**Slavic, Albanian, and Vedic cardinals in \*-*ti*-**

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**Abstract:** Slavic, Albanian, and Vedic Sanskrit all employ what appears to be the suffix \*-*ti*- to form numerals. Although this common feature has been noticed by many scholars, no research has been conducted to evaluate its significance as an isogloss that would infer a common node for these three languages. This study investigates the presence and development of \*-*ti*- in the numeral system and assesses its implications for Indo-European phylogeny. While it appears across these branches, its distribution and function suggest a significant divergence in morphological innovation and analogy. Slavic and Albanian forms reveal extensive restructuring due to contamination from adjacent numbers, whereas Vedic preserves PIE \**ti*-abstracts with extended functions to form decades and collectives. The findings suggest that the \*-*ti*- suffix does not represent a shared innovation inherited from a common Indo-Slavic-Albanian sub-node but rather reflects independent developments influenced by morphological and phonological factors. The suffix in Slavic and Albanian likely arose from analogical pressures, while in Vedic it continued a PIE pattern with additional functional extensions.

**Keywords:** cardinal numbers, morphological reconstruction, phylogenetic linguistics,

Proto-Indo-European numerals

# Introduction

The numeral systems of Indo-European languages exhibit remarkable diversity, reflecting both shared inheritance and independent innovation. Many branches preserve bare stem forms for cardinal numbers, reflecting direct inheritance from Proto-Indo-European with minimal morphological innovation. Examples include \**tréie̯ s* ‘three’, \**kʷetu̯óres* ‘four’, and \**pénkʷe* ‘five’,[[1]](#footnote-1) which remain largely unchanged in languages such as Gk. τρεῖς, τέσσαρες, and πέντε; Lat. *trēs*, *quattuor*, and *quīnque*; and Skt. *trí*-, *catúr*-, and *pañca*. These forms highlight the conservative nature of lower numerals in preserving their Proto-Indo-European structures. In contrast, there is ample evidence that numeral systems have undergone morphological restructuring, particularly suffixation. A well-known example is the numeral ‘one’, which appears to have developed competing suffixal forms across the daughter languages. The attested forms suggest that this process began as early as ‘core’ Indo-European, a node consisting of daughter branches that were left after Tocharian split off (Kloekhorst and Pronk 2019: fig. 1.1). This form evolved into \**h1ói̯*-*no*-, as seen in Lat. *ūnus*, Go. *ains*, and Skt. *éna*- ‘this, that’, \**h1ói̯*-*u̯o*-, found in Av. *aēuua*- and Cypr. Gk. οἶϝος ‘only, single’, and \**h1ói̯*-*ko*-, represented solely by Skt. *éka*- (cf. also Pokorny 1959: 286 for more examples).[[2]](#footnote-2) These variations underscore the dynamics and malleability of numerical systems across the Indo-European family, showing both archaicity and innovation.

Beyond the numeral ‘one’, other cardinal numbers also display innovation across branches, particularly through suffixation and grammatical realignment. For instance, Italic and Germanic languages underwent a morphological shift in their numeral ‘four’, transitioning from the singular \*˚*óres* to the plural \*˚*ōr*. This change was evident in Lat. *quattuor* (< PIt. \**kʷettwōr*) and OE *fēower* (< PGmc. \**fedwōr*), reflecting not only a shift in number, but also broader grammatical restructuring (see Prósper 2014: 6). Similarly, some numerals exhibit agreement in case, number, and gender, as seen in Sanskrit, where masculine *tráyas* contrast with feminine *tisrás*. These examples illustrate how despite its perceived conservatism, the numeral system was subject to systematic changes to align it with the evolving grammatical frameworks of individual branches.

Given this tendency for affixation and restructuring among cardinal numbers, one peculiar phenomenon that has garnered attention is cardinal formations that employ the suffix \*-*ti*-. Unlike the above examples where multiple branches attest a single proto-form for only one numeral, Slavic and Albanian employ the same overt suffix for the majority of numerals between ‘five’ and ‘nine’. For example, OCS *šestĭ* and Alb. *gjashtë* ‘six’ share formal and semantic similarities that demand explanation. In a similar fashion, Indo-Iranian also shows the same suffix to form decads and feminine collectives, the most important of which is Ved. *paṅktí*- ‘fivefold’. Does this parallel reflect a shared innovation inherited from a common Indo-European sub-node or is it a result of independent analogical developments?

From a larger perspective, the question might give useful insights into the fragmentation of ‘core’ Proto-Indo-European. The exact chronology of the daughter languages’ split-off from ‘core’ Proto-Indo-European remains a contentious topic. While an Indo-Slavic node has been proposed and is generally accepted and supported, in part, by lexical isoglosses (Palmér forthc.),[[3]](#footnote-3) handbooks usually give slightly different branches, depending on the author’s convictions. For instance, a study by Kroonen *et al*. (2022: 2) assigned Albanian and even Armenian as satellites to this Indo-Slavic node. The Indo-Slavic-Albanian hypothesis, advocated by Kortlandt (2016), posits a closer affinity between the aforementioned branches. The suffix \*-*ti*- is but one shared feature among these branches, and understanding its distribution and function will hopefully contribute to the broader debate on IE sub-grouping.

