Indo-Slavic Lexical Isoglosses and the Prehistoric Dispersal of Indo-Iranian

Axel I. Palmér

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In memory of
Edvard Selander Patrignani
**11 April 1994 †18 July 2022*

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List of Abbreviations

General

AB	Aitareyabrāhmaṇa
ĀpŚS	Āpastambaśrautasūtra
AV	Atharvaveda (Saṃhitās)
AVPariś	Atharvavedapariśiṣṭas
BCE	before common era
BMAC	Bactria-Margiana archaeological complex
BP	before present
Br.	Brāhmaṇas
Car.	Carakasaṃhitā
CE	common era
Dhātup.	Dhātupāṭha
dial.	dialectal
EBA	Early Bronze Age
Ench.	Enchiridion
Ep.	Epics
EV	Elbing Vocabulary
GṛSū.	Gṛhyasūtra
intr.	intransitive
JB	Jaiminīyabrāhmaṇa
KauśS	Kauśikasūtra
Kāv.	Kāvya
KS	Kaṭhasaṃhitā
LBA	Late Bronze Age
Lex.	lexicographical
MBA	Middle Bronze Age
MBh.	Mahābhārata
N	Nērangestān
Ny	Niyāyiš
p.c.	personal communication
Pāṇ.	Pāṇini's Aṣṭādhyāyī
PN	personal name
PS	Paippalādasaṃhitā
Ragh.	Raghuvaṃśa
Rājat.	Rājataraṅginī
RV	Ṛgveda (Saṃhitā)

S	supplement
ŚB	Śatapathabrāhmaṇa
ŚS	Śaunakasaṃhitā
Sū.	Sūtras
Suśr.	Suśrutasaṃhitā
tr.	transitive
TS	Taittirīyasaṃhitā
VarBr̥S	Varāhamihirabr̥hatsaṃhitā
VS	Vājasaneyisaṃhitā
Yt	Yašt
YV	Yajurveda (Saṃhitās)

Symbols

*	reconstructed form
**	incorrectly reconstructed form
∅	zero (morpheme)
°	attested in a compound, part of word missing
<	regular sound change from
>	regular sound change to
<<	irregular/analogical change, semantic change, derivation/borrowing from
>>	irregular/analogical change, semantic change, derivation/borrowing to
/ /	phonological transcription
[ ]	phonetic transcription
< >	orthographic transcription
C	any consonant
V	any vowel
N	any nasal
H	any laryngeal
R	any resonant
²	conflated tone (Latvian dialects)

Languages

Alb.	Albanian
Arm.	Armenian
Av.	Avestan
Bactr.	Bactrian

Bal.	Balochi
Bret.	Breton
Bulg.	Bulgarian
Car.	Carian
CLuw.	Cuneiform Luwian
CroatCS	Croatian Church Slavic
CS	Church Slavic
Cz.	Czech
D	Digoron (Ossetic)
Dor.	Doric
Du.	Dutch
Eng.	English
Far.	Faroese
Gaul.	Gaulish
Ger.	German
Goth.	Gothic
Gr.	Ancient Greek
Hitt.	Hittite
HLuw.	Hieroglyphic Luwian
I	Iron (Ossetic)
IIr.	Indo-Iranian
Ion.	Ionian
Khot.	Khotanese
Khow.	Khowar
Khwar.	Khwarezmian
Lat.	Latin
Latv.	Latvian
Lesb.	Lesbian
Lith.	Lithuanian
Luw.	Luwian
Lyc.	Lycian
Lyd.	Lydian
Man.	Manichaean
MBret.	Middle Breton
MHG	Middle High German
MiP	Middle Persian
MIr.	Middle Irish
MoP	Modern Persian
Mu.	Munji
MWelsh	Middle Welsh

Nep.	Nepāli
Novg.	Novgorodian
Nw.	Norwegian
OAv.	Old Avestan
OBret.	Old Breton
OCS	Old Church Slavic
OCz.	Old Czech
OE	Old English
OHG	Old High German
OIr.	Old Irish
OKhot.	Old Khotanese
OLith.	Old Lithuanian
ON	Old Norse
OP	Old Persian
OPhryg.	Old Phrygian
OPol.	Old Polish
OPr.	Old Prussian
Orm.	Ormuri
ORu.	Old Russian
OS	Old Saxon
Osc.	Oscan
Oss.	Ossetic
OSw.	Old Swedish
Pā.	Pāli
Pahl.	Pahlavi
Pal.	Palaic
Par.	Parači
Parth.	Parthian
PBSl.	Proto-Balto-Slavic
PCelt.	Proto-Celtic
PGm.	Proto-Germanic
PGr.	Proto-Greek
Phryg.	Phrygian
PIE	Proto-Indo-European
PIIr.	Proto-Indo-Iranian
PIr.	Proto-Iranian
Plb.	Polabian
Pol.	Polish
Psht.	Pashto
PSl.	Proto-Slavic

Rosh.	Roshani
RuCS	Russian Church Slavic
SCr.	Serbo-Croatian
SerbCS	Serbian Church Slavic
Shu.	Shughni
Si.	Sinhalese
Skt.	Sanskrit
Sln.	Slovene
Sogd.	Sogdian
Sogd. B	Buddhist Sogdian
Sogd. C	Christian Sogdian
Sogd. M	Manichaean Sogdian
Sogd. S	Sogdian, Sogdian script
Sw.	Swedish
Taj. Wj.	Tajik (Wanji)
ToA	Tocharian A
ToB	Tocharian B
Ukr.	Ukranian
Umbr.	Umbrian
Wakh.	Wakhi
Wan.	Wanetsi
Yagh.	Yaghnobi
YAv.	Young Avestan
Yazg.	Yazghulami
Yi.	Yidgha
Žem.	Žemaitian (Lithuanian)

CHAPTER 1

Introduction

1.1 Preliminaries: Historical Linguistics and the Study of Human Prehistory

Historical linguistics, despite the name, is just as much concerned with the prehistory as with the history of the human past. By definition, the reconstruction of protolanguages through the *comparative method* recovers linguistic structures and lexicon dating before the written attestation of the languages in question. In this sense, historical linguistics provides its own unique perspective on human prehistory, independent from and complementary to archaeology, which may be seen as the study of human prehistory *par excellence*.

At its core, archaeology studies human activity through material remains. The discipline has evolved into relying more and more on methods from natural sciences (Kristiansen 2014; Sørensen 2017), such as radiocarbon dating and stable isotope analysis (Vogel & Van Der Merwe 1977; Hanks et al. 2018; Sabatini et al. 2022; Pospieszny et al. 2023); in this sense, modern archaeology is fundamentally interdisciplinary. Through systematic analysis of artefacts, material complexes may be identified and classified into *cultures*, which are bounded in time and space. The concept of the *archaeological culture* has been criticized (Willey & Phillips 1958), as it has been used anachronistically for one-to-one equations of material culture with ethnic, racial or linguistic groups (Kossinna 1911; Childe 1929). However, the term is still widely used in the archaeological literature, and while culture-historical narratives in the style of Kossinna and Childe have largely been abandoned, *archaeological culture* as a descriptive term has not (Roberts & Linden 2011). In the present work, the term archaeological culture will be used to refer to "assemblages of artefacts" (Roberts & Linden 2011: 1), bounded in time and space, which have been classified as meaningful units in the archaeological literature. In this way, archaeological cultures are not seen as monolithic entities awaiting attribution to an ethno-linguistic group, but as a system of classification that has meaning within archaeology itself. From this perspective, archaeological evidence can be compared to evidence from other disciplines, such as historical linguistics.

During the 2010s, population genomics has emerged as a new line of evidence for prehistory through the study of ancient DNA (cf. the seminal studies by Allentoft et al. 2015; Haak et al. 2015). The full potential of ancient DNA is yet to be realized, as new methodologies are continuously being developed (e.g.,

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for identifying identity by descent (IBD) in ancient individuals, see Ringbauer et al. 2023), but it has already had a massive impact on the scientific discourse (Kroonen & Kristiansen 2023). In many ways, it has brought about a paradigm shift in the study of prehistory toward an increased focus on human mobility and migration, as it makes it possible to test hypotheses regarding the relationship between modern and ancient populations directly through genetic relatedness.

Historical linguistics holds an intermediate position between archaeology and genetics, since language is, on the one hand, a cultural phenomenon shaped by specific cultural conditions and interaction both within and between communities, and, on the other hand, a natural phenomenon, in the sense that it is a fundamental property of human cognition that is passed down through the generations, much like genes. By using the comparative method, historical linguistics can prove relatedness of attested languages that go back to a prehistoric common ancestor (Hock 1991: 567). By reconstructing the lexicon of the protolanguage, aspects of the culture of the speakers of the protolanguage can be reconstructed, which can be compared with the archaeological record to locate the protolanguage community in time and space; this is an extension of the comparative method termed *linguistic palaeontology* (Pictet 1859–1863; Mallory 2021). The phylogeny of language families like Indo-European, i.e., the internal structure of the family tree, can provide further clues as to how the protolanguage diverged, which can be compared with archaeological and genetic hypotheses on prehistoric migrations, population movements, and contact situations.

1.2 Aim of the Monograph

The aim of the present study is to uncover the earliest prehistory of Indo-Iranian, meaning the period between the split of Core Proto-Indo-European[1] and Proto-Indo-Iranian, by investigating the proposed phylogenetic subgroup consisting of the Indo-Iranian and Balto-Slavic branches, here termed Indo-Slavic.[2] These branches have been hypothesized to be connected by phonological and lexical isoglosses (Kuhn 1850: 324; Schmidt 1872; Arntz 1933; Porzig 1954; Ringe, Warnow & Taylor 2002). As we will see, while the phonological

1 I use the term Core (Proto-)Indo-European to denote a subgroup consisting of the non-Anatolian branches.

2 For a discussion of this terminology, see Olander (2019).

isoglosses cannot be proven to be exclusive to these two branches, the quantity and quality of the lexical isoglosses are not well understood, since previous studies are either outdated (Arntz 1933) or incomplete (Porzig 1954). Thus, the status of the Indo-Iranian-Balto-Slavic lexical isoglosses as evidence for an Indo-Slavic subgroup will be compiled and evaluated. The resulting isogloss corpus will serve as a basis for evaluating three competing hypotheses on the prehistoric dispersal of Indo-Iranian.

1.3 State of the Art: the Position of Indo-Iranian within the Indo-European Language Family

Indo-Iranian has always held a central place in Indo-European linguistics. Before the realization that Armenian is an independent branch (Hübschmann 1877), and before the discovery of Anatolian and Tocharian, Indo-Iranian was the sole proof that the Indo-European language family was not an exclusively European phenomenon. Moreover, it is one of the earliest attested branches with a rich literary tradition.

The debate on the position of Indo-Iranian within the Indo-European language family goes back to the pre-neogrammarian period. Schleicher (1853; 1861: 4–7) introduced the family tree model (*Stammbaumtheorie*) to Indo-European linguistics, dividing the Indo-European language family into three main groups: Asian (Indo-Iranian, Armenian still being counted as part of Iranian), southwest (Italo-Celtic, Greek, Albanian), and north (Balto-Slavic, Germanic). He argued that the Asian and southwest branches are more closely related, which may be seen as an early version of the Graeco-Aryan hypothesis.[3] Contrary to modern methodology (cf. Chapter 2), this conclusion seems to be based mainly on shared archaic features rather than innovations, i.e., the Asian and southwest branches were considered to be closer to Proto-Indo-European than the northern branch.[4] A Graeco-Aryan subgroup was sup-

3 An alternative term is Indo-Greek. However, this is ambiguous, since it also refers to the 2nd century BCE Yavana Kingdom, as well as to a larger proposed subgroup of Indo-European, uniting not only Indo-Iranian and Greek but also Armenian, Albanian, and Balto-Slavic (Olander 2019).

4 "Die indogermanische ursprache teilte sich zuerst durch ungleiche entwickelung in verschidenen teilen ires gebietes in zwei teile, es schied nämlich von ir auß das slawodeutsche [...]; sodann teilte sich der zurückbleibende stock der ursprache, das ariograecoitalokeltische, in graecoitalokeltisch und arisch [...]. Je östlicher ein indogermanisches volk wont, desto mer altes hat seine sprache erhalten, je westlicher, desto weniger altes und desto mer neubildungen enthält sie" (Schleicher 1853: 6).

ported by Kern (1858), based on the shared outcome of PIE *$\underset{\circ}{n}$; by Grassmann (1863a: 109; 1863b: 119), based on alleged similar treatments of Indo-European aspirates; and by Kretschmer (1896: 168–170), who also included Phrygian and Armenian in this group, based on the augment, the prohibitive particle *meh_1, the correspondence between Skt. *sahásra-* ~ Gr. χείλιοι 'thousand', etc.

On the other hand, a close relationship between Germanic and Balto-Slavic (Schleicher's *Slawodeutsch*) had been proposed already by Zeuss (1837: 18) and Grimm (1848: 1024–1026, 1030) based on a number of isoglosses, including the Germanic weak adjectival declension next to the Balto-Slavic definite adjectival declension, as well as lexical correspondences. Schleicher supported this hypothesis in several papers (1852; 1855; 1858a) and pointed to the Balto-Slavic and Germanic dat.pl. in *-m-* as an additional shared feature (Schleicher 1858b: 13; cf. also Leskien 1876: 157).

A competing hypothesis, perhaps first articulated by M. Müller (1853: 67), but developed by Lottner (1858a; 1858b), argued that Proto-Indo-European first split into an Indo-Iranian and a European subgroup (see also Fick 1870; 1873). According to Lottner (1858a: 19–24), the European branches share the distinction of **l* and **r*, various prepositions, and agricultural vocabulary to the exclusion of Indo-Iranian. The alleged lack of inherited agricultural terms in Indo-Iranian vs. the shared agricultural terms in the European branches was taken as evidence that the European branches must have separated from the Asian part of the language family before transitioning to an agricultural economy (Mommsen 1854: 14–15; more explicitly in Mommsen 1865: 15–16; Pictet 1859–1863: II, p. 121–122; Schrader 1883: 356–357; 1890: 284; Brandenstein 1936: 28). In this way, the internal structure of the family tree was inferred by reconstructing the chronology and geography of how Indo-European-speaking groups emigrated from the homeland, i.e., based on linguistic palaeontology (cf. 2.5).

A third position was taken by Kuhn (1850: 324), Bopp (1853: 4), and Latham (1862: 610), who argued for a closer relationship between Indo-Iranian and Balto-Slavic based on their status as satem languages, i.e., that they merge the Proto-Indo-European velars with the labiovelars and continue the palatovelars as sibilants/affricates. A close relationship between Indo-Iranian and Balto-Slavic had already been articulated by Zeuss (1837: 20), although he believed the connection between the latter and Germanic to be stronger. F. Müller (1873: 70) grouped Indo-Iranian, Balto-Slavic and Germanic together, from which Germanic subsequently separated, as opposed to a Celtic-Italic-Greek subgroup. After the recognition of Armenian as a separate branch (Hübschmann 1877), von Bradke (1890: 63) grouped all satem languages together.

Thus, already in the 1850s, three main hypotheses regarding the position of Indo-Iranian had been formulated: 1) a closer relationship to Greek and other so-called southwestern branches, 2) an early split from all European branches, 3) a primary division of centum and satem languages, Indo-Iranian of course belonging to the latter group. Consequently, Brugmann (1884; 1886: 1–3) stated that no subgroups, i.e., phylogenetic units comprising more than one branch, had been proven.

Not only was the internal structure of the family tree an open question, but the tree model itself was quickly called into question: already in 1872, Schmidt, a student of Schleicher, proposed the alternative wave model (*Wellentheorie*).[5] Instead of viewing the Indo-European language family as a result of a series of splits from an original monolithic protolanguage, the wave model envisions a continuum of contiguous dialects that over time develop into separate branches. Innovations spread from various centres of innovation, gradually affecting contiguous dialects. In this way, isoglosses can be explained without assuming that branches with shared features belong to the same subgroup to the exclusion of other branches. As evidence for his model, Schmidt presented lists of lexical isoglosses shared by various branch combinations.[6] The results show, according to Schmidt, that Balto-Slavic descends from an intermediate dialect between Germanic and Indo-Iranian.

Meillet (1908) further developed Schmidt's methodology, defining the relationship between the branches of Indo-European in terms of dialect areas. Moreover, he rejected the idea of a uniform protolanguage, emphasizing that language is in a constant state of variation. According to Meillet, the Indo-European language family can be divided into a western (Celtic, Italic, Germanic, Greek) and an eastern (Albanian, Armenian, Balto-Slavic, Indo-Iranian) dialect group, corresponding to the centum and satem groups. These groups

5 The main principles of the wave model, e.g., that Proto-Indo-European diverged gradually as geographically neighbouring dialects influenced each other, eventually giving rise to the various language branches, were already formulated by Pictet (1859–1863: I, p. 48): "Les émigrations lointaines auront été précédées par une extension graduelle, dans le cours de laquelle se seront formés peu à peu des dialectes distincts, mais toujours en contact les uns avec les autres, et d'autant plus analogues qu'ils étaient plus voisins entre eux." A similar idea was articulated by Schuchardt in 1866, with respect to the Romance languages: "Jede allgemeine Sprachveränderung entspringt auf einem beschränkten Raume und breitet sich nur allmählich über das ganze Sprachgebiet aus" (Schuchardt 1866: 103).

6 Germanic-Balto-Slavic: 143 isoglosses, Balto-Slavic-Indo-Iranian: 61, Germanic-Indo-Iranian: 15, Germanic-Balto-Slavic-Indo-Iranian: 14, Greek-Italic: 132, Greek-Indo-Iranian: 99, Italic-Indo-Iranian: 20, Greek-Italic-Indo-Iranian: 4, Greek-Balto-Slavic-Indo-Iranian: 10 (Schmidt 1872).

are not rigid, however, as isoglosses sometimes cross the centum/satem divide. For example, Meillet (1908: 17 ff.) defined a "northwestern" dialect area based on shared vocabulary in Balto-Slavic, Germanic, Italic, and Celtic. Meillet's methodology (1908: 10) states that only branches that were (at some point) geographically contiguous can be part of the same dialect area. In itself, this makes sense, but combined with the flexibility of the wave model, it introduces a high risk of circularity. Thus, when Meillet (1908: 135) eventually concludes that the Indo-European dialects were never displaced, i.e., the relative geographical position of the branches in the historical era is identical to the relative position of the Proto-Indo-European dialect groups that they developed from, it may be argued that the result is biased.

Meillet's dialectal model was complicated by the discovery of Tocharian (in 1908), which shares the centum treatment of the velars and *r*-endings in the middle with the western branches, despite being attested as far east as the Tarim Basin. To explain this, it may be argued that the centum languages are archaic, i.e., that satemization and *i*-endings in the middle are innovations of the "central" Indo-European dialects (Porzig 1954: 44; Burrow 1973: 13–14). However, the decipherment of Hittite (Hrozný 1915) and the other Anatolian languages, geographically situated between Greek, Armenian and Indo-Iranian, but linguistically divergent in many respects, meant that the dialectal distribution could no longer be accounted for in the way Meillet had attempted.

Porzig (1954) reassessed the question of whether the branches of Indo-European reflect dialectal differences that were already present in Proto-Indo-European. He collected isoglosses that unite various branch combinations, supporting Meillet's basic division into a western and an eastern group, although he considered Greek as part of the latter. As for Hittite (= Anatolian), Tocharian and Albanian, Porzig tentatively groups them together with the eastern group. In this model, the centum/satem isogloss is given less weight and is argued to postdate most other dialectal innovations. Indo-Iranian is seen as a branch in the eastern periphery of the dialect area, evidenced by archaisms shared with Italic and Celtic, representing the western periphery. Tocharian is argued to be particularly close to Balto-Slavic and Germanic. In this sense, Tocharian is believed to have been displaced from its relative prehistoric geographical position, being attested closer to Indo-Iranian. Importantly, Porzig thus attempts to derive the relative prehistoric positions of the branches from the linguistic evidence, not the other way around. However, he does not apply this practice consistently. Since Porzig's definition of archaism vs. shared innovation is at times problematic (cf. 2.2.3), it is unclear why his Indo-Iranian-Italic-Celtic isoglosses should not have consequences for his understanding of the prehistoric

geographic position of Indo-Iranian, unless the historical geographic position of the branches has been allowed to influence the analysis of shared features as archaisms or innovations.

In terms of shared dialectal innovations pertaining to Indo-Iranian, Porzig (1954: 157 ff.) lists features shared by Indo-Iranian and Balto-Slavic on the one hand and by Indo-Iranian, Greek and Armenian on the other, as well as features shared by all four branches. Indo-Iranian is argued to share 21 isoglosses with Balto-Slavic, including a future in *-*sie*/*o*-, the RUKI rule and 16 lexemes. Indo-Iranian and Greek are according to Porzig united by 16 isoglosses, including the comparative in *-*tero*- and 13 lexemes. Furthermore, Armenian is argued to share seven lexemes with Indo-Iranian, and five with both Indo-Iranian and Greek. While earlier works had claimed that the shared lexical material of Indo-Iranian and Balto-Slavic is particularly rich (especially Arntz 1933, listing over 300 isoglosses; cf. also Schmidt 1872; Meillet 1926; Bonfante 1931), Porzig's Indo-Iranian-Balto-Slavic list is thus only slightly longer than the Indo-Iranian-Greek one.

In the latter half of the 20th century, much of the research on Indo-European subgrouping was concerned with the position of Anatolian and Tocharian. While Forrer (1921) and Sturtevant (1926; 1933) had formulated the Indo-Anatolian hypothesis, in which all non-Anatolian branches formed a subgroup after Anatolian had split off,[7] Pedersen (1938: 190–191) stated that Anatolian had lost certain features, but retained others (archaisms) that had been lost elsewhere, basically treating Anatolian as any other branch. Eichner (1975: 100) argued that Anatolian in fact shows traces of certain Proto-Indo-European verbal categories that at first glance seem to be absent, which shows that they do not represent shared innovations in the non-Anatolian branches. This so-called *Schwundhypothese* was cautiously supported by Rieken (2009). An intermediate hypothesis argues that Anatolian separated early from the rest of Indo-European, but that the other branches did not undergo enough shared innovations to justify calling them a subgroup (Meid 1975; Neu 1976; Melchert 1998). Puhvel (1994) advocated a dialectal model in which Anatolian is close to the western branches (Celtic, Italic, Germanic, Greek, sometimes including Tocharian). However, there is increasing support for the Indo-Anatolian hypothesis (Cowgill 1974; Gamkrelidze & Ivanov 1995: 363; Lehrman 1996; Oettinger 2014). Kloek-

7 Forrer (1921: 26–27) even regarded Luwian as an earlier split than Hittite. It should be noted that the arguments on which Forrer and Sturtevant based their conclusions are different from those compiled by Kloekhorst & Pronk (2019). Rather than basing their conclusions on shared innovations of the non-Anatolian branches, Forrer and Sturtevant regarded Anatolian as having lost a host of features from the protolanguage, which in their view indicated an early split.

horst & Pronk (2019) have compiled 34 innovations, of which 23 are classified as plausible, shared by the non-Anatolian branches, which convincingly show that Proto-Indo-Anatolian split in a tree-like fashion into an Anatolian and a Core Indo-European subgroup. As for Tocharian, it is still unclear whether it reflects an early split defined by shared innovations of the non-Tocharian Core Indo-European branches (Peyrot 2022).

The Graeco-Aryan hypothesis, which posits a subgroup or dialect group consisting of Indo-Iranian, Greek, and often Armenian, also gained a more prominent status during this time. In his handbook, Fortson states that "it is widely thought that Indo-Iranian forms a subgroup with Greek, Armenian, and Phrygian" (2010: 203). Birwé (1956) and Meid (1975) argued that some of the similarities in the verbal system of Indo-Iranian and Greek may be shared innovations, although they explained this as a result of dialectal contact rather than descent from a common subgroup. However, as Kümmel (2022: 262) has argued, features like the reduplicated perfect and augmented imperfect are better analysed as archaisms (cf. Hoffmann 1970; Schlerath 1981). Euler (1979) studied shared features in nominal derivation in Indo-Iranian, Greek, and Armenian, which he argues form a dialect group within a wider eastern Indo-European group that also includes Balto-Slavic. Similarly, Gamkrelidze & Ivanov (1995: 345–373) group Indo-Iranian, Greek, and Armenian together based on morphological, phonological, and lexical isoglosses,[8] but treat them as a dialect group rather than a subgroup in the strict sense. In Gamkrelidze & Ivanov's model, the satem languages undergo shared innovations despite belonging to different primary groupings (i.e., Graeco-Aryan and Balto-Slavic-Germanic). Thus, in most articulations of the Graeco-Aryan hypothesis, Greek and Indo-Iranian are not derived from a uniform protolanguage but rather from a differentiated dialect group. A close relationship between Greek and Indo-Iranian has also been assumed in works on Indo-European comparative poetry and religion (Watkins 1995: 309; West 2007: 6, 46).

The second half of the 20th and early 21st centuries also saw the rise of statistical and computational methods for subgrouping in Indo-European and historical linguistics in general (already Kroeber & Chrétien 1937; Gleason 1959;

8 Morphological: gen.sg. **-osio*, case endings in **-bʰi-*, a comparative in **-tero-*, athematic and thematic aorists. Apart from the comparative in **-tero-*, these features are not exclusively Graeco-Aryan, however.

Phonological: **ŗ*, **ṃ* > **a*. This sound change does not include Armenian or Phrygian, however, the latter being the closest relative of Greek (Obrador-Cursach 2020: 67, 127).

As for Graeco-Aryan lexical isoglosses, Gamkrelidze & Ivanov cite Porzig (1954). For more comprehensive studies on Indo-Iranian-Greek-Armenian lexical isoglosses, see Solta (1960) and Martirosyan (2013).

Tischler 1973; Davies & Ross 1975; Dyen, Kruskal & Black 1992; Bird 1993). Ringe, Warnow & Taylor (2002) generated a family tree based on a dataset of 370 phonological, morphological, and lexical features, called *characters* (cf. 2.2.1). Aside from Anatolian representing the first split against the rest of the family, followed by Tocharian, the results group Indo-Iranian together with Balto-Slavic, which form a node within a larger subgroup together with Graeco-Armenian. In their model, the Indo-Slavic node is based on three isoglosses: 1) the merger of the velars **K* and labiovelars **K*^{w}, 2) the RUKI rule, i.e., retraction of **s* after **i*, **u*, **r*, **K*$^{(w)}$, and 3) the lexeme **ui-* 'all' (Ringe, Warnow & Taylor 2002: 104).

Kassian et al. (2021) generated a family tree combining the results of three different phylogenetic algorithms, based on 13 110-item Swadesh wordlists, each representing a branch of Indo-European.[9] The results basically support those of Ringe, Warnow & Taylor (2002). Anatolian, followed by Tocharian, are the earliest splits, whereas Indo-Iranian and Balto-Slavic form a subgroup. The Indo-Iranian and Balto-Slavic wordlists share 11 out of 110 lexical items to the exclusion of the other branches, although only one (**pleu-* 'to swim') is argued to be a compelling shared innovation (Kassian et al. 2021: S110). The Indo-Slavic node is part of a so-called Inner Indo-European clade together with Graeco-Armenian, Italic-Celtic-Germanic, and Albanian. The Inner Indo-European clade splits into four subgroups without demonstrable internal bifurcations.

A similar tree model is advocated by Olander (2019) and Søborg (2020: 5), in which all branches except Anatolian and Tocharian are grouped together under the label Indo-Celtic. This clade splits into an Italo-Celtic and an Indo-Germanic clade, the latter consisting of Albanian, Armenian, Balto-Slavic, Germanic, Greek, and Indo-Iranian. Within this clade, Indo-Iranian and Balto-Slavic are argued to form an Indo-Slavic subgroup. As evidence for this, Søborg (2020: 7) cites the RUKI rule, palatalization of the palatovelars, the merger of **K* and **K*^{w}, as well as seven lexical innovations. After the split of Indo-Germanic, the next branch to split off (i.e., stop taking part in shared innovations) in Olander's (2019: 241) model is Greek, followed by Armenian and Albanian (after which Indo-Slavic splits into Indo-Iranian and Balto-Slavic). Søborg (2020: 5), on the other hand, argues for a "Balkanic" subgroup (cf. Van Windekens 1963; Klingenschmitt 1994), consisting of Albanian, Armenian and Greek, as well as Messapic and Phrygian, which undergo shared innovations to the exclusion of Indo-Slavic.

Yet, besides the Graeco-Aryan and Indo-Slavic hypotheses, the "primary split" hypothesis has still retained some support. Hamp (1990), while accept-

9 Baltic, Slavic, Indo-Aryan, Iranian, Old Irish, and Brittonic are represented by independent wordlists.

ing the Indo-Anatolian hypothesis, argues for Indo-Iranian to be the second branch to split from the rest, whereas Balto-Slavic, Germanic, Albanian, and Celtic form a "northern" dialect group based on shared substratal developments. Kümmel (2022: 251) argues that the Indo-Iranian vocalization of laryngeals to **i*, as opposed to **a* in several other branches, could point to an early divergence from the rest of the family, but cautions that the development in the other branches need not be a shared innovation. Ultimately, he concludes that Indo-Iranian shares features with the satem branches, as well as, on the one hand, the northern branches (Balto-Slavic, Germanic) and, on the other hand, the southern branches (Greek, Albanian, Armenian), but that it does not clearly form a subgroup with any other branch.

Thus, it appears that the current hypotheses on the position of Indo-Iranian are basically the same as those already formulated in the 19th century: 1) the Graeco-Aryan hypothesis, implying a subgroup or dialectal group consisting of Indo-Iranian, Greek, Armenian, going back to Schleicher (1853), with the difference that Italic is no longer included in this grouping; 2) the primary split hypothesis, implying that Indo-Iranian is not part of any subgroup (now specifically within Core Indo-European rather than within Indo-European as a whole); and 3) the Indo-Slavic hypothesis, implying a subgroup or dialectal group consisting of Indo-Iranian and Balto-Slavic. In other words, the question remains unsolved, unless one settles for a radical wave model (e.g., Huld 1996), which can combine all three hypotheses by assuming that Indo-Iranian shares innovations with Greek and Armenian on the one hand, and with Balto-Slavic on the other, while at the same time being clearly separated from the European branches. The various proponents of the different hypotheses are summarized in Figure 1.

As mentioned above, already Pictet (1859–1863) and Schrader (1883) turned to interdisciplinary methods to infer the relationship between the branches of Indo-European. In some ways, this approach has been revived following the advances in population genomics and ancient DNA. Based on a combination of genome samples of modern Indo-Iranian-speaking individuals and ancient individuals from hypothesized Indo-Iranian-speaking contexts, Narasimhan et al. (2019) found that the genetic ancestors of Indo-Iranian speakers are similar to populations classified archaeologically as belonging to the Corded Ware cultures of central and eastern Europe.[10] The Corded Ware cultures have often been taken as an archaeological proxy for the ancestors of the speakers of Ger-

10 Indo-Iranian was connected to the Corded Ware horizon already by Specht (1934: 29–30), although he suggested that Indo-Iranian developed independently and merged with Corded Ware groups as these migrated to the east.

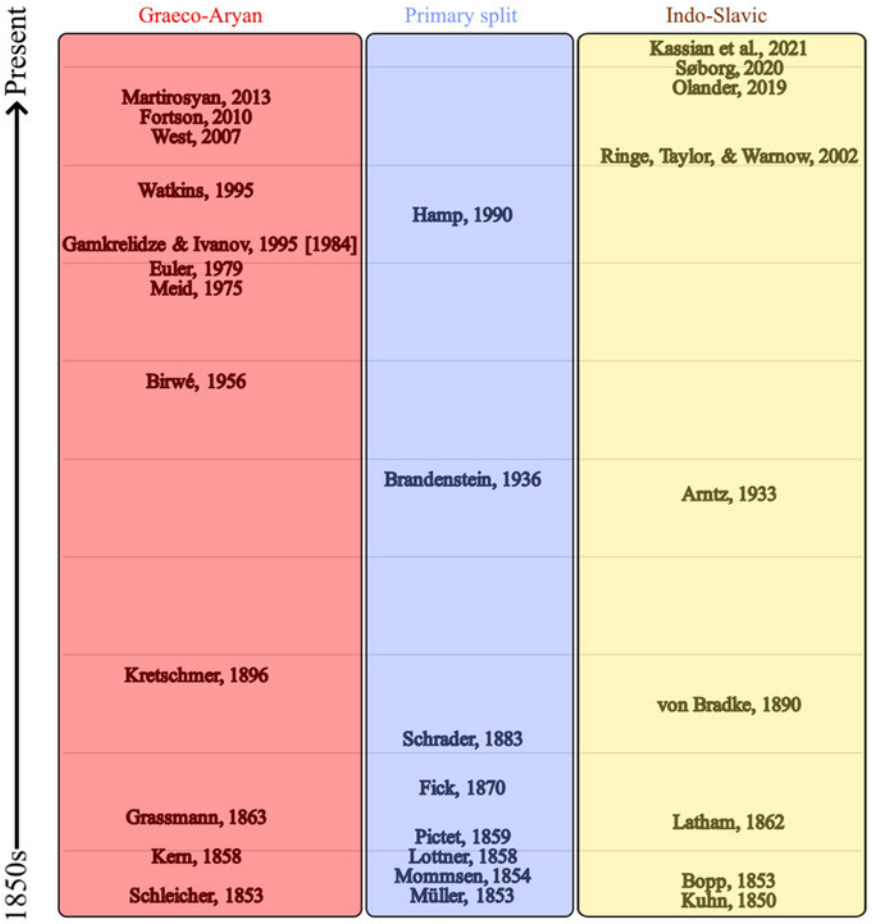

FIGURE 1 The supporters of three major hypotheses on the position of Indo-Iranian discussed in Chapter 1
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manic and Balto-Slavic (Anthony 2007: 367) as well as Italic and Celtic (Specht 1934; Mallory 1989: 264; Huld 1996). Narasimhan et al. (2019: 11) explicitly propose that a Corded Ware origin of Indo-Iranian correlates to its linguistic affiliation with Balto-Slavic, citing satemization and the RUKI rule as evidence.

A few remarks on the process of satemization and the RUKI rule are due in order to highlight the problems of using these sound changes to infer Indo-European phylogenetic relationships. First, since the reconstruction of the Proto-Indo-European velars is debated (cf. Steensland 1973: 1–2; Kümmel 2007: 310 ff.), it is uncertain to what extent satemization can be regarded as a shared

innovation. In the traditional three-way system, with contrastive palatovelar **Ḱ*, velar **K*, and labiovelar **Kʷ* (Bezzenberger 1890: 259; Bugge 1890: 108, fn. 1; Osthoff 1890: 63–64, fn. 1), the process of satemization solely implies the merger of **K* and **Kʷ* by loss of labialization: no palatalization need be assumed (cf. Panzer 1982). Since almost all Indo-European languages merged **K* with either **Ḱ* or **Kʷ*, however, the development may simply have affected various branches independently (on the status of Luwian, Albanian and Armenian, see below).

As an alternative to the three-way reconstruction, Meillet (1894) proposed that the pure velar series was not phonemic, but arose through conditional neutralizations of **Ḱ* and **Kʷ*; the centum languages merged this neutralized velar with **Ḱ*, while the satem languages merged it with **Kʷ* (cf. Kortlandt 1978b). However, Reichelt (1922) and Kuryłowicz (1935: 23; 1971) argued that Proto-Indo-European had a two-velar system of **Ḱ* and **K*, in which **Kʷ* is a later innovation of the centum languages, which implies that satemization is a retention and thus non-probative for subgrouping. Conversely, Hirt (1899: 224), while also working with a two-velar system, argued that Proto-Indo-European had **K* and **Kʷ*, in which case the palatalization of **K* and delabialization of **Kʷ* are innovations in the satem languages (also Meillet 1934: 92–93). This is essentially the position taken by Ringe, Warnow & Taylor (2002: 113). Steensland (1973: 125–127) reaches a similar conclusion, reconstructing Proto-Indo-European **K* vs. **Kʷ*, but argues that **Ḱ* originated as a conditioned allophone of **K*, which became the default realization of the phoneme in the satem languages (cf. Shields 1981). Steensland maintains that this may just as well be an independent development of the individual branches as a shared innovation of the satem group. Thus, even with a reconstruction **K* vs. **Kʷ*, satemization may be seen as a trivial change.

Before the discovery of Hittite and Tocharian, the centum/satem isogloss seemed to divide the Indo-European languages into a western and an eastern group (Pedersen 1931: 318). At first glance, the fact that Hittite and Tocharian are centum languages, but nevertheless eastern, seemed to support the idea that the centum treatment of the velars reflects the archaic situation, whereas satemization is the innovative state (Meillet 1934: 92–93; Burrow 1973: 13–14). Similarly, under the Indo-Anatolian hypothesis, the centum status of Hittite seems to support this notion. However, with the discovery of Luwian and Lycian, which seem to directly reflect a three-velar system (Luw. *z*, Lyc. *s* < **ḱ*, Luw., Lyc. *k* < **k*, Luw. *ku*, Lyc. *k*, *t* < **kʷ*, cf. Melchert 1987; 1989), the evidence points in favour of reconstructing a three-way distinction for Proto-Indo-Anatolian (Kloekhorst 2008: 17–18).[11] Not only would this suggest that satem-

11 Melchert (2012) later argued that the Luwian (and Lycian) situation arose through condi-

ization does not, in fact, involve palatalization, but it would also prove that "centumization", i.e., the merger of **Ḱ* and **K*, affected Hittite and the remaining centum branches independently. This lends additional credibility to the idea that the centum/satem isogloss is trivial.

Second, it does not make sense to use satemization as evidence for Indo-Slavic specifically, since Albanian and Armenian are also satem languages.[12] Yet, it has been argued that Albanian (Pedersen 1900: 340; Curtis 2018: 1807; Hyllested & Joseph 2022: 239) and Armenian (Macak 2017: 1048–1049; Olsen & Thorsø 2022: 205) did not merge **K* and **Kʷ*, whereas Balto-Slavic and Indo-Iranian did, in which case the merger could be seen as a shared Indo-Slavic innovation (thus Ringe, Warnow & Taylor 2002). This is unlikely, however, because the partial vocalization of **R̥* to **uR* in Balto-Slavic may have been conditioned by a preceding labiovelar, the outcome elsewhere being **iR* (Brugmann & Delbrück 1897: 453–455; Güntert 1916: 105–107; Vaillant I: 171–172).[13] Additionally, Balto-Slavic occasionally shows centum reflexes of Indo-European palatovelars, probably caused by depalatalization before certain resonants, which is only partly paralleled by Indo-Iranian (Kortlandt 1978b). In that case, the merger of **K* and *Kʷ* cannot be a shared Indo-Slavic innovation, but must have been preceded by branch-specific developments.

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tional palatalization of **k* < **ḱ*, **k*, and thus is compatible with a centum reconstruction of Proto-Anatolian. However, some cases of palatalization are difficult to explain phonetically, e.g., CLuw. *zanta* ~ Hitt. *katta* 'down' < **ḱmto*, Lyc. *sñta* 'ten' < **ḱmteh₂* (for the semantics, cf. Melchert 2004: 58). Kimball (1994) and Woodhouse (1998) argue against a Proto-Anatolian three-way system based on the alleged development Luw. *k* < **ǵ*$^{(h)}$ / _*o*. However, all three etymologies cited in favour of this sound change are problematic: CLuw. *katmarsi*(*ia*)- ~ Hitt. *kammarš-*^{zi} 'to defecate' < **ǵʰod-mr-* is doubtful, since **-d*$^{(h)}$*n-* yields Hitt. *-tn-* (Kloekhorst 2008: 432); HLuw. loc.sg. *ta-ka-mi-i* /tgmī/ 'earth', which may alternatively be read /tgāmi/ (Kloekhorst 2008: 861), contains a /g/ that could perhaps be explained by depalatalization before **m*, as in Balto-Slavic (Kortlandt 1978b); CLuw. *kallar-* n. 'something evil or unpleasant' may be a Hittite borrowing, cf. Hitt. *kallar-* adj. 'inauspicious, unpropitious, baleful, enormous', but even if it is native, the semantic connection to OIr. *galar* n. 'disease', Nw. *galder* 'swelling in the foot of horses' is not compelling.

12 Furthermore, based on genetic evidence, Armenian has been hypothesized to derive directly from the Yamnaya horizon, unlike Indo-Iranian and Balto-Slavic (Lazaridis et al. 2022; Thorsø 2023). Thus, the distribution of the satem branches based on genetics may not correlate with the distribution of the sound change.

13 The attested distribution of **iR*, **uR* < **R̥* in Balto-Slavic far from perfectly reflects the original situation, however, e.g., OCS *žьrǫ* 'to swallow, devour' < **gʷrh₃-*, Lith. *dùmti* 'to blow' < **dʰmH-*. An alternative explanation is that the distribution of **iR* and **uR* correlates to the full grades **eR* and **oR*, respectively (Mikkola 1913: 100; Trautmann 1923a), but this does not explain the split outcome of vocalized resonants in the first place. It may rather be seen as complimentary to the explanation based on labiovelar conditioning.

Moreover, the evidence for a three-way distinction in Albanian (Kloekhorst in prep.) and Armenian (Kortlandt 1975a) is very slim. In the case of Albanian, it is based on the alleged different outcomes of **K* and **K^{w}* before **e*, **i*. However, the palatalization of **k* > *q*, **g$^{(h)}$* > *gj* also affects Latin loans (Curtis 2018: 1807) and clearly belongs to a later phase of the development of Albanian than the palatalization of **k^{w}* > *s*, *g$^{w(h)}$* > *z* (cf. de Vaan 2018). Most examples of palatalization of the plain velars are plurals, e.g., Alb. *plak* m. 'old man', pl. *pleq*, where the palatalization must be posterior to the monophthongization and apocope of nom.pl. **-oi* > **-i*. Importantly, this palatalization also affects **k^{w}*, e.g., Alb. *ujk* m. 'wolf', pl. *ujq* < **ulk^{w}o-*. The handful of etymologies where the palatalization of **k* could be primary, e.g., *qoj* 'to awaken' < **ki-eh$_1$-*, cf. Lat. *cieō* 'to move, stir up', Gr. κινέω 'to set in motion, drive away, shake' (Demiraj 1997: 65; see further Pedersen 1900: 329–330), have alternatively been explained as analogical restorations (Hermann 1907: 47; Kortlandt 1980: 246). Furthermore, the absence of palatalization before **ē* in *kóhë* 'time' < **kēsḱo-* (which shows that **k* > *q* is posterior to **ē* > *o*), is irrelevant, since the word only has Balto-Slavic cognates, rendering the reconstruction of **k* circular. Additionally, it is doubtful whether we would expect palatalization before **ē* in the first place, since all alleged examples of **k^{w}ē*, **g$^{w(h)}$ē*> *so*, *zo* are uncompelling (cf. Demiraj 1997: s.vv.): Alb. *sórrë* 'crow' < **k^{w}ērsnā-* may be onomatopoeic, or reconstructed as **ḱu̯ērsnā-*, cf. SCr. *svràka* 'magpie'; *zog* 'bird; nestling' may be connected to Arm. *jag* 'little bird, sparrow; nestling' < **ǵ^{h}u̯āg^{h}u-* rather than to Gr. ζῷον 'living being'; *zórrë* 'gut, intestines' has no clear etymology, but a derivation from **g^{w}erh$_3$-* 'to swallow' is semantically doubtful; *zot* 'god' is not entirely clear, but is probably derived from **dieu-*. Thus, even if *kóhë* 'time' < **kēsḱo-* were a valid etymology, it would not prove a phonemic distinction between **K* and **K^{w}*, since there is no solid evidence that **ē* caused palatalization of **K^{w}*.

The proposed three-way distinction of the velar series in Armenian is based on the absence of evidence for palatalization of **K* and **g^{w}* before **e*, **i*, which affects **k^{w}* and **g^{wh}*. The phonetic justification for the special treatment of **g^{w}* is not clear. A similar conditioning is observed in Greek, e.g., Gr. βιός 'life' < **g^{w}ih$_3$-*, although not before **e*, cf. Gr. ἀδελφεός 'brother' < **g^{w}elb^{h}-*. As for the absence of palatalization of **K*, Kortlandt (1975a) argues that all examples may be explained as analogical restorations. Importantly, there are also examples of original **k^{w}* that escaped palatalization in the expected contexts, e.g., Arm. *hing* 'five' < **penk^{w}e*.

As for the RUKI rule (Pedersen 1895) as evidence for Indo-Slavic, the problem is that its application in Baltic, Slavic, and Indo-Iranian does not fully overlap (Lipp 2009: 32–38 with lit.). Generally, Indo-Iranian and Slavic apply the RUKI rule consistently (AiGr. I: 299 ff.; Vaillant I: 28), whereas there are many excep-

tions in Baltic (Petit 2018: 1649). This has been explained by assuming that the RUKI rule was a dialectal development that did not fully affect Baltic, situated in the western periphery (Stang 1966: 98–99). However, a more straightforward explanation is that RUKI originally operated on a phonetic level and was phonologized independently in the subbranches as a result of the introduction of additional sibilants into the phonology (Andersen 1968: 176; Martinet 1970: 239; Allen 1973: 107).[14] In Baltic, the rule only operates regularly after **r*, and in the case of **i* and **u* only when **s* is followed by **k* (Jakob 2023b). In Indo-Iranian, it operates not only after inherited **i* and **r*, but also after **i* < **H̥* and **r* < **l* (Lubotsky 2018). Therefore, while the RUKI rule itself is specific and non-trivial (Beekes 1988: 80; Hock 1991: 442), it is difficult to exclude that it also operated in (Core) Proto-Indo-European but failed to be phonologized in other branches.[15] Thus, there are major caveats associated with both satemization and the RUKI rule as evidence for subgrouping, and neither can be considered to provide compelling evidence for the Indo-Slavic hypothesis.

To sum up, we have seen three major hypotheses on the position of Indo-Iranian within the Indo-European language family: the Graeco-Aryan hypothesis, the primary split hypothesis, and the Indo-Slavic hypothesis. All three go back at least to the 1850s, and, to a greater or lesser degree, all retain proponents in the current literature. In other words, neither hypothesis has been supported by enough linguistic evidence to reach broad acceptance. Narasimhan et al. (2019) connect the hypothesized genetic connection between early Indo-Iranian speakers and Corded Ware populations to the Indo-Slavic hypothesis, with specific reference to satemization and the RUKI rule. However, as the discussion above has shown, these phonological isoglosses do not offer unambiguous linguistic evidence for Indo-Slavic. Yet, the genetic evidence provides an impetus to re-evaluate the linguistic evidence for the Indo-Slavic hypothesis. As we have seen, besides satemization and the RUKI rule, additional evidence for the Indo-Slavic hypothesis has been proposed. In particular, the lexical isoglosses shared by Indo-Iranian and Balto-Slavic have been taken as evidence for a period of dialectal proximity of Pre-Proto-Indo-Iranian and Pre-Proto-Balto-Slavic. However, this material deserves a reappraisal, for several reasons: 1) the bulk of the research is outdated (cf. Schmidt 1872; Arntz 1933) or dis-

14 For example, the development **ḱ* > *s* in Iranian and Slavic created an opposition between **s* and **š* after **r*, **u*, **k*, **i*, e.g., YAv. *vīša-* n. 'poison' < **uis-* vs. *vīs-* f. 'dwelling' < **uiḱ-*. Similarly, the merger of **ḱ*, **ǵ* and **š* before **t* in Proto-Indo-Iranian dissociated **š* from **s*, e.g., Skt. *iṣṭí-* f. 'search' < **h₂iš-ti-* vs. *íṣṭi-* f. 'worship, sacrifice' < **Hih₂ǵ-ti-* next to *astá-* 'thrown, shot' < **h₁es-to-* vs. *aṣṭá-* 'eight' < **h₃eḱt-eh₃-*.

15 For a possible reflex of the RUKI rule in Hieroglyphic Luwian, see Rieken (2010).

misses large parts of the material without justification (cf. Porzig 1954); 2) the lexical evidence has mainly been studied from a dialectological or wave model perspective, where the distinction between archaisms and shared innovations has not received sufficient attention (cf. Meillet 1908; Porzig 1954); 3) computational studies based on Swadesh-type wordlists leave most of the lexicon out of consideration, as a consequence of this methodology (cf. Kassian et al. 2021).

1.4 Research Questions

The main research questions of this study are the following:

A. Do the lexical isoglosses shared by Indo-Iranian and Balto-Slavic support an Indo-Slavic subgroup within Core Indo-European?
    1. How many Indo-Slavic lexical isoglosses are there? (Chapter 3)
    2. How many of the Indo-Slavic lexical isoglosses are plausible shared innovations? (Chapter 4)
    3. In terms of linguistic palaeontology, what does the corpus of Indo-Slavic lexical isoglosses suggest regarding the timeframe and location of the hypothesized Indo-Slavic community? (Chapter 4)

B. Which scenarios on the prehistoric dispersal of Indo-Iranian are possible based on the evidence from genetics and archaeology? Which scenario best accounts for the linguistic conclusions regarding question A? (Chapter 5)

CHAPTER 2

Theory and Methodology

2.1 Introduction

As the discussion in 1.3 has shown, the internal structure of the Indo-European language family has been described using the tree model or the wave model, which are often seen as complementary. In the following sections, the theoretical principles and methodological practices associated with both models will be discussed and evaluated. Special emphasis will be given to lexical evidence in subgrouping methodology. It will be argued that both the tree and wave models have their place, but occupy different stages in the workflow of subgrouping research. Finally, linguistic palaeontology and its role in debates on the homelands of prehistoric linguistic communities will be discussed.

2.2 Phylogenetic Subgrouping

The idea to represent the internal structure of the Indo-European language family in the form of a tree diagram goes back to Schleicher (1853; 1861).[1] As indicated by the title of his 1853 paper "Die erste Spaltungen des indogermanischen Urvolkes", Schleicher envisioned the splits between the branches in migrationist terms, i.e., the splits were caused by physical separation of speech communities. He operated with binary splits and indicated the longevity of branches by their relative length in the diagram. For example, "graecoitalokeltisch" represents a shorter period of unity than "arisch" (i.e., Indo-Iranian), despite the fact that these nodes are on the same level in the family tree (cf. Figure 2).

It has often been remarked that the tree model is too abstract or simplistic to reflect the actual process of diversification of a language family as a historical reality (Hoenigswald 1966; Schlerath 1981; Clackson 2022: 26). Sudden migrations, causing clear-cut splits of speech communities, as Schleicher describes them, are rare. Already in the mid-19th century, scholars like Pictet (1859–1863: I, p. 48) and Schuchardt (1866: 103) argued that linguistic divergence is gradual.

1 However, already Rask (1818: 84) used a tree-like diagram of the Celtic languages, and there are even older examples, e.g., by the 17th century scholars Georg Stiernhielm and Georg Hickes (Sutrop 2012).

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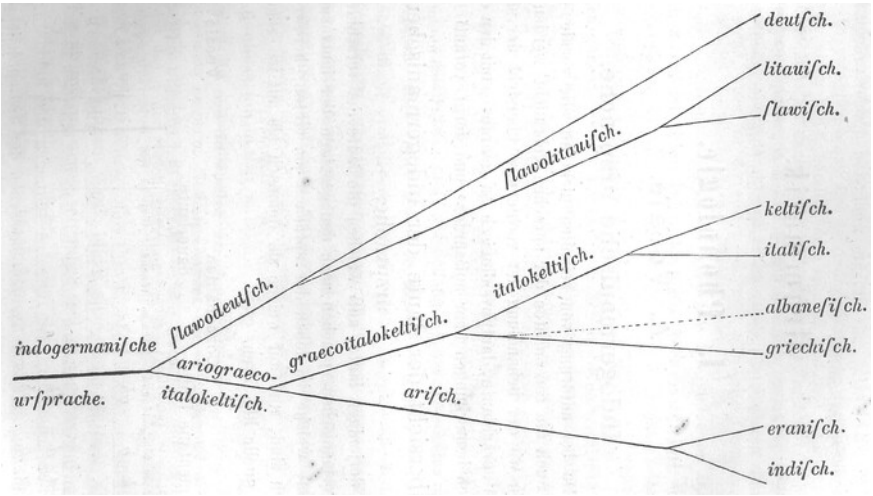

FIGURE 2 Schleicher's Indo-European family tree (1861: 7)

This realization was certainly an important motivation behind Schmidt's (1872) wave model (Geisler & List 2013). However, rather than reflecting the complex nature of actual linguistic divergence, the tree model may be seen as a post-hoc representation of the relationship between the branches. In other words, a split in the tree model does not, in most cases, correspond to a sudden split of a linguistic community, but rather to the observable result of a gradual diversification process. As we will see, the methodological strength of the tree model, in contrast to the wave model, lies in its rigidity (Schlerath 1981): it forces us to make explicit hypotheses regarding the phylogenetic relationship between the branches, which can be tested (and falsified) against the data.

2.2.1 *The Shared Innovation Principle*

A core principle in subgrouping methodology, or phylogenetics, is that subgroups, or clades, should be based on shared innovations, not shared retentions or archaisms (Fick 1873; Leskien 1876; Delbrück 1880; Brugmann 1884; Dyen 1953: 581; Porzig 1954: 55; Greenberg 1957: 49; Hoenigswald 1966; Ringe 2017: 62).[2] An innovation is any linguistic feature (phonological, inflectional, deriva-

2 Although Brugmann is usually credited for formalizing the principles of subgrouping methodology, already Fick (1873: 164) clearly states that subgroups must be based on shared innovations (here in an argument in favour of a European subgroup): "Um den Schluss auf eine ehemalige Spracheinheit aller Europäer wirklich zu begründen, müssen die Differenzen zwischen europäischer und arischer Sprache also derart sein, dass die europäische Eigenthüm-

tional, lexical, syntactical) of a language that was not present in its immediate ancestor. When two related languages have undergone the same innovation, it either reflects independent developments[3] or a shared development in a common ancestor. By compiling shared innovations of related languages, a family tree can be constructed, each branch or subgroup reflecting a set of shared innovations.

In the terminology of Ringe, Warnow & Taylor (2002), which is borrowed from cladistics, linguistic features may be described as *characters* with variable *states*. A character is an abstraction of phonology, morphology, lexicon or syntax, i.e., a phoneme, morpheme, lexeme, or syntactic structure. A state is the representation of a character in a particular language. For example, the Proto-Indo-European phoneme */p/ is a character that is reconstructed to explain a set of regular sound correspondences in the Indo-European languages. The character */p/ is reflected in the attested languages by different states, such as Latin *p*, Greek *p*, Germanic *f*. Based on the typological principle that *p* > *f* is a

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lichkeit eine Abweichung von der Ursprache enthält, dann zwingt uns dieselbe allerdings ein einheitliches sprachlich verbundenes Volk als Urheber dieser Umwandlung des früheren Bestandes anzunehmen, und wie uns die Differenz das Faktum der Scheidung verbürgt, so bezeugt *die gleichmässige Durchführung der sprachlichen Neuerung sprachlichen Zusammenhang unter den diese Neuerung durchführenden Individuen* [emphasis added]." It is possible that the shared innovation principle goes back to even earlier scholarship.

Leskien (1876: vii) argues: "Die Kriterien einer engeren Gemeinschaft können nur in positiven Uebereinstimmungen der betreffenden Sprachen, die zugleich Abweichungen von den übrigen sind, gefunden werden." Later (p. xxii), in a discussion on Schmidt's (1872) wave model, Leskien states that "Man bemerke, das es sich um lauter Verluste einst gemeinsamer indogermanischer Bildungen handelt. Sie beweisen für die nähere oder fernere Beziehung der betreffenden Sprachen nichts." Further on (p. xxiv), regarding an alleged Indo-Iranian-Balto-Slavic derivational correspondence, he argues that "Die Uebereinstimmung … beschränkt sich also … darauf, dass … in beiden Sprachgruppen eine gleichartige Weiterbildung mit Suffix *-ti-* vorgenommen ist, ein Umstand, dem ich bei der Häufigkeit des Suffixes in beiden keine besondere Bedeutung beilegen kann." With this, Leskien stresses that subgroups must be based on shared innovations, not shared archaisms or independent innovations.

Delbrück (1880: 135) contends that "nicht jede Gleichheit zwischen zwei Sprachen als argument für eine Urgemeinschaft betrachtet weden kann. […] [E]s bleiben streng genommen nur gemeinsam vollzogene Neuerungen als beweiskräftig übrig".

A few years later, Brugmann (1884: 231), in a dedicated methodological paper, concludes that "wirkliche Beweisgründe für die engere Zusammengehörigkeit zweier oder mehrerer Sprachen können nur solche Übereinstimmungen sein, welche Abweichungen von den übrigen Sprachen desselben Stammes sowie zugleich von der allgemeinen Grundsprache sind, also gemeinsam vollzogene Neuerungen".

3 Independent developments refer to innovations that are independent in the phylogenetic sense. As such, the term encompasses parallel innovations as well as areal developments, such as borrowing.

more likely sound change than the opposite, we hypothesize that Proto-Indo-European had the state **p*, which may be termed the *ancestral state*.[4] In this example, Germanic shows an innovative state, whereas Latin and Greek continue the ancestral state.

The identification of innovations presupposes that the ancestral state of a character can be determined. In practice, this is often extremely difficult. As discussed in section 1.3, the ancestral state of PIE **ḱ* has been reconstructed as a palatal/fronted velar or as a plain velar. Depending on the preferred reconstruction, the status of the attested states in the satem languages (e.g., Skt. *ś*, Av. *s* < PIIr. **ć*) as innovations or retentions changes.

Even if a state that is shared by two languages is decidedly innovative, it is often difficult to determine whether the innovation is shared or independent. Continuing with the centum/satem example, provided that the ancestral state is a three-way system **Ḱ*, **K*, **K^{w}*, the merger of **K* with either **Ḱ* or **K^{w}* is an evident innovation. However, if Luwian preserves the ancestral three-way system, Hittite must have merged **Ḱ* and **K* independently of the other centum languages.[5] This calls into question whether the centumization and satemization of the other branches could not also have happened independently (cf. Ringe 2017: 64).

2.2.2 *Typology of Shared Innovations*

Different types of characters are generally given different weight for subgrouping purposes (Porzig 1954: 59; Clackson 2022: 25). Innovations in inflectional morphology have been seen as the most significant,[6] since such morphemes are not easily borrowed, and often alter the morphosyntactic structure of the language (Greenberg 1957: 52; Clackson 1994: 25–26; Klingenschmitt 1994: 236). Yet, Greenberg (1957: 46) cautions that related languages may develop inde-

4 In the case of phonemes, the character and ancestral state are often identical, but refer to different aspects of the reconstruction; the character is a representation of the correspondence set responsible for postulating the phoneme, whereas the ancestral state refers to its phonological representation in the protolanguage. For morphological characters, the difference is more obvious; e.g., the 3sg. middle ending is a character with attested states such as Skt. *-te*, *-e*, Gr. *-ται*, *-τοι*, Lat. *-tur*. In this case, the reconstruction of the ancestral state is much more debated.

5 Here and elsewhere in this work, the validity of the primary branches of Indo-European is taken for granted.

6 Cf. Schleicher (1858b: 12): "… ich lasse nach einem bei mir feststehenden grundsatze nur den grammatischen ban als masstab der verwandtschaft zweier sprachen eines und desselben sprachstammes gelten und betrachte andere übereinstimmungen nur als willkommene zuthat …"

pendently in the same direction, since they share the same starting point. Innovations in derivational morphology are also given considerable weight, as new morphemes are unlikely to develop independently. However, they are less resistant to borrowing (Thomason 2001: 70–71). Phonological innovations, i.e., sound changes, are generally ranked lower than morphological innovations, since they are often typologically common and therefore may affect languages independently (Greenberg 1957: 50; Clackson 1994: 20). However, a chain of shared changes that feed each other seems more significant (Greenberg 1957: 51). An advantage of a particular type of phonological innovation, namely phonological mergers, is that their directionality is provable (Hoenigswald 1966). Less trivial sound changes are given more weight, but judging which sound changes are trivial often becomes subjective. Syntactic innovations are often disregarded for subgrouping purposes,[7] since the risk of chance resemblance is high, and since syntactic structures of the protolanguage are more difficult to access with the comparative method than phonological and morphological features (Clackson 2007: 157 ff.; 2022: 23; Gildea, Luján & Barðdal 2020). For some syntactic characters, e.g., basic word order, the number of possible states is so limited that the risk of independent innovations is high (cf. Ringe & Eska 2013: 262).

2.2.3 *Lexical Characters as Evidence for Subgrouping*

Lexical innovations have been given relatively little importance for inferring Indo-European phylogeny (Leskien 1876: xxiii; Delbrück 1880: 135; Hoenigswald 1966: 8). According to Meillet (1908: 126), this is because there are no two branches that do not share at least a few unique lexical correspondences. Porzig (1954: 59) argues that lexical correspondences only show that two branches were in contact, i.e., developed from contiguous dialect groups, but not that they form a subgroup in the strict sense. In Olander's (2022) volume on Indo-European phylogeny, lexical evidence is either seen as complementary to phonology and morphology, or disregarded, with the exception of Olsen & Thorsø (2022: 211–212), who take lexical innovations as the main evidence for a Graeco-Armenian subgroup (see also Martirosyan 2013, who interprets this as a dialectal grouping, however).

The main problem associated with lexical evidence in subgrouping methodology is that it is unclear if and how lexical characters can be defined in a way that makes them relevant for subgrouping purposes. There are essentially two options:

7 Notable exceptions include Longobardi & Guardiano (2009) and Longobardi et al. (2013).

1) *Character = etymon*: If the lexeme itself is the character, e.g., *h_2erh_3-*tro-* 'plough', all branches attesting the lexeme share the same state. However, as Ringe, Warnow & Taylor (2002: 71) argue, the branches that do not attest *h_2erh_3-tro-* must count as having different states, since they could have lost the lexeme independently. The consequence is that such a character is compatible with any tree structure, i.e., it can always be back-projected to the root of the tree, and is thus uninformative for subgrouping (cf. Kortlandt 2016). This problem was recognized by Porzig (1954: 58–59), who argued that isoglosses must be based on two positive states rather than presence and absence, which requires the use of semantic concepts rather than reconstructed etyma as characters. Peyrot (2022) describes the problem in terms of lack of *identifiability*. This term refers to the methodological criterion that "the linguistic element adduced as a shared innovation in the lower node should be clearly identifiable in the higher as well as in the lower node" (Peyrot 2022: 90). In other words, if a feature such as a lexeme is absent from an attested language, it is not identifiable, because we cannot determine whether it was lost in that language or never existed. By implication, the lexeme is not identifiable in the common ancestor; it may or may not have existed there. The result is that the ancestral state cannot be determined.

It is important to realize that identifiability is not only a concern regarding lexical characters. As exemplified by Peyrot (2022: 91), the comparative and superlative suffixes of, e.g., Greek and Indo-Iranian, are unattested in Anatolian and Tocharian. While one may be inclined to analyse them as innovations of the non-Tocharian Core Indo-European branches, it cannot in principle be excluded that these morphemes were lost in Anatolian and Tocharian. Therefore, in the strictest application of the identifiability criterion, the comparative and superlative suffixes are uninformative for the phylogeny. Many morphological characters in Ringe, Warnow, and Taylor (2002: 117–118), such as the augment and thematic optative, suffer from the same problem.

2) *Character = semantic concept*: If, as Porzig argued, semantic concepts are used as characters (thus, e.g., Ringe, Warnow & Taylor 2002; Kassian et al. 2021), e.g., PLOUGH, each branch that attests the same formation for a particular semantic concept is assigned the same state. As long as every branch has a word for PLOUGH, the identifiability criterion is met.[8] However, this approach does not resolve the problem of determining the ancestral state, i.e., which state should be reconstructed to Proto-Indo-European for that particular semantic

8 In reality, it is not necessarily the case that each branch attests a word for a given semantic concept.

concept. Furthermore, it restricts the object of study to basic vocabulary, since this is the only part of the lexicon where all languages are expected to attest one basic lexeme for each semantic concept, based on linguistic typology.[9] For non-basic vocabulary, such as PLOUGH, or more abstract concepts (e.g., BEAUTY, DOWNWARDS), languages show great variation in how semantic concepts are mapped. Therefore, using such concepts as characters is not justifiable.

However, even if exclusively basic vocabulary is considered, it is far from straightforward to accurately determine which lexeme occupied a certain basic vocabulary slot in modern languages, let alone in ancient languages or in the protolanguages of each branch (cf. the different approaches in Dyen, Kruskal & Black 1992; Kassian et al. 2021; Heggarty et al. 2023). As Peyrot puts it, "several etyma may have similar, overlapping or even identical meanings, and it is therefore difficult to prove that a certain meaning came to be expressed with a different etymon" (2022: 91).

Additionally, from a theoretical perspective, it is questionable whether the replacement of the lexical form mapped onto a particular semantic concept is in itself a significant process, comparable to a sound change or replacement of an inflectional ending, especially if the form itself is not a unique formation. Consider, for example, the character SWIM in Kassian et al. (2021: S86). Indo-Iranian and Balto-Slavic are argued to share the innovative state **pleu-* 'to swim', as opposed to, e.g., Gr. νέω 'to swim'. Yet, Greek also attests περιπλέω 'to bypass while sailing or swimming'. This implies that the meaning 'to swim' of **pleu-*, which elsewhere means 'to float, flow' (cf. LIV: 487), may be archaic. In Kassian et al.'s methodology, however, it is the fact that Indo-Iranian and Balto-Slavic use the same lexical material as the basic word for the same semantic concept that counts as a shared state, irrespective of whether a cognate is attested elsewhere. Even more questionable is the treatment of the basic vocabulary item FIRE in Kassian et al. (2021: S41–42). Although Indo-Iranian, Balto-Slavic, and Latin all attest reflexes of **h₁ngʷni-* 'fire', only the former two are argued to share the same state. Latin *ignis* 'fire' is coded as a separate state, since the other Italic languages attest reflexes of **peh₂ur/n-* 'fire', which is argued to be the ancestral state, as it is found in Anatolian (e.g., Hitt. *paḫḫur-/paḫḫuen-*). Therefore, the replacement of **peh₂ur/n-* by **h₁ngʷni-* in Latin is argued to be a post-Proto-Italic development, not shared with Indo-Iranian and Balto-Slavic. However, this argumentation fails to take into account that the alleged replacement of the basic word for fire could be an independent process in Indo-Iranian and

9 The notion of "basic vocabulary" is by no means unproblematic or objective, but cf. Tadmor, Haspelmath & Taylor (2010) for an empirically motivated basic vocabulary list.

Balto-Slavic as well. Thus, this methodology clearly represents a departure from the principles of the traditional comparative method.

In any case, for lexical comparison of words outside of the basic vocabulary, we are forced to retain the etymon, or lexeme itself, as the defining unit of the lexical character (*character = etymon*), as opposed to the semantic concept (*character = semantic concept*). As we have seen, this methodology carries with it two problems. First, the possibility of loss in one or several branches prevents identification of the lexical character in those branches. By extension, the ancestral state of lexical characters (which is limited to presence vs. absence) cannot be determined.

To address the difficulty of determining their ancestral state, lexical characters must be divided into subtypes, each with different limitations.

1) For root isoglosses, i.e., when branches share a unique root but no verbal or nominal derivatives, their status as archaisms or innovations is in general not possible to determine. The default assumption is that they are archaisms. An exception is if it can be demonstrated that a root is derived from another root by a suffix or *root extension*.

2) In the case of nominal and verbal derivatives, an important factor is whether it is reasonable to believe that the root was synchronically productive in the subgroup from which the branches that attest the formation are hypothesized to be descended. If the root is isolated, i.e., not found in any other formations, it may indicate, though not prove, that the shared derivative is an archaism. If the root has a solid Indo-European etymology, i.e., is found in other branches, it becomes more likely, although by no means proven, that the shared derivative is an innovation. Another important factor is the productivity of the derivational morphology in question. Shared formations with derivational morphemes that are highly productive may indicate independent innovations. Conversely, rare or obscure derivations may indicate archaisms.

3) Semantic isoglosses, i.e., when branches share a specific meaning of a lexeme attested in other branches, are powerful in the sense that they more easily fulfil the identifiability criterion. However, the directionality of the semantic change, and thus the ancestral state, is not always possible to determine.

4) Finally, shared lexemes may reflect borrowings from other (non-Indo-European) languages. Such loanwords are most plausibly identified by irregular correspondences in other Indo-European languages by or violations of Proto-Indo-European phonotactics (Meillet 1908–1909; Cuny 1910; Jakob 2023a; Thorsø 2023; Wigman 2023).

The list above represents some general considerations, but in practice, possible shared lexical innovations must be analysed case-by-case. As will be

shown in Chapter 3, a number of plausible innovations may be found among the Indo-Slavic lexical isoglosses, despite the numerous problems and caveats presented here.

To address the problem of identifiability of lexical characters (as well as characters more broadly), it is important to realize that a single character is rarely informative for the phylogeny of the whole family. For example, suppose a language family with five branches *ABCDE*. For a character *xy*, state *x* is attested in branches *A* and *B*, and can be shown to be a shared innovation as opposed to state *y*, attested in branches *C* and *D*. Branch *E* attests neither state *x* or *y*. Based on this situation, state *x* suggests that *A* and *B* derive from a subgroup to the exclusion of *C* and *D*. However, several scenarios are possible for branch *E*: 1) it could theoretically have taken part in the innovation of *x*, but subsequently lost it, in which case *E* would belong to the same subgroup as *A* and *B*, 2) it may have lost the ancestral state *y*, or 3) *E* had neither state *x* or *y*, in which case *y* is rather a shared innovation of *ABCD*, after which *AB* replaced *y* with *x*. Ideally, by combining the evidence of a large number of characters, each informing on different subsets of the branches of the language family, a true phylogeny may be inferred.

The above considerations notwithstanding, lexical evidence also has its advantages over morphology and phonology. New lexemes develop continuously through derivational processes and language contact, without altering the system of the language as a whole. Since the lexicon consists of a large number of discrete units, even a short-lived subgroup would be expected to show lexical innovations. Therefore, lexical isoglosses have the potential of disentangling phylogenetic relationships that cannot otherwise be defined by morphological or phonological isoglosses, either because there are none or because they have been obscured through later developments. Furthermore, lexical evidence indirectly encompasses derivational morphology and might reveal innovative patterns of derivation. Additionally, the lexicon can reveal material conditions of the speakers, such as familiarity with flora and fauna or technological innovations, which with the methodology of linguistic palaeontology can be compared with the archaeological record to trace subgroups in time and space (cf. 2.5).

2.2.4 *Quantity of Shared Innovations in Subgrouping*

Next to the shared innovation principle, discussions on subgrouping methodology generally assert that subgroups should be posited only when the number of shared innovations is high enough (Brugmann 1884: 253; Dyen 1953: 581). This is to avoid reliance on a small number of innovations that may in fact have been independent (Porzig 1954: 55). With respect to lexical innovations, a large num-

ber is argued to be especially important, since they are not given much weight individually (Clackson 1994: 25).

However, the required number of shared innovations is difficult to define objectively. As Porzig (1954: 55) notes, Brugmann & Delbrück (1897: 20–21) present "only" seven shared innovations as evidence for Balto-Slavic.[10] Clackson (1994: 199–200) concluded that the five lexical innovations (among 25 lexical isoglosses) he found in Greek and Armenian (with no supporting phonological or morphological innovations) were too few to support a Graeco-Armenian subgroup. Holst (2009: 53–54), on the other hand, argues that Clackson's conclusion is too conservative, and that the aggregate of evidence (including less convincing cases of shared innovations) rather tips the balance in favour of Graeco-Armenian.[11] These conflicting interpretations are mostly a consequence of different approaches to subgrouping; in Clackson's view, the paucity of lexical innovations is not only problematic due to the ever-present possibility that they were after all independent innovations, but also because such innovations would not have altered the structure of the ancestor of Greek and Armenian sufficiently to justify calling it a subgroup. Rather, Clackson attributes such shared innovations to dialectal developments within Proto-Indo-European. Holst (2009: 52) describes such statements as "Wischi-Waschi-Klassifizierungen", and calls for more explicit conclusions in terms of subgrouping. This debate illustrates the difficulty associated with the quantitative assessment of shared innovations.

A related question is whether a large number of lexical isoglosses is significant even if not all of them can be shown to be innovations. This is essentially what Holst (2009: 54) alludes to regarding Clackson's (1994) compilation of Graeco-Armenian isoglosses: "Wenn aber große Datenmengen in eine Richtung weisen, dann ist dies aussagekräftig." Holst's statement rests on the assumption that similarity (= a high number of lexical isoglosses) can serve as a proxy for subgroupiness (= a high number of shared innovations), which need not be the case (Holm 2003). Moreover, the problem is again how large that number must be to be significant in this regard, i.e., not a result of chance. Ideally, all Indo-European lexemes should be classified according to which

10 Although, in their defense, the list is called "Einige Kennzeichen des baltisch-slavischen Zweigs", which implies that additional shared innovations may have been excluded.

11 However, Holst (2009: 65) ultimately operates with a Balkan Indo-European subgroup, where Greek is closer to Albanian, Macedonian, and Phrygian than to Armenian. This is not insignificant for the interpretation of Clackson's material, since one of his five Graeco-Armenian lexical innovations (**wes-nu-* 'to clothe') is shared to the exclusion of Albanian, cf. Alb. *vesh* 'to clothe' ~ Skt. *vāsáyati* 'id.'.

branches attest them, to determine whether certain branches share disproportionate numbers of lexical isoglosses. Even with such a dataset, however, the Indo-European languages are not equal in terms of time depth, wealth and type of attestation. Again, due to lexical replacement, languages that are abundantly attested (modern and/or with rich ancient literature) have a higher chance of preserving more lexical material. Some languages tend to be more conservative, whereas others are known to have undergone heavy lexical replacement. This makes it difficult to assess to what extent the number of isoglosses shared by various branch pairs reflects actual relatedness.

2.2.5 *The Indo-Iranian Bias*

As discussed above, several methodological constraints apply to the distinction of lexical innovations from archaisms. On top of these, however, progress has been hindered, especially with regards to Indo-Iranian, by the practice of back-projecting all Indo-Iranian lexemes with cognates in other branches to Proto-Indo-European (e.g., Scherer 1952: 6–7), without considering the possibility that not all such cases need necessarily be archaisms. I call this the Indo-Iranian bias.

For example, Mallory & Adams (1997; also Mallory 2013; 2019) reconstruct any lexeme to Proto-Indo-European that has cognates in at least one European and one Asian branch (which here means Indo-Iranian and Tocharian).[12] Thus, the principle has a clear methodological purpose, namely to account for the probability that most Proto-Indo-European words are not retained in all the branches. To avoid back-projecting words attested in geographically contiguous branches, for which the possibility of post-Proto-Indo-European developments increases, the geographical distance between Indo-Iranian (+ Tocharian) and the rest of the non-Anatolian branches is invoked to make the reconstruction more plausible (cf. also Gaitzsch & Tischler 2017). While this is not entirely unreasonable per se, it is not surprising that, with this methodology, Indo-Iranian will have preserved the largest number of Proto-Indo-European lexemes, since a cognate in any of the seven "European" branches leads to back-projection. Yet, while a larger geographic spread might make it more likely that a word goes back to Proto-Indo-European, it does not prove it, since branches that are now far apart may have been closer in prehistory, or even part of a subgroup after the split of (Core) Proto-Indo-European. In fact, this methodology introduces a bias in the phylogeny, since it implicitly assumes a primary split

12 This is one of two possible criteria for Proto-Indo-European reconstruction in Mallory and Adams (1997); the other is attestation in Anatolian and any other branch, since they accept the Indo-Anatolian hypothesis.

between Indo-Iranian and the European branches. The result is that any potential evidence for a subgroup consisting of Indo-Iranian and a European branch, such as Balto-Slavic, is rejected out of hand.

2.3 Dialectal Subgrouping

As mentioned above (p. 5, fn. 5), Pictet (1859–1863: I, p. 48ff.) argued that linguistic divergence is gradual. He used an abstract geographical model (cf. Figure 3) to describe the dispersal of the Indo-European branches from a common origin. The model implies a period of dialectal differentiation where the branches gradually emerged from what was once a unified Proto-Indo-European language.

Schmidt (1872) formulated the wave model as a direct reaction to Schleicher's (1861) tree model.[13] Based on a rich dataset of overlapping lexical isoglosses shared by various combinations of Indo-European branches, Schmidt argued that it was not possible to view the diversification of the family in terms of splits from a common source. Instead, the branches reflect the remnants of a prehistoric dialect continuum, which was broken up when centres of innovation emerged at various points in the continuum, gradually making certain dialects more similar, and others more differentiated. This process can be conceived of as a stairway, where the steps become bigger over time.

Meillet (1908) adopted the premises of Schmidt's wave model, but focused on phonological and morphological isoglosses to establish dialectal groups among the branches of Indo-European (cf. Figure 4). Importantly, Meillet based these groups on shared innovations, just like subgroups in the tree model. His most important result was that the branches that share innovations are geographically contiguous, which was interpreted as evidence that the relative position of the branches reflects the relative position of prehistoric Proto-Indo-European dialect areas (Meillet 1908: 10–11, 134–135).

Bonfante (1976, reprint of 1931 original) reached a similar conclusion, supporting a fundamental east-west division corresponding roughly to the centum/satem isogloss, with Greek and Balto-Slavic occupying intermediate positions (cf. Figure 5). Bonfante (1976: 116–117) further argued that apart from Celtic and Indo-Iranian, any Indo-European branch can share isoglosses with any other branch, without overlap in geographically intermediate branches.

13 "Wollen wir nun die verwandtschaftsverhältnisse der indogermanischen sprachen in einem bilde darstellen, welches die enstehung irer verschiedenheiten veranschaulicht, so müssen wir die idee des stammbaumes gänzlich aufgeben. Ich möchte an seine stelle das bild der welle setzen, welche sich in concetrischen mit der entfernung vom mittelpunkte immer schwächer werdenden ringen ausbreitet" (Schmidt 1872: 27).

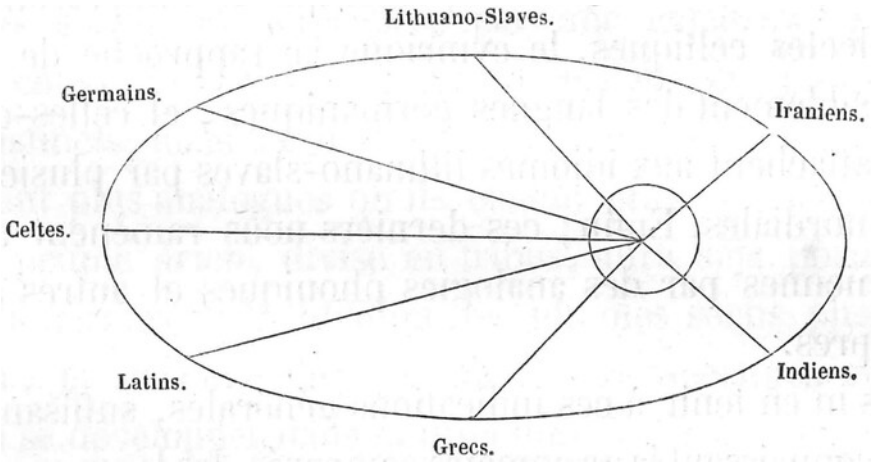

FIGURE 3 Pictet's divergence model (1859: 50)

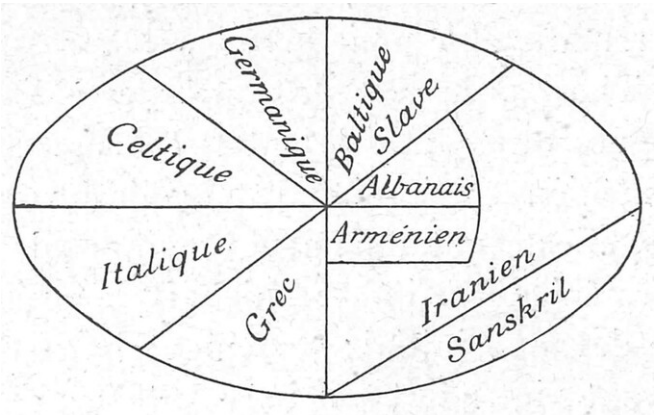

FIGURE 4 Meillet's Indo-European dialectal model (1908: 134)

Other dialectal models represent the isoglosses themselves, rather than just the relative position of the branches, cf. Figure 6 (from Bloomfield 1935: 316) and Figure 7 (from Anttila 1972: 305). It should be noted that the authors of these models do not claim to present a complete picture of Indo-European dialect relationships, but the models show that the dialectological methodology has had a lasting impact on Indo-European studies.

The advantage of the wave model and dialectal models above is that they allow more complex interrelations between branches to be represented, as opposed to the sharp splits of the tree model. Since dialect continua are the rule rather than exception in the historical period, it may be argued that dialectal models more accurately reflex the reality of linguistic divergence in prehistory.

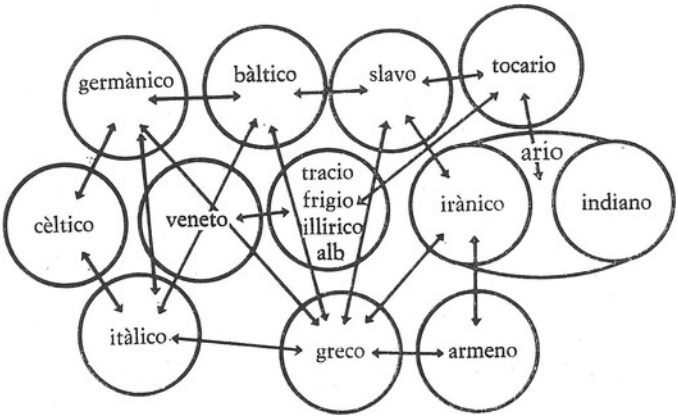

FIGURE 5 Bonfante's Indo-European dialectal model (1976/1931: 116)

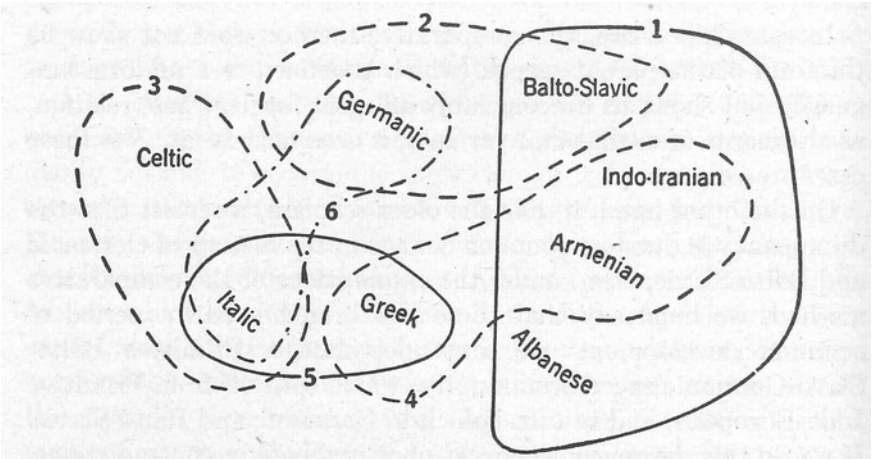

FIGURE 3. Some overlapping features of special resemblance among the Indo-European languages, conflicting with the family-tree diagram. — Adapted from Schrader.

1. Sibilants for velars in certain forms.
2. Case-endings with [m] for [bh].
3. Passive-voice endings with [r].
4. Prefix ['e-] in past tenses.
5. Feminine nouns with masculine suffixes.
6. Perfect tense used as general past tense.

FIGURE 6 Bloomfield's Indo-European dialectal model (1935: 316)

This was certainly the motivation behind Meillet's (1908) study of the internal relationships of the Indo-European language family.

However, the wave model is not only motivated by typological-theoretical considerations; for many proponents, the motivation stems directly from the data. According to Bloomfield (1935: 317), "scholars, who insisted upon the family-tree diagram, faced an insoluble problem", since the discovery of more and more overlapping isoglosses did not allow the Indo-European branches to be neatly divided into subgroups. Instead, explaining such isoglosses required the assumption that a branch could undergo shared innovations with different branches independently.

Yet, the alleged overlapping innovations usually cited are not unambiguous. For example, Bloomfield (1935: 315) points out that the shared instrumental-dative endings in *-*m*- of Germanic and Balto-Slavic contrast with endings in *-*bʰ*- of the other branches (cf. Schleicher 1858b: 13; Leskien 1876: 157), which conflicts with the centum/satem isogloss that otherwise divides Germanic and Balto-Slavic. However, even if we accept Bloomfield's premise, i.e., that Germanic and Balto-Slavic share an innovative state here,[14] the ancestral state is not straightforwardly reconstructed. Hirt (1895a) argued that both endings existed in the protolanguage with different function. In this case, the generalization of either one in the branches may reflect independent innovations (Pronk 2022: 280). As for the centum/satem isogloss, the discussion in 1.3 has shown that its value for subgrouping is limited, since the ancestral state is ambiguous, preventing us from proving beyond reasonable doubt that the satem languages have undergone a shared innovation.[15] In contrast to Meillet and Bloomfield,

14 The main argument for this is OCS dat.sg. *tebě* 'to you', showing that Balto-Slavic too retains an ending in *-*bʰ*-, which due to its marginal position may be considered a relic of an older inflectional system.

15 All isoglosses mentioned by Bloomfield (1935: 316) turn out to be uninformative: 1) Satemization; 2) Case-endings with *-*m*- for *-*bʰ*- (cf. above); 3) Middle endings with *-*r*. These are archaic, given that they are found in Anatolian. Since *-*r* is reflected in the Indo-Iranian 3pl. but lacking from the Celtic 2pl., the ancestral system cannot be reduced to featuring either a marker *-*r* or *-*i* (cf. Beekes 2011: 268–269); 4) The augment *h_1*e*-. The function of this morpheme is not identical in the branches that have it. This suggests that *h_1*e*- was grammaticalized independently in the branches, in which case the branches that do not show the augment may have lost it. Furthermore, it has been argued that Anatolian preserves traces of the augment (Norbruis 2021: 209ff.); 5) Feminine nouns with masculine suffixes. Rather than reflecting an innovation, such cases surely go back to the Proto-Indo-Anatolian gender system, which (like Anatolian) did not include the feminine gender; 6) Perfect tense used as general past tense. This is a typologically common change (also in Classical Sanskrit, for example) that need not be a shared innovation of Germanic and Italic, especially since these categories are morphologically divergent in the branches (e.g., Italic perfect resulting from a merger of the Proto-Indo-European perfect and aorist).

