Diachronic Interpretation of Phonological Processes in Vowel and Consonant Systems: Bomhard’s Nostratic Tree Phylogeny for *pʰah- (~ *pʰəh-)

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ABSTRACT

The article outlines the procedure of diachronic interpretation of phonological processes in vowel and consonant systems of Nostratic *pʰah- (~ *pʰəh-) (Bomhard’s version) following the developed five stages research methodology. The phonological correspondences have been attested in the genetic data material, i.e., from the Nostratic etymon to the etymon at the group level, including the language correspondences at the level of a separate language, to establish phonological processes in vowel and consonant systems. It was proved that the tendency to the diachronic divergent-convergent phonological transitions are recorded based on some regulations, such as: the provisions of the Rask-Grimm law / the first movement of consonants and the consonant root. In contrast, the tendency to the diachronic convergent-divergent phonological coincidences have been recorded based on some regulations, such as: the complete/partial coincidence of vowel phonemes according to the following characteristics: (a) tongue position, (b) mouth position, (c) labialisation/delabialisation (e.g., the provisions of the quantitative reduction of vowel phonemes), as well as consonant phonemes according to the following characteristics: (a) place and manner, (b) voice and noise. Thus, the hypothesis of the importance of phonological processes in vowel and consonant systems has been proved to be a key criterion in demonstrating the relationships among Nostratic constructs in the following Nostratic tree phylogeny: an etymon at the macrofamily level – an etymon at the family level – an etymon at the group level – the genetic data material.

KEYWORDS
diachronic interpretation, phonological processes, vowel system, consonant system, Nostratic etymon, Nostratic tree phylogeny

HOW TO CITE?
1. Introduction

Linguistic Macro-Comparative Studies once again refer to the developments of Nostratic linguistics, particularly focusing on phonological regularities or, more precisely, diachronic phonological laws that work to prove or disprove the prevalence of close or distant degrees of kinship between languages.

This formulation of the problem in the second half of the 20th century prompted representatives of Nostratic linguistics to revise the critical principles of language affinity (Tsereteli, 1968) and propose a slightly different methodology for studying the mass language affinity (Greenberg, 1987; Ringe, 2006; Starostin, 2013), referred to as **diachronic interpretation**. The term was introduced by its author O. Szemerényi (2002) and adopted by his followers (Dronova, 2012; Klimov, 1985) to denote "a further step in the reconstruction of etymons", aimed at involving the so-called pre-protolanguages: the ancestral states of the second (family etymon) and even more chronologically distant order [...] (Klimov, 1988, pp. 9-16).

The term "diachronic interpretation" is currently in the process of establishing its scientific scope since, during its testing, scholars of Macro-Comparative Studies have also used synonyms, such as "distant reconstruction", "further analysis" (German *weitere Analyse*) (Klimov, 1988), "reconstructive analysis" (Dyenl, 1969), "proto-reconstruction" (German *Prarekonstruktion* (Penzl, 1978)). However, we consider the term "diachronic interpretation" to be the most suitable for demonstrating the Nostratic affinity of languages. At this stage of etymological research, the scholar doesn't work with the actual linguistic substrate required for reconstruction (using the procedures of the comparative-historical method) at the level of the language family, but rather operates with archetypes from various language families (Neroznak, 1988) and aims to deepen the diachronic perspective of the study by examining more chronologically distant periods of proto-language states.

2. Literature Review

In contemporary Nostratic linguistics, the results of etymological analysis from various Nostratic versions are utilized, sourced from the following references: (1) "On the Universal
Relationship of Languages" (Russian "О всеобщем родстве языков") by Melnychuk (1991); (2) "Experience of Comparing Nostratic Languages (Semitic-Hamitic, Kartvelian, Indo-European, Uralic, Dravidian, Altaic)" (Russian "Опыт сравнения ностратических языков (семито-хамитский, картвельский, индоевропейский, уральский, дравидийский, алтайский)") by Illich-Svitych (1971, 1976, 1984); (3) "The Nostratic Macrofamily: A Study in Distant Linguistic Relationship" by Bomhard and Kerns (1994); (4) "Nostratic Dictionary" by Dolgopolsky (2012); (5) The International Internet Project "The Global Lexicostatistical Database 'Tower of Babel'" by Starostins (2006-2013); (6) "A Comprehensive Introduction to Nostratic Comparative Linguistics with Special Reference to Indo-European" by Bomhard (2018).

The preliminary analysis of the literature also showed that the determination of the degree of relationship of Nostratic languages is based on the following approaches: (1) phonological change, which reflects the regularity of phonological patterns that correspond to the phonologisation of allophonic variation (Abayev, 1933; Zhuravlyov, 1990; Toporov, 1992); (2) morphonological change, which reflects the result of morphonological shifts (Trubetsky, 1987); (3) semantic change: (a) semantic relations between lexi-co-semantic variants (LSV) that accompanied the phonological form; (b) semantic indisputability of LSV_1, LSV_2 ... LSV_n (Levytskyy, 2008).