The question of relatedness becomes even more relevant in light of the Albanian forms. Albanian appearently exhibits clear signs of the \*-*ti*- suffix in its numeral system, particularly between ‘six’ and ‘ten’, and appears to be even more productive than in Slavic and Vedic, as claimed by Hamp (1976: 44; 1992: 837). The formal resemblance between Albanian, Slavic, and Vedic raises the fundamental question of whether the shared presence of \*-*ti*- represents a common innovation, parallel development, or areal feature resulting from language contact. Moreover, although earlier and contemporary scholarship has paid attention to the shared features of Slavic and Vedic (e.g., Meillet 1925: 177; Debrunner and Wackernagel 1930: 353; Emmerick 1992: 168–69; Miyakawa 2003: n. 225), with Petit (2018: 1967) providing the most recent treatment, no comprehensive study has assessed its implications for Indo-European subgrouping. Albanian has often been overlooked in this discussion, despite its potential significance in understanding the development and spread of this suffix. By analyzing Albanian alongside the Vedic and Slavic systems, this study aims to offer valuable insights for this question of phylogeny while also providing an opportunity to explore this pattern from a broader perspective.

This study addresses this gap by conducting a comparative analysis of the \*-*ti*- suffix in the numeral systems of Slavic, Vedic, and Albanian. By systematically examining its distribution, morphological productivity, and potential analogical or phonological influences, this study seeks to determine whether this shared feature represents common innovation or independent development. The remainder of this paper is organized as follows. Section 2 outlines the theoretical framework for morphological reconstruction and subgrouping, emphasizing the importance of distinguishing between shared and parallel innovation. Section 3 provides an overview of the distribution of the suffix in Balto-Slavic, Indo-Iranian, and Albanian. Section 4 examines each numeral individually, analyzes the morphology and origins of the \*-*ti*- suffix in each language, and assesses whether it reflects inheritance, analogy, or contact. Finally, the results and their broader implications for IE linguistics are discussed.

# Methodology

The methodological approach in this study follows the principles of historical linguistics, specifically the comparative method and its application to morphological reconstruction. As already discussed, this study focuses on the use of the historical \*-*ti*- suffix in the numeral systems of Slavic, Vedic, and Albanian to evaluate whether this shared feature is a common innovation or independent, parallel development. Given how rare and complex shared innovations can be, a rigorous methodological framework is necessary to ensure reliable conclusions about genetic relatedness.

Morphological innovations, although less frequent than phonological changes, are particularly significant for sub-grouping languages. As noted by Olander (2019: 364), a shared innovation that is “peculiar enough to be unlikely to happen more than once” strongly indicates inheritance from a common ancestor rather than independent parallel developments. In essence, by detecting such innovations, we provide a solid basis for reconstructing sub-nodes. Olander further emphasizes that a single certain shared morphological innovation can, in principle, establish a sub-group, as morphology is generally more stable and less prone to borrowing than lexical items and syntax.

However, the utility of morphological features comes with challenges. Clackson (1994: 21) notes that it is critical to distinguish between

1. true shared innovations that are inherited from a common ancestor,
2. parallel developments resulting from analogical pressures or morpholog-

ical drift,

1. or borrowed features, which may arise through language contact.

Therefore, it is essential to analyze formally similar or even identical forms carefully, as the same innovation may arise independently under similar pressures. For instance, analogical leveling, a well-attested phenomenon, can lead to similar morphological outcomes across different languages without any shared ancestry. Thus, it is also necessary to evaluate the productivity, directionality, and broader patterns of morphological change within each language system, and distinguishing between retention and innovation is essential. A feature shared by two or more languages may reflect an inherited pattern rather than a novel shared development. To address this, careful attention must be paid to cognate forms in related languages in the same branch (*e*.*g*., Slavic with Baltic, Vedic with Avestan) to determine whether the feature is old or new.

# Distribution of \*-*ti*-

## Balto-Slavic

In Old Church Slavonic and all contemporary Slavic languages, there is a clear division between conservative and innovative cardinal forms. As Mańczak (1985: 350) observes, “the numerals 1–4 retain a conservative character, whereas the numerals 5–10 show innovations.” With the exception of *edinŭ* ‘one’ arising from a secondary prefixed \**h1ed*-*iH*-*no*- (Woodhouse 2012: 156; see also references for different views), the numerals *dŭva* ‘two’, *trĭje* ‘three’, and *četyre* ‘four’ have largely retained their archaic Proto-Indo-European roots with minimal morphological innovation. For instance, *dŭva* corresponds directly to \**du̯ó*-*h1* (the athematic dual ending \*-*ih1* will be mentioned and assessed in Section 4.4) and reflects straightforward retention of the original dual form.4

In contrast, the numerals from *pętĭ* ‘five’ to *desętĭ* ‘ten’ show evidence of significant restructuring, where the suffix \*-*ti*- appears consistently throughout. The presence of this suffix has been widely acknowledged in Indo-European linguistics as a distinctive feature of the Slavic cardinal system,5 marking them

