Compensatory Lengthening in Vedic and the Outcomes of Proto-Indo-Iranian *[az] and *[až][*]

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1. Introduction: "a troublesome mixture"

Old Indic and Old Iranian differ sharply in their treatment of Proto-Indo-Iranian (PIIr.) *[az] and *[až], as seen in example set (1):[1]

(1) Iranian voiced sibilants versus Vedic long vowels
   a. PIIr. */mas-dʰā́-/ → *[mazdʰā́-] 'wisdom' > Ved. *medhā́-*, Av. *mazdā-*.
   b. PIIr. */u̯ájʰ-tar-/ → *[vážd͡ʰar-] 'beast of burden' > Ved. *vóḍhar-*, OAv. *važdr-a-* (acc.pl. *važdrāŋg* Y. 46.4).
   c. PIIr. */misdʰá-/ → *[mižd͡ʰá-] 'reward' > Ved. *mīḍhá-*, Av. *mīžda-* (cf. Gk. μισθός 'wage').
   d. PIIr. */dʰa-dʰH-dʰí/ 2sg.pres.act.impv. *√dʰaH* 'put' → *[dʰazd͡ʰí] > Ved. *dhehí*, YAv. *dazdi*.

To the Iranian sequence of vowel + voiced sibilant corresponds "a troublesome mixture" (Jamison 1991:81) of long vowels in Indic (Vedic *e*, *o*, and *ā*), which has continued to bedevil scholars, although already Wackernagel (1896) constructed a complete typology and collected most of the relevant examples. For the nineteenth-century literature on the problem, one may consult the references in Wackernagel 1896:37–40 and 45–6; the treatments in Bloomfield 1882 and Bartholomae 1885 are especially worthy of attention. The issue has re-emerged periodically throughout the twentieth and early twenty-first centuries; two notable recent discussions are Lubotsky 2000 and Milizia 2004.

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1 A note on notation: throughout, underlying representations (URs) for any given synchronic phase will be placed between slashes (/ /), while surface representations (SRs) for reconstructed stages appear in square brackets ([ ]); forms in italics represent attested SRs. Textual abbreviations follow Kümmel 2000 and Franceschini 2007.

Stephanie W. Jamison, H. Craig Melchert, and Brent Vine (eds.). 2014.
Proceedings of the 25th Annual UCLA Indo-European Conference. Bremen: Hempen. 183–201.

Aside from Wackernagel's essentially agnostic presentation of the data, no scholar is willing to accept an indeterminate three-way split of the sequences *[az] and *[až]. Given the wealth of examples, the development PIIr. *[az.C] > Ved. *e.C* is universally accepted as lautgesetzlich.[2] The more meager data on PIIr. instances of *[až.C] admits of varied interpretation: one finds all three apparent outcomes (*e*, *o*, and *ā*) proposed as the regular Vedic development.[3] Consequently, the question rests on close consideration of a small set of data points.

Often, the broader problem of PIIr. *[az] and *[až] in Vedic overlaps with the treatment of Vedic /as/ in external sandhi. The connection on this point is evident: Vedic /as/ surfaces as *o* preceding voiced consonants where a word boundary intervenes; the natural historical interpretation of this process is that regressive voicing assimilation applied to PIIr. */s/ across word boundaries, thus creating further instances of PIIr. *[z]; the problem then becomes why PIIr. *[az] should appear to regularly yield Vedic *o* at a word boundary, but *e* word internally. Here, space constrains me to examine only the word-internal developments; a thorough treatment of external sandhi will appear elsewhere, though for a summary exposition of my views, please see Sandell 2014.

In the following section, I introduce the relevant datapoints that bear on the question at hand, and observe that the development of *[az/ž.C] > Ved. *e*/*o*/*āC* implies that compensatory lengthening is at work. Section 3 undertakes a detailed treatment of all words that potentially contain a reflex of *[až], as well as *[az] preceding *bh*- case endings. Based on this examination, I conclude that Ved. *e* is the only genuine reflex of PIIr. *[az/ž], except when preceding a word boundary (#).

2. Data: what is a lengthened PIIr. *[ă]?

In Vedic, after a syllable nucleus *[i], *[u], or *[r̥], the outcome of PIIr. *[ž] in a syllable coda is entirely straightforward and uncontroversial: the voiced sibilant is lost, and the corresponding long vowel appears. Example sets (2)–(4) illustrate this pattern; cf. Wackernagel 1896:44–5 and Lubotsky 2000:256.

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2 Since Ved. *o* < *[az] occurs only in external sandhi, that development is a separate, though related, problem. To my knowledge, only Jamison (1991:81–2) seems to accept that to PIIr. *[az#C] might produce Ved. *ā*.

3 Ved. *e*: Bloomfield 1882, though Bloomfield's precise position is that Proto-Indo-European *[ē] resulting from compensatory lengthening by loss of a sibilant gives Vedic *e*; Ved. *o*: Allen 1972:72, Milizia 2004:98ff.; Ved. *ā*: Renou 1952:30, Lubotsky 2000.

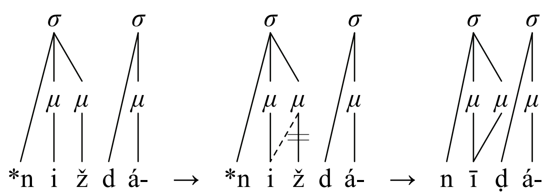
(2) PIIr. *[iž] > Ved. *ī*[4]
  a. *[niždá-] ‘nest’ > PInd. *[niẓḍá-] > Ved. *nīḍá-*
  b. *[miždʰá-] ‘reward’ > Ved. *mīḍhá-*.
  c. *[liždʰá-] PPP to √*lijʰ* ‘lick’ > *līḍha-* (epic+)

(3) PIIr. *[už] > Ved. *ū*
  a. *[uždʰá-] PPP to √*u̯ajʰ* ‘carry’ > Ved. *ūḍhá-*.
  b. *[duždábʰa-] ‘difficult to deceive’ > Ved. *dūḍábha-* (RV 7.60.6a, 7.86.4c).
  c. *[ruždʰá-] PPP to √*rudʰ* ‘ascend; grow’ > Ved. *rūḍhá-*.

