Toward the Reconstruction of Proto-Indo-European Music
A Basic Survey of Method

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Abstract:

This paper investigates the potential for reconstructing Proto-Indo-European (PIE) musical systems and institutions. Techniques from the comparative method of historical linguistics and studies of oral traditions are applied to ancient musical material with an eye towards isolating common features in ancient Indo-European (IE) traditions. This accomplished via comparison of the most ancient texts on music from Indo-European-speaking cultures (primarily Greek and Indic), as well as comparisons from non-IE traditions. Identifying musical universals and points of cultural exchange serves as a control for discerning inherited PIE features from those that are explicable by another means. Preliminary comparisons are provided as demonstrations of my method. At this stage, I cannot offer definitive statements on PIE music, but have identified numerous and significant materials for investigation. I intend to compile and interpret such comparisons exhaustively in a larger future work, ideally a dissertation.

1. What is Proto-Indo European and what are Indo-European Studies?

What follows is an overview of the concepts from Indo-European linguistics that are necessary to comprehend my aims and procedures. This primer is intended for a musicological audience with little or no exposure to historical linguistics. Readers with a command of this topic may wish to skip to section 2. where I discuss the comparative method as it applies specifically to music.

Indo-European is currently one of the world's most widely-spoken language families. The affinity between certain ancient Indo-European languages was observed as far back as Classical Antiquity, with Dionysus of Halicarnassus (c. 60 BC – after 7 BC) remarking:

> "The language spoken by the Romans is neither utterly barbarous nor absolutely Greek, but a mixture, as it were, of both, the greater part of which is Aeolic; and the only disadvantage they have experienced from their intermingling with these various nations is that they do not pronounce all their sounds properly."[1]

This suggests at least a passing awareness that Latin and Greek are "related", but the modern concept of genetic linguistic relationship remains unarticulated. I am aware of no evidence that the such relationships were explored systematically in antiquity. In Europe, full-fledged linguistic science does not emerge until the latter half of the 18th century, when Indo-European Studies was instigated by the observations of Sir William Jones, an English colonial jurist who lived in India and studied Sanskrit. His epoch-making pronouncement, delivered in a lecture at the Royal Asiatic Society in 1796, is traditionally included in nearly every introduction to PIE.

> "The Sanskrit language, whatever be its antiquity, is of a wonderful structure; more perfect than the Greek, more copious than the Latin, and more exquisitely refined than either, yet bearing to both of them a stronger affinity, both in the roots of verbs and the forms of grammar, than could possibly have been produced by accident; so strong indeed, that no philologer could examine them all three, without believing them to have sprung from some common source, which, perhaps, no longer exists; there is a similar reason, though not quite so

[1] Dionysius of Halicarnassus, Roman Antiquities

> forcible, for supposing that both the Gothic and the Celtic, though blended with a very different idiom, had the same origin with the Sanskrit; and the old Persian might be added to the same family."[2]

Subsequent scholars such as Jacob Grimm (1785-1863), Rasmus Rask (1787-1832), and Franz Bopp (1791-1867) began the project of comparing the various Indo-European languages with an eye towards *regular patterns of sound correspondences* in cognate sets (illustrated below in Table 1). By the end of the 19th century, serious attempts to reconstruct Jones' posited "common source" were well underway. This ancestral, *unattested*, language is termed **Proto-Indo-European** (*Urindogermanisch* in German scholarship). Notable texts from this period include Schleicher's *Compendium der vergleichenden Grammatik der indogermanischen Sprachen*. (1874), and Karl Brugmann's *Grundriss der vergleichenden Grammatik der indogermanischen Sprachen* (1892). Over the last century, the picture of PIE has been refined to a considerable degree of detail concerning its phonology, grammar, and lexicon. Major innovations of the 20th century are attributable to Ferdinand de Saussure (1857-1913), Antoine Meillet (1866-1936), Jerzy Kuryłowicz (1895 –1978), Émile Benveniste (1902 – 1976), Helmut Rix (1926-2004), and Jay Jasanoff (b. 1946), among many others.