3. Aim and Objectives

The article aims to perform the procedure of diachronic interpretation of phonological processes in vowel and consonant systems for Nostratic *pʰaŋ- (~ *pʰəŋ-) (according to Bomhard’s version) based on the developed research methodology. It also aims to present the main results on the Nostratic tree phylogeny in the following sequence: an etymon at the macrofamily level – an etymon at the family level – an etymon at the group level – the genetic data material.

The objectives of the article are as follows:

– to analyze the Nostratic etymons for *pʰaŋ- (~ *pʰəŋ-) and conduct a preliminary analysis;
4. Methods

The article presents a novel methodological algorithm for the elaboration of Nostratic versions, termed as "diachronic interpretation of a Nostratic version". While the focus is primarily on the phonological level, the primary attention is directed towards five stages of diachronic phonological interpretation (referred to as DPI), encompassing proto-language correspondences. These stages extend from the Nostratic etymon to the etymon at the group level. Conversely, language correspondences at the level of each language are also examined to identify phonological processes within vowel and consonant systems.

The first stage is aimed at conducting DPI for vowel and/or consonant phonemes to determine phonetic and phonological characteristics. For vowel phonemes (including monophthongs and diphthongs), this includes specifying a tongue (and if necessary, the short/long feature) and mouth positions. For consonant phonemes, characteristics such as place and manner of articulation are noted, including attributes like voiceless/voiced and sonority.

At the second stage, DPI of alternations (if available) is executed to identify hypothetical modifications or mutations of vowel and/or consonant phonemes.

At the third stage, we conducted a DPI of modifications/mutations of vowel and/or consonant phonemes to establish regularities observed within one language; regular correspondence of sounds in the exact words in two or more related languages or dialects; regular correspondence of sounds of the same language at different stages of its history (Abayev, 1933, pp. 1–14). If for vowel system we establish: (a) by tongue position: front, central, back shifts in horizontal level; (b) by mouth position: close, middle, open shifts in vertical level;
(c) by labialisation/delabialisation: labialisation (labialised), delabialisation (unlabialised); then for consonant system: (a) by place of articulation: labial, anterolingual, dorsal, guttural, glottal consonants; (b) by manner of articulation: nasal, breakthrough, implosive, etc. consonants; (c) processes by voice and noise: voiced/voiceless/sonority.

At the fourth stage, the DPI of the ictus(s) (if available) was carried out to establish prosodic-accentual processes, where the accent is the selection of a particular unit in a language/proto-language in a sequence of homogeneous units by phonetic means. Typically, these processes are graphically recorded in a Nostratic version.

At the fifth stage, the DPI of divergent-convergent/convergent-divergent phonological transitions were conducted at macro-, micro-, and cross-cutting levels, aiming to establish the development (probably evolutionary) of phonological processes in vowel and consonant systems.

5. Results

Today, Nostratic linguistics has attained the status of an independent science, complete with its own terminological framework, encompassing fundamental scientific concepts. The key concepts include the following: Nostratic macrofamily: A hypothetical language family encompassing six (Illich-Svitych, 1971, 1976, 1984) or even more (Bomhard, 2018) language families across Eurasia and Africa (Dybo, 1989; Peiros, 1997); Nostratic proto-language: a diachronically interpreted virtual pre-proto-language entity serving as the original foundation for language families bearing Nostratic status; Nostratic etymon: a descriptor for fragments of pre-proto-language reality, applied to reconstructed etymons within families, such as Altai, Afro-Asiatic, Eskimo-Aleut, Indo-European, Dravidian, Kartvelian, and Uralic. This term denotes the theoretically and practically formalized hypothetical phonological, morphonological, and semantic structure at the pre-proto-language level.

The status of this science is delineated by its research method. In the realm of Nostratic linguistics, the method of choice is diachronic interpretation (as introduced by O. Szemerényi) – a systematic approach to working with genetic material. This process encompasses two primary aspects, which involve, firstly, "a further step in the reconstruction of etymons"
Acta Humanitatis
Volume 1 Issue 1 (2023): 15-36
https://doi.org/10.5709/ah-01.01.2023-02
RESEARCH ARTICLE

(Klimov, 1988), aimed at involving the so-called pre-protolanguages: proto-language states of the second (etymon at the level of a family) and more chronologically distant order, and secondly, the presentation of its results in the form of phonological, morphonological and semantic transitions and coincidences.

The Nostratic version documented in sources focusing on Nostratic etymologies is a logically coherent text. Its interpretation enables the understanding and assimilation of crucial scientific information regarding the Nostratic etymon, its reconstructed reflexes, and genetic data (Holman, 2008). To validate this assertion, let us examine the outcomes of a diachronic interpretation of the Nostratic version for *pʰaħ- (~ *pʰəħ-), presented in "Comprehensive Introduction to Nostratic Comparative Linguistics: with special reference to Indo-European" (A. R. Bomhard).

The diachronic interpretation of a Nostratic version is the process and result of explaining a Nostratic etymon by studying its vertical and horizontal relations with genetically similar correspondences in the Nostratic languages. To interpret a Nostratic etymon means scientifically arguing that this pre-proto-language object is subject to the action of phonological, morphonological, and semantic laws (one or a set of laws).

