The development of Indo-Iranian voiced fricatives

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February 16, 2024

Abstract

The development of voiced sibilants is a long-standing puzzle in Indo-Iranian historical phonology. In Vedic, all voiced sibilants are lost from the system, but the details of this loss are complex and subject to debate. The most intriguing development concerns the word-final *-aḥ* to *-o* in sandhi. This paper presents a new account of the development of voiced sibilants from the Proto-Indo-Iranian period to Vedic with a special emphasis on Iranian comparative data. I propose a new explanation for the peculiar development of word-final voiced fricatives and motivate the new proposal with a phonetic explanation. I argue that *-s* lenited and voiced to *-ɦ* word-finally which colors the preceding short vowel *ă* to *ɔ* (*o* after lengthening). Word-internally, no debuccalization occurs. Voiced dental fricative *z* colors the preceding *a*-vowel to *ɛ* (*e* after lengthening). The voiced retroflex fricative *ẓ*, on the other hand, is central enough to cause no coloring. Voiced fricatives thus color the preceding vowels with respect to their place of articulation. Dental fricatives cause fronting, while breathiness causes backing, which is supported by typological data. This proposals explains several unusual aspects of Vedic and Avestan data.

1 Introduction

1.1 Indo-Iranian

Proto-Indo-Iranian had two voiced sibilants in the word-internal position: *z* [z] and *ž* [ʒ] (<*z* in the ruki-position) that go back to Proto-Indo-European (PIE) *s* before a voiced stop. This is confirmed by Avestan, where both sibilants are preserved, e.g. Av. *zdī* <*h₁z-dhí*; *mižda-* <*mižd^h á-* <*mizd^(h)ó-* (AiG I 273-275; Hoffmann and Forssman 2004²:104-105). There are two additional sources of voiced sibilants. First, *z* results from a cluster *dd^(h)* that yielded *dzd^(h)* and after the deocclusion resulted in a cluster *zd* in Avestan (e.g. YAv. *dazdi* <*dadd^h i*[1]; Mayrhofer 1986:110-111). Second, *ž* results from PIE palatals before voiced dental stops. The voiced dental stop can go back to a voiceless stop that results from Bartholomae's law (e.g. Av. *važdra-* <*vaǰd^(h)ra-* from the PIE root *u̯eĝ^(h)-* and the suffix *-tra-*).

Beside the plain voiced sibilants *z* and *ž*, there were also their aspirated counterparts *z^h* and *ž^h* in Proto-Indo-Iranian, which were the result of Bartholomae's law and, in case of *ž^h*, of the ruki-rule. Thus, *d^h s* first yielded *dz^h* and, after the loss of the dental stop and aspiration, resulted in a plain unaspirated voiced fricative Av. *z* (*uruuāza-* <*u̯rād^h sa-*). Further, *g^(u̯)h s* yielded *gž^h* which was deaspirated to ɣž, whereas *ĝ^h s* yielded *ǰž^h* which resulted in a plain *ž* after the deocclusion of palatals (Mayrhofer 1986:119;

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[1] In Vedic, *z* from in *dzd* (< *dd*) is lost regularly (*s* (*z*) > ∅ / T‿T). In *dhehí* and *dehí*, however, the first *d* of the *dzd* cluster was lost, likely due to the dissimilation as both words begin with another voiced dental stop. The dissimilation must have occurred before the operation of the *s*-loss (*s* (*z*) > ∅ / T‿T). *d(h)addhí* thus yields *d(h)azdhí* and further *d(h)ehí* with the regular *e* for *az* (Hoffmann 1956:21; Mayrhofer 1986:111).

Hoffmann and Forssman 2004[2]:95, 104-105). Likewise, *$b^h s$ yields Av. *βž*, since the ruki-rule operates also after labials in Avestan (Av. *drafša-* vs. Ved. *drapsá-*). At the Indo-Iranian stage, the fricative in this position likely did not yet undergo the ruki-rule (Proto-Indo-Iranian *bz^h < PIE *$b^h s$).

The development of the aspirated voiced sibilants is fairly unproblematic—in Avestan they get deaspirated and remain voiced.[2] In Vedic, on the other hand, they always appear in their devoiced and deaspirated variant *s*. This *s* could either be analogically introduced (Mayrhofer 1986:119), or it could be the result of a regular deaspiration and devoicing of *z^h and *$\acute{z}^h$ to *s* and *ṣ* (Schindler 1976:630), which is a more probable explanation.

