Sahasram Ati Srajas

Indo-Iranian and Indo-European Studies in Honor of

Stephanie W. Jamison

edited by

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Schwa Indogermanicum
and Compensatory Lengthening

ANDREW MILES BYRD

1 Introduction

In her seminal paper “The Quantity of the Outcome of Vocalized Laryngeals in Indic,” Stephanie Jamison demonstrates that the seemingly random reflexes of interconsonantal laryngeals in Indic were in fact rule-governed, once one takes morphology into consideration. She convincingly identifies a conditioned phonemic split within the prehistory of Indic, with ‘vocalized’ laryngeals being realized as long /¯ı/ before a consonant at the end of the word, and short /i/ elsewhere (Jamison 1988:220). In this small contribution in her honor I hope to address a hitherto ignored problem in the study of laryngeal vocalization in PIE as well as to explore briefly why pre-consonantal vocalized laryngeals were realized as long /¯ı/ in word-final position in Indic.

2 Schwa Indogermanicum

There are two possible ways that one may view the phonetic and phonological reality of vocalized laryngeals within PIE:¹

1. **Direct Vocalization:** */dʰh₁tó-/ → *[dʰh₁][tό-] ‘placed’ > Gk. θετός, Skt. hitá-

2. **Vowel Epenthesis:** */dʰh₁tó-/ → *[dʰh₁][tό-] ‘placed’ > Gk. θετός, Skt. hitá-

The first hypothesis, which claims that interconsonantal laryngeals were directly syllabified as the syllable nucleus, is certainly a reasonable one, given the many parallels in Salishan and Caucasian languages² and the fact that the PIE resonants behave in a sim-

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¹In this article I will make an explicit distinction between underlying forms (e.g. /ph₄térs/) and surface forms (e.g. [ph₄térs]), with syllable boundaries being marked with subscript sigma: [ph₄][térs]. An arrow (→) indicates a synchronic phonological process, a greater-than sign (> ) a diachronic one. Forms marked by (<*) are reconstructed, those marked by (<×) are ungrammatical/unattested.

²See Kessler n.d. for discussion and references.
ilar fashion (cf. */tntós/ → *[tntós] ‘stretched’). However, many Indo-Europeanists prefer to view laryngeal ‘vocalization’ as vowel epenthesis on account of certain cases of stop aspiration by *h₂ within Indo-Iranian;³ one need only cite the pair */ph₂tér-/ > pitár- (with unaspirated /p/) and */dh₂ugh₂tér-/ > duhitár- (with /h/ from earlier *j₂-).

This latter approach is the most common one, taken most notably by Mayrhofer (1986:138):

In virtuellen ersten Silben entstand ein überkurzer Sproßvokal vor dem Laryngal (eH), der indoiranisch zu /i/ führte, ohne vorangehende Verschlusslaute zu aspirieren . . . In virtuellen Mittelsilben stand der Sproßvokal hinter dem Laryngal (He), woraus sich Behauchung und Vokalisierung im Vedischen und Prasun (duhitár-), nur Behauchung in Teilen des Iranischen (altavest. dugadār-), nur Vokalisierung in einem Teil der restlichen Sprachen . . . , schließlich Schwund . . . in den übrigen Sprachen . . . ergab.

But a problem arises upon closer inspection. Why are forms with pre-laryngeal vowel epenthesis such as PIE *[poh₂tér-] ‘father’—with an “überkurzer Sproßvokal” that we may identify as *[e]—invariably found with a short vowel in the initial syllable in the daughter languages, and not a long one? That is to say, if a vowel had been epenthesized before a laryngeal in */ph₂tér-/, then why does it produce Lat. pater, Skt. pitár- and not Lat. × pāter, Skt. × pītár-? At first glance, such lack of compensatory lengthening (CL) appears to pose a problem for the vowel epenthesis hypothesis, arguing in favor of direct laryngeal vocalization. However, we will see that a lack of CL in this configuration has well-grounded theoretical and phonetic motivations, with parallels across many languages and language families.