Nostratic *pʰaħ- (~ *pʰəħ-) was formed based on the following etymons reconstructed at the level of the following families: Afro-Asiatic *f[a]h-, Indo-European *pʰéhh-ur- [*pʰáhh-ur-], *pʰəhh-wór-, and Kartvelian *px-, each of which reflects specific laws and regulations (see Appendix A).

Nostratic *pʰah- (~ *pʰəh-) reflects phonological processes in vowel system: (a) by tongue position: we record a central shift for *a (Nostratic *pʰah- (~ *pʰəh-)), *ə (Nostratic *pʰah- (~ *pʰəh-)); (b) by mouth position: we record an open shift for *a (Nostratic **pʰah- (~ *pʰəh-)), the middle shift for *ə (Nostratic *pʰah- (~ *pʰəh-)); (c) by labialisation/delabialisation: we record the delabialised *a (Nostratic *pʰah- (~ *pʰəh-)), *ə (Nostratic *pʰah- (~ *pʰəh-)).

The proto-language correspondences of Afro-Asiatic *f[a]h-, Indo-European *pʰéhh-ur- [*pʰáhh-ur-], *pʰəhh-wór- reflect phonological processes in vowel system: (a) by tongue

The Nostratic *[pʰ]ah- (~ *[pʰ]əh-) reflects the phonological processes in consonant system: (a) by place and manner of articulation: while at the beginning of the GMS, we record bilabial breakthrough *[p], at the end of the GMS – pharyngeal fricative *[h]; (b) by voice and noise: we record voiceless consonants both at the beginning of the GMS for *[p] and at the end of the GMS for *[h] (the beginning of the GMS: Nostratic *[pʰ]ah- (~ *[pʰ]əh-); the end of the GMS: Nostratic *[pʰ]ah- (~ *[pʰ]əh-)).


Afro-Asiatic *[f][a]h- reflects the phonological processes in vowel system: (a) by tongue position: we record a central shift for *a; (b) by mouth position: we record an open shift for *a; (c) by labialisation/delabialisation: we record a delabialised *a (Afro-Asiatic *[f][a]h-).

The proto-language correspondences of Semitic *pah-am, Central Chadic *ʔa-[wa]- reflect the phonological processes in vowel system: (a) by tongue position: we record a central shift...
for *a; (b) by mouth position: we record an open shift for *a; (c) by labialisation/delabialisation: we record delabialised *a (Semitic *pah-am, Central Chadic *ʔa-f[wa]-).

Afro-Asiatic *f[a]h- reflects the phonological processes in consonant system: (a) by place and manner of articulation: if at the beginning of the GMS, we record labiodental fricative *f, then at the end of the GMS – pharyngeal fricative *h; (b) by voice and noise: we record voiceless consonants both at the beginning of the GMS for *f and at the end of the GMS for *h (the beginning of the GMS: Afro-Asiatic *f[a]h-; the end of the GMS: Afro-Asiatic *f[a]h-).

The proto-language correspondences of Semitic *pah-am, Central Chadic *ʔa-f[wa]- allow us to record the phonological processes in consonant system: (a) by place and manner of articulation: if at the beginning of the GMS, we record bilabial breakthrough *p (Semitic *pah-am), glottal breakthrough *ʔ (Central Chadic *ʔa-f[wa]-), at the end of the GMS – pharyngeal fricative *h (Semitic *paħ-am), labiodental fricative *f (C Central Chadic *ʔa-f[wa]-); (b) by voice and noise: we record voiceless consonants both at the beginning of the GMS for *ʔ, *p and at the end of the GMS for *f, *h (the beginning of the GMS: Semitic *pah-am, Central Chadic *ʔa-f[wa]-; the end of GMS: Semitic *pah-am, Central Chadic *ʔa-f[wa]-).

The root in Semitic *pah-am corresponds to the CVC structure because, according to J. Huenergard (2008), "the occurrence of two or more consonants at the beginning and end of a word, the occurrence of three or more consonants, the occurrence of two or more vowels, and the presence of long vowels in closed syllables" were not allowed (p. 231). Although the correlates of three consonants prevailed, from the historical perspective, three-consonant roots evolved from two-consonant roots (internal and external reconstruction data evidence this). In order to obtain a specific grammatical form, certain vowels were inserted between the consonants of the root, as demonstrated by both Afro-Asiatic *f[a]h- and Semitic *pah-am. At the same time, certain restrictions were imposed on the structure of the root: roots with the same first and second consonants were impossible, and roots with the same first and third consonants were extremely rare (Huenergard, 2008, p. 233).
Most Afro-Asiatic languages have a similar consonant system. The initial group compmouth positions pharyngeal-fricative consonants, including the *h in Sam *pah-am. The second group closely resembles the pharyngeal fricative consonants category, but phonetically exhibits distinct articulations, such as differences in the airflow passage. In Semitic and Chadic languages, consonants exhibit unconventional types of airflow: breakthrough glottalised glottis, ejective glottis, and internal glottis. The glottalised hamzah bow ’ is utilized as a separate consonant. For Sam, a significant attribute is a transfix that dissects the root into distinct sounds, broken down into sound components (Stolbova, 2007). Furthermore, the fixation of the bilabial glottal breakthrough *p in Semitic *pah-am and the glottal breakthrough *ʔ in Central Chadic *ʔa-[wa]- testifies to the effect of the process of debuccalisation, a phonetic process, law or phenomenon in which a consonant sound loses its original place of origin and turns into a glottal slit [h], a glottal fissure [ʔ] or similar sounds. In Semitic languages, the laryngeal fissure is usually a complete phoneme (Blevins, 1994).