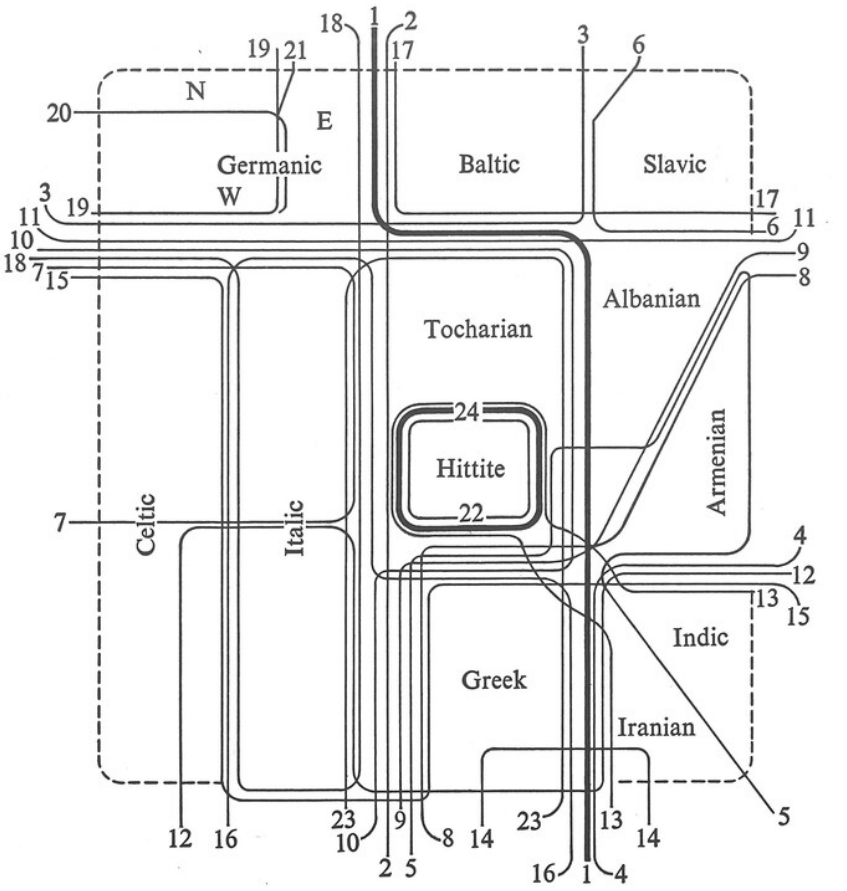

FIGURE 15-2. A dialect map of the Indo-European languages.

DEFINITIONS OF THE ISOGLOSSES

1. centum | satem [right] (§ 11.12)
2. *-ss-* | *-st-*, *-tt-* [right]
3. *aoə* | *a*, *āō* | *ō* [inside]
4. *eao* | *a* [inside]
5. *s* | *h* [inside]
6. *CVRC* | *CRVC* [inside] (§ 4.18)
7. k^w | *p* [inside] (§§ 18.13, 18.16)
8. *e-* | *ø* 'past' [left, outside] (§ 19.10)
9. *-osyo* 'genitive' [right, inside]
10. *-r* | *-i* 'present' [right, outside] (§ 19.10)
11. *-m-* | *-bh-* 'case marker' [below]
12. *-to-* | *-mo-* 'ordinal' [below]
13. *-u* 'imperative' [inside] (§ 19.10)
14. *proti* | *poti* 'preposition' [inside]
15. secondary endings (without no. 10 *-i*) [below] (§ 19.10)
16. feminine nouns with masculine endings [inside]
17. *-ad* 'ablative' | 'genitive' [inside]
18. new tense system from perfect [inside] (Chapter 12)
19. umlaut [inside] (§ 4.5)
20. *-ww-*, *-jj-* | stop + *w*, *j* [outside]
21. *-ggj-* | *-ddj-* [right] (no. 20)
22. laryngeals as *h*'s [inside] (§ 12.4)
23. uncontracted reflexes of sequence **yH* [inside]
24. unit pronouns | particles + enclitic pronouns [inside] (§§ 19.8, 19.9)

FIGURE 7 Anttila's Indo-European dialectal model (1972: 305)

Anttila's (1972: 305) model (Figure 7 above) makes no attempt to distinguish archaisms from shared or independent innovations. Consequently, it does not demonstrate the need to assume overlapping innovations to account for the relationship between the branches.

A further example of an alleged overlapping innovation is Meillet's (1908: 57–61) discussion on the development of the Proto-Indo-European dental cluster **tt*. Since the reflex **ss* shared by Italic, Celtic, and Germanic bears the least resemblance to the Proto-Indo-European reconstruction, Meillet interprets this as a shared innovation, which may well be the case. However, the development to **st* in the eastern branches, which Meillet considers "moins instructive, bien qu'encore notable", since it correlates with his idea of shared developments in contiguous branches, turns out to be uninformative. First, the change from **tt* to **tst* is shared with Anatolian and therefore reflects the ancestral state, cf. Hitt. 2pl.pres. *azzaštēni* 'you eat' < **h₁ed-t°*. In Indo-Aryan and Iranian, the outcome of **tst* (Skt. *-tt-*, Av. *-st-*) is posterior to branch-specific post-Proto-Indo-Iranian developments, i.e., Indo-Aryan loss of **s* between stops, cf. Skt. 3sg.aor. *ábhakta* < **Ha-bʰak-s-ta* from *bhaj-* 'to distribute', and Iranian loss of **t* before **s*, cf. YAv. *masiia-* m. 'fish' ~ Skt. *mátsya-* 'id.' < **matsia-*. Unlike Iranian, in Greek, the development of **tst* > στ is not identical to the development of **ts*, which is retained in some dialects (cf. Cretan αναδαζαθαι from δατέομαι 'to divide').[16] Based on these considerations, the evidence points to independent innovations in Greek and Indo-Iranian (thus also Porzig 1954: 78) and does not contradict the group defined by satemization, which Meillet (1908: 51) takes as a shared innovation.

One case where the wave model seems necessary to disentangle the internal structure of a language group is the Germanic branch (cf. Agee 2021). On the one hand, North and East Germanic share Holzmann's law, causing fortition of **-jj-* and **-ww-*. On the other hand, North and West Germanic share several innovations, such as deictic pronouns in **-si* and introduction of secondary diphthongs in strong verbs (Kroonen & Hansen 2022: 159). While the value of Holzmann's law for subgrouping has been questioned (Rasmussen 1990), it seems plausible that it spread in a Proto-Germanic dialect continuum, after which Northwest Germanic formed a subbranch defined by a large number of shared innovations (Kroonen & Hansen 2022: 160).

However, applying a wave model perspective to the ten branches of Indo-European is different from applying it to Germanic, which has only three sub-

16 According to Norbruis (2023), the regular outcome of **tst* in Greek is rather *-σθ-*, in which case it would be different from Iranian altogether.

branches and more shallow time depth. Thus, while the typological-theoretical motivation behind the wave model is sound, much remains uncertain regarding the extent to which it is actually necessary to apply it to the diversification of Indo-European. It seems a fair assessment that the inclination to abandon the tree model for the wave model has not been based on the strength of one or a few plausible examples of overlapping innovations (since the ones discussed above generally do not stand up to scrutiny). Rather, the observation that so many *possible* overlapping shared innovations are found in the first place has led to the suspicion that the tree model imposes artificial constraints on subgrouping (i.e., the disallowance of overlapping shared innovations) that do not reflect the reality of linguistic diversification.

The problem is that once the wave model is accepted, the distinction between shared and independent innovations becomes less important (e.g., François 2014: 177, who deliberately does not distinguish between them), since the model can easily accommodate overlapping innovations. As Ringe (2017: 65) puts it, "[a] major weakness of the dialect geography model is that it is difficult to falsify; new evidence that is at variance with the evidence already in hand can often be accommodated on an abstract dialect "map" without major revisions". Therefore, Ringe & Eska (2013: 263) argue that "… the *Stammbaum* hypothesis is always preferable *as a first hypothesis* because it is falsifiable".

In this sense, the wave model is secondary to the tree model in the workflow of subgrouping research. If (or rather, when) efforts to infer clear-cut splits in the family tree fail, wave-like developments may be assumed for those shared innovations that seem to contradict the tree structure. Both methods are—or should be—based on the shared innovation principle, but only the wave model allows overlapping shared innovations.

2.4 Hybrid Models

Already Leskien (1876: xii) saw the tree and wave models as complementary rather than contradictory, describing different aspects of language divergence and relatedness. For this reason, attempts have been made to devise a hybrid model that eliminates the shortcomings from which each model suffers on its own.

Meid (1975) proposed a model in which the branches of Indo-European descend not from a uniform protolanguage but rather from dialectally and chronologically diverse varieties of the protolanguage. To the Early Indo-European (*Frühindogermanisch*) layer belong features where all branches agree. Middle Indo-European (*Mittelindogermanisch*) and Late Indo-European (*Spätindoger-*

manisch) refer to less archaic stages with increasing dialectal differentiation. Anatolian split off before the Late Indo-European stage, but the remaining dialects are not argued to form a subgroup, because they did not innovate sufficiently together, rather forming a dialect continuum. Schlerath (1981) criticized Meid's approach, on the grounds that the comparative method by definition produces (at least in theory) a chronologically and dialectally uniform protolanguage. Therefore, Meid's model makes assumptions about Proto-Indo-European that, while not themselves implausible, do not follow from the comparative method, and thus cannot be falsified.

Gamkrelidze & Ivanov (1995: 363) present a hybrid "areal-genetic" model (cf. Figure 8), which follows Meid's division of the protolanguage into three stages, the latter two being dialectally differentiated. Later, the non-Anatolian part of the family splits into dialectal subgroups that in some cases nevertheless continue to innovate together (as in the case of Armenian, Indo-Iranian, and Balto-Slavic), long after what may be termed "dialectal Proto-Indo-European". However, in this model, it is unclear why certain innovations are treated as independent and others as shared by branches that had already split in the sense of the tree model. For example, the outcome of the dental clusters in Italic, Celtic, and Germanic (**ss*) is treated as independent innovations that have no implications for subgrouping, since the Italic development is argued to be posterior to Lachmann's Law (Gamkrelidze & Ivanov 1995: 356). Conversely, satemization is taken as an areal shared innovation at chronological level 6 (postdating the split of Aryan-Greek-Armenian and Balto-Slavic-Germanic), even though it is argued to be posterior to the vocalization of syllabic resonants at level 5 (Gamkrelidze & Ivanov 1995: 364). By treating relative chronology so inconsistently as a tool for distinguishing between shared and independent innovations, the model becomes difficult to falsify.

When branches share only a small number of innovations, Dyen (1953: 581) argues that this reflects shared dialectal features of the protolanguage, whereas a high number of shared innovations warrants the postulation of a subgroup. Similarly, Clackson (1994: 17) states that "[t]he difference between dialect and sub-group is therefore one of time and degree". This approach is similar to Leskien's (1876) and Meid's (1975) models and is hybrid in the sense that it recognizes both wave-like, dialectal developments and tree-like splits as important factors in language diversification. However, if the difference between wave-like dialect groups and tree-like subgroups were only one of degree, I see no reason why both types could not be represented in the tree model. Schleicher (1861) intended the length of a branch in his tree to reflect its longevity and by implication the number of shared innovations that the subgroup is based on. Thus, rather than a difference in degree, the fundamental

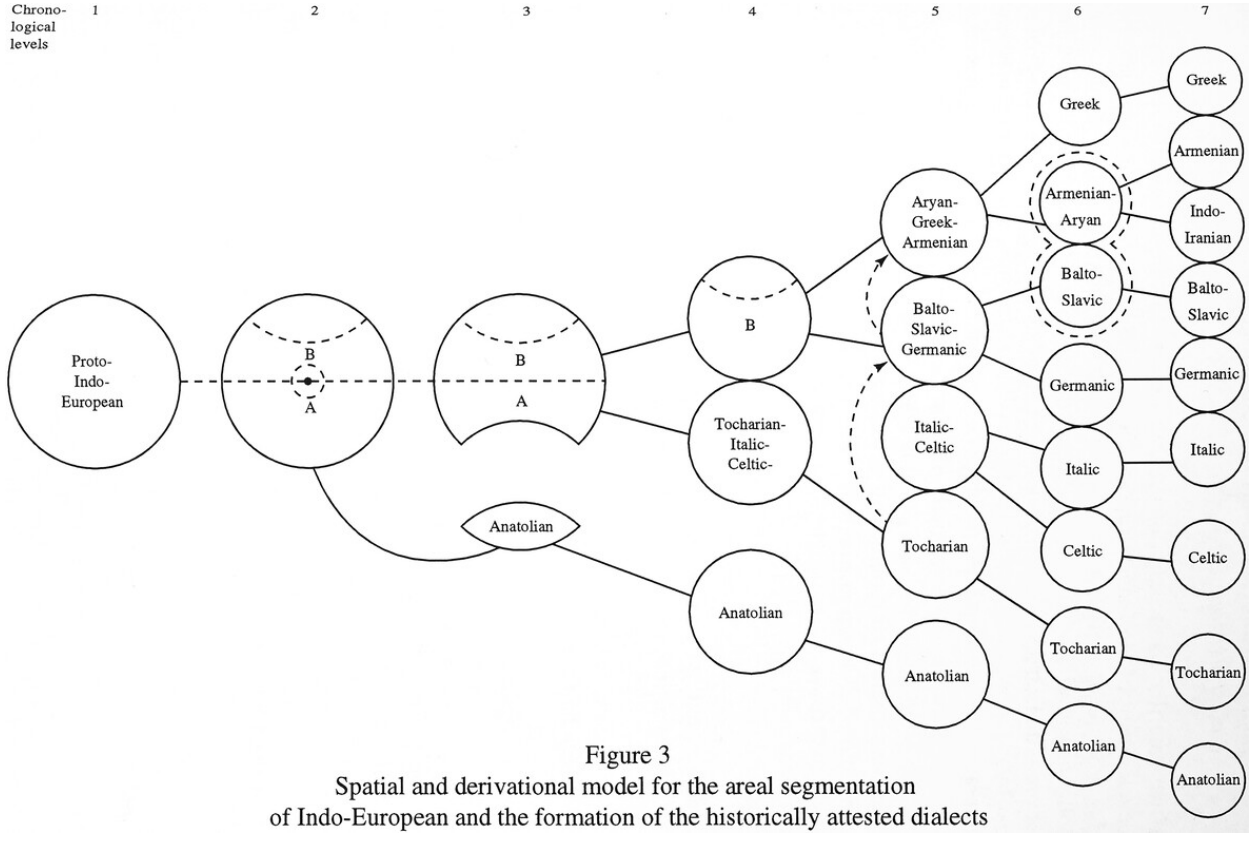

FIGURE 8 Gamkrelidze & Ivanov's Indo-European areal-genetic model (1995: 363)

difference between the models lies, as we have seen, in whether or not they accommodate overlapping shared innovations.

Ross (1997) developed a hybrid model that distinguishes "language fission" (= tree-like splits), cf. Figure 9, from "linkage breaking" (= breaking of a dialect continuum). The latter is preceded by "lectal differentiation", i.e., a period when overlapping innovations develop in a dialect continuum, cf. Figure 10. Both processes, termed "speech community events", are based on shared innovations, but only linkage breaking involves overlapping innovations. Linkage breaking is of course very similar to Schmidt's (1872) original formulation of the wave model: gradually increasing distance between dialects in a continuum eventually leads to sharp language boundaries. However, an important difference—besides the fact that tree-like splits, or fissures, are also included in Ross' model—is that the emergence and eventual differentiation of dialect continua, or linkages, are recursive, i.e., these processes may happen more than once in the history of a language family. As Ringe & Eska (2013: 262) point out, linkage breakings may be caused by the disappearance of intermediate dialects. Such dialect pruning may occur when neighbouring dialects are "pulled" apart toward different centres of innovation, as in Schmidt's (1872) wave model, or simply because the speakers of intermediate dialects undergo a language shift or die out.

Ross (1997: 228) furthermore includes "language fusion" and "linkage rejoining" in his model, which refer to shared innovations affecting languages or dialects that have already undergone exclusive innovations. Such processes presuppose that some level of mutual intelligibility remains between the dialects in question, although this is notoriously difficult to measure, especially for reconstructed protolanguages. This resembles Gamkrelidze & Ivanov's (1995: 364) treatment of the satem branches, and suffers from the same theoretical problem: lack of falsifiability. However, Ross's example from Anejom̃ (Austronesian) is instructive. Anejom̃ shows two reflexes of the Proto-Oceanic article **na*, which seem to be lexically distributed without phonological or other conditioning. This situation may be explained by assuming that Anejom̃ is a fusion of two separate dialects.[17]

Yet, the Anejom̃ example is not comparable to satemization, since here the satem branches show internally consistent, but slightly variable, reflexes of the Proto-Indo-European velar series (cf. 1.3). It has been argued that the limited velar reflexes of Proto-Indo-European palatovelars in Balto-Slavic point

17 It may be argued that the conditioning factor simply has not been found yet, but assuming that the analysis is correct, the postulation of a fusion event is a possible explanation.

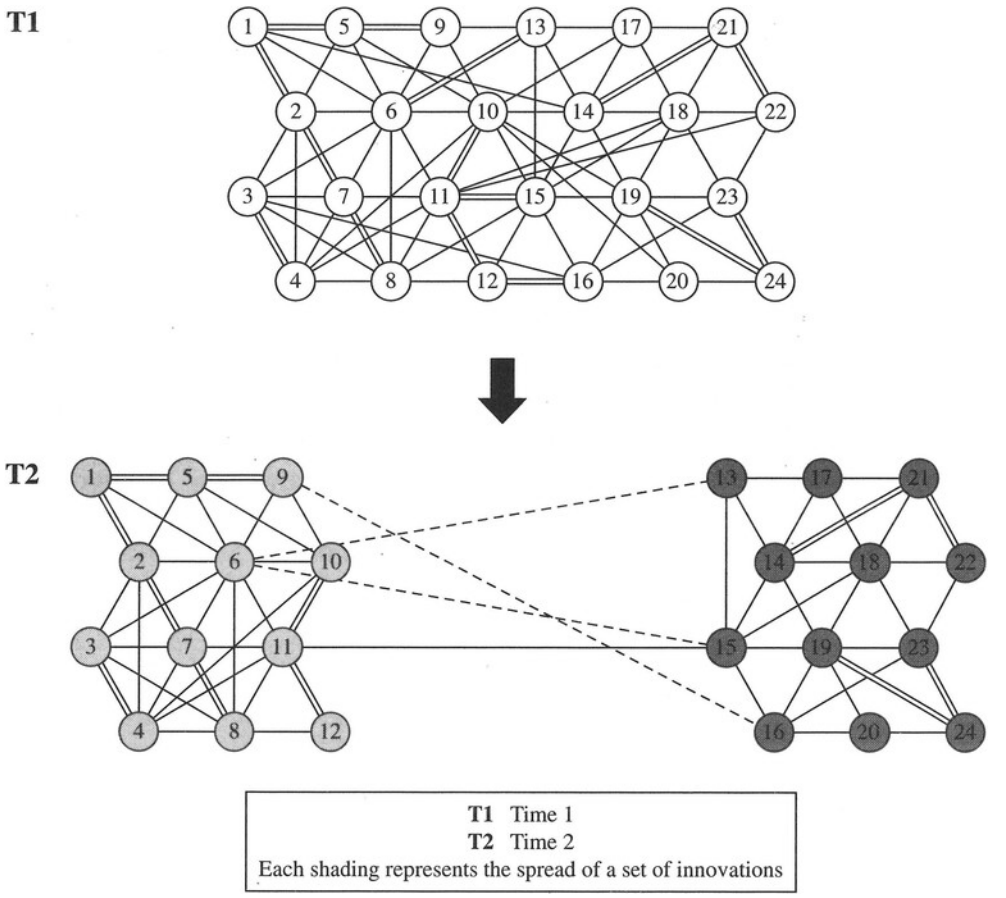

FIGURE 9 Language fissure according to Ross (1997: 218)

to borrowings from a centum-dialect, which would also be compatible with Balto-Slavic originating in a fusion of two Indo-European dialects (Čekman 1974: 133), but these alleged centum forms are rather conditionally depalatalized palatovelars (cf. Kortlandt 1978b) that do not justify such a scenario. In any case, language fusion and linkage rejoining are processes that must be taken into account in subgrouping research, but perilous to incorporate into models of Indo-European diversification. Given the language family's time depth, it is difficult to estimate at which point the would-be branches of Indo-European were different enough that shared innovation would no longer be possible. Accordingly, language fusion or linkage rejoining should only be assumed when tree-like splits and linkage breakings fail to explain the data, i.e., as a tertiary hypothesis.

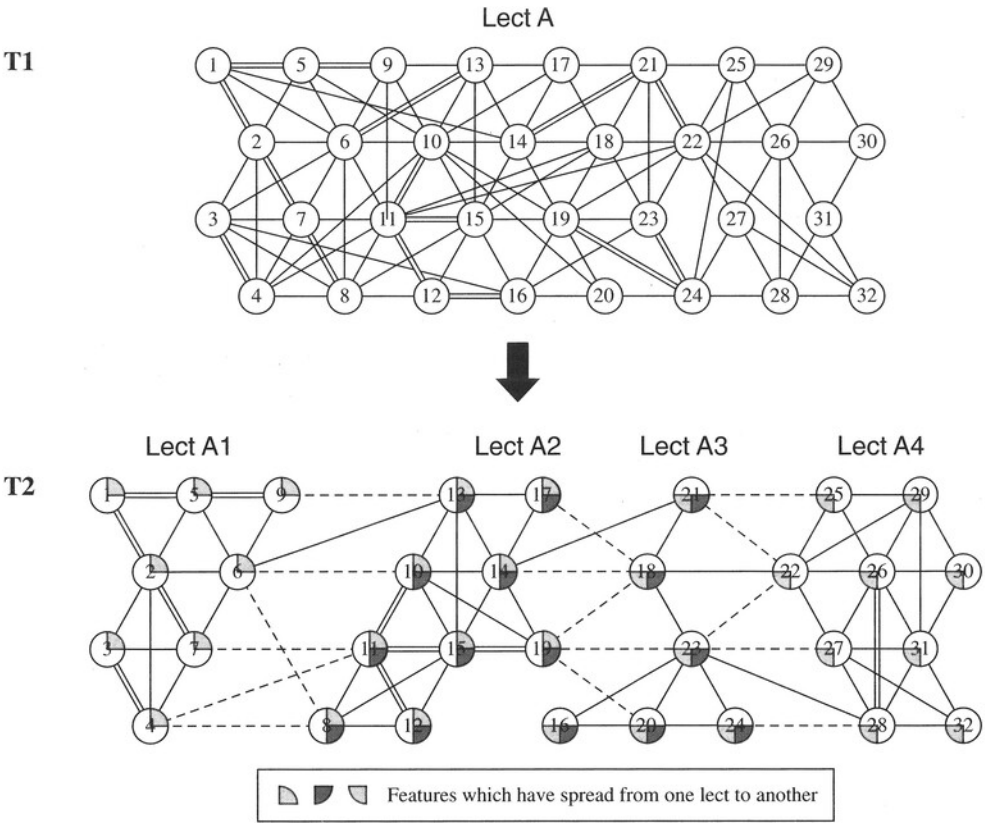

FIGURE 10 Lectal differentiation according to Ross (1997: 223)

2.5 Linguistic Palaeontology

Linguistic palaeontology (a term coined by Pictet 1859–1863) is an extension of the comparative method. While protolanguages may be reconstructed based on the comparative method, the basic idea of linguistic palaeontology is to infer aspects of the culture of the speakers of a certain protolanguage based on the contents of the reconstructed lexicon. Consequently, the focus lies on the semantics of reconstructed words. In most cases, the goal is to compare the culture of the protolanguage community to archaeological cultures, in order to formulate hypotheses on the timeframe and location of the protolanguage and its speakers, known as the *homeland* (Ger. *Urheimat*).

The first systematic application of linguistic palaeontology can probably be attributed to Kuhn (1845). Kuhn compiled reconstructed Proto-Indo-European words pertaining to the structure of the family (kinship terms), government, domesticated as well as wild animals, agriculture, and housing. Based on this,

he argued that Proto-Indo-European speakers organized their society on the model of the family, which was patriarchal and patrilocal. Furthermore, Kuhn concluded that the Indo-Europeans practiced both animal husbandry and agriculture, and that they had transitioned from a nomadic to a sedentary lifestyle. However, he does not use these results to infer an Indo-European homeland; rather, Kuhn (1845: 1–2) asserts in his introduction that Proto-Indo-European was spoken in Asia. In a revised version, Kuhn (1850: 338) specifically rejects a steppe homeland, and instead places it on the Tibetan plateau.[18] Similarly, Pictet (1859–1863), who applied linguistic palaeontology to the Proto-Indo-European lexicon in great detail, nevertheless takes a Bactrian homeland as a given, and interprets the lexicon against this assumption.[19]

Schrader (1883) reversed this workflow, and (in the second, revised edition of his *magnum opus*, published in 1890) located the Indo-European homeland in the Pontic-Caspian steppe based on linguistic palaeontological considerations, thus formulating the Steppe hypothesis. The most important arguments were the existence of Proto-Indo-European nomadic pastoralist vocabulary (i.e., domesticated animals and wagon terminology) vs. the absence of shared Indo-European agricultural terminology, as well as the presence of a word for 'horse' vs. the absence of words for 'camel' and 'donkey'.[20] These arguments have stood the test of time and still feature in studies on the Indo-European homeland (e.g., Mallory 1989; Anthony 2007; Anthony & Ringe 2015). Apart from arguments bearing on technologies and subsistence strategies, recent scholarship has also revisited the relationship between kinship terms as evidence for social organization (cf. Kuhn 1845) and archaeological and genetic evidence for patrilocal families in Chalcolithic Europe (Sjögren et al. 2020), which show a striking correspondence.

Schrader (1883) discusses three important methodological principles of linguistic palaeontology. The first principle (Schrader 1883: 168 ff.) is that conclu-

18 "[U]nsre gemeinsamen Vorfahren weideten ihre Heerden nicht in den kahlen Steppen, sondern auf den bewaldeten Bergen Hochasiens [Tibetan plateau, AP] …" (Kuhn 1850: 338).

19 For example, Pictet (1859–1863: I, p. 382–386) argues that the Indo-Europeans must have known the camel, despite the fact that no Proto-Indo-European word for 'camel' can be reconstructed, since the two-humped camel originates in Bactria, which according to Pictet is the location of the homeland.

20 As Schrader (1890) acknowledges in his preface, Benfey (1875) had already proposed a Pontic-Caspian steppe homeland, but merely as a comment on Hehn's (1873: 16–17) Asian homeland hypothesis, which according to Benfey did not explain the existence of a Proto-Indo-European word for 'salt'. Tomaschek (1878: 862; 1883: 706) supported Benfey's hypothesis based on the language contact between early Indo-European and Uralic languages.

sions should in the first instance be based on positive rather than negative evidence; in other words, *absence of evidence is not evidence of absence*. The failure to reconstruct a shared Indo-European word for a particular concept does not imply that Proto-Indo-European speakers were unfamiliar with that concept. If, however, a whole semantic field is absent from the protolanguage, and contrasts with abundant positive evidence for another, such as the lack of terms for relatives on the wife's side of the family vs. the rich terminology for relatives on the husband's side, Schrader argues that this may be significant and therefore tentatively may be used as evidence of absence. Mallory (2021: 281) argues that arguments based on absence should not be rejected by default, since they at least potentially may correlate to real-world situations, and are often used in other historical disciplines, such as archaeology.

Another principle, which follows from the comparative method, is that only words that are actually reconstructable to a particular linguistic layer, e.g., Proto-Indo-European, may be used as evidence for reconstructing the culture of that speech community (Schrader 1883: 175 ff.). For example, words that are only found in one or a few branches should not be back-projected to the protolanguage without good arguments. This ties into the general discussion of which criteria an etymon needs to fulfil to be reconstructed to Proto-Indo-European (cf. 2.2.5). Similarly, root cognates with different derivatives in various branches do not license the reconstruction of the derived concepts to the protolanguage, if the root in question is still productive in the branches (Schrader 1883: 188 ff.). Great care must be taken to understand the derivational history of words within the branches, to exclude independent innovations from consideration. A related issue is loanwords between branches, which must be filtered out to avoid projecting them back to the protolanguage (Schrader 1883: 201 ff.).[21] However, Schrader argues that it may in some cases be impossible to differentiate between an inherited formation and an early borrowing between Indo-European dialects that had not yet diverged phonologically to the extent that a borrowing could be identified (similarly Hehn 1877: 487–488).

A third principle (Schrader 1883: 194 ff.) is that attested semantics should not be back-projected to reconstructed forms without good arguments. For example, the reconstructed **h₁ekʷuo-* 'horse' did not necessarily refer to a domesticated horse (Hehn 1877: 53–54; Renfrew 1989), and so does not by itself prove that Proto-Indo-Europeans kept and/or rode domesticated horses. In

21 On the other hand, the identification of early borrowings may point to the adoption of a foreign or novel concept, whereas language internal derivation (e.g., PIE **kʷekʷlo-* 'wheel') may suggest a "native" technological development.

general, great care must be taken on a case-by-case basis not to overinterpret the semantic meaning of reconstructed lexemes.

The validity of linguistic palaeontology as a scientific methodology has been called into question (Pulgram 1958: 145; Anttila 1972: 373; Renfrew 1987: 77 f.; Zimmer 1990: 7; Clackson 2013). Heggarty, one of the most vocal critics of linguistic palaeontology, argues that the chance of parallel derivation and the uncertainty of semantic reconstruction make it impossible to use reconstructed lexemes as evidence for extra-linguistic situations (Heggarty 2006: 189). While he accepts reconstruction of forms as reliable in principle, Heggarty (2006: 190; 2013: 162; 2014: 607–608; Heggarty et al. 2023: S20–21) argues that semantic reconstruction to the level of detail required by linguistic palaeontology is not possible (cf. Krell 1998: 279), since semantic change is not governed by laws in the same way as sound change. For example, Heggarty claims that there is no way to determine with any degree of certainty that PIE **kʷekʷlo-* referred to the wheel of a wagon rather than some other circular object, with independent semantic shifts to 'wheel' in Indo-Iranian, Greek, Germanic, and Tocharian.

However, as we have seen above, the fact that both formal and semantic reconstruction suffers from a certain level of uncertainty has long been recognized by proponents of linguistic palaeontology; in any historical discipline, interpretations of the data are ultimately statements of likelihood. As Mallory (2021: 280) puts it, a reconstructed semantic meaning is an "inference to the best explanation […] for the current senses of a set of cognates". In the case of PIE **kʷekʷlo-*, other than the fact that its descendants refer to the 'wheel (of a vehicle)',[22] meaning that assuming independent semantic shifts is uneconomical, we may point to the typological tendency of the directionality *concrete* > *abstract*, which makes it less likely that Gr. κύκλος 'circle, ring, wheel' preserves an original meaning 'circle', to which 'wheel' is secondary. Furthermore, PIE **kʷekʷlo-* seems to be derived from **kʷel(H)-* 'to move around, roam', suggesting that its original meaning was associated with transportation rather than simply rotation or a round shape. Coleman's (1988: 450) assertion, cited by Heggarty (2014: 608), that **kʷekʷlo-* cannot be reconstructed for Proto-Indo-European because it is only attested in four branches, fails to take into account that the reduplicated stem of **kʷekʷlo-* is not a productive derivational type in any of the relevant branches (or indeed any branch of Indo-European). Heggarty's criticism is of course not limited to **kʷekʷlo-*, but concerns the methodology as a whole. However, this one example shows that he dismisses linguistic palaeontology without taking all the relevant facts into account.

22 Or, in the case of ToA *kukäl*, ToB *kokale* 'chariot, wagon', to the wheeled vehicle itself.

Heggarty (2013: 163–164; 2018: 169) further criticizes linguistic palaeontology as being subjective, because it has been used as evidence for conflicting homeland hypotheses (cf. Bryant 2001: 123). However, as Mallory (2021: 279) points out, the existence of competing hypotheses is the normal situation in all scientific frameworks. Heggarty does not take into account that other variables might be responsible for the varying results achieved by different scholars, such as different data sets, failure to correctly apply the comparative method and the methodological principles of linguistic palaeontology, or reliance on incorrect archaeological models.[23]

Thus, in the present work, linguistic palaeontology will be used following the methodological principles outlined above. The emphasis will lie on positive evidence and semantic fields that plausibly may be correlated to archaeological evidence.

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23 Heggarty (2018: 169) specifically mentions Gamkrelidze & Ivanov's (1995) Armenian hypothesis as opposed to the Steppe hypothesis. However, Gamkrelidze & Ivanov's (1995: 763–767) conclusions are based on a dataset that includes many lexemes that are highly unlikely to be Proto-Indo-European, e.g., **osono-* 'donkey' (based on the irregular correspondence of Gr. ὄνος 'donkey' and Lat. *asinus* 'donkey', cf. de Vaan 2008: 57), as well as controversial archaeological hypotheses, such as the Near Eastern origin of wheel/wagon technology (Schier 2015: 113).

CHAPTER 3

Lexical Isoglosses Shared by Indo-Iranian and Balto-Slavic

3.1 Introduction

In this chapter, potential lexical isoglosses shared by Indo-Iranian and Balto-Slavic proposed by Schmidt (1872), Meillet (1926), Arntz (1933), and Porzig (1954) are compiled and evaluated etymologically. Additionally, Derksen's Baltic (2015) and Slavic (2008) etymological dictionaries, as well as Fraenkel's LEW (1962), have been mined for potential exclusive isoglosses with Indo-Iranian.

All potential isoglosses are evaluated based on three criteria (summarized in Table 1): 1) Indo-Slavic exclusivity, 2) validity of the etymology, 3) likelihood of being a shared innovation.

The first criterion is fulfilled if the etymon in question is not found in any Indo-European branch other than Indo-Iranian and Balto-Slavic. If there is a potential cognate in another branch, which cannot be explained away, but for formal or semantic reasons is not a compelling cognate to the Indo-Iranian-Balto-Slavic words, the Indo-Slavic exclusivity is classified as uncertain. If the isogloss is shared with another branch, or must be reconstructed for another branch as the basis for an attested derivative, the isogloss is non-exclusive and is rejected.

The second criterion is fulfilled if the words forming the lexical isogloss are formally and semantically compelling cognates, i.e., if they are plausibly inherited from a common source. If there are indications that this is not the case, the isogloss is classified as doubtful or rejected.

The third and arguably most important criterion is whether the isogloss in question is a plausible shared innovation. As discussed in Chapter 2, in most cases it is difficult to determine with a high level of confidence whether isoglosses are shared innovations, archaisms, or independent innovations, either because other branches may have lost them (lack of *identifiability*) or because the *ancestral state* cannot be determined (or a combination of both). The result is that most isoglosses are classified as possible shared innovations. However, if an Indo-Slavic isogloss can be shown to reflect an innovative state *vis-à-vis* an ancestral state attested in other branches, it is classified as a plausible shared innovation. If there are compelling reasons to assume that an isogloss is an

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archaism or independent innovation, it is classified as a rejected shared innovation.

To allow the reader to get a quick overview of a given potential isogloss, the three criteria are treated independently as much as possible, even though they are often interdependent. For example, the etymology of **bʰag-o-* 'god' (cf. 3.5.1) is classified as *rejected*, since the Indo-Iranian and Slavic forms are not regular cognates. However, since there are no compelling arguments against a shared innovation per se, the shared innovation criterion is classified as *possible*. In reality, of course, the etymology criterion must be fulfilled for an isogloss to be considered compelling. Inevitably, the criteria sometimes intersect, since, e.g., indications that a proposed isogloss reflects independent innovations in the branches may lead to the etymology being classified as doubtful or rejected.

The potential lexical isoglosses are further classified according to type. The typological categories are:

1) borrowing (shared borrowings from known or unknown source)
2) nominal derivation (shared nominal derivatives from inherited roots)
3) verbal derivation (shared verbal derivatives from inherited roots)
4) root (shared root without shared derivatives)
5) semantics (shared semantics in a root or derivative)

The material is grouped into four sections. Etyma that fulfil the exclusivity and etymology criteria are classified as compelling isoglosses. These are subdivided into plausible and possible shared innovations (sections 3.2–3.3). Etyma for which the exclusivity is uncertain, or the etymology is doubtful, are classified as uncertain isoglosses (3.4). Etyma for which either the exclusivity, etymology, or shared innovation criterion is rejected, are classified as rejected isoglosses (3.5).

Within each section, the isoglosses are listed in alphabetical order according to their reconstructed form. Below the classification header for each potential isogloss, the Indo-Aryan, Iranian, Baltic, and Slavic cognates are listed. For Indo-Aryan, mainly Vedic Sanskrit is listed. For Iranian, cognates in the following languages are listed in sections 3.2–3.4: Avestan and Old Persian, Middle Persian (or Parthian), Modern Persian (or Balochi), Sogdian and Khotanese (or Khwarezian and/or Bactrian), Ossetic, Pashto, and Wakhi, when available, with occasional references to other Modern Iranian languages. In section 3.5, mainly Old Iranian cognates are listed. In the case of Baltic, Lithuanian and Latvian cognates are listed, followed by Old Prussian, when available. Lastly, Slavic cognates from Old Church Slavic, followed by a representative of each branch (East = Russian, West = Polish, South = Serbo-Croatian, or other languages from that branch when necessary) are listed.

TABLE 1 Criteria for classification of Indo-Slavic lexical isoglosses

Indo-Slavic exclusivity	Etymology	Shared innovation	Typology
Yes/ Uncertain/ No	Compelling/ Doubtful/ Rejected	Plausible/ Possible/ Rejected	Borrowing/ ^{N}Derivation/ ^{V}Derivation/ Root/ Semantics

3.2 Isoglosses: Plausible Shared Innovations

3.2.1 *ǵʰos-to- *'hand'*

Indo-Slavic exclusivity	Etymology	Shared innovation	Typology
Yes	Compelling	Plausible	^{N}Derivation

Indo-Aryan: Skt. *hásta-* m. 'hand'
Iranian: OAv., YAv. *zasta-* m. 'hand'; OP *dasta-* m. 'hand'; MiP Pahl. *dast,* Man. *dst* 'hand'; MoP *dast* 'hand'; Sogd. BMS *δst* 'hand, arm'; Khot. *dasta-* 'hand'; Psht. *lās* m. 'hand'; Wakh. *dast, δast* 'hand'
Baltic: Lith. *žãstas* m. 'upper arm; palm of the hand (Žem.)', *pažastìs* f. 'arm-pit'
Slavic: –

As noted by Arntz (1933: 37) and Porzig (1954: 169),[1] Lithuanian and Indo-Iranian share a stem **ǵʰos-to-* 'hand' (rather than **ǵʰes-to-* in view of Baltic *a* < **o*, cf. Neri 2013). This stands in opposition to **ǵʰes-r-*, reflected by Hitt. *keššar* c. 'hand' (Kloekhorst 2008: 471), Gr. χείρ f. 'hand, fist' (Beekes 2010: 1620–1621), Arm. *jeṙn* 'hand' (Martirosyan 2010: 431–432), Alb. *dorë* f. 'hand, handful, grip' (Demiraj 1997: 140), ToA *tsar*, ToB *ṣar* m. 'hand' (Adams 2013: 711–712), and perhaps Lat. *hīr, īr* n. 'palm of the hand' (Walde 1910: 366). The athematic stem of **ǵʰes-r-*, and its attestation in Anatolian, suggests that it is a more archaic formation than **ǵʰos-to-*.

1 However, only Lith. *pažastìs* is mentioned. Lith. *žãstas* 'upper arm; palm of the hand (Žem.)' has been left out of most sources, but see Hock et al. (2019: s.v. *pažastìs*).

The Indo-Iranian reflexes of **ǵʰos-to-* clearly mean 'hand'.[2] Lith. *žãstas* m. is attested both with the meaning 'palm of the hand' and 'upper arm', the latter being presupposed by the derivative *pažastìs* f. 'arm-pit'. It is possible that a semantic shift in most Lithuanian dialects occurred when *rankà* replaced *žãstas* as the basic word for 'hand'.

Lat. *praestō* 'available, ready' has been reconstructed as **preh₂i-ǵʰestōd* (e.g., LEW: 560) but has a more convincing alternative analysis as **preh₂i-sth₂-o-* (de Vaan 2008: 486). Lat. *hostus* m. 'the yield of olive oil from a single pressing', which Eichner (2002) has derived from **ǵʰos-to-* (**gʰ-* is also possible), a deverbal nomen actionis from a supposed root **ǵʰes-* 'to take, give in exchange', must be separated from **ǵʰos-to-* 'hand' based on the semantics. Even if the words are ultimately from the same root, the Latin stem is better analysed as an independent derivative, cf. Gr. χόρτος m. 'enclosure, court' < **ǵʰor-to-* << **ǵʰer-* 'to seize'.

Neri (2013) derives both **ǵʰes-r-* and **ǵʰos-to-* from old locatives of an unattested root noun **ǵʰes-* 'hand' << 'the one who gives or takes'. The latter stem would then have arisen through the derivational chain **ǵʰos-to-* 'upper arm' << **ǵʰes-tó-* 'belonging to the hand; situated in the hand' << **ǵʰés* loc.sg. 'in the hand'. This scenario is difficult to verify, since it hinges on the idea that **ǵʰos-to-* meant 'upper arm' originally, which as discussed above is not necessarily the case, and since an endingless locative **ǵʰés* cannot be distinguished from the bare root. In any case, Neri's proposal is not incompatible with taking **ǵʰos-to-* as an Indo-Slavic innovation, provided that Lat. *hostus* m. 'yield' is explained as an independent derivative.[3]

Superficially, **ǵʰos-to-* looks like a root **ǵʰos-* + suffix **-to-*, but the meaning 'hand' (<< 'taker'?) does not fit very well with the expected semantics of a *to*-stem from a root **ǵʰes-* 'to take, exchange', as suggested by, e.g., Lat. *hostus* m. 'yield' and Gr. χόρτος m. 'enclosure, court'. However, the sequence **-st-* is reminiscent of several other Indo-European words for 'hand' or related concepts, e.g., Gr. παλαστή f. 'flat hand, breadth of four fingers', ἀγοστός m. 'hand, arm',

2 Skt. *hásta-* sometimes refers to the wrist, e.g., *háste ná khādínam* 'like a bangle on the hand' (RV VI.16.40), *páry eti bāhúm … hastaghnó* 'it encircles the arm … the handguard' (RV VI.75.14), and later to the forearm as a measurement ('ell'), but not to the 'upper arm' (*pace* EWAia II: 812).

3 Besides Lat. *praestō* 'available, ready', which does not necessarily contain **ǵʰos-to-* (cf. above), Neri (2013) proposes that Lat. *hostis* m. 'enemy; stranger' ~ ON *gestr* m. 'guest' < **ǵʰos-ti-* 'the one who is in the hand (i.e., under protection)' provide independent evidence for an adjective **ǵʰes-tó-* 'belonging to the hand'. However, Slavic **gôstъ* m. 'guest', which is otherwise a perfect cognate to the Latin and Germanic words, must then be explained as a borrowing from Germanic, since it cannot reflect **ǵʰ-*.

OHG *fūst* f. 'fist', OCS *grъstь* f. 'handful', Skt. *gábhasti-* m. 'hand', *muṣṭí-* m./f. 'fist'. Although the origin of this *-*st-* is unknown, it is possible that **ǵʰos-to-* should be analysed as **ǵʰos-st-o-*, which could be an old compound. In either scenario, since the presumed verbal base for a *to*-stem or a compound, i.e., **ǵʰes-* 'to take, exchange', is unattested, the derivation of **ǵʰos-to-* within a hypothetical Indo-Slavic subgroup rests on the assumption that **ǵʰes-* existed in Indo-Slavic and was lost as a productive root at a later date, which is impossible to verify.

While the exact derivation of **ǵʰos-to-* remains elusive, the absence of any reflex of PIE **ǵʰes-r-* in Indo-Iranian and Balto-Slavic suggests that it was replaced by **ǵʰos-to-* in Indo-Slavic, which was subsequently replaced by **ronkaH-* in Balto-Slavic. Accordingly, it is not necessarily the derivation of **ǵʰos-to-* itself that is a plausible shared innovation (although this remains possible), but the replacement of **ǵʰes-r-* as the basic word for 'hand' (in the sense of Tadmor, Haspelmath & Taylor 2010) by **ǵʰos-to-*.

3.2.2 *h$_2$eǵ- *'goat'*

Indo-Slavic exclusivity	Etymology	Shared innovation	Typology
Yes	Compelling	Plausible	Borrowing Root

Indo-Aryan: Skt. *ajá-* m. 'billy goat', *ajā́-* f. 'she-goat'
Iranian: YAv. *aza-* m. 'billy goat'; MiP Pahl. *azag* 'goat';[4] Khot. *aysdāṃ* 'a commodity; goat's corn (?)'[5]
Baltic: Lith. *ožỹs* m. 'billy goat'; Latv. *âzis* m. 'billy goat'; OPr. *wosux* m. 'billy goat', *wosee* f. 'goat, she-goat' (EV)
Slavic: –

Based on the Indo-Iranian (EWAia I: 51; Hoffmann 1967) and Baltic (LEW: 519) forms, **h$_2$eǵ-* 'goat' may be reconstructed, which was listed as an isogloss by Arntz (1933: 37).

The root **h$_2$eǵ-* closely resembles the synonymous **h$_2$eiǵ-* 'goat', which is reflected in Gr. αἴξ f. 'goat' (Beekes 2010: 40–41), Arm. *ayc* 'she-goat, goat' (Mar-

4 The attestation in Frahang-i Pahlavīk is uncertain; it may stand for Aramaic *'ez* 'goat' (Nyberg & Utas 1988: 70–71).
5 If from **Haja-dʰaHnaH-* (Bailey 1979: 6).

tirosyan 2010: 58) and Alb. *edh* m. 'kid, young goat' (Orel 1998: 85; de Vaan 2018: 1739). LEW: 519 also cites Irish *ag* 'buck' as a cognate of Lith. *ožỹs*, but in eDIL (s.v. *ag*) it is translated as 'cow, ox' or 'deer, stag'. According to Pokorny (IEW: 7), it is rather related to Skt. *ahí́-* f. 'cow'.

Alb. *dhi* 'goat' has variously been connected to **h*$_2$*eiǵ-*, **h*$_2$*eǵ-* or Ger. *Ziege* < **dig*^{h}*-eh*$_2$- (IEW: 6–7; Demiraj 1997: 160; Orel 1998: 83; Kroonen 2013: 516). Even if **dig*^{h}*-eh*$_2$- is excluded, it seems uneconomical to derive *dhi* from **h*$_2$*eǵ-ih*$_2$-, separating it from Alb. *edh*, instead of **h*$_2$*eiǵ-ih*$_2$- (both being possible since initial unstressed vowels are lost, cf. de Vaan 2018: 1737), thereby reconstructing two words for 'goat' for Proto-Albanian.[6] We should therefore treat **h*$_2$*eǵ-* as an Indo-Slavic isogloss.

A zero-grade of **h*$_2$*eiǵ-* is reflected in YAv. *izaēna-* 'of leather', which presupposes a base PIr. **iǰa-* 'leather'.[7] It has been argued that Skt. *eḍa-* m. 'a type of sheep' also reflects **h*$_2$*eiǵ-* and developed through levelling of the stem of the dat.pl. **aiǰ-b*^{h}*ias* > **eḍbhyas*. However, not only is the meaning different, but it is unlikely that this sandhi development would not have been reverted upon thematicization.

While a thematic **Haǰ-a-* next to a feminine **Haǰ-aH-* can safely be reconstructed for Proto-Indo-Iranian, East Baltic shows a masculine *io*-stem (Lith. *ožỹs*) next to a secondary feminine reflected by Lith. *ožkà*. In Old Prussian, it is rather the masculine (*wosux* 'billy goat') that is secondary, being reflected by a diminutive. It seems attractive to assume that Baltic replaced an original *o*-stem by **āž-io-* based on the feminine **āž-iā-* (reflected by OPr. *wosee*), which would have been the unmarked form, cf. Gr. αἴξ f. 'goat'.[8] However, strictly speaking **h*$_2$*eǵ-* is merely a root isogloss.

Kroonen (2012: 245–246) argues that **h*$_2$*eǵ-* and **h*$_2$*eiǵ-* should be seen as loanwords originating in non-IE languages. This challenges the view that **h*$_2$*eǵ-* 'goat' is derived from **h*$_2$*eǵ-* 'to drive'. The substrate scenario is attractive, as it offers an explanation to the close formal and semantic similarity of these words, whereas the etymological connection to **h*$_2$*eǵ-* 'to drive' is unclear from a derivational point of view[9] and attributes the closeness to **h*$_2$*eiǵ-* to chance.

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6 The vocalism of Alb. *edh* cannot be explained by umlaut, since **h*$_2$*eǵ-io-* should have yielded Alb. ***ez*, cf. *vis* m. 'place, land, country' < **uiḱ-io-* (Demiraj 1997: 65). A preform **h*$_2$*eǵ-i-* may be possible but is *ad hoc*.

7 PIr. **iǰa-* seems to be directly attested in Khot. *häysä-* 'skin, hide'. Cf. also Yi. *ize*, Mu. *yijya* 'goatskin used for carrying sour milk', Psht. *žay* m. 'leather bag, mussuck' (Morgenstierne 1938: 195; 2003; Bailey 1979: 484).

8 A masculine *io*-stem may be reflected in Old Prussian place names, e.g., *Wosi-birgo* 'Ciginburg', i.e., 'Goat's Town' (Smoczyński 2018: 886).

9 Why would **h*$_2$*eǵ-o-* be 'the one being driven (by a goatherd)' rather than 'the driving one', cf. Skt. *ajá-* m. 'driver'?

However, the existence of YAv. *izaēna-* 'of leather' etc. has important implications for the substrate scenario. It presupposes the existence of *$*h_2eiǵ$-* in a prestage of (Indo-)Iranian from which *$*iǰa-$* < *$*h_2iǵ-o-$* could be derived through a native derivational process.[10] This prestage may be Core Proto-Indo-European, based on the attestation of *$*h_2eiǵ$-* in Greek, Armenian, and Albanian. The fact that the Indo-Iranian word for 'goat' contains *$*h_2eǵ$-* suggests that this root replaced *$*h_2eiǵ$-* in Indo-Iranian after the break-up of Core Proto-Indo-European. This replacement may be taken as a shared innovation with Balto-Slavic. The opposite scenario, i.e., that *$*h_2eiǵ$-* replaced an older root *$*h_2eǵ$-* 'goat', whether borrowed or derived from *$*h_2eǵ$-* 'to drive', is precluded by PIr. *$*iǰa-$* 'leather', as we would then expect the word for 'goat' in Indo-Iranian (and Balto-Slavic) to be derived from *$*h_2eiǵ$-*.

The root *$*h_2eǵ$-* 'goat' may thus be regarded as a root isogloss of Balto-Slavic and Indo-Iranian as well as a possible shared borrowing from an unknown source. Due to the shared derivative from this root, *$*h_2eǵ$-ino-* 'animal skin, leather' (see 3.2.3), *$*h_2eǵ$-* can hardly have been borrowed independently by the branches.

3.2.3 *h_2eǵ-ino- *'animal skin, leather'*

Indo-Slavic exclusivity	Etymology	Shared innovation	Typology
Yes	Compelling	Plausible	NDerivation Semantics

Indo-Aryan: Skt. *ajína-* n. '(animal) skin'
Iranian: YAv. *azina-uuaṇt-* 'who wears a hide'; Wakh. *yazn* 'inflated skin, mussuck'
Baltic: (Lith. *ožìnis* 'goat-')
Slavic: RuCS *jazьno* n. 'skin, leather'; SerbCS *jazьno*, *azьno* n. 'skin, leather'

A derivative in *-*ino-* from *$*h_2eǵ$-* may be reconstructed based on the Indo-Iranian (EWAia I: 51–52; Hoffmann 1967) and Slavic (Derksen 2008: 31–32; Vasmer III: 485) forms. This was listed as an isogloss by Arntz (1933: 37). The Lith.

10 The derivational process behind *$*h_2iǵ-o-$*, if from *$*h_2eiǵ-$*, is unclear to me. A possessive thematic derivative seems unlikely, as this should mean 'having goat'.

adjective *ožìnis* 'goat-' is better analysed as an independent innovation given its semantics and the productivity of *-ìnis*.

Alb. *dhirë*, *-në* 'pertaining to goat' is compared by Demiraj (1997: 160), but given the productive semantics it is likely an independent formation based on Alb. *dhi* 'goat', which more likely belongs with Gr. αἴξ 'goat' < **h*$_2$*eiǵ-* rather than **h*$_2$*eǵ-* (see p. 48).

The Proto-Indo-Iranian reconstruction of **Haǰ-ina-* is assured by Wakh. *yazn* 'inflated skin, mussuck' (not < **iz*(*a*)*na-*, *pace* Steblin-Kamenskij 1999: 424).[11] PIIr. **Haǰ-ina-* 'animal skin' existed next to **iǰa-* 'leather', which was retained in Iranian (see p. 48). According to Brugmann (1892: 146), **-ino-* was not productive in Indo-Iranian. AiGr. II, 2: 350–351 lists some innovative Sanskrit stems in *-ina-* but these mean 'having X' like *śākiná-* 'mit Kraut bewachsen' not 'pertaining to X' like *ajína-* presupposes. Some seem to be derivatives in *-a-* from *in*-stems, while others are *no*-derivatives from *i*-stems. It is therefore unlikely that **Haǰ-ina-* was derived within Indo-Iranian.

In Balto-Slavic, **-ino-* is commonly used for adjectives of material, origin, and type (Brugmann 1892: 147), which is similar to its usage in Greek. However, within Slavic **azьno* is not comparable to productive formations like OCS *želězьnъ* 'of iron' ~ *želězo* 'iron'.[12] Rather, it is a substantivized neuter adjective which was lexicalized with the meaning 'skin, leather', exactly parallel to PIIr. **Haǰ-ina-* 'animal skin'. Notably, **h*$_2$*eǵ-ino-* has lost its connotation to 'goat' in both branches, which constitutes a semantic innovation.

The fact that Slavic **azьno* is a neuter suggests that it was originally oxytone, since Indo-European barytone neuters became masculine due to the merger of unaccented nom.-acc.sg.n. **-om* > *-ъ* with nom.-acc.sg.m. *-ъ* (Illich-Svitych 1979: 115). This does not match Skt. *ajína-*. However, since the word is only attested in Church Slavic, the original accentuation is uncertain and difficult to use as an argument. It is possible that the accentual development of **azьno* was not exactly comparable to the type of neuters on which Illich-Svitych based his reconstruction.

Despite the possible difference in accentuation, the fact that Slavic and Indo-Iranian otherwise share both the derivational morphology and the semantics

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11 Wakhi underwent a stress shift from a short penultimate to the antepenultimate (Morgenstierne 1938: 483–484), thus *yazn* < **Háǰina-* < **Haǰína-*. A preform closer to YAv. *izaēna-* 'of leather' would not have produced the attested form. Similarly, Wakh. *yiǰín* 'carpet', which has been connected to YAv. *izaēna-* etc. (Bailey 1979: 484), is better explained as a derivative of *yazn* < **Haǰ-ina-* with weakening of unstressed initial **a-* (cf. Morgenstierne 1938: 478).

12 A seemingly parallel formation is OCS *platьno* n. 'linen', but in this case the derivational base is unclear.

of *$h_2eǵ$-ino- makes it a compelling isogloss. Neither branch is likely to have innovated *$h_2eǵ$-ino- independently, but, on the other hand, an archaism is also unlikely, as the base *$h_2eǵ$- 'goat' seems to have replaced an older *$h_2eiǵ$- in Indo-Iranian and Balto-Slavic (see p. 48). This makes *$h_2eǵ$-ino- a plausible shared innovation.

3.2.4 *neih$_1$- *'to churn'*

Indo-Slavic exclusivity	Etymology	Shared innovation	Typology
Yes	Compelling	Plausible	Root Semantics

Indo-Aryan: Skt. *nīta-* 'churned; butter' (ĀpŚS), *návanīta-* 'fresh butter' (KS+), *netra-* 'cord with which the churning stick is set in motion' (Br.+)
Iranian: Bal. *nēmaġ* 'butter'; Kajali *niru* 'to churn'; Khot. *nīyaka-* 'fresh butter', *ñ(y)e* 'buttermilk'; Shu. *nay-*, *nid-* 'to churn'; Wakh. *pərnəc* 'to churn'; Yi. *nə̌ya*, Mu. *nə̌yo* 'sour milk'
Baltic: Latv. *nīt*, *niju* 'to churn, thread (a needle)', *pa-nijas*, *pa-nīnas* f.pl. 'buttermilk', *sviêstnīņas* f.pl. 'the brine which gathers under butter'
Slavic: –

Although formally identical to Skt. *nay^{i}-* 'to lead', a separate root *neiH- 'to churn' has traditionally been reconstructed for semantic reasons (EWAia II: 25–26; Cheung 2007: 279). For the Baltic forms, see LEW: 505 and Derksen (2015: 545). However, Kloekhorst & Lubotsky (2014) have convincingly argued that Skt. *nay^{i}-* 'to lead' ~ Hitt. *nai-^{i}*, *nē-$^{a(ri)}$* 'to turn, send' (< *neiH-, cf. LIV: 450), on the one hand, and Lat. *neō* 'to spin' ~ Gr. νέω 'to spin' ~ OHG *nāen* 'to sew' (< *(*s*)neh$_1$-, cf. LIV: 571–572), on the other, belong under a single PIE root *(*s*)neh$_1$(*i*)- 'to turn, twist', from which *neih$_1$- 'to churn' may also be derived (cf. the turning of the churning stick). The meaning 'to churn' is restricted to Latvian and Indo-Iranian. Baltic and Slavic also reflect a noun *nih$_1$-ti- 'thread' (e.g., Lith. *nýtis* f. '(warp) thread', SCr. *nȉt* f. 'thread', cf. Derksen 2008: 353–354). Skt. *nīví-* f. 'piece of cloth wrapped around the waist, worn by women' (AV+) could show a similar connotation to textile production, but could also simply refer to a 'twisted' piece of cloth.

According to Kloekhorst & Lubotsky (2014), the **i* of *(*s*)neh$_1$(*i*)- is originally a verbal suffix. This situation is clearly discerned in Hittite, where the

present active *nai-^{i}* 'to turn, send' and the reduplicated *nanna-^{i}* 'to drive' are best reconstructed as *nh_1-oi-* and *ne-nh_1-oi-*, respectively, whereas the middle *nē-$^{a(ri)}$* may reflect a root stem *neh_1-*.[13] The *i*-suffix is ubiquitous in Indo-Iranian and Balto-Slavic verbal descendants of the root.[14] Latin *neō* 'to spin' and OIr. *snúid* 'to twist' could derive from a thematicized *i*-present *(*s*)neh_1-ie/o-*, but the *ie*/*o*-stem may also be secondary (cf. de Vaan 2008: 405). Similarly, Gr. νέω 'to spin', with the 3sg.imf. ἔννη, points to *(*s*)neh_1-*, but 3sg.pres. νῆ 'spins' < *(*s*)neh_1-ie/o- could reflect a thematicized *i*-present or a secondary *ie*/*o*-present.

As for nominal derivatives, Germanic (e.g., PGm. *$nēþlō$- 'needle', Kroonen 2013: 388), Celtic (OIr. *snáth* 'thread' < *sn(*o*)h_1-to-*, Matasović 2009: 348–349), Italic (Lat. *nēmen* n. 'yarn') all lack **i*. This also holds for the Core Proto-Indo-European stem *$sneh_1$-ur/n-* 'sinew' (ToB *ṣñor** n. 'sinew'; Skt. *snā́van-* n. 'sinew' (AV+); Gr. νευρά f. 'bowstring, sinew'; Lat. *nervus* m. 'sinew, muscle, nerve'; Arm. *neard* 'sinew, tendon').[15]

Conversely, Balto-Slavic and Indo-Iranian both have nominal derivatives containing *-i-*, showing that their creation must postdate the reanalysis of the suffix as part of the root. There are many parallels for this process in other Indo-European languages, e.g., *peh_3- / *peh_3i- / *$peih_3$- 'to drink' (LIV: 462–463), and the lexicalization of the secondary root can in many cases be projected to the protolanguage, but in this case Balto-Slavic and Indo-Iranian also share the semantic development to 'to churn'. This can hardly be an independent innovation in the separate branches; in Indo-Iranian, **naiH-* 'to churn' cannot be derived from **naiH-* 'to lead'; in Baltic, 'to churn' cannot be derived from '(to) thread'.

As such, *$neih_1$- 'to churn' is a plausible formal (albeit rather trivial) and semantic (quite specific) innovation of Indo-Slavic.

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13 This cannot be proven independently, however, since intervocalic *-i-* would be lost. Yet, the analysis is plausible from a morphological perspective (cf. Kloekhorst & Lubotsky 2014: 133).

14 Latv. *snãt* 'to wind loosely, braid, throw around one's shoulders' is a potential exception, but the *o*-vocalism is unexplained (cf. Derksen 2015: 551). If it is related to *(*s*)neh_1(*i*)-, the vocalism might indicate a denominal origin.

15 Additionally, a secondary root *(*s*)neh_1u- 'to twist, wind' may be reconstructed, reflected in Goth. *sniwan* 'to rush', RuCS *snuti* 'to warp', Latv. *snaujis* 'noose', and possibly Alb. *nus* 'thread, string'. Potentially, *(*s*)neh_1u- and *$sneh_1$-ur/n- both derive from a *u*-present of *(*s*)neh_1(*i*)-. Given that *$sneh_1$-ur/n- must be reconstructed for Core Proto-Indo-European, this *u*-present is likely archaic and should not be regarded as a shared innovation of Germanic, Balto-Slavic and Albanian.

3.2.5 *som *'together, with'*

Indo-Slavic exclusivity	Etymology	Shared innovation	Typology
Yes	Compelling	Plausible	NDerivation

Indo-Aryan: Skt. *sám* prev. 'together, with, at the same time' (RV+)
Iranian: OAv. *həm*, YAv. *hąm* prev. 'together'; OP *ha^{m}-gmata-* adj. 'gathered'; MiP Pahl. *han-ǰaman*, Man. *han-zaman* 'gathering, community'; MoP *an-ǰuman* 'gathering, community'; Sogd. M *'njmn* 'assembly'; Khot. *ham-* 'together'; Oss. I *æm-byrd* / D *æm-burd* 'gathering'
Baltic: Lith. *sù*, (dial.) *sà* prep. '(together) with', *sam-*, *san-*, *są-* pref. 'together'; Latv. *sa* prep. 'with', *suô-* pref. 'with'; OPr. *sen* prep. 'with', *sen-*, *san-* pref. 'together'
Slavic: OCS *sъ* prep. 'with', *sǫ-* pref. 'together'; Ru. *s*(*o*) prep. 'with, from', *su-* pref. 'together'; Pol. *z*(*e*) prep. 'with, from', *są-* pref. 'together'; Sln. *s*(*ə̀*) prep. 'with, from', *so-* pref. 'together'

Indo-Iranian and Balto-Slavic both attest preverbs/prepositions and prefixes that may be united under the reconstruction **som*(-) 'together, with' (EWAia II: 702; LEW: 753; Vasmer II: 564; Derksen 2008: 462, 478; 2015: 388, 434). Already Schmidt (1872: 49) argued that the use of **som* (**sam* in his reconstruction) as a preverb constitutes an Indo-Slavic isogloss.

The Balto-Slavic reflexes require some additional discussion.[16] While the prefixal forms (e.g., Lith. *sam-*, OCS *sǫ-*) all reflect **som-* regularly, it has been argued that the prepositional forms derive from a secondary zero-grade **sum* << **sm̥* (Trautmann 1923b: 250). This assumption is not necessary, however, since final **-om* would regularly yield PBSl. **-un* (Kortlandt 1978a; Hill 2013), so that an orthotone **sóm* would yield **sun* < **sum*. This directly accounts for Slavic **sъ*. The use of *sъ*(*n*)- as a verbal prefix in Slavic is clearly secondary. Lith. *sù*, on the other hand, does not regularly reflect **sun* < **som* (the regular outcome would be **sų*). Possibly, *sù* reflects **sṹn* (shortened by Leskien's Law), although the origin of the acute is unknown (Hock et al. 2019: s.v. *sù*).[17] Altern-

16 For a fundamentally different view on the Balto-Slavic material, see Dunkel (2014: 717 ff.).
17 A similar scenario has been proposed for Lith. (dial.) *sà* 'with', if secondarily extracted from prefixal *są́-*. For the vacillating vocalism, cf. also Lith. *ùž* ~ Lith. (dial.) *až*(*ú*) 'behind, beyond'.

atively, *sù* could reflect **sun* with irregular loss of the final nasal. The vocalism of Old Prussian *sen* 'with' also looks irregular but can easily be analogical (cf. Kortlandt 2000; 2007). Finally, the origin of Latv. *sa* prep. 'with' is unclear, but given the irregular outcomes in Lithuanian and Old Prussian, it seems unlikely that Latv. *sa* reflects PIE **so* (*pace* LEW: 753). In sum, there is no need to reconstruct Pre-PBSl. **sm̥*; **som*(-) accounts for both the preposition and the prefix. This reconstruction is more economical and fits with the fact that the prepositional and prefixal forms have the same meaning ('together, with') but different distribution (free vs. bound morpheme).

The Indo-Iranian preverb **sam* may theoretically reflect either **sem* or **som*. Given the semantic and functional correspondence with Balto-Slavic **som* 'together, with' rather than PIE **sem-* 'one' (see below), however, it likely reflects the *o*-grade form.

The preverb **som* is clearly related to PIE **sem-* 'one', reflected in Gr. εἷς 'one', Arm. *mi* 'one', ToA *ṣa-*, ToB *ṣe* 'one'. Next to orthotonic **sem-* there is a compound form **sm-* reflected in Lat. *sem-*, *sim-* 'once, one' (e.g., *semel* 'once', *simplex* 'having one layer'), Skt. *sa-* 'one, together', Av. *ha-* 'one', Gr. ἁ- 'one, same', Arm. *ham-* 'one, same' (e.g., *ham-hōreay* 'having the same father', Olsen 1999: 379), cf. the near identical compounds Skt. *sá-garbhya-* ~ Gr. ἀδελφεός lit. 'of (one and) the same womb'. From **sem-* 'one', the pronoun **smHo-* 'some, same' was derived, reflected in Skt. *sama-* 'anyone, someone', YAv. *hama-* 'anybody', Goth. *suma-* 'someone', Gr. ἅμα 'at the same time, together',[18] as well as **somHo-*, reflected in Skt. *samá-* 'like, same', Av. *hama-* 'the same', Gr. ὁμός 'common, similar', OIr. emphatic 3sg.pron. *-som*, ON *samr* 'same', Arm. *omn* 'someone'. The thematic stems **smHo-* and **somHo-* may both tentatively be derived from an athematic **s*(*o*)*m-H-*.[19] All the above formations may be reconstructed to (Core) Proto-Indo-European.

From this Core Proto-Indo-European state of affairs, where **sem-* and the derivatives based on it are exclusively nominal, **som* 'together, with' as a preverb is an innovation reflected in Indo-Iranian and Balto-Slavic. In these branches, **som* seems to have replaced a more archaic **kom* 'with', reconstructable based on Lat. *com-* pref., *cum* prep. 'with; completely', OIr. *co*, *cu* prep. 'with', Goth. *ga-* pref., *gan-iman-* 'to take along', and further Gr. κοινός 'common, public' < **kom-io-*, Hitt. *=kkan* ptcl. '?', Skt. *kám* final ptcl., OCS *kъ* 'to'. In addition to being more widely attested than **som*, a further indication that **kom* is an

18 Taken at face value, Gr. ἅμα suggests **smh*$_2$*e*, which would specify **smHo-* to **smh*$_2$*o-*, but *-α* could alternatively be a secondary adverbial element (Beekes 2010: 79). In view of the accent, Sihler (1973) argues that ἅμα is not derived from **smH-*.

19 Perhaps specifically **s*(*o*)*m-h*$_2$*-*, with the same adjectival suffix as in **meǵ-h*$_2$*-* 'much, large'.

archaism is that it has no known derivational base, unlike **som*. Evidently, **kom* was retained in peripheral functions in Indo-Iranian and Balto-Slavic.

As for potential extra-Indo-Slavic comparanda of **som*, a possible candidate is Hitt. =(*š*)*šan* 'over, on; close to; for the benefit of, about' (Eichner 1992: 46). While formally unproblematic, the function and semantics are not comparable to **som* 'together' or **sem-* 'one'. Even if Hitt. =(*š*)*šan* would be a formal cognate, the shared function of **som* in Indo-Iranian and Balto-Slavic could still be seen as a shared innovation.

Further, there is North Germanic *sam-* 'together' (de Vries 1977: 461), which must be a secondary development from PGm. **sama-* 'same', cf. ON *samfœðra* 'having the same father', since final **-m* would have been lost in Proto-Germanic (e.g., **ga-* < **kom*).

Gr. ξύν-, σύν- 'with, together' has been assumed as an irregular cognate of Skt. *sám* etc. (Dunkel 1982, with lit.). While Dunkel acknowledges that ξύν- is attested already in Mycenaean *ku-su* and "patterns like an archaism in Homer" (1982: 57), he argues that σύν- is the original form, from which ξύν- arose though contamination with **kom-* 'with'. Dunkel compares the initial **s-* in σύν- with Gr. σῦς 'swine' and δασύς 'hairy', hypothesizing a regular preservation of **s* before **u*. Besides the fact that both proposed parallels may be explained differently,[20] the problem is that the **u* in σύν-, if derived from **som*, must also be secondary, which Dunkel explains by extending the regular raising of **o* > **u* / $C_{[+\text{labial}]}_N$ to also include **s*. This hardly makes sense phonetically. Moreover, the irregular preservation of **s-* and the raising of **o* in σύν- are interdependent in this scenario, making the argument circular. Finally, the final **-n* of ξύν-, σύν- is not necessarily original, given the compound preposition μεταξύ. Greek also has a prefix ὁμ- 'one, same, together', which at face value looks like **som-*. However, unlike Indo-Slavic **som*, Gr. ὁμ- is strictly a nominal prefix that functions as a pre-vocalic allomorph of ἀ-, ἁμ- 'one, same'. Accordingly, rather than reflecting **som-*, ὁμ- is more likely an analogical replacement of ἁμ- on the model of Gr. ὁμός, ὁμοῦ.[21]

As no compelling cognates are found, Indo-Slavic **som* 'together, with' can be maintained as an isogloss and an innovation *vis-à-vis* **kom*.

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20 Gr. σῦς 'swine' is a variant of ὗς 'id.', which looks like the regular outcome of PIE **suH-s*. The former could be borrowed from another Indo-European language or result from contamination (cf. Beekes 2010: 1425). Gr. δασύς 'hairy' has been connected to Hitt. *dašš̆u-* 'heavy, strong', Lat. *dēnsus* 'dense', the semantic gap allegedly bridged by δαυλός 'thick, shaggy' < **dn̥su-lo-*, but the *-s-* in δασύς is likely analogical (van Beek 2013: 250). Of course, δαυλός is at the same time a counterexample to the supposed preservation of **s* before **u*.

21 Gr. ἁμαρτή 'at the same time' seems to show the regular development of **sm-h_2r-to-*

3.3 Isoglosses: Possible Shared Innovations

3.3.1 *b$^{(h)}$e, *b$^{(h)}$eǵ^{h} *'outside, without'*

Indo-Slavic exclusivity	Etymology	Shared innovation	Typology
Yes	Compelling	Possible	Root

Indo-Aryan: Skt. *bahíṣ* adv. 'outside, from outside, out'
Iranian: MiP Pahl. *bē* conj. 'but', Man. *byc* /bēz/ conj. 'but', Parth. *byc*, *byž* /bēž/ conj. 'but; except for', *byḫ* /beh/ adv. 'out, forth, away, outside'
Baltic: Lith. *bè* 'without'; Latv. *bez*, (dial.) *be* 'without'; OPr. *bhe* 'without'
Slavic: OCS *bez*(ъ) prep. 'without'; Ru. *bez* prep. 'without'; Pol. *bez* prep. 'without'; SCr. *bez* prep. 'without'

Meillet (1926: 173) mentions these words as an Indo-Slavic isogloss. The adverbial element *-*is* (cf. Skt. *āvíṣ*, p. 183), which characterizes Skt. *bahíṣ* (EWAia II: 220), is not paralleled in Balto-Slavic, however (LEW: 38; Derksen 2008: 38). Yet, *-*is* may have spread to *bahíṣ* by analogy to *āvíṣ* 'evidently, manifestly', *níṣ* 'out, forth, away, without'.

The prepositions MiP *byc*, Parth. *byc*, *byž* and adverb Parth. *byḫ* (Durkin-Meisterernst 2004), probably reflecting *b^{h}a-id + *-čid* (cf. Jügel 2013), cannot be directly compared with Skt. *bahíṣ*, but derive ultimately from *$b^{(h)}e$. In this sense, they look closer to the Baltic forms.

Lith. *bè*, Latv. (dial.) *be* and OPr. *bhe* have no final consonant, unlike Slavic and Sanskrit. Latv. *bez* has it, but may be explained as a borrowing from Slavic. Latvian also has the variants *bes* and *beš*. According to Endzelin (1923: 497), the former may be due to devoicing of *bez* before voiceless consonants, whereas the latter is argued to derive from the adverb *bešā* 'without' < *$be\text{-}tieh_2$-.

Baltic and Iranian thus seems to reflect *$b^{(h)}e$ as opposed to Slavic and Sanskrit *$b^{(h)}eǵ^{h}$. It is possible that the addition of *-$ǵ^{h}$ was a dialectal innovation of Indo-Slavic, but an archaism cannot be excluded.

(Beekes 2010: 83), but the denominal verb is either ἁμαρτέω 'to meet, come together' or ὁμαρτέω. Beekes (2010: 1075) argues that the vocalism of the latter is secondary after ὁμός and ὁμοῦ.

3.3.2 *bʰrodʰ-no- *'a (pale) horse colour'*

Indo-Slavic exclusivity	Etymology	Shared innovation	Typology
Yes	Compelling	Possible	NDerivation Root

Indo-Aryan: Skt. *bradhná-* adj. 'pale ruddy, yellowish, bay' (often of horses)
Iranian: –
Baltic: –
Slavic: CroatCS *bronъ* adj. 'white (of horses)'; ORu. *bronii* adj. 'white (of horses)'; Cz. *broný* adj. 'white (of horses)'

Indo-Aryan and Slavic share a colour adjective **bʰrodʰ-no-* used specifically to describe horses (EWAia II: 235; Derksen 2008: 64), which was listed as an isogloss by Schmidt (1872: 46). The exact meaning is not identical, however. An alternative etymology connects Skt. *bradhná-* to Lith. *blañdas* 'cloudiness' (cf. Derksen 2008: 47) but this root connection is semantically vague and contradicted by the Slavic **r*. The Slavic word has alternatively been connected to Gr. φαρύνει and φάρη (Hesychius) (see Vasmer I: 125), which is formally difficult.

Although **bʰrodʰ-no-* is an isogloss, the root of the derivation is unknown, which could point toward an archaism. The Slavic word has alternatively been taken as an Iranian loan. The fact that the word is not attested in Iranian makes this explanation less plausible.

3.3.3 *bʰudʰ-ro- *'attentive, awake'*

Indo-Slavic exclusivity	Etymology	Shared innovation	Typology
Yes	Compelling	Possible	NDerivation

Indo-Aryan: –
Iranian: YAv. *zaēni-buδra-* adj. 'eagerly attentive, waking'
Baltic: Lith. *budrùs* adj. 'vigilant', OLith. *bùdras* adj. 'vigilant'
Slavic: OCS *bъdrъ* adj. 'alert, cheerful'; Ru. *bódryj* adj. 'cheerful'; SCr. *bȁdar* adj. 'cheerful, alert'

Avestan *-buδra-*, attested in a compound (AirWb.: 968), corresponds to OLith. *bùdras* (Petit 2004: 266) and OCS *bъdrъ* (Derksen 2008: 69). In Lithuanian this was eventually remodelled to a *u*-stem. The stem looks like a normal *ro*-adjective from the root **b*^{h}*eud*^{h}- 'to become awake'. This stem type is archaic, but it is nevertheless a possible shared innovation.

3.3.4 *d^{h}eh$_1$i-nu- *'female mammal'*

Indo-Slavic exclusivity	Etymology	Shared innovation	Typology
Yes	Compelling	Possible	^{N}Derivation Semantics

Indo-Aryan: Skt. *dhenú-* f. '(dairy) cow, female mammal'
Iranian: YAv. *daēnu-* f. 'female mammal'; MiP Pahl. *dēnōdag* 'female, milch cow'; Khot. *dīnū* 'cow'; Khwar. *δy*(*n*) 'woman'
Baltic: Lith. *dienì* f. 'pregnant, with child (of cow, mare, sheep)'; Latv. *atdiẽne*, *a*[*t*]*daîne* f. 'a cow that calves already in its second year'
Slavic: –

Arntz (1933: 47) takes this stem as an Indo-Slavic isogloss.[22] The root is **d*^{h}*eh*$_1$*i-* 'to suck(le)'. Indo-Iranian has a feminine *u*-stem (EWAia I: 797). One could wonder whether it is derived within Indo-Iranian from the weak stem of Skt. *dhinoti* 'to nurture' (see LIV: 138), but this is unlikely since the feminines of *u*-stems generally end in *-ī*, cf. Skt. *pṛthvī́* (AiGr. II, 2: 467). Since neither *dhinoti* 'to nurture' < **d*^{h}*i-neu-* nor OIr. *denait* 'they suck' < **d*^{h}*en-* directly continue **d*^{h}*i-n-h*$_1$-, they may be secondary. To be noted is a category of deverbal nomina agentis (mostly from desideratives) in *-u-* that often correspond to abstracts nouns in *-ā-* (cf. Skt. *dhénā-* f. 'stream of milk, nourishing stream, stream of speech'), but the feminines of these *u*-stems generally have long *-ū-* (AiGr. II, 2: 468). Thus, the Indo-Iranian word rather looks like a substantivized *nu*-adjective (cf. AiGr. II, 2: 741).

In Baltic, feminine *u*-stems were generally remodelled to a *i*-stems (Ambrazas & Schmalstieg 2018: 1658). As shown by Vanags (1989: 114), archaic

22 Cf. already Schmidt (1872: 46), who compares Skt. *dhenā-* (sic) 'cow giving milk' to Lith. *dienà* 'pregnant', an uncertain variant of Lith. *dienì* (Derksen 2015: 127).

feminine *u*-stems are attested in Old Lithuanian, so it is possible that this remodelling was quite recent. Lith. *dienì* reflects a circumflex root but Latv. *atdiẽne* points to a laryngeal in the root (Derksen 2015: 127–128). The fact that neither Baltic nor Slavic has any other *n*-stem derivative from *d^heh_1i-* suggests that Lith. *dienì* ~ Latv. *atdiẽne* is archaic within Balto-Slavic.

Thus, **d^heh_1i-nu-* is a compelling Indo-Slavic isogloss, derived from **d^heh_1i-* 'to suck(le)'. Since not only the derivation but also the semantic specification of 'suckling (one)' >> 'female mammal' is shared, it may be an Indo-Slavic innovation.[23]

3.3.5 *d^hemH- / *d^hmeH- *'to blow'*

Indo-Slavic exclusivity	Etymology	Shared innovation	Typology
Yes	Compelling	Possible	Root

Indo-Aryan: Skt. *dhámati* 'to blow'
Iranian: YAv. ptc.int.med. *dāδmainiia-* 'blowing up'; MiP Pahl. *dam-* 'to blow'; MoP *damīdan* 'to blow; to breathe'; Sogd. B *δm'k* 'breath'; Khot. *dam-* 'to blow'
Baltic: Lith. *dùmti, -ia* 'to blow'; Latv. *dum̂t, -stu* 'to become overcast, cloud over'
Slavic: OCS *dъmy* nom.sg.pres.ptc. 'blowing'; ORu. *duti, dъmu* 'to blow', Ru. *dut', dúju* 'to blow'; Pol. *dąć, dmę* 'to blow'; SCr. *dȕti, dmēm, dȕjēm* 'to blow, inflate'

The root **d^hemH-* or **d^hmeH-* 'to blow' (cf. Skt. aor. *adhmās-*) is exclusive to Indo-Iranian (EWAia I: 775) and Balto-Slavic (Derksen 2008: 114–115; Derksen 2015: 145), as noted by Meillet (1926: 171–172) and Arntz (1933: 51).

The vacillating root structure in Sanskrit (*dham-* / *dhmā-*) may originate from the vocalization of **d^hmH-* > **d^hamH-*. Based on this, Skt. *dhámati* has been derived from a root present or *tudáti*-present (Gotō 1996: 46, fn. 11). However, as it is not found in Iranian, it cannot be excluded that Skt. *dhmā-* is a secondary root variant, in which case Skt. *dhámati* may be taken at face value as a class I thematic present. In Balto-Slavic, the paradigm is generally built on a zero-grade **dumH-* (Smoczyński 2018: 264), but the infinitive PSl. **dǫti* may point to an old full grade **domH-* (Pronk 2013: 130). The origin of the Balto-Slavic vocalization **um* < **$m̥$*, although not unparalleled (see Stang 1966: 77),

23 The human reference of Khwar. *dy*(*n*) 'woman' is surely secondary.

is unclear. Perhaps it is analogical from Lith. *dū́mai* 'smoke', OCS *dymъ* 'smoke', like Oss. I *dymyn* / D *dumun* 'to blow (up), smoke' (cf. Cheung 2002: 24).

Because of these uncertainties, it is not possible to determine whether the Indo-Iranian and Balto-Slavic verbal stems go back to same formation, e.g., **dʰmH-é/ó-* (*tudáti*-present), **dʰ*(*e*)*mH-* (root present), or **dʰémH-e/o-* (thematic present). Thus **dʰemH-* or **dʰmeH-* 'to blow' cannot be proven to be more than a root isogloss.

3.3.6 *dʰoH-neh$_2$- *'grains'*

Indo-Slavic exclusivity	Etymology	Shared innovation	Typology
Yes	Compelling	Possible	NDerivation Root

Indo-Aryan: Skt. *dhānā́-* f. 'roasted grains'
Iranian: YAv. *dānō.karš*(*a*)- 'a kind of ant'; MiP Pahl. *dān*(*ag*), Man. *d'ng* 'seed, grain'; Bal. *dān* 'grain'; Sogd. M *δ'n* 'seed'; Khwar. *δ'n* 'seed'; Khot. *dānā-* 'grain, seed'; Shu. *δůn* 'roasted grains'; Wakh. *δʁın* '(ritual meal of) roasted wheat'
Baltic: Lith. *dúona* f. 'bread, bread grains, rye'; Latv. *duõna* f. 'slice of bread, especially at the end of a loaf'
Slavic: –

Schmidt (1872: 46) and Arntz (1933: 47) list this stem as an Indo-Slavic isogloss. Hitt. NINDA*dannaš-* 'a bread-like food' should be considered as unrelated (*pace* Huld 2002; see further Tischler 1983–1994). Although it could be mechanically reconstructed as **dʰoh$_1$-n-os-*, it would require the highly implausible assumption of a secondary *s*-stem that was derived from a (thematic) *n*-stem. ToB *tāno* f. 'seed, grain' is a formally possible inherited cognate to the Indo-Iranian word, but the final *-o* and the close semantic match with Iranian rather suggest a borrowing from an Iranian source (Peyrot 2018: 259; Dragoni 2023: 122).

The Indo-Iranian and Baltic words (EWAia I: 787; Bailey 1979: 156; LEW: 111; Derksen 2015: 146) are thus the only attested reflexes of a stem **dʰoH-neh$_2$-*. Peyrot (2018: 258) doubts the etymology, however, because of the homophonous Latv. *duona* 'frame of a door, door jamb; bottom of a barrel; edge of a plate; a channel in the beater (of a loom)', which in his opinion shows that Lith. *dúona* 'bread' and Latv. *duõna* 'edge of a loaf' derive from a word meaning 'edge', which subsequently acquired several specified meanings. Yet, a secondary meaning of

Lith. *dúona*, cited in the LKŽ (s.v. *dúona*), is 'bread grains, rye', which supports the connection to Indo-Iranian.

The underlying root of *$*d^{h}oH\text{-}neh_2$- is unclear. A common suggestion is *$*d^{h}eh_1$- 'to set, put', with a meaning 'what is put in the ground' (Wodtko, Irslinger & Schneider 2008: 125), but the meaning of this root is too general to be compelling. Semantically, *$*h_2ed$- 'to parch, dry' would fit, but it is formally difficult. Thus, there is no convincing root from which *$*d^{h}oH\text{-}neh_2$- could have been derived, which suggests a shared archaism of Indo-Iranian and Baltic. However, the possibility remains that it was borrowed.

3.3.7 *d^{h}or-eie/o- *'to hold, support'*

Indo-Slavic exclusivity	Etymology	Shared innovation	Typology
Yes	Compelling	Possible	^{V}Derivation

Indo-Aryan: Skt. *dhāráyati* 'to hold, keep, support'
Iranian: OAv. 3sg.pres.inj. *dāraiiaṯ* 'to hold', YAv. 2sg.pres. *dāraiiehi* 'to hold'; OP *dārayātiy* 'to hold, have'; MiP Pahl. *dār-*, Man. *d'r-* 'to hold, keep'; Sogd. BMS *δ'r-* 'to have, hold'; Khwar. *δ'ry-* 'to hold, have'; Oss. I *daryn* / D *darun* 'to hold, put'
Baltic: Lith. *darýti*, *dãro* 'to produce, work on, do'; Latv. *darît*, *daru* 'to do'
Slavic: –

Verbal forms of the root *$*d^{h}er$- 'to hold' are exclusively attested in Indo-Iranian and Balto-Slavic (cf. LIV: 145).[24] As for the verbal stem formation, both branches attest an *eie*/*o*-present, although with divergent semantics.

Skt. *dhāráya-* 'to hold', most frequently attested in the imperfect, various modal forms, as well as participles, is essentially synonymous with the perfect *dadhā́ra* 'to hold' (Jamison 1983: 95–96). The stem does not seem to have a causative meaning and is unlikely to be a recent derivative. The Sanskrit situation is mirrored in Iranian, where the stem develops the secondary meaning 'to have' in Old Persian and younger Iranian languages.

24 Gr. (Hesychius) ἐνθρεῖν 'to guard' hardly belongs here (cf. Beekes 2010: 558). Hitt. *ter-^{zi}* / *tar-* 'to speak, say' is rather from a root *$*ter$- (Kloekhorst 2008: 870–871).