Useful recent publications that outline the current state of the field are Benjamin Fortson, *Indo-European Language and Culture* (2004), Donald Ringe, *From Proto-Indo-European to Proto-Germanic* (2006) and J.P. Mallory and D.Q. Adams, *The Oxford Introduction to Proto-Indo-European and the Proto-Indo-European World* (2006), although the last includes some linguistic theories that fall outside of the wider consensus (for instance, the inclusion of a fourth laryngeal). An excellent introductory text for historical linguistics in general is Lyle Campbell, *Historical Linguistics: An Introduction* (2004).

The **comparative method** of historical linguistics has also been applied to other language families around the world, each with their own reconstructed proto-language. The cornerstone of this method is the identification of **regular sound correspondences**. When the sounds of any language gradually change over time, they do so in a systematic manner. For instance, all Proto-Indo-European /t/ sounds became /th/ in Germanic. Historical linguists identify these correspondances and use them to deduce the common ancestral form for any cognate set. This is illustrated in **Figure 1**, which demonstrates Grimm's Law, the first sound change pattern to be identified.

English	**mother**	**thou**	**thack**	**think**	**beareth**
Latin	**māter** (idem)	**tū** (idem)	**tegō** "I cover"	**tongeō** "I know"	**fert**"carries"
Russian	**mat'** (idem)	**ty** (idem)	**stog** "heap, pile"	(no cognate)	**berjót** "takes"
PIE	***méh₂tēr**	***túh₂**	***(s)teg-**	***tongéyoh₂**	***bʰéreti**

[2] J. P. Mallory, In Search of the Indo Europeans (1989)

Figure 1. Cognate sets illustrating Grimm's Law, which states, among other sound changes affecting PIE stop consonants, that PIE /t/ was universally shifted to /th/ in Germanic. This Proto-Germanic /th/ sound is preserved in the Modern English examples. It is evident that /t/ was the original sound, as the other Indo-European languages agree on this point. Germanic is the outlier, and is readily explained as having shifted, while the other branches retain the older /t/ sound. Reconstructed forms are traditionally listed with a preceding asterisk.

1.1 Subgroupings of the Indo-European Family

The modern view of the IE family recognizes 10 main branches. Listed in order of their historical attestation these are:[3]

- Anatolian (extinct, spoken in Turkey c. 1600 BCE – 500 CE)
- Indo-Iranian (Sanskrit, Hindi, Farsi, Punjabi, Ossetic etc.)
- Hellenic (Ancient and Modern Greek)
- Celtic (Welsh, Irish, etc.)
- Italic (Latin and its descendants, Oscan, Umbrian, etc.)
- Germanic (English, German, Swedish, Old English, etc.)
- Armenian
- Tocharian (extinct, spoken in western China c. 5-800 CE)
- Balto-Slavic (Latvian, Russian, Polish, Old Church Slavonic, etc.)
- Albanian

There are various schemes for detailing the phylogeny of the these groups. Not all are accepted, but there is considerable agreement that *Hellenic, Armenian, and Indo-Iranian form such a group*, ie. they share a common ancestor more recent than PIE. This is crucial for our purposes. All comprehensive ancient IE musical material is related in Greek and Indic texts, so any cognate features found in these alone permit no further reconstruction than their common node on the phylogenetic tree (often termed Greco-Aryan)[4]. Taken by themselves, Greek and Indic can not bring us all the way back to PIE. To get that far, *evidence from other branches is mandatory*.[5]

In summary, PIE is the parent of all IE languages. It was spoken in pre-literate times, but is reconstructed by the comparative method. Shared features such as cognate words and grammatical forms may be reasonably projected back onto the parent language. This is made possible by regular sound changes established between the daughter languages, which then may be run backwards to arrive at a plausible reconstruction of the primordial PIE language.