The Indo-European *p’héh-ur- [*p’áhh-ur-], *p’həhh-wór- reflects the phonological processes in vowel system: (a) by tongue position: we record a frontal shift for *e (Indo-European *p’héh-ur-) / central shift for *a (Indo-European *p’héh-ur- [*p’háhh-ur-]), *ə (Indo-European *p’həhh-wór-); (b) by mouth position: we record a(an) middle shift for *e (Indo-European *p’héh-ur-), *ə (Indo-European *p’həhh-wór-), open shift for *a (Indo-European *p’héh-ur- [*p’háhh-ur-]); (c) by labialisation/delabialisation: we record delabialised *a (Indo-European *p’héh-ur- [*p’háhh-ur-]), *e (Indo-European *p’héh-ur-), *ə (Indo-European *p’həhh-wór-).

The Indo-European *p’héh-ur- [*p’áhh-ur-], *p’həhh-wór- reflects the phonological processes in consonant system: (a) by place of articulation: while at the beginning of the GSM, we record bilabial breakthrough *pʰ, at the end of the GSM – pharyngeal fricative *h; (b) by voice and noise: we record voiceless consonants both at the beginning of the GSM for *pʰ and at the end of the GSM for *h (the beginning of the GSM: Indo-European *p’héh-ur- [*p’áhh-ur-], *p’həhh-wór-; yje end of the GSM: Indo-European *p’héh-ur- [*p’áhh-ur-], *p’həhh-wór-).
The Kartvelian *px- reflects the phonological processes in consonant system: (a) by place of articulation: while at the beginning of the GSM, we record bilabial breakthrough *p, at the end of the GSM – velar fricative *x; (b) by voice and noise: at the beginning and the end of the GSM we record voiceless *p and *x (the beginning of the GSM: Kartvelian *px-; the end of the GSM: Kartv *px-). Thus, the initial constructions in Kartvelian could be characterised by primary labiality, which is demonstrated by the analysed form of Kartvelian *px-, where the bilabial breakthrough *p (Klimov, 1964). At the same time, Kartvelian *px- corresponds to the provision of a two-phoneme harmonic group of consonants of the decisive series, the essence of which is as follows: labial or noisy frontal + velar or uvular with laryngeal feature.

6. Discussion

The procedure of diachronic interpretation of the Nostratic *pʰəh- (≈ *pʰəh-) reflects transitions and coincidences at the vertical and horizontal trajectories. We are going to outline the main characteristics at the vertical level.

At the vertical level No. 1, we may record the regulations in vowel and consonant systems between Nostratic *pʰəh- (≈ *pʰəh-) and Afro-Asiatic *[a]ɪh-, Indo-European *pʰɛh-ur-* [pʰáh-ur-], *pʰəh-wőr-, Kartvelian *px-.

In terms of vowel system, it is possible to establish: (1) the diachronic divergent-convergent phonological transitions in the processes by tongue position: central shift for *a: Nostratic *pʰəh- (≈ *pʰəh-) ∆ *a: Nostratic *pʰəh- (≈ *pʰəh-) > frontal shift for *e: Indo-European *pʰɛh-ur-; (2) the diachronic convergent-divergent phonological coincidences in the following processes: (a) by tongue position: central shift for *a > *a: Nostratic *pʰəh- (≈ *pʰəh-) > Afro-Asiatic *[a]ɪh-; Indo-European *pʰɛh-ur-* [pʰáh-ur-] / *ə > *ə: Nostratic *pʰəh- (≈ *pʰəh-) > Indo-European *pʰəh-wőr-; (b) by mouth position: open shift for *a: Nostratic *pʰəh- (≈ *pʰəh-) > *a: Afro-Asiatic *[a]ɪh-; Indo-European *pʰɛh-ur-* [pʰáh-ur-] / middle shift for *a: Nostratic *pʰəh- (≈ *pʰəh-) > *e: Indo-European *pʰɛh-ur- / *ə: Indo-European *pʰəh-wőr-; (c) by labialisation/delabialisation: delabialised *a: Nostratic *pʰəh- (≈ *pʰəh-) > *a: Afro-Asiatic *[a]ɪh-; Indo-European *pʰɛh-ur-* [pʰáh-ur-] / *ə: Nostratic *pʰəh- (≈ *pʰəh-) > *e: Indo-European *pʰɛh-ur- / *ə: Indo-European *pʰəh-wőr-.
The presence of a central open vowel *a in Nostratic *pʰah- (~ *pʰəh-) and/or a central middle vowel *ə in Nostratic *pʰah- (~ *pʰəh-) is explained by the distributional characteristics of the phonemes surrounding it: the initial consonant *pʰ is breakthrough, so the transition of the mentioned phonemes to *e in Indo-European *pʰéh-ur- is caused by the influence of the initial bilabial *pʰ (Fortson, 2004, p. 61–62).