4 The expected long vowel can be seen in SCr./Sln. *dvȃ* and Čak. *dvå*. Formal correspondences of the*̑* old dual are evident in Epic Gk. δύω (Hom., Hes.), Ved. *dvā́* ‘two’, and Hitt. *dā*-*yuga*- ‘two years old’. 5 Despite the systematic use of PSl. \*-*tь* in cardinal forms, Slavic also demonstrates a broader range

table 1 Proto-Slavic numeral forms and their transpositions

|  |  |  |
| --- | --- | --- |
| Meaning | PSl.6 | PIE |
| ‘five’ | \**pę̑tь* | \**pénkʷ-ti-* |
| ‘six’ | \**šȇstь* | \**s(u̯)éḱs-ti-* |
| ‘nine’ | \**dȅvętь* | \**h1néu̯n̥-ti-* |
| ‘ten’ | \**dȅsętь* | \**déḱm̥ -ti-* |

as feminine *i*-stems (Dybo 1981: 25; Zaliznjak 1985: 138). This shift distinguishes the Slavic branch from others, such as Baltic, where higher numerals between ‘four’ and ‘nine’ are consistently structured as (*i*)*jo*-stems (see Schleicher 1856: 215; Wiedemann 1897: 99). The two exceptions are *sedmĭ* ‘seven’ and *osmĭ* ‘eight’, which seem to have arisen analogically from the ordinal ending -*mŭ* (Derksen 2008: 379, 443). For the present study, then, the higher numerals in Slavic, except for ‘seven’ and ‘eight’, will be part of the investigation (see Table 1).

Cardinal numbers in Baltic languages differ greatly from those in Slavic and Vedic, especially in that they do not have the \*-*ti*- suffix. Instead, higher numerals, such as Lith. *penkì* ‘five’, *šešì* ‘six’, and *septynì* ‘seven’, are distinguished by (*i*)*jo*-stem formations, as indicated above, that constitute a markedly different morphological trajectory. Because of this diversity, Baltic provides a useful comparative example for assessing whether \*-*ti*- is an inherited trait or a later innovation in other branches; Proto-Balto-Slavic will be of great importance in answering this question. Moreover, in Baltic, the absence of \*-*ti*- indicates two possible outcomes. Moreover, in Baltic, the absence of \*-*ti*- indicates two possible outcomes. First, it might indicate a loss of \**ti*-formations that were present in Proto-Indo-European or even earlier Proto-Balto-Slavic stages. In this case, Baltic would be in line with other branches, such as Iranian outside of the decads, which also do not demonstrate productive \**ti*-usage. Second, with numerical forms that precede the invention or spread of \*-*ti*- suffixation in other Indo-European branches, Baltic might reflect an early stage of development. Both viewpoints stress how Baltic can shed light on the different paths of morphological change throughout the Indo-European family, as well as the diachronic evolution of numerical systems.

Thus, different morphological methods are preferred in Baltic than in Slavic and Vedic, which nominalizes higher numerals with \*-*ti*-. Because the morphological distance from Slavic, Vedic, and Albanian makes direct comparison impracticable, this paper will not analyze Baltic forms in Section 4 because of

 of formations that use the same overt suffix. These include feminine deverbatives: \**mȍťь* ‘power, strength’ ← \**moťì* ‘to be able’; kinship terms: \**zę̀tь* ‘son-in-law’; and feminine abstracts: \**vȏlstь* ‘power, authority’. The suffix is however syncronically limited in its productivity since it cannot be used to form new nouns. The closest potential fossilized feminine \**ti*-collective is PSl. \**bъrtь* ‘hive of wild bees’, but contemporary Slavic has not retained the collective meaning, which makes the original function doubtful. In addition, the Slavic infinitive ending \*-*ti* traces back to the same underlying suffix. See Šur (1963) and Šekli (2019) for more information.

6 I will henceforth cite the Proto-Slavic forms for consistency, hence the change from *ĭ*/*ŭ* to *ь*/*ъ*.

these discrepancies. However, Baltic is still essential for a larger argument. Given that it is present in Slavic and Vedic, its lack of \**ti*-forms provides a benchmark for determining whether the suffix represents loss or archaism. This study aims to gain a better understanding of the process of morphological divergence and retention in Indo-European number systems by placing Baltic within this context.

## Indo-Iranian

Just like its Latin and Greek relatives, Vedic managed to retain the archaic, unsuffixed forms of its core numerals (with the exception of *éka*- ‘one’). The forms *dvá*- ‘two’, *trí*- ‘three’, and *catúr*- ‘four’, *etc*., retain forms closely aligned with their Proto-Indo-European antecedents. These lower numerals are typically inflected for case, number, and gender, as seen in nom. pl. m. *catvā́ras* *vs*. nom. pl. f. *cátasras* (Macdonell 1910: 307–8), reflecting a complex agreement system common in early Indo-European languages. Higher numerals from ‘five’ onward, however, begin to show a loss of morphological differentiation. These numerals remain uninflected in their basic forms and function as invariants in most syntactic environments. However, derived forms often feature additional suffixes that mark collective or ordinal meanings (Calude and Verkerk 2016). While the \*-*ti*- suffix is not a prominent feature of the basic Vedic numeral system, its use in decads and collectives like *daśatí*- ‘decad (of verses)’ and *viṃśatí*- ‘twenty’ suggests a secondary morphological role that extends beyond the core cardinal system. This hypothesis is further explored in Section 4. For the comparison with Slavic, for each suffixed example, a Vedic (formal) equivalent will be used, but this will not necessarily have the same meaning (see Table 2).