While there is an impressive degree of scholarly consensus regarding the major features of the reconstructions, it should be emphasized that we do *not have a complete, useable language*. Instead we are dealing with a reasonably comprehensive grammar and limited collection of basic vocabulary. Syntax is less understood, and forming a simple sentence can present major difficulties. It is important to bear these limits in mind when considering the prospect of reconstructing PIE music. It is fundamentally impossible to recover an entire piece of music without a clear, written score, or compelling evidence of accurate oral transmission. All that we may hope for is some foundational information about the musical system - i.e. scales, tuning, and the role music played in society.

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[3] List adapted from Fortson (2004) which treats each family in the order of its attestation.
[4] "Aryan" here refers to speakers of Indic and Iranian languages and has no racial connotation.
[5] See M.L. West Indo-European Poetry and Myth pp. 5-24 for a detailed discussion of this issue as it pertains to Indo-European poetics.

1.2 PIE culture and Poetics

In addition to reconstructing PIE as a language, Indo-Europeanists have taken an interest in the prehistoric culture that spoke it, reconstructing aspects of their material culture, religion, social institutions, and poetry. The most credible attempt to locate PIE culture (Maria Gimbuta's Kurgan Hypothesis) places the PIE *Urheimat* (primordial homeland) on the Pontic-Caspian steppes, around 4000-3000 BCE. An alternative view, proposed by archeologist Colin Renfew has the Proto-Indo-Europeans in Anatolia, about 3000 years earlier. This theory has virtually no support from the linguistic community and is beset with insuperable difficulties, largely centering around the fact that PIE very clearly has a word for "wheel" and the time depth posited by Renfew's theory sets PIE at a date several millennia before any evidence appears for wheels in the archeological record. From Fortson: "This theory can only be maintained by willfully ignoring the comparative linguistic evidence..."[6]. The probable homeland and migrations of the Indo-European people are shown in **Figure 2**.

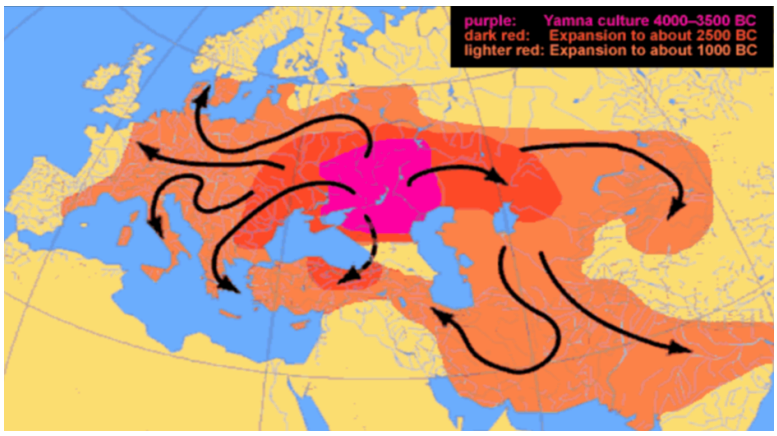

Figure 2: Indo-European homeland and migrations according to the Kurgan hypothesis.[7]

Within the compass of IE culture, the field of IE poetics is of particular note for our purposes. This compares poetic texts of the earliest IE cultures, such as the Vedas and Homeric epics in order to identify features inherited from the poetic tradition of the ancient Proto-Indo-Europeans. A seminal text is Jacob Wackernagel, *Indogermanische Dichtersprache* (1932). Recent works of note are Calvert Watkins, *How to Kill a Dragon* 1995, and M.L. West *Indo-European Poetry and Myth* (2007). Major discoveries treated in these works include:

- **Common textual formulae:** *$*g^{wh}ent\ h_1óg^{wh}im$* "he slew the serpent" (in reference to an ancient, common IE dragon-slaying myth) and *$*ḱléwos\ n̥d^hg^{wh}itom$* "imperishable fame" (what the poet is supposed to confer upon themselves and their subjects)[8]
- **Cultural conceptions of poetry and its function:** Poetry was composed by a highly specialized professional class, who regarded their work as a secret, arcane discipline. It was supposed to communicate with the gods, perform various magics, and act as an oral history to record great deeds.