In terms of consonant system, it is possible to establish: (1) the diachronic divergent-convergent phonological transitions in the processes: (a) by place and manner of articulation: the beginning of the GMS: bilabial breakthrough *pʰ: Nostratic *pʰah- (~ *pʰəh-) > labiodental fricative *f: Afro-Asiatic *[f]h-, which allows to trace the provisions of the Rask-Grimm law, or the first consonantal movement, which, although a phonetic law in Germanic, consisted in the change of proto-Germanic occlusive consonants (Campbell, 1998, pp. 46-47), however, it can be traced in the analyzed example; (b) by the place of articulation: the end of GMS: pharyngeal *h: Nostratic *pʰah- (~ *pʰəh-) > velar *x: Kartvelian *px-; (2) the diachronic convergent-divergent phonological coincidences in the processes: (a) by place and manner of articulation: the beginning of GMS: bilabial breakthrough *p > *p: Nostratic *pʰah- (~ *pʰəh-) > Kartvelian *px-, Indo-European *pʰéh-ur- [*[pʰáh-ur-], *pʰəh-wór-]; end of GMS: pharyngeal fricative *h > *h: Nostratic *pʰah- (~ *pʰəh-) > Afro-Asiatic *[f]h-; Indo-European *pʰéh-ur- [*[pʰáh-ur-], *pʰəh-wór-; (b) by the manner of articulation: the end of GMS: fricative *h > *x: Nostratic *pʰah- (~ *pʰəh-) > Kartvelian *px-; (c) by voice and noise: the beginning of GMS: voiceless *pʰ: Nostratic *pʰah- (~ *pʰəh-) > *f Afro-Asiatic *[f]h-, *p: Kartvelian *px-, *pʰ: Indo-European *pʰéh-ur- [*[pʰáh-ur-], *pʰəh-wór-; the end of GMS: voiceless *h: Nostratic *pʰah- (~ *pʰəh-) > *h: Afro-Asiatic *[f]h-; Indo-European *pʰéh-ur- [*[pʰáh-ur-], *pʰəh-wór-, *x: Kartvelian *px-.

Some etymons, in particular, Afro-Asiatic *[f]h-, Indo-European *pʰéh-ur- [*[pʰáh-ur-], *pʰəh-wór-, Kartvelian *px-, demonstrate the transition of consonants within the labial class, where labiodental *f could be transformed into bilabial *p. According to Gamkrelidze and Ivanov, it "could have resulted from a long interaction of these languages within a certain area unity – a union of languages" (Gamkrelidze & Ivanov 1984, p. 871). Scholars admit that some
words could have been positioned from Afro-Asiatic into Kartvelian and possibly from Indo-European (Ibid., pp. 878-879), where contacts between Afro-Asiatic and Kartvelian took place in the Central and Western Transcaucasia. At the same time, the only Afro-Asiatic culture in the Caucasus was probably the Maikop culture, which is archaeological evidence of the presence of a Semitic-speaking population within and near the borders of the common Kartvelian homeland.

At the vertical level No. 2, we may record the regulations in vowel and consonant systems between Afro-Asiatic *f[a]h- and Semitic *pah-am; Central Chadic *ʔa-f[wa]-.

In terms of vowel system, it is possible to establish: the diachronic convergent-divergent phonological coincidences in the following processes: (a) by tongue position: central shift for *a: Afro-Asiatic *f[a]h- > *a: Semitic *pah-am; Central Chadic *ʔa-f[wa]-; (b) by mouth position: lower shift for *a: Afro-Asiatic *f[a]h- > *a: Semitic *pah-am; Central Chadic *ʔa-f[wa]-; (c) by labialisation/delabialisation: delabialised *a: Afro-Asiatic *f[a]h- > *a: Semitic *pah-am; Central Chadic *ʔa-f[wa]-.

In terms of consonant system, it is possible to establish: (1) the diachronic divergent-convergent phonological transitions in the following processes: (a) by place and manner of articulation: the beginning of the GMS: labiodental fricative *f: Afro-Asiatic *f[a]h- > bilabial breakthrough *p: Semitic *pah-am; (2) the diachronic convergent-divergent phonological coincidences in the following processes: (a) by place and manner of articulation: the end of GMS: pharyngeal fricative *h: Afro-Asiatic *f[a]h- > *h: Semitic *pah-am; (b) by voice and noise: the beginning of the GMS: glottal *f: Afr *f[a]h- > *ʔ: Central Chadic *ʔa-f[wa]-, *p: Semitic *pah-am; the end of the GMS: voiceless *h: Afro-Asiatic *f[a]h- > *h: Semitic *pah-am, *f: Central Chadic *ʔa-f[wa]-.

At the vertical level No. 2, we may record the regulations in vowel and consonant systems between Semitic *pah-am, Central Chadic *ʔa-f[wa]- and their genetic correspondences.