Before we proceed with the matter at hand, a few words must be said about the process of syllabification within PIE. Indo-Europeanists have traditionally concerned themselves with how sequences were parsed into syllables in PIE, through the identification of syllable nucleus assignment and the placement of syllable boundaries in polysyllabic words. This topic has been well studied, by Hermann (1923), Meillet (1937:134–6), and most famously Schindler (1977:56), who characterized PIE syllabification as applying in a “right-to-left” iterative fashion, such that if two adjacent segments are potential syllable nuclei, the rightmost is always chosen as the nucleus as long as it is not adjacent to a “true” vowel (*e, *a, *o, etc.).⁴

However, beginning with Keydana 2004 (followed by Byrd 2010a), scholars have increasingly realized that we may also identify which sequences could be parsed into syllables in PIE. For while PIE allowed a number of different types of complex syllables, it did not allow all types of syllables. As I argue in Byrd 2010a:107, we may

⁴Schindler’s right-to-left syllabification algorithm has since been interpreted in a number of different ways, as onset maximization (Kobayashi 2004:22–4), the avoidance of coronal sonorants in coda position (Keydana 2008 [2010]), the alignment of syllables to the left edge of the word (Cooper 2012), and an epiphenomenon created by quantitative ablaut (Byrd 2013:175).
identify the entire range of possible syllable shapes in PIE as those which do not violate the Maximum Syllable Template (MST):

(1) Maximum Syllable Template (MST)

The maximum PIE syllable consists of two consonants in the onset and two consonants in the coda (CCVCC). The onset may violate the Sonority Sequencing Principle (SSP); the coda may not.5

The facts of the MST are as follows. While certain SSP violations were permitted within PIE onsets within fricative plus stop clusters (*[dʰuɡ]₂[h₂tɛr]- ’daughter’, *[s(y)kɛ]₆[sto]- ’sixth’ and *[h₁et]₆[skɛ/ò]- ’eat (iter.)’), within PIE codas they were not.6 If the MST was violated during the phonological derivation any number of syllabically driven phonological rules in PIE would be triggered. These could be rules of resonant syllabification, rules of consonant deletion (stray erasure),7 or rules of vowel epenthesis (stray epenthesis). We may identify two rules of stray epenthesis in PIE:


Since the underlying word-initial sequences */ph₂tr/- and */dʰɡ₃m/- violated the MST, they could not be syllabified in PIE, and therefore a vowel was epenthesized in order to produce licit syllable structure. Given that both rules involve the epenthesis of a reduced vowel to make an unsyllabifiable sequence syllabifiable, it is reasonable to assume that these were not disparate processes, but rather a single syllabically motivated rule of schwa epenthesis, which we may call schwa indogermanicum *[e]. But even so, the puzzling absence of compensatory lengthening in the sequence *-h₂x₃ remains unexplained.

5The SSP may be stated as follows: “Between any member of a syllable and the syllable peak, only sounds of higher sonority rank are permitted” (Clements 1990:285). I assume the following universal sonority hierarchy to have been present in PIE: vowels > glides > liquids > nasals > fricatives > stops. See Byrd 2015:176.

6Certain MST violations were permitted at word’s edge via rules of extrasyllabicity (Byrd 2010a:86, 100): cf. *[tīe]- ’strew’, *[h₁stē]- ’star (nom.sg.)’, and *[nēk]-ts ’evening (gen.sg.)’.

7The most widespread example of stray erasure in PIE involves laryngeal loss via Lex Schmidt-Hackstein in the word-medial sequence CH.CC: */dʰuɡh₂três/ → *[dʰuɡ]₆[h₂trés]₆ → *[dʰuk]₆[trés]₆ ’daughter (gen.sg.)’ (Schmidt 1973, Hackstein 2002). Loss of /t/ in the Indo-Iranian word for ‘st’ may be explained in the same fashion: */h₁okhtʰtʰ-/- → *[h₁ok]₆[tʰtʰ]- → *[h₁ok]₆[h₁tʰ]- > Skt. aṣṭi- (Rau 2003 [2009]). Lastly, the absence of otherwise expected r-epenthesis in the double-dental cluster in the configuration VTTRV (the métron rule) is to be attributed to a violation of the MST. Thus, the MST prohibits underlying */méd-trom/ from being realized as either *[mɛts]₆[trom]₆ or *[mɛt]₆[strom]₆, leading to the actual result *[mɛt]₆[rom]₆ (> Gk. μέτρον). See Byrd 2015:123–33.
Compensatory lengthening (CL) may be defined as “the lengthening of a segment triggered by the deletion or shortening of a nearby segment” (Hayes 1989:260). While there are a number of types of CL (see Kavitskaya 2002), it most commonly occurs in the following scenario: a post-vocalic consonant is lost in the tautosyllabic sequence VC(C₀)σ, and upon deletion, the preceding vowel is lengthened: VC(C₀)σ → V(C₀)σ. Such a process is illustrated in the following well-known example: PIE /nisdós/ → *[niz]σ[dós]σ > Lat. nīdus, Skt. nīdāh ‘nest’. Within the phonological literature (see Hayes 1989), CL is typically defined in terms of mora reassignment, with a mora (µ) defined as a unit of syllabic weight (Hayes 1989:254). Thus, after the loss of coda *z in the change from PIE *nizdós ‘nest’ to Latin nīdus, the mora that was originally associated with *z became linked to the preceding vowel, thereby creating a long vowel:

(2) PIE *nizdós ‘nest’ > Lat. nīdus

Of course, such a process requires the deleted consonant in question to have been moraic. But languages may in fact differ as to which types of segments can carry a mora in the coda: in Malayalam coda consonants never carry a mora, in Lithuanian only sonorants carry a mora, while in Latin all consonants carry a mora in the coda (Gordon 2006). If one were to posit that PIE had been a language like Malayalam or Lithuanian where obstruents were not moraic in coda position (cf. Cooper 2012), then compensatory lengthening in the sequence *-əh₃σ would not be expected, as laryngeals would not have carried weight.

But this is unlikely for a variety of reasons. To begin with, the quantitative poetic meters of most ancient IE languages (Latin, Greek, Sanskrit, etc.) suggest that all consonants, not just resonants, were assigned a mora in coda position. Second, as I have argued in Byrd 2010b, a grounded conception of Sievers’ Law requires obstruents to have been moraic in PIE, as Sievers’ Law was motivated by the avoidance of a superheavy syllable. And lastly, and for our purposes most significantly, there are a number of likely cases of obstruent consonant deletion reconstructible for PIE that exhibit compensatory lengthening:

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8See Kavitskaya 2002 for other types of CL.

9As Gordon (2006) discusses, syllable weight may be independently identified on the basis of a number of phonological rules, including stress, tonal assignment, and CL. However, since stress/tone (i.e. pitch accent) was phonemic in PIE, it is difficult to see how it could be a useful metric here.
(3) PIE Obstruent Deletion with CL

1. **Stang’s Law:**\(^{10}\) */-eh₁m/ → *[ḥ-ãm] > Skt. *sen-ãm, Gk. ðú-ðv, Lat. *puell-am

2. **Szemerényi’s Law:**\(^{11}\) */úkʷ-s/- → *[ʊóɡʷ] >> *[ʊókʷ-s] ‘voice’ > Av. *vāx, Lat. *vōx

3. **Degemination:**\(^{12}\) */h₂éu-s-os-s/- → *[h₂áumōs] ‘dawn (nom.sg.)’ > Skt. *usās

4. **Medial Cluster Simplification:**\(^{13}\) */té-tk-ti/- > *[ték-ti] ‘fashions’ > Skt. *táṣṭi

5. **Late/Post-PIE Laryngeal Deletion:**\(^{14}\) *[dʰêh₁mŋ] > Gk. (avá-)θημα ‘offering’

I recognize that many of the processes listed above are not universally recognized, and it is not my intention to sway the reader one way or another on these matters—I simply refer the reader to the references cited. Fortunately, for our purposes processes (3.1) and (3.5) will suffice: it is clear that laryngeals were moraic in coda position within PIE and afterwards. And since a laryngeal would have carried a mora in the sequence *-sh₁ₚ, CL is indeed expected.

Nevertheless, there are certain laryngeal-loss rules reconstructible for PIE that exhibit no CL.\(^{15}\) For instance, Kuiper’s Law (Mayrhofer 1986:149), which deletes post-vocalic laryngeals in absolute utterance-final position (in pausa), produces a short vowel: cf. Gk. νύµα ‘nymph (voc.sg.)’ and */nás-s/ ‘nose (nom.sg.)’ (see Melchert → ṣ). But none of these cases provides an exact parallel to the sequence *-sh₁ₚ: this sequence is never found in absolute utterance-final position, PIE */h₁/ could be syllabified in the sequence *-sh₁ₚ according to the MST, and *-sh₁ₚ does not obligatorily precede the sequence stop plus resonant. Of course, a form like *[pəh₁trés] ‘father (gen.sg.)’ may be collapsed into the

\(^{10}\) Mayrhofer 1986:164.