According to Fraenkel (LEW: 83), Lith. *darýti* (and Latv. *darît* 'to do') are causatives to Lith. *deréti* 'to be suitable, useful, handy'. However, since the productive causative to *deréti* is *dẽrinti* 'to adjust, fit (etc.)' (Smoczyński 2018: 213), *darýti* may rather be taken as an inherited formation from Proto-Balto-Slavic. The semantic difference *vis-à-vis* Indo-Iranian does not necessarily preclude a shared innovation, since the rather general meaning of the Baltic verbs could have developed from 'to hold, support', which presumably is the older meaning. It is noteworthy that the Baltic and Indo-Iranian verbs share the feature of transitivity.

3.3.8 *ǵelp- *'to murmur, babble'*

Indo-Slavic exclusivity	Etymology	Shared innovation	Typology
Yes	Compelling	Possible	Root

Indo-Aryan: Skt. *jalp-* 'to speak unintelligibly, murmur, babble'
Iranian: –
Baltic: Lith. *želpúoti*, *želpúoja* 'to babble, chat'
Slavic: –

This etymology (see LEW: 1296) is not considered in EWAia (I: 580), where Skt. *jalp-* 'to murmur (etc.)' together with Skt. *jap-* (with the same meaning) is explained as an onomatopoeic root. However, given the formal and semantic correspondence to Lith. *želpúoti*, the etymology is difficult to reject, even if the root is onomatopoeic. The preservation of **l* in Sanskrit need not imply a recent formation, but may be conditioned by the following **p* (Schoubben 2019).

3.3.9 *ǵuelH-e/o- *'to burn, shine'*

Indo-Slavic exclusivity	Etymology	Shared innovation	Typology
Yes	Compelling	Possible	^{V}Derivation

Indo-Aryan: Skt. *jválati* 'to burn'
Iranian: –

Baltic: OLith. *žvelantį* acc.sg.pres.ptc. 'burning, glowing', Lith. *žvìlti*, *žvỹla* 'to shine, gleam'
Slavic: –

Arntz (1933: 40) followed the old comparison of Skt. *jválati* 'to burn' to Lith. *žiūréti* 'to look at' (IEW: 479), which is semantically uncompelling. A more plausible root cognate is Lith. *žvìlti* 'to shine, gleam' (EWAia II: 607; Derksen 2015: 524). The root may also be reflected in ON *kol* n. 'coal', OIr. *gúal* m./f. 'coal' (Kroonen 2013: 309), although the latter requires a (secondary?) full grade **ǵoulH-* that diverges from Skt. *jval^{i}-*.

Although the root is probably not uniquely Indo-Slavic, only Sanskrit and Baltic attest verbal stems from **ǵuelH-*. Lith. *žvìlti* is generally taken as secondary (LIV: 170–171). According to Būga (RR II: 468), the OLith. participle *žvelant-* presupposes a thematic present that Smoczyński compares to Skt. *jválati* (2018: 1766). This stem is a possible shared innovation, although it is difficult to rule out that the branches innovated independently.

3.3.10 *ǵ^{h}euH-e/o- *'to call, curse'*

Indo-Slavic exclusivity	Etymology	Shared innovation	Typology
Yes	Compelling	Possible	^{V}Derivation

Indo-Aryan: Skt. *hávate* 'to call'
Iranian: YAv. *zauuaiti* 'to curse'; Sogd. S *'zw-* 'to call'
Baltic: (Lith. *žavéti*, *žãvi* 'to attract, charm, conjure, curse'; Latv. *zavêt*, *zavẽju* 'to cast a spell')
Slavic: OCS *zъvati*, *zovǫ* 'to call'; Ru. *zvát'*, *zovú* 'to call'; Pol. *zwać*, *zwę* 'to call'; SCr. *zvȁti*, *zòvēm* 'to call'

The possible isogloss involves the stem formation and semantics of this verb (cf. Schmidt 1872: 50; Arntz 1933: 45). The root **ǵ^{h}euH-*[25] is also attested in ToB *kwā-tär* 'to call out to, invite', which probably reflects the zero-grade **ǵ^{h}uH-* of a root present (*pace* Adams 2013: 254), and in ON *geyja* 'to bark; to mock' <

25 The root structure of **ǵ^{h}euH-* has been supposed to be secondary *vis-à-vis *ǵ^{h}ueH-* (LIV: 181; Kümmel 2000: 608), as attested in Skt. (JB) *hvātar-* ~ YAv. *zbātar-* 'caller'. However, this is more likely secondary, extrapolated from the present stem Skt. *hváya-* ~ Av. *zbaiia-* 'to call' < **ǵ^{h}uH-éie/o-* (similarly EWAia II: 811; Adams 2013: 254).

**ǵʰouH-ie-*. It may also be found in OIr. *guth* m. 'voice' < PCelt. **gutu-*, with pretonic shortening (Matasović 2009: 170). PGm. **guda-* 'god' has been connected (IEW: 313–314), but the short vowel cannot be explained by pretonic shortening, since this only occurred before resonants in Germanic. Arm. *jaunem* 'to consecrate' is hardly related given the *a* in the root.

Within Indo-Iranian, the thematic present stem appears to be archaic, given the correspondence between Skt. *hávate* and Sogd. *'zw-* 'to call'. Formally, YAv. *zauuaiti* 'to curse' looks like a compelling cognate, having undergone a semantic shift from 'to call' (cf. Narten 1969). However, Humbach (1973: 95) argues that YAv. *zauua-* reflects a different root **ǰ⁽ʰ⁾ab⁽ʰ⁾a-*, on the basis of Khwar. *zβ-* 'to curse', which cannot reflect **ǰʰau(H)a-*. For the Avestan form, a connection to Skt. *hávate* remains attractive, but to reconcile the Khwarezmian form, *zβ-* must then be explained from a stem with zero-grade in the root, where **u* > *β* would be regular, i.e., **ǰʰuHa-*, perhaps from the aorist (cf. Skt. *áhvat*). In any case, the thematic stem of Sanskrit and Sogdian may be compared with OCS *zъvati* 'to call' etc., as Schmidt (1872: 50) noted. This verbal stem is a potential Indo-Slavic shared innovation.

In LEW: 1293, Lith. *žavéti* 'to attract, charm, conjure, curse' is separated from **ǵʰeuH-*, but the etymology is quite compelling, if we assume a semantic shift from 'to call'. Although Baltic has innovated a new stem, a semantic shift from 'to call' >> 'to curse' could be a shared innovation of Indo-Slavic, if YAv. *zauuaiti* 'to curse' indeed belongs here. Narten (1969: 52) rejected this idea, arguing that the meaning of YAv. *zauua-* 'to curse' developed within Iranian, since the Indo-Iranian ritual contexts where the stem was used were considered "Daēvic"; the original meaning 'to invoke ritually' shifted to 'to invoke with unholy words' >> 'to curse'. This is possible, but not enough to reject a shared semantic innovation. However, in the phrase ON *goð geyja* 'to mock the gods', the Germanic cognate shows similar semantics to Baltic and Iranian, which leads to the conclusion that only the thematic stem of Indo-Iranian and Slavic is a possible shared innovation.

3.3.11 *ǵʰouH-o- *'call, invocation'*

Indo-Slavic exclusivity	Etymology	Shared innovation	Typology
Yes	Compelling	Possible	^{N}Derivation

Indo-Aryan: Skt. *háva-* m. 'call, invocation'
Iranian: OAv. *zauua-* m. 'invocation'

Baltic: –
Slavic: Ru. *zov* m. 'call'; Bulg. *zov* m. 'call'; Sln. *zòv* m. 'call'

Arntz (1933: 45), building on Trautmann (1923b: 367), lists this verbal noun from **ǵʰeuH-* 'to call' as an Indo-Slavic isogloss, which is formally and semantically compelling. ON *goðgá* 'improper behaviour, blasphemy' reflects an independent formation **ǵʰouH-eh₂-*.

3.3.12 *ǵʰuel- *'to be bent, walk crookedly'*

Indo-Slavic exclusivity	Etymology	Shared innovation	Typology
Yes	Compelling	Possible	Root Semantics

Indo-Aryan: Skt. *hvárate* 'to walk crookedly', *hváras-* n. 'trap, deceit', *hurás* adv. 'wrongfully'
Iranian: YAv. *zbarəṇt-*, *zbarəmna-* ptc. 'walking crookedly', *zŭrō.jata-* adj. 'wrongfully killed'; OP *zura* adv. 'wrongfully'; Oss. I *ævzær* 'bad, evil'
Baltic: Lith. *žvìlti*, *žvỹla* 'to bow, bend, lean over', (Žem.) *atžűlus* adj. 'rude'; Latv. *zvìlt*[2], *zvilstu* 'to lean over (slowly), lie down, be idle', *zvelt*, *zveļu* 'to roll, knock over'
Slavic: OCS *zъlъ* adj. 'bad, evil, wicked'; Ru. *zloj* adj. 'bad, evil, wicked'; Pol. *zły* adj. 'bad, evil, wicked'; SCr. *zȁo* adj. 'bad, evil, wicked'

Arntz (1933: 53) listed this root as an Indo-Slavic isogloss. However, the relationship between the Indo-Iranian and Balto-Slavic forms, as well as possible external comparanda, is complicated.

The Indo-Iranian root **ǰʰuar-* has been derived from **ǵʰuer-* and connected to Gr. θήρ m. 'wild animal' (Schindler 1972: 37), Lith. *žvėrìs* m. 'wild animal' etc. However, this etymology is problematic, since the acute root in Baltic points to **ǵʰueh₁r-* (Derksen 2015: 524). Instead, **ǰʰuar-* may be connected to Lith. *žvìlti* 'to bow, bend, lean over', OCS *zъlъ* 'bad, evil, wicked' etc., which seem to cover approximately the same semantic range as the Indo-Iranian forms. However, while Indo-Iranian **ǰʰuar-* is aniṭ (cf. Skt. *parihvṛ́t-*[26]), certain Balto-Slavic forms point to a root-final laryngeal. Lith. *žvìlti* points to **ǵʰuḷH-*, which can also explain Latv. *zvìlt*[2]. According to Derksen (2008: 551), the adjectival

26 The zero-grade is often metathesized, e.g., *-hruta-* 'crooked' (Lubotsky 1994: 100).

form reflected in Lith. (Žem.) *atžūlus* 'rude' points to a lengthened zero-grade of an acute root **ǵʰulH-*. Yet, this form and OCS *zъlъ* 'bad, evil, wicked' etc. are difficult to account for if **ǵʰulH-* is the original form, as the expected vocalization would be **ǵʰul̥H-* > PBSl. **źvilH-*. I am therefore inclined to follow Smoczyński (2018: 1765) in treating the Baltic zero-grade **źvil-* as secondary to the full grade **źvel-* (attested in Lith. *nuožvelnùs* 'diagonal'), to which the original zero-grade was **źul-*. The acute intonation of certain Baltic forms must then be considered as secondary.

In both branches, verbal forms continue the (presumably) original meaning 'to be bent, walk crookedly', whereas nominal forms reflect a metaphorical meaning 'wrongful, evil, bad', which may be a shared semantic development. In conclusion, **ǵʰuel-* 'to be crooked, walk crookedly' constitutes an Indo-Slavic root isogloss with a potential semantic innovation.

3.3.13 *g(w)eHi- *'to sing'*

Indo-Slavic exclusivity	Etymology	Shared innovation	Typology
Yes	Compelling	Possible	Root

Indo-Aryan: Skt. *gā-* 'to sing', *gā́yati* 'to sing'
Iranian: YAv. *gā-* 'to sing'; Sogd. C *ž'y*, M *j'y* 'to speak, talk'; Khot. *gāha-* 'verse'; Yagh. *žoy-* 'to read, sing; to study'; Yazg. *ǰay-* 'to call'
Baltic: Lith. *giedóti, gíeda* 'to sing'; Latv. *dziêdât, dziêdu* 'to sing'
Slavic: –

Arntz (1933: 35) presents the Indo-Iranian and Baltic forms as an isogloss along with ORu. *gajati* 'to caw, croak' (cf. also Derksen 2008: 161; LIV: 183). However, I believe the latter to be an unrelated onomatopoeic formation that cannot be used in the discussion of the remaining material.

In Indo-Iranian, the root is either *gā-* or *gāy-* (cf. Kümmel 2020: 183). The former appears in inherited nominal forms such as YAv. *gāϑra-* n. 'sung prayer' ~ Skt. *gāyatrá-* m./n. 'singing, song' (where the present stem has replaced the root), as well as in aorist stems. The latter, Skt. *gāy-*, is found in the present stem *gā́ya-* and related forms, as well as in clearly recent nominal forms such as *gīti-* f. 'song'.[27]

27 Seemingly from **gʷiH-ti-*, but the lack of palatalization shows that *gīti-* was derived within Sanskrit (or that the anlaut was restored).

The root variant *gāy-* clearly originates in the present stem (EWAia I: 483 with lit.). As argued by Kulikov (2012: 83), *gā́yati* 'to sing' is best analysed as a class I present (in line with Indian tradition), rather than a class IV *ie*/*o*-present (*pace* LIV: 183). The original stem may have been **g^{w}H-oi-*. If the Middle and Modern East Iranian forms (with palatalization) belong to this etymon, they would be consistent with a reconstruction **g^{w}H-oi-*; in an athematic stem **g^{w}H-oi-* / **g^{w}Hi-*(*V*) / **g^{w}iH-*(*C*), palatalization would have taken place in some forms, after which it could be levelled (in Iranian) or eliminated from the paradigm (in Sanskrit). A thematic stem **g^{w}eH-ie*/*o-* cannot account for this distribution.[28] However, see Steblin-Kamensky (1999: 200) for alternative proposals regarding the Iranian material.

Lith. *giedóti* 'to sing' is commonly believed to be derived from **g^{w}eHi-*, but the origin of the extension **-d$^{(h)}$-* (which appears in all nominal and verbal derivatives), while frequent in Baltic, is unknown. In any case, it does not give reason enough to doubt the etymology, given the semantic and near formal correspondence. Like in Indo-Iranian, the *i*-suffix has become part of the root. While it is difficult to exclude a shared archaism, it is possible that the *i*-stem as well as the lexicalization of a secondary root **g^{w}eHi-* is a shared innovation of Indo-Iranian and Balto-Slavic.

3.3.14 *g^{w}oih$_3$-o- *'life'*

Indo-Slavic exclusivity	Etymology	Shared innovation	Typology
Yes	Compelling	Possible	^{N}Derivation

Indo-Aryan: Skt. *gáya-* m. 'house, household, family, property'
Iranian: OAv., YAv. *gaiia-* m. 'life, lifetime, lifestyle'
Baltic: –

Slavic: ORu. *goi* m. 'piece, friendship'; OCz. *hoj* m. 'abundance'; Sln. *gòj* m. 'care, cultivation'

28 The quality of the laryngeal cannot be determined by Balto-Slavic evidence, since the alleged Slavic cognate has been removed. A reconstruction **g^{w}eh$_{2/3}$-* has been argued to explain the non-palatalization in Sanskrit (cf. Ollett 2014), but the palatalization in Iranian shows that any reconstruction with full grade in the root is incorrect (since **g^{w}eh$_1$-* would explain the Iranian but not Sanskrit forms).

Indo-Iranian and Slavic share an *o*-stem (EWAia I: 467; AirWb.: 503; Derksen 2008: 173), ultimately derived from the root **g^{w}eh$_3$i-* 'to live', which Arntz (1933: 45) lists as an isogloss. Lith. *gajùs* 'vigorous' may be derived from the *o*-stem (Derksen 2015: 162). Within the individual branches, this *o*-stem looks archaic, since the semantics are clearly lexicalized and since the **g^{w}* is unpalatalized unlike most attested verbal forms. The exact reconstruction largely depends on the reconstruction of the root **g^{w}eh$_3$i-*, which has several different forms in the Indo-European languages.

Two distinct full grades are attested: **g^{w}ieh$_3$-*, reflected in OAv. *jiiātu-* m. 'life' and Gr. ζώω 'to live', and **g^{w}eih$_3$-*, reflected in Gr. βέομαι 'will live'. Arm. *keam* 'to live' is unclear and may reflect either **g^{w}ieh$_3$-* / **g^{w}i(i̯)h$_3$-*, a full grade **g^{w}eih$_3$-* (LIV: 215), or **g^{w}h$_3$ei-* (Martirosyan 2010: 356). With Lubotsky (2011: 111ff.), I assume that the root originates from an *i*-present to **g^{w}eh$_3$-* (cf. Gr. βόσκω 'to feed, tend'). Laryngeal metathesis would have created a paradigmatic alternation between the strong stem **g^{w}h$_3$-ei-* and weak stem **g^{w}h$_3$i-V* / **g^{w}ih$_3$-C*. The *i*-suffix was subsequently reanalysed as part of the root (seen in, e.g., **g^{w}h$_3$i-uo-* > **g^{w}ih$_3$-uo-* 'alive' with laryngeal metathesis, cf. Skt. *jīvá-* 'alive', Lat. *vīvus* 'alive' etc.). Because of the varying order of root consonants in the full grade and zero-grade(s) in the verb, deverbal derivatives repaired the root structure in various ways, including **g^{w}ieh$_3$-* and **g^{w}eih$_3$-*.[29] In Balto-Slavic, the pre-metathesized root structure was instead restored (at least in some derivatives), which is evidenced by the broken tone of Latv. *dzîvs* 'alive' (Kortlandt 1992: 237, fn. 4), the mobile paradigm of Lith. *gývas* 'alive', the final stress of Ru. *žilá* f. 'lived' (Kortlandt 1975b: 3).

Turning to Skt. *gáya-* etc., the non-palatalized anlaut and short root vowel point to PIIr. **gaiHa-* < **g^{w}oih$_3$-o-*. This reconstruction also fits ORu. *goi* < PSl. **gôjъ*.[30] For Slavic, the preforms **g^{w}h$_3$eio-* or **g^{w}h$_3$oio-* are also possible, but the latter is incompatible with Indo-Iranian short **ă* in the root. In the former case we might expect laryngeal aspiration in Indo-Iranian (cf. Skt. *máh-* 'great, strong, powerful' < **meǵh$_2$-*), but as there are no clear examples of **h$_3$* causing aspiration (Kümmel 2018: 163), **g^{w}h$_3$eio-* remains possible. However, an *e*-grade in the root would be unexpected in a masculine verbal noun, which is why **g^{w}oih$_3$-o-* remains the most likely reconstruction. Since the root structure was elsewhere restored to **g^{w}h$_3$ei-* in Balto-Slavic, **g^{w}oih$_3$-o-* is likely old and may be compared directly with Indo-Iranian.

29 See Lubotsky (2011) for more evidence for a similar derivational chain in other roots, which seems to have been quite common in Proto-Indo-European.

30 A similar full grade is reflected in OCS *žito* n. 'corn, fruits', OPr. *geytye*, *geits* 'bread', probably cognate with Welsh *bwyd* m. 'food, meat'.

3.3.15 *g(wh)eh$_2$ǵh- *'to wade'*

Indo-Slavic exclusivity	Etymology	Shared innovation	Typology
Yes	Compelling	Possible	Root

Indo-Aryan: Skt. *gā́hate* 'to penetrate, step into the water, wade'
Iranian: Sogd. BMS *"γ'z*, C *'γ'z* 'to begin'; Khwar. *γ'z* 'to run'; Oss. I *qazyn* / D *ǧazun* 'to play, joke, enjoy (a game)'; Shu. *žōz-* 'to run'
Baltic: Lith. *góžti, -ia* 'to overthrow, overturn, pour out'; Latv. *gâzt, -žu* 'to overthrow, overturn, pour (out)'
Slavic: RuCS *izgaziti* 'to ruin'; SCr. *gȁziti* 'to trample, wade'

The root *$g^{(wh)}eh_2ǵ^h$- is not attested outside Balto-Slavic and Indo-Iranian (LIV: 183). Skt. *gādhá-* n. 'shallows, ford' must be kept separate (EWAia I: 486) since the *ta*-participle Skt. *gāḍha-* < *$gāž$-d^ha- shows that *gāh-* ended in a palatal. The Iranian forms further confirm this reconstruction (Cheung 2007: 96). The Baltic vocalism points to *-h_2-.

Gr. βῆσσα f. 'wooded combe, glen' has been connected (Beekes 2010: 213), but it is semantically distant. Moreover, it may be derived from βαθύς 'deep, high' and connected to OIr. *báidim* 'to sink into the water', Lat. *vadum* n. 'ford', Skt. *gādhá-* n. 'shallows, ford' < *$g^weh_2d^h$-.

The roots *$g^weh_2d^h$- and *$g^{(wh)}eh_2ǵ^h$- 'to wade' appear to be semantically identical and may be analysed as extensions of *g^weh_2- 'to step'.[31] Since *$g^weh_2d^h$- > Skt. *gādhá-* n. 'shallows, ford' is isolated in Indo-Iranian, the root seems to have been replaced by *$g^{(wh)}eh_2ǵ^h$-. In this context, the root extension *-$ǵ^h$-[32] in *$g^{(wh)}eh_2ǵ^h$- could be seen as an innovation of Indo-Slavic.

31 This could potentially explain the relationship between Gr. βῆσσα 'wooded combe, glen', βαθύς 'deep, high', and βένθος 'depth', if from *$g^weh_2d^h$- and *g^wemd^h- respectively, mirroring the suppletive roots *g^weh_2- and *g^wem- 'to go'.

32 Cf. Gr. νήω 'to swim' with the variants νήχω, νάχω.

3.3.16 *g$^{(wh)}$eld^{h}- *'to be greedy, desire'*

Indo-Slavic exclusivity	Etymology	Shared innovation	Typology
Yes	Compelling	Possible	Root

Indo-Aryan: Skt. *gardh-* 'to be greedy, long for something', *gárdha-* m. 'desire' (Pāṇ.)
Iranian: YAv. *gərəδa-* 'greedy'; Sogd. B *γyšc'n'k* 'mean, stingy'
Baltic: –
Slavic: OCS *gladъ* m. 'hunger', RuCS *žlъděti* 'to desire'; Ru. *gólod* m. 'hunger'; Pol. *głód* m. 'hunger'; SCr. *glâd* f. 'hunger, craving', *žúdjeti* 'to desire'

Arntz (1933: 35) lists the root as an Indo-Slavic isogloss. Skt. *gárdha-* 'desire' would provide a formal correspondence to OCS *gladъ* etc., but in view of its relatively late attestation, it may be secondary. No other cognate derivatives seem to be attested (EWAia I: 474; Derksen 2008: 173, 565). Lith. *gardùs* 'tasty' has alternatively been connected to the Indo-Iranian root (LEW: 136), but remains semantically remote. Goth. *gredus* m., ON *gráðr* m. 'hunger' have also been connected, but are rather from *$ǵ^{h}reh_{1}$- (cf. Kroonen 2013: 187).

The initial velar is either plain or labiovelar. As for the aspiration, the only indication comes from Skt. *gṛ́tsa-* 'clever, dexterous, wise', which would unambiguously point to *$g^{(w)}$- (PIIr. *$gr̥d^{h}$-sa-*). However, semantically, *gṛ́tsa-* is not very close to *gardh-* 'to be greedy' and may be from a different root. Even if it is related, it is possible that *gṛ́tsa-* was derived after Grassmann's Law had stopped operating, in which case *gardh-* might still reflect PIIr. *$g^{h}ard^{h}$-.

Szemerényi (1967: 8) proposed that *g$^{(wh)}$eld^{h}- 'to be greedy, desire' derives from *$g^{w}el(h_{3})$-[33] 'to wish, want' (Gr. βούλομαι, OCS *želěti*, both 'to wish, want') with an extension *-d^{h}-. The Slavic verb may alternatively be connected to Gr. ἐθέλω 'to wish, want' < *$h_{1}g^{wh}el$- (Beekes 2010: 377). Both alternatives would be semantically plausible as sources for *g$^{(wh)}$eld^{h}-, even though the existence of a root extension is difficult to prove. If Szemerényi is right, *g$^{(wh)}$eld^{h}- is a potential shared innovation of Indo-Iranian and Balto-Slavic. In any case, the root is an Indo-Slavic isogloss.

33 The reconstruction of a final laryngeal in *$g^{w}el(h_{3})$- 'to wish, want' is uncertain (cf. Beekes 2010: 377; LIV: 208). Perhaps Gr. βούλομαι is ultimately derived from *$g^{w}elh_{1}$- 'to throw'. Obviously, *$g^{w}elh_{1/3}$- (with a final laryngeal) could not have been the base of *g$^{(wh)}$eld^{h}-.

3.3.17 *HoustHo- *'lip'*

Indo-Slavic exclusivity	Etymology	Shared innovation	Typology
Yes	Compelling	Possible	[N]Derivation Root

Indo-Aryan: Skt. *óṣṭha-* m. '(upper) lip'
Iranian: YAv. *aošta-* m. 'upper lip', du. 'both lips'; Khot. *auṣṭä* 'lip'
Baltic: Lith. *úostas* m. 'port, harbour, (dial., arch.) mouth of a river'; Latv. *uõsta* f. 'port, harbour, mouth of a river'; OPr. *austo* 'mouth'
Slavic: OCS *usta* n.pl. 'mouth'; SCr. *ústa* n.pl. 'mouth'; Bulg. *ustá* n.pl., *ustá* f. 'mouth, opening'

Meillet (1926: 173) lists the Indo-Iranian, Slavic, and Prussian words as an isogloss. Since OCS *usta* 'mouth' and OPr. *austo* 'mouth' are morphologically plurals, it can be surmised that **HoustHo-* likely meant 'lip'.

The East Baltic forms (LEW: 1167) were not included by Meillet, probably due to the irregular vocalism. However, Derksen (2001; 2015: 482) explains Lith. *-úo-*, Latv. *-uõ-* as analogical from *h_1eh_3-s-* 'mouth', cf. Lith. *úoksas* m. 'opening, cavity, hollow'. The regular vocalism is argued to be preserved in the denominal verb Lith. *áusčioti* 'to gossip, talk nonsense', but this is convincingly rejected by Smoczyński (2018: 73–74).

Mallory & Adams (1997: 387) assume a similar development for Lat. *ōstium* n. 'door, entrance; aperture, mouth' (i.e., as replacing regular **ūstium* by analogy to *ōs* 'mouth'), which, if correct, implies that the isogloss is non-exclusive. It may be argued that Romance evidence supports this scenario, since Spanish *uzo* 'door', French *huis* 'door (to a house)' etc. presuppose **ūstium*.[34] However, this form probably reflects a regular raising of *$*\bar{o} > *\bar{u}$ before *-stį-*, cf. Romance **bīstius* ~ Lat. *bēstia* f. 'beast' (Rohlfs 1921). Since *ōstium* has a plausible inner-Italic etymology, by assuming an adjective **ōs-to-* 'having a mouth' (de Vaan 2008: 436), it may be concluded that there is no reflex of **HoustHo-* in Italic, which remains exclusively Indo-Slavic.

34 See FEW 7: 439, DCECH, RI–X: 726. A spelling *ustium* is attested from Hieronymus' Epist. 16 onwards (late 4th century CE). An earlier variant *austium* (attested already in Plautus) is best explained as a "hyper-urban" variant of *ōstium*.

Traditionally, all the above material has been derived from *$\bar{o}us$- (IEW: 784–785). While a connection between PIE *h_1eh_3-*s*- 'mouth' and **HoustHo*- 'lip' is semantically attractive, it is formally impossible (see futher Wodtko, Irslinger & Schneider 2008: 390). Alternatively, deriving the latter from *h_2eus-, the root of YAv. *uši* n.du. 'ear (ahuric), intelligence', Gr. οὖς n. 'ear', Lat. *auris* f. 'ear', Goth. *auso* n. 'ear', Lith. *ausìs* f. 'ear' etc., is semantically uncompelling. Since *h_2eus- may ultimately derive from *h_2eu- 'to perceive', the meaning 'ear' seems to derive from the notion of a perceiving organ, which could hardly develop into 'lip'. Thus, there is at present no compelling root etymology for **HoustHo*- 'lip'. If the aspirated Skt. *-th*- reflects a laryngeal,[35] the word is morphologically obscure, and it seems possible that it derives from a compound.

3.3.18 *$h_1ong^{(w)}$-l- *'coal'*

Indo-Slavic exclusivity	Etymology	Shared innovation	Typology
Yes	Compelling	Possible	NDerivation

Indo-Aryan: Skt. *áṅgāra*- m. 'coal'
Iranian: Sogd. B *'nk'yr* 'hearth'
Baltic: Lith. *anglìs* f. 'coal'; Latv. *ùogle* f. 'coal'
Slavic: OCS *ǫglь* m. 'coal'; Ru. *úgol'* m. 'coal'; Cz. *uhel* m. 'coal'; SCr. *ȕgalj* m. 'coal'

Schmidt (1872: 45) and Arntz (1933: 35) list the word for 'coal' as an Indo-Slavic isogloss, including MoP *angišt* 'coal', in which the suffix is unexplained, however (see EWAia I: 48). Gharib (1995: 41) tentatively reconstructs Sogd. B *'nk'yr* 'hearth' as PIr. **ham-garia*-, but the connection to Skt. *áṅgāra*- is attractive.

Arm. *acuł* 'coal' has been connected to the above (cf. Martirosyan 2010: 18–21, with lit.), through the reconstruction *acuł* < **awcúł-o*- < **an$^{w}k^{w}$-ul*- < **h_1ng^{w}-ōl*-. However, this is formally problematic, since the loss of **w* before **c* does not seem to be regular, cf. Arm. *awj* 'snake' < **h_2ng^{wh}-i*- and *awcanem* 'to anoint' < **h_3ng^{w}-nH*-.[36] Moreover, Arm. *acuł* may alternatively be connected to ON *kol* n. 'coal', OIr. *gúal* m./f. 'charcoal', if derived from **Hǵoul*- (Witczak 2003).

35 From the dual ending *-h_1?

36 Martirosyan's (2010: 20) explanation, that Arm. *acuł* 'coal' lost its **w* because it was pre-

In Balto-Slavic the word is inflected as an *i*- or *io*-stem (LEW: 10; Derksen 2008: 385; 2015: 55). Together with the long vowel in the *l*-suffix of Indo-Iranian, we may reconstruct a hysterodynamic stem *$*h_1ong^{(w)}$-l-*, which is a possible Indo-Slavic innovation. The root *$*h_1eng^w$-* is likely the same as in Skt. *agní-* m. 'fire, god Agni', Lat. *ignis* m. 'fire' etc. (cf. de Vaan 2008: 297). The fact that there are no attested verbal stems connected to this root may indicate an archaism, but an innovation remains possible.

3.3.19 *$h_1$su-dru- *'made of good wood'*

Indo-Slavic exclusivity	Etymology	Shared innovation	Typology
Yes	Compelling	Possible	NDerivation

Indo-Aryan: Skt. *sudrú-* adj. 'made of good wood'
Iranian: –
Baltic: Lith. *sū́drus* adj. 'thick, dense, solid, tight, (dial.) lush, fertile'
Slavic: –

Arntz (1933: 47) listed this compound as an Indo-Slavic isogloss. For the Lithuanian word and its etymology, see LEW: 937 and Derksen (2015: 434). Lith. *sū́drus* is isolated and has undergone Winter's Law, which implies an archaism within Balto-Slavic (Petit 2004). It is clearly a lexicalized compound, whose meaning has drifted considerably, assuming that the original meaning was 'made of strong wood'. Traditionally, OCS *sъdravъ* 'healthy' has been connected, but it is better kept apart (see p. 117).

Skt. *sudrú-* (cf. EWAia I: 721) is attested twice in the Rigveda.[37] In RV VII.32, it is used as an adjective (acc.sg.f. *sudrvàm*):

RV VII.32.20cd
á́ va índram puruhūtáṃ name girá́ nemíṃ tā́ṣṭeva sudrvàm

tonic, is unconvincing, since the same should have applied to *awcanem* 'to anoint' < *$*h_3ng^w$-nH-* (cf. Klingenschmitt 1982: 181).

37 There only other Rigvedic compound with *drú-* as the second member is *harídravaḥ* 'golden trees' (RV IV.43.1). This scarcity is consistent with taking *sudrú-* as an inherited compound.

> I bend Indra, invoked by many, here to you with a song, as a carpenter bends a felly made of good wood (Jamison & Brereton 2014: 922).

In my opinion, the metaphor is best understood if *sudrú-* is translated to 'solid', i.e., a solid felly made from a single piece of wood, rather than made of 'good wood'. In RV x.28.8, it is used as a noun (acc.sg. *sudrvàm*):

> RV x.28.8
> *devā́sa āyan paraśū́ṁr abibhran vánā vr̥ścánto abhí viḍbhír āyan*
> *ní sudrvàṃ dádhato vakṣáṇāsu yátrā kŕ̥pīṭam ánu tád dahanti*
>
> The gods came; they carried axes; hewing the trees, they advanced with their clans toward (the ritual ground), depositing the good wood in the belly [=the hearth(s) of the ritual fires]. Where there is brushwood [?], they [flames?] burn it up (Jamison & Brereton 2014: 1420).

Here, there seems to be an opposition between *sudrú-* 'good wood' and *kŕ̥pīṭa-* 'brushwood', in which case *sudrú-* could also be translated as 'solid wood'. While the word clearly refers to wooden objects and is analysable as a compound within Vedic, both attestations may reflect the initial stages of the same type of lexicalization and semantic shift that evidently affected Lith. *sū́drus*. Although a shared archaism is difficult to reject, a shared innovation does not seem implausible, especially given the semantic similarity.

3.3.20 ***h$_1$uk-ie/o-** ***'to be(come) accustomed to'***

Indo-Slavic exclusivity	**Etymology**	**Shared innovation**	**Typology**
Yes	Compelling	Possible	^{V}Derivation

Indo-Aryan: Skt. *ucyasi* 2sg.pres. 'you are accustomed to'
Iranian: –
Baltic: –
Slavic: ORu. *vyče-* 'to learn'

Sanskrit and Russian seem to share a *ie*/*o*-present from **h$_1$euk-* 'to be(come) accustomed to'. The root form is attested in various stem formations in other branches, cf. Arm. *owsanim* 'to learn', OIr. *to-ucci* 'to understand', Lith. *jùnkti*,

-sta 'to become accustomed', also Goth. *biuhts* 'accustomed'. Elsewhere in Slavic, the *ie*/*o*-stem has been replaced by a nasal stem, e.g., OCS *vyknǫti* 'to get used to, accustom oneself'. Due to the long **ū*- of ORu. *vyče*- 'to learn', the form has been taken as secondary (LIV: 244), but this may rather be explained as regular laryngeal metathesis **$h_1$uk*- > **uh_1k*- (cf. Pronk 2011).

It has been argued that *ucya*- is secondary in Sanskrit, as it replaces the perfect in post-Rigvedic texts (Kümmel 2000: 129; LIV: 244). However, given the Slavic parallel, it is difficult to exclude that the formation is old and simply adopted the function of the perfect in later Vedic. Still, an archaism cannot be excluded.

3.3.21 *$h_2$eu-r-eh_1 *Adv. '(over) there, downwards'*

Indo-Slavic exclusivity	Etymology	Shared innovation	Typology
Yes	Compelling	Possible	NDerivation

Indo-Aryan: Skt. *arvā́ñc*- adj. 'turned towards' (RV+), *arvāvát*- f. 'proximity'
Iranian: OAv. *aorā-cā* adv. 'downwards'; YAv. *aora* adv. 'downwards'; OP *aurā* adv. 'downwards'
Baltic: Lith. *aurè* 'there, over there', *aure* adv. 'there, then, approximately'
Slavic: –

Fraenkel (LEW: 26) mentions that Lith. *aurè* 'there, over there' may be remotely related to Skt. *avár* 'below' and YAv. *auuarə* 'downwards', but this does not explain the final *-è* of Lithuanian. Derksen (2015: 71) does not compare Lith. *aurè* to any Indo-Iranian forms, but mentions Gr. δεῦρο '(to) here', which seems to reflect the adverb **δε* + an unknown element **-uro*.

We may rather compare Lith. *aurè* to PIIr. **HauraH*, reconstructable based on secondary derivatives in Sanskrit and the Iranian adverbs YAv. *aora* and OP *aurā*.[38] In Sanskrit, **aurá́* underwent metathesis to **aruá́*, cf. Hoffmann (1956: 9). The adverb **HauraH* must be Proto-Indo-Iranian, since final **-r̥* gave *-ar* in both Indo-Aryan and Iranian, implying that a younger derivative would have given ***Hauarā*. Adverbial **-aH* likely reflects **-eh_1* as evidenced by the palat-

38 Dunkel (2009) also connected Umbr. gen.sg. *orer* 'of this one', but can reflect either **oso*-, **ouso*-, **oiso*-, or **oro*- and is unlikely to be related (Untermann 2000: 804).

alization in Skt. *áchā* 'to towards', *uccā́* 'high, up', *paścā́* 'after, later' (cf. Lubotsky 2001a: 41). This makes a comparison to Lith. *aurè* even more likely, as it would regularly develop from **aurḗ* with shortening of the acute final vowel due to Leskien's Law.[39]

PIIr. **HauraH* and its Baltic correspondent may ultimately derive from an *r*-locative[40] **h*$_2$*eu-*(*e*)*r* of the deictic particle **h*$_2$*eu-*, which formed the basis of several pronominal forms in various Indo-European languages (see p. 180). This **h*$_2$*eu-*(*e*)*r*, in turn, is directly attested in Skt. *avár* 'below' and YAv. *auuarə* 'downwards'. It should be noted that Gr. δεῦρο '(to) here' can hardly be connected to Lith. *aurè* and YAv. *auuarə* (*pace* Beekes 2010: 319), since **de-h*$_2$*ur-o* would give Gr. **δαῦρο.[41] On the other hand, Arm. *ur* 'where, where to' may continue **h*$_2$*u-r*, which could be seen as a variant of **h*$_2$*eu-r* (see Martirosyan 2010: 644–645 for alternative etymologies). In any case, we may reconstruct an adverbial **h*$_2$*eu-r-eh*$_1$ uniquely attested in Indo-Iranian and Baltic, which constitutes an Indo-Slavic isogloss and a possible shared innovation.

3.3.22 *h$_3$ieb^h-e/o- *'to copulate'*

Indo-Slavic exclusivity	Etymology	Shared innovation	Typology
Yes	Compelling	Possible	^{V}Derivation

Indo-Aryan: Skt. *yábhati* 'to copulate'
Iranian: Bal. *šāf-* 'to cover (a ewe), mate' (+ **fra-*); Khwar. *by'βy-* 'to make pregnant' (+ **upa-*)
Baltic: –
Slavic: Ru. *etí*, *ebát'*, *ebú* 'to copulate'; Pol. *jebać*, *jebię* 'to copulate, scold, beat'; SCr. *jèbati* 'to copulate'

39 A somewhat similar form is Lith. *rè* 'ecce', Latv. *re* 'id.' which is analysed as a shortened imperative from *regéti* 'to see'. In principle, *aurè* could then be seen as *au-rè*, but the chronology is problematic since it would have to be a very early derivative for *au-* to retain the meaning 'there' (the preverb *au-* means 'away' in Balto-Slavic), whereas *regéti* looks more recent (cf. LIV: 498).

40 For a discussion of *r*-locatives, see Bauhaus (2019).

41 One could argue that Gr. δεῦρο was formed after laryngeal colouring was no longer productive, but this is merely a possibility.

Indo-Iranian and Slavic share a thematic present from *h_3ieb^h- 'to copulate; to enter' (Derksen 2008: 147; Vasmer I: 388; Vaillant III: 158). The original meaning of *h_3ieb^h- seems to have been 'to enter', which is preserved in ToB *yäp-* 'to enter', pres. *yänmä́*$^{ske}/_{ṣṣä}$- (Malzahn 2010: 796; Peyrot 2013: 797). In Indo-Iranian, Slavic, and Greek (cf. οἴφω 'to copulate'), this has developed into 'to copulate'.[42] Gr. οἴφω most likely reflects a reduplicated stem *h_3e-h_3ib^h-e/o- (Cheung 2007: 175). Based on this, it is possible to regard the stem *h_3ieb^h-e/o- as an Indo-Slavic isogloss, but it cannot be excluded that this is either an archaism from Core Proto-Indo-European or a result of independent innovations.

3.3.23 *ḱeuH- *'to throw, shove, shoot'*

Indo-Slavic exclusivity	Etymology	Shared innovation	Typology
Yes	Compelling	Possible	Root

Indo-Aryan: –

Iranian: YAv. *spaiieiti* 'throws', *spāta-* 'thrown', *spåŋhaiti* 'will throw away'; OP *niy-asaya* 'threw down'; Parth. *nyspy-* 'to bend, bow'; MoP *bisūdan* 'to handle, feel, touch, rub'; Sogd. S *spy-* 'to throw away, reject'; OKhot. *paśś-* 'to let go, release', *niśś-* 'to throw away'; Psht. *āsp-* 'to collect, amass'

Baltic: Lith. *šáuti, -na* 'to shoot, (dial.) strike, hurl, push, shove'; Latv. *šaũt, -ju, -nu, saũt, -nu* 'to shove, strike, shoot'

Slavic: OCS *sunǫti* 'to pour out', *sovaatъ* (3sg.) 'overflows'; Ru. *súnut', súnu* 'to shove, thrust', *sovát', sujú* 'to shove, thrust'; Pol. *sunąć, sunę* 'to shove, slide', *suwać, suwam* 'to shove, slide'; SCr. *súnuti, sûnēm* 'pour, strew'

In Balto-Slavic, various verbal stems reflect a root **ḱeuH-*, which in LIV: 330 is assigned the meaning 'to throw, shove'. The vacillating anlaut of Latv. *šaũt, saũt* and the consistent absence of palatalization of initial *s-* in Slavic likely reflect analogical levelling of PBSl. **śjou-* < **ḱeuH-* from *o*-grade or zero-grade forms (cf. Derksen 2015: 441).[43] The Balto-Slavic forms have been compared with ON

42 Iranian may preserve a separate reflex of the original root, e.g., Sogd. BM *y'β*, C *y'b*, 'to wander, travel, rove', often with a nasal infix (see further Cheung 2007: 212–213) reminiscent of the Tocharian present stem.

43 The Slavic verb may alternatively be connected to Hitt. *šuue/a-zi* 'to fill' < **suH-*, which is closer semantically. Interestingly, Hittite has a homonymous *šuue/a-zi* 'to push (away),

skjóta 'to shoot' < PGm. **skeutan-*, with *s*-mobile in Germanic. However, as shown by Kroonen (2013: 445), the Germanic verb rather derives from PGm. **sket-*.

I would like to propose an Iranian cognate of the Balto-Slavic root. Among forms in several other Iranian languages, YAv. *spaiieiti* 'throws' has been argued to reflect PIIr. **ćuaH-* 'to throw', without further Indo-European cognates (Cheung 2007: 369; LIV: 339). This is problematic, as it requires the *ad hoc* assumption of shortening of **ā* before **i̯* in Avestan, Khotanese, and Old Persian (thus Emmerick 1968: 56). Rather, YAv. *spaiieiti* 'throws' reflects PIIr. **ćuH-áia-*, comparable to, e.g., Skt. *hváya-*, Av. *zbaiia-* < **ǰʰuH-áia-* < **ǵʰeuH-* 'to call'. The only attested full grade forms of the supposed PIIr. **ćuaH-* 'to throw' are YAv. verbal adjective *spāta-* 'thrown' and aor.subj. *spåŋhaiti* 'will throw away'. The former is clearly secondary, as a zero-grade is expected. The *s*-aorist may also be secondary according to LIV: 399, since, in view of its semantics, a root aorist would be expected. The attested *sa*-subjunctive may thus be an Iranian innovation. It follows that the root structure of PIIr. **ćuaH-* 'to throw' as such may be secondary, based on the present **ćuH-áia-*. This is paralleled by Skt. *hváya-*, Av. *zbaiia-*, which yielded a secondary full grade attested in Skt. *hvātar-*, YAv. *zbātar-* 'caller, invoker'. Thus, PIIr. **ćuaH-* 'to throw' likely derives from **ḱeuH-*, and may be directly compared with the Balto-Slavic root discussed above. This constitutes an Indo-Slavic root isogloss.

3.3.24 ***ḱieh$_1$-mo-** *'black, dark, grey'*

Indo-Slavic exclusivity	Etymology	Shared innovation	Typology
Yes	Compelling	Possible	^{N}Derivation

Indo-Aryan: Skt. *śyāmá-* adj. 'black, dark-coloured'
Iranian: YAv. *sāma-* adj. 'black', *siiāmaka-* m. 'name of a mountain'
Baltic: Lith. *šė́mas* adj. 'light grey, dark grey, bluish grey'; Latv. *sẽms*[2] adj. 'variegated'
Slavic: –

shove, cast off', which could be taken as a semantic parallel to the comparison of Lith. *šáuti* 'to shoot, (dial.) strike, hurl, push, shove' and OCS *sunǫti* 'to pour out'.

An adjective **ḱieh₁-mo-* may be reconstructed based on Indo-Iranian (EWAia II: 661; AirWb.: 1571, 1631) and Baltic (LEW: 972; Derksen 2015: 443), which Arntz (1933: 43) listed as an isogloss.

Possibly, the root of **ḱieh₁-mo-* is ultimately an *i*-extended variant of **ḱeh₁-*, reflected in Skt. *śaśá-* m. 'hare', OHG *haso* m. 'hare' < **ḱh₁-es-*, traditionally reconstructed as **ḱas-*. A similar scenario would explain ON *hárr* 'hoary, grey-haired', RuCS *sěrъ* 'grey', OIr. *cíar* 'dark-brown' < **ḱh₁e/oi-ro-*. This would imply that **ḱieh₁-* was originally a verbal root, although no verbal forms are attested. Technically, it cannot be excluded that Lith. *šémas* and Latv. *sẽ̀ms*[2] reflect an independent derivation from **ḱeh₁-*, without the *i*-extension, since **i* is lost before **e* in Baltic, but this is rather uneconomical as it leaves the Baltic forms isolated *vis-à-vis* related forms in Balto-Slavic (e.g., Lith. *šývas* 'light grey') and Indo-European.

LEW: 972 further connects Lat. *cīmex* m. 'bed-bug' (< **ḱih₁-m-ek-*?) but this etymology is semantically uncompelling (de Vaan 2008: 114).

The Armenian toponym *Sim* 'name of a mountain' is connected to **ḱieh₁-mo-* by Martirosyan (2010: 683), who compares it to YAv. *siiāmaka-* 'name of a mountain' and Skt. *śyāmā-* 'name of a river'. Although it is methodologically perilous to rely on onomastic evidence, the etymology finds some additional support by an alternative name of mount *Sim*: *Sewsar*, literally 'black-mountain'. However, **ḱi̯-* does not seem to yield Armenian *s-*, cf. *lowcᶜanem* 'to lighten' < **louḱ-i̯e-* (**ḱ* < **k* / *u_*, *loys* < **leuk-o-*). A solution would be to reconstruct **ḱih₁-mo-*, which would be close but not identical to the Indo-Iranian and Baltic forms, given the zero-grade in the root.

Additional evidence for a zero-grade variant **ḱih₁-mo-* is Alb. *thimë* 'grey', which also has the advantage of being an impeccable semantic match of the Indo-Iranian and Baltic words. Besides Alb. *thimë*, the closest root cognate of **ḱieh₁-mo-* is **ḱi(e)h₁-uo-* (see p. 186), which is reflected in Indo-Iranian, Baltic and Germanic. Since the latter stem preserves traces of root ablaut, it was likely athematic originally. An original athematic *m*-stem could be assumed for **ḱieh₁-mo-* and **ḱih₁-mo-* too,[44] based on Alb. *thimë* (and the Armenian and Latin forms, if included). Baltic and Indo-Iranian would then have thematicized the full grade form **ḱieh₁-m-*. It is also possible that **ḱieh₁-mo-* and **ḱih₁-mo-* are independent derivatives. Crucially, both scenarios constitute a possible shared innovation of Balto-Slavic and Indo-Iranian.

44 However, an athematic *m*-stem adjective may be unparalleled and therefore not a very plausible reconstruction.

3.3.25 *ḱleu-os- *'word'*

Indo-Slavic exclusivity	Etymology	Shared innovation	Typology
Yes	Compelling	Possible	Semantics

Indo-Aryan: –
Iranian: OAv., YAv. *srauuah-* n. 'word, saying, teaching; reputation'; MiP Pahl. *sraw* 'word, spell'
Baltic: –
Slavic: OCS *slovo* n. 'word'; Ru. *slóvo* n. 'word'; Pol. *słowo* n. 'word'; SCr. *slȍvo* n. 'letter (of the alphabet)'

Meillet (1926: 168) and Arntz (1933: 57) noted that only in Iranian and Slavic does **ḱleu-os-* mean 'word' (cf. AirWb.: 1643–1644; Derksen 2008: 454) beside 'fame', cf. Skt. *śrávas-* n. 'fame, praise, honour, reputation', Gr. κλέος n. 'rumour, fame, renown, reputation', OIr. *clú* n. 'fame, rumour'. Given the root meaning of **ḱleu-* 'to hear', **ḱleu-os-* likely originally meant 'what is heard', which became 'fame' already in (Core) Proto-Indo-European.

It seems possible that the meaning 'word' either developed from 'fame',[45] or that it represents a parallel development from an original **ḱleu-os-* 'what is heard'. Both scenarios imply a possible shared Indo-Slavic innovation, although an archaism cannot be excluded. Since the semantic correspondence is quite specific, independent innovations seem unlikely. Alternatively, it has been argued that the semantics of Slavic **slȍvo* were influenced by Iranian (Benveniste 1967), which is impossible to verify but difficult to entirely rule out. In Balto-Slavic, **ḱleu-os-* 'fame' was replaced by OCS *slava* 'glory, fame, magnificence', Lith. *šlãvė* f. 'honour, respect, fame',[46] whereas in Indo-Aryan, **ḱleu-os-* 'word' is unattested.

45 Cf. Italian *parola*, Spanish *palabra* 'word' < Lat. *parabola* 'speech' << Gr. παραβολή 'comparison'.

46 The variant Lith. *šlovẽ* 'glory, fame' has been regarded as a Slavic borrowing (Smoczyński 2018: 1409).

3.3.26 *Ḱop-o- *'straw (carried by water)'*

Indo-Slavic exclusivity	Etymology	Shared innovation	Typology
Yes	Compelling	Possible	NDerivation Root

Indo-Aryan: Skt. *śā́pa-* m. 'drift-wood, flotsam'
Iranian: MiP Pahl. *sabz* adj. 'green, fresh'; MoP *sabz* adj. 'green, fresh'; Bactr. σαβαγο 'crop'; Psht. *sābə́* m.pl. 'greens, vegetables; a fodder grass'; Shu. *sēpc* 'cultivated field'
Baltic: Lith. *šãpas* m. 'straw, blade of grass, dry twig, chip, speck', pl. *šãpai* 'branches and grass that floodwater has carried onto a field; litter for animals in a barn; fish bones'
Slavic: –

Arntz (1933: 36) listed Skt. *śā́pa-* and Lith. *šãpas* as an Indo-Slavic isogloss. The etymology is accepted by Mayrhofer (EWAia II: 629) but doubted by Derksen (2015: 440). Būga (1922: 289) takes Lith. *šãpas* as a derivative of *šèpti* 'to grow unevenly (of hair, beard)', without cognates outside Lithuanian (cf. Smoczyński 2018: 1352). The connection is not entirely obvious, but could perhaps be understood if we assume that the original meaning of *šèpti* was 'to strew' vel sim. Thus, it cannot be excluded that *šãpas* is an inner-Lithuanian derivative, but, on the other hand, there is nothing against comparing it to Skt. *śā́pa-* directly, reconstructing Indo-Slavic **ḱop-o-* 'straw (carried by water)'.

Skt. *śā́pa-* 'drift-wood, flotsam' refers to small pieces of wood that a river carries downstream.[47] The meaning is remarkably close to Lith. *šãpai* 'branches and grass that floodwater has carried onto a field', the only difference being that the latter only has this meaning in the plural. Further potential cognates are Psht. *sābə́* m.pl. 'greens, vegetables; a fodder grass' and Bactr. σαβαγο 'crop', which presuppose PIr. **ćāpa(ka)-* (Morgenstierne et al. 2003: s.v. *sāb'ə*). The

47 Cf. RV VII.18.5cd *śárdhantaṃ śimyúm ucáthasya návyaḥ śā́paṃ síndhūnām akṛnod áśastīḥ* 'Śimyu, who was vaunting himself above our newer speech—he [=Indra] made him into the flotsam of the rivers and his taunts (too)' (Jamison & Brereton 2014: 904) and RV X.28.4ab *idáṃ sú me jaritar ā́ cikiddhi pratīpáṃ śā́paṃ nadyò vahanti* 'Mark well this (speech) of mine, singer: The rivers carry the flotsam against their current' (Jamison & Brereton 2014: 1419).

comparison is somewhat lacking, however, since the Iranian words refer to some type of edible plant, whereas the Sanskrit and Lithuanian words rather denote the opposite.

As for the etymology of **ḱop-o-* 'straw (carried by water)', it is possible that it was derived from the root continued in *šèpti* 'to grow unevenly (of hair, beard)'. Alternatively, it could be connected to **(s)kep-* 'to chop, cut' (cf. LIV: 555), if the *s*-less form was **ḱep-*, in which case Lith. *kàpti* 'to cut, chop' etc. must be secondary (**(s)ḱep-* > **(s)kep-* > **kep-*).

3.3.27 *ḱuen-to- *'holy, sacred'*

Indo-Slavic exclusivity	Etymology	Shared innovation	Typology
Yes	Compelling	Possible	NDerivation

Indo-Aryan: –

Iranian: OAv., YAv. *spəṇta-* adj. 'holy'; MiP Pahl. *spandān* 'mustard seed', *spandarmad* 'Holy Thought; the 12th month of the calendar'; MoP *isfand* 'wild rue, *Peganum harmala*'

Baltic: Lith. *šveñtas* adj. 'holy, sacred'; Latv. *svẽts* adj. 'holy, sacred'; OPr. *swints*[48] adj. 'holy, sacred'

Slavic: OCS *svętъ* adj. 'holy, sacred'; Ru. *svjatój* adj. 'holy, sacred'; Pol. *święty* adj. 'holy, sacred'; SCr. *svêt* adj. 'holy, sacred'

Iranian (AirWb.: 1619–1621) and Balto-Slavic (LEW: 1041–1042; Vasmer II: 597–598) share an adjective **ḱuen-to-*, with practically identical semantics in the branches, noted as an isogloss by Schmidt (1872: 49), Meillet (1926: 169), Arntz (1933: 44), and Porzig (1954: 167). In Indo-Aryan, the root is probably found in Skt. *śuná-* n. 'prosperity, luck, welfare' < **ḱun-o-* (EWAia II: 646), which together with YAv. *spanah-* n. 'holiness' shows that **t* is not part of the root. The fact that the corresponding verbal stems in Lithuanian, e.g., *švę̃sti* (*švenčiù*) 'to sanctify', are denominal indicates that Lith. *šveñtas* is not a productive deverbal adjective but an archaic formation. Although Latv. *svẽts* is borrowed from Slavic (Derksen 2015: 456), Latvian preserves the root in the verbal stem *svinêt* 'to celebrate'.

48 The vocalism of OPr. *swints* has traditionally been seen as evidence that the word was borrowed from Polish (Trautmann 1910: 444), but according to Smoczyński (1989) it may reflect a regular change *e* > *i* / *_NC*.

PGm. **hunsla-* 'sacrifice' is probably from the same root with the deverbal instrumental suffix **-sla-* (cf. Kroonen 2013: 256–257). Hitt. *kunna-* 'right, favourable, successful' < **ḱun-no-* (Kloekhorst 2008: 493) is potentially also connected. According to Adams (2013: 252), ToB *kwants** 'firm, steadfast, solid, constant' may also be related, reflecting **ḱun-s-o-* 'having swollenness', although he acknowledges that the semantics are far from compelling. Mallory & Adams' (1997: 493) reconstruction **ḱuntio-* must be rejected, since **ti* would yield Tocharian *c*.

The evidence suggests that **ḱuen-to-* is an exclusively Indo-Slavic derivative from an Indo-European root. If the Hittite root cognate is correct, the meaning 'holy, sacred' may be a post-Anatolian innovation shared with Germanic.

3.3.28 *ḱuoit-ó- *'white, bright'*

Indo-Slavic exclusivity	Etymology	Shared innovation	Typology
Yes	Compelling	Possible	NDerivation

Indo-Aryan: Skt. *śvetá-* adj. 'white, bright'
Iranian: YAv. *spaēta-* adj. 'white'; MiP Pahl. *spēd*, Man. *'spyd* adj. 'white'; Bal. *spēt* adj. 'white'; Sogd. C *spty* adj. 'white'; Khot. *śśīta-* / *śśīya-* adj. 'white'; Shu. *sipēd* adj. 'white' (<< MoP?)
Baltic: (Lith. *šviẽsti*, *šviẽčia* 'to shine'; Latv. *kvitêt*, *kvitu* 'to shimmer, glimmer')
Slavic: OCS *světъ* m. 'light, world', *cvětъ* m. 'flower'; Ru. *svet* m. 'light, world', *cvet* m. 'flower'; Pol. *świat* m. 'world', *kwiat* m. 'flower'; SCr. *svȉjet* m. 'world, people', *cvȉjet* m. 'flower, bloom'

Arntz (1933: 44) listed **ḱuoit-ó-* as an Indo-Slavic isogloss. PGm. **ƕīta-* / **ƕitta-* 'white' has sometimes been adduced as a further cognate, despite its **t* instead of expected **þ*/*ð* (EWAia II: 679), but the voiceless dental stop in the Germanic forms is rather a consequence of Kluge's Law in a stem **ḱuit-nó-*, cf. Skt. *śvítna-* 'white, light' (Kroonen 2013: 267).

Slavic **svě̊tъ* 'light, world' does not show the regular Balto-Slavic depalatalization of palatovelars before **u* + $V_{[+back]}$ (Kortlandt 1978b, although the theory is not universally accepted; cf. Collins 2018: 1430). In all likelihood, the anlaut was taken over from the verb, e.g., OCS *svьtěti sę* 'to shine' (cf. Derksen 2008: 476). The regular depalatalized outcome is reflected in OCS *cvětъ* 'flower' < PSl. **kvě̊tъ*. The anlaut **kv-* is also found in OCS *cvisti* 'to bloom, blossom'

< PSl. **kvisti*. Since **kv-* is not regular here, the verb is probably denominal from **kvə̂tъ*, which is further indicated by the semantics. In Baltic, no cognate of Slavic **svə̂tъ* / **kvə̂tъ* is attested, but Latv. *kvitêt* 'to shimmer, glimmer' (vs. Lith. *šviẽsti* 'to shine', cf. Derksen 2015: 456, 541) suggests that a similar analogical interaction of noun and verb may have taken place here. The meaning of **kvə̂tъ* 'flower' likely goes back to 'bright, light one' and was lexicalized after the analogical form **svə̂tъ* 'light, world' took over the general meaning.[49]

The Indo-Iranian forms, reconstructable as PIIr. **ćuaitá-* 'bright, white', are adjectives. However, given the oxytone accentuation, PIIr. **ćuaitá-* was probably originally a nomen agentis, i.e., 'one who is bright, white'. Slavic **svə̂tъ* / **kvə̂tъ*, whose accent paradigm (c) reflects an original oxytone, could similarly be derived from 'that which is bright, white'. Therefore, the fact that **ḱuoit-ó-* yields an adjective in Indo-Iranian, as opposed to a noun in Slavic, does not preclude a direct comparison of the attested stems.[50]

It is probably not a coincidence that **ḱuoit-ó-*, a verbal noun, is exclusively attested in Indo-Iranian and Balto-Slavic, since these are also the only branches that attest verbal stems to the root **ḱueit-* (cf. LIV: 340).[51] The root is otherwise only attested as an adjective in Germanic (Wodtko, Irslinger & Schneider 2008: 435).[52] Possibly, **-it-* is analysable as a suffix appearing in colour terms, cf. Skt. *hárita-* 'yellowish, green', *palitá-* 'grey', *róhita-* 'red'. This would allow **ḱueit-* to be analysed as deriving from a root **ḱeu-* 'to shine', comparable to Gr. κοέω 'to notice' and, with *s*-mobile, OHG *scouwōn* 'to look at'.[53]

In conclusion, the deverbal *o*-stem **ḱuoit-ó-* is a compelling Indo-Slavic isogloss. While it is difficult to exclude independent derivations, the fact that verbal stems from this root are exclusively attested in Indo-Iranian and Balto-Slavic, as well as the possibility that **ḱueit-* is a secondary root, suggest that the

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49 This process is understandable as an example of Kuryłowicz's fourth Law of Analogy (1945); the non-analogical form (**kvə̂tъ*) preserves a peripheral meaning ('flower') whereas the analogical form (**svə̂tъ*) takes the general meaning of the original lexeme ('light, bright'), in this case synchronically derivable from the verb.

50 A reconstruction **ḱueito-* cannot be entirely ruled out for Indo-Iranian, however.

51 However, there are no direct correspondences among the attested verbal stems. The closest correspondence is a nasal present Skt. *śvíndate* 'shines' (Dhātup.) ~ Lith. *švisti*, *švĩnta* 'to become bright', ORu. *svьnuti* 'to become bright, dawn', which Arntz (1933: 44) took as an additional isogloss. However, the Sanskrit form is poorly attested and with an unexplained *d* for **t*, whereas inchoative nasal presents are productive in Balto-Slavic.

52 ToB gen.sg. *kuśiṅ* 'of Kuča' etc. has been adduced, but such onomastic evidence is semantically uncompelling. Additionally, there are alternative etymologies for the Tocharian material (cf. Adams 2013: 198).

53 A semantic development 'to shine' >> 'to appear, be noticed' is common crosslinguistically, cf. Eng. *shine* ~ Ger. *scheinen* 'to appear'.

verbal usage of **ḱueit-* as well as **ḱuoit-ó-* are Indo-Slavic innovations. However, since a nominal stem formed from **ḱueit-* is found in Germanic, it is difficult to exclude that the verbal stem and deverbal noun were lost here, as well as in other branches.

3.3.29 *k(o)rt- *'(one) time(s)'*

Indo-Slavic exclusivity	Etymology	Shared innovation	Typology
Yes	Compelling	Possible	Semantics

Indo-Aryan: Skt. *sá-kr̥t* adv. 'once', *kr̥tvas* adv. '– time(s)'
Iranian: YAv. *ha-kərəṯ* adv. 'once'; MiP Pahl. *hagriz* 'ever'
Baltic: Lith. *kařtas* m. 'once'
Slavic: OCS *kratъ* m./adv. 'once, time'; Cz. *krát* m./adv. 'once, time'; SCr. *krât* m./adv. 'once, time'

Arntz (1933: 49) listed these formations as an Indo-Slavic isogloss. Indo-Aryan and Iranian share a compound form **-kr̥t* 'time' and Sanskrit also has an adverb *kr̥tvas* that seems to be a fossilized acc.pl. of a *u*-stem (EWAia I: 391–392; AirWb.: 1742–1743). Balto-Slavic reflects a noun **korto-*, which is used adverbially in Slavic (Derksen 2008: 236; Derksen 2015: 229). These derivatives have been connected to various roots, such as **(s)kert-* 'to cut' and **kʷer-* 'to cut; to make' (LEW: 258; Smoczyński 2018: 496; Vasmer I: 657). In the latter case, the postpositions Osc. *-pert*, Umbr. *-per* '– time(s)' have also been adduced, but they are more likely related to Lat. *-per* in, e.g., *semper* 'always' (de Vaan 2008: 459). Perhaps a more compelling etymology may be found in Skt. *kart-* 'to spin, pull a thread' < PIE **kert-* (LIV: 356),[54] with a semantic parallel in Lat. *duplex* 'twofold' < **pleḱ-* 'to plait, twine' (and Lat. *duplus*, Gr. διπλόος, PGm. **fald-* < **pol-t-* 'to fold, ply').

54 ORu. *krjatati* 'to move', SCr. *krétati* 'to move' have been connected to Skt. *kart-* 'to spin, pull a thread', but the semantic connection is unclear. A semantically attractive cognate to the Sanskrit root is Hitt. *karza* n. 'spool, bobbin', although it is derivationally obscure (Kloekhorst 2008: 459–460). Gr. κάρταλλος m. '(type of) basket', Lat. *crātis* f. 'construction of wickerwork, hurdle', Goth. *haurds* f. '(lattice) door' and OPr. *corto* 'fence' have also been derived from **kert-* 'to spin'. However, while the Greek word may be non-Indo-European, the Latin word reflects **krh₂-ti-*. Given the formal similarity, the Gothic and Prussian words likely reflect the same formation.

While the Indo-Iranian and Balto-Slavic words are similar semantically and likely derive from the same root (possibly **kert-* 'to spin'), no shared derivative can be reconstructed. It is possible that several stems were innovated in Indo-Slavic (e.g., a compound form **-kr̥t* and simplex **kort-o-*), some of which were lost in the individual branches, leaving only the root connection and the semantics as a trace of the isogloss.

3.3.30 *krs-no- *'black'*

Indo-Slavic exclusivity	Etymology	Shared innovation	Typology
Yes	Compelling	Possible	NDerivation Root

Indo-Aryan: Skt. *kr̥ṣṇá-* adj. 'black'
Iranian: (YAv. *karšnaz-* 'name of an Iranian family'; Elam. *kur-iš-na* 'PN'; Yi. *kʸuṇγo* 'magpie')
Baltic: Lith. *kiřsnas* adj. 'black (of a horse)', *Kirkšnó-upis* 'name of a river', (*kéršas* 'spotted white and black'); OPr. *kirsnan* adj. 'black'
Slavic: OCS *črъnъ* adj. 'black'; Ru. *čërnyj* adj. 'black'; Pol. *czarny* adj. 'black'; SCr. *crn̂* adj. 'black'

Based on Indo-Iranian (EWAia I: 397–398; AirWb.: 459) and Balto-Slavic (LEW: 245; Derksen 2008: 92; Derksen 2015: 247), a colour adjective **krs-no-* 'black' may be reconstructed, which was taken as an Indo-Slavic isogloss by Schmidt (1872: 47), Arntz (1933: 43) and Porzig (1954: 167). The etymology of YAv. *karšnaz-* and Elam. *kur-iš-na* (which possibly continues an Old Persian reflex of **krs-no-*, cf. Tavernier 2007: 233) must be considered uncertain, since they are names. Yi. *kʸuṇγo* 'magpie' and corresponding Modern Iranian forms (cf. Morgenstierne 1938: 221) may continue **krs-no-*. Lith. *kiřsnas* lacks the RUKI development of **s* and may be a borrowing from another Baltic language (often labelled "Yotvingian", cf. LEW: 245).[55] Given the Prussian and Slavic cognates, however, **krs-no-* is securely reconstructable for Proto-Balto-Slavic.

55 This might also explain the specific meaning 'black (of a horse)', assuming that the word was borrowed in a trade context or other culturally significant setting.

A form that is often adduced is Alb. *sórrë* f. 'crow' (Demiraj 1997: 355; Orel 1998: 399, with literature), which would demand a reconstruction *$k^{w}ērs$-neh_2- (since *k allegedly palatalizes to Alb. *q*, but see 1.3). There are several problems with this etymology. First, the Balto-Slavic vocalization of *r points to a plain velar anlaut *k- (perhaps < *$ḱ$- with depalatalization?), although this is controversial. Second, there are many possible alternative reconstructions of Alb. *sórrë*, e.g., without *s in the root or with anlaut *$ḱu$-. Third, the semantics of Alb. *sórrë*, although not incompatible with 'black', rather suggest that it should be compared with SCr. *svrâka* 'magpie', or even Lat. *cornīx* 'crow', which are likely onomatopoeic.

A possible root cognate of *krs-no- is Du. *harder* 'grey mullet', Sw. *harr* 'grayling' < PGm. *$harzu$- < *$kors$-u- (IEW: 583).

As noted by Debrunner (AiGr. II, 2: 735), the root of *krs-no- 'black' is isolated and not attested in verbal stems. The root has previously been taken as the base of Lith. *kéršas* 'spotted white and black' (LEW: 245), but given the acute intonation this is unlikely to be correct. Consequently, it could be argued that *krs-no- is a shared archaism, as there is no reconstructable base for deriving it at a hypothetical Indo-Slavic stage. Yet, since it cannot be excluded that a productive root *$kers$- may have been lost within Indo-Slavic or independently in the branches, *krs-no- is a possible shared innovation.

3.3.31 *kseud- *'to make small; to spray'*

Indo-Slavic exclusivity	Etymology	Shared innovation	Typology
Yes	Compelling	Possible	Root

Indo-Aryan: Skt. *kṣod-* 'to spray, pulverize', *kṣudrá-* adj. 'minute, tiny', *kṣódas-* n. 'swell of the sea'

Iranian: YAv. *xšudra-* adj. 'liquid, fluent', *xšaodah-* n. 'swell of the water'; MiP Pahl. *šōy-*, Man. *šwy-* 'to wash'; MoP *šustan* 'to wash'

Baltic: –

Slavic: OCS *xudъ* adj. 'poor, insignificant, small'; Ru. *xudój* adj. 'thin, lean, bad'; Pol. *chudy* adj. 'thin, lean, insignificant, poor'; SCr. (dial.) *hûd* adj. 'bad, evil'

Arntz (1933: 37) listed this root as an Indo-Slavic isogloss. The Indo-Aryan and Iranian *ro*-stems are not to be separated (EWAia I: 439); rather, Iranian reflects a semantic change from 'to spray (of water)' to 'to flow', which is also evident

in Skt. *kṣódas-* n. 'swell of the sea'. Semantically, Skt. *kṣudrá-* 'minute, tiny' is closest to Slavic **xûdъ* 'small, thin', where the circumflex root (despite Winter's Law) is due to Meillet's Law (Derksen 2008: 206).

Lith. *skaudrùs* 'streaming (of water)', Latv. *skaudrs* 'harsh, unpleasant' have been connected (EWAia I: 439), but cannot be compared directly to the *ro*-adjective of Indo-Iranian. These words rather belong with Lith. *skaudéti* 'to hurt, experience pain' (see further Smoczyński 2018: 1188).

In conclusion, there seems to be nothing against taking **kseud-* as an Indo-Slavic isogloss,[56] yet there is no indication that this root would be a shared innovation.

3.3.32 *k^{w}er- *'to perform magic'*

Indo-Slavic exclusivity	Etymology	Shared innovation	Typology
Yes	Compelling	Possible	Semantics

Indo-Aryan: *kártra-* n. 'spell, charm', *kr̥tyā́-* f. 'curse, spell, magic', *abhicārá-* m. 'employment of spells for a malevolent purpose' (AV+)
Iranian: YAv. *cārā-* f. 'remedy'; MiP Pahl. *čārag* 'means, remedy'
Baltic: Lith. *keraĩ* m.pl. 'sorcery', *kerė́ti* 'to cast a spell, bewitch; to predict'
Slavic: OCS *čary* acc.pl.m. 'magic, sorcery', RuCS *čara* f. 'sorcery'; ORu. *čara* f. 'sorcery', Ru. *čáry* m.pl. 'magic, enchantment'; Pol. *czar* m. 'charm, enchantment' SCr. *čara* f. 'magic, sorcery'

Arntz (1933: 45) compared specifically the *ā*-stems YAv. *cārā-* 'remedy' to RuCS *čara* 'sorcery'. However, the co-existence of an *ā*-stem and an *o*-stem within Slavic, both with lengthened *ē*-grade, as well as the full grade in Lith. *keraĩ*, suggests that a root noun should be reconstructed for Proto-Balto-Slavic (Kortlandt 1985: 118).

While there are no direct cognates, the shared semantics of these Sanskrit and Balto-Slavic derivatives, which all seem to be derived from a root **k^{w}er-* 'to perform magic', is striking. The root is generally thought to be identical to

56 Albanian *hedh-* 'to throw, shoot; to dart off; to winnow' is probably unrelated, if it is true that **ks* > Alb. *sh*, (Demiraj 1997: 57). In any case, the semantic connection is not very strong.

$k^{w}er$- ‘to do, make’, reflected in, e.g., Skt. *kṛṇóti* ‘to do, make’ (EWAia I: 308–309; Smoczyński 2018: 527),[57] in which case *$*k^{w}er$-* ‘to perform magic’ must be regarded as a semantic innovation. It is difficult to exclude that this innovation is independent, however, given the semantic parallel in Gr. πρᾶξις f. ‘doing, business; (magical) operation, spell’ from πράσσω ‘to pass through; to finish, accomplish, do’.

Gr. τέρας n. ‘sign, emblem; wonder, monster’, if from *$*k^{w}er$-*, has been argued to show a similar semantic development relating to ‘magic’ (Beekes 2010: 1467–1468). However, the basic meaning seems to be ‘sign’, which is not necessarily derived from ‘to perform magic’. It is perhaps closer to OIr. *cruth* m. ‘shape, form’ < *$*k^{w}er$-* ‘to cut’. Alternatively, Gr. τέρας may be derived from *$*k^{w}erh_2$-s-* and connected to the Celtic name *Prasutagus*, containing PCelt. *$*k^{w}rh_2$-stu-* (David Stifter, p.c.; for the attestations, cf. Delamarre 2006).

3.3.33 *mentH-eh$_1$- *‘(wooden) tool for stirring’*

Indo-Slavic exclusivity	Etymology	Shared innovation	Typology
Yes	Compelling	Possible	NDerivation

Indo-Aryan: Skt. *mánthā-* m. ‘churning stick, whisk’

Iranian: (Bal. *mant-* ‘to churn’; Sogd. B *mnδ-* ‘to agitate, stir’; OKhot. *maṃth-* ‘to churn, stir’)

Baltic: Lith. *mentẽ*, *meñtė* f. ‘shoulder blade, paddle, trowel, shovel’, *menčià* f. ‘churning stick’, *mentìs* f. ‘twirling stick for kneading bread dough’; Latv. *meñte* f. ‘ladle, stirring spoon, flat wooden shovel’

Slavic: (OCS *męsti*, *mętǫ* ‘to trouble, disturb’; Sln. *mę́sti*, *mę́tem* ‘to disturb, churn’)

57 In turn, *$k^{w}er$-* ‘to do, make’ is likely a semantic innovation based on Indo-Anatolian *(*s*)*$k^{w}er$-* ‘to cut’, cf. Hitt. *kuer-^{zi}* ‘to cut’, OHG *sceran* ‘to cut’ etc., shared by Indo-Iranian (Skt. *kṛṇóti* ‘to do, make’ etc.), Celtic (cf. MWelsh *peri* ‘to cause, create, make’, Welsh 1sg.pres. *paraf*, MBret. 3sg.pret. *paras*, as well as OIr. *cruth* m. ‘shape, form’, *creth* ‘poetry’, MWelsh *pryd* m. ‘form, shape, time’, MBret. *pred* m. ‘moment’ < PCelt. *$*k^{w}ritu$-*), and Balto-Slavic, if Lith. *kùrti* ‘to light a fire; to build, furnish (a house, boat); to create, found’ is connected (cf. Smoczyński 2018: 641–642; see Derksen 2015: 267 for a different view). Matasović’s (2009: 182) gloss of PCelt. *$*k^{w}ritu$-* ‘magical transformation, shape’, indicating a connection to magic, similar to the Indo-Iranian and Balto-Slavic situation, does not seem to be supported by the attested forms.

Skt. *mánthā-* m. 'churning stick, whisk' is inflected like *pánthā-* m. 'road, path' < PIIr. **pant-aH-* and is compatible with a reconstruction **mentH-eh₁-*,[58] which may be compared with Lith. *mentẽ́*. The root is also attested in Balto-Slavic verbal stems, e.g., Lith. *mę̃sti* 'to mix', OCS *męsti* 'to trouble, disturb' (EWAia II: 312; LEW: 437). As for the root structure, Skt. *mánthati* 'to whirl, stir, shake' suggests a root-final laryngeal (cf. LIV: 438–439). This is confirmed by Skt. *mathnā́ti* 'to rob, take away' ~ ToB *mäntänā-* 'to stir, touch' < **mnt-ne-H-* and Skt. *mathāyáti* 'to rob, take away' ~ ToB *mäntäññ-* 'to destroy' < **mnt-n-H-ie/o-* (for the meaning, cf. Malzahn 2010: 479, 753). Synchronically, Sanskrit distinguishes *manth¹-* 'to whirl, stir, shake' from *math¹-* 'to rob, take away', but the Tocharian cognates suggest that they go back to one and the same root (*pace* EWAia II: 298; cf. Pronk 2019: 143).

The main argument against taking **mentH-eh₁-* as an Indo-Slavic isogloss is that Lith. *mentẽ́* could be a productive formation from *mę̃sti* 'to mix', like Lith. *mentùris* 'mashing stick, churning stick' and Latv. *mìeturis* 'id.'.[59] However, *ē*-stems are not normally instrument nouns in Baltic,[60] and *mentẽ́* with its variants *menčià* and *mentìs* rather behaves like an old root noun. This suggests that Lith. *mentẽ́* may rather be an archaic stem, cognate to Skt. *mánthā-*, which was transferred to the *ē*-stem inflection (and thus feminine gender) within Baltic.

3.3.34 **miḱ-ro-* *'mixed'*

Indo-Slavic exclusivity	Etymology	Shared innovation	Typology
Yes	Compelling	Possible	NDerivation

Indo-Aryan: Skt. *miśrá-* adj. 'mingled, blended'
Iranian: –

58 An alternative reconstruction is **ment-eh₁-*, in which case the aspiration in Skt. *mánthā-* can be from the weak stem. However, the verbal forms point to **mentH-*. To explain the final laryngeal, it may be argued that the verbal forms are ultimately derived from a nominal stem **ment-eh₁-*, rather than the other way round, but such a scenario is difficult to substantiate.

59 Latv. *meñte* 'ladle, stirring spoon, flat wooden shovel' is irregular and was likely borrowed from another Baltic dialect.

60 Lith. *dal̃gis*, *dal̃gė* 'scythe' could be analysed as an instrument noun from an unattested **dalgýti* 'to mow' (cf. Smoczyński 2018: 193), but see LEW: 81 for a different etymology.

Baltic: Lith. *mìšras* adj. 'mixed'
Slavic: –

The *ro*-adjective reflected by Skt. *miśrá-* and Lith. *mìšras* was taken as an Indo-Slavic isogloss by Arntz (1933: 51; see further EWAia II: 357; LEW: 450).

A root **meiḱ-* / **meiǵ-* 'to mix' is well attested, cf. Lith. *miẽšti* 'to mix', OCS *měsiti* 'to mix', Lat. *misceō* 'to mix, blend', OE *miscian* 'to mix', OIr. *mesc* adj. 'confused', and Gr. μίσγω 'to mix, bring together' (with unclear voiced **ǵ*, cf. Beekes 2010: 920).[61] In Sanskrit, the root has largely been replaced by *mekṣ-*, an *s*-extended variant of **meiḱ-*.[62] However, the bare root is continued in Khow. *amiṣṭ* 'mixed'. In Iranian, **meiḱ-* is continued in YAv. *mīšti* 'together' and reflexes of **meiǵ-* are widespread (cf. Cheung 2007: 261),[63] implying that the extension to *mekṣ-* in Sanskrit is a post-Proto-Indo-Iranian development.

In both Indo-Iranian and Balto-Slavic, Indo-European palatovelars seem to have been depalatalized to plain velars before **r* (Kortlandt 1978b), implying that the palatal in **miḱ-ro-* must have been restored based on other formations. The restoration of **ḱ* may have been a shared Indo-Slavic development, but independent restorations in Indo-Iranian and Balto-Slavic cannot be excluded. In any case, the stem **miḱ-ro-* is an Indo-Slavic isogloss.

3.3.35 *mosg^{h}-en- *'brain, marrow'*

Indo-Slavic exclusivity	Etymology	Shared innovation	Typology
Yes	Compelling	Possible	^{N}Derivation

61 Perhaps **meiǵ-* was the original root shape, with **meiḱ-* emerging as a secondary variant based on the present stem **miǵ-ske/o-*, where the **ǵ* may have been devoiced.

62 Skt. *sámmiśla-* 'close-linked' etc. may contain an *l*-variant of *miśrá-* or continue a separate formation from the same root. The form Skt. ptc.med. *michamāna-* 'vivid' could possibly reflect **mi(ḱ)-ske/o-*, but the translation is unclear. In any case, *micha-* could not have provided a model for the restoration of **ḱ* in *miśrá-*, since here it would have been lost, cf. *pṛcháti* < **pr(ḱ)-ske/o-*.

63 Some Iranian forms seem to reflect **meik/g-*, e.g., MiP Man. *'myxs* 'to be mixed' and Parth. *'myj-* 'to mix'. The apparent depalatalization could possibly originate in a lost Iranian reflex of **mik-ro-*, but as such a form is not continued, this is difficult to substantiate. See Korn (2010) for an alternative explanation of the Parthian forms.

Indo-Aryan: Skt. *majján-* m. 'marrow'
Iranian: –[64]
Baltic: Lith. (dial.) *smãgenys* m.pl. 'brain, marrow, gum'; Latv. *smadzenes* f.pl. 'brain, marrow, gum'; OPr. *mulgeno* [*musgeno*] 'marrow'
Slavic: RuCS *možděni* m.pl. 'brains'; Plb. *müzdin* m., *müzdenü* n. 'brain'; SCr. (dial.) *možděna* n.pl. 'brain'

An *n*-stem **mosg^{h}-en-* may be reconstructed based on Indo-Aryan (EWAia II: 291–292) and Balto-Slavic (LEW: 837; Derksen 2008: 328; Derksen 2015: 413), which was taken as an isogloss by Schmidt (1872: 47) and Arntz (1933: 49). The East Baltic forms, if related, must have undergone metathesis. It has been argued that the words instead originate as lexicalized participles of Lith. *smõgti* 'to hit, strike' (cf. LEW). OPr. *musgeno*, which is more similar in its consonantism to the Slavic and Indo-Iranian material, is also irregular, as *u* does not reflect **o*. However, RuCS *možděni* 'brain' and the other Slavic forms probably reflect an old *n*-stem.

Besides the *n*-stem, YAv. *mazga-* m., OCS *mozgъ* m., ON *mergr* m. 'marrow', and possibly MIr. *medg*, *medc* m. 'whey' continue a parallel stem **mosg^{h}-o-* 'brain, marrow'.[65] There is no indication that this *o*-stem is derived from **mosg^{h}-en-*, however, as we might then have expected ***mosg^{h}-no-*. Pronk (2015) has argued that there was a productive pattern in Indo-European of deriving singulative *n*-stems from body-parts, e.g., *h_3ek^{w}-n-* 'one eye' << **h_3ek^{w}-ih$_1$* du. 'eyes'. Following a suggestion by Lubotsky, Pronk (2015: 341, fn. 52) notes that Skt. *majján-* is often used "in the plural with the meaning 'marrow of one bone'", indicating that the *n*-stem is indeed a derivative from the *o*-stem, which may be regarded as a possible shared Indo-Slavic innovation.

Next to PIE **mosg^{h}-o-* 'brain, marrow', we may reconstruct **mre/og^{h}-mn-* 'brain, skull', reflected in PGm. **bragna-* 'brain' and Gr. βρεχμός m. 'front part of the head'. Lubotsky (2021) has suggested that the latter stem has been preserved in the compound Skt. *mastr̥han-* m. 'brain' (KauśS) ~ YAv. *mastərəγan-* m. 'brain' < **mast-(m)rg^{h}an-*. The first part of the compound may be identified with Skt. *mastíṣka-* m./n. 'brain' (RV+), *mastaka-* m./n. 'skull, head' (Gr̥Sū.+) ~ Khot. *māstai* 'brains, head', which has a plausible cognate in ToA *mäśśunt* 'marrow' < **mesti-uent-*. Based on its attestation in only Indo-Iranian and Tocharian, it is unclear whether **mesti-* should also be reconstructed for Proto-Indo-

64 Khot. *mijsaā-* 'marrow' has been interpreted as an Indo-Aryan loanword (Dragoni 2023: 158, fn. 322).

65 Lith. *mãzgas* 'knot' has been connected, but it is probably unrelated and may instead be compared to PGm. **maska-* 'mesh' (IEW: 746; Derksen 2015: 308).

European. In any case, the compound **mast-(m)rgʰan-* is likely an Indo-Iranian innovation, whereas **mosgʰ-en-* is shared by Indo-Iranian and Balto-Slavic.

3.3.36 *ne *'as, like'*

Indo-Slavic exclusivity	Etymology	Shared innovation	Typology
Yes	Compelling	Possible	Semantics

Indo-Aryan: Skt. *ná* 'as, like'
Iranian: YAv. *yaϑ-na* 'namely' (lit. 'like which')
Baltic: Lith. *nè* 'than; like', *negù* 'than', *néi* 'than, as if'; Latv. *ne* 'than'
Slavic: OCS *neže* 'than'; Ru. *ne* 'as, like'; Ukr. *niž* 'than'; Pol. *niż* 'than'; Cz. *než* 'than'; SCr. *neže* 'than'

Indo-Iranian and Balto-Slavic share a particle/conjunction **ne* 'as, like', which is generally explained as being etymologically identical to the Indo-European negation **ne* (EWAia II: 2; LEW: 489; Derksen 2008: 352; 2015: 331; Smoczyński 2018: 850–851; *pace* Vasmer II: 204).

Within Indo-Iranian, **na* 'as, like' is mostly attested in Sanskrit, although YAv. *yaϑna* 'namely' may reflect a fossilized remnant of the particle in Iranian.[66] Sanskrit *ná* 'as, like' is often, but not always, enclitic. Based on a metrical analysis of the Rigvedic material, Vine (1978: 183) showed that the enclitic position is secondary. This implies that the original syntax is the same as in Balto-Slavic (see below). Furthermore, Vine (1978) argues that *ná* 'as, like' originates in negated constructions of the type *ná yáṃ járanti śarádo ná mā́sā* 'whom neither years nor months make old' (RV VI.24.7a). Since *ná* 'not' is a verbal negation and not a conjunction, a literal translation would be 'whom years do not make old, (just like) months do not'. In this way, it is understandable how *ná* 'not' could be reanalysed as 'as, like'. Vine's explanation provides a plausible alternative to the traditional view (e.g., Whitney 1879: 366) that *ná* 'as, like' developed from constructions like *gauró ná tr̥ṣitáḥ piba* 'drink like a thirsty buffalo' << 'drink [although, to be sure] not [precisely like] a thirsty buffalo' vel sim. (RV I.16.5c).

66 For a different view on the Iranian material, in which the particle **na* is connected to a pronominal stem **ana-*, see ESIJ V: 405–408.