In terms of vowel system, it is possible to establish: (1) the diachronic divergent-convergent phonological transitions between Semitic *pah-am and genetic correspondences.
based in the following processes: (a) by tongue position: central shift for *a: Semitic *pah-am > front shift for e: Hebrew peḥām, Harari feḥama; (b) by mouth position: open shift for *a: Semitic *pah-am > middle shift for e: Hebrew peḥām, Harari feḥama / ə: Ge’ez/Ethiopian fāḥm, Argobba fāḥem; (2) the diachronic convergent-divergent phonological coincidences in the following processes: (a) by tongue position: central shift for *a: Semitic *pah-am > a: Syriac pahmā, Arabic fāḥm, Tigré fāḥam, ə: Ge’ez/Ethiopian fāḥm, Argobba fāḥem; (b) by mouth position: open shift for *a: Semitic *pah-am > a: Syriac pahmā, Arabic fāḥm, Tigray fāḥam; (c) by labialisation/delabialisation: delabialised *a: Semitic *pah-am > a: Syriac pahmā, Arabic fāḥm, Tigré fāḥam, e: Hebrew peḥām, Harari feḥama, ə: Ge’ez/Ethiopian fāḥm, Argobba fāḥem.

In terms of consonantal system, it is possible to establish: (1) the diachronic convergent-phonological transitions in the following process: by place and manner of articulation: the beginning of the GMS: bilabial breakthrough *p: Semitic *pah-am > labiodental fricative f: Arabic fāḥm, Argobba fāḥem, Ge’ez/Ethiopian fāḥm, Tigray fāḥam, Harari feḥama; (2) the diachronic convergent-divergent phonological coincidences in the following processes: (a) by place and manner of articulation: the beginning of GMS: bilabial breakthrough *p: Semitic *pah-am > p: Syriac pahmā; the end of GMS: pharyngeal fricative *h: Semitic *pah-am > *h: Arabic fāḥm, Argobba fāḥem, Ge’ez/Ethiopian fāḥm, Syriac pahmā, Tigré fāḥam, Harari feḥama; (b) by voice and noise: the beginning of GMS: voiceless *p: Semitic *pah-am > voiceless f: Arabic fāḥm, Argobba fāḥem, Ge’ez/Ethiopian fāḥm, Tigré fāḥam, Harari feḥama, voiceless p: Syriac pahmā; the end of the GMS: voiceless *h: Semitic *pah-am > h: Arabic fāḥm, Argobba fāḥem, Ge’ez/Ethiopian fāḥm, Syriac pahmā, Tigré fāḥam, Harari feḥama.

In terms of vowel system, it is possible to establish: (1) the diachronic divergent-phonological transitions between Central Chadic *ʔa-f[wa]- and genetic correspondences in the following processes: (a) by tongue position: central shift for *a: Central Chadic *ʔa-f[wa]- > front shift for e: mbar fee / back shift for o: Logone fo; (b) by mouth position: open shift for *a: Central Chadic *ʔa-f[wa]- > middle shift for e: Mbara fee; o: Logone
fo; (c) by labialisation/delabialisation: delabialised *a: Central Chadic *?a-f[wa]- > labialised o; Logone fo; (2) the diachronic convergent-divergent phonological coincidences in the following processes: (a) by tongue position: central shift for *a: Central Chadic *?a-f[wa]- > a: Musgu afu, Guidar afa; (b) by mouth position: open shift for *a: Central Chadic *?a-f[wa]- > a: Musgu afu, Gidar afa; (c) by labialisation/delabialisation: delabialised *a: Central Chadic *?a-f[wa]- > a: Musgu afu, Gidar afa, e: Mbar fee.

In terms of consonant system, it is possible to establish: (1) the diachronic convergent phonological transitions in the following process: by place and manner of articulation: glottal breakthrough *?: Central Chadic *?a-f[wa]- > labiodental fricative f: Guidar afa, Logone fo, Mbar fee, Musgu afu; (2) the diachronic convergent-divergent phonological coincidences in the following processes: (a) by place and manner of articulation: labiodental fricative *f: Central Chadic *?a-f[wa]- > f: Hydar afa, Logone fo, Mbarah fee, Musgu afu; (b) by voice and noise: voiceless *?: Central Chadic *?a-f[wa]-, *f: Central Chadic *?a-f[wa]- > f: Hydar afa, Logone fo, Mbarah fee, Musgu afu.

At the vertical level No. 3, we may record the regulations in vowel and consonant systems between Indo-European *pʰéhh-ur- [*pʰáhh-ur-], *pʰəhh-wór- and genetic correspondences.