\(^{11}\) Following the “broad” conception of Szemerényi’s Law; see Sandell and Byrd, in preparation.

\(^{12}\) Szemerényi 1970:109, Byrd 2010:15–22. The lengthened vowel in the suffix of *h₂áumōs is often taken to be analagical to forms such as *dʰēgʷám ‘earth (nom.sg.),’ but this is an unnecessary assumption. Moreover, as pointed out by Szemerényi (1996:117), such simplifications may handle difficult-to-explain long vocalisms, such as */nás-s/ → *[nás] ‘nose (nom.sg.)’ and */uś-s-s/- → *[uśś] ‘poison (nom.sg.).’


\(^{14}\) Byrd 2010:161.

\(^{15}\) Note that unlike in word-final position, medially-degemination never produces CL: */némm-mn/ → *[ném-mn] ‘gift’ > OIr. neim ‘poison’ (Rasmussen 1999:647), */h₁éś-s/st/ ‘you are’ > *[h₁éśi] > Skt. āsi, Gk. ēi, etc. (Mayrhofer 1986:120–1). Of course, these facts are irrelevant for the problem at hand, as the sequence *-sh₁ₚ is not part of a geminate sequence.

Schwa Indogermanicum and Compensatory Lengthening

weather rule, but other instances of schwa primum may not: */dʰh₁só-*/ → *[dʰh₁só-] ‘divine’ > Gk. ἡδῶς, HLuv. ῥεθαν-za ‘votive stele’. The precise reason for the absence of CL continues to elude us.

Cross-linguistically, one also observes that CL tends not to apply in unstressed syllables: observe the loss of /r/ in non-rhotic dialects within the name ‘Herbert’ → *[hɛːbɛːt], not *[hɛːbɛːt] or *[hɛːbɛːt]. While it is likely that stress is somehow connected to our present problem, it cannot explain it entirely, since unstressed sequences of */Vh₁σ* produce CL after laryngeal loss:

(4) Compensatory Lengthening in Unstressed Syllables

1. *[gʷh₁σ][ʊ-]* ‘alive’ > Ved. ḫivá-, etc.
2. *[bʰc₁][r₁h₂]* ‘I carry’ > Lat. ferō, Gk. βέω, etc.
3. *[dʰuh₂][mó-]* ‘smoke’ > Ved. dhūmá-, Lat. fūmus, etc.

To sum up, it seems exceedingly likely that laryngeals were moraic in coda position, and so laryngeal loss in the sequence */-h₁σ* should trigger CL. Since other phonological processes cannot be utilized to explain the problem at hand, we are led to conclude that there was something “special” about *[ə]* that led to short vocalisms in the IE languages.

4 PIE *[ə]* as a weightless vowel

Cross-linguistically, there are four basic factors that determine the length of a vowel in a word: (1) vowel quality, (2) stress, (3) the number of syllables in the word, and (4) whether the vowel is found in an open or closed syllable. In all four of these regards, PIE *[ə]* in the sequence */-h₂σ* comes out short: (1) *[ə]* is typically the shortest vowel of a vowel system, if a language possesses a *[ə]* phoneme or allophone; (2) *[ə]* is always unstressed in PIE—there are no securely reconstructible cases of accented vocalized laryngeal; (3) *[ə]* is always found in the initial syllable of polysyllabic words (such as *[dʰsh₁σ][tós]* ‘placed’); and (4) *[ə]* is always found in a closed syllable *[p₁h₂σ][trés]* ‘father (gen.sg.)’, *[d’agʰh₁σ][més]* ‘earth (gen.sg.)’. Put together, these facts argue strongly in favor of the idea that PIE *[ə]* was an extremely short vowel.