In Balto-Slavic, the relevant particles can be grouped into several categories, since some have been extended with suffixes or are otherwise divergent. Lith. *nè*, *negù* 'than' and Latv. *ne* 'than' are used after comparatives. This function could be a secondary extension of Lith. *nè* 'like',[67] but may rather have developed independently from the negation **ne* 'not'.[68] The Baltic comparative particles are comparable to Church Slavic, Czech and Serbo-Croatian particles reflecting PSl. **nežе* 'than' (*ne* + emph.ptcl. *že*). Similarly, Ukr. *niž* 'than' and Pol. *niż* 'than' derive from PSl. **ni že*, which probably originally meant 'nor', cf. OCS *ni že* 'nor' and fn. 68. Closest to Lith. *nè* 'like' is Ru. *ne* 'as, like', which is attested in Russian *byliny* (archaic epic poetry). This **ne* 'as, like' looks archaic within Balto-Slavic and may thus be compared directly to Indo-Iranian **na* 'as, like'. Finally, Lith. *néi* 'than; as if' has both functions and derives (with unclear acute) from Lith. *neĩ* 'not even' < PBSl. **nei*. This extended variant of **ne* 'not' is old (cf. Lat. *nī*, Goth. *nei*, Av. *nōiṯ*).

In sum, it seems possible that the development of **ne* 'as, like' from **ne* 'not' was a shared Indo-Slavic innovation, whereas the various particles meaning 'than' in Balto-Slavic are independent innovations.

3.3.37 *ni-h$_3$(e)k^w- *'facing downwards'*

Indo-Slavic exclusivity	Etymology	Shared innovation	Typology
Yes	Compelling	Possible	[N]Derivation

Indo-Aryan: Skt. *nyàñc-* adj. 'facing downwards', *nīcā́* adv. 'downwards', *nyàk* adv. 'down, downwards'
Iranian: YAv. *niiå̊ṇc-* adj. 'going away, facing away'
Baltic: Latv. *nīca* f. 'place downstream', *nīcām* adv. 'downstream'
Slavic: OCS *nicь* adj. 'facing downwards'; Cz. *nicí* adj. 'facing downwards'; Bulg. *nícom* adv. 'face down'

Meillet (1926: 172) took the corresponding Slavic and Sanskrit adjectives as an isogloss, to which we may add additional comparanda from Baltic and Iranian.

67 For the semantics, see LKŽ s.v. *ne*[3].

68 Cf. English dialectal *nor* 'than', e.g., *There wusnae less nor twenty horses* 'there were no fewer than twenty horses' (Wright & Wright 1898: s.v. *nor*).

The adjectives Skt. *nyàñc-* and YAv. *niiåṇc-* have secondary *-n-*, which is common in compounds with **h₃ekʷ-* 'eye' (see below). In Sanskrit, case forms of an originally athematic paradigm are preserved as adverbs, e.g., instr.sg. *nīcā́* (cf. EWAia II: 60; AirWb.: 1095). Based on the palatalization in Slavic, an *o*-stem may be reconstructed (Derksen 2008: 352–353), which could have replaced an earlier athematic inflection.

OE *nihol, nīowol* 'lying face down' has traditionally been connected to the Indo-Iranian and Balto-Slavic material (LEW: 503; KEWA II: 182). This etymology is doubtful, however, since the Old English forms reflect a short **i* (Schaffner 1996: 132). To maintain the connection, one would have to assume that an original long **ī* was shortened by analogy to **ni-þera-*. Schaffner (1996: 159) proposes a different analysis, deriving *nihol* from **ni-ḱuo-lo-* from **ni-ḱuo-* 'below, facing down', cf. Skt. *víśva-* 'all'. The stem **ni-ḱuo-* would also be reflected in the first part of the compound OE *niweseoða* 'lower part of the belly'.

Arm. *nkᶜtᶜem* 'to starve, faint from hunger' has been derived from **ni-h₃kʷ-* 'downwards', but Martirosyan's etymology (2010: 512), deriving it from **ni-* + **ktᶜ-* 'to faint' is semantically much more straightforward. Thus, it appears that **ni-h₃(e)kʷ-* is indeed exclusively Indo-Slavic.

Compounds of adverb + **h₃kʷ-* 'eye' seem to have been productive in early Indo-European, cf. Skt. *pratíka-* n. 'surface, face, image', *pratyàñc-* 'facing',[69] Gr. πρόσωπον n. 'face, countenance, mask, role, person', ToB *pratsāko* f. 'breast' < **proti-h₃kʷ-*; Lat. *antīquus* 'lying in front' < **h₂enti-h₃kʷ-*; Skt. *abhíka-* n. 'nearness' < **h₂nbʰi-h₃kʷ-*; Skt. *ápāñc-* 'located behind', PGm. **abuha-* 'turned the wrong way', OCS *opaky* 'the other way round' < **h₂epo-h₃kʷ-*; Skt. *ánīka-* n. 'face, appearance; front, row, array', Gr. ἐνῶπα 'in the face', OIr. *enech* n. 'face' < **h₁eni-h₃kʷ-*; Lat. *ferōx* 'fierce, arrogant' < **fēro-h₃kʷ-* 'having a fierce aspect'. Given the many parallel formations, some in several branches, but others clearly formed within branches, **ni-h₃(e)kʷ-* 'facing downwards' is a possible shared innovation, but it is difficult to exclude an archaism or independent innovation.

3.3.38 **nogʷ-o-* *'naked'*

Indo-Slavic exclusivity	Etymology	Shared innovation	Typology
Yes	Compelling	Possible	NDerivation

69 The Iranian counterpart YAv. *paitiianc-* 'turned against' contains **pati-*, which replaced **prati* 'against' in Iranian, showing that compounds with **h₃ekʷ-* remained productive into post-Proto-Indo-Iranian times.

Indo-Aryan: Skt. *nāgá-* m. 'elephant (AB+); snake (ŚB+)'
Iranian: –
Baltic: Lith. *núogas* adj. 'naked'; Latv. *nuôgs* adj. 'naked, poor'
Slavic: OCS *nagъ* adj. 'naked'; Ru. *nagój, nag* adj. 'naked'; Pol. *nagi* adj. 'naked'; SCr. *nâg* adj. 'naked'

Arntz (1933: 51) listed this *o*-stem as an Indo-Slavic isogloss. Two questions regarding this etymology must be addressed: the semantics of Skt. *nāgá-* 'snake; elephant' and the relationship between **nog^{w}-o-* and the more widely attested **nog^{w}-no-* 'naked'.

Mayrhofer (EWAia II: 33) dismisses the old idea that *nāgá-* 'elephant' is extracted from an unattested compound **nāga-hasta-* lit. 'having a snake-hand'. Instead, both 'snake' and 'elephant' seem old, which suggests an original meaning 'bare, naked (animal)'. This makes the connection to Balto-Slavic semantically plausible.

A root **neg^{w}-* is well attested in Indo-European words for 'naked', but several different formations exist (cf. Beekes 1994). Skt. *nagná-* 'naked' and YAv. *maγna-* 'naked' (with dissimilation) reflect **ne/og^{w}-no-*, as well as probably Gr. γυμνός 'naked, unarmed', OPr. *nognan* 'leather' (EV), and possibly Hitt. *nekumant-* 'naked' (if dissimilated from **neg^{w}no-nt-* Kloekhorst 2008: 603).[70] Arm. *merk* 'naked' reflects an *e*-grade and *r*-suffix, which together with **ne/og^{w}-no-* could point to an original heteroclitic. Latin and Germanic show forms with an unclear dental suffix **-o/e/ud^{h}-*, cf. Lat. *nūdus* 'naked', Goth. *naqaþs* 'naked', ON *nøkkviðr* 'naked', OSw. *nakuþer* 'naked'.[71] OIr. *nocht* 'naked' reflects **nog^{w}-to-*, likely a Celtic innovation. Based on this material, it is unclear whether a single Proto-Indo-Anatolian form can be reconstructed, although **ne/og^{w}-no-* seems like the best candidate.

Since both **ne/og^{w}-no-* and **nog^{w}-o-* are attested in Indo-Iranian, the latter did not simply replace an older formation, as appears to be the case in Balto-Slavic. Therefore, if **nog^{w}-o-* is an Indo-Slavic innovation, it may have originated as a dissimilated variant of **ne/og^{w}-no-*, possibly motivated by taboo reasons or in order to denote some other semantic nuance of 'naked', e.g., 'lacking clothes' vs. 'lacking hair'.[72]

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70 ON *nakinn* 'naked' is secondary and cannot reflect old **nog^{w}-no-*.

71 *Pace* Schrijver (1991: 274–275), not all Germanic forms can be explained from a suffix form **-od^{h}-*.

72 Cf. Sw. *naken* 'naked (in general, of parts of the body, metaphorically)' vs. *näck* 'lacking any clothes on the body'.

3.3.39 *peh$_2$gs-ó- *'(body part) having a side'*

Indo-Slavic exclusivity	Etymology	Shared innovation	Typology
Yes	Compelling	Possible	^{N}Derivation

Indo-Aryan: Skt. *pakṣá-* m. 'wing (RV); wing of a building (AV)', *upa-pakṣá-* m. 'armpit'
Iranian: Oss. *faxs* 'side, slope of a mountain'[73]
Baltic: –
Slavic: Ru. *pax* m. 'groin', *paxá* f. 'armpit'; Cz. m. *pach* 'groin', Pol. *pacha* f. 'armpit'

Arntz (1933: 38, 41) listed Skt. *pakṣá-* next to Ru. *pax*, reconstructable as **peh$_2$gs-ó-*, as an Indo-Slavic isogloss.[74] As will be argued below, **peh$_2$gs-ó-* derives from an *s*-stem **peh$_2$ǵ-os-* reflected by Skt. *pā́jas-* '(front) side; firmament; face'.

The *s*-stem **peh$_2$ǵ-os-* can be connected to **peh$_2$ǵ-* 'to become firm', continued in Skt. 3sg.int.med. *pāpaje* 'stays behind', Gr. πήγνυμι 'to fix, stick' etc., which suggests an original meaning 'support', 'that which is (or makes) firm'. This is reflected in Skt. *pā́jas-* n. 'firmament', i.e., 'the surface to which the sky is attached'. Skt. *pā́jas-* also means 'front side', e.g., the front side of a chariot, as well as 'face', as in the front side of a person (or deity). Furthermore, it means 'side, flank', often of the body. The Iranian cognates show a comparable semantic range, with Khot. *pāysa-* 'breast' and Sogd. C *p'z* 'face' etc. reflecting the 'front side' meaning, while Oss. I *faz* / D *fazæ* also means 'side, half, anus'.[75] Slavic does not preserve an *s*-stem, but has an *o*-stem in ORu. *pazъ* m. 'joint, groove', Sln. *pâz* m. 'joint' from the same root.

Skt. *pakṣá-* 'wing' may be explained as a possessive thematic derivative from *pā́jas-* '(front) side; firmament; face'. The derivation is likely old, for several reasons: first, it presupposes loss of the laryngeal in preconsonantal position, which is a Proto-Indo-Iranian development (Lubotsky 1981). This fits with the meaning of *pakṣá-* 'wing', which does not point to a synchronic derivation from

73 For further possible cognates in Iranian, reflecting PIr. **paxša-* 'mosquito', see ESIJ VI: 109–110.

74 Arntz also adduced Latv. *paksis* 'corner of a house', which is formally impossible.

75 The meaning of the hapax YAv. *pāzaŋʸhaṇt-* '(broad-)breasted (?)' is uncertain, but it shows that the *s*-stem is old in Indo-Iranian. Further cognates include Khwar. *p'z* 'breast', Shu. *puz* 'breast' and Wakh. *рыz* 'breast'.

pā́jas-. Additionally, Oss. *faxs* 'side, slope of a mountain', which can hardly be separated from Skt. *pakṣá-*,[76] is incompatible with a palatal **ǵ*, and rather points to PIIr. **-kš-* (e.g., Oss. I *æxsæv* / D *æxsævæ* 'night' < **kšapā-*). This suggests that **ǵ* underwent depalatalization in the heavy cluster that arose when **peh$_2$gs-ó-* was derived from **peh$_2$ǵ-os-*.

Although requiring an extra assumption, this scenario is attractive, because it also explains Ru. *pax* 'groin', *paxá* 'armpit' etc., which cannot have been derived within Slavic from, e.g., ORu. *pazъ* m. 'joint, groove' (nor from an unattested *s*-stem **pazo*), but nevertheless clearly belong here semantically. In this way, Sanskrit 'wing' and Slavic 'groin, armpit' developed from **peh$_2$gs-ó-* '(body part) having a side' << **peh$_2$ǵ-os-* 'side (that supports)'. The semantic closeness is further highlighted by Skt. *upa-pakṣá-* m. 'armpit'. This derivative is a possible Indo-Slavic shared innovation, although it cannot be excluded that the stem was lost in other branches.

3.3.40 *peh$_3$i-men- *'milk'*

Indo-Slavic exclusivity	Etymology	Shared innovation	Typology
Yes	Compelling	Possible	^{N}Derivation

Indo-Aryan: –
Iranian: YAv. *paēman-* n. 'mother's milk'; MiP Pahl. *pēm* 'milk'; MoP *pīnu* 'sour milk, cream cheese, buttermilk'; Sogd. C *rxpyn* 'whey, new cheese (?)' < **huxra-paina-*
Baltic: Lith. *píenas* m. 'milk'; Latv. *piẽns* m. 'milk'
Slavic: –

Arntz (1933: 56) considered the Persian and Lithuanian words for 'milk', both having lost the **-m-* of the related form YAv. *paēman-* 'mother's milk', to be an Indo-Slavic isogloss. An Iranian stem **paina-* is further reflected in Sogd. C *rxpyn* 'whey, new cheese (?)' < **huxra-paina-* (see p. 102). In (Core) Proto-Indo-European, the suffix **-mn-* was reduced to **-n-* in the oblique stem of

76 Based on its semantics, Oss. *faxs* 'side, slope of a mountain' is perhaps better compared with Skt. *pákṣas-* n. 'side' (Cheung 2002: 182), which is a secondary *s*-stem derived from *pakṣá-* 'wing'. In any case, the Ossetic form shows that the cluster must have been PIIr. **-kš-* rather than **-ćš-*.

roots containing a labial consonant (cf. AiGr. II, 2: 766; Kroonen 2006). This process explains the *no*-stems of Baltic and Iranian as thematicized variants of **peh$_3$i-men-*. The fact that this cluster reduction was a Proto-Indo-European phenomenon does not necessarily imply that **peh$_3$i-men-* is a shared archaism, since the process may well have been productive in Indo-Slavic.

As for potential extra-Indo-Slavic cognates, ON *feima* f. 'shy girl' and OE *fæmne*, *fémne* f. 'virgin, damsel, maid, woman' have been derived from **peh$_3$i-m(e)n-ieh$_2$-* lit. 'nursing woman' (cf. de Vries 1977: 115). Semantically, this etymology is not obvious, since a 'virgin' is specifically *not* a 'nursing woman'. A more plausible preform is **poh$_2$i-m(e)n-ieh$_2$-* 'shepherdess'.

The stem **peh$_3$i-men-* 'milk' is generally derived from **peh$_3$(i)-* 'to drink'. The *i*-extension appears in certain verbal derivatives of the root, e.g., Gr. imp. πῖθι 'drink!', Skt. *pāyáyati* 'to let drink', OCS *piti*, *pijǫ* 'to drink', and perhaps Alb. *pi* 'to drink'. From such verbal forms (an *i*-perfect with a dative subject is preserved in Skt. *pīpáya* 'swells up (with milk)' according to Lubotsky 2011: 121), a secondary root **peh$_3$i-* 'to swell (with milk), nurse' was lexicalized, which was the basis for **peh$_3$i-men-* 'milk'. This stem is a possible Indo-Slavic innovation.[77]

3.3.41 *pelH-ou- *'chaff'*

Indo-Slavic exclusivity	Etymology	Shared innovation	Typology
Yes	Compelling	Possible	Semantics

Indo-Aryan: Skt. *palā́va-* m. 'chaff, husks'
Iranian: –
Baltic: Lith. *pẽlūs* m.pl. 'chaff'; Latv. *pęlus* f.pl. 'chaff'; OPr. *pelwo* 'chaff' (EV)
Slavic: OCS *plěvy* f.pl. 'chaff'; Ru. *polóva* f. 'chaff'; SCr. *pljȅva* f. 'chaff'

Based on the Sanskrit and Balto-Slavic words for 'chaff', together with Lat. *pulvis* n. 'dust', an amphidynamic *u*-stem **pelH-ou-* may be reconstructed (IEW: 802; de Vaan 2008: 440; Smoczyński 2018: 940). Gr. παλύνω 'to strew, sprinkle'

77 Lith. *pajaĩ* 'beeswax' has been connected to **peh$_3$i-* 'to swell up' (LEW: 527) and compared to YAv. *paēnaēna-* 'made of honey', Orm. *pīn* 'honey', Sogd. B *'nkwpyn* 'honey', Psht. *gabína* 'honey' < **hangu-paina-* 'honey' (cf. Morgenstierne et al. 2003). While the semantic connection is interesting, there is no formal correspondence and the semantic shift in Iranian is explained by the compound **hangu-paina-* lit. 'bee's milk'.

is possibly denominative from an unattested reflex of **plH-u-* 'sprinkle (?)', a stem variant of **pelH-ou-*.[78] While the stem itself is not an isogloss, the meaning 'chaff' is restricted to Indo-Iranian and Balto-Slavic and reflects a possible shared semantic innovation.

Other formations from the same root also show a distribution between agricultural and non-agricultural meanings (see IEW: 802). ON *fǫl* n. 'thin layer of snow', Far. *følva* 'to cover in a thin layer (of snow, butter, flour)' and Alb. *pall* m. 'finely milled flour, chaff and dust from harvested grain' reflect **polH-uo-*. Here, the connotation to agricultural products may be an Albanian innovation. It is of course difficult to exclude that the agricultural meaning is original in both **pelH-ou-* and **polH-uo-*.

3.3.42 *seng- *'to attach, fasten'*

Indo-Slavic exclusivity	Etymology	Shared innovation	Typology
Yes	Compelling	Possible	Root

Indo-Aryan: Skt. 1sg.pres.act. *á sajāmi* 'I fasten, attach', 3sg.aor.med. *ní asakta* 'he has hanged (smth.) down at himself' (RV+), 3sg.pf. *sasañja* (Br.)
Iranian: OP 1sg.imf.act. *frāha$^{(n)}$jam* 'I hung out'; MiP Man. *'šynz-* 'to draw up'; MoP *āvang*(*ān*) 'hanging'; Yi. *awáž-* 'to hang up'
Baltic: Lith. *sègti, sẽga* 'to fasten, pin, tack, attach'; Latv. *segt, sẹdzu* 'to cover, fasten'
Slavic: CS *prisęgnǫti* 'to touch'; Ru. *sjagnút'* 'to reach for, attain'; Pol. *sięgać, sięgam, sięgnąć, sięgnę* 'to reach for, reach'; SCr. *sȅzati, sȅžem* 'to reach, attain', *ségnuti* 'to reach'

A root **se*(*n*)*g-* 'to attach, fasten' has been reconstructed based on the above verbal forms as well as nominal forms in other branches, viz. MIr. *sén* '(bird) trap' < PCelt. **segno-*, MWelsh *hoenyn, hwynyn* m. 'net, trap' < PCelt. **sogno-*, and MHG *senkel* m. 'shoelace, string; anchor, fishing net weighed down with lead balls' (IEW: 887–888).

There is a discussion in the literature whether the root was **seg-* or **seng-*. The abovementioned Celtic forms point to **seg-*, but it should be noted that

78 Alternatively, Gr. παλύνω may be derived from πάλη f. 'flour'.

these etymologies are rather uncertain, both in terms of semantics and form.[79] The meaning 'shoelace, string' of MHG *senkel* is secondary in view of OHG *senkil* m., which only means 'anchor, fishing net weighed down with lead balls' and is no doubt deverbal from *senken* 'to sink' (EWD s.v. *Senkel*).

As for the Indo-Iranian verbal forms, LIV: 516 follows Klingenschmitt (1982: 185 fn. 26) in taking the forms with *-n-* in the root as secondary. It is argued that they may be analogical, since they are not attested in RV. However, this claim does not take into account the Iranian forms pointing to **seng-*, viz. MiP Man. *'šynz-* 'to draw up' and MoP *āvang*(*ān*) 'hanging'.[80] In view of the Iranian evidence, **saŋ̆-* should be reconstructed for Proto-Indo-Iranian, while the forms without nasal in Sanskrit reflect the zero-grade **saŋ̆-* < **sng-*.

Baltic does not reflect a nasal in the root, but neither can the attested forms be derived regularly from **seg-*, since the root does not show the effect of Winter's Law. According to Kortlandt (1988: 389), the Baltic root was backformed from a nasal stem **seng-n-*, cf. CS *-sęgnǫti* 'to touch', where Winter's Law was blocked. The regular acute is reflected by, e.g., SCr. *sȅzati* 'to reach, attain'.

Thus, the likeliest reconstruction for both Indo-Iranian and Balto-Slavic is **seng-*, which constitutes an Indo-Slavic root isogloss. This may most plausibly be analysed as an archaism, although an innovation cannot in principle be excluded.

3.3.43 **seuk-** *'to turn, twist; to churn'*

Indo-Slavic exclusivity	Etymology	Shared innovation	Typology
Yes	Compelling	Possible	Root Semantics

79 Lat. *sagum* n. 'woollen cloak' is unrelated (cf. de Vaan 2008: 534). As for the Celtic forms, the semantic connection is possible but not compelling. The difference in root ablaut in Irish and Welsh is unexplained.

80 Khwar. *mfšnc-* 'to sit on (horse), ride' may also belong here. The meaning 'to sit on (horse), ride' may have developed from 'to hang (reins) around, fasten (reins) around (a horse)', especially in view of RV 1.33.3a *ní sárvasena iṣudhír̥ṁr asakta* 'fully armed, he has laden himself down with quivers' (translation by Jamison & Brereton 2014: 137), referring to Indra hanging quivers around his neck.

Indo-Aryan: –
Iranian: MoP *ruxbīn / rixbīn* 'sour milk, new cheese';[81] Sogd. C *rxpyn* 'whey, new cheese (?)'; Oss. I $x_{o}yrx$ / D *xurxæ* 'whey'
Baltic: Lith. *sùkti* 'to turn, twist; to spin (yarn), twist (strands of rope); to churn (butter)', *pãsukos* f.pl. 'buttermilk', *išsukos* f.pl. 'buttermilk', *sùkras* adj. 'agile, diligent, swift', *sukrùs* adj. 'tightly twisted, winding, vigorous; quick, agile'; Latv. *sukrs* adj. 'strong, energetic, swift'
Slavic: (CS *sukati* 'to turn'; Ru. *sukát'* 'to turn, twist'; OPol. *sukać* 'to twist threads together'; SCr. *súkati* 'to twist, wind')

The comparison of the Ossetic and Baltic words goes back to Lidén (1933: 7). He argued that a root **seuk-* 'to turn' is uniquely attested in Balto-Slavic and Iranian (Ossetic), which in both branches denotes curdling of milk. Moreover, Lidén noted the formal correspondence between Oss. I $x_{o}yrx$ / D *xurxæ* 'whey' < **sukrā-*[82] and Lith. *sùkras* 'agile, diligent, swift'.

We may now add Sogdian and Persian comparanda, reflecting a compound **sukra-paina-* 'whey, sour milk, new cheese' as additional evidence for Iranian **sukra-*. A possible interpretation is that **sukra-paina-* contains an adjective **sukra-* 'turned, twisted' rather than the nominalized **sukrā-* 'whey' reflected in Ossetic. If correct, Iranian **sukrā-* may be compared to Lith. *sùkras*, *sukrùs* and Latv. *sukrs*. Within Indo-Iranian, **sukrā-* and its semantic connection to dairy products must be an archaism, as the root is not attested elsewhere.

The Baltic *ro*-adjective is connected to Lith. *sùkti* 'to turn, twist; to spin (yarn), twist (strands of rope); to churn (butter)', which itself has retained the original meaning of the root, cf. CS *sukati* 'to turn' etc., as well as several specialized meanings including 'to churn'. Among its many nominal derivatives, those that relate to milk are *pãsukos* 'buttermilk' and *išsukos* 'grease from the axle of a wheel; dust off a grinding wheel; buttermilk' (cf. LEW: 548; Smoczyński 2018: 1324).[83]

As for the semantics of **seuk-*, it must be noted that it refers to 'buttermilk' in Baltic, whereas Iranian **sukrā-* mainly refers to 'whey' or 'cheese'. However,

81 Psht. *raxpín/ṇ* m. 'dried solids of buttermilk', *xarpín* m. 'whey' may be borrowings from Persian (Morgenstierne et al. 2003 s.vv.).

82 Cheung (2002: 251) alternatively reconstructs **surakā-* and connects the Ossetic word to YAv. *hurā-* f. 'an alcoholic drink, kumis', which requires the assumption that final *-x* is the result of assimilation.

83 Lith. *sunkà* 'juice; soup liquid; decoction; bodily fluids; whey' and Latv. *sūkalas* f.pl. 'whey' (cf. *sùkala* f. 'drop') are rather from Lith. *suñktis* 'to trickle out slowly (of resin, whey, sweat, blood, tears)', *suñkti* 'to sip, strain through a strainer, press out juice', Latv. *sùkt* 'to suck (of a leech); to strain through a strainer', related to Lat. *sūcus* m. 'juice', ON *súga* 'to suck' etc.

we also find a connection to 'buttermilk' in Psht. *raxpín/ṇ* m. 'dried solids of buttermilk', which indicates that the semantic difference from Baltic is trivial.

Thus, it is possible that the development 'to turn' >> 'to churn' was a shared Indo-Slavic change. The possibly shared formation **suk-ro-* 'turned, twisted' favours this conclusion.

3.3.44 *som-d^{h}eh$_{1}$- *'agreement'*

Indo-Slavic exclusivity	Etymology	Shared innovation	Typology
Yes	Compelling	Possible	Semantics

Indo-Aryan: Skt. *saṃdhā́-* f. 'agreement, promise' (AV+)
Iranian: –
Baltic: Lith. *samdà* f., *sam̃das* m. 'rent, hire, hired workers, servants, family'
Slavic: OCS *sǫdъ* m. 'court of law, trial, verdict, judgement'

Meillet (1926: 169) takes the formal and semantic correspondence between Skt. *saṃdhā́-* (EWAia I: 784) and Lith. *samdà* as an Indo-Slavic isogloss. YAv. *haṇ-dāiti-* f. 'collection' has a different suffix, **-ti-*, and in view of its productive semantics, it is derived within Iranian (cf. Gr. σύνθεσις f. 'putting together; agreement'). Lithuanian also has a variant *sam̃das*, which is attested earlier than *samdà* and is inflected as an *o*-stem, corresponding to OCS *sǫdъ* (LEW: 761; Derksen 2008: 463; 2015: 389). Consequently, **som-d^{h}h$_{1}$-o-* is the most likely Proto-Balto-Slavic reconstruction.

If PBSl. **som-d^{h}h$_{1}$-o-* is to be compared with Skt. *saṃdhā́-*, the latter being a compounded root noun (AiGr. II, 2: 15), one would have to assume that the *o*-stem is secondary. Such an assumption is complicated by Lithuanian compounds like *avìdė* 'sheepfold', *alùdė* 'beer keg', which have been argued to reflect an old root noun **d^{h}eh$_{1}$-* (LEW: 92). However, these compounds can just as well be analysed as derivatives in *-ė*, in view of the non-acute intonation.[84] Moreover, the retained nasal in compounds with *-das* in Lithuanian,

84 According to Kortlandt (1985: 120), the circumflex *-ẽ* in Lith. *avìdė* 'sheepfold' etc. is due to regular loss of laryngeals after **ē* in root nouns. However, even if the circumflex nominative in Lithuanian *ė*-stems is explained in this way, it does not prove that *avìdė* 'sheepfold' etc. reflect old root nouns, since *ė*-stems became productive in Baltic. The transparent semantics of *avìdė* 'sheepfold' and *alùdė* 'beer keg', i.e., 'where sheep/beer is put', derivable

e.g., *samdas*, *iñdas*, *indà* 'container, pot', implies that they are archaic (contra *są́-* 'together, with', *ę̃-* 'in'). In addition, the lexicalized semantics of both Lith. *samdas* and OCS *sǫdъ* indicate an archaic derivation, as they do not look deverbal. It therefore seems not at all impossible that PBSl. **som-dʰh₁-o-* is a thematicized root noun. The original meaning may have been 'agreement, conclusion (of business)' vel sim., which was further specified to an economic context in Baltic and a judicial context in Slavic.

Skt. *saṃdhā́-* 'agreement, promise' is also further lexicalized, i.e., further removed from the literal meaning of the root, when compared to other derivatives like *saṃdhí-* m. 'joint, juncture' (RV) (<< 'putting together') or *durdhā́-* f. 'disarrangement' (RV) (<< 'what is badly put'). In RV, *sám-* + *dhā-* generally means literally 'to put together'.[85] This suggests that *saṃdhā́-* 'agreement, promise' is not a recent deverbal stem, but rather an inherited formation.

In conclusion, **som-dʰeh₁-* 'agreement' may be analysed as an Indo-Slavic semantic isogloss, since the stem formation of the attested forms is not fully comparable. Naturally, it is difficult to rule out the possibility of independent innovation, but the fact that the preverb **som* 'together' is only used in Indo-Iranian and Balto-Slavic lends support to a shared innovation.

3.3.45 *suleh₂- *'juice; milk'*

Indo-Slavic exclusivity	Etymology	Shared innovation	Typology
Yes	Compelling	Possible	NDerivation

from the verb *dė́ti* 'to put, place', are also compatible with a later derivative. In the case of *alùdė*, the first member *alù-* is probably a Germanic borrowing, and so this particular case cannot be of Proto-Balto-Slavic age.

85 Grassmann (1996: 663ff.) glosses two attestations of *sáṃ-* + *dhā-* as '(einen Bund) schliessen', i.e., 'to form (an alliance)':

RV VIII.67.21ab: *ví ṣú dvéṣo vy àṃhatím ā́dityāso ví sáṃhitam*
O Ādityas, rip apart hostility, apart constraint, apart what is packed together (Jamison & Brereton 2014: 1157).

RV X.100.4bc: *rā́jā sómaḥ suvitásyā́dhy etu naḥ yáthā-yathā mitrádhitāni saṃdadhúr*
Let King Soma stay mindful of our welfare, in the same way that (pacts) concluded by allies bind (them [=allies]) together (Jamison & Brereton 2014: 1559).

As the translations show, *sáṃ-* + *dhā-* can in both cases be read as 'to put together', rather than 'to form an alliance'.

Indo-Aryan: Skt. *súrā-* f. 'an alcoholic drink'
Iranian: YAv. *hurā-* f. 'an alcoholic drink, kumis'; MiP Pahl. *hur* 'an alcoholic drink'; Khot. *hurā-* f. 'fermented mare's milk'
Baltic: Lith. *sulà* f. 'birch or maple juice'; Latv. *sula* f. 'tree sap; gastric juice'; OPr. *sulo* 'curdled milk' (EV)
Slavic: –

Arntz (1933: 53) listed this as an Indo-Slavic isogloss. Goth. **bi-sauljan* 'to make spotted, unclean', Nw. (dial.) *saula* f. 'dirt', OHG *sol* m. 'mud-puddle' have been connected (cf. Lehmann 1986: 72), but the semantics are not very close to the Indo-Iranian and Baltic words. Gr. ὕλη f. 'mud' has been seen as a reflex of **suleh$_2$-* (LEW: 940). However, according to Beekes (2010: 1530), this is merely a chance resemblance and the meaning 'mud' is secondary from ὕλη f. 'stuff, matter'.

While the Indo-Iranian (EWAia II: 737; AirWb.: 1837) and Baltic (LEW: 940) forms match formally, the semantics are divergent. In Iranian, the reflexes of **suleh$_2$-* denote a specific type of fermented mare's milk (kumis), which is common on the Eurasian steppe. Evidence for the consumption of mare's milk goes back to the Early Bronze Age in the Pontic-Caspian steppe (Wilkin et al. 2021). The exact meaning of Skt. *súrā-* is debated. It is possible that it originally meant 'kumis' but came to signify another type of alcoholic drink when the speakers of Indo-Aryan migrated away from the steppe. OPr. *sulo* 'curdled milk' is semantically quite close to Iranian. On the other hand, the East Baltic forms generally do not refer to milk.[86] However, the Prussian-Iranian correspondence suggests that Indo-Slavic **suleh$_2$-* could denote a dairy product, although this may not have been the only meaning of the stem (a possible root cognate with similar semantics is MIr. *suth* m. 'milk' < **su-to-*).[87]

The stem **suleh$_2$-* has been seen as a derivative from **seu-* 'to press' (IEW: 912–913), whence also Skt. *savá-* m. 'juice' and PGm. **sawwa-* n. 'juice' (Kroonen 2013: 428). Alternatively, one may assume a derivation from **suel-* 'to consume',

86 Latv. *suliņas* 'whey' (= 'milk juice'?) is probably a secondary derivative from *sula*, and does not prove that the latter originally denoted a dairy product in East Baltic.

87 If 'juice, sap' was part of the original semantic scope of **suleh$_2$-*, the meaning 'fermented/curdled milk' may have developed in a metaphorical sense as the 'juice from a mare/cow'. A parallel for this is OHG *quiti*, *kuti* m. 'resin', Skt. *játu-* n. 'varnish, gum', Welsh *bedwen* sgl. 'birch' < **g$^{\text{w}}$et-u-*, from which are derived ON *kváða* f. 'resin', Nw. *kvåde*, *kode* f. 'resin; watery fluid from a pregnant cow's udder; raw milk', Far. *kváð* n., *kváð*(*a*) f. 'viscous fluid from a cow's teat' (Hellquist 1922: 382; Kroonen 2013: 315). Arm. *kečʿi* 'birch' and *kitʿ* 'dairy produce' may be near identical to the formations attested in Germanic (Rasmussen 1999: 622–623; Martirosyan 2010: 359).

reflected only in Iranian, e.g., YAv. *xᵛaraiti* 'to consume, eat', Khwar. *x(w)r-* 'to consume, eat, drink'.[88] The root etymology of **suleh*$_2$- cannot be considered certain, but the stem is an Indo-Slavic isogloss and a possible shared innovation.

3.3.46 *tsprh$_{2/3}$-e/o- *'to kick away with the foot'*

Indo-Slavic exclusivity	Etymology	Shared innovation	Typology
Yes	Compelling	Possible	^{V}Derivation

Indo-Aryan: Skt. *sphuráti* 'to push away with the foot'
Iranian: YAv. *fra-spara-* 'to kick away'; MiP Pahl. *spar-* 'to trample, tread'; MoP *sipardan* 'to trample; to be trampled'; Sogd. C *pšpr-* 'to trample on'; Khot. *vaspuḍai* 'he trod'; Oss. I *æfsæryn* 'to press on; to push' / D *æfsærun* 'to kick with the feet'; Wakh. *nəsp(ə)r-* 'to kick (with the feet)'
Baltic: (Lith. *spìrti*, *-ia* 'to kick with a leg or hoof'; Latv. *speĩt*, *speļu* 'to kick, strike (of lightning)')
Slavic: Ru. *perét'*, *pru* 'to brace one's feet against, push'; Pol. *przeć*, *prę* 'to stem'; SCr. *zàprijeti*, *zȁprêm* 'to confine, close'

According to LIV: 585, only Indo-Iranian and Slavic attest a thematic present with zero-grade in the root from the root **sp*^{h}*erH-* 'to kick away with the foot'. The root is further attested in the Indo-European word for 'heel', cf. Skt. *pā́rṣṇi-* f. 'heel', Gr. πτέρνη f. 'heel', Lat. *perna* f. 'leg, haunch', Goth. *fairzna* f. 'heel', Hitt. *paršna* 'heel (?)'. I follow Lubotsky's (2006) reconstruction, with the specification of the final laryngeal according to Kloekhorst (2008: 410), i.e., **tsperh*$_{2/3}$-, which accounts for the initial clusters of the attested forms.

The Indo-Iranian evidence is straightforward (cf. EWAia II: 776). While YAv. *-spara-* could in theory reflect either PIIr. **sp*^{h}*arH-a-* or **sp*^{h}*rH-a-*, Skt. *sphuráti* unambiguously points to the latter.

The Slavic material is more complex, since the reflexes of **tsprh*$_{2/3}$-*e*/*o-* 'to kick away with the foot' partially overlap with verbal stems from other roots

88 Cf. LIV: 609. Cheung (2007: 147) considers Iranian **huar-* 'to consume' to have developed from *huar-* 'to take'. Alternatively, **huar-* 'to consume' derives from **suel-* 'to swell', with a semantic change from 'to swell (with milk)' >> 'to (give to) drink'. This would indicate that **suleh*$_2$- originally referred to milk.

(Vaillant III: 188–189). Derksen (2008: 396) groups Ru. *perét'* 'to brace one's feet against, push' together with the homonymous *perét'* 'to go', connecting them to Lith. *peřti* 'to beat' < **per-* 'to beat'. It seems more likely (with Vasmer II: 341) that *perét'* 'to go' belongs with **per-* 'to go across', cf. Skt. *pipárti* 'to bring across', Goth. *faran* 'to go', and that the Slavic correspondence of Lith. *peřti* 'to beat' is OCS *pьrati*, *perǫ* 'to beat, trample, wash' (due to the practice of washing by lashing with a bath besom). Ru. *perét'*, *pru* 'to brace one's feet against, push' < **tsprh$_{2/3}$-e/o-* then corresponds to Lith. *spìrti*, *-ia* 'to kick with a leg or hoof', although the present stem in Lithuanian is secondary (Smoczyński 2018: 1261).[89]

Since other branches reflect a potentially archaic nasal present, cf. Arm. *spaṙnam* 'to threaten', Lat. *spernō* 'to kick away; to despise', ON *sperna*, *sporna* 'to kick, spurn' < **tspr-n-h$_{2/3}$-*, Indo-Slavic **tsprh$_{2/3}$-e/o-* is a potential innovation. It is difficult to exclude that the Slavic form is a late innovation, however, since the stem type may have been productive, cf. OCS *požrěti*, *požьrǫ* 'to swallow, devour' < **g^{w}rh$_3$-e/o-*, (see p. 122). Yet, the fact that the present formations **g^{w}rh$_3$-e/o-* 'to devour, swallow' and **tsprh$_{2/3}$-e/o-* 'to kick away with the foot' are both exclusively shared by Indo-Iranian and Slavic increases the likelihood that this productivity goes back to a shared Indo-Slavic stage.

3.3.47 *tusk-io- *'empty'*

Indo-Slavic exclusivity	Etymology	Shared innovation	Typology
Yes	Compelling	Possible	NDerivation Root

Indo-Aryan: Skt. *tucchyá-* adj. 'empty'
Iranian: MiP Pahl. *tuhīg*, Man. *twhyg* adj. 'empty, vain'; Khot. *ttuśśaa-* adj. 'empty'; Oss. I *tyssæg* adj. 'empty'; Psht. *təš* adj. 'empty'; Wakh. *təṣ* adj. 'empty'
Baltic: Lith. *tùščias* adj. 'empty, hollow, idle, vain'; Latv. *tukšs* adj. 'empty, poor'
Slavic: OCS *tъštъ* adj. 'empty'; Ru. *tóščij* adj. 'gaunt, empty, poor'; Pol. adj. *czczy* 'empty'; SCr. *tȁšt* adj. 'empty, vain, conceited'

89 There is also OCS 3pl. *perǫtъ* 'they fly', which Vasmer connects to Ru. *perét'* 'to go' (Vasmer II: 341). Perhaps Derksen (2008: 427) is right that it rather belongs with OCS *pero* n. 'feather'.

Schmidt (1872: 49), Arntz (1933: 36) and Porzig (1954: 167) present this word as an Indo-Slavic isogloss, but do not comment on the reconstruction. The Indo-Iranian words, which go back to PIIr. **tusćia-*, have been analysed as a *io*-derivative from a present stem **tus-sk-*, cf. YAv. 3pl. *tusən* 'they lose (temper)', *taošaiieiti* 'to leave hold of, drop' (EWAia I: 652). Lubotsky (2001a: 42–43) argues against this etymology, since nominal derivatives are not normally based on present stems, and since YAv. *tusən* need not be old, as *sk*-presents became productive in Iranian. Instead, he analyses PIIr. **tusćia-* as deriving from **tusk-o-* 'emptyness', reflected in ORu. *tъska* f. 'grief, longing'. This reconstruction precludes a root connection to YAv. *taošaiieiti*, since a primary *ko*-stem would be as implausible as a deverbal stem **tus-sk-io-*. We are instead forced to assume a new root, **tu(e)sk-*, with final **-k*.

Derksen (2015: 475–476) rejects Lubotsky's reconstruction, arguing for a preform **tus-sk-tio-*, since the Baltic forms are incompatible with **tusk-io-*. However, Derksen's reconstruction is problematic on the Indo-Iranian side, since Skt. *tucchyá-* is accented on the suffix, whereas the deadverbial suffix *-tya-* < **-tio-* is unaccented (AiGr. II, 2: 697). A suffix *-čias* becomes productive in Lithuanian, but there is no attested verbal stem from which *tùščias* could have been derived (Lith. *tuštéti* 'to become empty' is denominal, cf. LEW: 1146).

More probably, the Baltic words may in fact be derived regularly from **tusk-io-*, assuming a special development of the cluster **-skʲ-* (cf. Gorbachov 2014). Conversely, Kortlandt (1979) argued that **skʲ* yielded Slavic **s*, Lith. *š*, Latv. *s* (i.e., PBSl. **ś*), but all three alleged examples are problematic. First, Lith. *šáuti* 'to shoot' and OCS *sovati* 'to throw' have been derived from a root **skeu-* > **skiau-*, but more likely reflect **ḱeuH-* (see p. 78), as **eu* > **iau* must postdate the palatalization of **sk-*.[90] Moreover, the only external evidence for **sk-* was the connection to PGm. **skeutan-* 'to shoot', but the etymology has been rejected by Kroonen (2013: 445), who derives the Germanic verb from **sket-*. Second, OCS *sěnь* f. 'shadow' and Latv. *seja* f. 'face, shadow' are usually connected to Skt. *chāyā́-* f., Gr. σκιά f. 'shadow' < **sk(o/e)Hi-eh$_2$-*. However, as both Kortlandt (1979) and Derksen (2015: 549) acknowledge, the anlaut *s-* < **sk-* must be secondary, since the vocalism of the Balto-Slavic forms points to **-e/oi-* rather than **i/ʲi-*. They argue that the *s-* was taken over from the verb (which constitutes the third example of **skʲ* > **ś*), e.g., PSl. **sijàti* 'to shine' < **skHi-*, where the palatalization would have been regular. However, it must be noted that in **tusk-io-*,

90 This chronology is required to explain why **r̥*, **l̥* > PBSl. **ir*, **il* etc. do not cause palatalization of a preceding **sk* (cf. Kortlandt 1979).

*sk is in a RUKI position, which is not the case for PSl. *sijàti*. It is not *a priori* certain that *šk would have the same development as *sk.

Thus, only one example of the alleged palatalization of *sk > *ś / _i can be maintained, but the phonology of PSl. *sijàti is not similar enough to Lith. *tùščias* to falsify the derivation of the latter from PBSl. *tušk-io- < *tusk-io-. I conclude that *tusk-io- is an Indo-Slavic isogloss. If *tusk-io- is a *io*-adjective derived from *tusk-o-, reflected in ORu. *tъska* 'grief, longing', it is a possible shared innovation.

3.3.48 *uert-men- *'course'*

Indo-Slavic exclusivity	Etymology	Shared innovation	Typology
Yes	Compelling	Possible	NDerivation

Indo-Aryan: Skt. *vártman-* n. 'track, course'
Iranian: –
Baltic: –
Slavic: OCS *vrěmę* n. 'time'; SCr. *vrijème* n. 'time'

This *men*-stem was listed as an isogloss by Arntz (1933: 53). Although Skt. *vártman-* (EWAia II: 520) differs slightly from OCS *vrěmę* (Vasmer I: 235; Derksen 2008: 516) semantically, the step from 'course' >> 'time' is a rather trivial semantic development, implying that the Indo-Aryan and Slavic words may derive from the same *men*-stem.

Verbal forms of *uert- 'to turn' retain the basic meaning in Slavic, e.g., OCS *vrъtiti sę* 'to turn' (cf. LIV: 691), which contrasts with the lexicalized meaning of PSl. *vermę 'time', indicating that the latter is not a recent deverbal formation. This is consistent with the fact that the suffix *-men- was only marginally productive in Slavic (Matasović 2014: 25). The semantics may not be too informative, however, since similar developments are attested in other nominal derivatives from *uert- 'to turn' in Balto-Slavic, e.g., OCS *vrъsta* f. 'age, generation' vs. Ru. *verstá* f. 'verst (a distance of 1.1 km)', Lith. *vãrstas* m. 'turn of the plough, verst'. While a shared innovation remains possible, it is difficult to rule out that the reflexes of *uert-men- were derived independently.

3.3.49 *uolḱ-o- *'hair'*

Indo-Slavic exclusivity	Etymology	Shared innovation	Typology
Yes	Compelling	Possible	[N]Derivation

Indo-Aryan: Skt. *válśa-* m. 'sprout, twig'
Iranian: YAv. *varəsa-* m. 'hair (on the head)'; MiP Pahl. *wars* 'hair'; MoP *gurs* 'hair'; Sogd. BCS *wrs* 'hair'; Psht. *weẍtə́*, Wan. *wušt* m. 'hair'
Baltic: –
Slavic: OCS *vlasъ* m. 'hair'; Ru. *vólos* m. 'hair'; Pol. *włos* m. 'hair'; SCr. *vlâs* m. 'hair'

Indo-Iranian and Slavic share an *o*-stem from a root *uelḱ-* (EWAia II: 526–527; AirWb.: 1374; Vasmer I: 221; Derksen 2008: 526–527), taken as an isogloss by Meillet (1926: 173). The meaning of Skt. *válśa-* m. 'sprout, twig' is likely secondary from 'hair', cf. Lat. *comātus* 'rich with foliage' << *coma arboris* 'hair of a tree' (KEWA III: 168).

Several Iranian languages have been argued to show a parallel *o*-stem with zero-grade in the root, viz. YAv. *frā.vərəsa-* adj. 'lacking hair', MoP *gurs* 'hair', Psht. *weẍtə́*, Wan. *wušt* m. 'hair' < PIr. **uṷrća-*. However, Gershevitch (1959: 265) has provided an alternative explanation for YAv. *frā.vərəsa-* < **-uṷrt-sa-*, and the Persian and Pashto forms are in fact compatible with a full grade form PIr. **uarća-*, with secondary labialization of the root vowel.

Although the *o*-stem **uolḱ-o-* is exclusively Indo-Slavic and a possible shared innovation, Gr. λάχνη f. 'woolly hair, down' < **ulḱ-sneh$_2$-* is probably from the same root (Beekes 2010: 839–840). The *sneh$_2$*-stem could be old or innovated within Greek, as the suffix was productive. Either way, λάχνη cannot be derived from a lost Greek reflex of **uolḱ-o-*, given the zero-grade in the root.[91]

91 However, in view of Skt. *vṛkṣá-* m., YAv. *varəša-* m. 'tree', one could reconstruct an *s*-stem **uelḱ-es-* 'twig' from which a possessive adjective **ulḱ-s-ó-* 'having twigs' >> 'tree' was derived. The same *s*-stem could have been the basis for Gr. λάχνη 'woolly hair; (metaphor of) leafage'.

3.3.50 *uolo- *'tail hair (of horse)'*

Indo-Slavic exclusivity	Etymology	Shared innovation	Typology
Yes	Compelling	Possible	NDerivation Root

Indo-Aryan: Skt. *vā́ra-* m. 'tail hair, horse tail, sieve', *vā́la-* m. (TS) 'id.'
Iranian: –
Baltic: Lith. *vãlas* m. 'fishing line; horse hair'
Slavic: –

Skt. *vā́ra-* (EWAia II: 545) with the variant *vā́la-* (EWAia II: 547) is formally identical to Lith. *vãlas*, which generally means 'fishing line', but also 'horse hair' in East Lithuanian (Derksen 2015: 485). LEW: 1188 adduces Lat. *adūlor* 'to fawn (upon), court', but de Vaan (2008: 25) rightly rejects this.

The stem could potentially contain the root **uel-* 'to enclose' or **uel-* 'to turn', but neither is semantically compelling. As we cannot reconstruct a plausible base from which **uolo-* could be derived in Indo-Slavic, there are no decisive arguments in favour of classifying it as an innovation. Alternatively, **uolo-* could be a substrate word, but there are no formal arguments for this.

3.4 Uncertain Isoglosses

3.4.1 *b^herH-men- *'support; burden'*

Indo-Slavic exclusivity	Etymology	Shared innovation	Typology
Yes	Doubtful	Possible	NDerivation Root

Indo-Aryan: Skt. *bhárīman-* n. 'support, maintenance, care'
Iranian: YAv. *barəmāiiaona-* adj. 'going with a burden (?)'
Baltic: –

Slavic: OCS *brěmę* n. 'load, burden'; Ru. (dial.) *berémja* n. 'armful, bundle, burden'; Pol. *brzemię* n. 'load, burden'; SCr. *brȅme* n. 'weight, load; pregnant woman'

The Sanskrit and Slavic words are sometimes compared (e.g., Derksen 2008: 37), supposedly derived from a *seṭ*-variant of **b^{h}er-* 'to bear'. Mayrhofer (EWAia II: 249) instead takes Skt. *bhárīman-* as a secondary variant of *bhárman-* n. 'support, preservation, care', which seems possible, since the laryngeal required for *bhárīman-* is unexplained. As for *bhárman-*, it is rather an infinitive and occupies a different functional domain than *bhárīman-*.

OE *beorma* m. 'leaven, yeast, froth' has been derived from **b^{h}er-me/on-* and would also be compatible with a root-final laryngeal (Wodtko, Irslinger & Schneider 2008: 16). De Vaan (2008: 213) connects *beorma* to Lat. *fermentum* n. 'ferment; yeast' and reconstructs **b^{h}er(H)-mn-*. Although formally similar to Skt. *bhárīman-*, these words are rather related to Skt. *bhuráti* 'to move rapidly' < **b^{h}ŗh$_1$-e-* and (more distantly) Lat. *ferveō* 'to boil' (Schrijver 1991: 253–256). Alternatively, OE *beorma* and Lat. *fermentum* may derive from **g^{wh}er-mn-* (Kroonen 2013: 306).

Semantically, the Sanskrit and Slavic words denote slightly different concepts: 'support' << 'bearing' vs. 'load, burden' << 'borne'. This could indicate parallel innovations, although the meanings may reflect two sides of the same coin. Furthermore, YAv. *barəmāiiaona-* (with uncertain meaning) might contain *barəman-* 'burden', which is equivalent to the Slavic meaning, although formally it may reflect either **b^{h}er-men-* or **b^{h}erH-men-*.

3.4.2 *b^{h}reh$_1$ǵ- *'to shine, dawn'*

Indo-Slavic exclusivity	Etymology	Shared innovation	Typology
Uncertain (Germanic)	Compelling	Possible	Root

Indo-Aryan: Skt. *bhrāj-* 'to shine, beam'
Iranian: YAv. *brāzaiti* 'to shine'; Parth. *br'z-* 'to shine'; MoP *barāzīdan* 'to shine, beam'; Sogd. B *βr"z"nt* 'shining'
Baltic: Lith. *brėkšti, -ta* 'to dawn'
Slavic: OCS *probrězgъ* m. 'dawn', Ru. (dial.) *brezg* m. 'dawn'; Pol. *brzask* m. 'dawn'; Sln. *brȇsk* m. 'dawn'

The root *$b^hreh_1ǵ$- is listed as an isogloss by Arntz (1933: 51). It is thought to be the base of Skt. *bhūrjá-* m. 'Himalayan birch', ON *bjǫrk* f. 'birch', Lith. *béržas* m. 'birch', SCr. *brȅza* f. 'birch'. However, the root structure of the Germanic and Balto-Slavic words for 'birch' (and further PGm. **barku-* 'bark', **berhta-* 'bright'; Alb. *bardhë* 'white', cf. Kroonen 2013: 53, 60–61) shows a full grade *b^he/$orh_1ǵ$-, which differs from the verbal stem of Indo-Iranian and Balto-Slavic (see LIV: 92; EWAia II: 279–280; Derksen 2015: 99).[92] In Germanic and Balto-Slavic, the full grade of this seemingly Schwebeablauting root could be explained as analogical from the zero-grade *ur/ir < *rH, but the same does not hold for Alb. *bardhë* 'white', where a zero-grade *rH would have given *ra, as in Alb. *bredh* m. 'fir' (< **bradh*, cf. Demiraj 1997: 108). If *$b^herh_1ǵ$- was the original root structure, the change to *$b^hreh_1ǵ$- could have been a common Indo-Slavic development, as a way to avoid heavy consonant clusters in certain forms. However, the isolated Nw. *brok* m. 'young (speckled) salmon' and Sw. *brokig* 'variegated' offer possible extra-Indo-Slavic evidence of *$b^hreh_1ǵ$-, although the connection is not certain.

3.4.3 *b^huHs- *'to be active, strengthen'*

Indo-Slavic exclusivity	Etymology	Shared innovation	Typology
Uncertain (Greek)	Doubtful	Possible	^{V}Derivation

Indo-Aryan: Skt. *bhū́ṣati* 'to support, be active, strengthen'
Iranian: OAv. *būždiiāi* inf. 'to render oneself active, to make an effort'
Baltic: –
Slavic: OCS *bystrъ* adj. 'quick'; Ru. *býstryj* adj. 'quick'; Pol. *bystry* adj. 'quick, sharp-witted'; SCr. *bȉstar* adj. 'clear, transparent, quick'

Derksen (2008: 71) compares the root of the Slavic adjective *$bỳstrъ$ to Indo-Iranian *b^huHs-, since the laryngeal could explain the Slavic acute. The limited verbal paradigm of *b^huHs- (only a thematic present in Sanskrit) suggests that it originates from *b^heh_2u- 'to become' (EWAia II: 270–271, with lit.), with an *s*-extension, cf. YAv. *būšiianṭ-* ptc. 'wishing to become', Lith. *bùs* 3sg.fut. 'will be'.

92 Welsh *berth* 'beautiful', MBret. *brez* m. 'prosperity' < PCelt. **berxto-* have often been included here, but the missing laryngeal points to a different root (cf. Matasović 2009: 63).

However, a connection could also be sought to the Greek *s*-aorist ἔφυσα 'made grow' (in which case Skt. *bhū́ṣati* could be an old aorist subjunctive), and it therefore remains uncertain whether the *s*-extension to **b^{h}eh$_2$u-* is a shared Indo-Slavic formation.

3.4.4 *b^{h}uh$_2$-r(i)- *'much, plenty'*

Indo-Slavic exclusivity	Etymology	Shared innovation	Typology
Yes	Doubtful	Possible	NDerivation

Indo-Aryan: Skt. *bhū́ri-* adj. 'much, abundant, numerous, great, mighty'
Iranian: OAv. *būiri-* adj. 'abundant'; Khot. *buro* 'to the limit, completion'
Baltic: Lith. *būrỹs* 4 m. 'crowd, flock, pack, platoon', *bùrti, -ia* 'to gather'; Latv. *bũra* f., *bũris* m. 'lot, mass, heap'
Slavic: –

Derksen (2015: 106) tentatively accepts this etymology (see also LEW: 66). Lith. *būrỹs* and Latv. *bũra*, *bũris* point to derivatives in **-iio-* and **-eh$_2$-* from a base **b^{h}uHr-*, in which the Latvian sustained tone proves the position of the laryngeal. Since **b^{h}uHr-* can hardly be a Proto-Indo-European root, it seems likely that the verb Lith. *bùrti* 'to gather' is of denominal origin. Skt. *bhū́ri-* and OAv. *būiri-* < PIIr. **b^{h}uH-ri-* belong together with the comparative YAv. *baoiiō* 'longer' and plausibly derive from **b^{h}auH-* 'to become'. The derivational history of adjectives in *-ri-* is unclear,[93] but it seems reasonable to assume that it is not a primary Indo-European suffix but rather an *i*-stem to an earlier *r*-stem **b^{h}uh$_2$-r-*. However, as this *r*-stem is not directly attested in either Indo-Iranian or Balto-Slavic, the etymology remains doubtful.

3.4.5 *-di- *3rd person encl. pron.*

Indo-Slavic exclusivity	Etymology	Shared innovation	Typology
Yes	Doubtful	Possible	NDerivation

93 One of the few attested cases apart from Skt. *bhū́ri-* is *sthū́ri-* 'one-horse, pulled by one horse' (AiGr. II, 2: 859).

Indo-Aryan: –
Iranian: YAv. *-di-* encl. pron. 'him, her, it, them'; OP *-di-* encl. pron. 'him, her, it, them'
Baltic: OPr. *-di-* encl. pron. 'him, her, them, one'
Slavic: –

Trautmann (1910: 266) connected the OPr. 3rd person enclitic pronoun *-di-* to YAv. *-di-* and OP *-di-* with similar function.

The exact paradigm of Old Prussian *-di-* is unclear. Bezzenberger (1907: 109) takes OPr. *-ts* 'he' as a continuation of an old nom.sg. **-dis*, with regular syncope (see also Euler 1992: 130). However, *-ts* may also continue nom.sg.m. **tas* (Stang 1966: 410), which seems more likely, since *-ts* is syntactically different from *-di-* in that it only attaches to verbs, never to prepositions or conjunctions. Nevertheless, OPr. *-di* and *-dei* indisputably have nominative function, being attested as translations of German impersonal *man* 'one'. Endzelin (1944: 122) takes *-di* as a nom.sg.n., which seems reasonable, if it derives from **-dit* (cf. YAv. *-diṯ*). He further takes *-dei* as a nom.pl.m. form. However, since *-dei* (which is a hapax) is functionally equivalent to *-di*, and the Old Prussian nom.pl.m. ending is generally *-ai*, it seems more likely that it reflects a spelling variant of the latter (cf. *geiwan* 'life' for *giwan*). In principle, *-di* may continue both the n.sg. **-dit* and n.pl. **dī*. Alternatively, both variants have been explained as reflexes of a nom.pl.m. **-djai* (Trautmann 1910: 266), but for *-di* this is formally impossible.

The accusative forms acc.sg.m./f. *-din* and acc.pl.m./f. *-dins* are more straightforward. In principle, they can be directly compared with YAv. *-dim* and *-dīš* < **-dins*. It is unclear if the variants *-dien* and *-diens* are spelling variants or reflect formal variants. According to Mažiulis (1994: 95), they arose as a result of the conflation of stem classes in the Catechisms. Alternatively, it is possible that *-dien* was modelled after acc.sg.m./f. *schien* 'him, her'.[94]

In Iranian, only accusative forms are attested (Bartholomae 1904: 684 ff.), which follow the same inflection as the enclitic YAv. 3rd person pron. *i-*, viz. YAv. acc.sg.m./f. *-dim*, acc.sg.n. *-diṯ*, acc.pl.m./f. *-dīš*, acc.pl.n. *-dī*. Caland (1909) derives Iranian **-di-* from a rebracketing of, e.g., YAv. *ād-im* 'then … him' to *ā-dim*, *pasāvad-im* 'after that … him' to *pasāva-dim*. Caland's scenario is difficult to reject, for several reasons: 1) *-di-* seems to be functionally equivalent to the enclitic pronouns *-i-* and **-si-* (Av. *-hi-*, OP *-ši-*, Skt. *-sīm*), 2) Old Avestan has only *-i-* and *-hi-*, not *-di-*, and 3) unlike *-i-* and **-si-*, *-di-* does not correspond to a known Indo-European pronominal stem (cf. Beekes 1983).

94 OPr. *schien* is only one of many spellings of the accusative of 3sg. pron. *schis*.

An alternative etymology connects pronominal *-*di-* to a PIE deictic particle **de*/*o* (Pokorny 1959: 181), reflected in, e.g., Gr. ὅδε 'this here', OE *to* 'to', OCS *do* 'towards'. This is difficult to substantiate, however, and does not help us determine whether Old Prussian *-di-* and Iranian *-*di-* reflect a shared innovation. Even if Iranian *-*di-* resulted from rebracketing, as in Caland's scenario, it technically does not preclude the possibility that this development occurred as a shared innovation with Balto-Slavic. The loss of final *-*t*/*d* in Old Prussian and Old Persian cannot be assumed to have triggered the creation of *-*di-*, as this loss does not affect Avestan. This implies that *-*di-* could be old (Indo-Slavic) *and* created through rebracketing. One final point is unexplained in this scenario, however; in Old Prussian, *-di-* also has nominative function, unlike in Iranian. This divergent syntax could indicate independent innovations. Given the above considerations, the status of *-*di-* as an Indo-Slavic isogloss is doubtful.

3.4.6 *d^{h}(o)r-uo- *'firm, healthy'*

Indo-Slavic exclusivity	Etymology	Shared innovation	Typology
Yes	Doubtful	Possible	^{N}Derivation

Indo-Aryan: Skt. *dhruvá-* adj. 'firm, solid, secure'
Iranian: YAv. *druua-* adj. 'healthy'; OP *duruva-* adj. 'firm, secure, invulnerable'; MiP Pahl. *drōd* 'health, well-being, prosperity, peace', *drust* adj. 'right; well, healthy'; Bactr. λρουο 'healthy'
Baltic: –
Slavic: OCS *sъdravъ* adj. 'healthy'; Ru. *zdoróvyj* adj. 'healthy'; Pol. *zdrowy* adj. 'healthy'; SCr. *zdrȁv* adj. 'healthy'

The Indo-Iranian forms (EWAia I: 798–799; AirWb.: 782) can be considered to show the regular development of *-*ŗuV-* (parallel to *-*ŗiV-* > *-riya-*, cf. Lubotsky 1997) and thus go back to **d^{h}r-uá-*. OCS *sъdravъ* and its many cognates in Slavic (cf. Derksen 2008: 478) have been connected by Meillet (1902–1905: 364), who considered this to be an Indo-Slavic isogloss (1926: 172). The Slavic words have alternatively been connected (e.g., by Vasmer I: 450) to Lith. *sū́drus* 'thick, dense' < **h$_{1}$su-dru-* (see p. 74), but this requires the assumption that *sъ-* was analogically restored, as we would otherwise expect lengthening via Winter's Law due to the following **d* (Derksen 2008: 478–479). The acute tone of, e.g., SCr.

zdrȃv does not presuppose a laryngeal in the root since an original **sȅ-dorvъ-* would have shifted to **sъ-dòrvъ-* with Dybo's Law (Derksen 2008: 479).

OIr. *derb* 'certain' is rather derived from **deru-* 'wood, tree', which is supported by OBret. *daeru* 'oaks' (Matasović 2009: 96). Germanic **trewwu-* 'loyal, trustworthy' probably reflects a similar derivation and semantic shift (Kroonen 2013: 523) and cannot in any case be related to Skt. *dhruvá-* (but cf. Harðarson 2018, who assumes secondary aspiration in Indo-Iranian).

Although the Indo-Iranian and Slavic forms seem to lack cognates in other branches, they vary in terms of root ablaut. One might try to account for this in two ways. Either the Slavic *o*-grade was inserted as a result of the compounding process, or the *o*/∅-ablaut reflects an unattested *u*-stem that was independently thematicized in the separate branches. However, there are to my knowledge no good parallels for secondary *o*-grades in (Balto-)Slavic compounds. Reconstructing an ablauting *u*-stem is rather *ad hoc* as these are normally not thematicized in Slavic (but were generally extended by *-kъ*) and since **-uo-* is also a primary suffix. In view of these difficulties, it seems more likely that the Indo-Iranian and Slavic stems are independent derivatives. Even if the forms ultimately go back to the same *u*-stem, it cannot be excluded that this is an inherited archaism.

3.4.7 *ǵembʰ- *'to suffer from cold'*

Indo-Slavic exclusivity	Etymology	Shared innovation	Typology
Yes	Doubtful	Possible	Semantics

Indo-Aryan: Skt. *hemantá-jabdha-* 'made stiff by winter', *jámbhate* 'snaps at'
Iranian: (YAv. 2pl.imp. *ham-zəṇbaiiaδβəm* 'crush!')
Baltic: (Lith. *žemñbti, -ia* 'to cut slantwise, sharpen')
Slavic: Ru. *zjábnut', zjábnu* 'to suffer from cold'; Cz. *zábsti, zebu* 'to suffer from cold, freeze'; SCr. *zépsti, zébēm* 'to freeze'

The root **ǵembʰ-* 'to snap, bite' is widespread in Indo-European languages and a stem **ǵombʰ-o-* 'row of teeth, tooth' may also be reconstructed (cf. Mumm 1999; LIV: 162; IEW: 369). Mumm (1999) has argued that Slavic and Sanskrit share a specific semantic development from 'to bite' >> 'to become stiff from cold'. In Slavic, 'to suffer from cold, freeze' has become a basic meaning of the verb (Derksen 2008: 543). According to Mumm (1999), the general meaning 'to suf-

fer from cold' would be secondary from 'to freeze' (i.e., 'freeze solid'), but this chronology is difficult to substantiate from the Slavic evidence.[95] An equally likely scenario is that 'to suffer from cold' developed directly from 'to bite', as a metaphor of the feeling of cold. Once this became the general meaning of the verb, it could also mean 'to freeze' in reference to inanimate objects.

In Sanskrit, the meaning is only attested in the compound *hemantá-jabdha-* 'made stiff by winter'. While *jabdha-* could be understood as 'made stiff from cold', it is difficult to rule out that it simply meant 'clenched', in the sense 'made stiff by being bit', with the connotation to 'cold' deriving from *hemantá-* 'winter'.

3.4.8 *ǵʰelh$_3$-en- *'green, yellow, gold'*

Indo-Slavic exclusivity	Etymology	Shared innovation	Typology
Yes	Doubtful	Possible	^{N}Derivation

Indo-Aryan: Skt. *híraṇya-* n. 'gold, precious metal', *hiraṇín-* adj. 'rich in gold, adorned with gold', *hiraṇmáya-* adj. 'golden'

Iranian: YAv. *zarańiia-* n. 'gold', *zaranaēna-* adj. 'golden', *zarənu°*, *zaranu°* 'gold'; MiP Pahl. *zarr* 'gold', Man. *zr* 'gold'; MoP *zar* 'gold'; Sogd. *zyrn* 'gold'; Khot. *ysīrra-* n. 'gold', *ysarūna-* adj. 'yellow, red', *ysarra-gūnä* 'gold-coloured', *ysaraṃjsa-* 'safflower'

Baltic: –

Slavic: OCS *zelenъ* adj. 'green'; Ru. *zelënyj* adj. 'green'; Pol. *zielony* adj. 'green'; SCr. *zèlen* adj. 'green'

Although the root **ǵʰelh$_3$-* is widespread in Indo-European, traces of an *n*-stem adjective **ǵʰelh$_3$-en-* are restricted to Indo-Iranian and Slavic. For Core Proto-Indo-European (excluding Anatolian and Tocharian, where **ǵʰelh$_3$-* is not attested), an *i*-stem **ǵʰelh$_3$-i-* may be reconstructed based on Skt. *hári-* 'fallow, yellowish, greenish' and Lat. *helvus* (< **ǵʰelh$_3$-i-uo-*, cf. de Vaan 2008: 282), and probably a *ro*-stem **ǵʰlh$_3$-ro-* based on Gr. χλωρός 'pale green, greenish yel-

95 Mumm (1999) argues that Gr. γόμφος m. 'peg, bolt, nail' and Ger. *Kamm* m. 'tenon joint' < **ǵombʰo-* also imply a root meaning 'to bite' (i.e., 'to make stiff by biting'). However, the carpentry-related meanings of Greek and Germanic can, in my opinion, simply be derived from 'tooth', in a metaphorical sense, which is likely the original meaning of **ǵombʰo-*.

low', since these form a 'Caland'-pair. The reflexes in other branches may rather be analysed as innovations, e.g., PGm. **gelwa-* / **gulu-* 'yellow' < **ǵʰelh₃-u-* and Lith. *žel̃vas* 'greenish, yellowish'.

Skt. *híraṇya-* 'gold, precious metal' and its Iranian cognates reflect **ǵʰlh₃-(e)n-io-*, which seems to be a deadjectival *io*-stem.[96] Similarly, YAv. *zarənu°*, *zaranu°* 'gold' may be analysed as a deadjectival *u*-stem. Khot. *ysarra-gūnä* 'gold-coloured' < **ǰʰarana-gauna-* (cf. YAv. *zairi.gaona-* 'yellow-coloured, gold-coloured') seems to reflect a thematicized *n*-stem adjective. Based on this, a Proto-Indo-Iranian adjective **ǰʰ(a)rH-an-* 'gold-coloured' may be reconstructed (cf. EWAia II: 816).

The semantic difference between the Indo-Iranian **ǰʰ(a)rH-an-* and Slavic **zelènъ* 'green' is trivial, as 'yellow' and 'green' do not seem to have been consistently distinguished in early Indo-European languages. It seems highly unlikely that **ǰʰ(a)rH-an-* was innovated within Indo-Iranian, since the suffix is not productive and since the verb **ǰʰarH-* 'to be angry' had undergone a semantic shift (<< 'to grow green'). The verb is also preserved in Lith. *želti* 'to grow green'. It is noteworthy that Indo-Iranian and Balto-Slavic are the only branches that attest a primary verb to this root.[97]

While an inner-Indo-Iranian innovation is unlikely, Slavic **zelènъ* 'green' has been taken as a petrified participle from a lost Slavic cognate of Lith. *želti* 'to grow green', with the parallels OCS *studenъ* 'cold' ~ Ru. *studít'* 'to cool', SCr. *cr̀ven* 'red' ~ RuCS *črьviti* 'to dye, redden' (Vaillant IV: 620). However, in both cases, the verb is denominal and transitive. As such, although it remains uncertain, it seems difficult to entirely reject the possibility that **zelènъ* 'green' is inherited and cognate with PIIr. **ǰʰ(a)rH-an-* 'gold-coloured'.

3.4.9 *ǵ⁽ʰ⁾(u)rstuo/eh₂- *'stone, gravel, sand'*

Indo-Slavic exclusivity	Etymology	Shared innovation	Typology
Yes	Doubtful	Possible	NDerivation

96 Skt. *hiraṇín-* 'rich in gold, adorned with gold' is from **hiraṇyín-* and does not prove the existence of an *n*-stem in Indo-Aryan (AiGr. II, 2: 328). Skt. (TS) *hiraṇmáya-* 'golden' is a late replacement of *hiraṇyáya-* 'golden' (AiGr. II, 2: 769).

97 According to LIV: 178, Indo-Iranian **ǰʰarH-* 'to be angry' is unrelated, but in my opinion the semantics are compelling.

Indo-Aryan: –
Iranian: YAv. *zarštuua-* n. 'stone'
Baltic: Lith. *žvirgždas* m. 'gravel, pebble'; Latv. *zvìrgzds* m. 'pebble'
Slavic: Ru. (dial.) *žerstvá*, *gverzdá*, *gverstvá* (Novg.), *gverstá* (Novg., Pskov) f. 'coarse sand'; Pol. (dial.) *żarstwa*, *żerstwa* f. 'coarse sand'

There are several problems regarding the proposed connection between the Indo-Iranian and Balto-Slavic words, both within and between the branches.

YAv. *zarštuua-* 'stone' has been compared to Skt. *dṛṣád-* f. 'stone, mill stone' (Insler 1999), under the assumption that the Sanskrit anlaut *d-* reflects a dissimilated **ǰ-*. Such a dissimilation is not unparalleled, cf. *dásyati* 'to waste, become extinguished' ~ *jásyati* 'to be starved, disappear', but here the development seems to be conditioned by a following *-y-* (Kulikov 2012: 536 ff., 551 ff.). Moreover, *dṛṣád-* seems to show a suffix *-ád-* which would be rather unlikely from an Indo-European perspective; suffixes generally do not contain *media*. Insler (1999) reconstructs an ablauting *d*-stem based on the idea that YAv. *zarštuua-* goes back to a nom.sg. **ǰérs-d-s*, whereas Skt. *dṛṣád-* reflects the oblique stem **ǰrs-éd-*. According to him, this would also explain the voiceless *t* in Avestan as the result of levelling from the strong stem, but this is mere speculation.[98] Moreover, YAv. *zarštuua-* may equally well reflect a zero-grade in the root with the regular sound change **r̥s* > YAv. *arš* (see de Vaan 2003: 522).

Balto-Slavic displays a host of variants which nevertheless are semantically very close and probably reflect the same Proto-Balto-Slavic form (for a more detailed analysis of the material, see Young 2005; also Derksen 2015: 252). The attested forms vary in terms of initial **ǵ(ʰ)* (Baltic) vs. **g(ʰ)* (Slavic) followed by **-u̯-* (Baltic and Slavic) or not (Slavic), and in terms of **-st(u)-* (Slavic) vs. **-zd-* (Baltic and Slavic). The vacillating initial consonant is probably connected to the Balto-Slavic depalatalization before resonants, although the details are unclear.[99] As for the **-u̯-* in the root, Young assumes that it originated in the suffix **-tuo/eh₂-*. In forms like Lith. *žvirgždas* and Ru. *gverstá*, then, the position of **-u̯-* is the result of "anticipatory displacement". The Novgorod form *gver-*

98 Interestingly, the parallel Insler offers for **ǰérs-d-s* / **ǰrs-éd-* and the levelling in Avestan is OAv. *-biš-* 'medicine' ~ YAv. *bišaziia-* 'to cure' ~ Skt. *bhiṣáj-* 'physician', which is likely a non-Indo-European substrate word (Lubotsky 2001b: 310). Even if it were old, it would not be compelling, however, since there is no evidence that OAv. *-biš-* contains the suffix **-(a)ǰ-*.

99 As no root ablaut is attested, the alternation between **ǵ(ʰ)* and **g(ʰ)* is difficult to explain within Kortlandt's (1978b) framework, which assumes that palatals were depalatalized before resonants and a following back vowel. Assuming that depalatalization happened irrespective of the vocalism, it would be difficult to explain the restoration of palatal **ǵ(ʰ)*, as there is no model.

stvá would then reflect an intermediate form, with *-u̯- in both root and suffix. Alternatively, both the root and the suffix may originally have had *-u̯-, after which the various languages and dialects dissimilated either the first or the second *-u̯- (Anthony Jakob, p.c.). In this scenario, one would have to assume that Iranian dissimilated the *-u̯- of the root.[100]

Finally, according to Young (2005), *-zd-* reflects the original form, whereas devoiced *-st(u)-* reflects *-zd- + -tuo/eh$_2$-. This would allow for a connection between Balto-Slavic *ǵrzd-tuo/eh$_2$- and a group of words denoting various types of cereals, represented by Lat. *hordeum* n. 'barley' < *g^{h}(o)rsd-, OHG *gersta* f. 'barley' < *g^{h}ersd-, Alb. *drithë* f. 'cereal, grain', and Hitt. *karaš* n. 'wheat, emmer wheat'. However, given that *ǵ$^{(h)}$(u)rstuo/eh$_2$- 'stone, gravel, sand' has no agricultural connotation, it is likely unrelated to the cereal words.[101] Furthermore, Ru. (dial.) *gverzdá* is difficult to explain if *-zd-* is original, since in that case the *-u̯- in the root cannot be explained as displaced from the suffix. Rather, we may assume that the variants with voiced *-zd-* are secondary. In the case of Lith. *žvirgždas* etc., the voicing could have been taken over from Lith. (dial.) *žiegždrà* f. 'coarse sand' ~ OPr. *sixdo* f. 'sand', which seems to reflect a different root.

In sum, the Balto-Slavic material is difficult to account for and any explanation must invoke irregular and/or analogical developments. While the Balto-Slavic and Iranian words are difficult to separate, the etymology is classified as doubtful, due to the many formal problems.

3.4.10 *g^{w}rh$_3$-e/o- *'to devour, swallow'*

Indo-Slavic exclusivity	Etymology	Shared innovation	Typology
Yes	Doubtful	Possible	^{V}Derivation

Indo-Aryan: Skt. *giráti* 'to devour, swallow'
Iranian: Psht. *nγaṛ-* 'to swallow'; Wakh. *nəž(γ)ər-* 'to swallow'
Baltic: –

100 If true, this would be a further indication that Skt. *dṛṣád-* is unrelated, as there was no motivation for dissimilation of the initial cluster here.

101 A semantic change from 'cereal' > 'sand' in Balto-Slavic and Iranian is unlikely. Although the opposite change from 'sand' > 'grain' is not inconceivable, it is extremely unlikely that Latin, Germanic, Albanian, and Hittite independently underwent this innovation.

Slavic: OCS *požrěti*, *požьrǫ* 'to swallow, devour'; ORu. *žьrati*, *žьru* 'to eat (of animals), gobble'; Pol. *żreć*, *żrę* 'to eat greedily'; Sln. *žrẹ́ti*, *žrèm* 'to eat (of animals), gobble'

Arntz (1933: 45) lists the present stem now reconstructed as **g^{w}rh$_3$-e/o-* as an Indo-Slavic isogloss. The root is widely attested in other stem types, e.g., Arm. aor. *eker* 'ate', Gr. βιβρώσκω 'to eat, digest', Lat. *vorō* 'to devour', but a present stem **g^{w}rh$_3$-e/o-* does not seem to be found outside of Indo-Iranian and Slavic.

However, the expected outcome of **g^{w}rh$_3$-e/o-* in Slavic is ***gъre/o-*, since the labiovelar would have coloured the vocalized **r̥* to **ur* in Proto-Balto-Slavic.[102] Thus, the palatalization in the attested form OCS *po-žьrǫ* etc. implies that it is a secondary formation within Slavic rather than a direct cognate to Skt. *giráti*. The palatalization may have originated in the aorist OCS *po-žrětъ* 'devoured'.

Nevertheless, the parallelism in the paradigm of **g^{w}erh$_3$-* in Indo-Iranian and Slavic is noteworthy. A thematic present with zero-grade in the root is only attested for seven roots in Old Church Slavic (Vaillant III: 189–190). These all have corresponding root aorists (e.g., OCS *po-žrětъ* 'devoured'), which is also the case for Skt. *giráti* (aor. *gar-*/*gr̥-*). It is not impossible that a phonologically regular form **gъre/o-* would have existed in Pre-Proto-Slavic, only to be replaced by **žьre/o-* by analogy to the aorist. However, as this is impossible to verify, the isogloss is classified as uncertain.

3.4.11 *Huep- *'to call'*

Indo-Slavic exclusivity	Etymology	Shared innovation	Typology
Yes	Doubtful	Possible	Root

Indo-Aryan: –
Iranian: OAv., YAv. *ufiia-* 'to sing'; Sogd. BMS *w'β* 'to say, speak'
Baltic: –
Slavic: OCS *vъpiti*, *vъpijǫ* 'to call, cry out'; Ru. *vopít'*, *vopljú* 'to cry out, wail'; Cz. *úpěti*, *úpím* 'to wail, howl'; SCr. *vàpiti*, *vàpijēm* 'to cry out, summon'

102 The origin and conditioning factors of the reflexes PBSl. **ir*/*ur* < PIE **r̥* are debated, cf. p. 13, fn. 13.

Iranian and Slavic share a possible verbal root **Huep-* 'to call'. Av. *ufiia-* 'to sing' has traditionally been connected to Skt. *vabh-* 'to weave' with secondary *f* < **bʰ* (AirWb.: 1346; LIV: 658). However, as Cheung (2007: 401) points out, the other Iranian languages show that we are dealing with two separate roots. In East Iranian, *β* has been levelled throughout the paradigm based on the verbal adjective **uβda-* < **ufta-*, cf. Sogd. *w'β*. The *-f* in, e.g., Sogd. CM *w'f* 'to weave' may be due to laryngeal devoicing in Iranian (Kümmel 2012a).

As for the Slavic verb, it is usually compared to Latv. *ūpêt* 'to howl' (LEW: 1169). However, the Latvian verb is likely denominal from Latv. *ũpis* 'owl', cf. also Lith. *ũpas* 'echo' etc. The Baltic words are probably related to CS *vypl'ъ* 'seagull' (Derksen 2008: 535), reflecting PBSl. **uHp-*, possibly from **Hup-* with metathesis. OCS *vъpiti* 'to call, cry out' would then have to contain a secondary zero-grade.

While it is possible to compare the Iranian and Slavic forms, the connection is uncertain, and the words (especially in Slavic) could also reflect later onomatopoeic formations.

3.4.12 *h_1ēd / *h_1ōd *'then, and, so'*

Indo-Slavic exclusivity	Etymology	Shared innovation	Typology
Uncertain (Albanian)	Doubtful	Possible	[N]Derivation

Indo-Aryan: *ā́t* adv. 'afterwards, then, and, further, so'
Iranian: OAv. *āṯ*, YAv. *āaṯ* adv. 'afterwards, then, and'
Baltic: Lith. *õ* conj. 'and, but', *ẽ́* conj. 'and, but, however'
Slavic: OCS *a* conj. 'and, but'; Ru. *a* conj. 'and, but'; Pol. *a* conj. 'and, but'; SCr. *a* conj. 'and, but'

Indo-Iranian adverbs reflecting PIIr. **Hāt* 'afterwards, and, then' and Balto-Slavic conjunctions meaning 'and, but' have been compared and constitute a potential Indo-Slavic isogloss. Derksen (2015: 339) reconstructs **h₁ōd* for Lith. *õ* and the Indo-Iranian and Slavic forms. Fraenkel (LEW: 117–118) also supports this, dismissing the idea that Lith. *õ* would be borrowed from Slavic, but remarks that Lith. *ẽ́* may just as well be the true cognate of PIIr. **Hāt*. Mayrhofer (EWAia I: 163) tentatively connects PIIr. **Hāt* to Lith. *ẽ́* and OCS *i* 'and', the latter being unlikely, since it should rather reflect, e.g., **h₁ei* (Derksen 2008: 207).

Additionally, Albanian *e* 'and' has been connected (Orel 1998: 85), although it has alternatively been explained as a borrowing from Latin *et* 'and' or Slavic **a* 'and, but'.

As for the relationship between the Balto-Slavic and Indo-Iranian forms, I see four possible scenarios: 1) Lith. *õ* and Slav. *a* go back to **h₁ōd* and are related to Indo-Iranian **Hāt*. 2) Lith. *õ* is borrowed from Slavic *a*, which reflects **h₁ōd* and is related to Indo-Iranian **Hāt*. 3) Lith. *õ* and Slavic *a* are related and reflect **h₁ōd* (or **h₁ād*), whereas Lith. *ẽ́* is related to Indo-Iranian **Hāt*, going back to **h₁ēd*. 4) Lith. *õ* is borrowed from Slav. *a*, which together with Lith. *ẽ́* reflects **h₁ēd* and is related to Indo-Iranian **Hāt*. In this scenario, the Slavic development is paralleled by *azъ* 'I' < *jazъ* < **ězъ* < **h₁eǵ-om*, where **j-* was apparently lost, but it is unexpected that there is no attested variant of Slav. *a* with initial *j-*, unlike in the case of *azъ*, *jazъ* 'I'.

Scenarios 1 and 2 have the disadvantage of leaving Lith. *ẽ́* without an etymology. Scenario 3 leaves Lith. *õ* and Slav. *a* without an Indo-European etymology (since it is unlikely that **h₁ēd* was remade to **h₁ād* after the productive Balto-Slavic ablative ending **-ād*). Scenario 4 explains the variants *õ* and *ẽ́* in Lithuanian, as well as the origin of both the Baltic and Slavic forms. The reconstruction **h₁ēd* is supported by the Hittite pronominal forms abl.sg. *kēt* 'from this' < **ḱéd*, instr.sg. *apet* < **Hobʰéd* (see further Kloekhorst 2008: 191, 426). In Core Proto-Indo-European, an abl.sg. **h₁é-d* may have undergone monosyllabic lengthening, yielding **h₁ēd*.

However, scenario 4 does not take into account Alb. *e* 'and', which, if inherited, can reflect **h₁ōd* (but not **h₁ēd*). As **ē* and **ō* merge in Indo-Iranian, it cannot be determined if PIIr. **Hāt* is closer to Albanian or Balto-Slavic, or if all three branches share **h₁ōd*, in which case Lith. *ẽ́* is left unexplained. Ultimately, this means that the isogloss is uncertain.

3.4.13 *h₁iti *'so, in this manner'*

Indo-Slavic exclusivity	Etymology	Shared innovation	Typology
Uncertain (Italic)	Doubtful	Possible	[N]Derivation

Indo-Aryan: Skt. *íti* adv. 'so, in this manner'
Iranian: OAv. *ūitī*, YAv. *uiti* adv. 'so, in the following manner'
Baltic: Lith. *ìt* adv. 'as if, like'
Slavic: –

Lith. *ìt* 'as if, like' has often been connected to Skt. *íti* 'so, in this manner' (LEW: 189).[103] The quality of the lost final vowel in the Baltic form is uncertain, but according to Skardžius (1938: 87) the pre-vocalic variant Lith. *ič* (< **itį*) shows that *ìt* derives from **iti*. This adverb possibly contains the pronominal stem **h*$_1$*i*- (Smoczyński 2018: 438) with the Indo-Anatolian abl.sg. ending **-ti*, cf. **h*$_1$*eti*, **proti*. In this case, **h*$_1$*iti* may be understood as an archaic form that underwent a shared lexicalization in Indo-Slavic.

However, Skt. *íti* has alternatively been compared to Lat. *ita* 'in the same way as, thus', which may be connected under a reconstruction **ith*$_2$ with vocalization of the final laryngeal (thus Dunkel 2014: 368). Possibly, Lith. *ìt* could also be included in this cognate set. This etymology has the disadvantage that *(*H*)*itH* is morphologically opaque, but it cannot be rejected on phonological or semantic grounds, which leaves the potential Indo-Slavic isogloss uncertain.

3.4.14 *h$_2$eid^{h}-smo- *'firewood'*

Indo-Slavic exclusivity	Etymology	Shared innovation	Typology
Uncertain (Germanic)	Doubtful	Possible	^{N}Derivation

Indo-Aryan: (Skt. *idhmá*- m. 'fuel, firewood')
Iranian: YAv. *aēsma*- m. 'firewood'; MiP Pahl. *ēzm*, Man. *'ymg* 'firewood'; MoP *hēzum* 'firewood'; Sogd. B *zmy* 'firewood'
Baltic: Lith. (dial.) *iesmẽ* f. 'amount of firewood that is thrown into the oven or stove at the same time'
Slavic: –

Arntz (1933: 56) listed the Lithuanian and Avestan words, which have traditionally been compared (IEW: 11–12), as an Indo-Slavic isogloss. The stem is generally derived from **h*$_2$*eid*^{h}- 'to kindle' (cf. Skt. *edh*- 'to kindle', Gr. αἴθω 'to kindle'), which is not attested as a verbal stem in Baltic. However, the etymology must be considered doubtful, since the acute root of Lith. *iesmẽ* remains unexplained under this reconstruction (Derksen 2015: 197). Yet, the words are difficult to separate given their semantic and (almost) formal similarity. A poten-

103 OAv. *ūitī*, YAv. *uiti* may continue **h*$_1$*iti* with analogical anlaut taken from *uta* 'and'.

tial explanation is that the Lithuanian acute was introduced by analogy from the zero-grade *h_2id^h-, which had undergone laryngeal metathesis to *ih_2d^h- (Pronk 2011: 315).