(4) PIIr. *[r̥ž] > Ved. *r̥̄*[5]
  a. *[mr̥ždantu] 3pl.pres.act.impv. to √*mrazd* ‘be merciful’ > Ved. *mr̥̄ḍantu* (RV 7.56.17a); likewise 2sg.impv. *[mr̥ždá] > *mr̥̄ḍá* (e.g., RV 4.9.1a).
  b. *[tr̥ždʰá-] PPP to √*tr̥jʰ* ‘crush’ > Ved. *tr̥̄ḍhá-*.
  c. *[dr̥ždʰá-] PPP to √*dr̥jʰ* ‘hold’ > Ved. *dr̥̄ḍhá-*.

This set of developments leads to the following basic interpretation: once voiced sibilants became illicit in surface forms in Proto-Indic, they were deleted, with compensatory lengthening (CL) on the preceding vowel.[6] The CL in question (transfer of prosodic weight from syllable coda to syllable nucleus) may be represented in an autosegmental framework (Goldsmith 1979) following Hayes 1989: when the segment is deleted, the unit of prosodic weight (the mora) with which it was associated reassociates to the preceding syllable nucleus. The change from PIIr. *[niždá-] to Ved. *nīḍá-* is given in example (5).

(5) COMPENSATORY LENGTHENING as Prosodic Weight Transfer



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4 One further example may be a PPP to √*mih* ‘urinate’: Whitney (1885 [1963] s.v. *mih*) cites a *mīḍha-* as Vedic, but I cannot independently confirm the attestation of such a form in Vedic Sanskrit.

5 Usually transmitted as ⟨*r*⟩, but metrical scansion confirms [r̥̄]; cf. Wackernagel 1896:31.

6 No compelling evidence exists to support the assumption of an intermediate lenition of [z] and [ž] to semivowel or laryngeal segments in syllable codas, and indeed some counter-evidence is available. If coda *[z] had become [i], we should expect to similarly find Ved. *ai* < PIIr. *[āz]. We do not: compare 2sg.pres.act.impv. *śādhi* (RV 2.28.9d) to √*śas* ‘teach, show’, not ˣ*śaidhi* < PIIr. *[ćāzdhi]. See further Wackernagel 1896:273.

Due to the RUKI rule, no comparable instance of compensatorily lengthened PIIr. *[i], *[u], or *[r̥] from loss of *[z] appears in Vedic. From examples (3)–(5), however, one may conclude that loss of PIIr. coda *[ž] induced CL, without auxiliary effects upon the vocalic nucleus. If one were to assume that PIIr. (and Vedic) */a/ and */ā/ were phonologically distinct solely in terms of length (like /i/ vs. /ī/ and /u/ vs. /ū/) one might expect to find Vedic *ā* as the regular outcome of those PIIr. *[az] and *[až], in parallel to examples (2)–(4).[7] Example sets (6)–(8), however, clearly illustrate that Vedic *ā* is but one apparent outcome, alongside *e* and *o*.

*2.1. Outcomes of PIIr. *[az]*

(6) Ved. *e* (numerous examples; see Wackernagel 1896:37):
- a. *[mazdʰā́-] 'wisdom' > Ved. *medhā́-*
- b. *[sazd-] weak stem of perf. to √*sad* 'sit' > Ved. *sed-*
- c. Two probable cases in external sandhi (cf. Jamison 2010):
  - i. *sū́re duhitā́* 'daughter of the sun' (RV 1.35.5d)
  - ii. *sū́re ná dhā́tā* 'placer of the sun' (RV 9.97.38a)

(7) Ved. *o* (only where a word boundary intervenes):
- a. before *bh*- case endings of *s*-stems, e.g., *[mánaz#bʰiš] > *mánobhiḥ*.[8]
- b. in external sandhi before voiced consonants, e.g., nom.sg. *-o* of *a*-stems, etc.

(8) Ved. *ā* (only before *bh*- case endings of [possible] animate *s*-stems; cf. Jamison 1991:81–2):
- a. */usás#bʰiām/ → *[ušázbʰiām] > *uṣā́bhyām* 'for the two dawns' (VS XXI.50 ≅ MS III.11.5, TB II.6.14.2)
- b. *apsarā́bhyas* 'for the apsaras' (AVŚ 2.2.5, 7.109.2)
- c. *ā́śābhyas* 'for the spaces' (RV 2.41.12a), if with Av. *asah*- 'place' (cf. *EWAia* s.v. *ā́śā-*)

If not for the two good cases of *e* in external sandhi involving the genitive *sū́re*, *e* and *o* < *[az] would stand in complementary distribution. The instances of *ā* < *[az] given above are exhaustive, to my knowledge. It is difficult to see a

7 The assumption that Sanskrit /a/ and /ā/ differ only in length would be incorrect, as Pāṇini (8.4.68) shows (cf. Deshpande 1975), and accordingly I adopt below the phonetic transcription [ə] for PIIr., PInd., and Ved. /a/.

8 The fact that *iṣ*-stems, such as *havíṣ-* 'oblation' exhibit the expected external sandhi treatment before *bh*- case endings (e.g., inst.pl. *havírbhiḥ*) demonstrates that within the synchronic grammar of Vedic, *o* in *s*-stems preceding *bh*- case endings is the product of external sandhi.

conditioning environment that could distinguish a form like *mánobhiḥ* from a form like *uṣā́bhyām*, in either a historical or synchronic derivation; I will discuss the problem in §3.2 below.