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[6] Fortson (2004) p. 48
[7] Image from Wikimedia Commons
[8] These formulae are treated in Watkins (1995) pp. 297-438, and pp. 173-178 respectively, the former being the titular subject of the book.

- **Metaphors about poetry:** Many of the metaphors used by ancient IE speakers to describe poetry point towards its transportive power, and ability to influence the gods and physical world: "language of the gods", "ship of song", "chariot of song", "the poet summons winds"
- **Common poetic meters:** A fundamental Iambic Octosyllable line is reconstructed on the basis of the Sanskrit *gayatri*, and Greek *Iambic Dimeter*. This basic structure is corroborated by evidence from the Italic Saturnian verse and Slavic *Bylini* meter, thus satisfying the requirement for comparanda outside of Greco-Aryan.[9]

2.1 Indo-European Union of Poetry and Music

It seems that to the ancient Indo-Europeans, poetry and music were inextricably linked. The Indo-European roots that may be reconstructed for "to sing" or "to play an instrument" also relate to reciting poetry, as evinced by the many reflexes (words descended from a particular root) that maintain this "double" meaning. For us, these are taken as separate concepts, but they were evidentally conflated by the Proto-Indo-Europeans. Below are some reconstructed PIE terms pertaining to singing and reciting poetry or incantations. Observe the similar semantic overlap of these distinct modern concepts among the given comparanda. Interestingly, the first two roots also produce reflexes related to bird calls.

gʰel- Old Norse *gala* "to sing, crow, chant (spells)" Old Armenian գեղօն(*gełōn*) "song"

keh₂n- Latin *canō* "I sing, recite, sound on an instrument, hoot (of an owl)", *carmen* "song, poem", Old Irish *canaid* "she/he sings", Farsi خواندن (*xândan*) "to read, recite, sing", Sanskrit कणति (*kaṇati*) "she/he sounds", Icelandic *hani* "cock, rooster".

gewH- Old Church Slavonic гѫдѫ (*gǫdǫ*), "I play an instrument", Russian говор (*góvor*) "talking, speech, murmur, dialect", Ancient Greek γόος (*góos*) "lament, wailing", Old English *ċīeġan* "to call, invoke, cry out", Sanskrit गीता *gītā* "sung, chanted, song"

sengʷʰ- English "song", Ancient Greek ὀμφή (*omphḗ*) "voice, oracle"

Furthermore, In both Greek and Sanskrit sources, the terms used to describe musical rhythm are the same as poetic meter. Both use a system of quantitative verse with two binary values "short" and "long" (Greek ***brakhús*** "short, brief, little", Sanskrit ***laghú*** "light, quick, short", Greek ***makrós*** "long, deep", Sanskrit ***gurú*** "heavy")

2.1 Accuracy of Transmission

Primary sources suggest that accurate performance of music and poetry was essential to the ancient IE-speaking peoples. This is important to note for our purposes, as it establishes the necessary basis of an oral tradition with considerable regard for accurate transmission - a key prerequisite for intact musical material traversing the immense time-scales involved.

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[9] See West (2007) pp. 45-58 for details. See also Paul Kiparsky, *Indo-European Origins of the Greek Hexameter* for a slightly differerent interpretation involving generative metrics, and derriving Dactylic Hexameter from PIE.