Even if the etymology is accepted, however, a problem is ON *eimr* m. 'fire, smoke, steam', which could reflect *h_2eid^h-*smo*-. Although *h_2oi-*mo*- would be a more straightforward reconstruction, OHG *eit* m. 'fireplace, pyre' < *h_2oid^h-*o*- (cf. Skt. *édha*- m. 'firewood') ensures the continuation of *h_2eid^h- in Germanic, which is widely attested in Indo-European, including in verbal stems in Indo-Iranian and Greek (LIV: 259).[104] Semantically, ON *eimr* m. 'fire, smoke, steam' is distinct from the Iranian-Baltic correspondence, so it could be argued that it reflects an independent formation, or that Indo-Slavic underwent a shared semantic shift, but this remains uncertain.

3.4.15 *$h_2$sus-ko- *'dry'*

Indo-Slavic exclusivity	Etymology	Shared innovation	Typology
Yes	Doubtful	Possible	NDerivation

Indo-Aryan: Skt. *śúṣka*- adj. 'dry'
Iranian: YAv. *huška*- adj. 'dry'; OP *ʰuška*- adj. 'dry'; MiP Pahl. *hušk* adj. 'dry'; MoP *xošk* adj. 'dry'; Khot. *huṣka*- adj. 'dry'; Oss. I *$x_o$ysk'* / D *xusk'*(*æ*) adj. 'dry'; Psht. *wuč* adj. 'dry'; Wakh. *wəsk* adj. 'dry'
Baltic: Lith. *sùskis* m./adj. 'mange; mangy'; Latv. *sušķis* m./adj. 'mange; mangy, unclean'
Slavic: –

Arntz (1933: 52) listed the above Indo-Iranian and Baltic velar-suffixed forms as an isogloss. A direct comparison is also advocated by Wodtko, Irslinger & Schneider (2008: 346).

According to Lubotsky (1985), Indo-Iranian **Hsuška*- is a denominal formation from the PIE adjective *$h_2(e)s$-*us*-, since *-*ka*- is not a deverbal suffix. This innovative *ka*-stem would eventually have replaced the original adjec-

104 Conversely, a root *h_2ei- 'to kindle' is only inferred based on the idea that *h_2eid^h- is an extended variant of the root of *h_2ei-*es*- 'copper', which is semantically uncompelling. Furthermore, *h_2ei- is not found in any other nominal or verbal derivations.

tive. The Baltic words can in principle be derived from a similar *ko*-stem, with the difference that here the Proto-Indo-European adjective was continued as a thematic stem, viz. Lith. *saũsas* 'dry'. In Baltic, *$*h_2$sus-ko-* would then have acquired more specific semantics than in Indo-Iranian. However, it is also possible to view Lith. *sùskis* etc. as an inner-Baltic formation based on the deverbal noun *sùsas* m. 'mange, ringworm, scabies' (Smoczyński 2018: 1331). This derivational pattern is paralleled by, e.g., *strùtos* f.pl. 'manure, urine' ~ *srùtkis* m. 'any old thing, junk', and has the advantage of explaining the semantic closeness between Lith. *sùsas* m. 'mange, ringworm, scabies' and *sùskis* m./adj. 'mange; mangy'.

3.4.16 *h_2ueh_1-iu- *'wind'*

Indo-Slavic exclusivity	Etymology	Shared innovation	Typology
Yes	Doubtful	Possible	NDerivation

Indo-Aryan: Skt. *vāyú-* m. 'wind, air, god of wind'
Iranian: YAv. *vaiiu-* m. 'air, atmosphere, a god'
Baltic: Lith. *vė́jas*, *vė́jus* m. 'wind'; Latv. *vējš* m. 'wind'
Slavic: –

Schmidt (1872: 50), Arntz (1933: 50), and Porzig (1954: 169) take the Indo-Iranian *u*-stems (EWAia II: 544) and Lith. *vė́jas* (LEW: 1216) as an Indo-Slavic isogloss. While the suffixes of these words do not match, some Lithuanian varieties show a *u*-stem (Derksen 2015: 496). However, this may be a dialectal innovation, given that Latv. *vējš* also presupposes an *o*-stem. An *o*-stem has been argued to be reflected in YAv. voc.sg. *vaiiō*, acc.sg. *vaēm* (AirWb.: 1357–1358). Although the vocative probably reflects a regular sound change *-*iau* > *-iiō* (de Vaan 2003: 366), the accusative *vaēm* is more difficult to explain away (de Vaan 2003: 326). Remmer (2011) argues that *vaēm* is secondary to a more archaic acc.sg. *vaiiąm* (Ny 1.1), which may continue an amphikinetic acc.sg. *h_2ueh_1-iou-m* with Stang's Law. Indeed, it seems more economical to assume that *vaēm* is secondary than to reconstruct an *o*-stem next to a *u*-stem for Proto-Indo-Iranian based on a single form in an otherwise uniform paradigm.

3.4.17 *ieh_2- *'to drive'*

Indo-Slavic exclusivity	Etymology	Shared innovation	Typology
Yes	Doubtful	Possible	^{V}Derivation

Indo-Aryan: Skt. *yā́ti* 'to drive (fast), speed'
Iranian: –
Baltic: Lith. *jóti, jója* 'to ride'; Latv. *jât, jâju* 'to ride'
Slavic: OCS *jaxati, jadǫ* 'to go, ride'; Cz. *jeti, jedu* 'to ride, drive'

The root *ieh_2- (possibly *h_1ieh_2-) is attested in several branches, e.g., Lat. *iānus* m. 'arched passage, doorway', OIr. *áth* m. 'ford' < *$iātu$-, perhaps OIr. *á* 'chariot' (Matasović 2009: 434–435), ToA *yā-* 'to go, ride', ToB *iyā-* 'to go, travel; lead', reflecting a reduplicated present (Adams 2013: 71). However, the secondarily suffixed verbal stems of Lith. *jóti, jója* and Cz. *jeti, jedu* (see Derksen 2008: 154; 2015: 212–213) probably reflect an old root present corresponding to Skt. *yā́ti* (LIV: 309–310). Meillet (1926: 171) and Arntz (1933: 51) took the verbal stem of *ieh_2- as an Indo-Slavic isogloss, although they did not know about the Tocharian evidence. In either case, the root present is a potential isogloss, provided that the analysis of the Balto-Slavic forms is correct, as Tocharian has a different stem. However, as the root present is an archaic category, it is not unlikely that *ieh_2- is a shared archaism.

3.4.18 *$ǩeh_1k^{(w)}$-o/eh_2- *'green edible plant'*

Indo-Slavic exclusivity	Etymology	Shared innovation	Typology
Uncertain (Germanic)	Compelling	Possible	^{N}Derivation

Indo-Aryan: Skt. *śāka-* n. 'potherb, vegetable' (Sū.+)
Iranian: –
Baltic: Lith. *šékas* m., *šéka* f. 'freshly mown green crops for feeding animals'; Latv. *sę̂ks* m., *sę̂ka* f. 'freshly mown grass (also clover, vetch) for feeding animals'; OPr. *schokis* m. 'grass' (EV)
Slavic: –

Arntz (1933: 43) listed the Sanskrit and Baltic words as an isogloss. However, ON *há* f. 'aftermath, hay of the second crop', which can reflect **ḱeh₁kʷ-eh₂-* (de Vries 1977: 199), cannot be excluded as an additional cognate.[105] On the other hand, it seems quite attractive to reconstruct ON *há* as PGm. **hawō-* and connect it to ON *hey* n. 'hay' < PGm. **hauja-*, which is derived from **hawwan-* 'to hew, chop' < **koh₂u-*.

The relationship between East Baltic **śēkas* and OPr. *schokis* is unclear. Since *sch-* is not regular before **ā*, Mažiulis (2012) assumes an original ablauting stem **śēka-* / **śāka-*, where **s-* < **ś* was palatalized before **ē*. The origin of this supposed ablaut is unclear, however.

3.4.19 *ḱei- *'to be orphaned'*

Indo-Slavic exclusivity	Etymology	Shared innovation	Typology
Yes	Doubtful	Possible	Semantics

Indo-Aryan: Skt. *śayú-* m. 'orphan, fatherless one'
Iranian: YAv. *saē* 'orphan'; MiP Man. *s'ywg* 'orphan'; Khot. *syūta-* 'orphan'; Oss. I *sizær* / D *sezær* 'orphan'
Baltic: Lith. *šeirỹs* m. 'widower', *šeirẽ* f. 'widow'
Slavic: OCS *sirъ* adj. 'orphaned'; Ru. *síryj* adj. 'orphaned'; Cz. *sirý* adj. 'abandoned, lonely, childless'

Arntz (1933: 53) listed the above words as an Indo-Slavic semantic isogloss (see also Vasmer II: 628; Derksen 2015: 442).

The Lithuanian words derive from an unattested adjective **šeira-* (Smoczyński 2018: 1361), cognate with the Slavic adjective, which likely did not only mean 'orphaned', but also 'abandoned' vel sim., cf. Cz. *sirý* 'abandoned, lonely, childless'.

Formally, **ḱei-u-* and **ḱei-ro-* can be derived from **ḱei-* 'to lie', although the semantic connection is unclear. Other forms with similar semantics, presumably from the same root **ḱei-* 'to lie', include **ḱoi-m-* (Latv. *sàime* f. 'members of a household', ON *heimr* m. 'home') and **ḱei-uo-* (Goth. *heiwa-frauja-*

105 According to Eichner (1975: 81 fn. 5), Hitt. *kikla-* 'kind of herb (?)' reflects **ḱēko-lo-*, but the assumed syncope is not regular in Hittite.

m. 'master of the house', Lat. *cīvis* m./f. 'citizen', Latv. *siẽva* f. 'wife', Skt. *śéva-* adj. 'dear, precious, friendly'). This shows that **ḱei-* is often the basis for nominal derivatives denoting various familial relationships, which could explain the meaning 'orphan' of the Indo-Iranian and Balto-Slavic forms in question. Since they are not formally identical, it is difficult to assess the likelihood of a shared semantic development, but independent innovations can hardly be excluded.

Arm. *sēr* 'fondness, love' and the denominal *sirem* 'to love' reflect **ḱei-ro-*. Although semantically distant, it is difficult to exclude that this reflects the same formation as the Balto-Slavic forms, which would allow the proposed isogloss to be definitively rejected.

3.4.20 *ḰolH-to- *'cold'*

Indo-Slavic exclusivity	Etymology	Shared innovation	Typology
Yes	Doubtful	Possible	NDerivation

Indo-Aryan: –
Iranian: YAv. *sarəta-* adj. 'cold'; MiP Pahl. *sard* adj. 'cold'; MoP *sard* adj. 'cold'; Sogd. B *srt* adj. 'cold'; Khot. *sāḍa-* adj. 'cold'; Oss. *sald* 'cold' (noun), I *sælyn* / D *sælun* 'to freeze'
Baltic: Lith. *šáltas* adj. 'cold'; Latv. *salts* adj. 'cold'; OPr. *salta* adj. 'cold'
Slavic: –

The Iranian and Baltic forms have been derived from a shared adjective stem (AirWb.: 1566; LEW: 960–961; Derksen 2015: 439). The root **ḱelH-* is further reflected in, e.g., Skt. *śiśira-* m./n. 'early spring, cold, frost', PGm. **hihelōn-* f. 'hoarfrost' (Kroonen 2013: 226), Lith. *šálti* 'to freeze', Lith. *šalnà* f., Latv. *salna* f. 'light frost', OCS *slana* f. 'hoarfrost'. Arm. *sarn* 'ice, cold' is unrelated (Martirosyan 2010: 569).

The etymology and reconstruction of **ḱolH-to-* are problematic for two reasons. First, the vocalism of YAv. *sarəta-* etc. is ambiguous, reflecting **ḱelH-to-*, **ḱolH-to-*, or **ḱlH-to-*. Although not in Avestan, verbal stems from this root are attested in, e.g., MiP Pahl. *afsar-* 'to cool down', caus. *afsār-* 'to cool', Parth. *wys'r* 'to cool off', Khwar. *sry-* 'to become cold, freeze', caus. *s'ry-* (Cheung 2007: 336–337). While verbal adjectives in **-to-* occasionally show full grade in the root in Indo-Iranian (cf. AiGr. II, 2: 551), it is more straightforward to take YAv. *sarəta-*

etc. as a regular verbal adjective **ḱlH-to-*. Second, the Baltic forms look like regular deverbal adjectives from the infinitive stem, e.g., Lith. *šálti* 'to be freezing, cold'. The Baltic *o*-grade has been suggested to originate in the perfect stem (LIV: 323); alternatively, it could be denominal.

In sum, there is no compelling reason to equate the Iranian and Baltic forms directly under a morphologically peculiar **ḱolH-to-*, and the isogloss is at best uncertain.

3.4.21 *keh$_2$-mo- *'desire'*

Indo-Slavic exclusivity	Etymology	Shared innovation	Typology
Yes	Doubtful	Possible	NDerivation

Indo-Aryan: Skt. *kā́ma-* m. 'wish, desire'
Iranian: OAv., YAv. *kāma-* m. 'wish, desire'; OP *kāma-* m. 'wish, desire'; MiP Pahl. *kām*, Man. *k'm*, *q'm* 'will, desire, purpose'; MoP *kām* 'will, desire, purpose'; Sogd. B *k'm*, C *q'm* 'wish'; Oss. *kom* 'consent'
Baltic: Latv. *kãmêt*, *kãmẽju* 'to hunger'
Slavic: –

Arntz (1933: 42) listed this *mo*-stem as an isogloss. The etymology, according to which Latv. *kãmêt* 'to hunger' is denominal from an unattested Baltic **kāma-*, is further supported by Fraenkel (LEW: 221) and Smoczyński (2018: 497).

The comparison is formally and semantically possible, but the precise origin of PIIr. **kaH-ma-* is unclear. Within Indo-Iranian, the root **kaH-* 'to desire' (< **keh$_2$-*, cf. Lat. *cārus* adj. 'dear', OIr. *caraid* 'to love') can hardly be separated from **kanH-* / *čanH-* 'to be pleased with', cf. Skt. aor. *ákāniṣ-*, *cánas-* n. 'delight, satisfaction, tendency', YAv. *cinman*(*a*)- n. 'desire'. Although the roots are semantically slightly different synchronically (Narten 1964: 94), **kanH-* / *čanH-* may have been extracted from a nasal present stem underlying Skt. pres.ptc. *kā́yamāna-*, OAv. 1sg.pres.subj. *kaiiā* < **k-n-H-ie*/*o-*, cf. Skt. *mathāyáti* 'to rob, take away' with the corresponding nasal present *mathnā́ti* 'id.'. Thus, PIIr. **kaH-ma-* may reflect either **keh$_2$-mo-* or **knH-ma-*, of which only the former can be compared with Latv. *kãmêt*.

Against a reconstruction **keh$_2$-mo-*, it may be argued that nouns in *-mo-* generally take *o*-grade in the root (Brugmann 1892: 160). An *e*-grade rather points to an adjective, cf. **ḱieh$_1$-mo-* (p. 79), but there is no indication that PIIr. **kaH-*

ma- was originally an adjective. The connection to Latv. *kãmêt* should therefore be considered doubtful.

3.4.22 *kenH- *'to dig'*

Indo-Slavic exclusivity	Etymology	Shared innovation	Typology
Yes	Doubtful	Possible	Root

Indo-Aryan: Skt. *khaṉ-* 'to dig', *khaní-* adj. 'burrowing', (Ragh.) f. 'mine', (Lex.) *khanī-* f. 'mine'
Iranian: YAv. *kan-*, *kəṇti* 'to dig'; OP *kan-* 'to dig'; MiP Pahl. *kan-*, Man. *qn-* 'to dig; to raze, destroy'; MoP *kandan* 'to dig (out)'; OKhot. *kaṃggan-* 'to dig'; Sogd. BM *kn-*, CM *qn-* 'to dig (out)'; Psht. *kan-* 'to dig'; Wakh. *kʁın-* 'to dig'
Baltic: Lith. *kìnis* m. 'den, lair (of a pig, boar, bear); bird's nest; bedding, litter for animals'
Slavic: –

Arntz (1933: 36) compares Lith. *kìnis* m. to Skt. *khaní-* f. directly, but the difference in gender suggests that these are independent formations. The adjective *khaní-* 'burrowing' can hardly be a direct cognate of the Lithuanian noun. However, it is possible that Lith. *kìnis* derives from the root **kenH-*, which is well attested in Indo-Iranian, but not otherwise found in Balto-Slavic or other branches of Indo-European.[106]

Indo-Aryan and Iranian do not agree as to the aspiration in the anlaut (see EWAia 1: 446 with lit.). Skt. *kh-* has traditionally been explained as analogical from *khā́-* f. 'spring, source', but this is semantically uncompelling. It remains unclear exactly from where the Sanskrit aspiration originates,[107] but it does not preclude a reconstruction **kanH-* for Proto-Indo-Iranian.

106 OPhryg. *keneman* '(part of) a monument' is formally possible (see further Lubotsky 1988a: 15), but semantically much too uncertain to be plausibly connected here. Lat. *caenum* n. 'mud, filth, slime' has traditionally been adduced (LEW: 254; cf. also Walde 1910: 108), but the connection to Lith. *kìnis* is formally impossible.

107 Kümmel (2000: 151–152) derives **kanH-* from a nasal present of **kaH-* (which would be preserved in *khā́-* 'spring, source'), which is possible, but still does not explain the origin of the initial aspirate.

Admittedly, the derivation of Lith. *kìnis* from **kenH-* 'to dig' is very uncertain (thus Smoczyński 2018: 545), since the semantics of the former allow for alternative interpretations. However, the etymology cannot be rejected on formal or semantic grounds and will therefore be classified as an uncertain root isogloss.

3.4.23 *k$^{(w)}$erḱ- *'to become lean, emaciate'*

Indo-Slavic exclusivity	Etymology	Shared innovation	Typology
Yes	Doubtful	Possible	^{V}Derivation

Indo-Aryan: Skt. *kṛ́śyati* 'to become lean', *cakárśa* 'to become lean'
Iranian: –
Baltic: Lith. *karšti, -ta, -ia* 'to reach the end of one's life, become frail with age, die; to ripen'; Latv. *kàrst, -tu* 'to grow old, ripen'
Slavic: Cz. *krsati, krsnouti* 'to decrease, decline'

Arntz (1933: 56) took the fact that verbal stems from the root **k$^{(w)}$erḱ-* 'to become lean, emaciate' are only attested in Balto-Slavic and Indo-Iranian as an Indo-Slavic isogloss. The root is further attested in the adjective **k$^{(w)}$rḱ-o-* 'lean, skinny', cf. ON *horr* 'lean', Skt. *kṛśá-* 'lean, thin, emaciated', Sogd. B *'ks-* 'small, thin'.

While it is true that no other branches continue verbal forms from **k$^{(w)}$erḱ-* (LIV: 355), there are no directly cognate formations in Indo-Iranian and Balto-Slavic. Sanskrit has a *ie*/*o*-present and a perfect that may be old (Kümmel 2000: 140). The acute intonation of Lith. *karšti*, which is inflected either as a *ie*/*o*-present or as a *sta*-present, has been attributed to the inchoative suffix **-sta-* (Smoczyński 2018: 495). Derksen (2015: 228) doubts this, since analogical *métatonie rude* is uncommon for verbs with *o*-grade. I find it difficult to reject, however, since the different inflections are synonymous. In this case, Lith. *karšti* may go back to a perfect form (explaining the *o*-grade) cognate with Skt. *cakárśa* (Kümmel 2000: 140), which is a potential isogloss.

3.4.24 *k$^{(w)}$leiḱ- *'to torment'*

Indo-Slavic exclusivity	Etymology	Shared innovation	Typology
Yes	Doubtful	Possible	Root

Indo-Aryan: Skt. *kleś-* 'to trouble, torment'
Iranian: –
Baltic: Lith. *klišas* adj. 'club-footed, bow-legged, lame, crooked', *klišės* f.pl. 'crab's claws, pincers', *klišti* 'to become deformed (about the foot), start limping'
Slavic: Ru. *kléšči* f.pl. 'claws, pincers'; Pol. *kleszcze* f.pl. 'pincers', (dial.) *kleścić* 'to castrate'; SCr. *klijèšte* f.pl. 'pincers', *klijèštiti* 'to squeeze'

Arntz (1933: 35) listed this root as an Indo-Slavic isogloss.

The Balto-Slavic root is compatible with **k$^{(w)}$leiḱ-*, but no shared Proto-Balto-Slavic derivatives can be reconstructed. The Lithuanian forms all seem to derive from the adjective *klišas* (Smoczyński 2018: 568), which suggests a basic meaning 'crooked' vel sim. In Slavic, all forms show a final **-t* that has been argued to originate in a nominal form **k$^{(w)}$loiḱ-t-ieh$_2$-* (Derksen 2008: 224). In that case, the verbal forms reflecting PSl. **klěstiti* must have been back-formed after, e.g., **pustiti*, **puščǫ* (ESSJ X: 23). In view of the semantics of the verb, i.e., 'to castrate; to squeeze', a denominal origin from a noun **klěšča* 'pincer' seems quite plausible.

Although formally comparable, the semantics of the Balto-Slavic and Sanskrit roots are not close enough to make this etymology compelling. It should be noted that the Balto-Slavic forms would also be compatible with **kleis-* or **ḱleis-* (with depalatalization). The forms could alternatively be compared to Skt. *śreṣ-* / *śleṣ-* 'to cling, stick to', YAv. *srišāiti* 'to stitch together' (LEW: 273; see Cheung 2007: 355 for additional Iranian cognates), which perhaps provide a better fit semantically than Skt. *kleś-* 'to trouble, torment'. The root **ḱleis-* is likely derived from **ḱlei-* 'to lean' (EWAia II: 671; LIV: 333) with an *s*-extension (desiderative?) constituting a possible shared innovation of Indo-Slavic.

3.4.25 *k$^{(w)}$o(n)Hd- *'to bite'*

Indo-Slavic exclusivity	Etymology	Shared innovation	Typology
Uncertain (Armenian)	Doubtful	Rejected	Root

Indo-Aryan: Skt. *khā́dati* 'to chew, bite, eat, digest'
Iranian: Parth. *x'z* 'to devour'; MoP *xāyīdan* 'to chew, gnaw, eat'; Bal. *khāδ-* 'to chew'; Khot. *khāś-* 'to eat, drink'
Baltic: Lith. *kąsti*, *kánda* 'to bite'; Latv. *kuôst*, *kuôžu* 'to bite'
Slavic: OCS *kǫsati*, *kǫsajǫ* 'to bite'; Ru. *kusát'*, *kusáju* 'to bite'; Pol. *kąsać*, *kąsam* 'to bite'; SCr. *kúsati*, *kûsām* 'to eat with a spoon'

Schmidt (1872: 47) listed this root as an Indo-Slavic isogloss. However, the etymology has been rejected in some more recent works (e.g., EWAia I: 451–452) and there are formal problems and possible additional cognates that must be addressed.

For Proto-Indo-Iranian, a root **kHaHd-* must be reconstructed, based on the consistent aspiration and length of the root vowel. It is often assumed that the aspiration is secondary from zero-grade forms of an original root **k$^{(w)}$eh$_2$d-* (cf. LIV: 344), but the details remain unclear.[108] Parth. *x'z* 'to devour' appears to show a root extension **-s-*, likely originally a suffix (Cheung 2007: 445). Arm. *xacanem* 'to bite, sting', which is incompatible with final **-d-*, can be explained similarly, and reflects an *s*-aorist according to Martirosyan (2010: 324 with lit.).[109] However, the closeness to the Parthian form could also point to an Iranian borrowing, especially given the productivity of *-s-* < **-ske/o-* in Iranian.

108 LIV refers to the zero-grade *khid-*, which is attested for the homonymous, but likely etymologically unrelated Skt. *khād-* 'to strike, press'. However, based on the short root vowel in the Iranian cognates, e.g., YAv. *vīxaδ-* 'to beat (the earth) apart' (Cheung 2007: 439), this root most likely reflects PIIr. *kHad-*. The vṛddhi vocalism in Skt. (JB) *s*-aorist 3pl. *akhātsur* and 3sg.perf. *cakhāda* is then entirely regular from **ē* and **o*, respectively, and need not be attributed to a laryngeal. The aspirated *kh-* in the zero-grade *khid-* < **kHd-* may thus be analogical from the full grade **kHad-*. The regular outcome of **kHd-* would likely have been **čid-* or **kid-*, since laryngeal vocalization in initial syllables (PIIr.) predates laryngeal aspiration (Indo-Aryan). Consequently, a zero-grade **k$^{(w)}$h$_2$d-* is an unlikely model of analogy for the aspirate in Skt. *khād-* 'to chew, bite, eat, digest'.

109 However, Skt. (JB) 3pl.aor. *akhātsur* cannot be used as evidence for an *s*-aorist to this root,

The Balto-Slavic situation is complicated. Baltic points to **kon(H)d-*, a form that could reflect a generalized nasal present stem (Derksen 2015: 232). Smoczyński (2018: 502) dates this development to post-Proto-Baltic times, but since the nasal is also found in Slavic it is likely Proto-Balto-Slavic. Slavic **kǫsati* thus corresponds in vocalism and nasal quality to Baltic, but the root ends in **-s-*. This is reminiscent of the Parthian and Armenian forms, but due to the nasal **kǫsati* cannot be an Iranian borrowing. Perhaps these forms are all better derived from an old sigmatic aorist.

Even if the potential Armenian cognate is left out of consideration, the Indo-Iranian and Balto-Slavic forms cannot easily be united under one reconstruction. The aspirated anlaut in Indo-Iranian normally corresponds to Slavic **x-*, but it is difficult to exclude that the aspiration (i.e., **kH-*) is secondary in Indo-Iranian. The *o*-grade vocalism of Balto-Slavic cannot be excluded for Indo-Iranian, but would be unexpected from a morphological point of view. One could assume that the Indo-Iranian forms derive from **knHd-*, which would explain the consistent lengthened grade vocalism, but this makes the origin of the aspiration all the more obscure.

3.4.26 *k^{w}(o)r-no- *'deaf, with mutilated ears'*

Indo-Slavic exclusivity	Etymology	Shared innovation	Typology
Yes	Doubtful	Possible	Semantics

Indo-Aryan: Skt. *kárṇa-* m. 'ear', *karṇá-* adj. 'long-eared, with a defect on the ears'

Iranian: YAv. *karəna-* m./adj. 'ear; deaf'; MiP Pahl. *karr*, Man. *kr*, *qr* adj. 'deaf'; MoP *kar* adj. 'deaf'; Sogd. BM *krn*, C *qrn* adj. 'deaf'; Khot. *kārra-* adj. 'deaf'; Psht. *kuṇ* adj. 'deaf'; Wakh. *kʰın* 'with mutilated ears (of sheep)'

Baltic: Lith. *kuřčias*, *kuřlas* adj. 'deaf'; Latv. *kuřns*, *kùrls*, *kuřls* adj. 'deaf'

Slavic: CS *krъnъ* adj. 'mutilated (with ears slit or cropped)'; Ru. (dial.) *kornój* adj. 'stocky, thickset'; SCr. *krn* adj. 'broken off, dented, knocked out (teeth), maimed', *krnja* adj. 'crop-eared, snub-nosed, toothless'; RuCS *črěnъ* m. 'handle'

as it belongs to the root *khād-*/*khid-* 'to strike, press' (EWAia II: 452), and might in any case be a secondary formation within Sanskrit (Narten 1964: 105–106).

Arntz (1933: 49) lists the above words as an Indo-Slavic isogloss.[110] However, the attested formations are not identical.

Within Indo-Iranian (EWAia I: 314–315; AirWb.: 455), **kárna-* 'ear' seems to be primary, from which a possessive adjective **karná-* 'having defective ears' is derived (cf. Skt. *śroṇá-* 'lame' << 'with bad hips' ~ *śróṇi-* f. 'hip'). Given the cognates in Indo-Aryan and Iranian, both the base and the derivative can be reconstructed for Proto-Indo-Iranian. Synchronically, the etymology of **kárna-* 'ear' is obscure.

In Baltic, there is a host of forms (LEW: 314–315).[111] Lith. *kuřčias* is derived from the synonymous Lith. *kuřtas* 'deaf', which synchronically looks like a derivative from Lith. *kùrti* 'to light a fire; to build'. However, it can hardly have been derived within Baltic, given the semantics.[112] The *l*-adjective is likely a Baltic innovation. Latv. *kuřns* corresponds to CS *krъnъ* which may be reconstructed as PBSl. **kurno-* (Derksen 2015: 540–541). In the various Slavic languages, the meaning is not restricted to 'ears', but refers to various kinds of mutilation or defects (Vasmer I: 628–629). Nevertheless, since the oldest meaning refers to 'ears', this may be due to semantic widening.

On the one hand, PIIr. **kárna-* 'ear', **karná-* 'deaf, having defective ears' vs. PBSl. **kurno-* 'deaf, with mutilated ears' share the suffix **-no-* and similar semantics, but on the other hand, the root ablaut is divergent, which precludes a direct comparison. A possible bridge between the branches may be found in RuCS *črěnъ* m. 'handle' (Arntz 1933: 36; see further Vasmer III: 321–322). If RuCS *črěnъ* goes back to an Indo-Slavic formation **kʷe/or-n-*, this may have meant 'handle' and referred to 'ear' metaphorically (whence Skt. *kárṇa-*).[113] From **kʷe/or-n-* 'handle, ear', possessive adjectives may then have arisen through thematicization of this athematic *n*-stem.

An alternative scenario is proposed by Fraenkel (1962: 315), in which the adjective **kʷ(o)r-no-* 'with mutilated ears', shared by Indo-Iranian and Balto-Slavic, is primary. PIIr. **kárna-* 'ear' would then be a back-formation from **karná-* 'deaf, having defective ears'. This seems more plausible than assuming

110 Lat. *curtus* 'mutilated, circumcised; imperfect' is according to de Vaan (2008: 158) derived from **(s)ker-* 'to shave, scratch off' rather than **kʷer-* 'to cut'. In any case, it does not bear any specific similarity in morphology or semantics to the Indo-Iranian and Balto-Slavic forms, and is better kept apart.

111 The accentuation of the various Balto-Slavic forms is a complicated issue that I will not go into here. The original accentuation of the Baltic forms cannot be determined (see Derksen 1996: 226).

112 Lith. *kuřsti* 'to become deaf' is doubtless denominative (Smoczyński 2018: 641).

113 Not here Welsh *carn* 'sword pommel', which requires a palatal or a plain velar (*pace* Vasmer III: 322; Pedersen 1909: 61).

an Indo-Slavic noun **k^{w}e/or-n-* 'handle, ear', but still does not offer an explanation for the divergent root ablaut in **k^{w}(o)r-no-* 'with mutilated ears'. Ultimately, the isogloss is uncertain.

3.4.27 *med^{h}u-h$_1$ed- *'honey-eater'*

Indo-Slavic exclusivity	Etymology	Shared innovation	Typology
Yes	Doubtful	Possible	^{N}Derivation

Indo-Aryan: Skt. *madh(u)vád-* adj. 'honey-eating'
Iranian: –
Baltic: –
Slavic: OCS *medvědь* m. 'bear'; Ru. *medvéd'* m. 'bear'; Pol. (dial.) *miedźwiedź* m. 'bear'; SCr. *mèdvjed* m. 'bear'

The Slavic word for 'bear' (Vasmer II: 110; Derksen 2008: 306) corresponds formally to Skt. *madh(u)vád-* 'honey-eating'. This is listed as an isogloss by Arntz (1933: 51).

The Slavic compound must be archaic since it preserves consonantal **u̯* (Dickenmann 1934: 144). Furthermore, it was no longer transparent for Slavic speakers, since new compounds like SCr. *mȅdojēd* 'honey-eater' were formed (see further ESSJ XVIII: 55).

Skt. *madh(u)vád-* 'honey-eating' (in German translation usually "Süsses essend", cf. KEWA II: 571) is attested in the tetrasyllabic nom.pl. *madh$_u$vádaḥ* (RV I.164.22a), which describes a (metaphorical) group of birds. According to Dickenmann (1934: 144; accepted by LEW: 207 and AiGr. I: Nachträge 207,8), the compound cannot be old, because *-uv-* is irregular after a light syllable (according to Sievers' Law). However, while **-uHá-* should regularly have yielded Skt. *-vá-* (cf. Kuiper 1987; Lubotsky 1997), this contraction could easily have been restored at the morpheme boundary between *madhu-* and *ád-*. Another Vedic compound *mádhvarṇas-* 'having sweet waves' (RV I.62.6d) is also tetrasyllabic.

While the form of Skt. *madh(u)vád-* 'honey-eating' does not preclude an archaic formation, it is difficult to exclude that it was created within Sanskrit, given the many parallels of *-ád-* 'eating' as a second member in compounds, including cases containing non-Indo-European words, e.g., *karambhắd-* 'porridge-eating'.

3.4.28 *m(e)itH-u- *'opposed'*

Indo-Slavic exclusivity	Etymology	Shared innovation	Typology
Uncertain (Italic)	Compelling	Possible	[N]Derivation

Indo-Aryan: Skt. *míthū* adv. 'wrongly, opposed, falsely', *mithuyā́* adv. 'falsely'
Iranian: –
Baltic: –
Slavic: ORu. *mitusъ* adv. 'opposite one another, criss-cross'; Pol. (dial.) *mituś* adv. 'across, criss-cross, the other way round'; Cz. (dial.) *mitvy* adv. 'in turn, alternately'

A connection between the above adverbs is advocated in Slavic etymological sources (Vasmer II: 139; Derksen 2008: 319), but the precise relationship is not elaborated upon. Based on Skt. *míthū* and Cz. *mitvy* (which shows that a *u*-stem is attested in Slavic), a *u*-stem **m*(*e*)*itH-u-* may be reconstructed. Here, I leave Skt. *mithuṇá-* adj. 'opposed, paired', YAv. *miϑβana-*, *miϑβara-* adj. 'paired' out of consideration, since they seem to reflect a heteroclitic *uer-*/*uen*-stem rather than an original *u*-stem (for a different view cf. EWAia II: 355). The same applies to Skt. *mithás* adv. 'contrary, variably, mutually', YAv. *miϑō* adv. 'wrongly, falsely', and OCS *mitě* adv. 'in turn, alternately'.

Lat. *mūtuus* adj. 'on loan, reciprocal' has been compared to the *u*-stem of Indo-Iranian and Slavic (Vasmer II: 139; Derksen 2008: 319), but the connection is uncertain. In Latin, old *u*-stem adjectives were normally not thematicized but turned into *i*-stems, cf. Lat. *gravis* 'heavy' < **graus* < **g*^{w}*reh*$_2$*-u-* and *lēvis* 'smooth' < **lēius* < **leh*$_1$*i-u-* (Fischer 1982; Schrijver 1991: 283–284). This rather suggests that *mūtuus* derives from an unattested *o*-stem **mūto-* 'object of change', which also was the basis for the denominal *mūtāre* 'to exchange, replace'. The stem **mūto-* may be derived from **mei-* 'to change' or *meitH-* (de Vaan 2008: 399).

Only if the Latin adjective is explained in this way (which is not necessarily justifiable) can **m*(*e*)*itH-u-* be considered as a compelling Indo-Slavic isogloss. The lexicalization of adverbs from various case forms of this stem was likely an independent development in the branches, given that the root ablaut does not match.

3.4.29 *nis-tio- *'(being) outside'*

Indo-Slavic exclusivity	Etymology	Shared innovation	Typology
Yes	Doubtful	Plausible	NDerivation

Indo-Aryan: Skt. *níṣṭya-* adj. 'external, foreign, strange'
Iranian: Orm. *pa-néx̌ta* 'outside, on the outside'[114]
Baltic: –
Slavic: OCS *ništъ* adj. 'poor, destitute'; Ru. *níščij* adj. 'destitute, poverty-stricken'; SCr. *nȉšt* adj. 'poor, destitute'

An etymological connection between these Sanskrit and Slavic words has long been assumed (Vasmer II: 222; EWAia II: 48), the problem being that the Slavic long vowel in **nīs-* does not match Skt. *niṣ-* (Derksen 2008: 353). It is possible that the long vowel was introduced by analogy to OCS *nizъ* 'down, below', but the Slavic form could also be an independent derivative *vis-à-vis* Skt. *níṣṭya-*.

The suffix **-tio-* forms adjectives from adverbs, cf. Skt. *nítya-* 'own, native, lasting' ~ Goth. *niþjis* 'relative', and **nis-tio-* is thus transparently built on **nis-*, reflected by Skt. *niṣ* 'out, forth, away, over, without, not-', OAv. *nīš* 'out'. While the derivational pattern is likely old, it is important to note that **nis-* is not attested outside Indo-Iranian. If the Slavic word is related, we may either assume that it has undergone a shift from 'being outside' >> 'being outside the community and therefore destitute' >> 'poor, destitute', or that **nis-tio-* originally had a broader scope of meaning, derived from the range of meanings of **nis-*, i.e., 'out; without' etc., after which Indo-Aryan and Slavic specified the semantics in different directions.

3.4.30 *pr(H)ḱ- *'rib, side, flank, chest'*

Indo-Slavic exclusivity	Etymology	Shared innovation	Typology
Yes	Doubtful	Possible	Root

114 Orm. *pa-néx̌ta* 'outside, on the outside' has also been derived from **niš-tara-*, cf. YAv. *ništara-* 'external', but Efimov's (2011: 294) reconstruction **ništiā-* is more plausible, since Ormuri seems to preserve final *-r* after apocope, cf. *cār* 'four' < PIr. **čaϑ̯ārа-*.

Indo-Aryan: Skt. *párśu-* f. 'rib; curved knife, sickle', *pārśvá-* n. 'flank, side', *pr̥ṣṭí-* f. 'rib'
Iranian: YAv. *pərəsu.masah-* 'having the size of a rib'; MiP Pahl. *pahlūg* 'side, rib'; MoP *pahlū* 'side, rib'; Sogd. M *prs'* 'hour, side', BM *prs'kh* 'side, rib' Khot. *pālsu-* 'rib, side; spoke of a wheel'; Oss. *fars* 'side', I *færsk* / D *færskæ* 'rib'; Psht. *puxtáy* f. 'rib'; Wakh. *pʏırs* 'rib'
Baltic: Lith. *pìršys* f.pl. 'chest (of a horse)'
Slavic: OCS *prьsi* f.pl. 'chest, bosom'; Ru. (arch.) *pérsi* f.pl. 'breast, bosom'; Pol. *pierś* f. 'breast, chest'; SCr. *pr̂si* f.pl. 'breast, chest'

Meillet (1926: 173) and Arntz (1933: 39) list the Indo-Iranian and Balto-Slavic forms as an isogloss. In Indo-Iranian, a *u*-stem is widely attested, alongside a thematicized *u*-stem (Skt. *pārśvá-* ~ Oss. *fars*, see Cheung 2002: 182). Skt. *pr̥ṣṭí-* seems to be a *ti*-derivative from the same root (EWAia II: 165). As Balto-Slavic has an *i*-stem, **pr(H)ḱ-* is classified as a potential root isogloss.

As noted by Derksen (2015: 358), the Balto-Slavic forms point to a laryngeal in the root, which is incompatible with Indo-Iranian. Unless the acute intonation is secondary, the etymology cannot be maintained. In that case, one may instead compare the Indo-Iranian words to OE *fealg* f. 'felly' < PGm. **felgō-*, although this may rather belong with Ru. *póloz* m. 'runner, skid', Sln. *plâz* m. 'plough sole; strip' (cf. Kroonen 2013: 134).

3.4.31 *(s)ker-men- *'hide, skin'*

Indo-Slavic exclusivity	Etymology	Shared innovation	Typology
Uncertain (Germanic)	Compelling	Possible	[N]Derivation Semantics

Indo-Aryan: Skt. *cárman-* n. 'hide, (flayed) skin'
Iranian: YAv. *carəman-* n. 'hide, leather'; OP *carman-* 'leather'; MiP Pahl. *čarm*, Man. *crm* 'skin, leather'; MoP *čarm* 'leather'; Sogd. BS *crm* 'skin, leather'; Khot. *tcārman-* 'hide'; Oss. I *carm* / D *car* 'skin'; Psht. *carmán* f. 'skin, hide'
Baltic: OPr. *kērmens* m. 'body'
Slavic: –

Arntz (1933: 48–49) listed the Indo-Iranian-Prussian correspondence as an isogloss. OPr. *kērmens* has been remade into an *i*-stem, which is not unparalleled, cf. *emmens* 'name' (Mažiulis 2012).

However, OHG *scirm* 'screen' < PGm. **skermi-* has often been connected, which would render the isogloss non-exclusive. The word has been taken as a *men*-derivative from *(*s*)*ker-* 'to cut'. Boutkan & Siebinga (2005: s.v. *skerma*) reject this etymology on semantic grounds, but a development from 'what has been cut' >> 'hide, skin' >> 'protective shield' does not seem implausible. Although the derivational path from *(*s*)*ker-men-* to PGm. **skermi-* is not entirely clear, the *e*-grade in the root points to a *men*-stem rather than a *mo*-stem, in which case *o*-grade would be expected (cf. PGm. **sauma-* 'seam' << **siujan-* 'to sew').

Alternatively, *(*s*)*ker-men-* has been connected to Hitt. *kariie/a-*^{zi} 'to cover' (Puhvel 1997: 82). In this case, the semantics of Indo-Slavic *(*s*)*ker-men-* 'hide, skin' would constitute an innovation *vis-à-vis* PGm. **skermi-* 'protective shield'. However, as the traditional etymological connection to *(*s*)*ker-* 'to cut' seems equally plausible, the isogloss is uncertain.

3.4.32 *sm-b^{h}eh$_2$- *'assembly, social gathering, meeting, company'*

Indo-Slavic exclusivity	Etymology	Shared innovation	Typology
Yes	Doubtful	Possible	^{N}Derivation

Indo-Aryan: Skt. *sabhā́-* f. 'assembly, social gathering, meeting, company'
Iranian: (YAv. *habāspa-* m. 'PN; having horses in the *habā-* (?)')
Baltic: –
Slavic: SerbCS *sebrъ* m. 'associate, partner, (type of) farmer' ORu. *sjabrъ* m. 'neighbour, companion'

Skt. *sabhā́-* 'assembly, social gathering, meeting, company' has often been compared to Goth. *sibja*[115] 'kinship' (IEW: 882–884), but already Edgerton (1914) suggested that it must derive from **sm-* 'together' + **b^{h}eh$_2$-* 'to speak', lit. 'colloquium'. According to Rau (1957: 75–81), the *sabhā́-* was a hall where the societal elite engaged in games of dice, banquets etc. However, Mayrhofer's assertion (EWAia II: 701) that the original meaning of *sabhā́-* was 'hall, big room' rather than 'assembly' leaves the word without an Indo-European etymology.

115 Proto-Germanic **sebjō-* 'kinship' is derived from a form of the reflexive pronoun (see Kroonen 2013: 429).

It seems more plausible that the meaning 'hall' is secondary after the function of this building, i.e., as a place of social gatherings (cf. Falk 1986: 85). In Sanskrit, the root *bhā-* means 'to shine', but an additional meaning 'to speak' must be reconstructed for Proto-Indo-European based on Gr. φημί 'to say' etc. (LIV: 69), which is continued in Skt. *bhánati* 'to speak' < *b^h-n-h_2-e/o-. This indicates that *sabhā́-* cannot have been derived within Sanskrit but must at least be Proto-Indo-Iranian, even if the name YAv. *habāspa-* does not belong here.

SerbCS *sebrъ*, ORu. *sjabrъ* reflect Proto-Slavic **sębrъ* (cf. Vasmer III: 62).[116] The form has been explained as a nasalized variant of ***sebrъ* and connected to Goth. *sibja* f. 'kinship' (IEW: 882–884), or as related to Proto-Slavic **sěmьja* 'household, family, servants' (Vaillant IV: 638) < **ḱoi-m-*, cf. Goth. *haims* f. 'village'. The former scenario should be given up, as the assumed nasalization is *ad hoc*. The latter scenario requires the assumption of a stem **ḱi-m-ro-* (thus Rozwadowski 1928), since **ḱoi-m-* cannot give Proto-Slavic **ę* < PBSl. **im* (or **em*). A weakness of this scenario is that all attested forms of **ḱoi-m-* have full grade in the root. However, since the stem variation within Balto-Slavic (cf. Lith. *šeimà*, *šeimẽ* f. 'family, household', Latv. *sàime* f. 'members of a household, (extended) family') points to an athematic stem, it cannot be excluded that zero-grade forms existed in the original paradigm. As for the required epenthesis **mr* > **mbr*, the only example Vaillant (I: 95) mentions is **sębrъ* itself.

An alternative etymology would be to derive PSl. **sębrъ* from the same compound as Skt. *sabhā́-*, i.e., **sm-b^heh_2-* 'assembly, social gathering, meeting, company'. From this, **sm-$b^h h_2$-ro-* 'one of the assembly, community etc.' would have been created, which ultimately gave the attested Slavic forms. This would directly account for the *ę*-vowel. Although the suffix **-ro-* primarily forms primary adjectives, it could also be used in denominal derivation, cf. Skt. *támisrā-* f. 'dark night' ~ Lat. *tenebrae* f.pl. 'darkness' < **temH-s-ro-*. A possible parallel to **sm-$b^h h_2$-ro-* is **m(e)n(s)-$d^h h_1$-ro-* 'wise',[117] if derived from the corresponding compounded root noun **m(e)n(s)-$d^h e h_1$-* 'wisdom'. The underlying stem **sm-$b^h e h_2$-* would then be an Indo-Slavic isogloss. Even if the formation would

116 Similar forms in neighbouring languages, e.g., Lith. *sẽbras*, (dial.) *sẽbras* 'companion'; Latv. *sẽbrs* 'neighbour', Alb. *sembër* 'peasants using the same pair of oxen', Modern Greek σέμπρος, σεμπρός 'type of farmer', Hungarian *cimbora* 'associate, partner', Romanian *sîmbră* 'community', are all Slavic borrowings. Differently on Lith. *sẽbras*, cf. Kalima (1940).

117 Cf. Skt. *médhira-* 'wise', YAv. *mązdra-* 'wise', OHG *muntar* 'perky, vivid', Lith. *mandrùs* 'cheerful, lively', OCS *mędrъ* 'wise'.

be an archaism, the shared semantic development from an original 'colloquium' >> 'assembly, social gathering, meeting, company' could be a shared innovation. However, since the competing etymology **ḱi-m-ro-* cannot be rejected, this remains uncertain.

3.4.33 *sor(H)-to- *'red(-faced)'*

Indo-Slavic exclusivity	Etymology	Shared innovation	Typology
Yes	Doubtful	Possible	NDerivation

Indo-Aryan: –
Iranian: YAv. *harəta-* adj. 'sick with a certain illness (?)'
Baltic: Lith. *sarˀtas* adj. 'bright-red, ginger'; Latv. *sārts*, *sàrts* adj. 'red-faced'
Slavic: –

This etymology is supported in various etymological dictionaries (e.g., LEW: 764; EWAia II: 726).[118] According to Derksen (1996: 90), the intonation of Latv. *sārts* adj. 'red-faced' and the presumably related Lith. *sárkanas* adj. 'pink, ruddy; transparent' represents the original Baltic situation. In any case, YAv. *harəta-* would be compatible with both **sor-to-* and **sorH-to-*. However, the etymology must be considered doubtful, because the meaning of the Avestan word is unclear. It is not at all certain that *harəta-* describes an illness causing redness in the face, as the etymology presupposes. Besides *harəta-* 'sick with a certain illness', there is a homophonous *harəta-* 'well-fed, fat', which may or may not be related.

3.4.34 *srom-o- *'lame'*

Indo-Slavic exclusivity	Etymology	Shared innovation	Typology
Yes	Doubtful	Possible	NDerivation

118 Skt. *sārāṅga-* 'variegated, spotted' is also included, but the connection is uncertain.

Indo-Aryan: Skt. *srāmá-* adj. 'lame', *srā́ma-* m. 'paralysis, illness'
Iranian: –[119]
Baltic: –
Slavic: OCS *xromъ* adj. 'lame'; Ru. *xromój* adj. 'lame'; Pol. *chromy* adj. 'lame, mutilated'; SCr. *hrȍm* adj. 'lame'

Arntz (1933: 38) listed this adjective as an Indo-Slavic isogloss. Indeed, the etymology is attractive from a semantic perspective, but it is formally problematic since the Slavic anlaut **xr-* does not regularly reflect **sr-* (cf. OCS *struja* 'stream' < **srou-ieh$_2$-*). ESSJ (VIII: 102) suggests that *xr-* derives from **skr-* and connects Slavic **xròmъ* 'lame' to Ger. *Schramme* f. 'scratch' (as well as ON *skráma* f. 'wound, scratch'). However, this is semantically less attractive. Although *ad hoc*, it is possible to assume that the Slavic **x-* is from **s-* due to a sporadic sound change after the phonologization of the RUKI rule, cf. Old Polish *smura* 'cloud' ~ *chmura* 'id.' (Collins 2018: 1433), which would allow the connection to Skt. *srāmá-* to be maintained as an Indo-Slavic isogloss. However, this is uncertain. In any case, it cannot be excluded that the stem is an archaism, as the root **srem-* is not attested in other (verbal) formations.

3.4.35 *telp- *'to make room'*

Indo-Slavic exclusivity	Etymology	Shared innovation	Typology
Yes	Doubtful	Possible	Root

Indo-Aryan: Skt. *tálpa-* m. 'bed, retreat, divan, marital bed'
Iranian: –
Baltic: Lith. *tiĩ̃pti*, *teĩ̃pa* 'to take place', *talpà* f. 'sufficient space, volume'; Latv. *tìlpt*, *tę̃lpu* 'to enter, take place'
Slavic: OCS *tlъpa* f. 'heap, drove'

Arntz (1933: 46) listed Skt. *tálpa-* 'bed, retreat, divan, marital bed' next to Lith. *talpà* 'sufficient space, volume' as a root isogloss (cf. EWAia I: 638). OIr. *-tella* 'to take place' has been adduced (cf. LIV: 623), but is rather to be analysed as *to-* 'to' + *ell-* 'to go, set in motion' (Pedersen 1913: 511). ToB *tsälp-* 'to be free of, pass away,

119 OAv. *rəma-*, *rāma-* adj. 'spraining' is unclear.

escape; be delivered' and *tälp-* 'to purge' have also been connected (Adams 2013: 315, 807), but this is semantically uncompelling. However, the same may be said for Skt. *tálpa-*. While a connection to the Balto-Slavic root is possible, it is not obvious, and its isolation within Indo-Iranian makes it even more uncertain.

3.4.36 *t(H)ong^{h}-eie/o- *'to pull'*

Indo-Slavic exclusivity	Etymology	Shared innovation	Typology
Yes	Doubtful	Possible	^{V}Derivation

Indo-Aryan: –

Iranian: YAv. *ϑaŋjaiieiti* 'to pull, steer (a wagon)'; MiP Man. *'hynz-* 'to draw (up)'; Sogd. B *δync-* 'to pull out'; Khot. *thaṃj-* 'to pull'

Baltic: (Lith. *tìngti*, *-sta* 'to become slow', *tingùs* 'lazy')

Slavic: CS *rastęšti*, *rastęgǫ* 'to tear apart'; Ru. *tjagát'*, *tjagáju* 'to pull', *túžit'*, *túžu* 'to strain'; Pol. *tężyć*, *tężę* 'to strain, tense';

Meillet (1926: 172) and Arntz (1933: 39) list the root of YAv. *ϑaŋjaiieiti* (AirWb.: 784–785) and Ru. *tjagát'* etc. (Derksen 2008: 493) as an Indo-Slavic isogloss. However, these cannot be separated from ToB *täṅk-* 'to check, stop, hinder' (Adams 2013: 306). The root is further attested in, e.g., ON *þungr* 'heavy' < **þungu-*, which is directly comparable to Lith. *tingùs* 'lazy' and OCS *tęžьkъ* 'heavy'.

The reconstruction of the root is disputed. LIV: 657 gives **t^{h}eng^{h}-*, arguing that the aspirated tenuis arose from **sd^{h}eng^{h}-* via Siebs' Law and subsequent loss of *s*-mobile. The alternative reconstruction **th$_2$eng^{h}-* is dismissed because of the lack of laryngeal colouring in Germanic **þinhslō-* 'drawbar, cartpole'. However, irrespective of the fact that **þinhslō-* rather reflects **tenk-*, there is no need to reconstruct **h$_2$* specifically, since **h$_1$* would also have triggered Iranian fricativization of **t*. Hoffmann (1974) explained the Iranian anlaut as resulting from metathesis of **teng^{h}-* > **t^{h}eng-*, which is followed by Kümmel (2011–2024 s.v. **teng^{h}-*). Similarly, Cheung (2007: 391–392) reconstructs **teng^{h}-*, arguing that the root must be a variant of **ten-* 'to stretch'.

Exclusive to Iranian and Slavic is the *eie*/*o*-stem reflected in Ru. *túžit'* 'to strain', Pol. *tężyć* 'to strain, tense' (Vasmer III: 148) and YAv. *ϑaŋjaiieiti*, Khot. *thaṃj-* 'to pull' (*j* < **ǰaa̯-*), which is a possible shared innovation, although the stems may have been formed independently.

3.4.37 *(t)plh$_1$- *'fort'*

Indo-Slavic exclusivity	Etymology	Shared innovation	Typology
Uncertain (Greek)	Compelling	Possible	[N]Derivation

Indo-Aryan: Skt. *púr-* f. 'fort, palisade'
Iranian: –
Baltic: Lith. *pilìs* f. 'fort, castle'; Latv. *pils* f. 'fort, castle'
Slavic: –

The Sanskrit and Baltic words are related to Gr. π(τ)όλις f. 'citadel, fort' (EWAia II: 145; LEW: 590–591). However, the Greek stem differs from Skt. *púr-* in ablaut (*o-* vs. zero-grade) and stem class (*i*-stem vs. root noun). Lith. *pilìs* shares the zero-grade root with Sanskrit but the *i*-stem with Greek. The Baltic *i*-stem could be secondary, since most old *i*-stems show full grade in the root in Baltic, e.g., Lith. *avìs* f. ~ Skt. *ávi-* m./f. 'sheep', whereas *i*-stems with zero-grade are generally derived from root nouns, e.g., Lith. *upìs* f. 'river' ~ Skt. *áp-* f. 'water', Lith. *pušìs* f. 'pine' ~ East Lith. nom.pl. *pùšes* (NIL: 553; Derksen 2015: 374). However, it is difficult to exclude that all three branches reflect the same original paradigm.

3.4.38 *uelk$^{(w)}$- *'to pull, drag'*

Indo-Slavic exclusivity	Etymology	Shared innovation	Typology
Yes	Doubtful	Possible	Root Semantics

Indo-Aryan: –
Iranian: YAv. *vərəca-* 'to pull, draw, tow', *aipi-varəc-* 'to pull on (clothing)'; OKhot. *valj-* 'to move'
Baltic: Lith. *viĨkti*, *veĨka* 'to drag', *vilkéti*, *viĨki* 'to be dressed, wear'; Latv. *vìlkt*, *vẹ̀lku* 'to drag; put on (clothes)'
Slavic: OCS *vlěšti*, *vlěkǫ* 'to drag'; Ru. *volóč'*, *volokú* 'to drag'; Pol. *wlec*, *wlokę* 'to drag'; SCr. *vúći*, *vúćēm* 'to drag'

A root *$h_2uelk^{(w)}$- has traditionally been identified as the base of Gr. ἄλοξ, αὖλαξ 'furrow' and the verb reflected in Iranian and Balto-Slavic (AirWb.: 1366–1367; LEW: 1253; Derksen 2015: 504), but the irregular variation in Greek suggests non-Indo-European origin (Beekes 2010: 73–74). Lat. *sulcus* m. 'furrow', Alb. *helq* 'to draw', and Gr. ἕλκω 'to draw' < **selk*- are unrelated (*pace* LEW; cf. de Vaan 2008: 598). The root *$uelk^{(w)}$- is thus a potential Indo-Slavic isogloss.

However, the analysis of the Iranian material is uncertain. The two Avestan attestations (*vərəca*- vs. *aipi-varəc*-) look formally divergent, but it cannot be excluded that *-varəc*- stands for older *-vərəc*-. As for the semantics, Yt 17.19 *nōiṯ mąm … fraorciṇta* (< **pra-určanta*) may plausibly be translated as 'they [the gods] cannot (forcibly) drag me [Angra Mainyu] off', especially given the following paragraph Yt 17.20 *raēkō mē haca aŋhå zəmaṯ vaŋhō kərənaoiti* 'he [Zaraθuštra] makes the leaving of this earth better for me'. However, this cannot be considered certain. The other attestation N 77.2 *yezi tarasca aiβiiåŋhana aipi.varəcaṇti ratufriiō* is part of an instruction on how to put on the sacred girdle, which is difficult to interpret. Waag (1941: 94–95) translates 'wenn sie [den Nackenschutz] unter der [angelegten] Gürtelschnur hindurch herausziehen, so stellen sie die Ratu's zufrieden',[120] which makes several unverifiable assumptions. Kotwal & Kreyenbroek (2009: 48–49) emend the text to *yezi tarasca aiβiiåŋhana aiβi.varzəṇti ratufriiō* and translate 'if they handle the girdle to the side (of this place), they satisfy the Ratus'. The emendation is unjustified, however, since *varz*- 'to do, work' otherwise has a *ia*-present *vərəziia*-. Ultimately, *aipi-varc*- can be translated to 'to put on (clothes)' (cf. Latv. *vìlkt*, 'to drag; put on (clothes)'), but since the context is obscure this cannot be considered certain. The possible Khotanese cognate *valj*- 'to move' (Bailey 1979: 378) or 'to go astray, be deceived' (Emmerick 1968: 120) does not help, as the semantics in any case cannot be demonstrated to be closer to the Balto-Slavic verbs.[121]

Given the problems surrounding the Iranian material, the isogloss is classified as uncertain.

120 'If they pull [the neck guard] out through under the [donned] girdle, then they satisfy the Ratus'.

121 If related, its meaning may have developed secondarily from 'to pull, drag', cf. Nw. *dra* 'to pull; go, travel'.

3.4.39 *u(e)nH- *'forest'*

Indo-Slavic exclusivity	Etymology	Shared innovation	Typology
Yes	Doubtful	Possible	NDerivation Root

Indo-Aryan: Skt. *ván-* n. (?) 'tree, wood', *vána-* n. 'tree, wood, forest'
Iranian: YAv. *vanā-* f. 'tree'; MiP Pahl. *wan* 'tree, stock, stem'; MoP *bun* 'log, root'; Sogd. *wn-* 'tree'; Psht. *wə́na*, *wúna* f. 'tree'
Baltic: –
Slavic: OCS *vъnъ* adv./prep. 'outside, away, out of'; Ru. *von* adv. 'away, off', *vne* prep. 'outside, out of'; Cz. *ven* adv. 'away, out'; SCr. *vȁn* adv./prep. 'out, out of, except, besides'

Arntz (1933: 56) listed the words as an Indo-Slavic isogloss. The etymology (supported by Vasmer I: 225; and Derksen 2008: 531) is based on the idea that the Slavic adverb/preposition is derived from a fossilized case form of a noun corresponding to Skt. *ván-* 'tree, wood'. While possible, the scenario is difficult to substantiate,[122] as there is no trace of the original lexeme in Balto-Slavic. On the formal side, one would have to assume a secondary zero-grade **un-* instead of expected **vin-*.[123] Even if the etymology is correct, the deeper origin of **u(e)nH-* 'forest' is unclear.

3.4.40 *uiḱ-poti- *'lord of the settlement'*

Indo-Slavic exclusivity	Etymology	Shared innovation	Typology
Yes	Doubtful	Possible	NDerivation

122 Lith. *laũkan*, *laukañ* adv. 'outside, into the field, away', derived from *laũkas* m. 'area of open land, field', is a possible parallel (Vasmer I: 225).

123 A zero-grade **vun* could be attributed to the existence of an *o*-grade form **uonH-* elsewhere in the paradigm.

Indo-Aryan: Skt. *víśpáti-* m. 'lord of the tribe, chief of the settlement, ruler', *viśpátnī-* f. 'ruler'
Iranian: YAv. *vīspaiti-* m. 'chieftain'
Baltic: Lith. *viẽšpatis*, *viẽšpats* m. 'lord', OLith. *viẽšpatni* 'hostess, lady of the house'; OPr. acc.sg.f. *waispattin* 'mistress'
Slavic: –

Schmidt (1872: 50) and Arntz (1933: 50) listed the compound **uiḱ-poti-* as an Indo-Slavic isogloss. The attested forms are not entirely formally equivalent, however. As evidenced by OPr. *waispattin* 'mistress', the first member of the Baltic compound has *o*-grade in the root, as opposed to Indo-Iranian **uiḱ-*. According to Knobloch (1980: 190), the Baltic full grade was secondarily introduced to prevent **viś-pati* to be parsed as 'lord of all'. This scenario is not very attractive, since Lith. *vìsas* and Latv. *viss* 'all' both contain *s*, not **ś*.[124] Schindler (1972: 32) argued that Baltic **uaiš-* reflects an archaic genitive **uoiḱ-s* << **ueiḱ-s* with analogical *o*-grade from the strong stem of a static root noun. However, it cannot be proven that the first member of the Baltic compound is a genitive as opposed to the bare stem. Larsson (2007) instead suggests that the first member should be identified with Lith. *viẽšis* m. 'guest', Latv. *vìesis*, *viess* m. 'guest', since stem vowels of immobile nouns are regularly lost in compounds, e.g., Lith. *viẽšnamis* 'guest house'. Based on these considerations, a direct comparison of the Baltic and Indo-Iranian compounds is doubtful.

3.4.41 *uisu(-) *'in every direction'*

Indo-Slavic exclusivity	Etymology	Shared innovation	Typology
Yes	Doubtful	Possible	[N]Derivation

Indo-Aryan: Skt. *víṣu-* 'in every direction'
Iranian: YAv. *vīžuuaŋc-* 'facing in different directions'
Baltic: Lith. *vìsas* adj. 'all'; Latv. *viss* adj. 'all'; OPr. *wissa-* adj. 'all'
Slavic: OCS *vьsь* adj. 'all'; Ru. *ves'* adj. 'all', ORu. (Novg.) *vxu* adj. 'all'; OPol. *wszy* adj. 'all'; SCr. *sȃv* adj. 'all'

124 The etymology of Lith. *vìsas* and Latv. *viss* 'all' is disputed (cf. 3.4.41), and it is not certain that it reflects a root **uiḱ-*, as presupposed in Knobloch's scenario.

Schmidt (1872: 50) and Arntz (1933: 50) listed Skt. *víśva-* 'all', Av. *vīspa-* 'all' and the Balto-Slavic words for 'all' as an isogloss, although the latter also included Skt. *víṣu-* as a cognate. However, given ORu. *vxu* (without progressive palatalization, cf. Vasmer 1: 192; Derksen 2008: 540), the comparison with Indo-Iranian **uićuo-* must be abandoned. Even if the suffix **-uo-* is analogical from **sarua-* (Skt. *sárva-* 'whole, all'), **ć* cannot be reconciled with Balto-Slavic **s*.

Regardless of whether **uiḱ(u)o-* or **uiso-* is reconstructed, the *-s-* of Lith. *vìsas* 'all' is irregular. Derksen (2008: 540; 2015: 507), following a suggestion by Kortlandt, argued that this irregularity can be explained under the assumption that Balto-Slavic **uiso-* derives from **uisu*, a form he compares with Skt. *víṣu-*, argued to reflect a locative plural of **h₁ui-* 'apart'. The regular Balto-Slavic outcome **uiṣu* would then have been replaced by **uisu* in Baltic when the allomorph loc.pl. *-su* was generalized. Subsequently, an *o*-stem adjective would have been derived from this locative plural form. A similar scenario may be envisioned for Slavic **vьśь* << **vьxъ* (*-xъ* being the regular loc.pl. ending). While Kortlandt's scenario is ingenious, it requires two potentially problematic assumptions: 1) **uiṣu* was still analysable as a loc.pl. in Proto-Baltic, and 2) Baltic and Slavic independently derived adjective stems from loc.pl. **uisu*.

Assuming that Kortlandt's scenario is correct, we may proceed to evaluate **uisu(-)* as a potential Indo-Slavic isogloss. In Indo-Iranian, **uišu-* has been lexicalized, i.e., is no longer analysable as a locative plural of **(H)ui-*. The same cannot be said for Proto-Balto-Slavic **uiṣu*, however, since Kortlandt's scenario requires the form to have been analysable as a locative plural at the time when the allomorphs of this case ending were levelled, which happened independently in Baltic and Slavic. The potential isogloss is thus reduced to the preservation of a locative plural form of **h₁ui-* 'apart', rather than the innovation of an adjective stem.

3.4.42 *ulp-i- *'(wild)cat'*

Indo-Slavic exclusivity	Etymology	Shared innovation	Typology
Yes	Doubtful	Possible	Semantics

Indo-Aryan: –
Iranian: MiP Pahl. *gurbag* 'cat'; MoP *gorbe* 'cat'

Baltic: Lith. *vilpišys* m. 'wildcat'
Slavic: –

Arntz (1933: 57) takes MiP *gurbag* 'cat' < **u̯rpaka-* and Lith. *vilpišys* m. 'wildcat' for '(wild)cat' as a semantic isogloss *vis-à-vis* Lat. *volpēs* f. 'fox'. However, given that the words have different suffixes, the origin of which are not fully clear, especially in the case of Lith. *vilpišys* (cf. de Vaan 2000; Palmér et al. 2021), the etymology is uncertain. Even if it is correct, it is difficult to exclude that '(wild)cat' is the more archaic meaning.

3.5 Rejected Isoglosses

3.5.1 *bʰag-o- *'god'*

Indo-Slavic exclusivity	Etymology	Shared innovation	Typology
Yes	Rejected	Possible	NDerivation Semantics

Indo-Aryan: Skt. *bhága-* m. 'wealth, share'
Iranian: OAv. *baga-* m., YAv. *bayа-* m. 'god'; OP *baga-* m. 'god'
Baltic: –
Slavic: OCS *bogъ* m. 'god', *u-bogъ* adj. 'poor'; Ru. *bog* m. 'god'; Pol. *bóg* m. 'god'; SCr. *bôg* m. 'god'

Schmidt (1872: 46) lists the Iranian and Slavic words for 'god', on the one hand, and the Sanskrit and Slavic words for 'wealth', on the other, as isoglosses. Meillet (1926: 168) argues against a Slavic borrowing from Iranian because he does not believe that a word of such cultural significance would be borrowed (cf. also Arntz 1933: 48). However, this claim is contradicted by Erzya (Mordvin) *paz*, *pas* 'god' < **pakas*, which is a loanword from Indo-Iranian (Holopainen 2019: 171). Meillet furthermore argues that OCS *u-bogъ* 'poor' and *bogatъ* 'rich' prove that OCS *bogъ* 'god' is inherited and underwent a shared semantic shift with Iranian from 'wealth' >> 'god'. However, the absence of Winter's Law renders the equation of OCS *bogъ* and OAv. *baga-* formally irregular, and the Slavic material is better explained as borrowings from Iranian.

3.5.2 *bʰebʰr-u- *'beaver'*

Indo-Slavic exclusivity	Etymology	Shared innovation	Typology
Uncertain (Germanic)	Doubtful	Rejected	[N]Derivation

Indo-Aryan: Skt. *babhrú-* adj. 'brown', Mitanni Indo-Aryan *babru-nnu* 'epithet of horses'
Iranian: YAv. *baβra-* m. 'beaver'; MiP Pahl. *babrag* 'beaver'
Baltic: Lith. *bẽbras*, *bebrùs* m. 'beaver'; Latv. *bę̣brs* m. 'beaver'; OPr. *bebrus* 'beaver'
Slavic: CS *bebrъ* 'beaver'; Ru. *bobr* m. 'beaver'; Pol. *bóbr* m. 'beaver'; SCr. *dȁbar* m. 'beaver'

Traditionally, a *u*-stem **bʰebʰr-u-* has been reconstructed for Skt. *babhrú-* 'brown', Lith. *bebrùs* 'beaver', OIr. *Bibar* 'PN', and ON *bjórr* m. 'beaver' (IEW: 136–137). Matasović (2009: 59) reconstructs **bʰebʰru-* for Celtic, but the only non-onomastic evidence is OBret. *beuer* 'beaver' and Old Cornish *befer* 'beaver', which may be loans from Vulgar Latin and Old English, respectively (cf. Delamarre 2003: 69), and in any case do not prove a *u*-stem. The only evidence for a *u*-stem in Celtic consists of OIr. *Bibar*, but as a name it is etymologically ambiguous, since its meaning cannot be determined. ON *bjórr* shows *u*-breaking, but is synchronically an *o*-stem. It can hardly derive from a *u*-stem, as these were generally retained in North Germanic, but rather reflects PGm. **bebura-* (de Vries 1977: 40; Kroonen 2013: 56), which looks like a thematicization of **bʰe-bʰr̥-*. Kümmel (2004) argues that Germanic must have inherited a *u*-stem on account of OE *beber*, *bebor* 'beaver', whose epenthetic vowel in the second syllable points to a disyllabic preform (i.e., **bʰebʰr-u-*). However, it is difficult to exclude that Old English reflects PGm. **bebra-*, originating as an alternative thematicization of Pre-Proto-Germanic **bʰe-bʰr̥-*. Thus, only Indo-Aryan and Baltic securely attest *u*-stems.

However, the equation of Skt. *babhrú-* and Lith. *bebrùs* is problematic. The Sanskrit word does not mean 'beaver' but 'brown' (EWAia II: 210). Since colour adjectives are frequently *u*-stems, *babhrú-* may be analysed as a derivative of PIIr. **bʰabʰra-* 'beaver', which is attested in Iranian. Since there were beavers in Iran and Afghanistan in ancient times, but not in India (Nowak & Paradiso 1983: 560), it is not unexpected that Sanskrit would have lost the 'beaver' word. The Baltic words (cf. LEW: 38) all mean 'beaver' and it is difficult to imagine what

would have motivated a shift from 'brown' >> 'beaver'. Given the great variation within Balto-Slavic, where not only *o*- and *u*-stems are attested, but also forms with different root vowels, e.g., Lith. *bãbras*, CS *bobrъ*, ORu. *bьbrъ*, the *u*-stems Lith. *bebrùs* and OPr. *bebrus* appear to have been cherry-picked to fit the idea of a PIE *u*-stem, which, upon closer examination, cannot be maintained. It is possible that the Baltic *u*-stem arose through reanalysis of case forms of **bʰebʰro-* with *u*-vocalism in the ending.

As stated above, PGm. **bebura-* implies an original athematic stem **bʰe-bʰr̥-*, which was thematicized after the Germanic development **r̥* > **ur*. Therefore, a case could be made for viewing YAv. *baβra-* and the Balto-Slavic *o*-stems as a shared innovation *vis-à-vis* the athematic stem. Lat. *fiber* m. 'beaver' is synchronically an *o*-stem, too, but requires the assumption of irregular raising of **e* > *i*. Since a variant *feber* is also attested, de Vaan (2008: 217) maintains that raising cannot be excluded. An alternative explanation, however, is that the variation between *fiber* and *feber* goes back to an alternation in the reduplicating syllable in Indo-European, i.e., **bʰi-bʰer-* / **bʰe-bʰr-*. In this scenario, the thematicization would have occurred within Italic. Nevertheless, the *o*-stem in Iranian and Balto-Slavic is not necessarily significant, since it could have developed independently, just like it eventually did in Germanic and Italic.

3.5.3 *bʰeHǵʰ- *'to press, stick'*

Indo-Slavic exclusivity	Etymology	Shared innovation	Typology
Yes	Rejected	Possible	Root

Indo-Aryan: Skt. *bā́hate* 'to press'
Iranian: –
Baltic: Latv. *bâzt*, *-žu* 'to stick, stuff'
Slavic: –

In older literature, this etymology, which is a potential Indo-Slavic isogloss, is sometimes supported (e.g., LEW: 38). However, Skt. *bā́hate* 'to press' is attested in late texts where *b*/*v* are not consistently differentiated (KEWA II: 427–428). It is best understood as a variant of *vā́hate* or *bā́dhate* 'to press', and the etymology should be rejected.

3.5.4 *$b^heh_2d^h$- *'to push, press'*

Indo-Slavic exclusivity	Etymology	Shared innovation	Typology
No (Germanic)	Compelling	Possible	Root

Indo-Aryan: Skt. *bādhá-* m. 'distress', *bā́dhate* 'to push, press, trouble, oppose, repel'
Iranian: (YAv. *auui.bāδa-* 'due to pressure')[125]
Baltic: Lith. *bósti, -ta* 'to bother, bore, be repugnant', *bóstis*, *bódžiasi* 'to be bored with, be disgusted by', (*bèsti, bẽda* 'to stick, drive (into), dig', *bėdà* f. 'misfortune, trouble, guilt', *bãdas* m. 'hunger'; Latv. *best, bẹdu* 'to dig, bury', *bẹ̀da* f. 'care, sorrow, grief', *bads* m. 'hunger')
Slavic: (OCS *bosti, bodǫ* 'to stab', *bědа* f. 'distress, need, necessity'; Ru. *bedá* f. 'misfortune, trouble'; Pol. *bieda* f. 'poverty, misery'; SCr. *bijèda* f. 'grief, misfortune')

Arntz (1933: 35) listed Skt. *bībhatsate* 'to be disgusted' and Lith. *bóstis* 'to be bored with, be disgusted by' as an Indo-Slavic isogloss (cf. also LEW: 29). However, although the roots of these stems may be compared, there are other potential cognates within as well as outside of Balto-Slavic and Indo-Iranian that must be taken into account.

The compound Skt. *jñu-bā́dh-* adj. 'bending the knees' has been compared with ON *kné-beðr* 'hassock', OS *kneo-beda* 'prayer'. ON *beðr* m. 'bed' is cognate to Eng. *bed* etc. (de Vries 1977: 29) and the Germanic compound may thus be analysed as 'knee-bed'. This is rather different from Skt. *jñu-bā́dh-*, which seems to mean 'knee-bending'. Although the etymology of ON *beðr* m. 'bed' is uncertain, it is difficult to imagine that it would be derived from a root meaning 'to push, bend'.

Skt. *bādh-* 'to press (etc.)' has long *ā* in most forms; whenever this is not the case, it is likely due to secondary shortening (Gotō 1996: 216). It has been compared to the root of OCS *bědа* 'distress, need, necessity', Lith. *bėdà* 'misfortune, trouble, guilt', and Latv. *bẹ̀da* 'care, sorrow, grief', where the non-acute accentuation points to *$b^hēd^h$- rather than *$b^heh_1d^h$- (*pace* LIV: 68), cf. also Lith. *bãdas*

125 The analysis of this word is unclear; it might be unrelated to Skt. *bādh-* 'to push, press, trouble, oppose, repel' (contra Hoffmann & Narten 1989: 82).

'hunger' and Latv. *bads* 'hunger'. However, within Slavic, OCS *běda* is close to OCS *běditi* 'to force, persuade', which in turn cannot be separated from Goth. *baidjan* 'to force', ON *beiða* 'to ask, request' (Derksen 2008: 39). Although it has been suggested, ON *beiða* (causative to *bíða* 'to wait for; suffer') cannot be related to ON *biðja* 'to ask, beg, pray' < *$b^{h}ed^{h}$- (?), but must go back to *$b^{h}eid^{h}$- 'to force' (Kroonen 2013: 57). Since *$b^{h}eid^{h}$- can produce OCS *běditi* 'to force, persuade' and *běda*, but not Lith. *bėdà*, Latv. *bẹ̀da*, the Baltic words have been taken as loanwords from Slavic. This is rejected by Būga (RR I: 345–346), however, as Slavic *ě is normally borrowed as Lith. *ie*. Based on this, Derksen (2008: 39) suggests that OCS *běditi* and *běda* reflect a merger of two roots *$b^{h}eid^{h}$- and *$b^{h}ēd^{h}$-.

Irrespective of whether Lith. *bėdà*, Latv. *bẹ̀da* are borrowed from Slavic or not, there is secure evidence for a root *$b^{h}ed^{h}h_2$-[126] 'to stab, dig' in Balto-Slavic, e.g., Lith. *bèsti* 'to stick, drive (into), dig', Latv. *best* 'to dig, bury', OCS *bosti* 'to stab', which is related to Lat. *fodiō* 'to dig', Hitt. *padda-^{i}* 'to dig', ToA *pātar* 'they ploughed'. It would be semantically possible to derive nominal forms such as OCS *běda* 'distress, need, necessity' and Lith. *bãdas* 'hunger' from *$b^{h}ed^{h}h_2$- 'to stab, dig' (as in 'something that stabs at you'). Furthermore, it would be tempting to include Skt. *bādh-* in this etymon. However, the long *-ā-* cannot be explained from *$b^{h}od^{h}h_2$-, since the laryngeal would have blocked Brugmann's Law.

Thus, Skt. *bādh-* seems impossible to reconcile with *$b^{h}ed^{h}h_2$-, from which all above-mentioned Slavic forms and most Baltic forms can be derived (marked with brackets in the section header). We may instead return to Arntz' original suggestion, namely a direct comparison with Lith. *bóstis* 'to be bored with, be disgusted by', *bósti* 'to bother, bore, be repugnant'. Like Skt. *bādh-*, Lith. *bósti* also seems incompatible with *$b^{h}ed^{h}h_2$- and rather points to *$b^{h}eh_2d^{h}$-. Also, semantically, there is *a priori* no reason to connect Lith. *bósti* with *bèsti*, *bãdas* 'hunger' etc. Although it is not a direct semantic match to Skt. *bā́dhate* 'to push, press, trouble, oppose, repel', Lith. *bósti* 'to bother, bore, be repugnant' may well have developed from 'to push away, trouble, repel', cf. also Lith. *bodùs* 'boring, annoying, unpleasant, disgusting'. A hint at the same development is found in Skt. *bādhá-* m. 'distress' and Skt. *bībhatsate* 'to be disgusted' (< 'to wish to push away').

Besides Indo-Iranian and Baltic, however, a root *$b^{h}eh_2d^{h}$- 'to push, press' seems to be attested in OS *under-badon* 'to oppress' and Nw. *bada* 'to press' < PGm. **badōn-*, if from zero-grade *$b^{h}h_2d^{h}$-. As such, the isogloss is non-exclusive.

126 With final *-h_2 due to Hittite (Kloekhorst 2008: 655).

3.5.5 *$b^{h}oh_2u$-eie/o- *'to cause to be, linger (?)'*

Indo-Slavic exclusivity	Etymology	Shared innovation	Typology
Yes	Rejected	Rejected	[V]Derivation

Indo-Aryan: Skt. *párā bhāvayati* 'to make perish' (AV+)
Iranian: –
Baltic: –
Slavic: Ru. (dial.) *bávit'* 'to linger'; Pol. *bawić, bawię* 'to amuse, be, abide'; SCr. *bȁviti se* 'to engage in'

Arntz (1933: 50) argues that the causatives to *$b^{h}eh_2u$- 'to become', attested in Sanskrit and Slavic, constitute an Indo-Slavic isogloss. However, the distant semantics suggests independent innovations. The fact that Skt. *párā bhāvayati* 'to make perish' seems to be a productive causative to *párā bhavati* 'to perish' (Jamison 1983: 116) is consistent with this conclusion.

3.5.6 *b^{h}(o)lg$^{(w)h}$- *'good; a deity (?)'*

Indo-Slavic exclusivity	Etymology	Shared innovation	Typology
Yes	Rejected	Possible	Root

Indo-Aryan: Skt. *bṛ́has-páti-* m. 'name of a God'
Iranian: YAv. *bərəj-* f. 'rite, ritual praise', *bərəjiia-* m. 'a god who augments the crop-droves'
Baltic: –
Slavic: OCS *blago* n. '(the) good'; ORu. *bologo* n. '(the) good'; Pol. *błogo* n. 'good, happiness' SCr. *blâgo* n. 'wealth, money, cattle'

Arntz (1933: 39) listed this as an Indo-Slavic isogloss (see further EWAia II: 232–233; Derksen 2008: 51). Although formally possible, the etymology is not semantically compelling and should be rejected. YAv. *bərəj-* f. 'rite, ritual praise' may be connected to a root *$b^{h}erg^{h}$- 'to consider, observe' (LIV: 79–80).

3.5.7 *b^{h}ong-o/eh$_2$- *'wave'*

Indo-Slavic exclusivity	Etymology	Shared innovation	Typology
Yes	Rejected	Rejected	^{N}Derivation

Indo-Aryan: Skt. *bhaṅgá-* m./adj. 'breach; breaking, splitting; wave (Ragh.)'
Iranian: –
Baltic: Lith. *bangà* f. 'wave, (dial.) multitude'; Latv. *bañga* f. 'wave, downpour, multitude, cloud'
Slavic: –

Schmidt (1872: 45) and Arntz (1933: 48) listed this as an Indo-Slavic isogloss. However, the Indo-Aryan and Baltic formations are not identical (*o*-stem vs. *eh$_2$*-stem). Furthermore, the etymology is semantically uncompelling, since the meaning 'wave' is late and clearly secondary within Sanskrit. I therefore follow Derksen (2015: 81), who treats the words as independent innovations.

3.5.8 *b^{h}oud^{h}-eie/o- *'to make awaken'*

Indo-Slavic exclusivity	Etymology	Shared innovation	Typology
Yes	Doubtful	Rejected	^{V}Derivation

Indo-Aryan: Skt. *bodháyati* 'to make awaken'
Iranian: YAv. *baoδaiieiti* 'to reveal, make perceive'
Baltic: Lith. *báudyti*, *báudo* 'to incite, instigate'; Latv. *bàudît*, *bàudu* 'to incite, instigate'; OPr. *etbaudinnons* pf.ptc.act 'awakened'
Slavic: OCS *ubuditi*, *ubuždǫ* 'to awaken'; Ru. *budít'*, *bužú* 'to awaken, arouse'; Pol. *budzić*, *budzę* 'to awaken, arouse'; SCr. *búditi*, *bûdīm* 'to awaken, arouse'

Arntz (1933: 50) listed this as an isogloss. For the Indo-Iranian forms, see EWAia II: 234. The Baltic verb is metatonical and could be secondary, although Derksen does not consider causatives in *-yti* to be productive (Derksen 1996: 346; 2015: 83). LIV: 83 considers only the Slavic and Indo-Iranian forms to be old. However, the Sanskrit and Avestan causatives have different meanings

and are probably independent post-Proto-Indo-Iranian formations from Skt. *búdhyate* 'to wake' and YAv. *būiδiia-* 'to perceive', respectively. The Sanskrit and Slavic forms are semantically comparable, but as the suffix is productive in both branches, this is not necessarily significant.

A case could be made that the meaning 'to become awake' of **bʰeudʰ-*, which only appears in Indo-Iranian and Balto-Slavic, is a semantic isogloss. However, the root may have meant both 'to become attentive' and 'to become awake' in Proto-Indo-European, since the difference is rather trivial.

3.5.9 *bʰruH-no- / *bʰrouH-neh₂- *'embryo; scale'*

Indo-Slavic exclusivity	Etymology	Shared innovation	Typology
Yes	Rejected	Rejected	NDerivation

Indo-Aryan: Skt. *bhrūṇá-* n. 'brood, embryo'
Iranian: –
Baltic: Lith. *briaunà* f. 'edge, cornice, crust of bread, haft'; Latv. *braũna* f. 'flake, scale, abandoned skin or shell, caul, entrails'
Slavic: –

EWAia (II: 283) tentatively supports a connection between the Sanskrit and Latvian words. Derksen (2015: 528) connects Latv. *braũna* to Skt. *bhrūṇá-* and OIr. *brú* f. 'abdomen, belly, bowels, interior', but the latter is rather from **brus-on-* (Matasović 2009: 81); comparable to Ru. *brjúxo* n. 'belly' (Derksen 2008: 63). Without the Celtic cognate, the Sanskrit and Latvian words constitute a possible Indo-Slavic isogloss.

Yet, the etymology is formally and semantically problematic. Both Derksen (2015: 528) and Fraenkel (LEW: 57) separate Latv. *braũna* from Lith. *briaunà*, which has possible cognates in Celtic and Germanic (cf. Derksen 2015: 100). In my opinion, the connection within Baltic is not so easily dismissible. Within Lithuanian, *briaunà* has several secondary meanings that seem to derive from 'edge', such as 'crust', which is quite close to the Latvian semantics. On the other hand, the semantic connection between the Baltic and Sanskrit forms is quite weak. Moreover, Skt. *bhrūṇá-* and Latv. *braũna* do not reflect the same ablaut grade in the root, nor the same stem suffix, implying that they can only be indirectly compared through the (rather speculative) assumption of an athematic stem **bʰrouH-n-*. Ultimately, the etymology is best rejected.

3.5.10 *deḱm-t- *'decade'*

Indo-Slavic exclusivity	Etymology	Shared innovation	Typology
No (Greek)	Compelling	Possible	NDerivation

Indo-Aryan: Skt. *daśát-* f. 'decade'
Iranian: –
Baltic: Lith. *dešimtìs*, *dẽšim(t)s* 'ten'; Latv. *desmit* 'ten'; OPr. *dessempts*, *dessimpts*, *dessimton* 'ten'
Slavic: OCS *desętь* 'ten'; Ru. *désjat'* 'ten'; Pol. *dziesięć* 'ten'; SCr. *dȅsēt* 'ten'

Indo-Aryan (EWAia I: 709) and Balto-Slavic (LEW: 91; Derksen 2008: 100) share a *t*-stem derived from the PIE cardinal **deḱm* 'ten'. Dialectal evidence shows that the Baltic word is declined as a consonant stem (Zinkevičius 1966: 325), and clearly distinct from the ordinal *dešimtas* 'tenth', cf. PGm. **tehunþ/dan-* 'tenth'.