Such brevity holds ramifications for PIE phonology. As Gordon (2006:45) notes, in many of the world’s languages vowels must have some minimal duration in order

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17Cited here in Received Pronunciation.
18Ladefoged 2005:72.
19Cf. Flemming 2009:87: “The medial schwa vowels [in English (AMB)] . . . average 64 ms . . . By comparison, tense vowels can be as long as 100 ms in citation forms . . . and are on the order of 150 ms in fluent speech.”
20I explicitly reject the reconstruction of any word-medial or word-final instances of schwa primum for PIE, for which I refer the reader to Byrd 2015:14–7. Thus, */dʰugʰh₁ter-*/ ‘daughter’ was pronounced as *[dʰugʰh₁ter-]*, not *[dʰugʰh₁ter-]* and */(e)mleu²h₂e* ‘spoke’ as *[(e)mleu²h₂e]*, not *[(e)mleu²h₂e]*.

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Andrew Miles Byrd

to receive a mora. Mayrhofer was therefore on the right track in his assumption of an “überkurzer Sproßvokal”—PIE *[ə] was just too short to receive a mora. The assumption that *[ə] was a weightless vowel would directly explain the lack of CL in the PIE sequence *-sh₂, as weightless vowels are frequently invisible to phonological processes, including CL (Gordon 2006). One such example may be found in Sliammon [támɛn], a Central Coast Salish language spoken in British Columbia (Blake 2000), in which a short vowel is monomoraic, a long vowel or sequence of vowel plus consonant bimoraic, and [ə] is non-moraic, consisting of a bare nucleus not associated with any mora. In Sliammon one of the functions that epenthetic schwa serves is to satisfy certain syllable structure constraints (such as *COMPLEXONSET); similarly, the purpose of PIE *[ə] was to satisfy the syllable structure constraint MST in addition to other highly ranked markedness constraints.²¹ As evidenced by CL, coda consonants in Sliammon are moraic (Blake 2000:106).

(5) Sliammon Compensatory Lengthening
1. /gaʔtʰap/ → [gaʔtʰApʰ] ‘drive, steer’
2. /tiʔta/ → [tita] ‘that one (gen.)’
3. /tih/ → [tʰ] ‘big’
4. /səʔpʰiqʰəʔas/ → [sáʔpʰeqʰəʔas] ‘he hit me on the head’

Examples of consonant deletion following [ə] are quite rare in Sliammon, due to a lack of CL in unstressed syllables (Blake 2000:109) and a constraint blocking stressed [ə] in open syllables (Blake 2000:231). However, in sequences of [ə] + glide, we do find fusion of the two segments into a short vowel, which necessitates that [ə] be weightless (Blake 1992:37, 86):

(6) Sliammon Schwa Diphthongs
1. /ə + y/ → [i] /say-say’y/ → [sisim’y] ‘they are afraid’
2. /ə + w/ → [u] /tɔω-towmay’ə/ → [tútuumáy’s] ‘west wind’

Kager (1990:248) describes a similar situation for Dutch, where (as in Sliammon) short vowels are monomoraic, long vowels and the sequence vowel plus consonant are bimoraic, and /ɔ/ is non-moraic. As expected, /ɔ/ is never lengthened via CL if a coda consonant is deleted (Booij 1995:139–40), unlike short vowels (cf. Booij 1995:148).

(7) Deletion of Coda /n/ in Dutch
1. open /open/ → [oɔn] ‘open’
2. kuikentje /kœykɔn-tjɔ/ → [kœykɔtjɔ] ‘chicklet’
3. on-weer /ɔn-veer/ → [ɔnveer] ‘thunderstorm’
4. on-zeker /ɔn-zekɔr/ → [ɔnzekɔr] ‘uncertain’

As in Sliammon and Dutch, I propose that the PIE vowel system contained three types of syllable nuclei at the surface: monomoraic (*[i, e, a, o, u]), bimoraic (*[ı, ė, ā, ĕ, ě]), and non-moraic (*[ə]).