> "If an actor dances slightly out of time, or recites a verse with either a syllable too short or too long, he is booed and hissed off stage." - Cicero[10]

> "Correct intonation of the recitations and the songs of the Ṛg-, Sama, and Yajurveda during the sacrifices was very important. Saṃgītamakaranda of Nārada I. I. 4-6 curses the man who does not correctly produce the notes"[11]

Furthermore, in light of the suggested unity of poetry and music, the fact that reconstructable features of PIE poetry are recoverable allows that musical elements may have been passed down alongside the poetic material.

2.2 Sources for Ancient Indo-European Music

The only ancient writings on music theory in Indo-European languages come from Greek and Indic sources.

- The oldest thorough Ancient Greek source is the *Elements of Harmony* by Aristonexus (fl. c. 335 BCE). It deals with key topics such as harmonics, temperament, and the Ancient Greek modal system.
- In Sanskrit, we have Bharata's *Nāṭyaśāstra* as the oldest discussion of music theory. It is a treatise on the performing arts, particularly drama, with five chapters devoted to music theory, instrumental and vocal technique.

Other authors in both traditions offer valuable insights as well, but these are by far the two most comprehensive sources. Others will be treated later as necessary. It is difficult to establish information about music from traditions outside of the Greco-Aryan group, as discussed above in 1.1. For this, we must turn to studies of conservative folk music traditions within the IE family. I have not yet pursued this line of investigation, and it may be impossible to secure meaningful comparative material, however, there are examples of oral folk traditions that were attested quite late, such as Lithuanian folk songs transcribed in the 19th century that preserve poetic material of PIE antiquity. It is conceivable that they may also contain shreds of archaic musical materials.

3.1 The Comparative Method and Music

Music is not language and while the comparative method of historical linguistics is a valuable model, the details of its execution must by adapted to musical purposes. From a diachronic perspective, a major difference between music and languages is that musical evolution is not subject to rules of regular sound change. Due to this, cognate features are much harder to identify. As with linguistics, mere resemblance is not enough to assert common ancestry.

A fundamental distinction must be drawn between **genetic** and **areal** features. Shared features are *genetic* when they are the result of *inheritance from a common ancestor*. Shared features are *areal* when they are the result of *borrowing across languages* (or here musical cultures/traditions).

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[10] Cicero, *paradoxa stoicorum*
[11] Nijenhuis (1970) p. 96

We also must contend with musical universals arising from the physical reality of the harmonic series, the human voice, imitation of nature, etc. If a feature is so common that almost every culture has it, it need not be the result of genetic relationship. It is crucial to be able to make these distinctions for supposed proposed musical cognates. One way to check for genetic relationship is to make comparisons outside of the Indo-European family. This allows us to check for universal features by referring to cultures who were largely isolated from IE speakers, and for areal relationships by consulting their ancient neighbors (such as Near Eastern civilizations).

As with languages, there are ample historical examples of cross-cultural influence in music; just one being the recent adoption of Western musical practices across the globe. Considering the ability of musical influence to easily cross language boundaries, it is necessary to establish some means of determining if a feature is inherited or borrowed from a nearby culture. The historical peoples under investigation are known to have had cultural exchange with certain neighbors, for instance the Greeks and peoples of the near east such as the Babylonians. Culture contact between the Aegean and Near east is well documented as far back as the Bronze age. It is securely established that the Greeks imported mathematics, astronomy, mythemes, etc. from non-IE peoples of the ancient Near East.[12]

It is probable that musical material was imported as well, especially considering that the Babylonians, Hurrians, and others had music theory and notation antedating the Greek contributions. As such, it is crucial to identify features that are particular to Greek and Indian sources alone if they are to be regarded as genuine inheritances from the PIE (or at least Greco-Aryan) musical tradition. This may be accomplished by examining the Near Eastern material, and identifying points of concord and divergence.