*2.2. Outcomes of PIIr. *[až]*

(9) Ved. *e*:
tṛṇéḍhu 3sg.pres.act.impv. to √*tṛh* 'crush' (AVŚ 8.8.11, AVP 9.6.3d); 2sg.impv. *tṛṇeḍhi* (JB 2.271).

(10) Ved. *o*:
a. *vóḍhar-* 'beast of burden', inf. *vóḍhum* (to √*vah* 'lead').
b. *ṣóḍaśa-* 'sixteen'; *ṣoḍhā́* 'six-fold'.
c. *soḍhum* inf. to √*sah* 'overcome' (epic+; 12× R.); nomina agentis *soḍhar-* (Clas. Skt.).

(11) Ved. *ā*:
a. nom.sg.perf.part.act. *sāhvā́ṃs*, *ásāḍha-* 'undefeatable' (RV), nomina agentis *sā́ḍhar-* (RV 7.56.23c) all built to √*sah* 'overcome' (< IE **seĝʰ-*; cf. Gk. ἔχω 'have, hold', Goth. *sigis* 'victory').
b. *tāḍhi* 2sg.pres.act.impv. to √*takṣ* 'hew' (RV 10.180.2d = AVŚ 7.84.3d, AVP 1.77.2d).
c. *bāḍhá-* PPP to √*baṃh* 'make firm' (nom.sg. *níbhāḍhaḥ*, RV 1.106.6b, loc.sg. *bāḍhé* RV 1.181.7b; *bāḍhasŕtvā* RV 1.122.10c).
d. *gāḍhá-* PPP to √*gāh* 'enter (into water), dip into water' (ŚrSū.+; RV pres. *gā́hate* 1.127.4d; cf. *EWAia* s.v. *GĀH*).

Likewise, the outcomes of *[až] given here are, to my knowledge, exhaustive. Although *ā* appears to be the best represented outcome, I will argue below that all such cases plausibly contain underlying /ā/, not /a/, or reflect an inherited PIE *[ē], and therefore do not constitute genuine evidence for the development of PIIr. *[až].

Although the data demonstrate that the loss of *[z] and *[ž] have the effect of lengthening a preceding *[a], exactly what a PIIr. *[a], if lengthened, should produce in Vedic is not immediately clear. Moreover, cases involving PIIr. *[z] and *[ž] seem to provide the only evidence for CL in Vedic: "Außerhalb der Formen mit ursprunglichem *z ž* ist die sogen[annte] Ersatzdehnung dem A[lt]i[ndischen] fremd'' (Wackernagel 1896:45).

However, I have argued (Sandell 2013, building on observations in Lubotsky 2013) that a number of weak stems of the perfect in Vedic that exhibit the form C_1eC_2- are best understood as reflecting a compensatorily lengthened /ă/, where a surface form with evident reduplication $C_1aC_1C_2$- would have contained

a phonotactically illicit sequence. Specifically, I hold that the perfect weak stems *bhej-* (to √*bhaj* 'divide'), *pec-* (to √*pac* 'cook'), and *śek-* (to √*śak* 'create, shape') in fact reflect Proto-Indo-Iranian (or at latest Proto-Indic) *[bʰəːj-] ← */bʰa-bʰjh-/, *[pəːč-] ← */pa-pč-/, and *[ćəːk-] ← */ća-ćk-/, because the faithful surface realization of the underlying sequences */bʰj/, */pč/, */ćk/ was banned by phonotactic constraints. A realization of compensatorily lengthened PIIr. */a/ as Ved. *e* speaks strongly in favor of Lubotsky's (2013) interpretation of Vedic and PIIr. */a/ as [ə].[9] I will therefore write [ə] rather than [a] for the realization of Vedic or Indo-Iranian /a/ for the remainder of this paper. Most importantly, given that Ved. *e* can result from CL upon not only loss of *[z] and perhaps [ž], but also */bʰ/, */p/, or */ć/, the simplest hypothesis is that PIIr. *[əː] becomes Ved. *e* word internally.

3. Making the mixture less troublesome

In this section, I first re-evaluate the evidence for the three-way outcome of *[əž] as *e*, *o*, and *ā*, and conclude that *e* is the true unconditioned outcome. I then argue that the evidence from animate *s*-stems for an outcome *ā* < *[əz#] is not compelling, leaving only *o* and *e* as Vedic results of earlier *[əː].

*3.1. The outcome of *[əž]*

3.1.1. tṛṇéḍhu

The question of what vocalism PIIr. *[əž] ultimately shows first turns on how the 3sg.pres.act.impv. *tṛṇéḍhu* is to be explained. *tṛṇéḍhu* in fact directly continues PIIr. *[tr̥náždʰu] ← */tr-ná-jʰ-tu/; the word-internal *e* vocalism found here directly reflects *[əː], just as *[səzd-] > *[səːd-] > *sed-* or */papč-/→ *[pəːč-] > *pec-*. Three competing explanations on the overall problem that take Vedic *o* or *ā* as the lautgesetzlich outcome account for *tṛṇéḍhu* otherwise:

1. *tṛṇéḍhu* is analogical to another Class VII present of the form √°*nadh*, in which the 2sg.impv. and 3sg.impv. would have been ˣ[°nédhi] and ˣ[°nédhu], exhibiting *e* < *[əz] (Bartholomae 1885:364).
2. *tṛṇéḍhu* continues *[tr̥ṇázḍʰu] < Proto-Indic *[tr̥ṇáẓḍʰu], in which retroflex *[ẓ] underwent dissimilation to *[z]; thus *e* would result from *[əz], not *[əẓ] (Milizia 2004:100).

9 The view of Keydana (2013:138 n.7), who holds that */a/ was realized as [ɑ] and */ā/ as *[aː], is wholly incompatible with the outcome of lengthened */a/ as Ved. *e*.