However, there are possible cognates in other branches. According to Demiraj (1997: 162–163), Alb. *dhjétë* 'ten' is either from **deḱm-* or **deḱm-t-*. However, since the numerals 6–10 in Albanian are identical to the ordinals (e.g., (*i*) *dhjetë* 'tenth', *gjashtë* 'six' ~ (*i*) *gjashtë* 'sixth'), *dhjétë* 'ten' may be secondary. The irregular anlaut *dh-*, which likely originates in, e.g., *tridhjetë* 'thirty', favours this conclusion. A more promising potential cognate is Gr. δεκάς, -άδος f. 'decade' (Beekes 2010: 311–312). Olsen (1989) suggested that **t* was regularly voiced after an accented nasal in Greek (see already Brugmann 1892: 368; also van Beek 2017). This proposal is attractive, as δεκάς is identical to Skt. *daśát-* in gender and meaning, and because it offers an explanation of the suffix -άδ- which is otherwise obscure.

3.5.11 *deḱs(i)-no- *'right'*

Indo-Slavic exclusivity	Etymology	Shared innovation	Typology
No (Celtic)	Compelling	Possible	NDerivation

Indo-Aryan: Skt. *dákṣiṇa-* adj. 'right, southern'
Iranian: YAv. *dašina-* adj. 'right, southern'; MiP Pahl. *dašn*, Man. *dšn* 'right hand'

Baltic: Lith. *dẽšinas* adj. 'right'
Slavic: OCS *desnъ* adj. 'right'; ORu. *desnъ* adj. 'right'; SCr. *dèsnī* adj. 'right'

It has long been recognized that the Indo-European languages display a variety of derivatives from **deḱs(i)-* 'right' and that Indo-Iranian (EWAia I: 690; AirWb.: 703–704) and Balto-Slavic (LEW: 91; Derksen 2008: 100–101; Derksen 2015: 124) share a *no*-stem (Schmidt 1872: 46; Arntz 1933: 46; Porzig 1954: 166). However, *pace* Brugmann (1892: 130), there is no evidence that OCS *desnъ* contained an **i* (Beekes 1994: 87), which rather reflects **deḱs-no-*, unlike Baltic and Indo-Iranian, which reflect **deḱs-i-no-*.

Greek (Gr. δεξιός 'right'), Celtic (OIr. *dess* 'right, south', Gaul. *Dex(s)iua* 'a theonym'), and Germanic (OHG *zeso* 'right', Goth. *taihswa* f. 'right hand') reflect **deḱs(i)-uo-*, whereas Lat. *dexter* 'right' shows the suffix **-tero-*. The origin of Alb. *djathtë* 'right' is open to several interpretations. Since **ḱs* regularly becomes Alb. *sh*, e.g., *gjashtë* < **sueḱs-*, *djathtë* cannot regularly reflect **deḱs(i)-uo-* or **deḱs(i)-no-*. Taken at face value, it looks like **deḱ-to-*. According to Kortlandt (1987: 221), *djathtë* ultimately derives from **deḱs-no-*, but replaced the *n*-suffix by *-të* after **s* had regularly been lost before **n*, thus explaining the outcome *th*. However, Albanian also has *djathë* 'right (side)' and the adverb *ndjath* 'right' (Orel 1998: 67–68; Demiraj 1997: 137), which according to Demiraj can be taken as reflexes of an adverbial **deḱs*. After the regular loss of word final **-s*, the productive suffix *-të* was added at some point in the history of Albanian. Although the exact scenario is difficult to determine, there is no secure evidence for a *no*-suffix in Albanian.

Clear extra-Indo-Slavic evidence for **deḱsi-no-* comes from Celtic, however. As noted by Stifter (2015: 98), OIr. *deisen* 'right hand' looks like a cognate of Skt. *dákṣiṇa-* etc., but has been left out of most etymological works. Based on this, **deḱs(i)-no-* is rejected as an Indo-Slavic isogloss.

Even if the Old Irish form could be explained away, OCS *desnъ* does not entirely correspond to Baltic and Indo-Iranian, as noted above. This could be interpreted as evidence that the addition of a suffix **-no-* occurred independently in the separate branches. However, a similar variation is present in the reflexes of the *uo*-stem, where Celtic has forms both with and without **i*, and Greek and Germanic have forms with and without **i*, respectively. Since there seems to be a fundamental variation, reconstructable for Proto-Indo-European, between **deḱs* and **deḱsi* (perhaps originally different case forms of a stem **deḱ-s-*), it is possible that this variation was carried over into the secondary derivatives. Therefore, **deḱs(i)-no-* constitutes a possible innovation in Celtic, Balto-Slavic, and Indo-Iranian, which may or may not have been created independently.

3.5.12 *dlh$_1$g^h-ó- *'long'*

Indo-Slavic exclusivity	Etymology	Shared innovation	Typology
No (Albanian)	Compelling	Possible	^{N}Derivation

Indo-Aryan: Skt. *dīrghá-* adj. 'long'
Iranian: OAv. *darəga-* adj. 'long'
Baltic: Lith. *ìlgas* adj. 'long'; Latv. *ilg̃s* adj. 'long (of time)'
Slavic: OCS *dlъgъ* adj. 'long'; Ru. *dólgij* adj. 'long'; Pol. *długi* adj. 'long'; SCr. *dȕg* adj. 'long'

The Indo-Iranian and Slavic forms are regular from **dlh$_1$g^h-ó-* (EWAia I: 728–729; AirWb.: 693; Derksen 2008: 133). Arntz (1933: 47) listed this stem as an Indo-Slavic isogloss. A reasonable explanation of the Baltic situation, although *ad hoc*, is that **dilgas* was first assimilated to **gilgas*, after which the initial **g-* was dissimilated against the following **-g-*.[127] According to Meillet (1926: 172), **dlh$_1$g^h-ó-* is uniquely Indo-Slavic. Other branches seem to reflect slightly different forms, albeit probably ultimately related: Gr. δολιχός 'long',[128] εν-δελεχής 'continuous' < **delh$_1$g^h-*; Goth. *tulgus* 'firm' < **dlh$_1$g^h-u-* (Kroonen 2013: 525); Hitt. *talugai-* 'long' < **dolug^h-i-* (Kloekhorst 2008: 820); ON *langr* 'long', Lat. *longus* 'long' < **dlong^h-o-*. Goth. *tulgus* is the only form where the root corresponds exactly to **dlh$_1$g^h-ó-*. These adjectives are possibly independent derivations from a Proto-Indo-European nominal stem.

However, it is not possible to reject Alb. *gjatë*, (older) *glatë* 'long' as an extra-Indo-Slavic reflex of **dlh$_1$g^h-ó-*. The Albanian form has been compared to Lat. *longus* and ON *langr* < **dlong^h-o-*, but would then require a zero-grade **dlng^h-o-*, which is otherwise unattested. As such, the most economic reconstruction is **dlh$_1$g^h-ó-*, with secondary suffixation by *-të* (Demiraj 1997: 185). Thus, **dlh$_1$g^h-ó-* cannot be maintained as an Indo-Slavic isogloss, but is a possible innovation shared with Albanian.

127 It might appear easier to postulate a change **dl-* > **gl-*, parallel to **tl* > Baltic *kl*, but the relative chronology is impossible; since Slavic preserves initial **d-*, the change to **gl-* would have to postdate Proto-Balto-Slavic, at which time the **l* would already have been vocalized to **il*.

128 Gr. δολιχός must reflect an *o*-grade in the root since **dl̥h$_1$g^h-* would regularly give PGr. **dlēk^h-*. The **i* of the root is then perhaps best understood as a raised **e* < **h$_1$*, although it could also be compared to the unexplained **u* of Hitt. *talugai-* < **dolug^h-i-*.

3.5.13 *drǵʰ- *'fetter; belt, strap, girdle'*

Indo-Slavic exclusivity	Etymology	Shared innovation	Typology
Yes	Rejected	Possible	Root

Indo-Aryan: (Skt. *prāṇa-dṛ́h-* adj. 'making the breath firm' (KS+))[129]
Iranian: OAv. *dərəz-* f. 'fetter'
Baltic: Lith. *diržas* m. 'belt, strap'; Latv. *dîrža* f. 'leather girdle'
Slavic: –

Arntz (1933: 48) listed the Avestan and Baltic words as an isogloss. The etymology is complicated, as OAv. *dərəz-* has been connected to several different Indo-European roots (EWAia I: 707, with lit.). Starting instead with the Baltic evidence, it is possible that the broken tone of Latv. *dîrža* necessitates a reconstruction *$d^{(h)}rǵ$- or *$d^{(h)}rHg^h$- (Derksen 2015: 133). As for OAv. *dərəz-*, it is most closely related within Iranian to YAv. *darəzaiieiti* 'to attach, fetter', Khot. *dalś-* 'to make firm, fasten, load' etc. (cf. Cheung 2007: 62–64). These verbal forms in turn correspond to Skt. *dṛh-* 'to fix, make firm', which excludes a reconstruction with *-*ǵ* or *-*Hg^h*, making a connection to Baltic doubtful. Even if the Baltic and Indo-Iranian roots could be connected, Goth. *tulgus* 'firm', *tulgjan* 'to make firm, fortify' presents a closer semantic match to Indo-Iranian (Szemerényi 1979: 109–110); Lat. *indulgeō* 'to be indulgent' may also belong here (de Vaan 2008: 302; LIV: 113). This makes a reconstruction *$delǵ^h$-, from which Lith. *diržas* etc. could never be derived, more probable for Indo-Iranian *$darǰ^h$-.

3.5.14 *dr(H)-ueh$_2$- *'wild grass (?)'*

Indo-Slavic exclusivity	Etymology	Shared innovation	Typology
No (Germanic, Celtic)	Doubtful	Possible	[N]Derivation

129 The apparent Sanskrit root noun can hardly be directly compared to OAv. *dərəz-* given the divergent semantics.

Indo-Aryan: Skt. *dū́rvā-* f. '*Cynodon dactylon*, a grass'
Iranian: –
Baltic: Lith. *dirvà* 2/4 f. '(arable) land, field'; Latv. *dìrva*[2] f. '(arable) land, field'
Slavic: Ru. *derévnja* f. 'village, (dial.) field, wasteland, ploughed field'

Skt. *dū́rvā-* '*Cynodon dactylon*, a grass' is usually compared to Du. *tarwe* 'wheat' < PGm. **terwō-* and Welsh *drewg* 'darnel', Bret. *draok*, *dreok* 'id.' < PCelt. **drāu̯ā-*, which demand a laryngeal in the root. Conversely, the Balto-Slavic forms point to a reconstruction without a laryngeal. However, Lubotsky (1997: 148) remarks that **-ŕu-* might regularly have yielded Skt. *-ū́r-*, as there are no other examples of this sequence. Even if this is the case, there is no compelling reason to reject the connection between Sanskrit, Germanic, and Celtic.

3.5.15 *d^he-d^hh_1- '(*sour*) *milk*'

Indo-Slavic exclusivity	Etymology	Shared innovation	Typology
No (Albanian)	Compelling	Possible	NDerivation

Indo-Aryan: Skt. *dádhi*, gen.sg. *dadhnás* n. 'sour milk'; Khow. *don* 'ghee'
Iranian: –
Baltic: OPr. *dadan* n. 'milk', *ructandadan* n. 'sour milk'
Slavic: –

This reduplicated stem is presented as an isogloss by Arntz (1933: 47). See further EWAia 1: 693–694. However, Alb. *djathë* m. 'cheese' cannot be separated from the Indo-Aryan and Prussian words, although the irregular voiceless *-th-* is unclear (see Demiraj 1997: 135–136); it may possibly be explained by generalization of a variant where the consonant is word-final.

The word is generally etymologized as a reduplicated stem from **d^heh_1*(*i*)- 'to suck, suckle'. The reconstruction of the reduplication syllable is problematic, since Alb. *-ja-* points to **e*, whereas OPr. *-a- a priori* suggests an *o*. However, as Beekes (1987: 54) remarks, OPr. *dadan* could reflect earlier **dedan*, since OPr. *a* occasionally seems to correspond to East Baltic *e* (cf. Trautmann 1910: 104–105). A possible parallel of a change **e* > OPr. *a* is *nadele* 'Sunday' << Slavic **neděl'a*. Skt. *dádhi* is not informative, since Brugmann's Law would have been blocked in the oblique stem *dadhn-*, but the vocalism is easiest explained from an **e*. Thus, there are no compelling arguments against reconstructing **d^he-* for all three forms.

The *i*/*n*-suffix of Sanskrit is not paralleled in either Old Prussian or Albanian. While the *n*-suffix in the weak stem may be an Indo-Iranian innovation (as argued by Beekes 1987) or an archaism lost in the other branches, the *i*-suffix of the strong stem probably reflects a vocalized laryngeal in nom.-acc.sg. **d^{h}e-d^{h}h$_{1}$*. This reconstruction would also be consistent with the devoicing of final **d^{h}* in Albanian. In Old Prussian, the stem was thematicized.

3.5.16 *d^{h}eg^{wh}-e/o- *'to burn'*

Indo-Slavic exclusivity	Etymology	Shared innovation	Typology
No (Albanian, Tocharian)	Compelling	Possible	^{V}Derivation

Indo-Aryan: Skt. *dáhati* 'to burn (tr.)'
Iranian: YAv. *dažaiti*[130] 'to burn (tr.)'; Khot. *dajs-* 'to burn; to ripen'
Baltic: Lith. *dègti, dẽga* 'to burn, light'; Latv. *degt, dẹgu* 'to burn, light'
Slavic: OCS *žešti, žegǫ* 'to burn'; Ru. *žeč', žgú* 'to burn'; Pol. *żec, żgę* 'to burn'; SCr. *žèći, žèžēm* 'to burn'

Schmidt (1872: 46) and Arntz (1933: 48) took this shared thematic present stem as an Indo-Slavic isogloss. However, Alb. *djeg* 'to burn (tr.)' belongs here as well (Demiraj 1997: 138–139), which makes the isogloss non-exclusive.

A further possible cognate is ToAB *tsäk-* 'to burn' (Adams 2013: 802). The anlaut *ts-* is complicated, however, as it seems to reflect **d-* rather than **d^{h}-*. This has been explained by assuming a Tocharian "Grassmann's Law" (Winter 1962: 24). Yet, ToA *tpär*, ToB *tapre* 'high', if from **d^{h}ub^{h}ro-* 'deep', presents a strong counterexample. The connection must thus be considered uncertain.

3.5.17 *d^{h}eh$_{1}$i- *'to contemplate, behold, see'*

Indo-Slavic exclusivity	Etymology	Shared innovation	Typology
No (Albanian)	Compelling	Possible	Root

130 According to Martínez (1999: 130), YAv. *dažaiti* rather reflects a *ie*/*o*-present.

Indo-Aryan: Skt. *dhī́-* f. 'observation, vision, thought', *dhay^{i}-* 'to contemplate, behold, see'
Iranian: OAv., YAv. *daēnā-* f. 'conception, view, religion'
Baltic: –
Slavic: OCS *divъ* m. 'astonishment, amazement'; Ru. (dial.) *div* m. 'miracle, astonishment'; Pol. *dziw* m. 'miracle'; SCr. *dîvan* 'wonderful, splendid'

While Meillet (1926: 168) claimed that the circumflex of SCr. *dîvan* 'wonderful, splendid' excludes direct comparison of OCS *divъ* and Skt. *dhī́-*, he acknowledges that the words are likely ultimately related (cf. also Arntz 1933: 46). In fact, the Serbo-Croatian non-acute is explained by Meillet's Law. In any case, it seems likely that these stems, including Av. *daēnā-* f. 'conception, view, religion', are derived from the same root **d^{h}eh$_{1}$i-* (cf. Kümmel 2020: 183).[131] This is possibly a variant of **d^{h}eh$_{1}$-* 'to put', originating from a verbal *i*-stem, cf. Hitt. *dai-^{i}* / *ti-* 'to lay, put, place' (Lubotsky 2011: 122).

Gr. σῆμα, Dor. σᾶμα 'sign, symbol, trait' < **d^{h}ieh$_{2}$-mn-* and θαῦμα 'wonder, astonishment' have been adduced as root cognates (see further Beekes 2010: 535, 1323), but as they require a different root structure, the connection is uncertain.

However, Alb. *di* 'to know' may well reflect **d^{h}eh$_{1}$i-*, with a trivial semantic shift (Demiraj 1997: 132–133; LIV: 141–142). Thus, **d^{h}eh$_{1}$i-* must be rejected as an Indo-Slavic isogloss.

3.5.18 *d^{h}er-men- *'support; agreement'*

Indo-Slavic exclusivity	Etymology	Shared innovation	Typology
Yes	Doubtful	Rejected	^{N}Derivation

Indo-Aryan: Skt. *dhárman-* n. 'support, law'
Iranian: MiP Pahl. *darmān*, Man. *drm'n* 'medicine, remedy, cure (?)'

131 There is a discussion in the literature about the position of the laryngeal in Av. *daēnā-* and Skt. *dhī́-* (see EWAia I: 777 with lit.). I follow Narten (1986) and Lubotsky (1995: 214; 2011: 122), who reconstruct Av. *daēnā-* < **daiH-ana-*, based on its trisyllabic scansion. Skt. *dhī́-* has a monosyllabic instr.sg. *dhyā́*, which has been argued to reflect **d^{h}Hi-aH*, but could just as well reflect **d^{h}iH-áH*.

Baltic: Lith. *dermẽ* f. 'agreement, consensus, harmony, treaty', *dernà* f. 'id.'
Slavic: –

The etymology is supported by LEW: 83 but not by EWAia I: 780. Lat. *firmus* 'firm, stable' is likely a root cognate, but is an adjective and does not reflect a *men*-stem. Although the Indo-Iranian and Baltic forms are formally comparable, they seem to derive their semantics from their respective corresponding verbal stems: Skt. *dhāráya-* 'to hold firm, support' vs. Lith. *deréti* 'to be suited, agree upon'. This indicates that the words are independent innovations.

3.5.19 *d^hoiH-neh$_2$- *'conception; song'*

Indo-Slavic exclusivity	Etymology	Shared innovation	Typology
Yes	Rejected	Possible	^{N}Derivation

Indo-Aryan: –
Iranian: OAv., YAv. *daēnā-* f. 'conception, view, religion'
Baltic: Lith. *dainà* f. '(secular) song'; Latv. *daiņa* f. '(folk) song'
Slavic: –

The above words were listed as an isogloss by Schmidt (Schmidt 1872: 46) and Arntz (1933: 48). However, Av. *daēnā-* is trisyllabic and must reflect **daiHana-* or **daHiana-* (Narten 1986: 263; Lubotsky 1995: 214; 2011: 122), which is formally incompatible with Baltic **d^hoiH-neh$_2$-*. Semantically, the connection is not compelling.

3.5.20 *ǵorh$_2$-eie/o- *'to make old, let ripen'*

Indo-Slavic exclusivity	Etymology	Shared innovation	Typology
Yes	Doubtful	Rejected	^{V}Derivation

Indo-Aryan: Skt. *jaráyati* 'to make age'
Iranian: –

Baltic: –
Slavic: OCS *sъzori* 3sg.aor. 'ripened (tr.)'; Ru. (dial.) *zorít'* 'to make (berries) ripen by spreading (them) on a mat'; OCz. *szořiti* 'to ripen (tr.)'; Sln. *zoríti*, *zorím* 'to ripen (tr.)'

Although Arntz's (1933: 48) comparison of Skt. *jī́ryati* 'to grow old, obsolete' to OCS *sъzьrěti* 'to ripen' cannot be maintained on formal grounds (cf. LIV: 165), both branches have potentially cognate causative formations. However, a closer look at the attested forms shows that this can hardly be the case. The short root vowel of Skt. *jaráyati* 'to make age' need not be due to the root-final laryngeal, but rather indicates that the stem is a secondary formation (within Indo-Aryan) to *járati* 'to make age' with the same meaning (Jamison 1983: 154, cf. *várdhati* vs. *vardháyati*). In Slavic, the causative may have been formed at any point, as a contrastive formation to the intransitive OCS *sъzьrěti* 'to ripen'.

3.5.21 *g^{h}rem-e/o- *'to murmur; to thunder, rage'*

Indo-Slavic exclusivity	Etymology	Shared innovation	Typology
Yes	Rejected	Possible	^{V}Derivation

Indo-Aryan: –
Iranian: YAv. *gramәṇt-* ptc. 'raging'; Sogd. S *'γr'n-* 'to get angry'; Psht. *γar-éğ-* 'to roar, thunder'
Baltic: Lith. (dial.) *gramė́ti*, *grãma*, *grumė́ti*, *grùma* 'to dash, fall, sink'; Latv. *gremt*, *-ju* 'to murmur'
Slavic: –

Iranian and Latvian have been argued to share a thematic present from a root *g^{h}rem- (LIV: 204). The root is also reflected in ON *gramr* 'angry', OE *grimman* 'to rage, roar; rush', OCS *gromъ* m. 'thunder', *grъměti* 'to thunder', Gr. χρόμος m. 'kind of noise'. Based on the attested semantics, the root may be onomatopoeic in origin, with Iranian and Germanic sharing a semantic development to 'to rage'. However, the Baltic verbs are so semantically divergent that it is unlikely that they belong to this cluster.

3.5.22 *gʷes-e/o- *'to be extinguished'*, *gʷōs-eie/o- *'to extinguish'*

Indo-Slavic exclusivity	Etymology	Shared innovation	Typology
Yes	Rejected	Rejected	VDerivation

Indo-Aryan: Skt. *jásamāna-* aor.ptc.med. 'being extinguished', *jāsáyati* 'to exhaust'
Iranian: –
Baltic: Lith. *gèsti, gę̃sta* 'to be extinguished'; Latv. *dzèst, dzešu, dzèšu* 'to extinguish, put out'
Slavic: OCS *ugasiti, ugašǫ* 'to extinguish'; Ru. *gasít', gašú* 'to extinguish'; Pol. *gasić, gaszę* 'to extinguish'; SCr. *gásiti, gâšīm* 'to extinguish'

Arntz (1933: 48) and Schmidt (1872: 46) listed both a thematic present and a causative formation from PIE **gʷes-* as Indo-Slavic isoglosses. However, the stem Skt. *jása-*, only attested as a participle, is rather an aorist (Gotō 1996: 84) and cannot be equated with Lith. *gèsti*. As for the causative, while Skt. *jāsáyati* and Slavic **gasìti* can formally both be derived from **gʷōs-eie/o-* (with analogical palatalization in Sanskrit), lengthened *ō*-grade is not expected and indicates that these are independent formations.

3.5.23 *gʷi-n-h₃- *'to feed'*

Indo-Slavic exclusivity	Etymology	Shared innovation	Typology
Yes	Rejected	Possible	VDerivation

Indo-Aryan: Skt. *jinóti* 'to impel, feed, strengthen'
Iranian: –
Baltic: –
Slavic: OCS *žęti, žьnjǫ, žьnǫ* 'to reap, mow'; Ru. *žat', žnu* 'to reap, mow'; Pol. *żąć, żnę* 'to reap, mow'; SCr. *žȅti, žȁnjēm* 'to reap, mow'

Although they are not formally identical, these Sanskrit and Slavic nasal presents have been argued to go back to the same Indo-European formation (LIV:

215). According to Vaillant (III: 306), Slavic underwent a change from the original meaning to 'to provide subsistence, collect food' as the nasal stem was lexicalized in a neo-root **žьn-*. However, a more plausible etymology for the Slavic verb is **gʷʰen-* 'to beat, slay' (Derksen 2008: 561), which was used in cereal processing contexts already at an early date, cf. Skt. *parṣáṅ … hanmi* 'I thresh sheaves', Gr. Περσεφόνη 'a Goddess; "the threshing maiden"' (Wachter 2007). Accordingly, the connected to Indo-Iranian may be rejected.

3.5.24 *gʷrH- *'rock'*

Indo-Slavic exclusivity	Etymology	Shared innovation	Typology
No (Albanian, Greek?)	Compelling	Possible	Root

Indo-Aryan: Skt. *girí-* m. 'mountain, hill'

Iranian: YAv. *gairi-* m. 'mountain'; Khot. *gara-*, *ggari-* 'mountain'; Sogd. *γr-* 'mountain'; Psht. *γar* 'mountain, pile of stones'; Yi. *γar* 'hill, mountain'; Yazg. *γār* 'stone, cliff, crag'

Baltic: Lith. *girià*, (Žem.) *gìrė* f. 'woods'; Latv. *dziŗa*, *dzire* f. 'woods'; OPr. *garian* (EV), *garrin* f. (Ench.) 'tree'

Slavic: OCS *gora* f. 'mountain'; Ru. *gorá* f. 'mountain'; Pol. *góra* f. 'mountain'; SCr. *gòra* f. 'mountain, (dial.) wood'

Schmidt (1872: 47) and Arntz (1933: 48) listed the above words as an Indo-Slavic isogloss. However, Alb. *gur* m. 'stone, rock' cannot be separated from this cluster (Demiraj 1997: 181), which means that the isogloss is non-exclusive.

Gr. δειράς f. 'height, mountain ridge' has been connected, but it is not easy to explain formally from **gʷ(e)rH-*; it is better derived within Greek from δέρη 'neck, ridge' (Beekes 2010: 311). Gr. βορέας m. 'north wind, north' is a less problematic possible cognate, perhaps derived from an unattested *βόρειος 'of the mountain', but this remains speculative.

The exact reconstruction is unclear. The East Iranian thematic stems can be later replacements of the *i*-stem otherwise attested in Khotanese, Avestan, and Sanskrit (Emmerick 1968: 289). For PIIr. we may thus reconstruct **grH-i-*. Balto-Slavic shows alternation between zero-grade and *o*-grade in the root, as well as suffix variation, which points to an original athematic paradigm. The meaning 'wood' in Baltic (and marginally in Slavic) is likely secondary from 'mountain'. Alb. *gur* must go back to a form with zero-grade in the root, but it can hardly

reflect an *i*-stem, as this would have caused *i*-mutation of **u* > *y*, cf. Alb. (*sh*)*typ* 'to crush' < **tup-ie*/*o*-, *kryq* 'cross' << Lat. *crucem*.

It is unclear whether all branches ultimately reflect the same stem, or if we must reckon with independent derivations. As for the root, a possible candidate is **g*^{w}*reh*$_2$-, reflected in Skt. *gurú-* 'heavy' and *grā́van-* m. 'pressing stone', provided that the position of the full grade vowel in Slavic **gorà* 'mountain' is secondary.

3.5.25 *g$^{(w)}$riH-ueh$_2$- *'neck, nape'*

Indo-Slavic exclusivity	Etymology	Shared innovation	Typology
No (Albanian)	Compelling	Possible	^{N}Derivation

Indo-Aryan: Skt. *grīvā́-* f. 'neck, nape'
Iranian: YAv. *grīuuā-* f. 'neck (of Daevic beings)'; MiP Pahl. *grīw* 'neck, throat'; MoP *girībān* 'neck-guard, gorget'
Baltic: Latv. *grīva* f. 'estuary'
Slavic: Ru. *gríva* f. 'mane'; Pol. *grzywa* f. 'mane'; SCr. *grȉva* f. 'mane'

The Indo-Iranian forms (EWAia I: 509; AirWb.: 530) and the Balto-Slavic forms (Derksen 2015: 535; Vasmer I: 309) are formally identical and have similar, but not identical, semantics. Latv. *grīva* 'estuary' may be understood as a metaphor of 'neck' or 'throat', but hardly 'nape' or 'mane', indicating that the Proto-Balto-Slavic meaning was 'neck'. This stem was listed as an Indo-Slavic isogloss by Schmidt (1872: 47), Arntz (1933: 45), and Porzig (1954: 167).

Gr. δέρη f. 'neck' (Ion. δείρη, Lesb. δέρα) is often adduced, but the Greek dialectal evidence precludes a reconstruction ***g*^{w}*er*(*H*)-*eh*$_2$-. In any case, the Greek word does not have **-iH-* in the root. It may alternatively be connected to Gr. δειράς f. 'height, mountain ridge' (Beekes 2010: 311).

However, Alb. *grykë* f. 'throat' < **grīwīkā-* (Orel 1998: 126) << **grīwā-* is a cognate to the Indo-Iranian and Balto-Slavic words that apparently has escaped the notice of most etymological dictionaries. The stem **g*$^{(w)}$*riH-ueh*$_2$- 'neck, nape' is thus not exclusively Indo-Slavic, but includes Albanian.

The stem **g*$^{(w)}$*riH-ueh*$_2$- has been argued to be derived from **g*^{w}*erh*$_3$- 'to swallow' (EWAia I: 509). If correct, one would have to assume an *i*-present **g*^{w}*rh*$_3$-(*o*)*i-* from which a *ueh*$_2$-stem noun was derived (or perhaps with an intermediate *u*-stem), reminiscent of a derivational chain described by Lubot-

sky (2011). Since no *i*-present or related verbal stem is attested for *$*g^{w}erh_3$- (see LIV: 211–212; Lith. *geriù* can be recent), this would have to be an archaic derivation. There are other potential Proto-Indo-European words for 'neck', most prominently *$*mon(H)$-*i*-, which is continued in Skt. *mányā*- f.du./pl. 'neck', YAv. *zarənu-maini*- 'with a golden necklace', Lat. *monīle* n. 'necklace, collar', MIr. *muin* f. 'the upper part of the back below the neck', and OHG *mana* f. 'neck, mane'. Furthermore, **kneK-n*-, reflected in Germanic **hnekkan*- ~ **hnakka*(*n*)- 'neck' and ToA *kñuk* 'neck' (Kroonen 2013: 234) must be quite archaic. However, it cannot be excluded that *$*g^{(w)}riH$-*ueh*$_2$- co-existed with these stems in PIE (*pace* Porzig 1954: 167), forming a triad with slightly different semantics, viz. 'neck', 'throat', and 'nape'.

3.5.26 *(H)roh$_1$d^{h}-i *'on account of, for the sake of'*

Indo-Slavic exclusivity	Etymology	Shared innovation	Typology
Yes	Rejected	Possible	^{N}Derivation

Indo-Aryan: (Skt. *rādh*- 'to succeed, be successful')
Iranian: OP *avahya-rādiy* 'for this reason'; Parth. *rād* 'on account of'; MoP *rāy* 'on account of'
Baltic: (Lith. *ródyti*, *ródo* 'to show, indicate, demonstrate')
Slavic: OCS *radi* 'for the sake of, because of'; SCr. *ràdi*, *râdi* 'for the sake of'; Sln. *zarâdi* 'because of'

The root is also found in PGm. **rēdan*- 'to decide' (Kroonen 2013: 408), OIr. -*ráidi* 'deliberates, says', and may be reconstructed as *$*Hre/oh_1d^{h}$- (similarly LIV: 499–500). Meillet (1926: 166) presents the postposition found in Iranian and Slavic as a strong isogloss (also Schmidt 1872: 48; Vasmer II: 482). However, unlike the related verbal stem OCS *raditi* 'to care about', SCr. *ráditi* 'to work, do', the accentuation of SCr. *râdi*, Sln. *zarâdi* does not seem to be compatible with a laryngeal in the root, which indicates that it is rather a borrowing from Iranian (cf. Derksen 2008: 432). The fact that Baltic and Indo-Aryan cognates are missing is consistent with this conclusion.

3.5.27 *$h_1$endro- *'kernel; egg, testicle'*

Indo-Slavic exclusivity	Etymology	Shared innovation	Typology
Yes	Rejected	Possible	[N]Derivation

Indo-Aryan: Skt. *āṇḍá-* n. 'egg, testicle'
Iranian: –
Baltic: –
Slavic: Ru. *jadró* n. 'kernel, core'; Pol. *jądro* n. 'grain, kernel, core'; SCr. *jédro* n. 'kernel, core'

This old comparison was listed as an isogloss by Schmidt (1872: 46) and Arntz (1933: 50). However, the words can hardly be related, since the alleged development **ndr* > Skt. *ṇḍ* must be rejected. Semantically, the comparison is not particularly compelling.

3.5.28 *h_1(e)r(H)ks- *'thorn'*

Indo-Slavic exclusivity	Etymology	Shared innovation	Typology
Yes	Rejected	Possible	Root

Indo-Aryan: Skt. *anr̥kṣará-* adj. '?'
Iranian: –
Baltic: Lith. *eršk̃ėtis* m. 'thorn-bush'; Latv. *ẽršķis* m. 'thorn-bush, thorn, prickle'
Slavic: Sln. *rẹ̑šək* m. 'sow thistle'

Arntz (1933: 38) listed the above words as an Indo-Slavic isogloss. Skt. *anr̥kṣará-*, occurring four times in the RV, describing a path, has traditionally been translated as 'thornless'. Derksen (2015: 156) tentatively accepts the connection, but remarks that the Baltic evidence points to a laryngeal in the root, which is incompatible with Skt. *anr̥kṣará-*.

However, the translation of Skt. *anr̥kṣará-* as 'thornless' is incorrect. As Jamison (1993) has convincingly argued, there is no evidence in favour of this translation, since the supposed base ***r̥kṣara-* 'thorn' is neither attested, nor can be

inferred from etymological considerations. According to her, *anṛkṣará-* is better analysed as *a-nṛ-kṣar-á-* 'not sweeping men away', i.e., 'harmless for men'. Thus, the proposed isogloss must be rejected.

3.5.29 *$h_1$mene *'of me'* (*1sg.gen. pronoun*)

Indo-Slavic exclusivity	Etymology	Shared innovation	Typology
No (Anatolian, Celtic, Tocharian)	Compelling	Rejected	NDerivation

Indo-Aryan: Skt. *máma* 'of me'
Iranian: OAv. *mā.nā*, YAv. *mana* 'of me'; OP *manā* 'of me'
Baltic: Lith. *manęs* 'of me'; Latv. *manis* 'of me'
Slavic: OCS *mene* 'me, of me'; ORu. *mene* 'id.'; SCr. *méne*, *mȅne* 'me, of me, to me'

The Iranian and Slavic forms reflect *h_1*mene* (AirWb.: 1098–1099; Derksen 2008: 308). Skt. *máma* is usually explained by assimilation or by analogy to the acc.sg. *mā́m* (EWAia II: 284–285), whereas the Baltic forms may have been influenced by the 2sg. (Derksen 2015: 304).

Meillet (1926: 167) considered *h_1*mene* to be a strong Indo-Slavic isogloss. Porzig (1954: 164) assumes that the genitive of the 1sg. personal pronoun was uninflected in Proto-Indo-European and regards the ending *-ne* as a shared innovation of Indo-Slavic. However, since MWelsh *vy* 'my' (with nasalization) also reflects **mene*, the isogloss is non-exclusive. Furthermore, Kloekhorst (2008: 111) argues that Hitt. obl. stem *amm-* goes back to *h_1*mne-* and suggests that the pronominal stem *h_1*me-* preserved in Core Indo-European branches is a dissimilation of this form (for the dissimilation, cf. Skt. *drāghmán-* 'length', instr.sg *drāghmā́*). Additionally, the palatalized anlaut of ToB *ñäś* 'I' may originate in *h_1*m(e)ne-*. This would imply that the genitive *h_1*mene* is an archaism, reconstructable to Proto-Indo-Anatolian.

3.5.30 *h_1(o)r-ti- *'attack, fight'*

Indo-Slavic exclusivity	Etymology	Shared innovation	Typology
Yes	Rejected	Rejected	NDerivation

Indo-Aryan: Skt. *ṛtí-* f. 'attack' (VS), *ŕti-* f. 'attack, hit' (AV+)
Iranian: YAv. *ərəti-* f. 'energy (?)'
Baltic: –
Slavic: OCS *ratь* f. 'war, fight'; ORu. *ratь* f. 'war, battle, troops'; SCr. *rȁ̑t* m. 'war'

Schmidt (1872: 48) listed these words as an Indo-Slavic isogloss. YAv. *ərəti-* may belong here, although the translation is uncertain (cf. AirWb.: 350). Formally, Skt. *ŕti-*, *ṛtí-*[132] looks like a *ti*-stem from *ar-* 'to reach, come towards, meet with', but given its semantics it is likely old. While the etymology is semantically compelling, the Indo-Iranian zero-grade in the root vs. Slavic *o*-grade is not easily explained, since *ti*-stems otherwise have no root ablaut. It is thus unlikely that the forms go back to a shared proto-form. To connect them, one would have to assume a proterodynamic stem **h*$_1$*or-ti-* / **h*$_1$*r-tei-*, which would indicate an archaism.

3.5.31 *h$_1$ui-d^{h}h$_1$-eu-eh$_2$- *'widow'*

Indo-Slavic exclusivity	Etymology	Shared innovation	Typology
No (Greek)	Compelling	Possible	^{N}Derivation

Indo-Aryan: Skt. *vidhávā-* f. 'widow'
Iranian: YAv. *viδauua* nom.sg.f. 'widow'
Baltic: OPr. *widdewū* f. 'widow'
Slavic: OCS *vъdova* f. 'widow'; Ru. *vdová* f. 'widow'

According to Meillet (1926: 171), the Indo-Iranian and Balto-Slavic forms of the Indo-European word for 'widow' share a full grade in the suffix versus zero-grade in Goth. *widuwo* f. and OIr. *fedb* f. However, Gr. ἠΐθεος m. 'unmarried youth', which is likely derived from the older feminine stem, likely shows the same full grade of the suffix, and the isogloss is thus non-exclusive. Lat. *vidua* f. 'widow' could be derived form either zero-grade or full grade in the suffix.

132 The accentual variation is secondary. Skt. *ṛtí-*, *ŕti-* 'attack' should not be confused with *ṛtí-* 'manner, way' < **h*$_2$*ṛ-ti-*, cf. Lat. *ars* 'art'.

3.5.32 *$h_1$ui-$d^h h_1$-u-r(i)o- *'separated'*

Indo-Slavic exclusivity	Etymology	Shared innovation	Typology
Yes	Rejected	Possible	[N]Derivation

Indo-Aryan: Skt. *vidhura-* adj. 'bereft, bereaved, alone, solitary' (Kāv.; Rājat.), *vi-dhura-* adj. '(a chariot) without shaft' (MBh.), *vithurá-* adj. 'shaky' (RV)
Iranian: YAv. *aiβiϑūra-* adj. 'rings, sehr siegreich'
Baltic: Lith. *vidurỹs* m. 'middle'
Slavic: –

The Indo-Iranian material is rather obscure. First, Skt. *vi-dhura-* '(a chariot) without shaft' (MBh.) is a transparent compound from *dhúr-* 'joint, pivot of the chariot pole and the yoke' and likely unrelated to the rest (cf. Monier-Williams 1899: 951). Conversely, *vidhura-* 'bereft (etc.)' has traditionally been regarded as a secondary and corrupt form of Vedic *vithurá-* 'shaky' (AiGr. II, 2: 486; EWAia II: 554; KEWA III: 208). Yet, the semantics of *vidhura-* are better explained if we assume an etymological connection to Skt. *vidhú-* 'solitary' and *vidhávā-* f. 'widow' (ultimately from PIE *$h_1$ui-$d^h h_1$-u-* 'set apart'). Thus, the fact that the roots *vidh-* 'to allot, apportion' and *vyath-* 'to shake, stumble' were eventually conflated in later Sanskrit does not necessarily imply that *vidhura-* is corrupt. YAv. *aiβiϑūra-* (AirWb.: 92) has generally been taken as a cognate of Skt. *ávithura-* 'unshakeable', but could theoretically be connected to *avidhura-* with Kümmel's Iranian laryngeal devoicing rule (2018).

Within Baltic, Lith. *vidurỹs* 'middle' is clearly related to *vidùs* m. 'middle' and *viduř* 'in the middle' (LEW: 1238). Lith. *vidùs* 'middle' is further related to Skt. *vidhú-* 'solitary', ON *viðr* m. 'tree, wood' < PGm. *widu-* and OIr. *fid* m. 'tree, wood, forest' (IEW: 1177). Of the attested forms, the semantics of Skt. *vidhú-* 'solitary' seem to be closest to PIE *$h_1$ui-$d^h h_1$-u-* 'set apart'. The semantics of Lith. *vidurỹs* rather suggests that it was derived within Baltic from *vidùs* 'middle', after this had already shifted from the original meaning 'set apart'. Although the ultimate origin of the suffix *-urỹs* is unclear, it is not uncommon in Lithuanian, cf. *dubùs* 'hollow, deep' ~ *duburỹs* 'hollow, hole, pond'; *angìs* 'snake' ~ *ungurỹs* 'eel' (see further Skardžius 1941: 309). In this regard the adverbial form *viduř* 'in the middle' may provide a crucial link between *vidùs* and *vidurỹs* and explain the latter as a deadverbial *io*-stem. Thus, it seems unlikely that Lith. *vidurỹs* and Skt. *vidhura-* represent the same formation.

3.5.33 *$h_{2/3}$eg$^{(w)}$-ro- *'top; first, early'*

Indo-Slavic exclusivity	Etymology	Shared innovation	Typology
Yes	Rejected	Possible	[N]Derivation Root

Indo-Aryan: Skt. *ágra-* n. 'top, summit, beginning'
Iranian: YAv. *aγra-* adj. 'first, topmost'
Baltic: Latv. *agrs* adj. 'early'
Slavic: –

Arntz (1933: 38) listed this as an Indo-Slavic isogloss (see also EWAia I: 45). However, the etymology must be rejected, as the short vowel of Latv. *agrs* is not compatible with the Indo-Iranian media.

3.5.34 *$h_2$ep- *'water'*

Indo-Slavic exclusivity	Etymology	Shared innovation	Typology
No (Tocharian, Italic, Armenian)	Compelling	Possible	Root

Indo-Aryan: Skt. *áp-* f. 'water'
Iranian: OAv., YAv. *ap-* f. 'water'; OP *ap-* f. 'water'
Baltic: Lith. *ùpė* f. 'river, stream'; Latv. *upe* f. 'river, stream'; OPr. *ape* 'brook, stream' (EV)
Slavic: –

Arntz (1933: 50) lists the root noun *h_2ep- 'water' as an Indo-Slavic isogloss. The Indo-Iranian and Baltic words (of which the vocalism of the East Baltic words is unclear) have been compared with Hitt. *ḫapa-* c. 'river',[133] CLuw. *ḫāpa/i-*

133 According to Kloekhorst (2008: 295), the meaning of the alleged Hittite all.sg. *ḫāppa* 'to the river', with geminate *-pp-* < **p* rather than **b*$^{(h)}$, cannot be determined.

c. 'river', Pal. *ḫāpna-* c. 'river' and OIr. *aub* f. 'river', which, however, reflect **h*$_2$*eb*$^{(h)}$-. Furthermore, Lat. *amnis* f. 'stream, river' and ToAB *āp-* 'river (?)' may be adduced, although these may in theory reflect either **h*$_2$*ep-* or **h*$_2$*eb*$^{(h)}$- (see further Wodtko, Irslinger & Schneider 2008: 311ff.).[134] Hamp (1972) attempted to clarify the relationship between these two variants by reconstructing **h*$_2$*ep-h*$_3$*on-*, based on the *n*-stems of Palaic and Celtic, with *h*$_3$-voicing as in Skt. *píbati*, OIr. *ibid* 'to drink' < **pi-ph*$_3$*-e-*. A possible unambiguous non-Indo-Slavic cognate is Arm. *hawaṙi* 'river-bed, river-shore', which could reflect **h*$_2$*ep-* 'river' + **sr*(*o*)*u-* 'to flow' (Martirosyan 2010: 206).

In sum, although the most transparent reflexes of **h*$_2$*ep-* are attested in Indo-Iranian and Baltic, evidence from other branches cannot confidently be refuted, and the isogloss cannot be maintained.

3.5.35 *h$_2$eu- *'to weave'*

Indo-Slavic exclusivity	Etymology	Shared innovation	Typology
No (Albanian)	Compelling	Possible	Root

Indo-Aryan: Skt. *o-* 'to weave', pres. *váyati*
Iranian: –
Baltic: Lith. *áusti*, *áudžia* 'to weave'; Latv. *aûst*, *aûžu* 'to weave'
Slavic: –

Arntz (1933: 54) argued that the unenlarged root of Lith. *áusti* 'to weave' < **h*$_2$*eud-* is preserved only in Lith. *auklẽ* f. 'shoelace' and Skt. *o-* 'to weave' < **h*$_2$*eu-*.[135] However, Alb. *vej* 'to weave' may in fact reflect the same present stem formation as Skt. *váyati* 'to weave' < **h*$_2$*u-eie*/*o-* (Demiraj 1997: 413), which means that the isogloss is non-exclusive.

134 Since Lat. *amnis* seems to be derived from an *n*-stem, it is likely from the same Proto-Italo-Celtic **h*$_2$*eb*$^{(h)}$*-on-* that also gave OIr. *aub*.

135 Lith. *auklẽ* f. 'shoelace' can hardly be separated from *aũti* 'to put on shoes'.

3.5.36 *h$_2$eu-o- *3sg.pron. 'that'*

Indo-Slavic exclusivity	Etymology	Shared innovation	Typology
Yes	Rejected	Rejected	NDerivation

Indo-Aryan: –
Iranian: OAv., YAv. *auua-* 'that'; OP *ava-* 'that'; MiP Pahl. *ōy*, Man. *'wy* 'he, she, that'; Sogd. *w-* 'that, the'
Baltic: –
Slavic: OCS *ovъ* 'someone, someone else, other'; Pol. *ów* 'that'; SCr. *òvāj* 'this'

Both Iranian (AirWb.: 163–167) and Slavic (Vasmer II: 251; Derksen 2008: 384) attest demonstrative pronoun stems that may be unified under a reconstruction **h$_2$eu-o-*. It was proposed as an isogloss by Schmidt (1872: 48). Skt. gen.du. *avóṣ* 'of those two' has traditionally been connected, but is rather an assimilated variant of *ayóṣ* (Klein 1977; EWAia I: 135).

The pronoun has variously been derived from **h$_2$eu-* 'away' (Dunkel 2014, 2: 96, 111) or **h$_2$eu-* 'again' (Beekes 2010: 173), which may ultimately be the same root. The root is widespread in Indo-European, e.g., Hitt. *u-* 'hither', Skt. *áva* 'away, off', OIr. *ua-* 'neg. prefix', Lith. *au-* 'away', Lat. *aut* 'either … or', Gr. αὖ 'again, on the other hand'. Gr. αὐτός 'self; the same' ~ Phryg. *auto-* 'self' is another pronominal derivative (most likely from **h$_2$eu-* 'again'). The Albanian deictic particle *a-* reflected in Alb. *aí*, *ajó*, *atá* 'ille, -a, -ud' probably also continues **h$_2$eu-*.

Lyd. *osk* nom.-acc.pl. 'and that' and Car. *u-* 'the one by you' are adduced as further evidence for a PIE pronoun **h$_2$eu-o-* by Dunkel (2014, 2: 111). However, the Lydian word can hardly be equated to YAv. *auua-* etc. in view of the *-s-*, which goes back to PIE **si* (cf. Melchert 1994: 337). Yet, Melchert (2009: 157) does derive Lyd. *os-* and (hesitatingly) Car. *u-* from **e/ouo-*, stating that the Lydian form was secondarily inflected. However, Carian preserves **h$_2$* as *k* (Adiego Lajara 2007: 260), and the same is likely true for Lydian (Yakubovich 2019). A more plausible etymology is that proposed by Eichner (1988: 55), who explained *os-* from *au-* + *es-* 'this'.

Although **h$_2$eu-o-* seems to be limited to Iranian and Slavic, there are strong indications that the Iranian form is a relatively recent innovation. The nom.sg.m. OAv. *huuō*, YAv. *hāu* look like the pronoun **sa* + particle **u* or **au*, respectively. This form must be compared with Skt. nom.sg.m. *asáu* 'ille', to

which the pronominal stem **a-* was added. Tedesco (1947) reconstructed a PIIr. nominative **sāu* and argued that the Iranian non-nominative stem **aua-* was created by adding the deictic particle **au-* to the pronominal stem **a-*. In Indo-Aryan, the particle was instead post-posed in its zero-grade form,[136] leading to acc.sg.m. **am-u*, which was regularized to Skt. *amúm* and used as the base for a new paradigm with the stem *amú-*. The "irregularity" of the Sanskrit paradigm shows that **aua-* did not exist in Proto-Indo-Iranian, as there would otherwise be no reason to innovate *amú-*. In fact, even the reconstruction of **sāu* is uncertain, since OAv. *huuō* rather reflects **sau*,[137] implying the existence of two different nominative forms in Proto-Iranian. This means that Iranian **aua-* cannot be directly compared to Slavic **ovъ*, which may have been independently derived from **$h_2$eu-* within Slavic.

3.5.37 *(h_2)gr-ŏm- *'heap'*

Indo-Slavic exclusivity	Etymology	Shared innovation	Typology
Yes	Rejected	Rejected	NDerivation

Indo-Aryan: Skt. *grā́ma-* m. 'train, troops, village community'
Iranian: MiP Pahl. *grāmag* 'wealth'; Sogd. B *γr'm'k* 'riches'; Khwar. *γr'm* 'weight, burden'; Oss. I *ærγom* / D *ærγon* 'bundle of firewood, burden, load'
Baltic: Lith. *grùmulas* m. 'lump', *gramañtas* m. 'big lumps', *gromulỹs*, *grõmulas* n. 'cud, rumination, digestion'
Slavic: RuCS *gromada* f. 'heap, pile, bonfire'; OCS *gramada* f. 'heap, pile'; ORu. *gromada* f. 'heap, pile, bonfire', *gramada* f. 'pile'; Pol. *gromada* f. 'pile, multitude, village community, gathering'; SCr. *gromáda*, *grmada* f. 'cliff, crag, heap, pile', *gramáda* f. 'clod, pile of firewood'

The Indo-Iranian and Balto-Slavic words are often compared (EWAia I: 507–508; Derksen 2015: 191) and constitute a potential Indo-Slavic isogloss. However, several problems regarding the Balto-Slavic forms as well as the deeper Indo-European etymology have not been sufficiently addressed.

136 However, in the neuter, the full grade was used, i.e., *adó* < **adáu* (cf. Tedesco 1947: 119).
137 Cf. De Vaan (2003: 365). Narten argued that OAv. *huuō* was replaced in Young Avestan by the feminine *hāu*, but one must agree with Tedesco (1947: 118) that this is rather unlikely, especially since masculine **sa* + *au* is paralleled by Skt. *asáu* and neuter *adó*.

First, the Balto-Slavic material presents several difficulties. The irregular vocalism of Lith. *grùmulas* has been suggested to reflect a metathesized zero-grade **gur-m-*, possibly through contamination from *gùmulas* 'lump' (Derksen 2008: 190). In terms of root vocalism, Lith. *gramañtas* (LEW: 162) is closer to the Slavic forms, but the suffix *-añtas* remains unexplained. If Lith. *gromulỹs* belongs here, the vacillation of *o*/*a* in the root does not look old. For Slavic, we must reckon with three different variants, viz. **gromada* (East, West, South Slavic), **gramada* (East, South Slavic) and **grmada* (South Slavic). The root vocalism hardly reflects old ablaut, but rather indicates a more recent formation. The unexplained suffix *-ada-* presents a further argument against an old athematic *m*-stem. On the whole, the Balto-Slavic evidence does not point to an inherited etymon.

For Proto-Indo-Iranian, a stem **grāma-* may be straightforwardly reconstructed. However, the deeper Indo-European etymology is uncertain. PIIr. **grāma-* has been derived from **$h_2$ger-* 'to gather' (cf. Gr. ἀγείρω 'to gather'), in which case one would have to assume an athematic stem **$h_2$gr-om-* (cf. **$d^h\acute{g}^h$-om-* 'earth') with subsequent thematicization in Indo-Iranian. As athematic *m*-stems are exceedingly rare, and the root **$h_2$ger-* is otherwise unattested in Indo-Iranian, this etymology is far from certain. Another possibility is to reconstruct **graHma-* and connect it to Skt. *grā́van-* m. 'pressing stone' and *gurú-* 'heavy, hard, vehement'. This is especially attractive in view of the semantics of Khwar. *γr'm* 'weight, burden' and Oss. I *ærγom* / D *ærγon* 'burden, load', from which the meaning of Skt. *grā́ma-* 'train, troops, village community' may have developed secondarily. The Slavic variants with short **o* in the root, e.g., RuCS *gromada* 'heap, pile, bonfire', are incompatible with PIIr. **graHma-*.

Lat. *gremium* n. 'lap, bosom' has been adduced as a cognate, but it is hardly old, since it has not undergone the sound change **-mi̯-* > Lat. *-ni-* (de Vaan 2008: 272). De Vaan argues that *gremium* may have been derived within Latin from an earlier **gremo-*, in turn derived from a stem variant of **$h_2$gr-om-*. However, the meaning of *gremium* is not very close to Indo-Iranian **grāma-*. Furthermore, as argued above, the reconstruction of an athematic *m*-stem is problematic. Lat. *gremium* may instead belong with MHG *krimmen* 'to grab, squeeze' < PGm. **krimman-* 'to crumble' (Kroonen 2013: 305).

In conclusion, an etymological connection between Indo-Iranian **grāma-* and the Balto-Slavic material cannot be supported and it should be rejected as an Indo-Slavic isogloss.

3.5.38 *h_2ōu-is *'evidently, manifestly'*

Indo-Slavic exclusivity	Etymology	Shared innovation	Typology
No (Germanic, Greek, Italic)	Doubtful	Possible	NDerivation

Indo-Aryan: Skt. *āvíṣ* adv. 'evidently, manifestly'
Iranian: OAv., YAv. *āuuiš* adv. 'apparently, evidently'
Baltic: Lith. *ovyje* adv. 'in reality'
Slavic: OCS *javě*, *avě* adv. 'manifestly, openly, clearly'; SCr. *javi* adv. 'just like, as if'

Schmidt (1872: 47), Meillet (1926: 173), and Arntz (1933: 48) list this adverb as an isogloss of Indo-Iranian and Balto-Slavic. However, this conclusion has several problems.

First, an *e*-grade variant *h_2*eu-is* likely formed the basis of Lat. *audiō* 'to hear' and Gr. αἰσθάνομαι 'to perceive' < *h_2*eu-is-d^{h}h$_1$-*, as well as Gr. ἀΐω 'to perceive, hear' (IEW: 78; de Vaan 2008: 61; Beekes 2010: 43, 46). Moreover, Kroonen (2013: 45) has argued convincingly that OE *ēawis* 'apparent' and OHG *awi-zoraht* 'evident' preserve a Germanic reflex **awiz*, which could continue a long or short root vowel, as a long vowel would have undergone Dybo's pretonic shortening (cf. the oxytone Skt. *āvíṣ*).

Second, the Indo-Iranian and Balto-Slavic forms are difficult to reconcile formally, since Slavic **a* points to **ō* or **ē*. Lith. *ovyje* 'in reality' rather points to **eh$_2$*, but may be a borrowing from Slavic (cf. Derksen 2015: 341). While a lengthened grade is formally possible for Indo-Iranian (thus EWAia I: 177), it makes little sense from a morphological perspective. A more plausible reconstruction would be **h$_2$*ou-is*, with Brugmann's Law, which may be independently supported by Gr. οἴομαι 'to suspect, expect, think, believe, deem' (Beekes 2010: 1059–1060). The *o*-grade may have been taken over from the verbal stem, cf. Hitt. 1sg.pres. *uḫḫi* 'I see' < **h$_2$*ou-h$_2$*ei*. Since OCS *javě*, *avě* is incompatible with a reconstruction **h$_2$*ou-is*, it may rather be explained as a borrowing from Iranian.

3.5.39 *$h_2$sous-eie/o- *'to make dry (up)'*

Indo-Slavic exclusivity	Etymology	Shared innovation	Typology
No (Germanic)	Doubtful	Rejected	[V]Derivation

Indo-Aryan: Skt. *śoṣáyati* 'to make dry up' (AV)
Iranian: MiP Pahl. *hōš-* 'to dry up, wither'; MoP *xōš-* 'to dry'
Baltic: Lith. *saũsinti, -ina,* (dial.) *saũsyti, saũso* 'to dry (something) off'; Latv. *sausinât* 'to dry'
Slavic: OCS *sušiti, sušjǫ* 'to dry, exhaust'; Ru. *sušít', sušú* 'to dry'; Pol. *suszyć, suszę* 'to dry'; SCr. *súšiti, sûšīm* 'to dry'

Indo-Iranian and Balto-Slavic both attest *eie*/*o*-stems from *$h_2$seus- 'to be dry' (for the denominal origin of this root, cf. Lubotsky 1985). However, Nw. *søyre* 'to make dry', although not unlikely secondary from *søyr* adj. 'dry', could also reflect *$h_2$sous-eie/o-. In any case, Skt. *śoṣáyati* 'to make dry up' (with secondary *ś-*) could be a productive formation after the intransitive Skt. *śúṣyati* 'to dry up' (Jamison 1983: 145). Lith. *saũsinti* 'to dry (something) off' and Latv. *sausinât* 'to dry' are probably better analysed as denominal from the adjective Lith. *saũsas* 'dry' etc.

3.5.40 *$h_2$uodH-eie/o- *'to speak'*

Indo-Slavic exclusivity	Etymology	Shared innovation	Typology
Yes	Doubtful	Rejected	[V]Derivation

Indo-Aryan: Skt. *vádati* 'to raise one's voice, speak, talk' (RV+), *vādáyati* 'to make speak' (Br.+)
Iranian: –
Baltic: –
Slavic: OCS *vaditi, važdǫ* 'to accuse'; Ru. *vádit'* 'to slander, lure, spend time, deceive'; Pol. *wadzić, wadzę* 'to annoy, hamper'; Sln. *váditi, vâdim* 'to report, charge'

Arntz (1933: 55) compared the causative Skt. *vādáyati* 'to make speak' to OCS *vaditi* 'to accuse'. However, the Sanskrit form is not attested in the oldest language and may well be a productive formation. Moreover, the Slavic verbs have divergent semantics, and one may wonder whether at least some of the attested forms are rather derived from **ued^{h}-* 'to lead', cf. Lith. *vadìnti* 'to call', Latv. *vadinât* 'to lead, accompany, urge, lure'.

3.5.41 *h$_3$nob^{h}-i- / *h$_3$nob^{h}-H- *'nave, navel'*

Indo-Slavic exclusivity	Etymology	Shared innovation	Typology
No (Germanic)	Compelling	Possible	NDerivation

Indo-Aryan: Skt. *nā́bhi-* f. 'nave, navel; origin, relation, kin', *nā́bhā-nédiṣṭha-* 'PN'
Iranian: YAv. *nāfa-* m. 'navel; relative, family', *nabā-nazdišta-* 'next of kin'
Baltic: Latv. *naba* f. 'navel'; OPr. *nabis* 'nave, navel'
Slavic: –

Skt. *nā́bhi-* (cf. EWAia II: 13–14) is often reconstructed as an *i*-stem (Wodtko, Irslinger & Schneider 2008: 385). OPr. *nabis* (Derksen 2015: 562) has been argued to derive from the same formation (Klingenschmitt 1978: 100), in which case the *i*-stem could constitute an Indo-Slavic isogloss. However, the Prussian form could just as well reflect an *o*-stem, cf. OPr. *deywis* ~ Lith. *diẽvas* (Stang 1966: 181). Furthermore, the distribution of voiceless *-f-* in YAv. *nāfa-* vs. voiced *-b-* in *nabā-*[138] points to an old athematic *H*-stem **h$_3$nob^{h}-H-* / **h$_3$nb^{h}-eH-*, which could also explain the *i*-stem of Sanskrit as a result of laryngeal vocalization (Kümmel 2021). This athematic *H*-stem could also be the basis for the Baltic forms, as well as ON *nøf* 'nave', OHG *naba* 'nave' etc. (cf. Kroonen 2013: 380–381).

3.5.42 *ieu-o- *'grain, barley'*

Indo-Slavic exclusivity	Etymology	Shared innovation	Typology
No (Anatolian, Greek)	Compelling	Possible	NDerivation

138 Possibly, the short root vowel of YAv. *nabā-* is the result of secondary shortening (de Vaan 2003: 137–138).

Indo-Aryan: Skt. *yáva-* m. 'grain, corn, crop, barley'
Iranian: YAv. *yauua-* m. 'grain'; MiP Pahl. *ǰaw* 'barley'; Oss. *jæw* 'millet'; Par. *žō* 'barley'
Baltic: Lith. *javaĩ* m.pl. 'corn, grain'
Slavic: –

Porzig (1954: 169) takes **ieu-o-* as an isogloss, since Gr. ζειαί f.pl. 'one-sided wheat, spelt' reflects a different derivation (**ieu-ieh*$_2$-). The Greek word may be derived from the *o*-stem, however. Moreover, Hitt. *eu̯an-* n. 'a kind of grain' shows that the root is Indo-Anatolian. The Hittite word is sometimes inflected as an *o*-stem, but even if this is old (which Kloekhorst 2008: 263–264 deems unlikely), the neuter gender could point to an independent formation from Skt. *yáva-* etc. (see further Weiss 2021).

Arm. *ǰov* 'sprout, branch; string' is formally comparable to **ieu-o-*, but the meaning is too far removed to make it a likely cognate. ToB *yap* 'barley' is borrowed from an Indo-Iranian source (Peyrot 2018: 245).

3.5.43 *ḱi(e)h$_1$-uo- *'dark, black, grey'*

Indo-Slavic exclusivity	Etymology	Shared innovation	Typology
No (Germanic)	Compelling	Possible	[N]Derivation

Indo-Aryan: Skt. *śyāvá-* adj. 'dark brown, dark'
Iranian: YAv. *siiāuua°* adj. 'dark' (in names); MiP Pahl. *syā*, Man. *sy'w* adj. 'black'; Khot. *śāva-* 'copper, copper-coloured'; Sogd. *š'w* adj. 'black'; Khwar. *s'w* adj. 'black'; Oss. *saw* adj. 'black'
Baltic: Lith. *šývas* adj. 'light grey (of horses)'; OPr. *sywan* adj. 'grey' (EV)
Slavic: Ru. *sívyj* adj. 'grey'; Pol. *siwy* adj. 'grey'; SCr. *sȉv* adj. 'grey'

The Indo-Iranian (EWAia II: 661; AirWb.: 1631; Abaev III: 42–43) and Balto-Slavic words (LEW: 996; Vasmer II: 621) have been taken as an Indo-Slavic isogloss by Schmidt (1872: 49), Arntz (1933: 43) and Porzig (1954: 166–167). However, OE *hāwi* 'blue, purple, grey, discoloured' < PGm. **hēwja-* (Kroonen 2013: 224) cannot be excluded as a cognate and the isogloss is therefore non-exclusive. It is also notable that the Balto-Slavic forms show zero-grade of the root, whereas Indo-Iranian has full grade, indicating that they are separate thematicizations of an earlier *u*-stem.

3.5.44 *Ḱlei-e/o- *'to lean against (intr.)'*

Indo-Slavic exclusivity	Etymology	Shared innovation	Typology
No (Tocharian)	Compelling	Possible	[V]Derivation

Indo-Aryan: Skt. *śráyate* 'to lean against (intr.)'
Iranian: YAv. 3sg.pres.inj.med. *upa-sraiiata* 'leaned upon (intr.)'
Baltic: Lith. *šliẽti, -ja* 'to lean, rest against'; Latv. *slìet, sleju* 'to support, erect; lean against (tr.)'
Slavic: –

Arntz (1933: 57) listed the Indo-Iranian and Baltic thematic present formations from **ḱlei-* 'to lean against' as an isogloss. This may be contrasted with the more widely attested nasal present from this root, cf. YAv. *ni-sirinaoiti* 'to bring, assign', Gr. κλίνω 'to lean on, bend', Lat. *dēclīnō* 'to deviate, divert', OHG *hlinēn* 'to lean against' (LIV: 332).[139] In Lithuanian, the root vocalism *-ie-* of the infinitive has been levelled throughout the paradigm (Smoczyński 2018: 1404). The acute accent in Baltic must be secondary (RR II: 430) and Latv. 1sg. *sleju* may reflect the original accentuation.

However, ToA *kälytär*, ToB *kaltär* 'to stand' may also be derived from **ḱlei-e/o-* (LIV: 332; Ringe 1991: 152). Malzahn (2010: 593) and Peyrot (2013: 738) argue, based on ToA 1sg.pres.med. *kälymār*, that a root present should be reconstructed for Proto-Tocharian. Yet, it seems more likely that the thematic forms attested in both Tocharian A and B are old and that the athematic forms arose within Tocharian, since the palatalizing effect of the thematic vowel was neutralized due to the root-final **-i* (Friis 2024).

One might envision the following scenario: in Proto-Indo-European, **ḱlei-* formed an intransitive root aorist, to which an oppositional transitive nasal present **ḱl-ne-i-* was created. The thematic present reflected in Indo-Iranian, Balto-Slavic and Tocharian, in turn, may be seen as an oppositional intransitive to **ḱl-ne-i-*. The thematic stem **ḱlei-e/o-* may reflect an innovation in these three branches, but could also be an archaism that was lost elsewhere.

139 Latv. *slìenu* 'I lean' may belong here but could just as well be an independent innovation.

3.5.45 *Ḱok(H)olo- *'chip of wood'*

Indo-Slavic exclusivity	Etymology	Shared innovation	Typology
Yes	Rejected	Possible	NDerivation

Indo-Aryan: Skt. *śákala-* m./n. 'chip, fragment, splint, log, piece' (YV, TS+)
Iranian: –
Baltic: Lith. *šakalỹs* m. 'chip of wood, splinter, pinewood'; Latv. *sakaļi* m.pl. 'torches'
Slavic: –

Arntz (1933: 49) took the Sanskrit and Baltic words as a shared derivative in *-*l-* from *$*ḱok^{(w)}$-h_2-* 'branch', reflected in Skt. *śā́khā-* f. 'branch', Goth. *hoha* m. 'plough', and Arm. *c^{c}ax* 'branch'. There are several problems with this etymology, however. First, Lith. *šakalỹs* and Latv. *sakaļi* are probably productive diminutive formations from Lith. *šakà* f. 'branch' etc. and need not be old. Skt. *śákala-*, on the other hand, may be unrelated to *śā́khā-* given the unaspirated *-*k-*. To connect them, one would have to assume that Skt. *śákala-* reflects *$*ḱek^{(w)}$-*o-* + *-lo-*, i.e., a different formation without the suffix *-h_2-*. A preform *$*ḱek^{(w)}$-*olo-* could not produce Lith. *šakalỹs*. Ultimately, the connection between the Sanskrit and Baltic words must be rejected.

3.5.46 *Ḱor-H(-keh$_2$)- *'a kind of bird'*

Indo-Slavic exclusivity	Etymology	Shared innovation	Typology
No (Greek)	Doubtful	Possible	NDerivation

Indo-Aryan: Skt. *śā́ri-* f. 'a kind of bird, *Gracula religiosa* (?)' (YV+), *śārikā-* f. (Ep.+) 'id.'
Iranian: MoP *sār*, *sārak* 'starling'
Baltic: Lith. *šárka* f. 'magpie'; OPr. *sarke* f. 'magpie' (EV)
Slavic: CS *svraka* f. 'magpie'; Ru. *soróka* f. 'magpie'; Pol. *sroka* f. 'magpie'; SCr. *svrȁka* 'magpie'

Arntz (1933: 44) listed these words as an Indo-Slavic isogloss (cf. also EWAia II: 630). However, the words are difficult to separate from similar-looking bird names in other branches. While Arm. *sarik* 'starling' is likely an Iranian loanword (Hübschmann 1897: 236), Gr. κόραξ m. 'raven' could reflect **ḱorh₂k-* (Beekes 2010: 750), which would make it formally very close to Balto-Slavic. Gr. κορώνη f. 'crow' and Lat. *cornīx* f. 'crow' may be derived from an *n*-stem of the same root. Alb. *sórrë* f. 'crow', if inherited, could go back to **ḱuērneh₂-* and has been compared with SCr. *svrȁka* etc. (Demiraj 1997: 355), although the Slavic forms that seem to reflect an anlaut **ḱu-* may be secondary (cf. Derksen 2008: 477). At any rate, it seems likely (with de Vaan 2008: 136) that we are dealing with an Indo-European onomatopoeic formation **ḱor-*, and there are no compelling arguments for taking the Indo-Iranian and Balto-Slavic forms as an isogloss.

3.5.47 *ḱun-ko/eh₂- *'dog-like; bitch'*

Indo-Slavic exclusivity	Etymology	Shared innovation	Typology
Yes	Rejected	Rejected	[N]Derivation

Indo-Aryan: Skt. *śvaka-* m. 'wolf'
Iranian: YAv. *spaka-* 'dog-like'; MiP Pahl. *sag*, Man. *sg* 'dog'; MoP *sag* 'dog'; Psht. *spay* m. 'dog', *spəy* f. 'bitch'
Baltic: –
Slavic: Ru. *súka* f. 'bitch'; Pol. *suka* f. 'whore'; Plb. *sauko* f. 'whore'

Schmidt (1872: 49) and Arntz (1933: 49) listed the above words as an Indo-Slavic isogloss. However, it is unlikely that the Indo-Iranian and Slavic words reflect the same formation, for several reasons. First, the semantics are divergent. In Indo-Iranian, the *-ka-* suffix means '-like', or makes a diminutive, whereas in Slavic it means 'female dog'. Secondly, a reconstruction **ḱun-keh₂-* only accounts for part of the Slavic evidence, but not Pol. *suka* and Plb. *sauko* 'whore'. In view of these considerations, I reject a direct comparison of the Indo-Iranian and Slavic words.

3.5.48 *kor-o- *'army'*

Indo-Slavic exclusivity	Etymology	Shared innovation	Typology
Uncertain	Compelling	Rejected	NDerivation

Indo-Aryan: –
Iranian: OP *kāra-* m. 'army, people'; Bactr. καρο 'people'
Baltic: Lith. *kãras*, *kãrias* m. 'war, army'; Latv. *kaŗš* 'war, army'; OPr. *kragis* [*kargis*] m. 'army' (EV)
Slavic: –

Arntz (1933: 43–44) observed that Baltic and Iranian share an *o*-stem **kor-o-*, while Gr. κοίρανος m. 'ruler, commander, lord', OIr. *cuire* m. 'troop, tribe' and Goth. *harjis* m. 'host, troop' reflect **kor-io-* (LEW: 220; Derksen 2015: 226). However, Baltic also preserves the *io*-stem, as evidenced by Lith. *kãrias*, indicating that both formations are inherited. The relationship between the *o*-stem and *io*-stem is unclear, as they appear to have the same meaning, but it seems difficult to exclude the possibility that the *io*-stem is derived from the *o*-stem, in which case the latter would be a shared archaism.

3.5.49 *krouh$_2$-io- *'corpse; flesh'*

Indo-Slavic exclusivity	Etymology	Shared innovation	Typology
No (Germanic)	Compelling	Possible	NDerivation

Indo-Aryan: Skt. *kravyā́d-* adj. 'eating flesh, corpses' (RV+), *kravyá-* adj. 'bloody' (PS, TS)
Iranian: –
Baltic: Lith. *kraũjas* m. 'blood'; OPr. *crauyo* f. 'blood' (EV), *krawia* f., *krawian* acc.sg.n. 'blood'
Slavic: –

Arntz (1933: 44) listed this *io*-stem as an Indo-Slavic isogloss. However, these words cannot be separated from ON *hræ* n. 'corpse, remains', OE *hrǣ*(*w*), *hrā*(*w*)

n. 'corpse, remains' < PGm. **hraiwa-*, which derives from **hrauja-* < **krou-io-* with metathesis (Kroonen 2013: 242). The Germanic cognate has not been taken into account in much of the literature on this etymology (e.g., Pinault 1982; EWAia I: 411; Wodtko, Irslinger & Schneider 2008: 444).

3.5.50 *kseub^{h}- *'to sway, swing'*

Indo-Slavic exclusivity	Etymology	Shared innovation	Typology
No (Germanic)	Compelling	Rejected	Root

Indo-Aryan: Skt. *kṣobh-* 'to stagger, begin to swing, tremble'
Iranian: YAv. *xšufsąn* 3pl.pres.subj. 'they will tremble'
Baltic: Lith. *skubė́ti, skùba* 'to hurry', *skubùs* adj. 'hasty'; Latv. *skubrs* 'hasty'
Slavic: Cz. *chybati* 'to hesitate'; Pol. *chybać*, *chybam* 'to sway, rock, run, rush'

Arntz (1933: 36) listed this root as an Indo-Slavic isogloss (see also LIV: 372). The Baltic forms have alternatively been connected to Goth. *af-skiuban* 'to push away, reject' under a reconstruction **skeub^{h}-* (LIV: 560). However, since **ks-* metathesizes to *sk-* in Germanic and Baltic, the forms may all reflect **kseub^{h}-* (Kroonen 2013: 444–445). The only reason to separate the Germanic root would be Slavic **skub-* in, e.g., SCr. *skúpsti* 'to pluck out', which Smoczyński (2018: 1214) connects to Lith. *skubė́ti* 'to hurry', but this is semantically remote and likely unrelated.

3.5.51 *kuměl- *'young (of animal)'*

Indo-Slavic exclusivity	Etymology	Shared innovation	Typology
Yes	Rejected	Possible	^{N}Derivation

Indo-Aryan: Skt. *kumārá-* m. 'child, son'
Iranian: –
Baltic: Lith. *kumẽlė* f. 'mare', *kumelỹs* m. 'stallion'; Latv. *kumele* f. 'mare', *kumeļš* m. 'stallion'
Slavic: –

Arntz (1933: 42) listed this stem as an isogloss (cf. also LEW: 309; EWAia I: 369). While the Sanskrit and Lithuanian forms are formally comparable, uniting them yields a rather obscure Indo-European reconstruction. To account for the long *-ā-* of *kumārá-* as opposed to the short *-ẽ-* of *kumẽlė*, one would have to assume an ablauting stem **kum-el-*, which is implausible, since a root **kuem-* is otherwise unknown. Furthermore, it must be taken into account that *-elė*/*-elys* is a diminutive suffix in Baltic. Perhaps the Baltic words are rather to be compared with ORu. *komonъ* 'horse' (Derksen 2008: 232) or Ger. *Hummel* 'hornless ox, castrated bull'.

3.5.52 *k^{w}eit- *'to perceive'*

Indo-Slavic exclusivity	Etymology	Shared innovation	Typology
No (Germanic)	Compelling	Possible	Root

Indo-Aryan: Skt. *cet-* 'to perceive, take notice of', *cétas-* n. 'insight'
Iranian: OAv. *cōiϑ-* 'to perceive'
Baltic: Lith. *skaitýti*, *skaĩto* 'to read, count'; Latv. *šķist*, *šķìetu* 'to think, suppose', *skàitît*, *skàitu* 'to count, recite, read'
Slavic: OCS *čisti*, *čьtǫ* 'to count, read, honour'; Ru *čitát'*, *čitáju* 'to read'; Cz. *čísti*, *čtu* 'to read'; SCr. *čísti* (13th–16th century AD) 'to read'

The root **k^{w}eit-* 'to perceive' has been explained as a *t*-extended variant of the synonymous **k^{w}ei-* (LIV: 382). The enlarged variant, attested in nominal and verbal derivations in Indo-Iranian (EWAia I: 547–548) and Balto-Slavic (Derksen 2008: 89; Derksen 2015: 552–553), constitutes a possible Indo-Slavic isogloss, as suggested by Schmidt (1872: 49) and Arntz (1933: 40).

However, there are two problems with this etymology. First, the allegedly original root **k^{w}ei-* is continued in OCS *čajati* 'to expect, thirst for' and SCr. *čȁjati* 'to wait', which corresponds to Skt. *cā́ya-* 'to perceive' and Gr. τίω 'to esteem'. This verbal stem has been reconstructed as a so-called Narten-present **k^{w}ĕi-* (LIV: 377), but the Slavic acute points to **k^{w}eh$_{1}$i-* (Derksen 2008: 78; cf. also Weiss 2017; Kümmel 2020), implying that the traditional analysis of **k^{w}eit-* can hardly be maintained.

Second, besides Skt. *cet-* 'to perceive', there is the homophonous *cet-* 'to shine', reflected in, e.g., *citrá-* 'shining', *ketú-* m. 'appearance', which cannot be separated from PGm. **haidra-* 'clear' (Kroonen 2013: 200) and Goth. *haidu-*

m. 'way, manner' (Lehmann 1986: 168). Since there is no evidence that *cet-* 'to perceive' and its cognates reflect a labiovelar, the two roots may be combined under a reconstruction **keit-*.[140] A semantic shift from 'to be bright' >> 'to appear' >> 'to perceive' is conceivable, cf. Eng. *shine* vs. Ger. *scheinen* 'to shine; seem, appear'. If correct, this scenario implies that **keit-* not exclusively Indo-Slavic.

3.5.53 *k$^{(w)}$it-ti- *'thinking, consideration'*

Indo-Slavic exclusivity	Etymology	Shared innovation	Typology
Yes	Compelling	Rejected	^{N}Derivation

Indo-Aryan: Skt. *cítti-* f. 'thinking, understanding'
Iranian: OAv., YAv. *cisti-* f. 'consciousness'
Baltic: –
Slavic: OCS *čьstь* f. 'honour, respect'; Ru. *čest'* f. 'honour, respect'; Pol. *cześć* f. 'honour, respect'; SCr. *čâst* f. 'honour, respect'

Although this root is not an Indo-Slavic isogloss (see p. 192), a *ti*-abstractum is only found in Indo-Iranian (EWAia I: 547–548; AirWb.: 598) and Slavic (Derksen 2008: 94), which was listed as an isogloss by Arntz (1933: 44). However, in Sanskrit, practically every root has a corresponding *ti*-stem (AiGr. II, 2: 622–628). Given the transparent semantics in relation to the verb *cet-* 'to perceive', it may be a productive formation. Similarly, OCS *čьstь* 'honour, respect' is semantically close to the corresponding verb *čisti* 'to count, read, honour'.

3.5.54 *k^{w}u-d^{h}e *'where'*

Indo-Slavic exclusivity	Etymology	Shared innovation	Typology
No (Anatolian, Italic)	Compelling	Rejected	^{N}Derivation

140 There is no need to assume delabialization of **k^{w}* in Germanic, which in any case did not occur before **o* (cf. Kroonen 2013: xxxii).

Indo-Aryan: Skt. *kúha* 'where'
Iranian: OAv. *kudā* 'where'
Baltic: –
Slavic: OCS *kъde* 'where'

Porzig (1954: 168) claims that the formation *$k^{w}u$-$d^{h}e$ is exclusive to Indo-Iranian and Slavic. However, it is impossible to exclude Lat. *ubī*, Osc. *puf*, Umbr. *pufe* 'where' as cognates, even though they could alternatively reflect *$k^{w}u$-$b^{h}ei$ (de Vaan 2008: 636). A further possible cognate is Lyd. *kud* 'where' (Kloekhorst 2008: 490), in which case the formation could be Proto-Indo-Anatolian.

3.5.55 *$leh_1ǵ^{h}$- *'to crawl; to go'*

Indo-Slavic exclusivity	Etymology	Shared innovation	Typology
Yes	Rejected	Possible	Root

Indo-Aryan: –
Iranian: YAv. *vī-rāzaiti* 'to boast, brag'; Khot. *rrāys-* 'to cry out (of birds)'; Bactr. ραζ- 'to call, name'
Baltic: Latv. *lẽzêt*, *lẽzẽju* 'to go slowly, slide'; OPr. *līse* 3sg. 'crawls'
Slavic: OCS *izlěšti*, *izlězǫ* 'to go out of'; Ru. *lezt'*, *lézu* 'to climb, crawl, drag oneself along'; Pol. *leźć*, *lezę* 'to climb, crawl upwards, drag oneself along'; SCr. *ljȅsti*, *ljȅzēm* 'to crawl, climb'

Meillet (1926: 171) argued that OCS *izlešti* and its Balto-Slavic cognates, which reflect *$leh_1ǵ^{h}$- (cf. Derksen 2008: 275–276; LIV: 400), are related to YAv. *vī-rāzaiti*, which Bartholomae glosses as 'gehen' (AirWb.: 1526). However, Kellens (1995: 57) glosses the Avestan verb as 'fanfaronner', i.e., 'to boast, brag', which fits better with its cognates in Khotanese and Bactrian (cf. Cheung 2007: 306–307). The Balto-Slavic words have often been connected to ON *lágr* 'low' < PGm. **lēgu-* but this is more likely derived from PGm. **leg*(*j*)*an-* < *leg^{h}- (Kroonen 2013: 330).

Although the Iranian and Balto-Slavic verbs are formally comparable and lack convincing cognates in other branches, the etymology is semantically uncompelling.

3.5.56 *loip-eie/o- *'to smear, stick';* *li-n-p-e/o- *'to smear, stick'*

Indo-Slavic exclusivity	Etymology	Shared innovation	Typology
No (Germanic)	Rejected	Rejected	[V]Derivation

Indo-Aryan: Skt. *lepayati* 'to cause to smear; to smear, anoint' (Suśr.), *limpáti* 'to besmear, adhere to, deceive'
Iranian: –
Baltic: Lith. *lipìnti*, *-ìna* 'to glue, stick', *lìpti*, *liñpa* 'to stick'
Slavic: OCS *prilěpiti*, *prilěpljǫ* 'to stick'; Ru. *lepít'*, *lepljú* 'to model, mould, stick'; Pol. *lepić*, *lepię* 'to glue, stick'; SCr. *lijèpiti*, *lȉjepīm* 'to cover with clay'

Arntz (1933: 54) listed these causative formations as an isogloss, but this conclusion cannot be maintained. First, Goth. *bi-laibjan* 'to leave behind' (cf. Kroonen 2013: 323) is formally identical, although it may well be an independent formation given the divergent semantics. For formal reasons, Lith. *lipìnti* must be an independent formation, as it is derived from *lìpti* 'to be sticky, stick' (Smoczyński 2018: 711–712). Second, Skt. *lepayati* 'to besmear' is attested late (Suśr.) and may be a recent formation. In terms of semantics, it is divergent from the Slavic causative, which indicates independent formations.

In addition to the causative, it has been argued that only Baltic and Sanskrit reflect an inherited nasal present, whereas other nasal formations, viz. Gr. λιπαίνω 'to make fat, anoint', OCS *pri-lьnǫti* 'to stick', Goth. *af-lifnan* 'to be left over' and ToA *lipñat* 'you will be left over' are independent innovations (LIV: 408). Thus, the thematicized nasal present of Baltic and Sanskrit could be seen as a shared innovation. However, the semantics of the formations are different (Skt. *limpáti* is transitive whereas Lith. *lìpti* is anticausative) and the Lithuanian formation belongs to a productive class (Villanueva Svensson 2011). This indicates that they are independent innovations.

3.5.57 *l(o)uk-i- *'light'*

Indo-Slavic exclusivity	Etymology	Shared innovation	Typology
Yes	Rejected	Possible	[N]Derivation

Indo-Aryan: Skt. *rúci-* f. 'splendour, light' (AV+)
Iranian: –
Baltic: OPr. *luckis* m./f. 'firewood, spill' (EV)
Slavic: RuCS *lučь* m. 'ray, light, shining'; Ru. *luč* m. 'ray, beam, (dial.) torch'; Cz. *louč* f. 'torch'; SCr. *lûč* m./f. 'torch, light, ray'

Arntz (1933: 48) listed this *i*-stem from **leuk-* 'to become bright' as an Indo-Slavic isogloss. However, the root ablaut and stem variation within Balto-Slavic rather points to a root noun, cf. Skt. (RV+) *rúc-* f. 'light, splendour, lustre, appearance', Lat. *lūx* f. 'light'. The etymology is therefore not compelling.

3.5.58 *loup-eie/o- *'to tear (off), peel'*

Indo-Slavic exclusivity	Etymology	Shared innovation	Typology
Uncertain	Rejected	Rejected	^{V}Derivation

Indo-Aryan: Skt. *lopayati* 'to cause to break' (Br.+), *ropayati* 'to cause to suffer' (PS)
Iranian: –
Baltic: Lith. *laupýti*, *laũpo* 'to tear off', Latv. *làupît*, *làupu* 'to peel, rob, plunder'
Slavic: Ru. *lupít'*, *lupljú* 'to peel (off)'; Pol. *łupić*, *łupię* 'to plunder, loot'; SCr. *lúpiti* 'to clean, peel'

Arntz (1933: 53) listed this causative stem as an Indo-Slavic isogloss. However, it is far from certain that the Sanskrit forms belong to the Indo-European root **leup-* 'to peel (off)', which is the basis of the Balto-Slavic forms. In fact, Skt. *lop-* is generally derived from **Hreup-* 'to break' (EWAia II: 482), cf. ON *reyfa* 'to break, tear; rob' < **raubjan-* (LIV: 511), which is a better fit semantically. Possibly, Skt. *lop-*/*rop-* is a conflation of **leup-* and **Hreup-*, but the *eie*/*o*-stem in Sanskrit is more likely from **Hreup-*.

3.5.59 *mei(H)-e/o- *'to (ex)change, switch'*

Indo-Slavic exclusivity	Etymology	Shared innovation	Typology
Yes	Rejected	Possible	^{V}Derivation

Indo-Aryan: Skt. 3pl.pres.med. *ví mayante* 'they alternate'
Iranian: YAv. *maiiaṯ* '?'
Baltic: Latv. *mît*, *miju* 'to exchange'
Slavic: –

Arntz (1933: 55) listed this thematic present as an isogloss (cf. also LIV: 426; Derksen 2015: 544). However, Latv. *mît*, *miju* has zero-grade in the root, which precludes a direct comparison to Indo-Iranian. Moreover, the origin of the Latvian intonation is unclear. Derksen (2015: 544) argues that the broken tone is an innovation, whereas Smoczyński (2018: 739) reconstructs **meiH-*. The latter is incompatible with Indo-Iranian, as the root is *aniṭ*, cf. Skt. *apa-mítya-* n. 'loan, debt'.

3.5.60 *mor-o- *'plague'*

Indo-Slavic exclusivity	Etymology	Shared innovation	Typology
No (Greek)	Compelling	Rejected	Semantics

Indo-Aryan: Skt. *māra-* m. 'death, plague' (VarBṛS, AVPariś), *pramará-* m. 'death' (RV), *mara-* m. 'death'
Iranian: –
Baltic: Lith. *mãras* m. 'plague, death'
Slavic: OCS *morъ* m. 'plague, death'; Ru. *mor* m. 'plague'; Pol. *mór* m. 'plague'; SCr. *môr* m. 'death, plague'

Porzig (1954: 166) argues that the specific meaning 'plague' justifies separating Indo-Slavic **mor-o-* 'plague' from Gr. μόρος 'doom, death'. See also Arntz (1933: 51) and LEW: 409. However, a closer look at the Sanskrit evidence casts doubt on the translation of *māra-* as 'plague', which probably stems from Monier-Williams (1899: 811). In the AVPariś, *māra-* is attested in three compounds: *śiśu-māra*(*ka*)- '(South Asian river) dolphin' (lit. 'child-killer'), *bubhukṣā-māra-* 'death of desire, hunger', and *jana-māra-* 'plague' (lit. 'people-killer'). In VarBṛS, we find *kṣut-māra-* 'famine' (lit. 'death by hunger'). Thus, *māra-* only means 'plague' in the compound *jana-māra-*, whereas in earlier attestations, e.g., AV *kṣudhā-márā-* 'death by starvation', it means simply 'death'. This indicates that the meaning 'plague' is not a shared innovation with Balto-Slavic, and that Gr. μόρος cannot be separated from this etymon.