In the Iranian branch, the suffix plays a similar role as Vedic but contrasts with Slavic. Unlike the latter two branches, however, where \*-*ti*- appears in specific cardinals or secondary formations, its primary function in Iranian is tied to the expression of decads. According to Emmerick (1992: 173), Old Iranian employs the \*-*ti*- suffix in numerals ranging from ‘twenty’ to ‘fifty’, with these forms often described as feminine collective nouns. This pattern extends to higher decads such as ‘sixty’ to ‘ninety’, which are likewise formed as abstract collective derivatives of their respective bases (Gotō 2017; Kim 2022). For example, these formations in \*-*ti*- function as grammatically feminine *ti*-stems (Skjærvø 2009: 86). Emmerick (*loc*. *cit*.: 193–94) also raises the question of whether these Iranian decads in \*-*ti*- are derived from *ti*-stem abstracts, although the origin of this pattern remains uncertain. What is clear, however, is that the suffix in Iranian plays a central role in marking collectives, emphasizing its role as a secondary morphological feature rather than as a primary suffixation strategy for core numerals.

Given this restricted use of \*-*ti*-, Iranian provides a significant contrast to Slavic and Vedic, in which the suffix integrates more directly into the numeral system. While the fourth section of this paper focuses on Slavic, Vedic, and Albanian examples, it is essential to delineate the Iranian context here to establish a broader Indo-European background for *ti*-formation. Furthermore, the table 2 Vedic numeral forms and their transpositions

|  |  |  |
| --- | --- | --- |
| Meaning | Ved. | PIE |
| ‘fivefold’ | *paṅktí*- | \**penkʷ-tí-* |
| ‘sixty’ | *ṣaṣṭí*- | \**s(u̯)eḱs-tí-* |
| ‘ninety’ | *navatí*- | \**h1neu̯n̥-tí-* |
| ‘decad (of verses)’ | *daśatí*- | \**deḱm̥ -tí-* |

selected Avestan examples, as representatives of the Old Iranian, are further analyzed in Section 4 to elucidate the comparative framework. This approach ensures that Iranian serves as a critical point of contrast while maintaining the paper’s central focus on Slavic, Vedic, and Albanian. The Avestan examples are *xšuuašti*- ‘sixty’ and *nauuaiti*- ‘ninety’.

## Albanian

Albanian numerals between ‘six’ and ‘ten’ all end in -të, which has been claimed to be a reflex of \*-*ti*- (Orel 2000: 220). This is especially notable given the absence of the suffix in Baltic and its limited role in Slavic. Like Slavic, on the other hand, where \*-*ti*- is restricted to the infinitive, numeral system, and some fossilized \**ti*-stems, Albanian seems to exhibit the same level of restricted productivity. Nonetheless, these instances raise important questions about whether Albanian shares a common innovation with Slavic and Vedic or if its development of \*-*ti*- is an independent extension of a Proto-Indo-European morphological pattern. The numerals in question also highlight significant structural differences, unlike Slavic and Vedic, where \*-*ti*- often functions to nominalize or collectivize cardinals, the suffix appears fully integrated into the core numeral system for certain ranges.

The question of relatedness becomes complicated when we consider the geographical and linguistic separation from Slavic and Vedic. Since the numerals in Albanian have been concluded to show clear suffixation with \*-*ti*-, when a broader numeral structure is considered, this seemingly larger presence of the suffix suggests substantial innovation that is specific to Albanian (this will be addressed in Section 4.4). It seems that Albanian adopted an alternative strategy for forming higher numerals, which is functionally distinct from the ti-stem collectives seen in Iranian and Vedic. In any case, Albanian will be a critical comparison for late evaluation of the Indo-Slavo-Albanian hypothesis (Kortlandt 2016), since the spread of \*-*ti*- cannot be easily dismissed as a parallel development without further scrutiny. Owing to its distinct characteristics, Albanian will be the central focus of Section 4, where its morphological patterns will be compared in detail with those of Slavic and Vedic. Although no Avestan-style decads or Baltic-like \**io̯*-stem patterns are attested, the productive suffixation system in Albanian offers valuable insights into the broader question of whether \*-*ti*- represents a shared innovation or independent development across these branches (see Table 3 for the Albanian forms).

table 3 Albanian numeral forms and their transpositions

|  |  |  |
| --- | --- | --- |
| Meaning | Alb. | PIE |
| ‘six’ | *gjashtë* | \**s(u̯)éḱs-ti-* |
| ‘seven’ | *shtatë* | \**septḿ̥ -ti-* |
| ‘eight’ | *tetë* | \**h₁óḱ-ti-* |
| ‘nine’ | *nëntë* | \**h1néu̯n̥-ti-* |
| ‘ten’ | *dhjetë* | \**déḱm̥ -ti-* |

# Comparative analysis

## PSl. \**pęt̑ ь* ‘five’ and Ved. *paṅktí*- ‘fivefold’

To reiterate, it is universally agreed upon that the Proto-Indo-European form for ‘five’ was \**pénkʷe*. While many branches preserve the bare stem reflexes of the root (for example, Gk. πέντε, Lat. *quīnque*, TA *päñ*),[[4]](#footnote-4) the Slavic and Vedic forms are morphologically identical with the addition of \*-*ti*-, indicating a divergence. Despite this formal similarity, the suffix appears to have developed independently in each branch driven by different functional and analogical pressures.