In addition to comparing musical material itself, insights may arise from comparing musical terminology and metaphors about music. This approach, has already been fruitful in the domain of comparative IE poetics, as outlined in section 1.2

3.2 Tuning and Scales as Comparative Material

Bharata and Aristonexus both provide information on tuning a basic scale (the Greek Dorian mode and Indic *ṣaḍja grāma*) and deriving modes from it. Each provides names for exactly seven scale degrees, and independent names for the modes built from each as a primary tone. These, and other sources also mention special associations for each scale degree and mode (planets, deities, animal sounds, etc.)[13]

Some parameters for comparison are:

- temperament
- definition of musical intervals
- sequence and size of intervals in the basic scale
- terms for the scale degrees
- terms for the modes
- special associations for the scale degrees
- special associations for the mode
- cultural functions of music

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[12] See Nancy Saunders *The Sea Peoples* (1978) and Morris Kline *Mathematics for the Nonmathematician* (1967)

[13] See Nijenhuis (1970) Kathleen Schlesinger *The Greek Aulos* (1939)

3.3 The “Middle” Scale Degree

I proceed with some preliminary demonstrations of my basic method. The first being an example of a feature that initially appears to be cognate, but falls through under scrutiny, as well as another comparison that remains viable. Both Greek and Sanskrit sources refer to the fourth degree of a scale as its "middle" Sanskrit *madhyam*, Greek *mése*, both from PIE **méd^{h}yos* "middle". It is possible this terminology goes back to PIE? Probably not. Sanskrit texts refer to an earlier name for this note in Vedic times - the *cathurta*, which just means four.

Additionally, the ancient Chinese also refer to the fourth degree of their basic diatonic scale as the "mean", which involves the character for “middle”, 仲 呂 (*chung-lü*) Levis, 1936). It seems this is simply a logical thing to call this scale degree. Numerous cultures have done so independently, and at least in India it looks to be a relatively new term at the time of our sources. Therefore it is highly unlikely to be a genetic feature.

3.4 The Smallest Audible Interval

Aristonexus and Bharata both discuss and define the "smallest audible interval", and the foundational role it plays in their respective musical systems.

- For the Greeks this is the ***diesis***, (< *dis* "two" plus *híêmi* "I release, let go, say" < PIE **(H)yeh$_1$-* "throw" cf. Latin iaciō "throw") approximately a quarter tone. This interval is functional and is used in the construction of scales of the enharmonic genus. Plutarch defines other larger intervals by combing dieses. (Hewitt, 2014)

- In the *Nāṭyaśāstra* we are told of the ***śruti*** (from PIE **ḱlútis, *ḱlew-* "hear". This is also approximately equal to a quarter tone. Larger intervals (*svaras*) are defined by how many *śrutis* they encompass. The interval cannot function as an independent scale degree, and was used as an ornament, if at all. (Nijenhuis 1970)

> "The voice cannot differentiate, *nor can the ear discriminate*, any interval smaller than the smallest ***diesis***." - Aristonexus[14]

> "In consequence of the possibility of *perception by the auditory organ* a sound is a ***śruti***.” - Bṛhaddeśī of Mataṅga[15]

The basic scale described in the *Nāṭyaśāstra* is the *ṣaḍja grāma*, defined by the number of *śrutis* in each interval. Bharata clearly states that an octave consists of 22 *śrutis* (1200/22 = 54.5 cents per *śruti*). He then defines each interval of the basic *ṣaḍja grāma* scale by the number of *śrutis* it contains. Values of 2, 3, and 4 are possible. 2 *śrutis* = 109 cents (2 x 54.5), 3 = 164, and 4 = 218. These intervals are approximately a semitone, a semi + quarter tone, and a tone. Unlike in Western, and later Indian music, the notes are named for the interval they complete - for instance, the first value in the scale "sa" is defined by the relationship between scale degrees $\hat{7}$ to $\hat{1}$. Note also that the Indian treatises convey no awareness of the harmonic series, and as such, there is no attempt to derive tunings from perfect intervals as in the Greek system, which involves tetrachords spanning just fourths .