3. *tṛṇéḍhu* is analogical to 2sg.pres.impv. forms containing *e* < *[əz] such as *edhí* (to √*as* 'be'), *dehí* (to √*dā* 'give'), and *dhehí* (to √*dhā* 'put') (Marsh 1941:47, Renou 1952:30, Lubotsky 2000:257–8).

Milizia's suggestion is impossible, because, if Vedic is properly indicative of Proto-Indic on this point, coronal obstruents must agree in place of articulation: sequences ˣ*sṭ* and ˣ*ṣt* do not exist in Vedic. Consequently, even if a form *[tr̥ṇáẓḍʰu] required repair due to an overabundance of retroflex consonants, a dissimilation could only have produced *[tr̥ṇəzdʰu] > Ved. ˣ*tṛṇédhu*.

The two analogical solutions are both ad hoc and difficult to formalize. This is especially true for the version that Marsh, Renou, and Lubotsky all adopt—how precisely is the *e* vocalism found in imperatives such as *dhehí* to have affected an earlier ˣ*tṛṇā*/*oḍhu*? This version might propose that the *e* vocalism first entered the 2sg.impv. of the verb by an interparadigmatic analogy, creating *tṛṇeḍhi* (though attested but once, at JB 2.271), then the 3sg.impv. by intraparadigmatic analogy, thus creating *tṛṇéḍhu*. However, the only instance of a spread of *e* vocalism from a 2sg.pres.impv. to which this account can point is the 2pl.impv. *dhetana* (2× RV), but this form reflects the selection of an alternate surface weak stem from within the same paradigm (*dhe*-, parsable from *dhehí*, instead of from *dhat*-, parsable from, e.g., 3sg.mid.ind. *dhatte*).

Formalization of Bartholomae's proposal using a four-part analogy or morphophonological surface mapping (following Albright 2002b) demonstrates that it is false. Bartholomae's specific example, √*rudh* 'obstruct', forms a Class VII present, three PIIr. forms of which would have been 3sg.pres.act.ind. *[runə́zdʰi] ← */ru̯-ná-dʰ-ti/, 3sg.pres.act.impv. *[runə́zdʰu]* ← */ru̯-ná-dʰ-tu/, 3pl.impv. *[rundʰə́ntu] ← */ru̯-n-dʰ-ántu/. If inherited directly into Vedic unchanged, we would find 3sg.ind. *ruṇédhi**, 3sg.impv. *ruṇédhu**, 3pl.impv. *rundhántu**. In Bartholomae's view, possible *ruṇédhu** would lead to *tṛṇédhu*, replacing ˣ*tṛṇóḍhu*. The Class VII paradigm of √*tṛh*, in Bartholomae's view would contain *o* everywhere that √*rudh* would exhibit *e*; elsewhere, the root final *h* would correspond to root-final *dh*. No precise point of contact between the two paradigms could have existed. The false four-part analogies in (12) illustrate this point.

(12) False analogies between *tṛṇáh*- and °*nadh*- (cf. *ruṇadh*- 'obstruct', *ṛṇadh*- 'thrive', *inadh*- 'kindle')

a. From 3sg.pres.: *ruṇédhi** : *ruṇédhu** :: ˣ*tṛṇóḍhi* : X, where X is solved as … ˣ*tṛṇóḍhu*!

b. From 3pl.pres.: *rundhánti* : *ruṇédhu** :: *tṛnhánti** : X—does not apply: *-ndhánti* ≠ *-nhánti*.

The inapplicability of an analogy along the lines of (12b) becomes all the more clear in recognizing that the three known roots ending in *-dh* to which a Class VII present is attested would constitute a closed "Island of Reliability," in the sense of Albright 2002a. Assuming a mapping from the 3pl.pres.act.ind. to the 3sg.impv. for expository purposes, the Class VII forms of √*rudh*, √*ṛdh*, and √*idh* would predict and reinforce one another, but because the rule is so specific, it cannot take scope over other possible forms.

(13) *dhánti* → *édhu* / *V* {*n̥*, *n*} __ #

This rule cannot take scope over *tṛṇhánti**, because the structural change would require a more general input, $C_{[+\text{voice, }+\text{slack glottis}]}$*ánti* → *édhu*, which would capture any voiced aspirate as well as /h/ (= [ɦ]).

Moreover, no form like *ruṇédhu** is actually attested in Vedic: because the PIE and PIIr. Double Dental Rule (DDR), which caused the leftmost dental in an underlying sequence of two dentals to surface as a sibilant, is no longer active in Indic, /ru-ná-dh-ti/ surfaces as *ruṇáddhi*. Bartholomae must therefore at least assume that the loss of voiced sibilants, and the analogy that would generate *tṛṇéḍhu*, preceded the DDR's death in the history of Indic. I see no evidence that bears decisively on the relative chronology of those two changes, given that any form which shows Ved. *e* < *[əzD] ← */aDD/ may have been lexicalized.[10]

The foregoing considerations indicate that no plausible morphological change is able to generate *tṛṇéḍhu*. In light of the fact that not only *[əz] > *[əː] > *e*, but also */ap/, */abʰ/, and */aǵ/ → *[əː] > *e*, the apparent development of */tr-ná-ǰʰ-tu/ → *[tr̥nážd$^{\text{h}}$u] > *tṛṇéḍhu* is indeed the expected development. The issue now is how to account for the apparent instances of *[əž] > *o* and *ā*.