In Proto-Slavic, this certain instance of \*-*tь* seems to be a secondary analogical extension, likely influenced from the succeeding \**šȇstь* ‘six’ when \*-*tь* was added to a pre-existing †*pękь*. Importantly, the absence of \*-*ti*- in Baltic reflexes such as Lith. *penkì*, Latv. *pieci*, Latg. *pīci*, and Sud. *pank* (< PBS \**pénki*) suggests that \*-*tь* was not inherited from an extrapolated \**pénkʷ*-*ti*- but rather developed later within the Slavic branch. Furthermore, by other accounts, the numeral might have acquired its \*-*tь* from the ordinal in \*-*tъ* (Instytut Języka Polskiego PAN 2007–, accessed [2024/12/29]), further validating analogical extension.

In contrast, in Vedic Sanskrit, the form *paṅktí*- ‘fivefold’ represents a feminine collective noun. Although the oldest attestations are only two in the *Ṛgveda* (*ṚV*; 1.40.3, 10.117.8),[[5]](#footnote-5) it can nonetheless directly be derived from \**pénkʷ*-*ti*-, where \*-*ti*- serves as a suffix for forming collectives (cf., in contrast, Slavic numerical collectives in -*e*/*oro*) and abstract numerals. In both instances, the word is used to denote a multiplied form of something and never as a cardinal, in opposition to the Slavic form (*pace* Skok 1973: 388–89):

(1) a*. ṚV* 1.40.3 *praítu bráhmaṇas pátiḥ prá devy ètu sūnṛt́ ā* | *ácchā vīráṃ náryam* ***paṅktírādhasaṃ*** *devā́ yajñáṃ nayantu naḥ* ||

 “Let the Lord of the Sacred Formulation go forth, let the goddess Libe- rality go forth / to the hero belonging to men, **whose gifts come in fives**. Let the gods lead our sacrifice.” (Jamison and Brereton 2014: 149)

b*. ṚV* 10.117.8b *cátuṣpād eti dvipádām abhisvaré sampáśyan* ***paṅktīŕ*** *upatíṣṭhamānaḥ* || “The four-footed [=dog?] comes at the call of the two-footed ones as it watches over the **fivefold** **ones** [=herds?], staying by them.” (*ibid*.: 1587)

Moreover, this pattern is not unique to *paṅktí*-; the suffix is productively used to form higher numerals and decads of any kind, as seen in for instance *saptatí*- ‘seventy’—an innovation that likely dates back to Proto-Indo-European itself. Support for the antiquity of this pattern comes from comparative evidence in

Italic and Germanic. According to Brugmann (1892: 14) and Mayrhofer (1992– 2001: 2.63), Umbr. *ponte*- ‘group of five’[[6]](#footnote-6) and OIcel. *fimt* “vera fimmmenningar” (Blöndal 1920: 186) show a structurally and semantically similar use of the *ti*-abstract. These attestations would suggest that numerals in \*-*ti*- were already employed in Proto-Indo-European to form *Zahlabstrakta*, a pattern retained in Sanskrit, but lost in many other branches.

## PSl. \**šȇstь*, Alb. *gjashtë* ‘six’, Ved. *ṣaṣṭí*-, and Av. *xšuuašti*- ‘sixty’

The Proto-Indo-European numeral for ‘six’ is commonly reconstructed as \**su̯éḱs* (with the variant \**séḱs* depending on the reconstruction). The bare stem form is retained in many daughter languages, including Gk. ἕξ, Lat. *sex*, and OIr. *se*. However, in both Slavic and Albanian, the forms derived from this numeral show suffixation.

Like its predecessor \**pę̑tь*, \**šȇstь* seems also to be suffixed, yet the origin of this form can easily be explained through secondary, analogical extension. The Baltic cognates, Lith. *šešì*, Latv./Latg. *seši*, and OPr. \**us*10 show no sign of \**t*-suffixation of any kind. The Proto-Balto-Slavic form would then have to be reconstructed as the bare stem \**šéš*, with Baltic -*i* being secondary from having been modelled from *keturì* ‘four’. The Slavic form must then *a priori* be secondary, since we would expect a -*t*- in Baltic if it were original (Brückner 1927: 548). How then did ‘six’ acquire its \*-*tь*? The easiest and most straightforward explanation would be distal contamination from \**dȅvętь* ‘nine’. Equally possible is Preobraženskij’s (1964: 96–97) proposition that the suffix was modelled after the ordinal. Although the Proto-Slavic form in question can be transposed to PIE \**s(u̯)éḱs*-*ti*-, explaining them as products of such transpositions is not economical (*pace* Debrunner and Wackernagel 1930: 353). Therefore, I see no other option than to invoke analogy, especially considering that they were not nominally inflected, probably increasing the odds of congruence (lower numerals are inflected).