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[14] Macran, *The Harmonics of Aristonexus* (1902) p. 175
[15] Nijenhuis (1970) p. 89

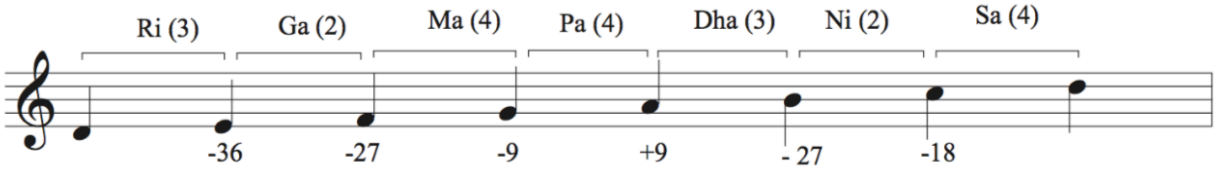

Figure 3: *ṣaḍja grāma* scale according to Bharata, with cents deviation from Equal Temperment.[16]

Ancient Greek scales were conceived as two tetrachords joined to produce a seven note scale. There are three *genera* of tetrachords, each with different divisions of the fourth into smaller intervals. Any scale must be built from two tetrachords of the same genera. These are the diatonic, chromatic, and enharmonic genera. For tuning the enharmonic genus, Didymus[17] defines the two *dieses* (the intervals between the first and second) as 32/31 and 31/2, yielding intervals of 55 and 57 cents respectively. These values are remarkably similar to Bharata's 54.5 cent *śruti*.

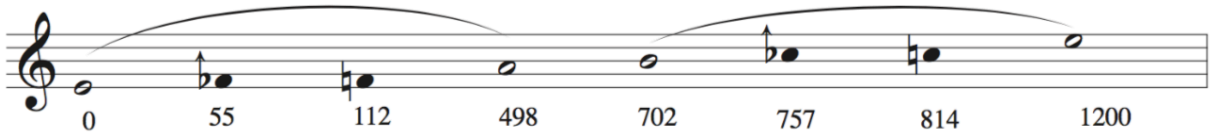

Figure 4: *enharmonic scale based on the tuning of Didymus*. Cents indicate the distance of each scale degree from the "tonic" or primary tone. Adapted from Hewitt (2014) p. 171

The ancient Chinese sources I have reviewed do not systematize the quarter tone as the Greek and Indic writers do. Chiang Kuei makes references to notes that are "a little higher" than regular chromatic notes, but no attempt is made to formalize them and they do not appear fundamental to the system (ie. they are not used to define other intervals).[18] *It is not necessary to claim that quarter tones were totally unknown in China*, simply that they did not commonly play a foundational role in music theory, particularly in the definition of other larger intervals. Therefore it remains possible, but is by no means guaranteed, that the concept of a "smallest audible interval" that was used as a basic unit in the definition of larger intervals, may be of PIE, or at least Greco-Aryan date. Note also that the *ṣaḍja grāma* is divisible into two tetrachords of identical intervalic content, providing another point comparison.

4. Conclusions and further research

The tentative nature of this treatment cannot be overemphasized. Nonetheless, there is sufficient comparative material to warrant further investigation, and I am unaware of any published monograph dealing exclusively with this topic. I intend to fill this abence with the book-length final phase of this research. The primary areas for future comparison have been outlined above and are expanded upon in this final section

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[17] This is Didymus the Musician "Δίδυμος ὁ Μουσικός" who wrote in the first century BC and lived in Alexandria.