*3.1.2. *[u̯əː] > Ved.* o

Already Bloomfield (1882:30–1) offered a viable explanation for the *o* vocalism that is found in Ved. *vóḍhar-* 'beast of burden' (and similar derivatives of √*vah* 'lead') and two derivatives of the numeral 'six': the presence of a preceding labiovelar approximant induced rounding of [əː] to [o]. Renou (1952:52), Jamison (1991:81 n.8), and Lubotsky (2000:258) all adopt this same explanation. In the

10 Indeed, doublets such as 2sg.impv. *daddhí* alongside more frequent *dehí* (to √*dā* 'give') prove that the latter is a lexicalized archaism.

case of *vóḍhar-*, the development from PIIr. proceeds as follows: */u̯ájʰ-tar-/ → *[u̯ə́ždʰər-] > *[u̯ə́:ḍʰər-] > *vóḍhar-*.[11]

Precisely the same development explains *ṣóḍaśa-* 'sixteen' and *ṣoḍhā́* 'six-fold', though less obviously, because the onset *[ṣu̯-] simplified to *ṣ-* in Sanskrit. However, Lubotsky (2000:258–9) points out that *[ṣu̯-] probably remained as such in the Indic dialects that underlie various Prākrits and Modern Indo-Aryan languages (thus Hindi *cha* 'six' < *[ṣu̯aṭ]). Other Indo-European cognates also confirm the earlier presence of a *[u̯]: Av. *xšuuaš*, Heraklean ϝέξ, and Welsh *chwech* 'six' all show a direct reflex (cf. *EWAia* s.v. *ṣáṣ-*, Hoffmann 1965:254). The development of *ṣóḍaśa-* from PIIr. is then *[šu̯ə́ždaća-] > *[ṣu̯ə́:ḍaśa-] > *ṣóḍaśa-*.[12]

Particularly vexing, at first sight, are the derivatives to √*sah* 'conquer' that show both *o* and *ā*. Again, however, Bloomfield (1882:30) rightly observes that forms with *o* vocalism (such as inf. *soḍhum*) do not appear before epic; only forms with *ā* (such as RV *sā́ḍhar-*) are known in Vedic. Given that the roots √*sah* and √*vah* both form a Class I present (RV+), where the phonological similarity between the two roots is evident, a four-part analogy is easy to construct:

(14) pres. *váha-* : *vóḍhar-* :: pres. *sáha-* : X, where X is solved as *soḍhar-* (<< RV *sā́ḍhar-*).

Worrisome is the fact that this analogy rests solely on forms of √*vah*. Nevertheless, given the total absence of forms built to √*sah* with *o* vocalism in Vedic, accounting for *soḍhar-* and *soḍhum* in this fashion is safer than Bartholomae's (1885:363–4) assumption that the forms with *o* are lautgesetzlich, but remained hidden until epic, while somehow having been replaced with *ā* in the language of the RV.

Bartholomae (1885:363) does, however, adduce one possible counter-example to the proposed change *[u̯əː] > *vo*: the *s*-stem (subst. and adj.) *vedhás-* (of uncertain meaning), which he connects with the Avestan forms inst.sg. *vazdaŋhā* (Y. 49.10) and nom./acc.sg. *vazduuarə̄* (Y. 31.21). Mayrhofer (*EWAia* II: 582) opines that the Vedic forms are not to be separated from the Avestan. Space

11 A crucial point worth noting here is that the [+round] feature alone, which the sounds [w] and [o] share, is responsible for inducing the change *[u̯əː] > *vo*. The feature [+labial] does not have the same effect, to judge from *[pəːč-] > pec- and *[bʰəːj-] > *bhej-* (labial stops are [–round]).

12 On the reconstruction of the anlaut, see generally Lubotsky 2000 and discussion in *EWAia* s.v. *ṣáṣ-*.

here does not permit a full discussion of this problem, but the meaning of the Avestan forms remains uncertain (see the literature cited in *EWAia* s.v. *vedhás-*), and, depending upon the exact corresponding rendering of *vedhás-* (Mayrhofer abjures of giving a gloss), the Vedic form might be seen as a derivative of √*vidh* 'do satisfaction; divide; worship' (so Grassmann 1872 [1976] s.v. *vedhás-*).[13] Pinault (2013)'s recent treatment only illustrates how fraught the interpretation and etymology of this form is. Particularly troubling for an interpretation that would deny the connection between *vedhás-* and the Iranian material is the apparent piece of Indo-Iranian phraseology that Vedic *vedhā́ ṛtásya* 'Ordainer of Truth' (RV 10.86.10; cf. Jamison 1996:80) and the Av. personal name *Aṣuuazdah-* might constitute.[14] To accept that *vedhás-* indeed does directly continue earlier *[u̯əː] < *[u̯əz] would have serious consequences for the present enterprise, and would seemingly require that one accept instead the following set of developments, for which Bartholomae (1885:363) and Milizia (2004:98–106) argue:

1. PIIr. *[əz] > Ved. *e*.
2. PIIr. *[əž] > Ved. *o*.

Bartholomae offers no phonetic motivation for this difference in developments. Milizia, meanwhile, proposes that Proto-Indic *[ẓ] was a "fricativa faringializzata/velarizzata," and consequently, *[ẓ] underwent lenition to *[u̯], resulting in Vedic *o* following the monophthongization of diphthongs.[15] One might salvage Milizia's proposal in assuming a coarticulatory effect of a coda *[ẓ] on a preceding *[ə], namely, that *[ẓ] induced backing of *[ə] to *[o].[16]

However, in Hamann's (2003:96–107) examination of coarticulatory effects of retroflex segments on neighboring vowels, the author finds that only [+high] or [+front] vowels are notably affected by retroflexes; the retroflexes may trigger

13 Pinault (2013:115) rightly notes that no other full grade forms of √*vidh* are known in Vedic.

14 I very hesitantly offer the suggestion, somewhat along the lines of Thieme (1949:47), who proposed that Vedic inherited two distinct forms *vedhás-*, that both a derivative of √*vidh*, *vedhás-* and a cognate of Av. *vazdah-*, *vodhás-** originally coexisted, but the semantic overlap and formal similarity between the two forms permitted a reinterpretation as unconditioned variants of the same lexical item, and *vedhás-* ousted *vodhás-**.