3.5.61 *mud-ro- *'cheerful, lively'*

Indo-Slavic exclusivity	Etymology	Shared innovation	Typology
Yes	Rejected	Possible	NDerivation

Indo-Aryan: Skt. *mudrá-* adj. 'happy'
Iranian: –
Baltic: Lith. *mudrùs*, *mùdras* adj. 'quick, valiant, smart, arrogant'; Latv. *mudrs* 'quick, lively, cheerful'
Slavic: –

Arntz (1933: 51) listed this *ro*-adjective as an isogloss. The Sanskrit and Baltic words have traditionally been compared (EWAia II: 383; LEW: 467; Smoczyński 2018: 825–826). However, the etymology is formally problematic, since Baltic does not show the effects of Winter's Law. According to Rasmussen (1999: 537), Winter's Law did not operate before resonants, but there are several counterexamples, e.g., Lith. *ū́dra* f. 'otter' < *$udreh_2$- (see further Derksen 2002: 8).

3.5.62 *neigʰ-o- *'itching, disease'*

Indo-Slavic exclusivity	Etymology	Shared innovation	Typology
Yes	Rejected	Possible	NDerivation Root

Indo-Aryan: –
Iranian: YAv. *naēza-* m. 'a sickness; lumps, mushy mass'; Oss. I *nīz* / D *nez* 'disease'
Baltic: Lith. *niežaĩ* m.pl. 'scabies', *niẽžas* m. 'itch mite, scabies, ulcer', *niežéti* 'to itch'; Latv. *naĩža* f., *naizs* m. 'scabies', *niẽzêt* 'to itch'
Slavic: –

Arntz (1933: 39) listed YAv. *naēza-* 'a sickness' and Lith. *niežaĩ* 'scabies' as an isogloss, which can be united under a reconstruction *$neigʰ$-o-. Fraenkel (1962:

502) tentatively compares Arm. *anic* 'nit, louse egg', but this rather belongs with Gr. κονίς f. 'eggs of lice, fleas, bugs' (Beekes 2010: 747).

The Baltic words clearly derive from a verbal root reflected in Lith. *niežéti* 'to itch'. Latvian *niẽzêt* 'to itch' has an acute root that is reflected in some but not all nominal derivatives (Smoczyński 2018: 863). This could be secondary but no explanation has been presented.

Oss. I *nīz* / D *nez* 'disease' seems to be a general designation of sickness which can be specified to certain body parts, e.g., *særnīz* 'headache, migraine' (Abaev II: 186). YAv. *naēza-* denotes an unknown disease and is as such difficult to assess. Perhaps the meaning is derived from the homonymous *naēza-* m. 'lumps, mushy mass'. YAv. *naēza-* n. 'sharp point (of a needle)' is another possible root cognate, but it is semantically closer to Skt. *nikṣ-* 'to pierce'. In any case, there is no indication that the Iranian words have anything to do with 'to itch', which makes the comparison with Baltic uncompelling.

3.5.63 *oti-loik^{w}-o- *'leftover, surplus'*

Indo-Slavic exclusivity	Etymology	Shared innovation	Typology
No (Greek)	Rejected	Rejected	^{N}Derivation

Indo-Aryan: Skt. *atireka-* m. 'abundance, surplus'
Iranian: Bactr. αδοριγο m. 'PN' (?)[141]
Baltic: Lith. *ãtlaikas* m. 'remnant, leftover'
Slavic: OCS *otъlěkъ* m. 'remnant, leftover'

These Sanskrit and Balto-Slavic compounds were taken as an isogloss by Arntz (1933: 56) and Porzig (1954: 167). However, since Skt. *áti-* corresponds to Gr. ἔτι, Lat. *et* and Goth. *iþ* (EWAia I: 57), whereas the Balto-Slavic prefix has *o*-grade but no final *-i*, the formations cannot be compared directly, and are most likely independent. Both compounds contain **loik^{w}-o-*, which is also reflected in Gr. λοιπός 'remaining'.

141 Cf. Sims-Williams (2007: 188); the interpretation is not certain.

3.5.64 *ped-ti- *'walking on foot'*

Indo-Slavic exclusivity	Etymology	Shared innovation	Typology
Yes	Rejected	Rejected	NDerivation

Indo-Aryan: Skt. *pattí-* m. 'pedestrian, foot soldier'
Iranian: OP *pasti-* m. 'foot soldier'; Oss. I *fistæg* / D *fest*(*æg*) 'pedestrian'
Baltic: Lith. *pė́sčias* adj. 'pedestrian, walking on foot'
Slavic: OCS *pěšь* adj. 'on foot'; Ru. *péšij* adj. 'on foot'; Pol. *pieszy* adj. 'on foot'; SCr. *pjȅše* adv. 'on foot'

Skt. *pattí-* and Lith. *pė́sčias* have been derived from a stem **ped-ti-*, which is not found in other branches (LEW: 562; EWAia II: 74). In earlier accounts, the Lithuanian acute is explained from a lengthened **ē*, but Derksen (2015: 353) considers it as a result of Winter's Law. It is possible that Winter's Law would have been blocked in a cluster **dt* (due to early assimilation to **tt*), but in any case, the acute could easily have been restored at a later date (after, e.g., Lith. *pėdà* f. 'foot, footstep').

The etymology cannot be maintained, however, since Lith. *pė́sčias* is clearly derived from *pė́stas* 'on foot', like *stãčias* 'standing' from *statùs* 'standing' (cf. Smoczyński 2018: 951) or *mesčias* 'restrained, moderate' from *mẽstas* m./adj. 'measure; restrained, moderate'. The Slavic forms reflect **pěšь* < **ped-sio-*[142] (Vasmer II: 353; Derksen 2008: 398) and thus cannot be directly compared to Skt. *pattí-*. The Slavic stem **ped-sio-* could perhaps be understood as deriving from an *s*-stem **ped-os-*, although no such form is attested. Possibly, Lith. *pė́stas* could be derived from **ped-s*(*i*)*o-* as well, if we assume metathesis of **ds* > *st*, since **-Ts*-clusters are not tolerated in Baltic (Tijmen Pronk, p.c.).

Since the derivation of Lith. *pė́sčias* from *pė́stas* is a Baltic process, which does not involve a *ti*-stem, a shared innovation with Indo-Iranian must be rejected.

142 Just like in the case of Lith. *pė́sčias*, the effect of Winter's Law may have been analogically restored, if it was regularly blocked in this environment. Forms like Cz. *pěchý* 'on foot' and Ru. *pexóta* 'infantry' are secondary (cf. Vasmer II: 350).

3.5.65 *pě(n)s-(n)u- *'dust, sand'*

Indo-Slavic exclusivity	Etymology	Shared innovation	Typology
Yes	Rejected	Possible	[N]Derivation Root

Indo-Aryan: Skt. *pāṃsú-* m. 'dust, sand'
Iranian: YAv. *pąsnu-* m. 'dust'; Khot. *phāna* 'dust, mud'; Oss. I *fænyk* / D *funuk* 'ash'
Baltic: –
Slavic: OCS *pěsъkъ* m. 'sand'; Ru. *pesók* m. 'sand'; Pol. *piasek* m. 'sand'; SCr. *pijèsak* m. 'sand'

Schmidt (1872: 48) and Arntz (1933: 36) listed the above Indo-Iranian and Slavic words as an isogloss. However, the etymology is now considered uncertain (EWAia II: 114–115). In fact, the Indo-Iranian words are difficult to unite under a single Proto-Indo-Iranian form. Assuming that Sogd. B *spn'k* 'dirt, filth' does not belong here, the Avestan, Khotanese and Ossetic words can probably all be derived from **pansnu-* (Kümmel 2012b), but the varying suffix *vis-à-vis* Skt. *pāṃsú-* remains unexplained. The variation within Indo-Iranian points to post-Proto-Indo-Iranian loanwords. Even if the inner-Indo-Iranian variation is taken as secondary, the Sanskrit and Avestan forms have an **-n-* in the root, which is not reflected in Slavic. The words may be indirectly connected as independent borrowings, but can hardly go back to a putative Indo-Slavic stage.

3.5.66 *perg$^{(w)}$enio- / *perk$^{(w)}$uHno- *'a (thunder) god'*

Indo-Slavic exclusivity	Etymology	Shared innovation	Typology
Uncertain[143]	Rejected	Possible	Root

143 The question regarding a possible link between Lith. *perkū́nas* and Lat. *quercus* f. 'oak' etc. will not be treated here.

Indo-Aryan: Skt. *parjánya-* m. 'rain cloud, rain, rain god'
Iranian: –
Baltic: Lith. *perkū́nas* m. 'thunder, thunder god'
Slavic: ORu. *perunъ* m. 'a god'

Meillet (1926: 171) mentions this word as an isogloss, but does not comment on the formal problems. EWAia (II: 96–97 with lit.) does not completely rule out the possibility that Skt. *parjánya-* reflects older **parc-ánya-*, following a taboo deformation. At best, the words may then contain the same root, but even this is highly speculative.

3.5.67 *post-sk$^{(w)}$(-eH) *'behind, after, afterwards'*

Indo-Slavic exclusivity	Etymology	Shared innovation	Typology
Yes	Rejected	Rejected	^{N}Derivation

Indo-Aryan: Skt. *paścā́* adv. 'behind, after, later', *paścā́t* adv. 'from behind, backwards'
Iranian: YAv. *pasca* adv. 'after, behind', *paskāṯ* adv. 'from behind'
Baltic: Lith. *paskuĩ, pãskui, pãsakui* adv. 'behind, backwards, later, afterwards'
Slavic: –

Schmidt (1872: 48) takes this adverb as an isogloss, arguing that Lat. *post* 'behind, after' is unrelated. However, while it lacks the suffix *-*sk*$^{(w)}$-, it is likely that Lat. *post* contains the same root as Skt. *paścā́* (cf. de Vaan 2008: 483–484). The derivation in *-*sk*$^{(w)}$- would then be the potential Indo-Slavic isogloss. However, Lith. *paskuĩ* and the variant *pãsakui* seem to be derived within Baltic from *pasèkti* 'to follow', by analogy to *viduĩ* 'inside, within' (Smoczyński 2018: 918; Hock et al. 2019: s.v. *paskuĩ*). The formations should therefore be regarded as independent.

3.5.68 *poti- *'self'*

Indo-Slavic exclusivity	Etymology	Shared innovation	Typology
Yes	Compelling	Rejected	Semantics

Indo-Aryan: –
Iranian: YAv. *xᵛaē-paiti-* adj. 'himself, herself', *xᵛaē-paiϑiia-* adj. 'own'; OP *uvaipašiya-* adj. 'own'
Baltic: Lith. *pàts*, OLith. *patìs* m. 'husband; self', *pàt* adv. 'self, just'; Latv. *pats* m. 'husband; self', *pat* adv. 'self, just'
Slavic: –

Meillet (1926: 167) argues that Iranian and Baltic share a semantic development in PIE **poti-* 'husband, master', which in both branches is also used in the meaning 'self'. However, in Iranian, *paiti-* only means 'self' in a compound with *xᵛaē-* < **suai-* (see AirWb.: 1860–1861), which likely means that it developed independently from Baltic.

Fraenkel (LEW: 552), on the other hand, suggests that **poti-* originally meant 'self', from which 'lord, husband' subsequently developed. Since the latter meaning is widespread in Indo-European, this scenario implies that the Baltic-Iranian correspondence is an archaism. In line with this etymology, it has been proposed that **poti-* is an inflected enclitic particle **-pot* 'exclusively, specifically', reflected in Hitt. *=pat* 'the same, self, exclusively' (Pinault 2021), but the lenis stop of Hittite is incompatible with PIE **p* (Kloekhorst 2008: 653).

3.5.69 *prh$_2$-uo- *'first, foremost'*

Indo-Slavic exclusivity	Etymology	Shared innovation	Typology
No (Tocharian, Germanic)	Compelling	Possible	NDerivation

Indo-Aryan: Skt. *pū́rva-* adj. 'first, foremost'
Iranian: YAv. *pauruua-* adj. 'foremost, first, previous'
Baltic: (Lith. *pìrmas* adj. 'first'; Latv. *pìrmaĩs* adj. 'first'; OPr. *pirmas*, *pirmois* adj. 'first')
Slavic: OCS *prъvъ* adj. 'first'; Ru. *pérvyj* adj. 'first'; Pol. *pierwszy* adj. 'first'; SCr. *prvī* adj. 'first'

Schmidt (1872: 48) and Meillet (1926: 172) claim that only Balto-Slavic (Derksen 2008: 430) and Indo-Iranian (EWAia II: 157; AirWb.: 870–872) reflect a stem **prh$_2$-uo-* 'first', which was later replaced by **prh$_2$-mo-* in Baltic. However, ToA *pärwat* 'first', with secondary *-t* after other ordinals, cannot be separated from this cognate set (Adams 2013: 383). OE *forwost*, *forwest* m. 'chief, captain' may

also be derived from a Germanic reflex of **prh$_2$-uo-* (IEW: 810–816; Holthausen 1934: 113). Alb. *párë* 'first' has been derived from **prh$_2$-uo-*, but since *CRHC*-clusters regularly yield Albanian *CRaC* (cf. de Vaan 2018: 1738), this is impossible. Demiraj (1997: 311) mentions that **prh$_2$-u-* could account for Alb. *párë*, but the easiest solution (thus also Orel 1998: 311) is that it is derived within Albanian from Alb. *para* / *pár*(*ë*) 'before, previous, forth' < **prH-os* 'former', also reflected in Gr. πάρος 'before, formerly', Skt. *purás* 'forth, before'.

3.5.70 *pusk-o- *'flower; tuft'*

Indo-Slavic exclusivity	Etymology	Shared innovation	Typology
Yes	Rejected	Possible	NDerivation

Indo-Aryan: Skt. *púṣkara-* n. 'lotus flower'
Iranian: –
Baltic: Latv. *pusks* m. 'tuft'
Slavic: –

Arntz (1933: 55) listed these words as an Indo-Slavic isogloss, including Lith. *pùškas* 'pimple, blister', which is unrelated (cf. Smoczyński 2018: 1046). Skt. *púṣkara-* has been derived from *poṣ-* 'to bloom, thrive' < **h$_3$peus-* (EWAia II: 152; LIV: 303). Based on this, it would be possible to postulate a stem **pus-ko-* that is shared with Latvian. However, the formation is obscure, since *-ka-* is not a primary nominal suffix in Indo-Iranian. Together with Skt. *púṣpa-* 'flower', *púṣkara-* could be seen as a non-Indo-European loanword (cf. Lubotsky 2001b: 305).

3.5.71 *seu-io- *'left'*

Indo-Slavic exclusivity	Etymology	Shared innovation	Typology
No (Celtic, Tocharian)	Compelling	Possible	NDerivation

Indo-Aryan: Skt. *savyá-* adj./m. 'left; left hand'
Iranian: YAv. *haoiia-* adj. 'left'

Baltic: –
Slavic: CS *šui* adj. 'left'; Sln. *šûj* adj. 'left'

The correspondence between Indo-Iranian (EWAia II: 716; AirWb.: 1736) and Slavic (Derksen 2008: 487–488) is taken as an isogloss by Arntz (1933: 36) and Porzig (1954: 168). However, the words cannot be separated from MWelsh *aswy*, *asw* 'left, sinister, clumsy', MBret. *hasou* 'left', which go back to a prefixed form **ad-seu-io-* (Matasović 2009: 44). Matasović (2009: 360) suggests that the Celtic words may be derived from PCelt. **suwo-* 'to turn, wind', but there is no compelling reason to reject the connection to Skt. *savyá-*. A further possible cognate is ToB *saiwai* (indecl.) 'left', if derived with metathesis from **sou-io-* (Adams 2013: 767).

3.5.72 *(s)poh$_1$i-men- *'foam'*

Indo-Slavic exclusivity	Etymology	Shared innovation	Typology
No (Italic, Germanic)	Compelling	Rejected	^{N}Derivation

Indo-Aryan: Skt. *phéna-* m. 'foam, froth'
Iranian: MoP *fīn* 'snot', *fīnak* 'sea foam'; Sogd. B *pym'kh* 'foam, froth'; Oss. I *fynk* / D *finkæ* 'foam'
Baltic: Lith. (dial.) *spáinė* f. 'foam (on waves)'; OPr. *spoayno* f. 'foam (of fermenting beer)'
Slavic: OCS *pěny* f.pl. 'foam'; Ru. *péna* f. 'foam'; Pol. *piana* f. 'foam'; SCr. *pjȅna* f. 'foam'

Schmidt (1872: 48) and Arntz (1933: 49) listed this stem as an Indo-Slavic isogloss. For the attested forms, see EWAia II: 204, Abaev I: 498, and Derksen (2008: 397; 2015: 418). These words cannot be separated from Lat. *spūma* f. 'foam' and PGm. **faima*(*n*)- m. 'foam', however (cf. Kroonen 2013: 123–124). Porzig (1954: 166) argued that Indo-Iranian and Balto-Slavic share a simplification of the cluster **-mn-* > **-n-*, whereas Latin and Germanic show a different dissimilation of **-mn-* > **-m-*. However, the cluster simplification **-mn-* > **-n-* was a Proto-Indo-European development, conditioned by a labial in the root, cf. PIE **b^{h}ud^{h}-mēn-*, gen. **b^{h}ud^{h}-*(*m*)*n-os* 'bottom' > (Pre-)PGm. **budmē*, gen. **buttaz*, Lat. *fundus* m., Skt. *budhná-* m. (cf. AiGr. II, 2: 766; Kroonen 2006). This suggests that Lat. *spūma* and PGm. **faima*(*n*)- levelled the strong stem of *(*s*)*poh$_1$i-men-* throughout the paradigm.

Thus, rather than the dissimilation itself, it is the generalization of the dissimilated weak stem that is a potential Indo-Slavic isogloss. This cannot be a shared innovation, however. Within Iranian, there is variation between forms with *-*m*- (Sogd. B *pym'kh* 'foam, froth') and *-*n*- (e.g., Oss. I *fynk* / D *finkæ* 'foam'), showing that the athematic paradigm must have been retained into Proto-Iranian. Furthermore, the aspiration in Sanskrit and fricativization in Iranian point to PIIr. **pHai-na-*, whereas the Balto-Slavic acute points to **(s)poh$_1$i-neh$_2$-* (cf. Lubotsky 2011: 115).

3.5.73 **tek^{w}- 'to run (of water), flow'*

Indo-Slavic exclusivity	Etymology	Shared innovation	Typology
No (Tocharian)	Compelling	Possible	Semantics

Indo-Aryan: Skt. *tak-* 'to run (of animals, rivers)'
Iranian: YAv. *tak-* 'to run (of animals), flow (of water)'
Baltic: Lith. *tekéti*, *tẽka* 'to run, flow'
Slavic: OCS *tešti*, *tekǫ* 'to flow, run'; ORu. *teči*, *teku* 'to flow, move, run'; Pol. *ciec*, *ciekę* 'to flow, run'; SCr. *tèći*, *tèčēm* 'to flow, run'

The root **tek^{w}-* is well attested and possibly Indo-Anatolian, cf. Hitt. *ḫatku-* 'to jump, flee' (Kloekhorst 2008: 990). Other cognates include OIr. *teichid* 'to flee' and Alb. *ndjek* 'to follow, pursue' (LIV: 620). Although a verbal stem is attested in other branches (*pace* Schmidt 1872: 49), Porzig (1954: 167) argues that Indo-Iranian and Balto-Slavic share a semantic development from 'to run, flee' > 'to flow' (EWAia I: 610; AirWb.: 624–626; LEW: 1074; Derksen 2008: 489; 2015: 462). However, ToB *cake* n. 'river' < **tek^{w}-os-* must now be adduced (Adams 2013: 267), with **k^{w}* > *k* before **o*, which shows that the meaning 'to flow' is not exclusive to Indo-Iranian and Balto-Slavic.

3.5.74 **t(e)nH-u-ko- 'thin'*

Indo-Slavic exclusivity	Etymology	Shared innovation	Typology
Yes	Compelling	Rejected	^{N}Derivation

Indo-Aryan: Skt. *tanuka-* adj. 'thin' (Car.), *tanú-* adj. 'thin'
Iranian: MiP Pahl. *tanuk* adj. 'thin, shallow'; MoP *tanuk* adj. 'thin, shallow'
Baltic: –
Slavic: Ru. *tónkij* adj. 'thin, slender, fine'; Pol. *cienki* adj. 'thin, slender, fine'; SCr. *tȁnak* adj. 'thin, slender, fine'

A *u*-stem adjective **t*(*e*)*nH-u-* may be reconstructed for Proto-Indo-European, cf. Skt. *tanú-*, Lith. *tę́vas*, Lat. *tenuis*, Gr. ταναός, OIr. *tanae* 'thin', but the *ko*-suffixed variant is a potential Indo-Slavic isogloss, as recognized by Arntz (1933: 46). In Slavic, *u*-stem adjectives were consistently extended by **-ko-*/*-keh*$_2$*-*, however (Langston 2018: 1545). Given that Slavic reflects a zero-grade in the root (Derksen 2008: 505), whereas Lith. *tę́vas* (LEW: 1086) has *e*-grade, we must reckon with an ablauting stem in Proto-Balto-Slavic. With this in mind, it seems unlikely that the thematicization by **-ko-* happened before the separation of Baltic and Slavic. It cannot be determined whether Indo-Iranian had root ablaut, since the zero-grade **tnH-u-* would have merged with the full grade. However, Skt. *tanuka-* is attested late beside the older, unenlarged *tanú-* (EWAia I: 620–621). Thus, the evidence suggests that the *ko*-extensions are independent innovations.

3.5.75 *tetḱ- *'to cut, hew, carpenter'*

Indo-Slavic exclusivity	Etymology	Shared innovation	Typology
Yes	Compelling	Rejected	^{V}Derivation

Indo-Aryan: Skt. 3sg.pres.ind. *tāṣṭi* (AB), 3pl. *tákṣati* 'to carpenter, hew, fashion' (RV)
Iranian: YAv. 3sg.pres.ind. *tāšti*, OAv. 3sg.pres.inj. *tāšt* 'to fashion, make'; Sogd. *t'š-* 'to cut'; Khot. *ttäṣ-* 'to cut'
Baltic: Lith. *tašýti*, *tãšo* 'to hew'; Latv. *test*, *tešu* 'to hew, smoothen, beat'
Slavic: OCS *tesati*, *tešǫ* 'to hew'; Ru. *tesát'*, *tešú* 'to hew'; Pol. *ciosać*, *ciosam* 'to hew'; SCr. *tèsati*, *tȅšēm* 'to cut, trim, polish'

Meillet (1926: 172) and Arntz (1933: 46) observed that verbal stems from the root **tetḱ-* are only attested in Indo-Iranian (EWAia I: 612; AirWb.: 644–645) and Balto-Slavic (Derksen 2015: 459).[144] Traditionally, Lat. *texō* 'to weave' has also

144 It should be noted that no direct stem cognates are attested, but the Balto-Slavic forms

been derived from **tetḱ-* (IEW: 1058–1059), but it is nowadays instead reconstructed as **teks-* (LIV: 619) or **teḱs-* (de Vaan 2008: 619) and compared to Hitt. *takš-zi* 'to devise, unify, undertake, mingle', originally 'to put together' (Kimball 1999: 258).

While verbal stems from **tetḱ-* are restricted to Indo-Iranian and Balto-Slavic, the root is also found in Gr. τέκτων m. 'carpenter, manufacturer, artist', cognate with Skt. *tákṣan-* m. 'carpenter' and Av. *tašan-* m. 'creator'.[145] Nominal derivatives in other branches like OHG *dehsala* f. 'axe' and OIr. *tál* m. 'axe' < PCelt. **tāxslo-*, may be derived from either **teks-* or **tetḱ-*.

The ablaut in the paradigm of Skt. 3sg. *tāṣṭi* (AB),[146] 3pl. *tákṣati* (RV) is rare, and has been argued to continue a Proto-Indo-European static paradigm with an alternation of **é* and **é* in the root (Narten 1968). However, if we examine the reconstructed paradigm of Skt. *tāṣṭi*, two features stand out: 1) in the 3sg. **tḗ(t)ḱ-ti*, the apparent lengthened grade coincides with loss of **-t-* in the root, and 2) in the 3pl. **tétḱ-nti*, **-t-* is retained, and the zero-grade ending **-nti* is used, which is otherwise only found in reduplicated presents. Rather than root ablaut, this suggests that the stem was originally reduplicated, i.e., 3sg. **té-tḱ-ti*,[147] 3pl. **té-tḱ-nti*. In the singular, **-t-* was lost with compensatory lengthening in the cluster **-tḱt-*.[148] This did not happen in the plural, where the cluster **-tḱn-* was tolerated because the **n̥* was vocalic. This scenario implies that **tetḱ-* is a secondary root from **teḱ-*, extracted from a reduplicated verbal stem. As such, the existence of nominal derivatives from the secondary root **tetḱ-* in Greek (τέκτων), as well as possibly Celtic and Germanic, presupposes the previous existence verbal stems from **tetḱ-* in Proto-Indo-European. Therefore, the shared Indo-Slavic preservation of verbal stems from **tetḱ-* must be an archaism.

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may ultimately be derived from the same paradigm as Skt. 3sg. *tāṣṭi*, 3pl. *tákṣati*. The Balto-Slavic forms can technically be derived directly from **teḱ-*, cf. Gr. aor. ἔτεκον 'bore, begat', but they are semantically closer to **tetḱ-* 'to cut, hew, carpenter'.

145 Arm. *hiwsn* 'carpenter' is often adduced but does not belong here (cf. Martirosyan 2010: 410).

146 Despite the relatively late attestation, *tāṣṭi* must be archaic in view of OAv. 3sg.inj. *tāšt*, YAv. 3sg.pres. *tāšti*.

147 This form is admittedly problematic, as the expected ablaut in 3sg. of a reduplicated present would be **te/i-teḱ-*.

148 Cf. Lubotsky apud Kortlandt (2004). For a similar account of the origin of **tetḱ-*, see LIV: 638 (with lit.), although here an original reduplicated aorist is assumed, from which a Narten present was derived.

3.5.76 *teuh$_2$- *'to become fat'*

Indo-Slavic exclusivity	Etymology	Shared innovation	Typology
Yes	Compelling	Rejected	^{V}Derivation

Indo-Aryan: Skt. *út tavīti* 'to become strong'
Iranian: OAv. *tauuā* 1sg.pres.subj.act. 'I will be able'
Baltic: –
Slavic: RuCS *tyti* 'to become fat'; Pol. *tyć*, *tyję* 'to become fat'; SCr. *tȉti* 'to become fat'

Verbal forms of the root *$teuh_2$- are only attested in Indo-Iranian and Slavic (LIV: 639–640), which constitutes a potential isogloss. The root can hardly be separated from **teuk*-, reflected in Lith. *tùkti* 'to become fat', nor from **tuem*-, reflected in Lat. *tumēscō* 'to swell'. Although the origin of these root variants is unclear, they seem to be connected to the verbal system, cf. *$g^{w}em$- vs. *$g^{w}eh_2$- 'to go'. Accordingly, it is likely that the nominal formations from *$teuh_2$-, e.g., Gr. ταῦς 'great, much', are ultimately deverbal, and that the corresponding verbal formations were lost in other branches. This implies that the Indo-Slavic verbal stems from *$teuh_2$- are archaisms.

3.5.77 *tok^{w}-o- *'course'*

Indo-Slavic exclusivity	Etymology	Shared innovation	Typology
Yes	Rejected	Possible	^{N}Derivation

Indo-Aryan: –
Iranian: YAv. *taka*- m. 'running, course'
Baltic: Lith. *tãkas* m. '(foot-)path'; Latv. *taks* m. '(foot-)path'
Slavic: OCS *tokъ* m. 'current, course'; Ru. *tok* m. 'current, course'; Pol. *tok* n. 'current, course'; SCr. *tôk* m. 'current, course'

The words are listed as an Indo-Slavic isogloss by Arntz (1933: 46). See also LEW: 1051–1052 and Derksen (2015: 457). However, the short **ă* in Iranian cannot

reflect **o*, as it would have been lengthened by Brugmann's Law. YAv. *taka-* is rather related to RuCS *tekъ* m. 'course' etc. (Derksen 2008: 490), which cannot be separated from OIr. *intech* n. 'road'.

3.5.78 *top-eie/o- *'to make hot'*

Indo-Slavic exclusivity	Etymology	Shared innovation	Typology
No (Germanic)	Compelling	Possible	VDerivation

Indo-Aryan: Skt. *tāpáyati* 'to heat up, torture' (AV+)
Iranian: YAv. *tāpaiieiti* 'to make hot'
Baltic: –
Slavic: Ru. *topít'*, *topljú* 'to stoke, heat, melt'; Pol. *topić*, *topię* 'to melt, fuse'; SCr. *tòpiti*, *tòpīm* 'to melt'

According to Arntz (1933: 56), Indo-Iranian (EWAia I: 623–624; Cheung 2007: 378–380) and Slavic (Derksen 2008: 496) share a causative stem not found in other branches (cf. LIV: 630). However, ON *þefja* 'to cook thick', though only attested as a past participle,[149] seems to reflect a similar formation. Therefore, **top-eie*/*o-* is not exclusively Indo-Slavic.

3.5.79 *tous-eie/o- *'to make calm, silent'*

Indo-Slavic exclusivity	Etymology	Shared innovation	Typology
Yes	Doubtful	Rejected	VDerivation

Indo-Aryan: Skt. *toṣáyati* 'to appease, satisfy' (Sū.+)
Iranian: –
Baltic: Lith. *tausýtis*, *taũsos* 'to become calm (of wind)'
Slavic: Ru. *tušít'*, *tušú* 'to quench, extinguish'; Pol. *potuszyć*, *potuszę* 'to comfort'; Sln. *potúšiti* 'to quench, extinguish'

149 Cf. *hann hafði þá eigi þafðan sinn graut* 'he had not cooked his porridge thick'.

Arntz (1933: 46) listed this causative stem as an Indo-Slavic isogloss. While the forms are surely derived from the same Indo-European root **teus-* 'to be calm' (EWAia I: 672; Vasmer III: 158; Smoczyński 2018: 1457), it cannot be excluded that they reflect independent derivatives. The late attestation of Skt. *toṣáyati* 'to appease, satisfy' suggests that this is indeed the case.

3.5.80 *tr-ne-d- *'to pierce, split'*

Indo-Slavic exclusivity	Etymology	Shared innovation	Typology
Yes	Rejected	Rejected	^{V}Derivation

Indo-Aryan: Skt. *tr̥ṇátti* 'to pierce, split, open'
Iranian: –
Baltic: Lith. *trendéti, -ėja* 'to be eaten up by moths or worms'
Slavic: –

According to the etymology supported by Fraenkel (LEW: 1117) and Mayrhofer (EWAia I: 634), Lith. *trendéti* 'to be eaten up by moths or worms' reflects a neo-root **trend-* that was extracted from a nasal present stem corresponding to Skt. *tr̥ṇátti* 'to pierce, split, open'. This was listed as an Indo-Slavic isogloss by Arntz (1933: 46). However, as argued by Smoczyński (2018: 1511), Lith. *trendéti* cannot be separated from *trenėti* 'to rot, decay (of wood); to become tattered (of clothes)', from which it is likely derived. This development may have been shared with Slavic in view of OCS *trǫdъ* m. 'tree fungus; illness' etc. (Derksen 2015: 469). Accordingly, the connection to Skt. *tr̥ṇátti* should be rejected.

3.5.81 *uer- *'to choose, put faith in'*

Indo-Slavic exclusivity	Etymology	Shared innovation	Typology
Yes	Rejected	Possible	Root

Indo-Aryan: Skt. *var^{i}-* 'to choose'
Iranian: OAv., YAv. *var-* 'to choose', 3sg.pres.inj. *fraorəṇta* 'he professed his faith'

Baltic: –
Slavic: OCS *věra* f. 'faith, belief'; SCr. *vjȅra* f. 'id.'

Meillet (1926: 170–171) argued that Skt. *var^{i}-* etc. is related to OCS *věra* 'faith, belief', citing the Avestan form *fraorəṇta* 'he professed his faith' as a semantic link between the two. However, I see no reason to prefer this etymology over the traditional view that OCS *věra* is related to OIr. *fír* 'true', Lat. *vērus* 'true', OHG *wāra* f. 'treaty, loyalty, protection', etc. (cf. Derksen 2008: 520).

3.5.82 *ure/o-to/eh$_2$- *'vow'*

Indo-Slavic exclusivity	Etymology	Shared innovation	Typology
Yes	Rejected	Possible	^{N}Derivation

Indo-Aryan: Skt. *vratá-* n. 'vow, religious observance, commandment'
Iranian: OAv. *uruuata-* n. 'rule, order, indication'; Oss. I *iræd* / D *ærwæd* 'bride price'
Baltic: Lith. *ratà* f. 'formula, oath, vow'
Slavic: ORu. *rota* f. 'oath'; Pol. *rota* f. 'oath'; SCr. *rota* f. 'oath'

Arntz (1933: 54) listed the above words as an Indo-Slavic isogloss. In older literature, the etymology has often been accepted (LEW: 702; Vasmer II: 539), but it is not mentioned by Mayrhofer (EWAia II: 595). Indeed, despite the semantic similarity, the Indo-Iranian and Balto-Slavic words can hardly be equated. Indo-Iranian **urata-* presupposes Pre-PIIr. **ureto-*, which excludes the often-assumed relatedness to Gr. ῥήτρα f. 'verdict, agreement', ῥητός 'appointed' < **uerh$_1$-* 'to say'. The deeper etymology of PIIr. **urata-* is unknown. The Balto-Slavic forms, on the other hand, of which Lith. *ratà* 'formula, oath, vow' is apparently a Slavic borrowing (LEW: 702), have *o*-grade in the root. It is perhaps more plausible to take ORu. *rota* 'oath' etc. as borrowings from Iranian (as suggested by Schlerath 2001: 289).

3.5.83 *urH-uo/eh$_2$- *'enclosure; hole, burrow'*

Indo-Slavic exclusivity	Etymology	Shared innovation	Typology
Yes	Rejected	Rejected	[N]Derivation

Indo-Aryan: Skt. *ūrvá-* m. 'container, enclosure, dungeon'
Iranian: –
Baltic: Lith. *ùrvas*, *uřvas* m., *ùrva*, *urvà* f. 'hole, burrow, cave'; Latv. *urva* f. 'hole in the ground, pit'
Slavic: –

Arntz (1933: 52) listed the above words as an Indo-Slavic isogloss. However, the forms can hardly be reconciled formally, as unaccented *-*rHu*- would regularly give Skt. *-urv-* in prevocalic position, cf. *urvárā-* f. 'arable land, field yielding crop' < *h_2rh_3-*uer-eh$_2$-*. Lubotsky (1997) argues that the long *ū* is secondary from Skt. *ūrṇóti* 'to cover', deriving *ūrvá-* from **uel-* 'to cover', which would imply that a connection to the Baltic words (with *-r-*) is excluded (similarly EWAia 1: 245). The Baltic vocalism also looks irregular, cf. Lith. *vìlna* f. 'wool' < **Hulh$_1$-neh$_2$-*. Following Smoczyński (2018: 1571), the semantic difference between Skt. *ūrvá-*, whose basic meaning seems to be 'enclosure', and the Baltic word, which seems to derive from an adjective meaning 'hollowed out', is a further counterargument against the etymology.

CHAPTER 4

Analysis of the Indo-Slavic Isogloss Corpus

4.1 Introduction

Fifty-five (55) isoglosses fulfil the required criteria and may be regarded as the corpus of Indo-Slavic lexical isoglosses. In this chapter, the compelling isoglosses are categorized and analysed based on their type, semantics, and languages of attestation. The aim is to assess the value of the isoglosses for research question A: "Do the lexical isoglosses shared by Indo-Iranian and Balto-Slavic support an Indo-Slavic subgroup within Core Indo-European?". Additionally, non-exclusive isoglosses classified as rejected and uncertain are summarized.

4.2 Attestation across Indo-Aryan, Iranian, Baltic, Slavic

The Indo-Slavic isoglosses are distributed across the Indo-Aryan, Iranian, Baltic, and Slavic subbranches as shown in Figure 11.

Figure 11 shows that a majority of the isoglosses are attested in three or four subbranches. Indo-Aryan shares fourteen (14) isoglosses with Baltic, Slavic, or both Balto-Slavic subbranches vs. Iranian's six, which may be attributed to the poorer attestation of Old Iranian. Otherwise, no single subbranch stands out markedly in sharing more isoglosses with the other branch, e.g., Baltic shares roughly the same number of isoglosses with Indo-Iranian as Slavic does.

Thus, the data suggests that partially attested isoglosses (e.g., Iranian-Baltic) should not be treated differently from those attested in all subbranches (Indo-Aryan, Iranian, Baltic, and Slavic). Of course, wider attestation in the subbranches may ensure the antiquity of the formation in question, but that is a separate issue. Since Indo-Iranian and Balto-Slavic, respectively, are defined by a large number of shared innovations (cf. Kümmel 2022; Pronk 2022), there is no compelling reason to assume that, e.g., an Indo-Iranian-Baltic isogloss resulted from a shared innovation to the exclusion of Slavic. Rather, the most economic assumption is that partial attestation within the branches is due to lexical replacement and loss. Therefore, as a general principle, I weigh isoglosses attested in only one subbranch of each branch equally as those attested in both. It may be noted that a larger number of isoglosses is attested in both

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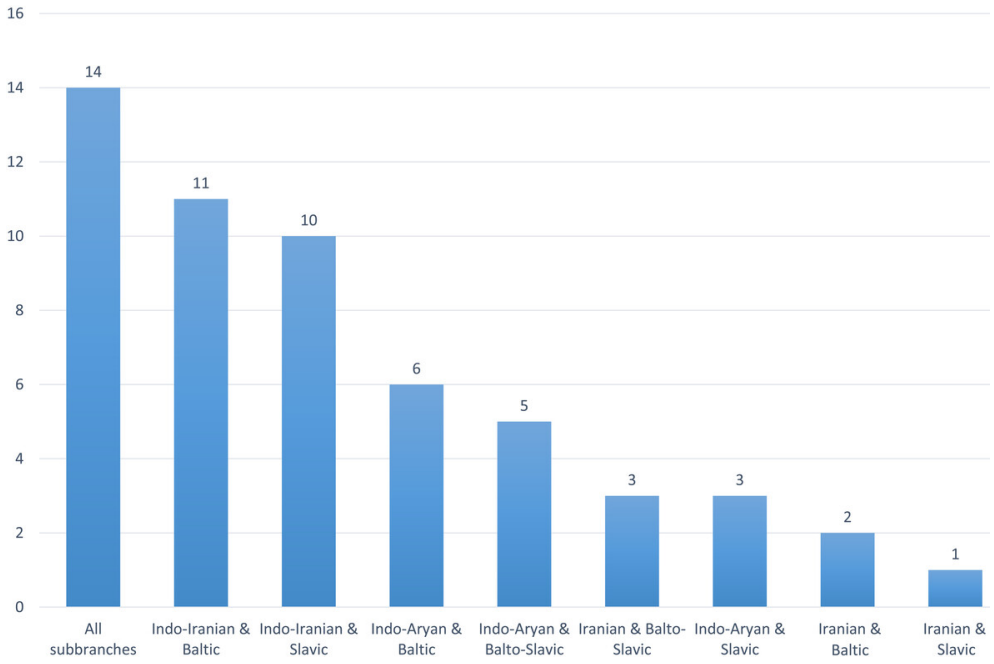

FIGURE 11 Isogloss distribution across (sub)branches
A.I. PALMÉR

Indo-Iranian subbranches but only in one Balto-Slavic subbranch than *vice versa*. This may possibly be attributed to the relatively late attestation of Balto-Slavic, increasing the chance of lexical replacement and loss.

Nevertheless, the isoglosses uniquely shared by Slavic and Indo-Iranian require a separate discussion, since Slavic is known to have been in contact with Iranian languages previously spoken in eastern Europe (Abaev 1965; Matasović 2008: 47; Sakhno 2018).

Of the 10 Indo-Iranian-Slavic isoglosses, *$h_2eǵ$-*ino*- 'animal skin, leather' and *$ǵ^heuH$-*e*/*o*- 'to call, curse' show acute accentuation in Slavic due to the effect of Winter's Law or a laryngeal, respectively, and can therefore hardly be Iranian borrowings. The same goes for *h_3ieb^h-*e*/*o*- 'to copulate', where the *e*-vowel of the Slavic reflexes cannot reflect Iranian *a* < **e*. Similarly, **ḱuoit*-*ó*- 'white, bright' shows depalatalization of **ḱ* in Slavic, which must be a (Pre-)Proto-Balto-Slavic development. The velar-sibilant clusters of **kseud*- 'to make small; to spray' and **peh$_2$gs*-*ó*- '(body part) having a side' have different developments in Slavic and Iranian. The Slavic reflex of *g^woih_3-*o*- 'life' is semantically different from its Iranian cognate, which means that a borrowing is unlikely. Finally, the Slavic reflexes of *$g^{(wh)}eld^h$- 'to be greedy, desire' and **uolḱ*-*o*- 'hair' have *l*

contra Iranian *r*. For **ǵʰouH-o-* 'call, invocation', no specific arguments against a borrowing from Iranian can be found.

As for the Iranian-Slavic semantic isogloss **ḱleu-os-* 'word; fame', Slavic **slo̯vo* 'word' can hardly be borrowed from Iranian **sraṷah-*, on account of the *l*. However, it has been argued that the inherited Slavic **slo̯vo*, which originally only meant 'fame', was influenced semantically by Iranian **sraṷah-* through language contact (Benveniste 1967). This is possible, but not verifiable, and in any case not more plausible than assuming that the shared semantics are inherited.

Lastly, three isoglosses are only attested in Indo-Aryan and Slavic. The Slavic reflex of **h₁uk-ie/o-* 'to be accustomed to' has undergone Balto-Slavic laryngeal metathesis and can hardly be a borrowing. In the case of **uert-men-* 'course', the *e*-grade in the root in Slavic precludes a borrowing scenario. For **bʰrodʰ-no-* 'a (pale) horse colour', there are no phonological arguments against borrowing, but the fact that the word is not attested in Iranian makes such an assumption problematic.

In sum, the isoglosses shared by Slavic and Indo-Iranian are best explained as cognates and should not be explained away as borrowings.

4.3 Typological Classification of Isoglosses

As described in 3.1, the isoglosses were classified according to type. A summary of the typological classification of the lexical isoglosses is presented in Figure 12. Note that one and the same isogloss may belong to more than one category (e.g., "root" and "nominal derivation"), which is why the total number here exceeds fifty-five (55). In what follows, each category is treated separately.

4.3.1 *Shared Borrowings*

Not to be confused with borrowings from, e.g., Iranian to Slavic, shared borrowings (from unknown sources) go back to the Pre-Proto-Balto-Slavic and Pre-Proto-Indo-Iranian periods. These may also be termed shared substrate words. The only case identified as a shared borrowing from an unknown source among the lexical isoglosses is **h₂eǵ-* 'goat'. The scarcity of identifiable shared borrowings is not surprising, since the methodological criteria are quite strict (cf. 2.2.3); it is not enough that a word is limited to Indo-Slavic and lacks an Indo-European etymology, there should also be irregular correspondences with other languages, as in the case of **h₂eǵ-* vs. **h₂eiǵ-*. It cannot be excluded that other isoglosses which lack a compelling Indo-European etymology are loan-

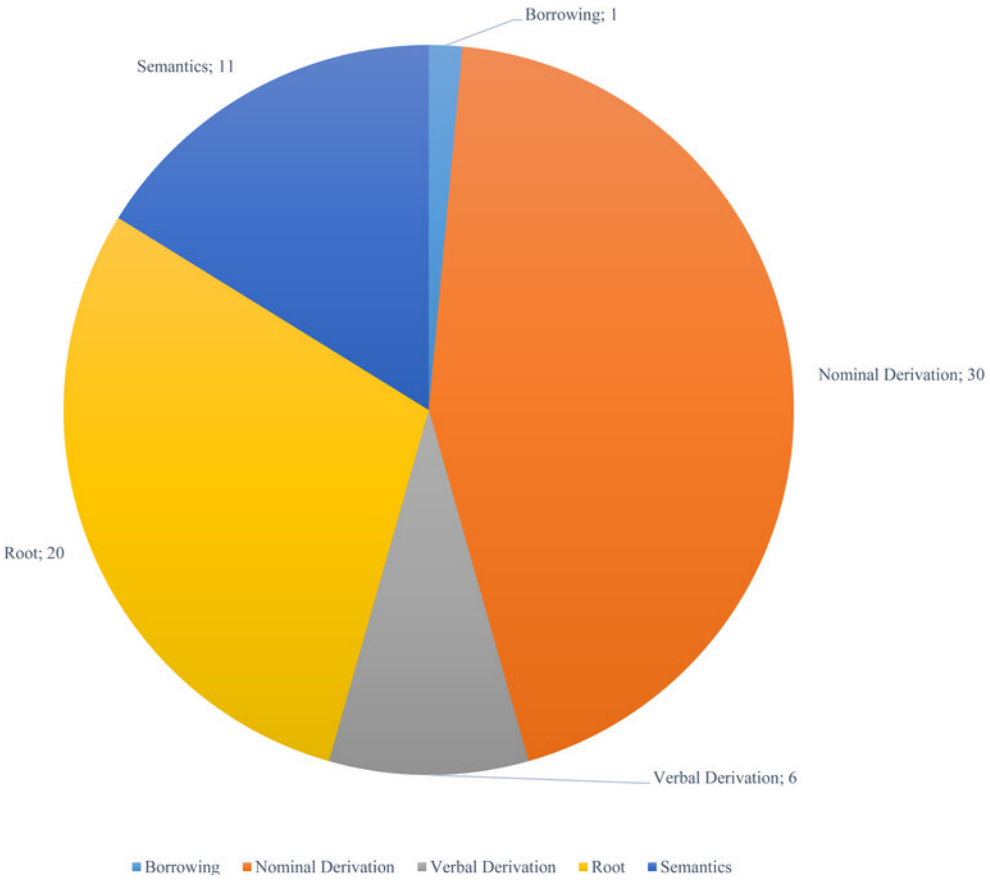

FIGURE 12 Typology of Indo-Slavic lexical isoglosses
A.I. PALMÉR

words (e.g., *$d^{h}oH$-neh_2- 'grains', *$uolo$- 'tail hair (of horse)'), but these cannot be corroborated by irregular correspondences in other branches.

As discussed in 3.2.2, it is unlikely that *$h_2eǵ$- is an archaism that was replaced by *$h_2eiǵ$- in Greek, Armenian, and Albanian, since the latter is also attested in the isolated Iranian *ija- 'leather'. At the same time, on account of the shared derivative *$h_2eǵ$-ino- 'animal skin, leather', it seems unlikely that *$h_2eǵ$- was borrowed independently by Indo-Iranian and Balto-Slavic. As such, *$h_2eǵ$- constitutes an important piece of evidence in favour of a period of Indo-Slavic linguistic unity.

As for the origin of *$h_2eǵ$- 'goat', we may only speculate. Given the formal closeness to *$h_2eiǵ$-, it is possible that *$h_2eǵ$- was mediated through an unattested Indo-European language. However, a non-Indo-European source is also possible.

4.3.2 *Nominal Derivation*

Thirty (30) isoglosses involving nominal derivation were found, including cases of derivation through suffixation, ablaut, and compounding. Below, a distinction is made between nominal derivatives whose roots are attested elsewhere in Indo-European and those for which the root also constitutes an Indo-Slavic isogloss.

4.3.2.1 Derivatives of Roots Attested in Other Indo-European Branches

4.3.2.1.1 *Adjectives*

The roots of **ḱieh$_1$-mo-* 'black, dark, grey' and **ḱuen-to-* 'holy, sacred' do not occur in verbal formations. The stems could still be innovations, since the corresponding verbal stems may have been lost at a later date. However, it cannot be ruled out that they are archaisms.

The stem **h$_2$eǵ-ino-* 'animal skin, leather' is a noun, but clearly based on an adjective in **-ino-*. Since 1) the root **h$_2$eǵ-* 'goat' is unlikely to be an archaism, 2) **-ino-* is not productive in Indo-Iranian, and 3) both Indo-Iranian and Slavic show the same substantivization of the original adjective, **h$_2$eǵ-ino-* is a plausible shared innovation.

4.3.2.1.2 *Adverbs and Preverbs*

The adverb **h$_2$eu-r-eh$_1$* '(over) there, downwards' is not entirely clear from a derivational perspective, but may derive from an old locative **h$_2$eu-r* + adverbial suffix **-eh$_1$* (which may be identical to the instrumental ending). The formation may well be a shared innovation, but an archaism is difficult to exclude.

Indo-Slavic **som* 'together, with' is a shared derivative of PIE **sem-* 'one' and is also used in a syntactically equivalent way in the branches, i.e., as a preverb in Indo-Iranian and preposition in Balto-Slavic, deriving historically from a preverb. As discussed in 3.2.5, **som* is a compelling shared innovation *vis-à-vis* **kom*, attested in all branches except Albanian, Armenian, and Tocharian.

4.3.2.1.3 *Athematic Nouns*

Seven isoglosses are athematic stems. Indo-Slavic **mosg^h-en-* 'brain, marrow' is probably denominal from **mosg^h-o-* and could be a shared innovation, although the derivational pattern was already productive in Core Proto-Indo-European. As for **d^{h}eh$_1$i-nu-* 'female mammal', **mentH-eh$_1$-* '(wooden) tool for stirring', **peh$_3$i-men-* 'milk', **uert-men-* 'course', and **suleh$_2$-* 'juice; milk', they may be understood as deverbal derivatives of roots that are all attested in Balto-Slavic and/or Indo-Iranian, although in the case of **suleh$_2$-* 'juice; milk' it is not clear whether the base is **seu-* 'to press' or **suel-* 'to consume'. In all cases,

shared innovations are possible. However, since the suffixes are found elsewhere in Indo-European, archaisms are difficult to exclude.

Conversely, **h₁ong⁽ʷ⁾-l-* 'coal' does not have an attested verbal base, but is probably formed from the same root as PIE **h₁ng⁽ʷ⁾-ni-* 'fire'. It may therefore be taken as an archaism, but it cannot in principle be excluded that the verbal root was lost after the derivation of **h₁ong⁽ʷ⁾-l-* in Indo-Slavic.

4.3.2.1.4 *Barytone Thematic Stems with* o*-Grade in the Root*

There are two nomina actionis among the isoglosses, **ǵʰouH-o-* 'call, invocation' and **gʷoih₃-o-* 'life', from **ǵʰeuH-* 'to call' and **gʷeh₃i-* 'to live', respectively. This category of deverbal nouns, characterized by *o*-grade in the root, is also common in, e.g., Greek and Germanic (Brugmann 1892: 104). It remained productive in Indo-Iranian and Balto-Slavic, implying that **ǵʰouH-o-* and **gʷoih₃-o-* may or may not be shared innovations.

The isogloss **uolḱ-o-* 'hair' has a similar structure, but cannot be connected to any known verbal root. Based on the comparison with Gr. λάχνη f. 'woolly hair, down' < **ulḱ-sneh₂-*, a verbal root **uelḱ-* 'to stick out, sprout (?)' may be reconstructed. It may be argued that the derivatives must be archaisms, since the verb was lost in the branches. However, it cannot be excluded that the loss happened independently in Greek on the one hand and Indo-Slavic on the other, and that the derivatives are independent.

The adjective **nogʷ-o-* 'naked' is probably not deverbal at all, but may rather be a dissimilation or taboo deformation of an earlier **nogʷ-no-*, and is as such a possible shared innovation.

Finally, **ǵʰos-to-* 'hand' is clearly connected to a root **ǵʰes-* as reflected in Proto-Indo-Anatolian **ǵʰes-r-* 'hand', as well as other nominal formations (e.g., Skt. *sahásra-* n. 'thousand', Lat. *mīlle* 'thousand'). However, corresponding verbal forms are not attested. Furthermore, the structure of **ǵʰos-to-* 'hand' is unclear. If **ǵʰos-to-* is a deverbal *to*-stem from an unattested **ǵʰes-* 'to grasp, grab', it is unclear why it should mean 'hand', cf. Gr. χόρτος m. 'enclosure, court' < **ǵʰor-to-* << **ǵʰer-* 'to seize'. In any case, it is highly conspicuous that **ǵʰos-to-* 'hand' is attested in precisely those branches that do not continue the archaic stem **ǵʰes-r-* 'hand'. This suggests that a lexical replacement took place in Indo-Slavic. In this sense, it is not so much the derivative itself but its relationship with the other Indo-European word for 'hand' that may be understood as a plausible shared innovation.

4.3.2.1.5 *Compounds*

Shared Indo-Slavic compounds include **h₁su-dru-* 'made of good wood' and **ni-h₃(e)kʷ-* 'facing downwards'. Given the many parallels formed from other

preverbs, the productivity of compounds with *$h_3(e)k^w$- 'eye' may be reconstructed to Core Proto-Indo-European. However, they remained productive in some branches, evidenced by, e.g., Skt. *pratyàñc-* 'facing' vs. YAv. *paitiianc-* 'turned against', where Iranian has replaced **prati* by **pati*.

As for *$h_1$su-dru-* 'made of good wood', parallel formations may also be cited, e.g., Skt. *sudív-* 'bringing the good day', Gr. εὐδία f. 'beautiful, bright weather, calm (of wind), quiet (of the sea)'. However, such compounds of course continued to be productive in Indo-Iranian.

On balance, it does not seem unlikely that *$h_1$su-dru-* and *ni-$h_3(e)k^w$-* are shared innovations, but archaisms cannot be excluded.

4.3.2.1.6 *Oxytone* o-*Stems*

Two isoglosses are oxytone *o*-stems, although of different types. As argued in Chapter 3, **peh$_2$gs-ó-* '(body part) having a side' is likely derived from **peh$_2$ǵos-* 'side' and constitutes a possible shared innovation, although it cannot be excluded that the stem was lost in other branches.

As for **ḱuoit-ó-* 'white, bright', it may be analysed as originating from a nomen agentis of **ḱueit-* 'to shine', or alternatively from a possessive adjective (i.e., 'having brightness') of an unattested nomen actionis **ḱuoit-o-* 'brightness'. Since the stem looks ultimately deverbal, and verbal stems from this root are exclusive to Indo-Iranian and Balto-Slavic, **ḱuoit-ó-* is a possible Indo-Slavic innovation.

4.3.2.1.7 ro-*Adjectives*

Two adjectives in *-*ro-* are shared by Indo-Iranian and Balto-Slavic: *b^hud^h-ro-* 'awake, waking' and **miḱ-ro-* 'mixed'. Adjectives in *-*ro-* are famously part of the Caland system and their productivity goes back to Proto-Indo-European.[1] While neither *b^heud^h-* 'to become awake, attentive' nor **meiḱ-* 'to mix' have tended to feature in treatments of the Caland system (e.g., Nussbaum 1976), *b^hud^h-ro-* 'awake, waking' fits into the pattern in the sense that it also has an *s*-stem reflected by YAv. *baoδah-* n. 'observation, recognition, perception'.[2,3] Based on this, it may be argued that *b^hud^h-ro-* 'awake, waking' must reflect a shared archaism.

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1 For Anatolian, cf. Hitt. *pangarit* adv. 'in large numbers', possibly from an unattested **pangara-* < **$d^hb^hng^h$-ro-*, a Caland-variant of **$d^hb^hng^h$-u-*, reflected in Skt. *bahú-* 'many, much'.

2 The *i*-stem of Skt. *bodhi-* f. 'perfect wisdom' and YAv. *baoδi-* f. 'smell, fragrance' is probably not old.

3 According to Bozzone (2016), Caland roots formed root aorists with contrastive Class I presents in Vedic, which is also true for Skt. *bodh-* (EWAia II: 234).

For **meiḱ-* 'to mix', a Caland-like derivational structure is not evident. As discussed in Chapter 3, the palatal **ḱ* of **miḱ-ro-* has probably been restored, which could point to a shared innovation after satemization, but this chronology is difficult to prove.

It may be concluded that *ro*-adjectives do not offer the most convincing evidence for an Indo-Slavic subgroup.

4.3.2.2 Derivatives of Roots Exclusive to Indo-Slavic

Seven nominal derivatives contain roots that are not attested elsewhere in Indo-European. In some cases, a root connection outside of Indo-Iranian-Balto-Slavic is formally possible but semantically uncompelling.

4.3.2.2.1 *Nouns*

The *o*-stems **ḱop-o-* 'straw (carried by water)' and **uolo-* 'tail hair (of horse)' are formally comparable to the barytone *o*-stems discussed above (cf. 4.3.2.1.4). Within Lithuanian, *šãpas* < **ḱop-o-* is connected to *šèpti* 'to grow in an untidy manner (of hair)'. As for **uolo-*, it could be connected to **uel-* 'to twist, wind', but this is not particularly compelling. Similarly, **d^hoH-neh$_2$-* 'grains' has been connected to, e.g., **d^heh$_1$-* 'to put', but a compelling root etymology remains to be found. These stems may reflect derivatives of roots that were subsequently lost, in which case it could be argued that they are archaisms. However, it is equally possible that the roots were lost at a later stage (i.e., post-Indo-Slavic) or that the words in fact are borrowings from non-Indo-European languages.

The structure of **HoustHo-* 'lip' is not well understood. It may be argued that its non-transparent structure points to an archaic formation, perhaps an old compound. Alternatively, if the aspirate in Skt. *óṣṭha-* m. '(upper) lip' is secondary, it may have been derived from a root **Heus-* (+ *-to-*) that was subsequently lost, in which case the same considerations apply as for the stems above.

4.3.2.2.2 *Adjectives*

The two adjectives **b^hrod^h-no-* 'a (pale) horse colour' and **krs-no-* 'black' share the same suffix and semantic field. This could be taken to indicate that colour adjectives in **-no-* were productive in Indo-Slavic. However, the fact that the roots are not (securely) attested elsewhere may serve as an argument for analysing them as archaic formations, assuming that the roots were lost in Proto-Indo-European already.

The structure of **tusk-io-* 'empty' is disputed, but it may be connected to YAv. *tusən* 'they lose (temper)'. Since verbal stems from this root are not attested elsewhere, it is not unlikely that **tusk-io-* is a shared innovation in this scenario.

4.3.2.3 Indo-Slavic Derivational Morphology?

All nominal derivatives (for which the derivational structure is transparent) are formed using morphology that is known from other branches of Indo-European. In other words, no uniquely Indo-Slavic suffixes or other derivational strategies are discernible from the data.

4.3.3 *Verbal Derivation*

Six verbal stems are found among the isoglosses, all thematic presents of various types.

The full grade thematic present **ǵʰeuH-e/o-* 'to call' contrasts with a root present continued in ToB *kwātär*. However, since Sanskrit has a root aorist (3sg.med. *áhvat* with secondary *-t*), the Tocharian root present may be secondary, and it is difficult to exclude that **ǵʰeuH-e/o-* 'to call' is archaic. Similarly, **h₃iebʰ-e/o-* 'to copulate' contrasts with Gr. οἴφω 'to copulate' < **h₃e-h₃ibʰ-e/o-*, which could be analysed as a more archaic formation or as an iterative to the simple thematic stem. ToB *yäp-* 'to enter' with the present *yänmäśke*/$_{\text{ṣṣā}}$ not only reflects a different formation but also different semantics and thus looks more archaic than either the Indo-Slavic or Greek formations. Finally, with **ǵuelH-e/o-* 'to burn, shine', the situation is more uncertain, as no other branches attest verbal stems from this root. In all three cases, it is difficult to exclude independent innovations, since thematicization is productive, especially in Balto-Slavic.

Several *eie/o*-presents were rejected or classified as uncertain, due to indications that they are secondary, productive formations within the branches. A special case is **dʰor-eie/o-* 'to hold, support'. Since this does not look like a productive formation in either Indo-Iranian or Baltic, it is hardly an independent innovation, although this also means that it may be taken as an archaism.

The stem **h₁uk-ie/o-* 'to be(come) accustomed to' is a compelling isogloss, but an archaism cannot be excluded.

The stem **tsprh₂/₃-e/o-* 'to kick away with the foot' contrasts with a nasal stem **tspr-ne-h₂/₃-* attested in Armenian, Latin and Germanic. In this sense, it may be an innovation. It is especially interesting that Sanskrit and Slavic share traces of a root aorist from the same root, cf. Skt. 2sg.aor.inj. *spharīs* (Narten 1964: 282). The same pattern of an Indo-Slavic *tudáti*-present next to a root aorist is found in **gʷrh₃-e/o-* 'to devour, swallow', although the latter was classified as uncertain. Yet, these two cases may preserve a trace of a productive pattern of forming *tudáti*-presents to root aorists, which could be Indo-Slavic, although it is difficult to exclude that it is a more archaic derivational pattern.

4.3.4 *Roots*

Twenty (20) roots exclusive to Indo-Iranian and Balto-Slavic were identified. Since eight of these have already been treated in 4.3.1 and 4.3.2 above, this section will focus on the pure root isoglosses, where no shared nominal or verbal derivatives are attested. Generally, roots tend not to be innovated. However, some of the Indo-Slavic root isoglosses may contain innovative elements.

The root **neih$_1$-* 'to churn' likely derives from **(s)neh$_1$(i)-* 'to turn, twist', where the **-i-* was incorporated from an *i*-present. The process, although rather trivial, could be a shared innovation, especially since it is accompanied by a plausible semantic innovation in the root, cf. 4.3.5. Similarly, **g$^{(w)}$eHi-* 'to sing' derives from **g$^{(w)}$eH-*, but since the *i*-form in this case has not completely ousted **g$^{(w)}$eH-*, which still appears in Indo-Iranian, it is difficult to exclude an independent innovation.

It is attractive to analyse **g$^{(wh)}$eh$_2$ǵ^h-* 'to wade' as **g^{w}eh$_2$-* 'to go' + **-ǵ^h*, especially in view of the semantically identical and formally close root **g^{w}eh$_2$d^h-* 'to wade'. The same root extension seems to be found in **b^{h}eǵ^h-* 'outside, without' and could possibly be identical to the particle **-ǵ^{h}i* (cf. Dunkel 2014: 272–273). The root **g$^{(wh)}$eld^h-* 'to be greedy, desire' is possibly an extended version of **g^{w}el(h$_3$)-* or **h$_1$g^{wh}el-* 'to wish, want', but the exact reconstruction is uncertain.

The root **ǵelp-* 'to murmur, babble' is likely onomatopoeic. This could be a shared innovation, although an archaism or independent innovation cannot be excluded.

For the remaining root isoglosses, **d^{h}emH- / *d^{h}meH-* 'to blow', **ǵ^{h}uel-* 'to be bent, walk crookedly', **ḱeuH-* 'to throw, shove, shoot', **kseud-* 'to make small; to spray', **seng-* 'to attach, fasten', and **seuk-* 'to turn, twist; to churn', there are no indications that the roots themselves are innovations, or that they contain root extensions.

4.3.5 *Semantics*

The eleven (11) semantic isoglosses may be divided into two types: 1) roots or formations that are found in other branches but have a different meaning in Indo-Slavic, 2) roots or formations that are not found elsewhere but that for various reasons seem to have undergone a shared semantic shift in Indo-Slavic.

Of the five isoglosses that belong to the first type, **ḱleu-os-* 'word; fame' and **pelH-ou-* 'chaff' are possible innovations, although it cannot be excluded that the shared semantics are archaic.

On the other hand, **k^{w}er-* 'to perform magic' reflects a semantic specification of **k^{w}er-* 'to do, make' that can hardly have happened in the other direction. Similarly, **ne* 'as, like' derives from **ne* 'not', not the other way around. Also **k(o)rt-* '(one) time(s)', whether it is derived from **(s)kert-* 'to cut' or **kert-* 'to

spin', is a semantic innovation. In these cases, independent innovation in Indo-Iranian and Balto-Slavic remains possible, but shared Indo-Slavic innovation is not unlikely.

The six semantic isoglosses of the second type include *$d^{h}eh_1i$-*nu*- 'female mammal' and *$h_2eǵ$-*ino*- 'animal skin, leather', the former having undergone semantic narrowing from 'suckling (one)' and the latter semantic broadening from 'goat skin, goat product', which would have been the expected primary meanings of the derivatives. In both cases, independent innovations are unlikely, given the non-productive shared morphology. In the case of *$d^{h}eh_1i$-*nu*- 'female mammal', it cannot be excluded that the meaning is archaic along with the stem itself, but for *$h_2eǵ$-*ino*- this is implausible, since the root and derivative are plausible innovations in their own right.

The root *$neih_1$- 'to churn' has undergone a semantic shift from *$(s)neh_1(i)$- 'to turn, twist'. The same root gave rise to Indo-Iranian *$naiH$- 'to lead' and Balto-Slavic *niH-*ti*- 'thread'. As argued in Chapter 3, *$neih_1$- 'to churn' is unlikely to be an archaism, since the root it derives from, *$(s)neh_1(i)$- 'to turn, twist', is still attested in the other branches. On the other hand, it looks archaic within Indo-Iranian and Balto-Slavic, as it cannot be derived from the other reflexes of *$(s)neh_1(i)$- in the respective branches. Therefore, *$neih_1$- is a plausible shared Indo-Slavic innovation.

Similarly, *$seuk$- 'to churn' has undergone a semantic shift from 'to turn, twist'. In Iranian, *$seuk$- 'to churn' is limited to a single derivative and must be regarded as archaic within Indo-Iranian. However, while a shared innovation is possible, the fact that Balto-Slavic also preserves the basic meaning of the verb, i.e., 'to turn, twist', makes it difficult to exclude that the semantic development is independent in Baltic.

The basic meaning of *$ǵ^{h}uel$- may be reconstructed as 'to be bent, walk crookedly', but both Indo-Iranian and Balto-Slavic have derivatives that mean 'wrongful, evil, rude' vel sim. While this may reflect a shared innovation, it cannot be excluded that the root itself and its semantics are archaic and were lost in the other branches.

The compound *som-$d^{h}eh_1$- acquired the meaning 'agreement' << 'putting together' in Indo-Iranian and Balto-Slavic, possibly in a compounded root noun reflected by Skt. *saṃdhā́*-, although an exact formal parallel in Balto-Slavic is lacking. This can hardly be an archaism, since the preverb *som is also an Indo-Slavic isogloss. However, independent innovation is difficult to exclude, especially given the semantic parallel found in Gr. σύνθεσις f. 'putting together; agreement'.

4.4 Semantic Clusters in the Isogloss Corpus

This section explores groups of isoglosses that can be clustered based on semantics. The aim is to provide a basis for studying the hypothesized Indo-Slavic subgroup from a linguistic palaeontological perspective, as per research question A3 (cf. 1.4). As described in 2.5, inferences on cultural developments based on linguistic palaeontology rely on successful phylogenetic stratification of reconstructed words. This implies that shared lexical innovations may be hypothesized to correlate with cultural innovations, whereas independent innovations and shared archaisms may not. However, shared archaisms are not irrelevant, as they may attest to continuous familiarity with a particular concept.

Not all semantic clusters discussed below are relevant for linguistic palaeontology (e.g., body parts in 4.4.4), but are listed anyway, as they attest to lexical similarity of Indo-Iranian and Balto-Slavic in certain semantic fields.

4.4.1 *Agriculture*

The attested Balto-Slavic and Indo-Iranian reflexes of *d^hoH-neh_2- 'grains' and *$pelH$-ou- 'chaff' are terms referring to processed cereals. In the Rigveda, *dhānā́-* refers rather generally to roasted[4] grains (e.g., RV III.52), but the following attestation more clearly suggests an agricultural connotation:

> RV X.94.13cd
> *vápanto bī́jam iva dhānyākr̥taḥ pr̥ñcánti sómaṃ ná minanti bápsataḥ*
>
> Like grain-producers [=farmers/millstones] strewing seed, strewing their "seed" [=semen] they engorge the soma. They do not diminish him though they gnaw at him (Jamison & Brereton 2014: 1547).

Lith. *dúona* f. has a clearly agricultural meaning, referring to 'bread', but also 'bread grains, rye'. This correspondence implies that *d^hoH-neh_2- should be reconstructed with agricultural semantics, although it is difficult to exclude the possibility that the term originally referred to processed wild seeds. Similarly, the attested forms of *$pelH$-ou- 'chaff' agree in meaning, but it is difficult to entirely rule out that it could have originally referred to chaff from wild cereals, such as *Stipa*, also known as feather grass (Rühl, Herbig & Stobbe 2015).

4 The semantic specification is evidenced by RV IV.24.7b *pácāt paktī́r utá bhr̥jjáti dhānā́ḥ* 'he will cook the cooked foods, and will roast the grains'. The meaning 'roasted grains' agrees with Shu. *ðůn* 'roasted grain' and Yagh. *don* 'roasted grain'.

The question of Indo-European agricultural terminology reaches far beyond *d^hoH-neh_2- 'grains' and *$pelH$-ou- 'chaff', however. In the case of Balto-Slavic, it is commonly recognized that the branch shares a set of agricultural terms with other European branches (cf. Kroonen et al. 2022). Conversely, it has been argued that Indo-Iranian split off from the Indo-European community before the European branches innovated their agricultural vocabulary (Schrader 1883). On the other hand, Hirt (1892; 1895b) argued that Proto-Indo-European society had agriculture, but that most agricultural vocabulary was lost in Indo-Iranian.

Kroonen et al. (2022) show that Indo-Iranian in fact does share some agricultural terms with the European branches, which are, additionally, shared innovations to the exclusion of Anatolian, viz. *h_2erh_3- 'to plough', *$peis$- 'to grind', *se-sh_1-io- 'a cereal', *h_2ed-$o(s)$- 'a (parched?) cereal'. This suggests that agriculture did not play an important role in Proto-Indo-Anatolian society, but became increasingly important in Core Proto-Indo-European. Especially striking is the formation reflected by Skt. *urvárā*- f. 'arable land, field yielding crop' and Av. *uruuarā*- f.pl. 'food plant' < *h_2rh_3-uer-eh_2-, which presupposes that Indo-Iranian participated in the semantic shift in h_2erh_3- 'to plough' << 'to grind, crush'. The retention of these Core Indo-European terms in Indo-Iranian implies that there is no need to assume that the agricultural semantics of Indo-Slavic *d^hoH-neh_2- 'grains' and *$pelH$-ou- 'chaff' are secondary, since familiarity with agriculture seems to be confirmed by independent evidence. In fact, doing so would be uneconomical, as it presupposes independent semantic shifts in the respective branches. Based on these considerations, the most straightforward scenario is that the agricultural semantics of these words are old.

As discussed in 4.3, it cannot be determined whether *d^hoH-neh_2- 'grains' and *$pelH$-ou- 'chaff' are archaisms or innovations in Indo-Slavic. In any case, it seems improbable that they were formed in Proto-Indo-Anatolian. Together with the other agricultural terms innovated in (and inherited from) Core Proto-Indo-European, they suggest a continuous familiarity with cereal farming between the split of Core Proto-Indo-European up until the attestation of Indo-Iranian and Balto-Slavic, which must be taken into account in archaeolinguistic hypotheses on the dispersal of these branches.

Besides the inherited terms, Shu. *rivand*, Rosh. *ravand* 'chickpea', Yazg. *raván* '(chick)pea' (Morgenstierne 1974: 70) < PIr. *$H(a)rab^{(h)}anTa$- may reflect an irregular correspondence of Gr. ἐρέβινθος m. 'chickpea', OHG *arawīz* f. 'pea', which may be borrowings from an agricultural substrate language (Hehn 1870: 140; Furnée 1979: 22). Since the Iranian forms are limited to Pamir languages, it is uncertain whether they go back to Proto-Indo-Iranian, however. Similarly, Yazg. *wis*, Taj. Wj. *gis* 'oats' may reflect PIr. *$(H)(a)uić$-, which can be

compared to SCr. *òvas* m. 'oats' < PSl. **ovьsъ*, Lith. *avižà* f. 'oats', and Lat. *avēna* f. 'oats' (Blažek 2005; Kümmel 2017; Kroonen et al. 2022). However, the irregular correspondence between Baltic *ž* and Slavic *s*, as well as the limited distribution in Indo-Iranian, may point to more recent borrowing. Thus, **H(a)rab$^{(h)}$anTa-* 'chickpea' and **(H)(a)uić-* 'oats' represent possible additional agricultural terms shared with European languages, but their reconstruction to Proto-Indo-Iranian, let alone Indo-Slavic, is far from certain.

4.4.2 *Dairy*

Five terms relating to dairy production are found among the isoglosses: **mentH-eh$_1$-* '(wooden) tool for stirring', **neih$_1$-* 'to churn', **peh$_3$i-men-* 'milk', **seuk-* 'to turn, twist; to churn', and **suleh$_2$-* 'juice; milk'. Of these, **neih$_1$-* 'to churn' is a compelling shared innovation. This cluster could indicate technological innovation in dairy production and/or an increased reliance on dairy products.

Consumption of milk products from sheep, goat, cow, and horse is attested in Early to Middle Bronze Age steppe cultures such as Yamnaya, Poltavka, and Sintashta (Wilkin et al. 2021). Dairy production in Yamnaya culture contexts, which in the Steppe hypothesis is the homeland of (Core) Indo-European (cf. 5.2), is consistent with dairy terms shared by various Core Indo-European branches, such as **h$_2$melǵ-* 'to milk',[5] **tuH-ro-* 'curdled milk',[6] and **d^{h}e-d^{h}h$_1$-* '(sour) milk'. Thus, the set of Indo-Slavic dairy terms attests to continued familiarity with dairy products from Core Proto-Indo-European up until the time of attestation of Indo-Iranian and Balto-Slavic. Additionally, the innovation of **neih$_1$-* 'to churn' possibly reflects continued innovation in dairy production.

4.4.3 *Pastoralism*

Four terms relating to pastoralism are **d^{h}eh$_1$i-nu-* 'female mammal', **h$_2$eǵ-* 'goat', **h$_2$eǵ-ino-* 'animal skin, leather', and **uolo-* 'tail hair (of horse)'. Since Proto-Indo-European is believed to have had a mainly pastoralist economy (Schrader 1890; Kroonen et al. 2022), this cluster need not indicate technological innovation but rather a continued reliance on domesticated animals. Judging by its derivation from **d^{h}eh$_1$i-* 'to suck(le)', **d^{h}eh$_1$i-nu-* highlights the milk-giving function of female animals in the herd, further highlighting the

5 A root **h$_2$melǵ-* is reflected in ToB *malkwer* m. 'milk', Gr. ἀμέλγω 'to milk', Lat. *mulgeō* 'to milk', OIr. *mligid* 'to milk', Goth. *miluks* f. 'milk', Lith. *mélžti* 'to milk', Alb. *mjel* 'to milk'. However, the root is conspicuously absent from Indo-Iranian.

6 A stem **tuH-ro-* 'curdled milk' may be reconstructed based on YAv. *tūiri-* n. 'curdled milk' and Gr. τῡρός m. 'cheese'.

importance of dairy products, as discussed in 4.4.2. The tail hair of a horse, i.e., **uolo-* 'tail hair (of horse)', may have been used for various purposes, such as fishing lines (cf. Lith. *vãlas* m. 'fishing line; horse hair').

4.4.4 *Body Parts*

Several Indo-Slavic isoglosses are terms for body parts. Such words are often considered to be basic vocabulary items, which are potentially significant for subgrouping purposes. In this cluster, we may especially note **ǵʰos-to-* 'hand' and **uolḱ-o-* 'hair', which denote concepts that are found on the Leipzig-Jakarta list of basic vocabulary (Tadmor, Haspelmath & Taylor 2010). It is unclear if **peh₂gs-ó-* '(body part) having a side' may be considered a basic vocabulary item, since the exact meaning is not clear, and since the base of this derivative (**peh₂ǵ-os-* 'side') need not primarily have referred to the body. Conversely, **HoustHo-* 'lip' is semantically clear but derivationally obscure. The stem **nogʷ-o-* 'naked' is not a body part per se, but relates to the body.

Of course, body parts are not technological innovations and there need not be a particular reason why they are innovated or replaced. The stem **mosgʰ-en-* 'brain, marrow' did not replace the more widespread **mosgʰ-o-* 'brain, marrow', but may have had a specialized meaning. Similarly, **nogʷ-o-* 'naked' did not oust **nogʷ-no-* but may be a dissimilated variant or taboo deformation. One may only speculate that other isoglosses in this cluster, e.g., **ǵʰos-to-* 'hand', started out as peripheral variants of more basic lexemes, before replacing them.

4.4.5 *Colours*

Four colour adjectives are found among the isoglosses, viz. **bʰrodʰ-no-* 'a (pale) horse colour', **ḱieh₁-mo-* 'black, dark, grey', **ḱuoit-ó-* 'white, bright', and **krs-no-* 'black'.

Of particular interest is **bʰrodʰ-no-*, since it is specifically used to describe horses. Domesticated horses have been regarded as a key feature of early Indo-European communities (Anthony 2007; 2023a; 2023b), but horse domestication and horse riding have alternatively been argued to be post-Proto-Indo-European innovations (Hehn 1877: 53; Schrader 1890: 382; Renfrew 1989; Meid 1994). Based on genetic evidence, Librado et al. (2021) show that by 2200 BCE, the modern domesticated horse spreads from the Sintashta horizon, i.e., in post-PIE times. Before this, local breeds were more genetically diverse. Since horse coat colour is a feature of domestication, a word like **bʰrodʰ-no-* could have served to designate a local breed. However, it cannot be connected to a specific archaeological context.

4.4.6 *Magic and Religion*

The isoglosses **ḱuen-to-* 'holy, sacred' and **kʷer-* 'to perform magic' belong to a magical or religious semantic cluster. Additionally, at least in Indo-Iranian, the reflexes of **g(ʷ)eHi-* 'to sing' are associated with singing in a ritual context. These terms may reflect novel ritual practices. Unfortunately, such cultural features are difficult to compare to the archaeological record in a meaningful way.

4.5 Non-Exclusive Isoglosses

Many proposed isoglosses were rejected on formal or semantic grounds, or because they can convincingly be argued to reflect independent formations. Other proposed isoglosses were rejected because a cognate was found in a third branch of Indo-European. Certain branches appear in multiple rejected isoglosses as the third branch next to Indo-Iranian and Balto-Slavic. Such cases, e.g., Indo-Slavic-Albanian isoglosses, could in theory correlate with a higher node in the Indo-European family tree.

Of course, it may well be the case that such non-exclusive isoglosses have previously been analysed as Indo-Slavic isoglosses simply because the etymological lexicography of the third branch was less advanced at the time. For example, already in the 19th century, Latin etymologies were widely available, so that, e.g., Schmidt (1872) or Arntz (1933) would not have proposed an Indo-Slavic isogloss if there was an obvious Latin cognate. Conversely, Tocharian was not known at the time and could not be taken into account. Therefore, it should be noted that the isoglosses listed in the following sections are probably far from exhaustive.

With this in mind, non-exclusive Indo-Slavic isoglosses shared with a third branch are discussed below. Non-exclusive isoglosses that were classified as uncertain are also included, whereas rejected etymologies and rejected shared innovations are left out.

4.5.1 *Albanian*

Five compelling cases of Indo-Slavic-Albanian isoglosses are found, viz. **dlh₁gʰ-ó-* 'long', **dʰe-dʰh₁-* '(sour) milk', **dʰeh₁i-* 'to contemplate, behold, see', **g(ʷ)riH-ueh₂-* 'neck, nape', and **h₂eu-* 'to weave'.[7]

7 The isoglosses **gʷrH-* 'rock' (3.5.24) and **dʰegʷʰ-e/o-* 'to burn' (3.5.16) are not included here, since they have possible cognates in Greek and Tocharian, respectively.

In the case of *$*h_2eu$- 'to weave', it is interesting to note that Alb. *vej* 'to weave' and Skt. *váyati* 'to weave' both seem to reflect *$*h_2u$-*eie*/*o*-, which is a possible shared innovation. The reduplicated stem *$*d^he$-$*d^hh_1$- 'milk' looks archaic, but an innovation cannot be excluded. The adjective *$*dlh_1g^h$-*ó*- 'long' is a possible innovation, since the branches of Indo-European display several formations from this root with the same meaning, not all of which can be inherited. The root *$*d^heh_1i$- 'to contemplate, behold, see' may reflect a semantic innovation, as it seems to be derived from an *i*-stem of *$*d^heh_1$- 'to put'. In the case of *$*g^{(w)}riH$-$*ueh_2$- 'neck, nape', the deeper etymology is unclear, but it may be an archaism or an innovation based on a lost verbal stem *$*g^{(w)}erh_3$-*i*-.

Finally, *$*h_1ēd$ / *$*h_1ōd$ adv. 'then, and, so' was classified as uncertain, since it cannot be determined if the Indo-Iranian forms are closer to the possible Albanian or Balto-Slavic cognates, or if they are all related.

Since Albanian is attested so late and preserves relatively few inherited lexemes, it is striking that it shares at least five isoglosses with Indo-Slavic, several of which are possible shared innovations.

4.5.2 *Armenian*

The root *$*k^{(w)}o(n)Hd$- 'to bite' was classified as uncertain due to formal problems regarding the comparison between Indo-Iranian and Balto-Slavic, but also due to Arm. *xacanem* 'to bite, sting'. This could thus be classified as an uncertain Indo-Slavic-Armenian isogloss. However, as a root isogloss, a shared archaism is not unlikely.

4.5.3 *Celtic*

The sole Indo-Slavic-Celtic isogloss in the corpus is *$*deḱs(i)$-*no*- 'right'. It is a possible innovation, since the branches of Indo-European attest different formations from an adverb *$*deḱs(i)$. However, since Slavic reflects *$*deḱs$-*no*- as opposed to Baltic *$*deḱsi$-*no*-, an independent innovation is difficult to exclude.

4.5.4 *Germanic*

Indo-Slavic-Germanic lexemes are the most numerous among the non-exclusive isoglosses in the corpus, numbering seven plus four uncertain cases.

Roots shared with Germanic include *$*b^heh_2d^h$- 'to push, press', *$*kseub^h$- 'to sway, swing', and *$*k^weit$- 'to perceive'. The latter has been explained as an extended variant of *$*k^wei$- 'to perceive', but as this root must be reconstructed as *$*k^weh_1i$-, the etymology is uncertain at best. There is no clear indication that any of the three roots is an innovation, although it is difficult to exclude.

The Indo-Iranian, Baltic, and Germanic words for 'nave, navel' can be united under a reconstruction *$*h_3nob^h$-*H*-. This formation is a possible shared innov-

ation, since several different formations from this root are attested in the branches of Indo-European. Further, **ḱi(e)h₁-uo-* 'dark, black, grey' and **krouh₂-io-* 'corpse; flesh' are shared derivatives that may be shared innovations.

The *eie*/*o*-present **top-eie*/*o-* 'to make hot' is shared with Germanic, but independent innovations are difficult to exclude.

Of the isoglosses classified as uncertain, there is nothing against taking **h₂eidʰ-smo-* 'firewood', **ḱeh₁k(ʷ)-o*/*eh₂-* 'green edible plant', and **(s)ker-men-* 'hide, skin' as Indo-Slavic-Germanic isoglosses, but the Germanic forms all have alternative etymologies. In the case of **bʰreh₁ǵ-* 'to shine, dawn', the Germanic comparanda are isolated to North Germanic, and the analysis of this root as an archaism or innovation *vis-à-vis *bʰe*/*orh₁ǵ-* is uncertain.

Although several cases discussed here are not compelling shared innovations, the comparatively high number of Indo-Slavic-Germanic lexical isoglosses is interesting, especially in view of the many lexical isoglosses shared by Balto-Slavic and Germanic presented by Stang (1972).

4.5.5 *Greek*

Four Indo-Slavic-Greek isoglosses are found, viz. **h₁ui-dʰh₁-eu-eh₂-* 'widow', **deḱm-t-* 'decade', **mor-o-* 'plague', **oti-loikʷ-o-* and 'leftover, surplus'.

The potential shared element in **h₁ui-dʰh₁-eu-eh₂-* 'widow' is the full grade in the suffix, as opposed to zero-grade in Germanic and Celtic. This is a rather trivial development, however, and could be independent. Moreover, it cannot be excluded that Lat. *vidua* f. 'widow' also shows full grade in the suffix. As an athematic *t*-stem, **deḱm-t-* 'decade' may be an archaism.

Although the proposed semantic innovation in **mor-o-* 'death' was rejected for Indo-Slavic, the formation itself constitutes an isogloss with Greek. Similarly, the compound **oti-loikʷ-o-* 'leftover, surplus' was rejected as an Indo-Slavic formation, but the stem **loikʷ-o-* is a possible shared innovation with Greek. However, both cases could be archaisms or independent innovations.

Additionally, three uncertain Indo-Slavic-Greek isoglosses are found. In the case of **bʰuHs-* 'to be active, strengthen', it is possible that the various attested formations are all independent developments from archaic forms of the root **bʰeh₂u-* 'to become'. The second case is **(t)plh₁-* 'fort', which is unclear, since the Baltic word could either be closer to the Greek *i*-stem or the Indo-Iranian root noun. All could go back to the same stem, but this is uncertain. Finally, **ḱor-H(-keh₂)-* 'a kind of bird' is a possible reconstruction that unifies various Greek, Balto-Slavic, and Indo-Iranian bird names, but these words also have different etymologies.

4.5.6 *Italic*

There are two potential Indo-Slavic-Italic isoglosses in the corpus, which were both classified as uncertain. The stem **m(e)itH-u-* 'opposed' has a possible Italic cognate with unclear ablaut. In the case of **h₁iti* 'so, in this manner', the reconstruction is not clear, as the Indo-Iranian form can be connected to either an Italic or Baltic cognate. Alternatively, all forms may be united under a reconstruction **(H)itH*.

4.5.7 *Tocharian*

Two Indo-Slavic-Tocharian isoglosses are found in the corpus: **ḱlei-e/o-* 'to lean against (intr.)' and **tekʷ-* 'to run (of water), flow'. The former may be an oppositional intransitive to **ḱl-ne-i-*, and is as such a possible shared innovation. The latter is a possible shared semantic innovation, if the root originally meant 'to run (of people, animals)'. However, it is difficult to exclude that the development went in the opposite direction, or that the original semantic range of the root covered a wider scope, i.e., 'to run (of water, people, animals)'.