[18] See John Hazedel Levis *Chinese Musical Art* (1936) for a good treatment of Chinese music theory sumarized from the ancient primary sources

The exhaustive cataloging of further comparanda between the ancient Indic and Greek works discussed above is central to the project, but must be expanded to *comparisons outside Greco-Aryan* if derivation from the earliest stage of PIE is to be asserted. There are several possible sources for IE musical material in addition to the classical texts, both within Greco-Aryan, and in the broader IE-speaking world. Material antedating the Classical Sanskrit treatises is available in the corpus of Vedic Chants, which, like the Vedas themselves, are thought to have been orally-transmitted for centuries prior to their attestation with great accuracy. Recently documented oral traditions such as Scandinavian, Baltic, Celtic, Indian, and Iranian folk music are highly unlikely to evince many truly archaic IE inheritances, but may nevertheless prove useful as corroborating evidence for secure cognates in Greco-Aryan (much as Lithuanian folk songs, Slavic *Bylini*[19], Old Irish poetry, and Saturnian meter[20] have in the domain of IE poetics). The same may true of liturgical musics such as Byzantine Chant, Armenian Chant, and Zoroastrian Sacred Music.

Comparison with *a broader field of non-IE traditions* is also paramount. Candidates include independent pitch-based systems such as Gamelan, Sub-Saharan polyphony, and music of the Ancient Near East. (Hurrians, Babylonians, etc). I have yet to identify pitch-based systems indigenous to the Americas, but provided that any are documented, they should furnish invaluable comparisons for musical universals. This is due to the firm conclusion that mutual influence with IE material is prohibited by total geographical isolation. Similarly, material evidence for prehistoric musical instruments (e.g. Paleolithic bone flutes excavated in the *Grotte Chauvet* tuned in pentatonic scales) provides comparanda for universal approaches towards pitch systems that are distantly removed from the earliest attested IE musics, as well their supposed PIE antecedents. Every putative IE cognate is to be individually subjected to as many comparisons with these external systems as the data permit, taking care to treat occurrence of musical universals and cross-cultural interface as separate phenomena.

There is another avenue for comparison that has yet to receive detailed treatment in this paper; *ancient accounts of musical practice*. One such comparison is found in Bede the Venerable (an English monastic writing in the 8th century CE) and Cicero (the famous author and statesman of the late Roman Republic). Both mention a tradition of guests at social gatherings taking turns at singing accompanying themselves stringed instrument. Furthermore, both use Latin "*canō*", listed in 2.1 as denoting both singing and recitation of poetry. This is plausibly attributed to the extensive cultural contact between Romans and Germanic peoples, but may provide yet another line of investigation when subjected to wider comparisons.

Another technique from historical linguistics applicable to the project is *internal reconstruction*; the practice of deducing information on the development of a language by diachronically comparing various historical forms of the same language, as well and observing synchronic patterns of irregularity. This is distinct in invoking no external comparison to related languages, and is often applied where such material is unavailable (as with linguistic isolates, or reconstructed proto-languages). This is feasible with both Indic and Greek sources, as the attested material spans at least several centuries. Additionally, studies on rapidly codified orally transmitted musics are to be consulted with an eye towards the internal structure and

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[19] The *Bylini* (Rus. sg. *bylina*) are traditional Slavic epics on mythic themes. In addition to preserving a highly-developed poetic system, they are also performed with music.

[20] The Saturnian is an archaic poetic meter indigenous to Rome. It is attested in Old Latin texts from early Republican times; before Latin poets exclusively adopted Greek meters. While far from thoroughly understood, it provides corroborating evidence for the PIE iambic octosyllable alluded to in 1.2.

development of such systems. One salient example is Willi Apel's work on fixed formulae in the corpus of Gregorian Chant, a feature analogous to the fixed formulae of IE poetics discussed in 1.2.

I presently reserve judgement on the ultimate viability of reconstructing Proto-Indo-European scales or tunings in any larger aspects. Even if credible cognates are identified, it may remain outside the scope of my methods to plausibly reconstruction these features for the earliest PIE times. Regardless of the outcome, an attempt to do so will invariably compile interesting and useful information on musical systems and their evolution that I hope will be useful for composers, musicologists, theorists, and Indo-Europeanists alike.

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