15 See n.6 above for evidence against the common assumption that coda voiced sibilants underwent lenition to semivowels in the history of Indic.

16 Lubotsky (2000) similarly suggests that PInd. *[ẓ] and *[r] had the effect of backing and lowering */a/ to Vedic [ɐ], and therefore Ved. *ā* is the expected outcome of PIIr. *[əž].

lowering, centralization (backing), rounding, or diphthongization of such vowels. The first three effects are transparently the result of the lowered third formant (F3) typical of retroflex consonants (cf. again Hamann 2003:93), the articulatory correlate of which is likely the "sublingual cavity" that retroflex consonants form. Precisely because [–back] and [–front] vowels do not typically exhibit an F3 substantially different from retroflex consonants, such vowels are not subject to notable coarticulatory effects in the environment of retroflexes. Thus, the possibility that PInd. *[ẓ] would trigger the development of *[ə] to Ved. *o* is unlikely at best.

To summarize: I follow many other scholars in adopting Vedic *vo* as the specific outcome of PIIr. *[u̯əž], and I take the *o* vocalism found in derivatives of √*sah* as secondary. The only possible counter-example to the development PInd. *[u̯əː] > Ved. *vo*, *vedhás-*, is of uncertain provenance. Given that an unconditioned development of PIIr. *[əž] > Ved. *o* is difficult to motivate, and that a non-phonological alternative to the *e* vocalism in *tṛṇéḍhu* is wanting, *vedhás-* is best left aside.

*3.1.3. *[əž] ⊁ Ved.* ā

More bothersome than the ostensible cases of Ved. *o* < *[əž] are the seeming instances of *ā* < *[əž]. In each instance, however, the *ā*, in one sense or another, reflects a different source of Vedic *ā*, and not *[əž]. This general assessment reinforces the view that the unconditioned reflex of PInd. *[əː] (compensatorily lengthened */a/) is Vedic *e*. I treat the four arguable instances of *ā* < *[əž] in order of difficulty.

1. The PPP *gāḍhá-* poses no problem. The Class I present stem *gáha-*, which is the only verbal stem built to the root √*gāh* 'dip (in water)' in Vedic, demonstrates that the synchronic UR of *gāḍhá-* is /gāh-tá-/.
2. The 2sg.pres.act.impv. *tāḍhi* (RV 10.180.2d and many mantra repetitions) to the root √*takṣ* 'fashion, hew' is more interesting, but still readily explained. To see the *ā* in this form as a potential reflex of *[əž] creates a pseudo-problem, because a form PIIr. *[tə́žd^{h}i] or PInd. *[tə́ẓḍ^{h}i] could never have existed. To reconstruct PIE **tetk̂-d^{h}i* as the basis of the Vedic form (cf. Lubotsky 2000:257) is misleading in several respects: /tétk̂-d^{h}í/ may be a proper PIE UR, but it cannot be the PIE SR that would, through mechanical sound changes, generate *tāḍhi*. First, note that PIE obstruent clusters must agree in voicing, and that either SRs *[téd.ĝd^{h}i] or *[tédĝ.d^{h}i] would treat the sequence */tk̂d^{h}/ illicitly: the latter, with two stops in a coda, would grossly violate PIE principles of syllabification

(see generally Byrd 2010), while the former would create a syllable *[ted-] in which the onset and coda would share place and manner of articulation, which may constitute a violation of the OBLIGATORY CONTOUR PRINCIPLE (OCP; cf. Zukoff 2014 in this volume).[17] *[téd.ĝdʰi] ought furthermore to exhibit a thorn-cluster treatment in the second syllable, which would lead to Vedic ˣ*tátkṣi*.

tāḍhi might therefore continue an original PIE form *[tḗĝdʰi]. This form is the expected output from the UR /té-teǩ-dʰí/: because neither ˣ*[téd.ĝdʰi] nor ˣ*[tédĝ.dʰi] would have been permitted PIE surface forms, the repair is to delete the leftmost consonant in the offending cluster, with CL, thus producing *[tḗĝ.dʰi]. *[tḗĝ.dʰi] would yield PIIr. *[tā́ždʰi] and Ved. *tā́ḍhi*, in which case the *ā* would derive from PIE *[ē], not a compensatorily lengthened */a/. This account fits with the emerging consensus that "Narten" presents (of which *tā́ṣṭi* is a prime example) are indeed genuine IE present formations, most likely originally derived through reduplication; see Kümmel 1998, Kortlandt 1999, de Vaan 2004, and Melchert in press.

Conversely, *tāḍhi* may be a Vedic-internal formation that derived this 2sg.impv. from the strong stem /tā́ṣ-/, thus /tā́ṣ-dʰí/ → *tāḍhi*. Wackernagel (1896:38) follows this approach. If one assumes a synchronic UR /táks-dʰí/, then *tāḍhi* is a very unfaithful output; the best repair would rather be to delete /s/, which would allow for a well-formed SR ˣ[tágdʰi]. Since ˣ[tágdʰi] does not exist, *tāḍhi* must either derive synchronically from /tā́ṣ-dʰí/, or directly from IE *[tḗĝdʰi].

3. Forms such as *sā́ḍhar-* and *sāḍhum* built to √*sah* are explicable as derived from the by-stem *sāh-*, rather than *sah-*. Note first that, outside of the Class I present *sáha-*, the stems *sah-* and *sāh-* appear in seeming free variation. Particularly striking is the existence of the 2sg.root-aor.mid. impv. as both *sákṣva* (RV 1.131.3c) and *sā́kṣva* (RV 3.37.7c); contrast further 3pl.root-aor.act.opt. *sahyuḥ* (RV 7.90.6d) with 1pl.root-aor.act. opt. *sāhyā́ma*, 3sg.*iṣ*-aor.mid.ind. *ásahiṣṭa* (RV 7.98.5c) with 1pl.*iṣ*-aor.