The Albanian form is likewise a product of contamination. Although I do agree with most scholars (*e*.*g*., Meyer 1891: 138; Jucquois 1965: 440; Huld 1984: 68; Orel 1985: 279; Kortlandt 1987: 219; Demiraj 1990: 195) that although the Albanian cardinals—especially *gjashtë* ‘six’—give a striking formal resemblance to Skt. *ṣaṣṭí*- ‘sixty’, it is not enough to merely look at morphological correspondence alone. Judging by the evidence and considering the fact that adjacent numerals are often prone to contamination (cf. Andrijanić 2024 who gives examples from Indic languages),11 the easiest conclusion to draw here is that a pre-form †*gjash* added a -*të* when in contact with *shtatë* ‘seven’.

The Indo-Iranian forms can be reconstructed as inherited from PIIr. \**šwaš*-*tí*- ‘sixty’, but apart from the formal similarity, the semantic meaning is different. What is clear from the structure is that the \*-*ti*-suffix does not convey an abstract collective, i.e., \*\*‘a group of six’ but always ‘sixty’. This usage is evident in the *ṚV* and Avestan texts, which are often used with supplementary numbers. For example: *ṣaṣṭím sahásrā* (*ṚV* 1.53.9b) ‘sixty thousand’, not \*\*‘six groups of one thousand’. The following question then arises: Which function, or both, is older? It is by no way easy to determine which function is older: abstracting and collective or decad -*ti*-.12 Judging by the semantics, there is no reason to warrant a closer affinity with Slavic or Albanian.

## PSl. \**dȅvętь*, Alb. *nëntë* ‘nine’, Ved. *navatí*-, and Av. *nauuaiti*- ‘ninety’

When looking at the Slavic form, it is difficult to imagine a scenario that does not require analogical restructuring, especially in the case of \**dȅvętь* ‘nine’. Clearly, this is not the form we expect if it were to have descended from \**h1néu̯n̥*, as the outcome would have been †*nevę*. Instead, the new form exhibits two notable innovations: dissimilation of \**n*- > \**d*-, and the addition of \*-*tь*. These changes require separate explanations, both of which underscore the role of analogy and contamination in the numeral system.

Beginning with the former process, dissimilation appears to have occurred independently in both Slavic and Baltic. As indicated by the East Baltic cognates, Lith. *devynì* Latv. *deviņi*, and Latg. *deveni* all reflect PEB \**dewin* ‘nine’. In contrast, OPr. *newīnjai* does not show this change, and combined with Žolobov’s (2005: 170) proposal that Proto-Slavic retained initial \**n*- in Cz. *nevěsil* ‘elecampane’,13 a Proto-Balto-Slavic form \**néwin* is reasonable to reconstruct. This process likely involved contamination with the succeeding ‘ten’ (PB \**dešimts* and PSl. \**dȅsętь*, respectively), a well-attested phenomenon in numeral systems, where analogical pressure from adjacent numerals result in phonological alignment. Scholars like Joseph (1981: n. 4) identify such contamination

1. Therefore a trivial development; PIt. and PCelt. \**p* … *kʷ* > \**kʷ* … *kʷ* (which might as well have simul- taneously been contaminated by preceding \**kʷetwōr*; alternatively, the contamination might be parallel), Lat. *quīnque*, OW *pimp*; PGmc. ***hw****edwōr*\* ‘four’ *:* \****fi****mfe* ‘five’ → \****f****edwōr* (cf. Voyles 1987:

 491–92).

1. See also secondary *ti*-stems in Liebert (1949: 202–12).
2. Compare also Kortlandt (2008: 8); *pace* Petit (2021: 208). Cf. Russ. *devjasíl*, Bel. *dzivasíl*, Ukr.

 *dev'jatysýl*, and Pol. *dziewięćsił*. Žolobov (*loc*. *cit*.) also cites SCr. *nevisilj* ‘id.’, but this seems to be a phantom word.

as a plausible mechanism, although parallel developments in Slavic and Baltic cannot be entirely ruled out (see Derksen 2015: 126).

The addition of \*-*tь* is a secondary innovation, as evidenced by Baltic forms. The suffix likely reflects contamination influenced by ‘ten’, where the final \*-*tь* was analogically extended to ‘nine’. The chronological sequence of these changes can be represented as follows:

1. \**h1néu̯n̥* > †*nevę*
2. †***n****evę* *:* \****d****ȅsętь* → †***d****evę*
3. †*d****evę*** *:* \**d****ȅsę****tь* → \****d****ȅvętь*

The above scenario aligns \**dȅvętь* with \**dȅsętь* both phonologically and morphologically, demonstrating how analogy can reshape the forms of higher numbers. Therefore, in light of this development, \**dȅvętь* does not present a strong point of comparison with forms like Ved. *navatí*-, Av. *nauuaiti*- ‘ninety’, and Alb. *nëntë* ‘nine’.