We may now return to the etymon cited above, */dʰh₁tós/ ‘placed’, whose original moraic structure was *[dʰh₁to₅s₅] in PIE. At whatever point laryngeal loss occurred within the sequence *-e₁h₇σ (whether within late PIE or in the IE daughter languages), the mora once linked to the laryngeal became associated with the preceding weightless vowel *[e], resulting in a true, monomoraic vowel, *e₅. It is in this way that CL does in fact occur:

(8) PIE *[dʰh₁tós] ‘placed’ > post-PIE *[dʰe₅]σ[.todos]σ

This monomoraic vowel later merges with other vowels within the prehistory of each IE language family: Gk. e, a, o, IIr. i, elsewhere a. But what about schwa secundum, by which I mean PIE *[ə] that was not immediately followed by a laryngeal? In all languages but one, this weightless *[ə] merged together with the inherited monomoraic schwa: Lat. a (quattuor ‘four’ < *kʷstu₁r), Hitt. a (taknaš ‘earth (gen.sg.)’ < *dʰg₇m₅s), Toch. a (katna₇n, A kn₅s ‘strew’ < *kød₅n₅h₇). But in Greek, which is famously conservative in its vocalisms, a distinction is maintained. Monomoraic *e₅ merges with one of three non-high vowels (/e, a, o/), while weightless *[ə] merges with /i/, one of the shortest vowels in its phonemic inventory, continuing its extremely brief pronunciation from PIE. This /i/ (< *[ə]) was likely maintained as the default epenthetic vowel in Proto-Greek, utilized in later inner-Greek formations such as ρίζα ‘root’ (< *urɪdɪ₅) and ἵπνος ‘oven’ (< *sipnɔs).23

All of this brings us back to where we began—with Sanskrit, in which vocalized laryngeals merged together with long [i] in pre-consonantal word-final position (*[e](m)e₅l₇h₂t₁] > Skt. ábrvrit) and short [i] elsewhere (*[p]₇b₇t₇] > pitā, *[d¹ugh₇t₇] > dóbhá̄). With the above taken into consideration, we would perhaps expect a short [i] across the board, given the brevity of the epenthetic vowel in PIE. So how did Indic [i] come about? Recall that *[ə] only surfaced in word-initial syllables in PIE; thus,
PIE *[pɔh₂t̪eɾ] beside *[dʰuɡh₂t̪eɾ], *[e]mleu₂t̪]. Perhaps inherited *[ə] was utilized in Proto-Indo-Iranian to fix an illicit laryngeal sequence in word-final position: *[am-rau₂t̪] → *[am-rau₂t̪]. It is well-known that vowels are cross-linguistically longer in final syllables than in non-final ones, and so it is conceivable that this length was transferred when the merger of *[ə] with /i/ occurred: non-final *[ə] > /i/, final *[ə] > /i/. But such an explanation does not account for why short [i] is produced in absolute word-final position; thus, */mégʰ₂t̪ > máḥi ‘great’, not *máḥi.

Since laryngeal vocalization in word-final position was a post-PIE, i.e. Indo-Iranian process, it is possible that the change of PIE *[ə] to PIIr. *[i] preceded word-medial and word-final vocalization, with monomoraic *[i] becoming the default epenthetic vowel in Proto-Indo-Iranian, as in Proto-Greek. To account for the differences in length (as has been done in the past), we may suppose that epenthetic *[i] was inserted before the laryngeal in the word-final sequence *CHC#, triggering CL on the preceding vowel after laryngeal loss: */am-rauHt̪ > *[a]r[ma]r[yiHt] > abraτ. Crucially, epenthetic *[i] was inserted after the laryngeal in the other environments, and it is for this reason that CL did not occur in word-medial or absolute word-final position: */dʰuɡHt̪ > *[dʰug]h₂[Ht̪] > duhita, */máḥ₂ > *[má]h₂ > máh. While the aspiration found in duhita and máh appears to position the epenthetic vowel, it must be noted that we find aspiration within the sequence *-CHC# as well: PIE *(e)g’reb₂t > Skt. ágrabḥ ‘grabbed’. However, it is not inconceivable that analogy could account for these facts (as surely must be true for gḥmnáti and other forms), a suggestion I leave for future research.

References


26For instance, in English, non-final schwa vowels (above) average a length of 64 ms, while word-final schwas (sofa) have a mean duration of 154 ms (Flemming and Johnson 2007).

27In addition to gra(b)h-, LIV² cites two other roots of the shape *Pb₂ (where P = any unaspirated stop) that directly attest root aorists in the singular: máḥitit ‘steals’ (< *mét₂t) and (máḥ) lebḥ redistribution of the initial vowel: ‘(don’t) scratch!’ (< *reḥ₂t).