17 PIE seems to lack roots of the shape */*C*e*C*-/ in which both consonants share place and manner of articulation; e.g., there are no roots **tet-*, **ted-*, **tedʰ-*, **det-*, **ded-*, **dedʰ-*, **dʰet-*, **dʰed-*, or **dʰedʰ-* A difference in glottal state alone may be insufficient to avoid the OCP violation. Perhaps the only genuine exception, **ses-* 'sleep', is less problematic, because the second *[s] could almost always be parsed into a different syllable.

mid.opt. *sāhiṣīmáhi* (RV 8.40.1d), or nom.sg.masc.pres.part.act. *sā́han* (6.73.2d) with fem. *sáhantī* (RV 7.56.5b). Thus, that /sā́h-tar-/ (or *[sāždʰar-]) underlies *sā́ḍhar-* is entirely possible. The more difficult question is where the by-stem *sāh-* originates, and why it, rather than *sah-*, should have been used in the derivation of *sāḍhar-* and *sāḍhum*.

I cannot answer the latter part of this question with certainty, but can merely observe that *sāh-* is not limited to the two forms under discussion in Vedic nominal derivatives. Also attested is the thematic adj. *sāhá-* 'victorious' (RV 8.20.20a, though the padapātha reads *sahá-*), alongside a synonymous *sahá-*. The existence of a thematic noun/adj. to IE **seĝʰ-* with *o* grade in Greek (dat.sg. ὄχοι 'harbors', *Odyssey* 5.404, ὀχός 'solid' [Ph.Byz.], and in numerous compounds, e.g., ἡνίοχος '(chariot) driver'; cf. Chantraine 1968–1980 [2009] s.v. ἔχω) makes possible the derivation of *sāhá-* from an IE *[soĝʰó-]. *sāhá-* establishes *sāh-* alongside *sah-* (as seen in, e.g., *sáhas-*) in Vedic primary nominal derivatives. In this sense, IE *o* grade gives one source for the stem *sāh-*.

sāh- also appears in the perf.part.act. *sāhvā́ṃs-* (10× RV), which must be a lexicalized stem, given that the stem *seh-* (in perf.part.mid. *sehāná-*), whether derived phonologically from /sa-sh-āná-/, with CL of /a/ → *e*, or analogically (to the *sed*-type), is the synchronically expected perfect weak stem. Both Bartholomae (1885:364) and Kümmel (2000: 565) independently propose that *sāhvā́ms-* continues a late PIE/early PIIr. *[sēĝʰu̯os-]/*[sējʰu̯os-], in which */s/ in */se-sĝʰ-u̯os-/ is deleted with CL. However, a clear motivation for the deletion of */s/ is wanting; Bartholomae suggests an assimilation *[sezjʰu̯os-] > *[sejjʰu̯os] > *[sējʰu̯os-]; Kümmel proposes a dissimilation of the sequence *[zjʰ]. Given that the sequence *[zjʰu̯] is totally unique to this form in PIIr., any particular explanation of *sāhvā́ṃs-* that does not wish to accept the development *[əz] > Ved. *ā* will necessarily be ad hoc. However, further anecdotal phonotactic evidence from the RV and the Avesta can be adduced to support a deletion of /s/ in */se-sjʰ-u̯os-/: the sequence *juu-* occurs only in absolute anlaut in the Avesta, while *hv* in RV occurs only in absolute anlaut or between two vowels, where it would be parsed heterosyllabically as [Vh.vV]. From this distribution, one could infer that an onset PIIr. *[jʰu̯-] was licit only at the left edge of a word, where a wider class of onsets is usually permissible in IE languages. Consequently, among the candidates *[sējʰ.u̯os-], ˣ[sez.jʰu̯os-], and ˣ[sezjʰ.u̯os-] to the UR /se-sjʰ-u̯os-/, the latter two were ill-formed, exhibiting either a (word-internally) illegal

onset *[jʰu̯], or a complex coda [zjʰ]; *[sējʰ.u̯os-], with deletion and CL, wins.

4. Most difficult to explain is the isolated PPP *bāḍhá-* 'thickened, strong'.[18] Etymologically, the form likely belongs to the root √*baṃh* that derives *bahú-* (< IE *[bʰm̥ĝʰú-]; cf. Gk. παχύς 'thickness, strength'); cf. *EWAia* s.v. *BAṂH*. Precisely because of its isolated status, a diachronic derivation IE */bmĝʰ-tó-/ → *[bm̥ĝdʰó-] > PIIr. *[bəždʰə́-] > Ved. *bāḍhá-* is a very real possibility. Nevertheless, Hoffmann (1965:180) has pointed out that, at least post-RV, *bāḍhá-* is no longer isolated, but has been incorporated into the verbal system of √*bādh* 'press, compel', ousting the genuine PPP *bādhitá-* (10× RV) to that root. In fact, already one RV'ic usage of *bāḍhá-* seems to belong with √*bādh*:

   (15) *índram kútso vṛtraháṇaṃ śácīpátiṃ*
   kāṭé ***níbāḷha*** *ṛ́ṣir ahvad ūtáye*

   The *ṛ́ṣi* Kutsa, (as if he were) pressed/squeezed (< 'made tight' < 'made thick') into a pit, called on Indra, the slayer of Vṛtra, lord of might, for aid. (RV 1.106.6ab)

   Compare the following usage of *nibādhitá-*:

   (16) *yátra rā́jabhir daśábhir* ***níbādhitam***
   prá sudā́sam ā́vataṃ tṛ́tsubhiḥ sahá

   … when you helped Sudā along with the Tṛtsus, when he was pressed upon by the ten kings. (RV 7.83.6cd)

   The sense of being "pushed in" to a tight space in both verses predominates. In effect, the expected form *beḍhá-*** may have been "contaminated" by √*bādh*, thus producing *bāḍhá-*, as the semantics of *beḍhá-*** fell together with *bādhitá-*. Note also *bādhitá-* (10× RV) and the *iṣ*-aorist (1× RV) provide the only evidence for a *seṭ* root, in contrast to the more frequent Class I present *bādha-* (52× RV) and intensive (12× RV). These token frequencies make possible that a learner might not have received adequate exposure to forms showing *seṭ* quality (the PPP and *iṣ*-aorist) in order to acquire a *seṭ* root. In turn, a speaker having con-

18 The meaning 'strong' derives essentially from the compound *bāḍhasṛ́tva-* 'pumped-up runner' (RV 1.122.10c, after Jamison and Brereton 2014). The sense of the loc. *bāḍhé* at 1.181.7b is unclear, and *nibāḍhá-* has a rather different sense (see example (15)).