The Albanian form appears formally identical to its Slavic counterpart, yet its origin can also be explained through analogy. Just as in the Slavic example, *nëntë* ‘nine’ would saliently have been contaminated by the succeeding *dhjetë* ‘ten’. Alb. *nëntë* is thus secondary and not eligible for further scrutiny.

In contrast to both Slavic and Albanian forms, the Indo-Iranian forms illustrate a different trajectory of development. Here, the suffix represents, again, a productive marker of decadal numerals rather than an analogical extension from ‘ten’. Nonetheless, this form can be transposed to PIIr. \**Hnawa*-*tí*-, suggesting that PIE \*-*ti*- became associated with decads (semantic broadening?) before the split between Indo-Aryan and Iranian.

## PSl. \**dȅsętь*, Alb. *dhjetë* ‘ten’, and Ved. *daśatí*- ‘decad (of verses)’

Having established the secondary origin of \**dȅvętь*, we must next address the origin of \**dȅsętь*, especially how it acquired its \*-*tь*. The answer may lie in reanalysis. The expected form of \**déḱm̥*-, as seen in Lat. *decem*, Gk. δέκα, and OIr. *deich* would be †*desę*, yet the Balto-Slavic forms consistently show \*-*t*-. In view of the Baltic evidence, Lith. *dẽšimt* and Latv./Latg. *desmit*, it can be reasonably inferred that Proto-Balto-Slavic has a lemma similar in form to \**déśimt*. Likewise, as Trubačëv (1977: 217) rightly points out, \**dȅsętь* points to an original \**t*-stem. Despite this reconstruction, however, and as is well known in Slavistics, Slavic phonotactics would not allow a closed syllable (cf. Čekman 2003: 54). This would explain the addition of \*-*i*- as an inner Slavic development, reflecting an earlier pre-PSl. \**dȅsįt*-*i*- (cf. Comrie 1991: 747–48). Additionally, according to Preobraženskij (1964: 183), the word has undergone rapid phonological changes, as has already been seen above, leading to ambiguity. Specifically, \**dȅsętь* can be explained as an archaic \**t*-stem extension with an additional front yer that was added secondarily due to phonological constraints. It should hence not be used as a comparison, thus practically eliminating Slavic correspondences. Conclusively, the influence of \**dȅsętь* thus extends beyond its direct contamination of \**dȅvętь* ‘nine’, having shaped the forms of numerals further removed in the sequence, such as \**pę̑tь* ‘five’ and \**šȇstь* ‘six’, as already shown above.

Although *dhjetë* ‘ten’ might on the surface look like a clear instance of a \*-*ti*- suffix, the Albanian numeral presents challenges in determining its ultimate origin due to the phonological ambiguity of its final segment -*të*. As shown by Jokl (1963: 150-56), the suffix can represent multiple phonemes. Judging by his data, it can reflect adjectives in \*-*(t)o*-: cf. *butë* ‘soft, gentle, mild’ < \**bʰugʰ*-*to*-, *cite* ‘full, brim-full’ < \**ku̯eiH̯*-*to*-; \*˚*en*-, \**i* and \**u*. As such, it is difficult to ascertain what proto-vowel *ë* represents. Pedersen (1900: 284) and Erat (2008: 4) argued that -*të* likely originated from a pre-form †*dhje* + -*të*, which subsequently extended to other numerals, creating uniformity across the Albanian numeral system. Interestingly, ordinals in Albanian also frequently end in -*të* (Orel 2000: 249), raising the possibility that *dhjetë* reflects a secondary analogical formation influenced by ordinal patterns (just like in Slavic ‘seven’ and ‘eight’). In contrast, Demiraj (1996: 162–63) suggests that -*ë* is secondary, leaving ˚*t*- as a part of the root. However, this explanation does not resolve whether the original form of *dhjetë* is derived from \**déḱm̥*-*ti*-, \**déḱm̥*-*to*-, or \**déḱm̥*-*tu*-.14 Another important parallel is Alb. *natë* ‘night’, which reflects PIE \**nókʷt*- instead of \**nókʷt*-*i*- (Hamp 1961). This suggests that the original form might have been an archaic \**déḱm̥ t*-, with -*ë* being a secondary addition that matches the form to the ordinals. Its current shape may thus reflect an inner Albanian development.