4.6 Indo-Slavic? Innovations, Archaisms, and Quantity of Isoglosses

As the analysis of the isogloss corpus has shown, it is in most cases not possible to exclude beyond reasonable doubt that Indo-Slavic lexical isoglosses are archaisms or independent innovations rather than shared innovations. This is due to the methodological issues surrounding lexical isoglosses, as described in Chapter 2; in most cases, it cannot be excluded that a certain formation did not at one point exist in other branches.[8] However, a small part of the isogloss corpus consists of compelling shared innovations. In these cases, there are compelling arguments against assuming that they ever existed in other branches: **ǵʰos-to-* 'hand', **h₂eǵ-* 'goat', **h₂eǵ-ino-* 'animal skin, leather', **neih₁-* 'to churn', and **som* 'together, with'. These are few in number, but are most easily explained by assuming a period of shared development after the split of Core Proto-Indo-European but before the Balto-Slavic and Indo-Iranian branch-defining innovations occurred.

8 For example, the shared Indo-Slavic nominal derivatives **dʰeh₁i-nu-*, **h₁su-dru-*, **h₂eu-r-eh₁*, **ḱuen-to-*, **ḱuoit-ó-*, **mosgʰ-en-*, **ni-h₃(e)kʷ-*, **nogʷ-o-*, **peh₃i-men-*, **suleh₂-*, **tusk-io-*, **uolḱ-o-* should not be understood as unlikely shared innovations. On the contrary, they are fully consistent with the Indo-Slavic hypothesis. However, in these cases, we are unable to determine the ancestral state; e.g., **dʰeh₁i-nu-* need not have replaced a formation attested in other branches.

Since the number of compelling shared innovations is low, we may instead consider the isogloss corpus from a quantitative perspective. Is the number of Indo-Slavic isoglosses (55) high enough to provide a significant argument in favour of the Indo-Slavic hypothesis? As discussed in 2.2.4, several factors make it difficult to answer that question. First, due to lexical replacement, it is not unexpected that all possible branch pairs show a base-line number of lexical isoglosses due to chance (Meillet 1908: 126). On the basis of the results of this study alone, there is no way of objectively determining whether the number of Indo-Slavic isoglosses surpasses this base-line number. To achieve this, the Indo-Slavic isogloss corpus would need to be compared to corpora of lexical isoglosses shared by other hypothesized subgroups, such as Graeco-Aryan (Martirosyan 2013) or Germano-Balto-Slavic (Stang 1972). However, as the present study has shown, the results of previous studies are in many cases outdated (e.g., Schmidt 1872; Porzig 1954), due to advances in the understanding of sound laws and morphological structures of Indo-European languages, as well as in the etymological lexicography of Indo-European languages. Moreover, the evidence for competing hypotheses would have to be studied using the same methodology as applied here to the Indo-Slavic lexical isoglosses to produce a comparable result. Therefore, a comparative study of Indo-Slavic vs. other potential subgroups is not feasible at the moment.

Furthermore, even if the number of Indo-Slavic lexical isoglosses presented here could be compared with that of other branch-pairs, the problem remains that branches may have replaced lexical items at different rates. This implies that a difference in the number of Indo-Slavic lexical isoglosses vs. the number of Graeco-Aryan lexical isoglosses, if such a difference exists, is not necessarily significant (Holm 2003). Thus, as long as the lexical replacement rates are unknown, quantities of lexical isoglosses are inherently difficult to compare. Since the lexicon is not a closed set, statistical modelling of whole-lexicon comparison may not be possible. Yet, naïve quantitative comparison of lexical isogloss corpora (e.g., Indo-Slavic vs. Graeco-Aryan) could offer a supporting role in the argumentation, next to the identification of shared innovations, which provides more foundational evidence for subgrouping.

In sum, qualitative analysis reliably shows a small number of shared innovations of Indo-Iranian and Balto-Slavic to the exclusion of other branches. To assess the weight of the rest of the lexical isogloss corpus, further research needs to investigate whether 1) Indo-Iranian and Balto-Slavic respectively share innovations with other branches that conflict with the shared innovations of Indo-Slavic (e.g., shared innovations of Balto-Slavic and Germanic, where Indo-Iranian preserves the ancestral state); 2) the number of Indo-Slavic isoglosses is

disproportionately lower or higher as opposed to other hypothetical subgroups, taking the varying state of attestation of the various branches into account.

4.7 Indo-Slavic and Alternative Scenarios

As laid out in 1.3, various hypotheses regarding the phylogenetic and dialectal position of Indo-Iranian have been put forward. Here, each hypothesis is evaluated based on the Indo-Slavic lexical isogloss corpus, to determine to what extent the hypotheses are compatible with the shared lexical innovations of Indo-Iranian and Balto-Slavic.

4.7.1 *Graeco-Aryan Hypothesis*

In the Graeco-Aryan hypothesis (Schleicher 1853; 1861; Grassmann 1863a; Kretschmer 1896; Birwé 1956; Euler 1979; Gamkrelidze & Ivanov 1995; Martirosyan 2013), Indo-Iranian forms a subgroup with Greek, which in most cases also includes Armenian and Phrygian. With respect to this hypothesis, an important result of the present study is that the Indo-Slavic lexical isogloss corpus contains shared innovations to the exclusion of Greek and Armenian. Indo-Slavic **ǵʰos-to-* 'hand' and **h₂eǵ-* 'goat' have been analysed as innovations *vis-à-vis *ǵʰes-r-* 'hand' and **h₂eiǵ-* 'goat', which are archaisms shared by Greek and Armenian. Additionally, Greek does not reflect the Indo-Slavic semantic innovation in **neih₁-* 'to churn'. This implies that the strong version of the Graeco-Aryan hypothesis, in which Greek, Armenian and Indo-Iranian form an innovation-defined subgroup, may be rejected, as it is inconsistent with the fact that Indo-Iranian shares innovations with Balto-Slavic to the exclusion of Greek and Armenian.

However, most proponents of the Graeco-Aryan hypothesis do not exclude the possibility that the branches involved share innovations with other branches (cf. especially Euler 1979; Gamkrelidze & Ivanov 1995; Martirosyan 2013). If Graeco-Aryan is seen as a non-exclusive dialectal grouping, it is possible to accommodate the Indo-Slavic lexical innovations without rejecting the Graeco-Aryan hypothesis as such. As the discussion in 1.3 has shown, it is unclear whether there are any Graeco-Aryan shared innovations to the exclusion of Balto-Slavic (i.e., where Balto-Slavic retains the ancestral state) which could justify positing a specifically Graeco-Aryan dialect group.

4.7.2 *Primary Split Hypothesis*

In the primary split hypothesis (Müller 1853; Lottner 1858a; Fick 1870; Brandenstein 1936; Hamp 1990), Core Proto-Indo-European splits into an Asian (Indo-

Iranian) and a European subgroup. Proponents vary as to whether they believe that the European branches form an innovation-defined subgroup in the strict sense (Fick 1870; 1873; Brandenstein 1936), or that there are dialectal groups within the European part of the Indo-European language family, which excludes Indo-Iranian (Hamp 1990).

The Indo-Slavic shared innovations presented in this study imply that the strong version of the primary split hypothesis must be rejected, since Indo-Iranian shares innovations with a European branch that cannot be projected back to the Core Proto-Indo-European stage. Even from a wave model perspective, the results show that Balto-Slavic shares innovations outside of the European group, and it is unclear whether there are any innovations shared by all European branches to the exclusion of Indo-Iranian that would warrant postulating a pan-European dialect group.

Shared European agricultural vocabulary to the exclusion of Indo-Iranian has been used as an argument for a European subgroup (Mommsen 1865; Schrader 1883; Brandenstein 1936). However, while the evidence points to innovations in the European branches (cf. Kroonen et al. 2022), these are never shared by all European branches, e.g., *$h_2eǵ$-*ro*- 'cultivated field' << 'field of pasture' (Germanic, Greek, Italic; Indo-Iranian is archaic); *$prḱ$(-eh_2)- 'furrow' << 'gap' (Celtic, Germanic, Italic; Baltic and Indo-Aryan are archaic). Note that in the latter case, neither Balto-Slavic nor Indo-Iranian participated in the innovation. In other European agricultural terms, neither the archaic nor the innovative state are attested in Indo-Iranian, which implies that it cannot be excluded that Indo-Iranian participated in the innovation, viz. *$h_2eḱ$-*os*- 'ear of grain' << 'tip of grass' (Germanic, Italic; Tocharian is archaic); **neik*- 'to winnow' << 'to stir up' (Celtic, Baltic, Greek; Anatolian and Slavic are archaic); *seh_1-*men*- 'seed' (Celtic, Balto-Slavic, Germanic, Italic; Anatolian is archaic);[9] **selk*- 'to plough' << 'to draw, pull' (Germanic, Greek, Italic; Armenian and Tocharian are archaic); **sper*- 'to sow' << 'to strew' (Albanian, Greek; Anatolian is archaic). The case of **ǵrH-no*- 'cereal' (Celtic, Balto-Slavic, Germanic, Italic) relies on whether Psht. *zə́ṛay*, *zúṛay* m. 'seed, pit', *zaṇ-γozay* 'edible pine seed' (Morgenstierne et al. 2003 s.v.)—which seem to preserve a non-agricultural meaning—really represent a cognate, which is uncertain. In the case of *$g^{\text{w}}reh_2$-*uon*- 'stone; grinding stone, quern', ToB *kärweñe* 'stone, rock' preserves the basic meaning, whereas Skt. *grā́van*- m. means both 'pressing stone'

9 As shown by Skt. *sasyá*- n. 'corn, grain' ~ YAv. *hahiia*- adj. 'pertaining to grain' < *se-sh_1-*io*-, Indo-Iranian participated in the semantic shift from *seh_1- 'to impress' >> 'to sow'. Accordingly, it cannot be excluded that *seh_1-*men*- was lost in Indo-Iranian.

and 'stone' in general,[10] which indicates that it participated in the semantic shift seen in Goth. *qairnus* m. 'quern', Lith. *gìrnos* f.pl. 'quern', Arm. *erkan* 'quern' etc., but preserved the polysemy. Finally, in the case of **puH-ro-* > Gr. πῡρός m. 'wheat' and Lith. *pūraĩ* m.pl. 'winter wheat', Lat. *pūrus* 'clean' and OIr. *úr* 'fresh' preserve the archaic meaning, whereas Skt. *pávana-* n. 'sieve, winnowing basket' implies that Indo-Iranian participated in the same development from 'to clean'>> 'to winnow' that is presupposed by Greek and Balto-Slavic, to the exclusion of Italic and Celtic. Thus, there is no obvious dichotomy between Indo-Iranian and the European branches as a whole in terms of agricultural terminology.

4.7.3 *Indo-Slavic Hypothesis*

In the Indo-Slavic hypothesis (Kuhn 1850; Bopp 1853; Ringe, Warnow & Taylor 2002; Kassian et al. 2021), Indo-Iranian and Balto-Slavic form a subgroup within Core Indo-European to the exclusion of the other non-Anatolian branches. The shared innovations among the Indo-Slavic lexical isoglosses provide an important argument in favour of this hypothesis, since the phonological isoglosses often cited as evidence for Indo-Slavic (satemization, RUKI) cannot unambiguously be analysed as shared innovations (cf. 1.3). The Indo-Slavic lexical isoglosses, including the shared innovations, would also be compatible with a wave model scenario, where Indo-Iranian and Balto-Slavic form part of a larger dialectal grouping (Schmidt 1872; Bonfante 1931; Arntz 1933; Porzig 1954), before undergoing their respective branch-defining innovations.

4.7.4 *Indo-Balkanic Hypothesis*

In addition to the three main hypotheses on the position of Indo-Iranian, three additional hypotheses will be discussed here and in the two following sections.

Various scholars have proposed a closer dialectal relationship between Indo-Iranian, Balto-Slavic, Albanian, Armenian, Greek, and Phrygian: the so-called eastern Indo-European dialect group (Meillet 1908; Bonfante 1931; Porzig 1954; Meid 1975; Euler 1979). The same group of branches have also tentatively been considered to form a phylogenetic subgroup by Olander (2019) and Søborg (2020), following Ringe, Warnow & Taylor (2002), which may be termed the Indo-Balkanic hypothesis.

Importantly, the results show three shared innovations (**ǵʰos-to-* 'hand', **h_2eǵ-* 'goat', and **neih$_1$-* 'to churn') that occur in Indo-Iranian and Balto-Slavic to the exclusion of Greek, Albanian, and Armenian. The latter branches reflect

10 However, the meaning 'stone' is attested late (MBh.+) and could be secondary.

the ancestral states **ǵʰes-r-* 'hand', **h₂eiǵ-* 'goat', and **(s)neh₁-* 'to turn, twist' (only Greek), which means that the Indo-Slavic innovations cannot be back-projected to the hypothetical Indo-Balkanic stage. Thus, even if additional evidence for an Indo-Balkanic subgroup emerges, such a scenario has to reckon with an Indo-Slavic node further down in the tree structure.

4.7.5 *Indo-Balto-Germanic Hypothesis*

Zeuss (1837) considered Germanic as the closest relative of Balto-Slavic, and Indo-Iranian as the next closest, whereas Müller (1873) believed that all three branches formed a subgroup, from which Indo-Slavic separated. While this subgrouping scenario, which may be termed the Indo-Balto-Germanic hypothesis, has not since had a prominent position in the literature, Balto-Slavic has often been considered to occupy an intermediate dialectal position between Germanic and Indo-Iranian (Schmidt 1872; Porzig 1954).

Similar to the Graeco-Aryan and Indo-Balkanic subgroup hypotheses, an Indo-Balto-Germanic subgroup where Balto-Slavic and Germanic are more closely related is contradicted by Indo-Slavic shared innovations to the exclusion of Germanic. In the case of **neih₁-* 'to churn' and **som* 'together, with', Germanic reflects the ancestral states **(s)neh₁-* 'to turn, twist' and **kom*, respectively. Thus, in a strict tree model, a subgroup with the structure [Indo-Iranian, [Balto-Slavic, Germanic]] may be rejected. As discussed in 1.3, the often-cited case endings in **-m-* do not provide unambiguous evidence for a shared innovation of Germanic and Balto-Slavic to the exclusion of Indo-Iranian.

As remarked in 4.5.4, a number of non-exclusive Indo-Slavic isoglosses are shared with Germanic, and could potentially be shared innovations at a hypothetical Indo-Balto-Germanic stage. Furthermore, while Germanic shows the ancestral states of **neih₁-* 'to churn' and **som* 'together, with', it attests neither the archaic nor innovative state in the case of the remaining Indo-Slavic innovations (**ǵʰos-to-* 'hand', **h₂eǵ-* 'goat', **h₂eǵ-ino-* 'animal skin, leather'), which implies that it cannot in principle be excluded that it participated in them. On the other hand, Germanic and Balto-Slavic have been argued to share a large number of lexical isoglosses (Stang 1972; Mańczak 1980). It remains to be determined if the Germanic-Balto-Slavic isogloss corpus contains shared innovations to the exclusion of Indo-Iranian,[11] or if these isoglosses could instead be back-projected to an Indo-Balto-Germanic subgroup with the structure [[Indo-Iranian, Balto-Slavic], Germanic]. Alternatively, in a wave model

11 A potential case is **tuHs-(d)ḱmt-* > Goth. *þusundi* f. 'thousand', Lith. *tū́kstantis* m. 'thousand', OPr. *tūsimtons* acc.pl. 'thousand', OCS *tysǫšti* f. 'thousand', but the etymology is formally problematic (cf. Pijnenburg 1989).

scenario, all three branches could be linked in a dialectal grouping, with overlapping shared innovations.

4.7.6 *Indo-Balto-Albanian Hypothesis*

As discussed in 4.5.1, a byproduct of the compilation of the Indo-Slavic isogloss corpus is a set of compelling isoglosses shared by Indo-Iranian, Balto-Slavic, and Albanian. Although few in number, this result is striking, since Albanian (just like Armenian) has lost much of the inherited Indo-European vocabulary that is preserved in other branches (Matzinger 2018). Additionally, all five are possible innovations, which could have resulted from a post-Proto-Indo-European period of shared development. This would furthermore be consistent with the fact that Indo-Iranian, Balto-Slavic, and Albanian all undergo satemization.

However, as pointed out in the discussion on the Graeco-Aryan and Indo-Balkanic hypotheses, Albanian preserves the ancestral states **ǵʰes-r-* 'hand' and **h₂eiǵ-* 'goat' vs. the innovative Indo-Slavic **ǵʰos-to-* 'hand' and **h₂eǵ-* 'goat'. Thus, in an Indo-Balto-Albanian subgroup scenario, the tree structure would be inferred as [[Indo-Iranian, Balto-Slavic], Albanian].

4.7.7 *Conclusion*

One of the two main research questions of this study, as laid out in Chapter 1, is whether the lexical isoglosses shared by Indo-Iranian and Balto-Slavic provide evidence for an Indo-Slavic subgroup within Core Indo-European (RQA). As the discussion and analysis of the lexical evidence in this chapter and in Chapter 3 have shown, there are 55 compelling lexical isoglosses shared by Indo-Iranian and Balto-Slavic, of which 5 are compelling shared innovations. The question may thus be answered in the affirmative.

Furthermore, the existence of Indo-Slavic innovations to the exclusion of Greek, Armenian, and Germanic, imply that the two main competing hypotheses on the position of Indo-Iranian, namely the Graeco-Aryan and primary split hypotheses, may be rejected, at least from a tree model perspective.

As discussed in Chapter 2, Dyen (1953) and Clackson (1994) define phylogenetic subgroups as having undergone a high number of shared innovations that clearly set them apart from other parts of the family, whereas a small number of shared innovations point to a dialect group in the disintegrating protolanguage. From this perspective, the Indo-Slavic lexical innovations are most compatible with a dialect group.

However, as pointed out in the discussion on Dyen (1953) and Clackson's (1994) distinction between subgroups and dialect groups, it is not the number of shared innovations, but rather the existence of overlapping shared innova-

tions that constitutes the fundamental difference between phylogenetic subgroups and dialect groups (cf. Ross 1997). If there are no overlapping innovations between branches, the internal structure of the language family can be adequately described using a tree model where the length of the branches indicates the number of shared innovations. If, on the other hand, there are overlapping innovations that predate the respective branch-defining innovations, the internal structure must include a dialectal period after the split of the protolanguage when certain would-be branches are connected in a dialect continuum, or linkage.

According to this definition, the results of the present study alone do not allow us to determine whether the lexical isoglosses and innovations tying Indo-Iranian and Balto-Slavic together arose in the setting of an exclusive Indo-Slavic subgroup or a dialect linkage that also included other branches of Indo-European. The fact that the evidence for Indo-Slavic is limited to lexical innovations,[12] which would not by themselves have caused a break in mutual intelligibility with other Core Indo-European dialects, suggests that it may be most appropriate to speak of an Indo-Slavic linkage, at least for the time being. Future research will be tasked with determining whether there are any compelling shared innovations that link Indo-Iranian and Balto-Slavic to other branches, respectively (e.g., Greek, Armenian, Germanic, and Albanian).

12 As we have seen, satemization and the RUKI rule may or may not have co-occurred with the Indo-Slavic lexical innovations, and in any case, it is difficult to evaluate to what extent these changes would have made Indo-Slavic unintelligible with centum dialects, if at all. The RUKI rule most certainly would not have hindered mutual intelligibility, as it was a phonetic change with rather limited scope. As for satemization, the situation is more complex. If by "satemization" one refers exclusively to the merger of *k and *k^w, while *$\acute{k}$ was retained as a palatal stop vel sim., it might not have significantly hindered mutual intelligibility.

CHAPTER 5

The Archaeology and Genetics of Indo-Iranian Prehistory

5.1 Introduction

In section 4.7.7, it was concluded that lexical isoglosses shared by Indo-Iranian and Balto-Slavic provide evidence for a period of shared innovation that may be termed Indo-Slavic. As the Indo-Slavic period is intermediate between Core Proto-Indo-European and Proto-Indo-Iranian, it has implications for our understanding of the prehistoric dispersal of the Indo-Iranian languages. The aim of this chapter is to contextualize Indo-Iranian linguistic prehistory from archaeological and genetic perspectives. The focus, on the one hand, lies on the location of the Proto-Indo-Iranian homeland, and, on the other hand, on the dispersal of Pre-Proto-Indo-Iranian from the Proto-Indo-European homeland following the split of the protolanguage. For the latter question, three main scenarios will be presented and evaluated according to their compatibility with the linguistic evidence presented in Chapters 3 and 4. For reference, the most important archaeological cultures discussed throughout the chapter are summarized in Table 2.

5.2 The Indo-European Homeland Question

Although many homeland hypotheses have been proposed over the years (cf. Mallory 1989: 144), the debate on the Indo-European homeland has in recent decades been centred around the controversy between the Steppe hypothesis, the Anatolian hypothesis, and, albeit to a lesser extent, the Armenian hypothesis (see Gaitzsch & Tischler 2017).[1]

Proponents of the Steppe hypothesis (Benfey 1875; Tomaschek 1878: 862; Schrader 1890; Gimbutas 1956; Mallory 1989; Anthony 2007), which places the Indo-European homeland north of the Caucasus, between the Black Sea and the Caspian Sea, have relied on linguistic palaeontology as evidence for

1 A notable alternative theory is Nichols' (1997) "Bactria-Sogdiana" homeland, although she has now retracted this hypothesis. Incidentally, a Bactrian homeland was also proposed by Pictet (1859–1863).

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TABLE 2 Summary of archaeological cultures discussed in the chapter. EBA = Early Bronze Age, MBA = Middle Bronze Age, LBA = Late Bronze Age

	Period	Date (BCE)	Approx. location	Subsistence strategy
Yamnaya	EBA	3300–2600	Pontic-Caspian steppe	Mobile pastoralism (+ mixed farming west of the Dnipro)
Corded Ware	EBA–MBA	3000–2350	Northwest and Northeast Europe	Pastoralism, mixed farming
Fatyanovo- Balanovo (Corded Ware)	EBA–MBA	2900–2050	Northeast Europe, Dnipro to Vyatka-Kama interfluve	Pastoralism, mixed farming
Bactria-Margiana archaeological complex	MBA–LBA	2250–1700	Central Asia, Amu Darya River	Irrigation farming
Abashevo	MBA	2200–1900	Middle Volga to South Urals	Sedentary pastoralism (+ mixed faming?)
Poltavka	MBA	2800–2100	Volga-Ural steppe	Mobile pastoralism
Sintashta	MBA	2100–1800	South Trans-Urals	Sedentary pastoralism
Alakul'-Fëdorovo	LBA	2000–900	Central Asian steppe	Mobile/Sedentary Pastoralism
Srubnaya	LBA	1850–1450	Eastern Pontic-Caspian steppe	Sedentary Pastoralism

the connection between Proto-Indo-European culture and Early Bronze Age steppe cultures, termed Yamnaya ("pit grave"). A range of reconstructed terms, including words for wheeled vehicles and domesticated animals, delimit the timeframe of the Proto-Indo-European community to ca. 3500–2500 BCE, in which the Yamnaya culture (3300–2600 BCE, cf. Morgunova & Khokhlova 2013) provides a plausible origin for the dispersal of Indo-European to Europe and Asia, respectively (Anthony & Ringe 2015; Anthony 2023b).

Conversely, proponents of the Anatolian hypothesis (Renfrew 1987) have rejected arguments based on linguistic palaeontology as evidence in the homeland question. Their focus has instead lain on explaining the demographic processes behind the spread of the language family, arguing that the expan-

sion of agriculture from Anatolia from ca. 7000 BCE provides a plausible vector for the spread of Indo-European (Bellwood 2001; 2013). Another argument comes from datings of Proto-Indo-European based on Bayesian phylogenetic analysis that are too early (ca. 8000–5000 BCE) to be compatible with the Steppe hypothesis (Gray & Atkinson 2003; Bouckaert et al. 2012; Heggarty et al. 2023). However, the early dating of Proto-Indo-European has largely been rejected by historical linguists, since it is incompatible with the evidence from linguistic palaeontology (Anthony & Ringe 2015; Kroonen et al. 2023). Moreover, the methodology is fundamentally based on the idea that rate of lexical replacement can be used to estimate divergence times of related languages (cf. Swadesh 1952), which is disputed (Bergsland & Vogt 1962; Nettle 1999).

Although the demographic argument was seen as a strong argument in favour of the Anatolian hypothesis, Allentoft et al. (2015) and Haak et al. (2015) have shown that (Indo-European-speaking) European and Central and South Asian populations have received significant gene flow from populations related to Pontic-Caspian steppe groups, forcing archaeologists to reconsider their views on the demographic dynamics between sedentary farmers and mobile pastoralists in prehistory. In fact, migrations of steppe populations caused massive population turnover in many parts of Europe and (to a lesser extent) Asia (Damgaard et al. 2018; Mathieson et al. 2018; Mittnik et al. 2018; Olalde et al. 2018; Narasimhan et al. 2019) on a scale that is compatible with the introduction of and subsequent shift to a new language family. Taking the evidence from linguistic palaeontology and archaeogenomics together, the Steppe hypothesis comes out as the most plausible.

Lazaridis et al. (2022) argue that Proto-Indo-Anatolian may originate south of the Caucasus, with the non-Anatolian branches sharing a secondary homeland on the Pontic-Caspian steppe. This hybrid model in some way resembles the Armenian hypothesis (Gamkrelidze & Ivanov 1995), with the crucial difference that Indo-Iranian is still believed to have spread to Central and South Asia from the steppe region, rather than via the Iranian plateau. The advantage of the hybrid hypothesis is that it offers an explanation for the lack of steppe ancestry in Anatolia. However, the near-complete absence of reconstructable agricultural terms in Proto-Indo-Anatolian matches poorly with an Anatolian homeland, since this area was deeply agricultural (Kroonen et al. 2022). Thus, in this work, I place the Indo-European homeland in the 4th millennium Pontic-Caspian steppe.

Ultimately, for the purposes of this study, the difference between the Steppe hypothesis and the hybrid hypothesis of Lazaridis et al. (2022) is essentially inconsequential, since, in both models, the starting point of the Indo-Iranian

dispersal (and the Balto-Slavic dispersal, for that matter) is the Early Bronze Age Pontic-Caspian steppe.

5.3 The Sintashta Culture as an Archaeological Context for Proto-Indo-Iranian

The Sintashta culture encompasses around two dozen fortified settlements east of the Ural Mountains that share several material cultural and funerary features. The area is famous for the earliest attestation of the spoke-wheeled chariot in the late 21st century BCE (Lindner 2020). Besides the eponymous Sintashta site (Gening 1979), another major settlement was Arkaim (Kuz'mina 2007: 603). The culture is dated to 2100–1800 BCE (Anthony 2009: 57; Epimakhov, Zazovskaya & Alaeva 2023). It is thus chronologically intermediate between earlier Middle Bronze Age cultures west of the Urals such as Poltavka (2800–2100 BCE) and Abashevo (2200–1900 BCE) and Late Bronze Age cultures in Central Asia such as Alakul'-Fëdorovo[2] and Srubnaya (1850–1450 BCE).

The economy of the Sintashta culture was centred around pastoralism, as evidenced by the findings of domesticated animals of various species in burials. Judging from the proportion of bones found, the herd of Sintashta groups typically consisted of ~60% cattle, ~25% ovicaprids and ~15% horse (Koryakova & Epimakhov 2007: 88). Single instances of pig or boar are also found, but pigs were not part of the herding economy (Zdanovich & Zdanovich 2002; Kuz'mina 2007: 146). Distinguishing sheep from goats is difficult without DNA analysis, but Kuz'mina (2007: 148) argues that sheep were more frequent than goats and that the latter are not found in burials as sacrificial animals, indicating that goats were less significant. Domesticated animals were a source for meat and milk (Zdanovich & Zdanovich 2002), which is confirmed by stable isotope analysis (Ventresca Miller et al. 2014; Hanks et al. 2018). Additionally, Judd et al. (2018: 11) argue that the lack of caries in individuals from Kamennyi Ambar-5 points to consumption of dairy products.

Although stockbreeding was the main subsistence strategy for the Sintashta population, Kuz'mina (2007: 141) argues that limited cereal farming was practiced as well. The proposed evidence for this consists of the placement of settlements, finds of stone querns, bronze sickles, and grain imprints on tools: all indirect evidence. Moreover, such tools may have been used for wild plants

2 The terms Alakul' and Fëdorovo refer to what in earlier literature is known as the Andronovo culture, which is now regarded as inappropriate by many archaeologists (cf. Grigoriev 2021).

or other activities (Gerling 2015: 244; Mariotti Lippi et al. 2015). Zdanovich & Zdanovich (2002: 255) argue that the lands around Arkaim show traces of irrigation canals, pointing to earlier usage as fields for cultivation. Conversely, more recent studies stress the absence of any direct evidence for cereals in Sintashta settlements (Rühl, Herbig & Stobbe 2015; Judd et al. 2018). Absence of cereals is also supported by the lack of dental caries in Arkaim individuals (Anthony 2007: 405). Anthony mentions that charred millet grains found at Alandskoe have been taken as evidence for consumption of millet, at least at some sites, but widespread millet consumption in the Trans-Urals is not found during the Bronze Age, based on carbon and nitrogen isotope analysis (Ventresca Miller & Makarewicz 2019).

Previous research has drawn connections between Proto-Indo-Iranian and the Sintashta culture (Gening 1979), based on a combination of archaeological, linguistic, and genetic arguments.

First, by applying a "retrospective approach", Kuz'mina (2007: 163–164) derives the historically attested Iron Age steppe cultures of the Sauromatians and Saka peoples (who were Iranian-speaking) from the Sintashta culture. This argument is based on shared material cultural elements in these cultures, such as the strong equestrian tradition, similar types of arrows, spears, as well as other tools and weapons. Importantly, also non-functional elements of Sauromatian-Saka material culture have their roots in Sintashta culture, e.g., ceramic ornamentation, burial tradition, and aspects of the traditional dress, such as the pointy hat of the Saka. According to Kuz'mina (2007: 11), non-functional elements point to cultural identity.

Second, besides showing a cultural connection to historical Indo-Iranian-speaking communities, the chronology of the Sintashta culture roughly fits with an approximate dating of Proto-Indo-Iranian based on purely linguistic evidence. On the Indo-Aryan side, the relative chronology of the Vedas establishes the Rigveda (RV) as the oldest (cf. AiGr.), followed by the Atharvaveda (AV). Both clearly reference Panjab toponyms and were thus composed in South Asia (Witzel 1987). For the AV, a *terminus post quem* can be determined based on the mention of iron, which was widely used in South Asia from ca. 1000 BCE (Uesugi 2018: 4).[3] The earliest attestation of an Indo-Aryan language from the Mitanni kingdom can be dated to the 15th–14th centuries BCE (Witzel 1995: 99).[4] On the Iranian side, the earliest direct attestation is repres-

3 The introduction of iron likely started already in the second millennium BCE, but was not widespread until after 1000 BCE. See further Uesugi (2018).

4 For an overview of the Mitanni Aryan language as an Indo-Aryan dialect, cf. Mayrhofer (1961). The Indo-Iranian presence in the Middle East may go back as early as the 18th century BCE,

ented by the Old Persian inscriptions from the 6th century BCE, next to Iranian personal names attested in Assyrian and Babylonian sources (Schmitt 1989: 25). The Avestan Gāthās, which reflect a linguistically more archaic stage than Old Persian, have been approximately dated to ca. 1000 BCE (Kellens 1989: 36). As in the case of the AV, the mention of iron in Avestan (cf. YAv. *hao-safnaēna-* '(made) of steel', lit. 'good iron'?) can be used to establish a *terminus post quem*. Although the exact geographical origin of the Avesta is unknown, the introduction of iron in the wider region of Iran and Central Asia begins ca. 1250–1000 BCE (Askarov 1999; Danti 2013). Together, the dating of the earliest Old Indo-Iranian texts implies a *terminus ante quem* for Proto-Indo-Iranian around 1500 BCE at the latest. Since the Rigvedic and Gāthic Avestan texts are so similar linguistically, the split cannot have been too long before this date. A split around ca. 2000 BCE fits well with the dating of the Sintashta culture to 2100–1800 BCE.

Third, a *terminus post quem* for Proto-Indo-Iranian can be approximated based on Indo-Iranian chariot terminology. Indo-Aryan and Iranian share a set of terms that can be reconstructed for Proto-Indo-Iranian, including **HratHa-* 'chariot', **HratHiH-* 'chariot driver', and **HratHai-štaH-* 'chariot warrior' (Malandra 1991; Oettinger 1994; Lubotsky 2023). Taken at face value, these words suggest that Proto-Indo-Iranian did not split before the invention of the spoke-wheeled chariot in the 21st century BCE. However, **HratHa-* 'chariot' is derived from an Indo-European word for (solid) wheel, **HrotHo-*, and could in principle have referred to a more primitive vehicle originally. On the other hand, the specific reference to the **HratHiH-* 'chariot driver' vs. **HratHai-štaH-* 'chariot warrior' strongly suggests a military context, implying a spoke-wheeled chariot; in the Near East, four-wheeled solid wheel wagons pulled by donkeys or onagers were used in military contexts as early as the 3rd millennium BCE, but there is no evidence for a similar practice in the steppe region (Hüttel 1994). Yet, it is striking that several Indo-Aryan technical terms relating to the spoked wheel, viz. Skt. *arás-* m. 'spoke', *nemí-* f. 'wheel rim', *pavís-* m. 'metal felly', are not paralleled in Iranian. Although this is an *argumentum ex silentio*, it could be interpreted as evidence that the split of Indo-Iranian preceded the invention of the chariot (cf. Lubotsky 2023).

Fourth, locating the Proto-Indo-Iranian homeland close to the Ural Mountains is suggested by the many loanwords from early Indo-Iranian into Uralic languages (cf. Holopainen 2019). While many loanwords are from Proto-Iranian or later, there is also a Proto-Indo-Iranian and potentially a Pre-Proto-Indo-

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if *ṣāb ma-ri-ia-nim* /*ṣābīša ma-ri-a/ia-nim*, attested in the Leilan letter L.87–887 (cf. Eidem 2014: 142, fn. 16), reflects a Hurrian borrowing of Indo-Iranian **maria-* 'young man, warrior'.

Iranian layer (see further 5.4), indicating a continuous presence of Indo-Iranian speakers in the Ural region.

Fifth, a layer of loanwords into Proto-Indo-Iranian have been argued to come from an unknown language of the Bactria-Margiana archaeological complex (BMAC) (Lubotsky 2001b). The BMAC civilization was at its peak around 2250–1700 BCE (Lyonnet & Dubova 2021: 32). Around its fortified settlements, the BMAC people practiced irrigation farming, cultivating wheat, barley, lentil, pea, grass pea, chickpea, grape, apple, and flax (Spengler et al. 2014). Domesticated animals include cattle, sheep, camels, pigs, and donkeys (Lyonnet & Dubova 2021: 23–24). Some of the proposed loanwords, e.g., **iauīiā-* 'canal', **Hustra-* 'camel', **kHara-* 'donkey', **kaćiapa-* 'tortoise',[5] can plausibly be connected to the BMAC, and suggest that Indo-Iranians came into contact with BMAC groups from the north rather than from the south, as they should otherwise have been familiar with such concepts (Lubotsky 2001b: 307). Contact between BMAC agriculturalists and steppe pastoralists may further be evidenced by finds of Andronovo ceramics in BMAC contexts (Salvatori 2008: 64).[6] Finds of cotton at the Sintashta culture settlement Kamennyi Ambar suggest contacts with Central or South Asian cultures (Shishlina, Koryakova & Orfinskaya 2022). The fact that some loanwords show irregular correspondences between Indo-Aryan and Iranian (Lubotsky 2001b; Palmér 2019) suggests that the contact with BMAC groups happened as Proto-Indo-Iranian was disintegrating, postdating the earliest Uralic contacts, which again supports a north to south movement of Indo-Iranian speakers.

Finally, population genomics suggests that steppe ancestry (i.e., ancestry related to Yamnaya steppe herders) spread to South Asia from Central Asian Middle Bronze Age groups around 2000–1500 BCE (Narasimhan et al. 2019: 7). Furthermore, from 2100–1700 BCE, outlier individuals from BMAC sites resemble Central Asian MBA groups (Narasimhan et al. 2019: 4). By comparing modern Iranian-speaking populations and ancient populations of Central Asia, Guarino-Vignon et al. (2022) show that there is genetic continuity from the Iron Age, and that the ancient populations can be modelled as a mix between local BMAC and incoming Central Asian steppe groups. With regards to South Asia (India in particular), a direct link to the Sintashta population is complicated by the fact that the Y-chromosome haplogroup overwhelmingly found in Sintashta is R-Z2124 (Narasimhan et al. 2019: S Table 1), whereas modern

5 The Russian tortoise, *Testudo horsfieldii*, is native to the area of the BMAC (cf. Uetz et al. 2022).

6 However, these ceramics belong to the Tazabag'yab culture, which is no longer considered to be closely related to other so-called Andronovo cultures by some archaeologists (cf. Grigoriev 2021: 5).

Indians with haplogroups related to R1a mostly have R-Y3+ (Underhill et al. 2015). Granted, both subclades are derived from R1a-Z93, but the formation of R-Z2124 and R-Y3 predates the formation of the Sintashta culture (Poznik et al. 2016). It is possible that an unsampled steppe population, autosomally similar to Sintashta, but with different Y-chromosome haplogroups, brought Indo-Iranian to India (cf. 5.4).

In sum, a diverse set of arguments support the Sintashta culture as a plausible archaeological proxy for early Indo-Iranians. However, that it would correspond one-to-one to the Proto-Indo-Iranian homeland, from which all subsequent Indo-Iranian languages originate, is doubtful, based on genetic evidence and the uncertainties regarding chariot terminology. As the following section will show, a slightly more complex scenario, involving the Abashevo culture, may be required to explain all the facts.

5.4 The Abashevo Culture as an Archaeological Context for Pre-Proto-Indo-Iranian

When attempting to trace the origins of the Sintashta culture, archaeologists seem to agree on the importance of the Abashevo culture (Anthony 2009). Although previously believed to be older, the Abashevo culture is now radiocarbon dated to 2200–1900 BCE (Molodin, Epimaxov & Marčenko 2014; Mimoxod 2022), preceding the Sintashta culture by just over 100 years. Divided according to the location of sites, three variants are recognized: the Middle Volga, Don-Volga, and South Ural Abashevo culture (Mallory & Adams 1997: 1), the latter overlapping geographically with the Sintashta culture. Parpola (2022) has taken the Abashevo culture as an archaeological proxy for Pre-Proto-Indo-Iranian.

The Abashevo culture followed the kurgan burial custom of the Early Bronze Age Pontic-Caspian steppe cultures and shows evidence of a rich metallurgical tradition with copper and arsenic bronze weapons and tools (Kuz'mina 2021). The economy was mainly pastoralist, with a herd consisting of ~60–70 % cattle, ~10–20 % ovicaprids, and at most 15 % horses and domesticated pigs, respectively (Koryakova & Epimakhov 2007: 65). This is similar to the Sintashta culture (Kuz'mina 2007: 146), except for the inclusion of the domesticated pig. Parpola (2015: 55) has argued that metal sickles and stone querns provide evidence for agriculture, but Kuz'mina (2021) states that there is no direct evidence for farming. Pig husbandry is often taken as an indirect sign of agriculture, since they feed on rest products, but Koryakova & Epimakhov (2007: 65) argue that Abashevo pigs may have been fed acorns instead.

The argument that the Sintashta culture derives from the Abashevo culture is partly based on similarities in material culture. Not only have Abashevo pots been found in Sintashta burials, but the Abashevo ceramic tradition is argued to have influenced Sintashta pottery (Anthony 2007: 382; Koryakova & Epimakhov 2007: 74). Additionally, Sintashta weapons, tools, and adornments show influence from Abashevo precursors (Kuz'mina 2021). The connection between the cultures also makes sense from a geographical-chronological perspective, since the Abashevo culture spread eastward from the Middle Volga region, across the Urals, to the area of the Sintashta culture, shortly before the emergence of the latter (Anthony 2007: 382; Epimaxov 2020; Parpola 2022: 15).

As for genetic evidence, Engovatova et al. (2023) present the first publication of samples from Abashevo individuals, all male (n = 14). Seven individuals carry Y-chromosome haplogroup R1a-Z93 and therefore show a plausible relationship to the Sintashta population.

Furthermore, linguistic evidence for language contact between Indo-Iranian and Uralic languages may support a connection between early Indo-Iranian speakers and the Abashevo culture. As mentioned in 5.3, there are loanwords in Uralic from Proto-Indo-Iranian and potentially even from Pre-Proto-Indo-Iranian (Holopainen 2019). The earliest loanwords were likely borrowed into an already dialectally differentiated post-Proto-Uralic stage (Common Uralic), as evidenced by their distribution in the western branches of Uralic, excluding Samoyed. Especially important are Common Uralic **mekši* 'honeybee' and **meti* 'honey', attested in Finnic, Mordvin, Permic, and Hungarian. Due to their vocalism, it has been argued that these words may have been borrowed from the Pre-Proto-Indo-Iranian ancestors of PIIr. **makši-* 'bee, fly', **mad^{h}u-* 'honey' < Pre-PIIr. **mekši* and **med^{h}u-*, respectively (Parpola 2022: 17–18). Since apiculture was not practiced east of the Urals at the time, these loanwords likely entered Common Uralic as speakers migrated west from the Proto-Uralic homeland east of the Urals (Grünthal et al. 2022). Early Uralic speakers were likely associated with the westward spread of the Sejma-Turbino phenomenon (Zeng et al. 2023), dated to 2200–1900 BCE (Marchenko et al. 2017), which came into contact with the Abashevo culture (Černyx & Kuz'minyx 1987).

Although calling this layer of borrowings Pre-Proto-Indo-Iranian is consistent with linguistic reconstruction and archaeological facts, it must be borne in mind that vowel substitutions in Indo-Iranian-Uralic loanwords are notoriously difficult to interpret phonetically (Kümmel 2019). In the case of **makši-* 'bee, fly', since there are no cognates in other Indo-European languages (EWAia II: 287), the reconstruction of Pre-PIIr. **mekši-* rather than **mokši-* is based on Uralic, and therefore not decisive.[7] In the case of **meti* 'honey', it is

7 The same is true for the idea that Common Uralic **ertä* 'side (of the body)' is borrowed from

difficult to exclude that Uralic **e* reflects Proto-Indo-Iranian **a*.[8] Thus, while the words plausibly link early contacts between Indo-Iranian and Uralic to the Abashevo-Sejma-Turbino context, determining the linguistic layer as specifically Pre-Proto-Indo-Iranian, as opposed to Proto-Indo-Iranian, must be considered uncertain.

In fact, the view that Sintashta and Abashevo reflect Proto-Indo-Iranian and Pre-Proto-Indo-Iranian, respectively (Parpola 2022), may be overly simplistic. The cultures overlap chronologically and geographically with each other, and even if there is a difference in material culture, this need not correlate one-to-one with the linguistic situation. From the perspective of genetics, as discussed in 5.3, the Sintashta population does not provide a perfect fit for Indo-Aryan-speaking groups in South Asia. Since the Abashevo population is, as of yet, much less thoroughly sampled, one might wonder if the missing R-Y3+ haplogroup males, which could explain the prevalence of this haplogroup in India, are hidden here.

To explore this idea further, let us consider an area where the Abashevo culture may be a better archaeolinguistic fit for Proto-Indo-Iranian than the Sintashta culture. Proto-Indo-Iranian inherited two words for 'domesticated pig' from Proto-Indo-European, **suH-* and **porḱo-*, as evidenced on the one hand by YAv. *hū-* m. 'pig', MiP Pahl. *hūg* 'pig', Oss. I x_oy / D *xu* 'pig', and on the other by YAv. *parsa-* m. 'pig(let)', Khot. *pā'sa* 'pig, hog'.

Skt. *sūkará-* m. 'boar' has traditionally been adduced, but the formation is obscure (**sūka-* + *-rá-*?). It is conspicuously similar in form to MiP Pahl. *hūkar*(*ag*) 'porcupine' (MacKenzie 1986: xxii), which could point to a PIIr. **suHkara-* 'swine; porcupine' that is etymologically distinct from **suH-ka-* 'pig'.[9]

Pre-PIIr. **Herdʰo-* (Holopainen 2019: 81; Parpola 2022: 18), ancestral to Skt. *árdha-* m. 'side, part, region', *ardhá-* m/n. '(one) half'. No Indo-European cognates confirm the reconstruction of an *e*-grade in the root; rather, the Indo-Iranian situation suggests a nomen actionis **Hordʰo-* 'separation, division' (cf. Lubotsky 1988b: 71, fn. 21).

8 It could be argued that Common Uralic **kekrä* 'circular thing' and **kečrä* 'spindle', corresponding to Skt. *cakrá-* m./n. 'wheel' and *cat*(*t*)*ra-* n. 'spindle', provide more convincing evidence that Uralic **e* reflects Pre-PIIr. **e*, since they appear to have been borrowed before the Proto-Indo-Iranian palatalization of $*k^{(w)} > *č$. However, Kümmel (2019) argues that Proto-Indo-Iranian **č* may have been realized as a palatal stop at an early stage, which could have yielded Uralic **k*.

9 In view of the irregular correspondence with YAv. *sukurəna-* m. 'porcupine', MoP *sugur*(*na*) 'id.', Wan. *suguṇ*/*ṛ* 'id.' < **sŭkurna-* and Psht. *škuṇ* 'porcupine', Bal. *sīkūn*, *sīnkur* 'id.' < **sĭkurna-* (cf. Morgenstierne et al. 2003), a substrate origin is possible. In that case, the word for 'porcupine' may have been related to the word for 'needle' in the substrate language, borrowed as Skt. *sūcí-* f. 'needle', YAv. *sūkā-* f. 'needle' (Lubotsky 2001b), and subsequently folk-etymologically associated with the inherited word for 'pig', i.e., **suH*(*-ka*)-.

Although usually translated as 'wild boar', a specific connotation to wild rather than domesticated pigs is not evident from the earliest attestations:

> RV VII.55.4ab
> *tváṃ sūkarásya dardṛhi táva dardartu sūkaráḥ*
>
> Keep tearing at the boar; let the boar keep tearing at you (Jamison & Brereton 2014: 948).
>
> ŚS XII.1.48c
> *varāhéṇa pṛthivī́ saṃvidānā́ sūkarā́ya ví jihīte mṛgā́ya*
>
> … the earth, in concord with the boar, opens itself to the wild hog (Whitney 1905: 669).

The phrase *sūkarā́ya mṛgā́ya* 'to the wild *sūkará-*' could imply that *sūkará-* on its own was semantically underspecified and could refer to either domesticated or wild pigs. This agrees with the Middle and Modern Indo-Aryan material, where the descendants of **sūkará-* vary in meaning, cf. Pā. *sūkara-* m. 'pig', Nep. *sũgar*, *sũgur* 'domesticated pig', Si. (*h*)*ūrā* 'boar, wild pig'.

Based on the contrastive stem PIIr. **uarāj*^{h}*a-* 'wild boar' (Skt. *varāhá-* m. 'wild boar', YAv. *varāza-* m. 'id.'),[10] PIIr. **suH*(*-ka*)- and **parća-* likely referred to domesticated pigs, although perhaps not exclusively. As mentioned in 5.3, according to Kuz'mina single instances of pig or boar bones have been found in Sintashta contexts, but in general she argues that "the complete absence of the pig make[s] up the characteristic feature […] of Indo-Iranian stock-raising" (Kuz'mina 2007: 158–159). Koryakova & Epimakhov (2007: 88) report no evidence of domesticated pig at Sintashta sites.[11] Mallory (1994) argues that this is consistent with the loss of the Indo-European pig words in most Indo-Iranian languages. This assessment is at odds with the reconstructed Proto-Indo-Iranian situation. Conversely, Abashevo sites offer clear evidence that the pig was part of the typical Abashevo herd. It is of course possible that the pig words could have been retained in an exclusively Sintashta-based Proto-Indo-Iranian community, through contact with nearby cultures that did keep

10 The meaning 'wild boar' is supported by Skt. *varāhayú-* adj. 'wishing for boar, boar-hunting'.

11 Furthermore, the pig is not part of the herd in (presumably Indo-Iranian-speaking) Alakul'-Fëdorovo contexts, believed to derive from the Sintashta culture (Koryakova & Epimakhov 2007: 127; Kuz'mina 2007).

domesticated pigs. However, together with the evidence for contact with Uralic, the pig words could be taken as evidence that part of the Proto-Indo-Iranian community should be identified with the Abashevo culture.

Expanding the Proto-Indo-Iranian homeland to include the Abashevo culture seems to be at odds with Proto-Indo-Iranian chariot terminology, however, since the Abashevans did not build chariots. Yet, as the discussion of the linguistic evidence for chariot technology has shown, most technical terms are not shared by Indo-Aryan and Iranian. The few terms that are shared (**HratHa-* 'chariot', **HratHiH-* 'chariot driver', **HratHai-štaH-* 'chariot warrior') are more general, and would also be compatible with a scenario where only parts of the Proto-Indo-Iranian community were building chariots, whereas the rest only knew of their existence (like the Abashevans likely did, given their cultural contact and proximity to the Sintashta culture). Once chariots had been invented, the technology quickly spread to the west of the Urals by the early 2nd millennium BCE (Kuznetsov 2006; Koryakova & Epimakhov 2007: 66; Kuznetsov & Mochalov 2016: 75), so the time gap between the formation of the Abashevo culture around 2200 BCE, the invention of the chariot 2050–2000 BCE, and the dissemination of the technology is rather insignificant.

Thus, two archaeolinguistic lines of evidence contradict each other in being consistent with either the Abashevo culture or the Sintashta culture as the Proto-Indo-Iranian homeland. As the discussion has shown, both the pig words and chariot terms may be explained away as valid linguistic palaeontological arguments by attributing their existence to cultural contacts rather than native cultural practices. Yet, there are other arguments linking both cultures to early Indo-Iranians, and since they are partly overlapping geographically, chronologically, and in terms of material culture, it is possible that the archaeological classification has little or nothing to do with the linguistic situation. Both cultures may represent parts of the Proto-Indo-Iranian homeland.

As argued in 4.4.1, Indo-Iranian attests some inherited agricultural terms, which indicate continuous familiarity with farming from Core Proto-Indo-European times. This seems to be at odds with locating the Proto-Indo-Iranian homeland in the Sintashta culture, since there is ample evidence against agriculture being practiced by the Sintashta population (cf. 5.3). It is unclear if the hypothesis presented here, i.e., expanding the Proto-Indo-Iranian homeland to include the Abashevo culture, resolves this problem, since the presence of agriculture in the Abashevo culture is debated (cf. above). Even if neither the Abashevo culture nor the Sintashta culture practiced agriculture, it should be noted that these populations would have been in contact with the agriculturalists of the BMAC to the south (cf. 5.3), which could alternatively explain the presence of agricultural terms in Proto-Indo-Iranian.

5.5 From Yamnaya to Abashevo and Sintashta

As the previous sections have shown, the prehistory of the Indo-Iranian dispersal can be connected to the Sintashta and Abashevo cultures of the south Ural region in the end of the 3rd millennium BCE. For the preceding period, between the emergence of these cultures and the Indo-European homeland, there are several hypotheses that outline alternative scenarios for how speakers of Indo-Iranian reached the south Ural region.

5.5.1 *Scenario 1: Eastward Migration Hypothesis*

The most widely held hypothesis on how (Pre-Proto-)Indo-Iranian spread to the south Ural region is what I call the *Eastward migration hypothesis*. Individual variations aside, its proponents hold that the Proto-Indo-Iranian linguistic community of the south Urals was the result of a (north)eastward migration from the Indo-European steppe homeland during the 3rd millennium BCE. In a way, this may be thought of as the default hypothesis of Indo-Iranian origins, since a direct eastward migration is the shortest route from the steppe to the Ural region. That is not to say that the hypothesis is only based on geographical proximity, however.

Although Gimbutas (1963) connects Indo-Iranian to the Alakul'-Fëdorovo cultures, she makes no explicit mention of how the speakers got there from the Indo-European homeland. Mallory (1989: 263) follows Gimbutas' identification, and adds that the precursor of Indo-Iranian likely developed east of the Volga in the 3rd millennium BCE, corresponding to the Poltavka culture (Mallory & Adams 1997: 440). Also Parpola (2012; 2015; 2022; cf. also Carpelan & Parpola 2001) has explicitly connected Pre-Proto-Indo-Iranian to the Poltavka culture in his scenario of the prehistory of Indo-Iranian. Kuz'mina (2007: 305) agrees that Pre-Proto-Indo-Iranian may be connected to the Poltavka culture.

The Poltavka culture is essentially a Middle Bronze Age descendant of the Yamnaya culture that developed on the steppe between the Volga and Ural rivers ca. 2800–2100 BCE (Chernykh 1992: 132). It continues the kurgan burial tradition of the Yamnaya culture but is characterized by new ceramic styles and an increase in metallurgy. Unlike its contemporaneous western neighbour, the post-Yamnaya Catacomb culture, the copper used in Poltavka mainly came from the Ural region (Chernykh 1992: 133). The pastoralist economy was dominated by ovicaprids, supplemented by cattle and horses (Kuznetsov & Mochalov 2016: 86), and evidence for agriculture is lacking (for the lack of dental caries in Poltavka individuals, cf. Murphy & Khokhlov 2016: 170–171). Like Yamnaya, the Poltavka culture herders were mobile, which makes an agricultural subsistence all the more unlikely (Anthony 2016: 3–6).

From an archaeological perspective, the Eastward migration scenario makes sense, as both the Abashevo and Sintashta cultures have been argued to show significant influence from the Poltavka culture (Anthony 2007: 383, 386; Parpola 2015: 297; Kuznetsov & Mochalov 2016: 85). The precursor of Indo-Iranian would then have developed on the eastern fringe of the Yamnaya culture, spreading further northeast during the Middle Bronze Age and reaching the Ural region toward the end of the 3rd millennium BCE, forming the Abashevo and Sintashta cultures.

From the perspective of genetics, however, continuity between the Poltavka culture and the Abashevo/Sintashta cultures is much less evident. Poltavka individuals cluster very close to the Yamnaya population (Mathieson et al. 2015; Narasimhan et al. 2019), indicating population continuity between the Early and Middle Bronze Age periods. However, they lack the Early European Farmer component found in Sintashta populations (Mathieson et al. 2015). Furthermore, Poltavka males generally carry Y-chromosome haplogroup R1b, associated with Yamnaya males, specifically the subclade R-Z2103 (Narasimhan et al. 2019: S Table 1). This haplogroup is also found in four samples from an Abashevo context (Engovatova et al. 2023), but is absent from Sintashta samples and later Central and South Asian populations associated with Indo-Iranian speakers.[12] Based on this, the Poltavka population is implausible as a source for the Sintashta culture population and later groups related to the Indo-Iranian dispersal.

However, among the nine sampled individuals from Poltavka sites published by Mathieson et al. (2015) and Narasimhan et al. (2019), there is an outlier (sample I0432) that resembles Sintashta groups, showing admixture between steppe-related and European Farmer-related ancestry and carrying Y-chromosome haplogroup R1a-Z93 (specifically the Sintashta-like subtype R-Z2124, cf. Mathieson et al. 2015: S11). The individual is carbon dated to 2925–2536 calBCE and could provide a genetic link between the Poltavka and Sintashta cultures. According to Mathieson et al. (2015), the lack of additional evidence for this type of ancestry in Poltavka contexts could be explained by assuming that R1a males persisted in the area since the Chalcolithic, but were excluded from kurgan burials. However, in addition to being impossible to prove, this scenario was based on the fact that, at the time, males with Y-chromosome haplogroup R1a-Z93 had not been found elsewhere among

12 Since all but one of the hitherto sampled Abashevo individuals come from the Pepkino mass grave, presumably the result of a battle, it is conceivable that the buried individuals came from different cultural groups.

ancient Europeans. This changed with Saag et al. (2021), who found ample evidence for such lineages in individuals from the Fatyanovo-Balanovo culture, an eastern extension of the European Corded Ware cultures. The latter population provides a more plausible source for later Central Asian groups such as Sintashta (cf. 5.5.2). Still, it is puzzling why a single individual matching the genetic signature of Sintashta groups would appear several hundred years prior to the formation of the Sintashta culture, genetically isolated from the rest of the Poltavka samples.[13] Importantly, there is no plausible nearby source for the European Farmer-related ancestry found in the Poltavka outlier, making its ancestry type difficult to explain as a local development in the context of the Poltavka culture.

Thus, while some details remain unclear, the overall impression is that the genetic evidence does not mirror the archaeological continuity between the Poltavka culture on the one hand and the Abashevo and Sintashta cultures on the other. This has consequences for the Eastward migration hypothesis that have not been acknowledged by its proponents. Most importantly, if the linguistic origins of Indo-Iranian lie in the context of the Poltavka culture, it requires the assumption of a language shift in the groups that would form the Sintashta culture, since the populations are so divergent genetically. It is difficult to imagine that such a language shift would have taken place without leaving traces in the Sintashta population or subsequent Indo-Iranian-speaking groups. Even in a scenario with language shift in the Sintashta population due to elite dominance of an Indo-Iranian-speaking minority with Poltavka origins, some genetic trace, if not in the autosomal DNA, then in Y-chromosome haplogroups, would be expected.

5.5.2 *Scenario 2: via-Corded Ware Hypothesis*

Genetic evidence betrays a close relationship between the Sintashta population and Corded Ware groups of eastern Europe (Allentoft et al. 2015; Damgaard et al. 2018; Narasimhan et al. 2019). While Yamnaya groups can be modelled as a mix of Eastern Hunter-Gatherer and Caucasus Hunter-Gatherer ancestry (Allentoft et al. 2015; Haak et al. 2015), it has been argued that an additional ~1/7 Anatolian Farmer ancestry is required (Wang et al. 2019; Lazaridis et al. 2022). In contrast, the Corded Ware population has a larger proportion of Anatolian Farmer-like ancestry, as well as a small amount of Western Hunter-

13 One possible explanation is that the carbon dating is wrong, and that the Poltavka outlier (I0432) in reality belongs to a later layer (after 2200 BCE). Apparently, the grave from which the individual was excavated was cut through by a later burial associated with the Middle Bronze Age Potapovka culture (Mathieson et al. 2015: S11).

Gatherer ancestry (Allentoft et al. 2015; Haak et al. 2015). The Corded Ware population is thought to result from admixture between steppe migrants and European Farmer populations in the late 4th millennium BCE (Papac et al. 2021; Ringbauer et al. 2024).[14] In the eastern Corded Ware populations belonging to the Fatyanovo culture, the Anatolian Farmer-like ancestry component makes up ~33% of the genetic ancestry, and all sampled male individuals carry Y-chromosomes of haplogroup R1a-Z93 (Saag et al. 2021). This is strikingly similar to the Sintashta population, which shows similar levels of Anatolian Farmer-like ancestry and the same predominance of Y-chromosome haplogroup R1a-Z93 among males.[15] R1a-Z93 males have now also been found in an Abashevo context (Engovatova et al. 2023). Since the earliest sampled Fatyanovo individuals are carbon dated hundreds of years before the emergence of the Abashevo and Sintashta cultures (Saag et al. 2021), these can plausibly be explained as resulting from migrations of Fatyanovo groups.

The *via-Corded Ware hypothesis* can also be supported by archaeological evidence. Long before aDNA evidence had become available, archaeologists described connections between Corded Ware cultures and the Abashevo culture, seen as an off-shoot from the eastern Corded Ware cultures otherwise known as Fatyanovo-Balanovo (Gimbutas 1965: 605; Anthony 2007: 380ff.; Kuz'mina 2007: 305; Nordqvist & Heyd 2020). As discussed in 5.3–5.4, the Sintashta culture is closely related to the Abashevo culture, and may therefore be considered to be indirectly related to the Corded Ware complex.

The Fatyanovo and Balanovo cultures make up the eastern part of the Corded Ware horizon, which stretches across the northern half of Europe from the Netherlands to the Volga, occupying the forest-steppe zone. The traditional view has been that the Fatyanovo culture formed as a result of western impulses from central Europe (possibly mediated via the Middle-Dniepr culture, cf. Anthony 2007: 380). Although the chronological difference is small, this view seems to be supported by recent radiocarbon dating, which gives 2900 BCE as an upper boundary for Fatyanovo (Saag et al. 2021), compared to

14 The origin of the Corded Ware genetic ancestry profile is a hotly debated topic. The fact that Corded Ware males carry Y-chromosomes of haplogroup R1a, which is unknown in Yamnaya males (where haplogroup R1b is predominant), suggests that the steppe ancestry component in Corded Ware individuals is not identical to that of Yamnaya populations. However, Ringbauer et al. (2024) have shown that Corded Ware individuals share IBD segments with Yamnaya individuals, which proves that they share ancestors only a few hundred years back.

15 The same traits are found in modern South Asian populations, albeit with significant admixture with other ancestry groups and more Y-chromosome haplogroup variation among males (Narasimhan et al. 2019).

the earliest finds of Corded Ware in Bohemia dating as far back as 3000 BCE (Papac et al. 2021). The latest dated Fatyanovo individual has a lower boundary of 2047 BCE (Saag et al. 2021), and there are charcoal remains dated between the 22nd and 18th centuries BCE, but in general most dates cluster around the early to middle 3rd millennium BCE (Nordqvist & Heyd 2020).

The Fatyanovo culture is mainly known from burials, which (unlike in the Abashevo and Sintashta cultures) are flat earth graves containing various grave goods, but only rarely metal objects (for an overview, cf. Nordqvist & Heyd 2020). Kurgan burials are found further east in Balanovo contexts, which possibly reflects influence from steppe cultures. The Balanovo culture is also characterized by the existence of settlements, which appear to be absent from Fatyanovo. Evidence for copper metallurgy is solid but not abundant, and is stronger in the area of the Balanovo culture closer to the Ural region. The subsistence strategy of Fatyanovo-Balanovo groups is debated. It seems clear that these Corded Ware groups were the first pastoralists in the forest-steppe zone of eastern Europe, with evidence for pigs, ovicaprids, cattle and horses. It has generally been assumed that Fatyanovo-Balanovo groups practiced agriculture, but there is little to no hard evidence for it, perhaps owing, at least partly, to the scanty attestation of settlements.

In linguistic terms, the via-Corded Ware scenario implies that Indo-Iranian would have formed in a linguistic community deriving from groups of Indo-European speakers who moved into central Europe at the turn of the 4th–3rd millennium BCE, forming the Corded Ware cultures. As these groups expanded to the northeast, forming the Fatyanovo-Balanovo cultures, the first specifically Indo-Iranian sound changes may have occurred toward the end of the Balanovo horizon, or in the context of the Abashevo culture (i.e., ca. 2300–2100 BCE). In this scenario, the Poltavka culture, which also influenced both Abashevo and Sintashta culturally, would not have been linguistically Indo-Iranian, but would rather reflect other Indo-European-speaking groups, who may eventually have assimilated linguistically to Indo-Iranian in the 2nd millennium BCE.

The Fatyanovo culture has been associated with Balto-Slavic, often specifically Baltic speakers (Gimbutas 1956: 163; Carpelan & Parpola 2001: 88; Anthony 2007: 380; Kuz'mina 2007: 305; Parpola 2022: 13). Given the results of Chapters 3–4, showing evidence for a period of Indo-Slavic shared innovation, it becomes possible to view the Fatyanovo culture as a plausible archaeological context for the Indo-Slavic linkage (cf. Narasimhan et al. 2019).

5.5.3 *Scenario 3: Bell Beaker Hypothesis*

The origin of the Abashevo culture has played a crucial role in the Eastward migration and via-Corded Ware hypotheses, since it is seen as the immedi-

ate ancestor of the Sintashta culture. Most archaeologists have considered the Abashevo culture to contain elements derived from the Corded Ware cultures as well as the Poltavka culture. There is another hypothesis, however, which contends that the Abashevo culture arose following a migration of Bell Beaker people from central Europe.

Without completely rejecting the idea of influence from local predecessors, Mimoxod (2022) argues that the Middle Volga Abashevo culture is "fundamentally different from the previous substrate, which is represented by the Fatyanovo culture" (p. 122). He argues that the Abashevo burials with wooden coffins and kurgans surrounded by pillar fences find parallels in Moravian and other central European Bell Beaker sites, but not in any local cultures of eastern Europe. The Abashevo kurgan tradition is argued to be partly due to steppe influence, however. Unlike previous researchers, Mimoxod rejects any continuation of Fatyanovo ceramics in the Abashevo culture.

The formation of the Abashevo culture just after 2200 BCE coincides with the 4.2 ka BP climatic event, which was a period of global climate change causing increased wintertime precipitation in higher latitude areas and aridization in lower latitude areas (Mimoxod et al. 2022). These conditions pushed pastoralists in parts of Europe to seek winter pastures in areas such as the Pontic-Caspian steppe. Mimoxod et al. (2022) hypothesize that Bell Beaker groups from the Carpathian basin for this reason migrated to the Middle Volga region, forming the Abashevo culture. However, apart from being the closest area from which Bell Beakers could have migrated to the Middle Volga, there is no independent evidence that the migration would have come from the Carpathian region.

If the formation of the Abashevo culture was the result of a migration of Bell Beaker groups from central Europe, this should have left a signal in the genetic ancestry of the Abashevo population. However, seven of the 14 Abashevo samples published so far carry Y-chromosomes of haplogroup R1a-Z93 (Engovatova et al. 2023), which is rather associated with Corded Ware groups of the Fatyanovo culture (Saag et al. 2021), as well as later Sintashta groups and other populations linked to Indo-Iranian speakers (Narasimhan et al. 2019). Bell Beaker people from central Europe would be a poor fit as a source for these populations, since they tend to have lower proportions of steppe-like ancestry (~46%) and higher proportions of Anatolian Farmer-like ancestry (~43%) compared to Sintashta individuals (Olalde et al. 2018). It remains possible that it was an unsampled Bell Beaker group, whose ancestry profile more closely resembled that of Sintashta/Corded Ware groups, that formed the Abashevo culture. However, for the time being, the migration assumed by Mimoxod (2022) cannot be considered supported by genetic evidence.

From a linguistic perspective, the *Bell Beaker hypothesis* would imply that Pre-Proto-Indo-Iranian was spoken somewhere in central Europe, perhaps in the Carpathian region, until just before 2200 BCE, from where it spread to the Middle Volga region. Unlike in the via-Corded Ware scenario, where Pre-Proto-Indo-Iranian is part, albeit on the eastern margins, of the Indo-Europeanization of central Europe, the Bell Beaker scenario places Indo-Iranian in central Europe proper until almost a millennium after the dissolution of Core Proto-Indo-European, in a cultural context that otherwise has mostly been associated with Celtic and Italic groups (e.g., Anthony 2007: 367).

5.6 Integration with Linguistic Evidence

Having presented three hypotheses on the origins of Indo-Iranian based on archaeological and genetic evidence, the aim of this section is to determine which scenario is the most consistent with the linguistic evidence.

The present study has shown that Indo-Iranian shares a substantial set of unique lexical isoglosses with Balto-Slavic, of which at least five are shared innovations. If the conclusion of Chapter 4 is accepted, an Indo-Slavic linkage must have existed somewhere in space and time between the split of Core Proto-Indo-European (before 3000 BCE) and Proto-Indo-Iranian (after 2200 BCE).

In the Eastward migration scenario, Indo-Iranian developed on the eastern fringe of the Indo-European homeland, associated with the Poltavka culture, and subsequently the Abashevo culture. Parpola (2022: 15) argues that isoglosses shared by Indo-Iranian and Balto-Slavic, such as the RUKI rule, resulted from language contact between (Pre-Proto-)Balto-Slavic-speaking Fatyanovo-Balanovo groups and (Pre-Proto-)Indo-Iranian-speaking Abashevo groups. However, there is no indication that the RUKI rule would have been a contact-induced phenomenon rather than an inherited development. As argued in Chapter 1, the RUKI rule may be an old sound change that failed to phonologize in other branches. Similarly, satemization cannot plausibly be explained as a contact-induced change in a Fatyanovo-Balanovo-Abashevo context, since it also includes Armenian and Albanian, which are unlikely to ever have been spoken in the Middle Volga region (cf. Thorsø 2023). As for the Indo-Slavic lexical isoglosses, there is no indication that they would have resulted from contact, since they predate all branch-specific sound changes. In any case, a scenario where the shared Indo-Slavic features, whether contact-induced or vertically transmitted, developed in the Middle Volga region requires all attested descendant languages to originate from there. This does not seem likely for

Balto-Slavic, for which a more western homeland has been proposed (Gimbutas 1956: 163; Anthony 2007: 380; Kuz'mina 2007: 305).

Additionally, the Indo-Slavic lexical isoglosses include two probable agricultural terms (*d^hoH-neh_2- 'grains' and *$pelH$-ou- 'chaff', cf. 4.4.1). This makes the Poltavka culture and the Middle Volga region problematic as a staging ground for the Indo-Slavic linkage, since there is no evidence for cereal cultivation in the steppe east of the Dnipro during the Early to Middle Bronze Age (Rassamakin 1999: 152; Cunliffe 2015: 96; Kuznetsov & Mochalov 2016; Murphy & Khokhlov 2016). Similarly, the agricultural terms inherited from Core Proto-Indo-European in Proto-Balto-Slavic and Proto-Indo-Iranian, such as *h_2erh_3- 'to plough' (cf. 4.4.1), suggest that both branches originate from the western part of the Indo-European homeland, west of the Dnipro (Kroonen et al. 2022).

In the via-Corded Ware scenario, the Indo-Slavic linkage may be correlated with the northeastward expansion of the Fatyanovo culture from western Ukraine, starting around 2900 BCE and reaching the Middle Volga region well before the end of the 3rd millennium BCE. This fits well with the chronological boundaries of Indo-Slavic (ca. 3000–2200 BCE) determined by the split of Core Proto-Indo-European and emergence of Proto-Indo-Iranian. Moreover, this scenario is compatible with the agricultural vocabulary of Indo-Iranian, in the sense that Indo-Iranian would ultimately originate in the agricultural western Ukraine, the proposed homeland of Core Indo-European (Kroonen et al. 2022). As for the Fatyanovo culture itself, direct evidence for cereal cultivation is lacking, but archaeologists tend to believe that agriculture played a role in its subsistence, based on indirect evidence (Nordqvist & Heyd 2020). Furthermore, it could be argued that familiarity with agriculture is implied by the fact that the Fatyanovo population shows substantial admixture with a European Farmer-like population (Saag et al. 2021).

Additionally, in the via-Corded Ware scenario, if satemization is taken as a shared innovation of the satem branches, this would have to have occurred in the late 4th or early 3rd millennium BCE, in a disintegrating Core Proto-Indo-European-speaking western Ukraine. This could be consistent with the dispersal of Armenian, which has been argued to originate in a western post-Yamnaya Catacomb culture context (Anthony 2007: 92; Thorsø 2023).

In the Bell Beaker scenario, Pre-Proto-Indo-Iranian speakers would have been situated in central Europe until a rapid migration displaced them to the Middle Volga region around 2200 BCE. In principle, this is compatible with the existence of an Indo-Slavic linkage; since the Bell Beaker phenomenon was likely multi-ethnic, not being correlated closely with a single genetic population type, it is possible that Indo-Slavic speakers carried Bell Beaker cul-

ture without showing significant linguistic affiliations to other Indo-European groups usually connected to the Bell Beaker phenomenon, such as Celtic and Italic (cf. Anthony 2007: 367). However, it is not the most attractive scenario. As for the Indo-Slavic and Indo-Iranian agricultural vocabulary, it is compatible with a central European context, as presupposed in the Bell Beaker scenario, since cereal cultivation is attested here (cf. Heyd, Husty & Kreiner 2004).

Aside from agricultural vocabulary, another linguistic palaeontological variable is represented by words for 'pig'. As discussed in 5.4, Proto-Indo-Iranian inherited both **suH-* 'pig' and **porḱo-* 'pig(let)' from Core Proto-Indo-European, indicating familiarity with domesticated pigs. Interestingly, pig husbandry is not mentioned as a feature of the Poltavka culture (Cunliffe 2015: 96; Kuznetsov & Mochalov 2016), but is securely attested in the Fatyanovo culture (Nordqvist & Heyd 2020), which seems to favour the via-Corded Ware hypothesis. The Bell Beaker hypothesis is more difficult to evaluate from this perspective, since the exact location of the Pre-Proto-Indo-Iranian community in this scenario is unclear, but pig husbandry was likely present in most of central Europe (Caliebe et al. 2017). It may of course be argued that the Poltavka population could have words for 'pig' without breeding them, in which case the evidence would not be incompatible with the Eastward migration scenario. However, the Proto-Indo-Iranian pig words are more consistent with the via-Corded Ware or Bell Beaker hypotheses.

A third line of evidence that may be indicative of the migration route of Pre-Proto-Indo-Iranian speakers is substrate words, i.e., words borrowed from non-Indo-European languages in prehistory. All branches of Core Indo-European in Europe, including Armenian, have been argued to share substrate words that may have been borrowed from pre-Indo-European languages of hunter-gatherer and farmer populations of Europe (cf. Schrijver 1997; Kroonen 2012; Jakob 2023a; Thorsø 2023; Wigman 2023 with lit.). A defining feature of most substrate words is formal irregularities that preclude a Proto-Indo-European origin. Many substrate words belong to semantic fields such as local flora and fauna, as well as agricultural terminology. Although they are in the minority, some substrate words are attested in branches whose historical locations are far apart, indicating that they were borrowed at a time when the branches were still located in closer proximity to each other.

If the Indo-Iranian branch originates from Indo-European populations that migrated to central or eastern Europe, before spreading east to the Ural region, as proposed in the via-Corded Ware and Bell Beaker hypotheses, we would expect to find traces of substrate words shared with European branches in Indo-Iranian languages. An exhaustive study is beyond the scope of this work,

but a few potential cases may be discussed.[16] First, the Indo-Slavic isogloss *$h_2eǵ$- 'goat' was argued to be a borrowing, with an irregular correspondence *$h_2eiǵ$- 'goat' in Greek, Albanian, and Armenian (cf. 3.2.2). Although the meaning—seemingly belonging to a pastoralist semantic field—is not typical for a European substrate word, it represents a possible case linking Indo-Iranian to a European context. As for words with agricultural meaning, as discussed in 4.4.1, Iranian *$H(a)rab^{(h)}anTa$- 'chickpea' and *$(H)(a)uić$- 'oats' are possible comparanda of the European substrate words Gr. ἐρέβινθος m. 'chickpea' and PSl. *$ovьsъ$ m. 'oats', respectively. Especially *$H(a)rab^{(h)}anTa$- 'chickpea' is difficult to reject, given the formal and semantic similarity to Greek. However, given its isolated attestation in a few Pamir languages and absence from Old Indo-Iranian languages, it is uncertain whether it goes back to Proto-Indo-Iranian. Another possible substrate word shared with a European branch is Skt. *kapā́la-* n. 'bowl, skull' ~ OE *hafola* m. 'skull' < **kapolo-*, cf. also Lat. *caput* n. 'head' (EWAia I: 300). Given the required reconstruction of **a*, this is unlikely to be a native Indo-European word (Lubotsky 1989). However, since Skt. *kapā́la-* structurally resembles substrate words from a later, post-Proto-Indo-Iranian stratum (Lubotsky 2001b),[17] it may be a much younger borrowing. In a similar semantic field, there is Skt. *kumbhá-* m. 'jar, pitcher', YAv. *xumba-* m. 'pot', which may be compared to Gr. κύμβη f. 'cup, bowl' (cf. EWAia I: 370). However, the Sanskrit and Avestan words do not match formally (**k-* vs. **kH-*),[18] suggesting that they were borrowed after the split of Proto-Indo-Iranian. In this case, they cannot be projected back to a European context.

Thus, there are some possible European substrate words in Indo-Iranian, although only *$h_2eǵ$- 'goat' may be securely back-projected to Proto-Indo-Iranian, given its Indo-Slavic origin. In this sense, the Indo-Iranian situation is not entirely incompatible with the via-Corded Ware and Bell Beaker hypotheses. However, the substrate material appears much more limited in comparison to the European branches, which can be taken as an argument in favour of the Eastward migration hypothesis, where Pre-Proto-Indo-Iranian speakers remained far away from the pre-Indo-European linguistic landscape of Europe.

Yet, a caveat for this discussion is that it is unclear exactly when most substrate words were adopted into the European branches. The formation of the

16 Indo-Iranian languages have been argued to reflect a Central Asian substrate, associated with the BMAC (Lubotsky 2001b; Witzel 2003).

17 I.e., the "trisyllabic nouns with long middle syllable" (Lubotsky 2001b: 303).

18 The Sanskrit and Avestan words can only be reconciled by assuming that Grassmann's Law affected voiceless aspirates, i.e., **kHumbʰa-* > **kʰumbʰa-*, or by assuming that Avestan underwent aspiration metathesis, i.e., **kHumba-* > **kʰumba-* > **kumbʰa-*.

TABLE 3 Interdisciplinary compatibility of three hypotheses on Indo-Iranian origins

	Linguistics				Archaeology	Genetics
	Indo-Slavic lexical isoglosses	**IIr. agricultural terminology**	**IIr. pig words**	**Scarcity of Eur. substrate in IIr.**	**Succession of archaeological cultures**	**Population continuity**
Eastward migration	–	–	–	+	+	–
Via-Corded Ware	+	+	+	?	+	+
Bell Beaker	+	+	+	?/–	+	–

Corded Ware population, resulting from admixture between steppe populations and European Farmers (Papac et al. 2021; Ringbauer et al. 2024), is a plausible scenario for the adoption of some of the earliest substrate words. However, some substrate words show irregular correspondences within branches, e.g., PSl. **ovьsъ* m. 'oats' vs. Lith. *avižà* f. 'oats', suggesting that they reflect a later stratum of loanwords. Accordingly, the question is to what extent substrate words from the earliest stratum would show formal irregularities between the branches, or if such words would rather appear as regular Indo-European etyma. For example, Indo-Slavic **dʰoH-neh₂-* 'grains' has no compelling Indo-European etymology, and could reflect an early borrowing just like Indo-Slavic **h₂eǵ-* 'goat'. More research is needed to clarify the origins of European substrate words, as well as to what extent such words are reflected in Indo-Iranian.

Following the above discussion, a summary of the compatibility of the three hypotheses on the Indo-Iranian dispersal with linguistic, archaeological, and genetic evidence is presented in Table 3.

To begin with, all three hypotheses are in principle compatible with the archaeological record, since the Abashevo and Sintashta cultures have been argued to be successors of the Poltavka culture, Fatyanovo culture, or Bell Beaker culture, respectively. However, when we incorporate population genomics into the picture, only the connection between the Fatyanovo culture and the Abashevo and Sintashta cultures correlates clearly with genetic evidence. With the caveat that the details surrounding the Poltavka outlier individual are still unclear (cf. 5.5.1), the Poltavka population does not seem to contribute to the genetic ancestry of Abashevo and Sintashta populations. This suggests that the influences of Poltavka material culture on Abashevo and Sintashta resulted from cultural contacts rather than migration. As for the Bell Beaker scenario, it does not seem compatible with the current genetic evidence.

Of the linguistic variables discussed, the Eastward migration hypothesis is inconsistent with Indo-Iranian agricultural terminology and pig words, since neither agriculture nor pig husbandry are features of the Poltavka culture. Similarly, the Poltavka culture does not provide a plausible context for the Indo-Slavic linkage, since the lexical isoglosses contain words with probable agricultural semantics. Conversely, the via-Corded Ware and Bell Beaker hypotheses seem consistent with the Indo-Slavic lexical isoglosses, as well as Indo-Iranian agricultural terminology and pig words. The one variable where the Eastward migration hypothesis has an edge over the other two is in the scarcity of European substrate words in Indo-Iranian. However, as discussed above, Indo-Iranian has a few potential European substrate words, which is why the compatibility of the via-Corded Ware hypothesis is marked with a question mark here. Perhaps the scarcity of European substrate words is most problematic for the Bell Beaker hypothesis, since in this scenario Pre-Proto-Indo-Iranian is argued to be situated in central Europe for hundreds of years following the split of Core Proto-Indo-European, whereas in the via-Corded Ware hypothesis it is associated with the Fatyanovo culture on the eastern fringes of Europe.

Thus, with regards to research question B (cf. 1.4), based on the results of the present study, the via-Corded Ware hypothesis is the most consistent with the combined evidence from linguistics, archaeology, and genetics. While the linguistic evidence previously adduced in favour of this scenario (i.e., satemization, RUKI rule, cf. Narasimhan et al. 2019) was determined to be ambiguous in Chapter 1, the Indo-Slavic lexical isoglosses present additional evidence in its favour, which, combined with linguistic palaeontological considerations, is consistent with an Indo-Slavic linkage that is correlated archaeologically and genetically with the Fatyanovo-Balanovo culture in the eastern Corded Ware horizon. A model of the prehistoric dispersal of Indo-Iranian based on this scenario is presented below (Figure 13).

5.7 Limitations and Outlook

The aim of this work has been to investigate the prehistoric dispersal of Indo-Iranian, specifically in the period between Core Proto-Indo-European and Proto-Indo-Iranian, by studying the phylogenetic relationship between Indo-Iranian and Balto-Slavic. The study of lexical isoglosses shared by these branches resulted in the postulation of a period of shared innovation that may be referred to as the Indo-Slavic linkage.

The discussion in 5.6 has argued that the Indo-Slavic linkage is consistent with a scenario in which Indo-Iranian did not spread directly eastward from

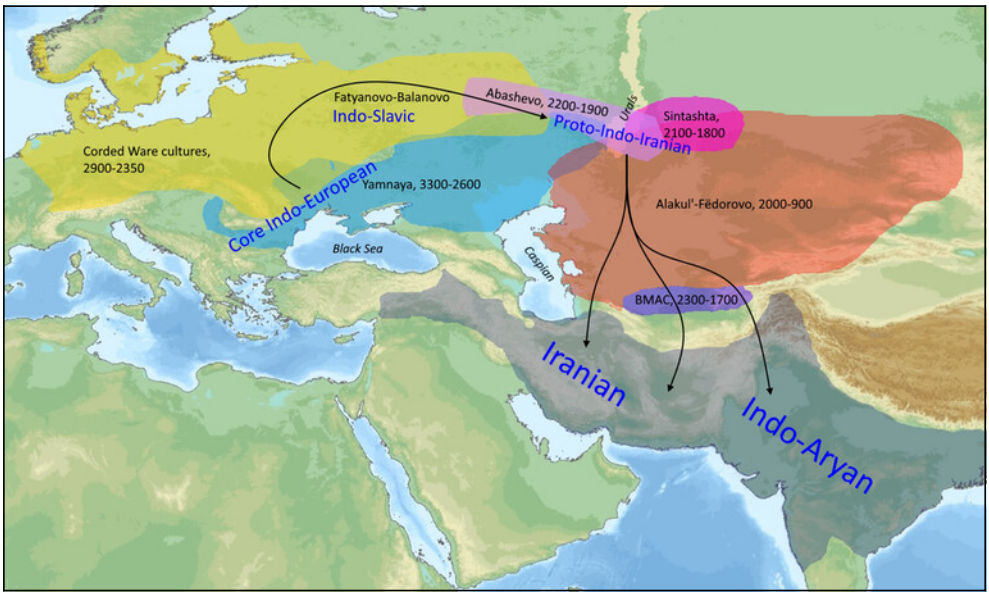

FIGURE 13 Model of the prehistoric dispersal of Indo-Iranian in the via-Corded Ware scenario. Archaeological cultures are given with dates BCE. Names for the chronological stages in the development from Core Indo-European to Indo-Iranian are indicated in blue. Approximate dispersal route of Indo-Slavic and Indo-Iranian is marked with arrows
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the Core Indo-European homeland, but rather moved to northeast Europe during the 3rd millennium BCE and gradually spread eastwards to the Ural region. However, as concluded in Chapter 4, the phylogenetic position of Indo-Iranian and Balto-Slavic with respect to the other branches, particularly Greek and Germanic, is still to be determined. If Indo-Iranian and Balto-Slavic can be shown to also share innovations with other branches, this must be taken into account in hypotheses on their prehistoric dispersal. The possibility of Indo-Balto-Germanic shared innovations can probably be accounted for in the via-Corded Ware hypothesis, since Germanic has also been connected to the Corded Ware horizon (Anthony 2007: 360). On the other hand, Greek and Armenian have generally not been associated with the Corded Ware cultures, but rather with the Catacomb culture, developing out of the western Yamnaya horizon (Anthony 2007: 368; Clemente et al. 2021; Thorsø 2023). Therefore, if Indo-Iranian can be shown to share innovations with these branches to the exclusion of Balto-Slavic, this may have implications for the via-Corded Ware hypothesis.

The attempt to connect the Indo-Slavic and Proto-Indo-Iranian linguistic communities to archaeological contexts has utilized the methodology known

as linguistic palaeontology. In some cases, it proved difficult to find linguistic material that could disambiguate between archaeological cultures. For example, Indo-Slavic was argued to have five unique terms related to dairy production (cf. 4.4.2), but since all relevant archaeological cultures (Yamnaya, Poltavka, Fatyanovo, Abashevo, Sintashta) likely used dairy products as part of their subsistence, the linguistic evidence is not very informative. In other cases, however, the linguistic material was able to provide important insights when compared to the archaeological record. Words relating to chariots and apiculture allowed the Proto-Indo-Iranian homeland to be correlated with the Abashevo and Sintashta cultures. In the Pre-Proto-Indo-Iranian period, agricultural terms and pig words point in favour of the Fatyanovo culture over the Poltavka culture. Yet, as the discussion of these semantic fields has shown, the material is often compatible with conflicting interpretations, due to the limitations of semantic reconstruction. In particular, the distinction between wild and domesticated cereals and animals is often difficult to establish with a high degree of certainty. In these cases, it is rather a matter of determining the most probable interpretation, and comparing this to other lines of evidence (from linguistics, as well as archaeology and genetics), keeping in mind that new material may appear in the future that strengthens or weakens the chosen interpretation.

This monograph has explored how linguistic considerations relating to phylogenetic subgrouping and linguistic palaeontology can be correlated to archaeological and genetic evidence, in order to reconstruct the prehistoric dispersal of the Indo-Iranian branch. It is hoped that future research will be able to fill the remaining gaps regarding Indo-European phylogeny that limit the conclusions of this study, as well as further refine the reconstruction of Eurasian population genomics, in order to reach a more complete understanding of Indo-European prehistory.

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1 Here and in the next section, publications in Russian have been transliterated into the Latin alphabet according to the academic transliteration style. Publications in English by Russian authors follow the transliteration style of the publication.

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During the past decade, the ancient DNA revolution has had a massive impact on the scholarly debates on the origins and dispersals of language families. Now, linguists are asking the question: does linguistic and genetic evidence paint the same picture of the human past? This book sheds new light on an old hypothesis on the relatedness of Indo-Iranian and Balto-Slavic languages, by studying unique lexical correspondences of these branches. It argues that their common *Indo-Slavic* origin supports an emerging picture based on ancient DNA, which shows a genetic relationship between prehistoric populations of Eastern Europe and Central Asia.

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