> strued an *aniṭ* root √*bādh* would expect a PPP ˣ*bāddhá*-, thus coming close to *bāḍhá*- Frustratingly, I see no further proof that necessitates this conclusion, and the relevant conditioning for "contamination" remains vague.[19]

I reiterate the following assessment based on the preceding discussion: the vocalism in the 3sg.impv. *tṛṇéḍhu* has no plausible account other than direct inheritance of a sequence *[əž], while rounding from a preceding *[u̯] explains the Vedic reflex *vo* < *[u̯əž] (excluding the possible counter-example *vedhás*-), and only *bāḍhá*- stands a good chance of containing *ā* < *[əž], but the *ā* vocalism may rather reflect "contamination" from the root √*bādh*.

*3.2. *[əz] ⊁ Ved.* ā

The instances of supposed *[əz] > *ā* to which Jamison (1991:81–2) points would all belong to feminine *s*-stems: dat.du. *uṣā́bhyām* to *uṣas*- 'dawn', dat.pl. *apsarā́bhyas* to *apsaras*-, and dat. and inst.pl. *áśābhyas* and *áśābhis* to *áśas*-* 'space'. Macdonell (1910:224–6) suggests that these forms all belong to parallel *ā*-stems, rather than *s*-stems. Indeed, clear instances of *ā*-stems stand alongside *áśābhyas*, *apsarā́bhyas* (AVŚ 2.2.5, 7.109.2), and *uṣā́bhyām* (VS XXI.50): a nom./acc.pl. *áśās* (7× RV), a loc.pl. *apsarā́su* (AVŚ 2.2.3),[20] and an acc.sg. *uṣā́m* (RV 1.181.9b, 10.68.9a).

To generate this set of forms through a four-part analogy based on neuter *s*-stems is also straightforward. Since the *bh*- case forms of neut. *s*-stems are interpretable as the nom./acc.sg. plus an ending (because the nom./acc.sg. is equivalent to the stem), the *bh*- case forms of some animates could be built likewise:

(17) nom./acc. /mánas/ : *bh*- case /mánas#bh-/ :: nom. /uṣā́s/ : X, where X is solved as /uṣā́s#bh-/ → [uṣā́bh-].

To analyze the forms given above as continuing *[əz#bʰ] is thus unnecessary, since they admit of several alternative explanations.

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19 For some systematic attempts at grasping "contamination" and "blends" see Lehrer 2003, Gries 2004, and Lavrova 2007.

20 The only possible synchronic Vedic UR for *apsarā́su* is /apsarā́-su/ (*ā*-stem); an underlying /apsarás-su/ would surface as ˣ*apsarássu* (cf. *vakṣássu* to *vakṣás*- 'chest, breast', 4× RV). In PIE or PIIr., where identical adjacent segments were not licit in surface forms, the simplification of underlying heteromorphemic geminates never results in CL (cf. PIE */$h_1$es-si/ → *[h_1é.si], not ˣ[h_1ḗ.si]).

4. Summary

We may thus conclude that the genuine developments of PIIr. *[əz] and *[əž] in Vedic were as follows:

1. *[əz], *[əž] > *[əː] > *e*. This is just a special case of *[əC] > *e*, where *C* may be any consonant, lost for whatever reason (cf. *bhej-*, *pec-*, *śek-* discussed in §2 and Sandell 2013).
2. *[u̯əž] > *[u̯əː] > *vo*. Presumably also *[u̯az] > *vo-*, but no examples exist.
3. *[əz#$C_{[+voice]}$] > *o* (usual external sandhi preceding a voiced consonant) or *e* (*sū́re duhitā́*/*dhā́tā*).

Developments 1 and 2 happily bring the behavior of compensatorily lengthened */a/ into line with the behavior of other compensatorily lengthened short vowels from the loss of voiced sibilants.[21] Only the distribution of *o* and *e* in the third development still lacks an explanation. In this case, the evidence from gen.sg. *sū́re* and the nom.sg. *-e* of *a*-stems in "Eastern" Indic (e.g., Māgadhī, Ardhamāgadhī *putte* 'son') is too strong to dismiss.[22] We therefore require a nuanced account of the development of *[əz] in external sandhi, that can generate both *o* and *e* vocalism without making incorrect predictions for the word-internal cases already considered. Building on the results here, I will further pursue this problem elsewhere.

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21 The conclusion that compensatory lengthening of PIIr. */a/ regularly gives Ved. *e*, most likely via *[əː], also provides further confirmation that */a/, at least in Proto-Indic, was realized as *[ə]. For the purposes of this paper, I have assumed that PIIr. */a/ was also realized as *[ə], but this assumption should seek confirmation in Iranian as well.

22 On the nom.sg. *-e* of *a*-stems, see generally Pischel 1900:§§17 and 345; Balbir 1989:505–6 on "ardhamāgadhisms" in Jaina Māhārāṣṭrī; Norman 1989:370–1 and Oberlies 2001:141–2 on its presence in Pāli; Bloch 1950, Introduction §4, and Caillat 1989b:428 on this feature in Aśokan inscriptions.

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