In terms of vowel system, it is possible to establish: (1) the diachronic convergent phonological transitions in the following processes: (a) by tongue position: front shift for *e: Indo-European *pʰéhh-ur- / central shift for *a: Indo-European *pʰéhh-ur- [*pʰáhh-ur-] / *ə: Indo-European *pʰəhh-wór- > back shift for o: Gothic fōn, Tocharian A por; u: Armenian hur, Greek πορ, Old English fūr, Old Icelandic fůrr, funi, Old Czech půř; (b) by mouth position: middle shift for *e: Indo-European *pʰéhh-ur- / *ə: Indo-European *pʰəhh-wór- / low shift for *a: Indo-European *pʰéhh-ur- [*pʰáhh-ur-] > high shift for i: Old High German fiur, Umbrian piř; u: Armenian hur, Greek πορ, Old English fūr, Old Icelandic fůrr, funi, Old Czech půř; (2) the diachronic convergent-divergent phonological coincidences in the following processes: (a) by tongue position: front shift for *e: Indo-European *pʰéhh-ur- > i: Old High German fiur, Umbrian piř / central shift for *a: Indo-European *pʰéhh-ur- [*pʰáhh-

Since *a in Indo-European *[pʰáh]-ur- and *e in Indo-European *[pʰeːh]-ur- are located before the bilabial breakthrough [p] and the glottal fricative *[h], this change can be explained by the fact that the quantitative origin of the change from *a into *e depends on the preceding segment. As a result, such a distribution established by Rasmussen receives a better phonetic motivation (Asingh et al., 1989, p. 139ff.). The transition of *a: Indo-European *[pʰáh]-ur- to *ɵ: Indo-European *[pʰəh]-wór- is explained by a quantitative reduction of vowels, i.e., a reduction in the length of the vowel that is unstressed. As a result, the unstressed final vowel loses its qualitative characteristics and turns into a null sound.

In addition, we notice that *a in Indo-European *[pʰáh]-ur- turns into *o in Gothic fōn, which indicates the peculiarities of the Germanic phonetic system. The main characteristic includes changes in a and o, which corresponds to the joint Germanic consonant movement (Waterman, 1976).

In terms of consonant system, it is possible to establish: (1) the diachronic divergent-convergent phonological transitions in the following processes: (a) by place and manner of articulation: the beginning of the GMS: bilabial breakthrough *[pʰ: Indo-European *[pʰeːh]-ur- *[pʰáh]-ur-], *[pʰəh]-wór- > labiodental fricative f: Gothic fōn, Old High German fiur, Old English fUr; (b) by voice and noise: the end of the GMS: voiceless *[h: Indo-European *[pʰeːh]-ur- *[pʰáh]-ur-], *[pʰəh]-wór- > sonorant n: Gothic fōn, Old Prussian panno, r: Old High German fiur, Old English fUr, Old Czech půř, Tocharian A por; (2) the diachronic convergent-divergent phonological coincidences in the following processes: (a) by place and manner of articulation: the beginning of GMS: bilabial breakthrough *[pʰ: Indo-European *[pʰeːh]-ur-
[\text{*p}^\text{h} \text{áh}-\text{ur}-], \text{*p}^\text{b} \text{éh}-\text{wór} \rightarrow \text{p}: \text{Greek} \ \tau \text{û}, \text{Old Prussian} \ \text{panno}, \text{Old Bohemian} \ \text{pûř}, \text{Luwian} \ \text{pa}-\text{áh}-\text{u}-\text{u}, \text{Tocharian A} \ \text{por}, \text{Hittite} \ \text{pa}-\text{aḥ}-\text{ḫu}-\text{ur}; \text{the end of GMS}: \text{pharyngeal fricative} \ *\text{h}: \text{Indo-European} \ \text{*p}^\text{h} \text{éh}-\text{ur}- \ [\text{*p}^\text{h} \text{áh}-\text{ur}-], \text{*p}^\text{b} \text{éh}-\text{wór} \rightarrow \text{ḥ}: \text{Luwian} \ \text{pa}-\text{aḥ}-\text{ḫu}-\text{u}, \text{Hittite} \ \text{pa}-\text{aḥ}-\text{ḫu}-\text{ur}; (b) \text{by voice and noise}: \text{the beginning of the GMS}: \text{glottal} \ *\text{h}: \text{Indo-European} \ \text{*p}^\text{b} \text{éh}-\text{ur}- \ [\text{*p}^\text{b} \text{áh}-\text{ur}-], \text{*p}^\text{b} \text{éh}-\text{wór} \rightarrow \text{glottal} \ f: \text{Gothic} \ \text{fûn}, \text{Old High German} \ \text{fiur}, \text{Old English} \ \text{fûr}, \text{voiceless} \ p: \text{Greek} \ \tau \text{û}, \text{Old Prussian} \ \text{panno}, \text{Old Czech} \ \text{pûř}, \text{Luwian} \ \text{pa}-\text{aḥ}-\text{ḫu}-\text{u}, \text{Tocharian A} \ \text{por}, \text{Hittite} \ \text{pa}-\text{aḥ}-\text{ḫu}-\text{ur}; \text{the end of the GMS}: \text{voiceless} \ *\text{h}: \text{Indo-European} \ \text{*p}^\text{b} \text{éh}-\text{ur}- \ [\text{*p}^\text{b} \text{áh}-\text{ur}-], \text{*p}^\text{b} \text{éh}-\text{wór} \rightarrow \text{voiceless} \ ḥ: \text{Luwian} \ \text{pa}-\text{aḥ}-\text{ḫu}-\text{u}, \text{Hittite} \ \text{pa}-\text{aḥ}-\text{ḫu}-\text{ur}.

