-	-ħ-	-Ø-	-Ø-	-Ø-	-Ø-
ʔ-	ʔ-	Ø-	ʔ-	Ø-	Ø-	Ø-	Ø-
-ʔ-	-ʔ-	-Ø-	-ʔ-	-Ø-	-Ø-	-Ø-	-Ø-
h-	h-	Ø-	h-	Ø-	Ø-	Ø-	Ø-
-h-	-h-	-Ø-	-h-	-Ø-	-Ø-	-Ø-	-Ø-
y-	y-	y-/Ø-	y-	y-	y-/Ø-	y-	y-
-y-	-y-		-y-	-y-	-y-	-y-	-y-
w-	w-	w-	w-	w-	v-/Ø-		v-
-w-	-w-	-w-	-w-	-w-	-v-		-v-
m-	m-	m-	m-	m-	m-	m-	m-
-m-	-m-	-m-	-m-	-m-	-m-	-m-	-m-
n-	n-		n-	n-	n-		n-
-n-	-n-	-n-	-n-	-n-	-n-/-ɳ-	-n-	-n-
n^y-	n-		n-	n^y-	ñ-	n^y-	
-n^y-	-n-		-n-	-n^y-	-ɳ-	-n^y-	
-ŋ-	-n-		-n-	-ŋ-	-ɳ-	-ŋ-	-ŋ-
l-	l-	l-	l-	l-	l-		l-
-l-	-l-	-l-	-l-	-l-	-l-	-l-	-l-
-l^y-	-l-	-l-	-l-	-l^y-	-l̩-	-l^y-	
r-	r-	r-	r-	r-			r-
-r-	-r-	-r-	-r-	-r-	-r-/-ɾ-	-r-	-r-
-r^y-	-r-	-r-	-r-	-r^y-	-ɾ-	-r^y-	

Proto-Nostratic	Proto-Indo-European	Proto-Kartvelian	Proto-Afrasian
i	i, e	i	i
ə	e, a, ə	e, i	i, u
u	u, o	u	u
e	e	e	e
a	a, o, ə	a	a
o	o	o	o
iy	ĭy, ey, ī, ē, ĭ	iy, i	iy
əy	ey, ay, ĭy, ĭ	ey, i	iy, uy
uy	ĭy, ī, ĭ	uy, i	uy
ey	ey, ĭy, ē, ĭ	ey, i	ey
ay	ay, oy, ĭy, ĭ	ay, i	ay
oy	oy, ĭy, ĭ	oy, i	oy
iw	ū, ŭw, ŭ	iw, u	iw
əw	ew, aw, ŭw, ŭ	ew, u	iw, uw
uw	ū, ō, ŭw, ow, ŭ	uw, u	uw
ew	ew, ŭw, ŭ	ew, u	ew
aw	ow, ŭw, ŭ	aw, u	aw
ow	ō, ow, ŭw, ŭ	ow, u	ow

Proto-Nostratic	Proto-Uralic	Proto-Dravidian	Proto-Altaic*	Proto-Eskimo
i	i	i	i, ï	i
ə	e	e	ɨ (ə) (?)	ə
u	ú	u	u, ü	u
e	e	e	e	i
a	a, ä	a	a, ä	a
o	o	o	o, ö	u
iy	iy, i	iy, ī		iy
əy	ey	ey, ē		əy
uy	uy	uy, ū		uy
ey	ey, e	ey, ē		iy
ay	ay, äy	ay, ā		ay
oy	oy	oy, ō		uy
iw	iw	iv, ī		iv
əw	ew	ev, ē		əv
uw	uw, u	uv, ū		uv
ew	ew	ev, ē		iv
aw	aw, äw	av, ā		av
ow	ow, o	ov, ō		uv

*Note: The developments of the sequences **iy*, **əy*, **uy*, **ey*, **ay*, **oy*, **iw*, **əw*, **uw*, **ew*, **aw*, **ow* in Proto-Altaic are unclear.