The Sanskrit forms *daśatí*- and *daśat*- emerged as unique innovations within Indo-Aryan. According to Monier-Williams (1899: 472), *daśatí*- originally appears in the *Sāma-Veda* with the meaning ‘decad of verses’, functioning as a chapter divider, each containing ten verses. It is not until Epic Sanskrit in the *Mahābhārata* that the meaning expands to signify ‘hundred’, which would suggest an association of -*ti*- with decad formation, a secondary extension of its function based on other similarly-formed decads. It would therefore seem that usage in the *Sāma-Veda* is old, reflecting a synchronic feminine *ti*-collective. To understand its origins, it is useful to analyze the synonym *daśat*-, which reflects \**déḱm̥ t*-*s*. The oldest attestatin comes from the *Ṛgvedakhilāni* (4.11.8a) and has the meaning ‘ten’: *ye pañcapañcā daśataṃ śataṃ ca sahasraṃ ca niyutaṃ nyarbudaṃ ca* ‘those (numbers) that are five, five times (five), ten, a hundred, a thousand, ten thousand, and a hundred million’. In later texts, specifically the *Maitrāyaṇī-Saṃhitā* and *Taittirīya-Saṃhitā*, it takes on the meaning of ‘decad’. Judging by the data, it seems that *daśat*- is diachronically a consonant stem that underwent a reanalysis into something akin to a possessive *mat*-stem, meaning ‘consisting of’.15 *daśatí*-, on the other hand, can be derived from an original \**deḱm̥ t*-*í*- → \**deḱm̥*-*t*-*í*- → \**deḱm̥*-*tí*-, illustrating that Ved. -*ti*- served a clear morphological function, whereas \*-*t*- lost its function early on and fused with the \**i*-suffix. This fusion was expected to occur because of other diachronic Proto-Indo-European \**ti*-stem forms.

1. Hyllested and Joseph (2022: 223) take a seemingly cautious approach and reconstruct the suffix only as \*-*tV*-.
2. Cf. Epic Skt. *hanu*-*mat*- ‘having (large) jaws’ and *gó*-*mat*- ‘possessing or containing cattle or cows or herds’.

This development is further corroborated by examining the various attestations for ‘twenty’. Gk. εἴκοσι can be intepreted as a formation analogous to other feminine nouns, such as στάσις ‘standing, placing, setting’ and δόσις ‘giving, permission, portion’, reflecting an archaic final \*˚*t*-. Moreover, the final consonant is also present in δεκάς ‘ten, group of ten’. It is particularly noteworthy that Lat. *vīgintī*, OW *uceint*, and Alb. -*zet*, appear to preserve archaic forms pointing to the old dual ending \*-*ih1*. Given the absence of a hypothesized \*\*-*tih1*, the evidence consistently suggest that the \**t* in \**déḱm̥ t*- is inherently part of the root. The final consonant was most likely lost in the core numeral ‘ten’ due to phonological constraints.

# Conclusion

This study examined the morphological innovations in the numeral systems of Slavic, Albanian, and Vedic, focusing on the \**ti*-suffix and its implications for Indo-European phylogeny. The Slavic and Albanian forms reveal extensive secondary analogical restructuring, primarily due to contamination from adjacent numeric forms. In contrast, Vedic forms not only preserve the Proto-Indo-European feature of *ti*-abstracts but also show a secondary extension of its function to form decades. The similarities across these branches are best understood as an independent development. In the case of ‘ten’, what has been called a \**t*-extension is most likely an archaism at best. However, evidence suggests that the last consonant is a root consonant. As such, the numerical usage of \*-*ti*- cannot be used as evidence for a common Indo-Slavic-Albanian sub-node.

**Language abbreviations**

Alb.—Albanian; Av.—Avestan; Bel.—Belorussian; Čak.—Čakavian; Cypr.—Cypriot;

Cz.—Czech; Gk.—Greek; Go.—Gothic; Hitt.—Hittite; Latg.—Latgalian; Lat.—Latin; Latv.—Latvian; Lith.—Lithuanian; OCS—Old Church Slavonic; OE—Old English; OIcel.—Old Icelandic; OIr.—Old Irish; OPr.—Old Prussian; OW—Old Welsh; PBS—Proto-Balto-Slavic; P(E)B—Proto(-East)-Baltic; PCelt.—Proto-Celtic; PGmc.—Proto-Germanic; (P)IE—(Proto-)Indo-European; PIIr.—Proto-Indo-Iranian; PIt.—Proto-Italic; Pol.—Polish; PSl.—Proto-Slavic; Russ.—Russian; SCr.—Serbo-Croatian; Skt.—Sanskrit;

Sud.—Sudovian; T(A/B)—Tocharian (A/B); Umbr.—Umbrian; Ved.—Vedic

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1. All numerals will be treated as roots in and of themselves without any distinction in potential derivational affixes, as has been speculated by Shields (1996) and Martínez (1999: 207–9). [↑](#footnote-ref-1)
2. Maybe also Hitt. *ānki* ‘once’; see Eichner (1992: 42–43), Melchert (2012: 181–82), and Kalniņš (2017:

 fn. 4). [↑](#footnote-ref-2)
3. I wholeheartedly thank Axel Palmér for generously giving me an early copy of his dissertation! [↑](#footnote-ref-3)
4. Of course also Skt. *páñca*, Av. *paṇca*; Alb. *pesë* is the regular outcome (Orel 1998: 316) and is there- fore disregarded here. [↑](#footnote-ref-4)
5. Note that, according to Witzel (*apud* Bryant 2001: 66–67), *maṇḍalas* 1 and 10 are younger additions, potentially reflecting a later stage of Vedic Sanskrit. [↑](#footnote-ref-5)
6. There is no indication of such a form being attested outside of Mayrhofer. 10 OPr. *usts* ‘sixth’ reflects \*-*to*-*s*. [↑](#footnote-ref-6)