\textbf{At the vertical level No. 3}, we may record the regulations in consonant systems between Kartvelian \text{*px}- and genetic correspondences.

In terms of consonant system, it is possible to establish \textit{the diachronic divergent-convergent phonological coincidences} in the following processes: (a) \textit{by the place of articulation}: \text{the beginning of the GMS}: \text{bilabial breakthrough} \ *\text{p}: \text{Kartvelian} \ \text{*px} \rightarrow \text{p}: \text{Georgian} \ \text{px}-, \text{Lazian} \ \text{px}-, \text{Svanese} \ \text{pxin}; \text{the end of the GMS}: \text{velar fricative} \ *\text{x}: \text{Kartvelian} \ \text{*px}- \rightarrow \text{x}: \text{Georgian} \ \text{px}-, \text{Latvian} \ \text{px}-, \text{Svanese} \ \text{pxin}; (b) \text{by voice and noise}: \text{the beginning of the GMS}: \text{voiceless} \ *\text{p}: \text{Kart} \ \text{*px} \rightarrow \text{p}: \text{Georgian} \ \text{px}-, \text{Latvian} \ \text{px}-, \text{Svanese} \ \text{pxin}; \text{the end of the GMS}: \text{voiceless} \ *\text{x}: \text{Kart} \ \text{*px} \rightarrow \text{x}: \text{Georgian} \ \text{px}-, \text{Latvian} \ \text{px}-, \text{Svanese} \ \text{pxin}.

\textbf{7. Concluding Remarks}

The diachronic interpretation of phonological processes in vowel and consonant systems has revealed that the Nostratic tree phylogeny contains both vertical and horizontal trajectories, each of which not only signifies the relationship between proto-language correspondences but also highlights regularities. The Nostratic version of \text{*p}^\text{b} \text{ah}- (\sim \text{*p}^\text{b} \text{ḥ}-) has enabled the identification of three distinct vertical trajectories. The determination of these trajectories typically relies on the presence or absence of an etymon (always with an asterisk \text{*}). Thus, the diachronic interpretation of the Nostratic \text{*p}^\text{b} \text{ah}- (\sim \text{*p}^\text{b} \text{ḥ}-) and Afro-Asiatic \text{*f[a]}\text{ḥ}-, \text{Indo-European} \ \text{*p}^\text{b} \text{éh}-\text{ur}- \ [\text{*p}^\text{b} \text{áh}-\text{ur}-], \text{*p}^\text{b} \text{éh}-\text{wór}-, \text{Kartvelian} \ \text{*px}-. No. 2 records the regulations in vowel and consonant systems between Afro-
Asiatic *f[a]h- and Semitic *pah-am; Central Chadic *ʔa-f[wa]-, as well as the regulations in vowel and consonant systems between Semitic *pah-am, Central Chadic *ʔa-f[wa]- and their genetic correspondences; No. 3 records the regulations in vowel and consonant systems between Indo-European *pʰéhh-ur- [*pʰáhh-ur-], *pʰəhh-wór- and genetic correspondences, as well as the regulations in consonant systems between Kartvelian *px- and genetic correspondences.

The tendency towards the reconstruction of Nostratic *pʰah- (~ *pʰəh-) has shown that the diachronic divergent-convergent phonological transitions are recorded in the following regularities: the provisions of the Rusk-Grimm law / the first movement of consonants, the existence of the consonant root, etc., while the diachronic convergent-divergent phonological coincidences are recorded in the following regularities: (a) by tongue position, (b) by mouth position, (c) by labialisation/delabialisation (e.g., quantitative reduction of vowel phonemes), as well as consonants by the following characteristics: (a) by place and method of production, (b) by voice and noise.

Prospects for further research are seen in the diachronic interpretation of the horizontal trajectory for further comparison of certain regularities with those presented in the vertical trajectory.

Funding:
This research received no external funding.

Acknowledgments:
The authors thank all academic peers for the research findings and article writing.

Conflicts of Interest:
The authors declare no conflict of interest.

Disclaimer Statement:
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**Authorship and Level of Contribution:**

Dr. Bolesław Cieślik, Dr. Bozena Iwanowska, and Dr. Yan Kapranov contributed to the research article's design and implementation, the results analysis, and the manuscript's writing.

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Appendix A
The Bomhard’s Nostratic Version for *p'ah- (~ p'ah-)

22.4. Proto-Nostratic *p' (→ Proto-Afrasian *q)

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130. Proto-Nostratic root *p'ah- (~ p'ah-); *(vb.)* *p'ah-* ‘to warm, to heat, to burn’; *(a.)* *p'ah-a* ‘fire, flame, spark’

Extended forms:
*(vb.)* *p'ah-V-w-* ‘to warm, to heat, to burn’;
*(a.)* *p'ah-w-a* ‘fire, flame, spark’


Acta Humanitatis
Volume 1 Issue 1 (2023): 15-36
https://doi.org/10.5709/ah-01.01.2023-02

RESEARCH ARTICLE

Bomhard (2018, pp. 158–159)