In the final position which includes both the pre-pausal word-final position and the final position of first members in compounds, voiced sibilants always result from final voicing or voicing assimilation if the sibilant appears before a voiced stop. Avestan and Vedic data suggest that final voicing is likely of Indo-Iranian age, at least in compounds, e.g. Ved. *dur-itá-*, Av. *duž-ita-* (<*dus-ita-*), *duž-niδāta-*, *ərəž-uxδa-*, etc. Whether voicing in word-final position before word boundary occurs already at an Indo-Iranian stage is an open question. In Vedic, obstruents are always voiced before word-boundaries, e.g. *yád aṅgá* for *yát aṅgá*. Avestan and Old Persian, on the other hand, never feature voiced obstruents in these positions.[3] While this can be due to pada-pāṭha-like transmission of Avestan and Old Persian, there is no strong evidence suggesting that final voicing in the pre-pausal position operated already at the Indo-Iranian stage. It is possible that final voicing operated only in compounds in Indo-Iranian (e.g. in compounds such as *$duž$-ita-*) or in analogical formations such as Av. *īžā-*, *yūžə̄m*), whereas voicing before word boundaries would be a later Vedic innovation. Voicing is not unexceptional even in compounds in Iranian, e.g. Y 1.31.12 *miθahuuacah-* and *ərəšuuacah-*.

1.2   The development in Iranian and Indic branches

Word-internal voiced sibilants are generally preserved in the Iranian branch, with the exception of aspirated sibilants that get deaspirated (*z^h and *$\acute{z}^h$ to *z* and *ž*). In the final position, *z* and *ž* are preserved in compounds (e.g. YAv. *duž-ita-*, *x^v arənaz-dā-*, OP. *Vahyaz-dāta-*).[4] No voiced consonants are attested in the pre-pausal position. There are two variants of word-final *-as (or *-ah) in Avestan: *-ə̄* and *-ō*. Word-final *-ās (*-āh) yields *-ā̊*. In Old Persian, word-final *s is lost, but the preceding vowel (if originally short) does not lengthen (cf. Hoffmann and Forssman 2004[2]:63-64; de Vaan 2003:429-461; Brandenstein and Mayrhofer 1964:42).

In Vedic, on the other hand, all voiced sibilants undergo significant changes. First, *ž undergoes a context-free retroflection to *ẓ (parallel to *š > ṣ).[5] The retroflex voiced fricatives are later lost, but their presence is reflected on the following dentals (e.g. *mīḍhá- <*miẓḍhá-*). Word-internally, *z and *ẓ are then lost with compensatory lengthening. The outcome of lengthening differs based on the preceding vowel. The sequence *az yields *e* word-internally, *-a* word-finally before vowels, and *-o* word-finally before voiced consonants. The sequences *iz and *uz yield long *ī* and *ū* word-internally and *ir* and *ur* word-finally before voiced consonants and vowels.[6] Likewise, *r̥z yields a metrically long *r̥* in the word-internal position. The sequence *aẓ yields either *ā*, *o*, or *e* word-internally and are not attested word-finally (cf. AiG I). In the word-internal position, *ā* is the most common outcome, *o* is the outcome only if *aẓ is preceded by *u̯, and *e* is rare and could be analogical (for a thorough treatment of the sequence *aẓ, see Lubotsky 2000). Long vowels and diphthongs *e* and *o* (<*ai̯ and *au̯) do not undergo any changes after the loss of voiced sibilants.

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[2]According to Hoffmann and Forssman (2004[2]:96), aspirated voiced sibilants are sometimes analogically replaced by their voiceless unaspirated counterpart *s/š* (e.g. YAv. *han-gərəfšāne* to the root √*grab*). In this example the PIE root ends in a laryngeal and not in an aspirated *b^h. Besides analogy, we could also assume that the laryngeal did not cause the preceding voiced labial to aspirate (which would stand in opposition to *dugədar- <*$d^h ugh_2 ter$-*, where precisely this happens).

[3]E.g. word-final *-š* is never written as *-ž*, likewise we only get *-t* as word-final variant of *t*.

[4]Old Persian cuneiform does not have a character for *ž*, therefore the evidence for a retained *ž* here comes only from Avestan.

[5]For a detailed study of retroflection of *š*, see Hall (1997).

[6]The sequences *-iz* and *-uz* yield *-ī* and *-ū* word-finally only before words with initial *r*.

In compounds the outcome is twofold: either loss with compensatory lengthening (*mīḍhá-* <**miẓdhá-*)[7] or the development to *r* without lengthening (*dur-itá-* <**duz-itá-*; *agnír námasā* <**agníz námasā*). There are also instances in the Rigveda with the first development even in word-final position (perhaps even in external sandhi), e.g. *dū-ḍábha-* <**duẓ-ḍábha-*; *dū-ṇáśa-* <**duẓ-ṇáśa-*; *svádhitīva* <**svádhitiẓ (i)va*.

2 Prior accounts

Various proposals have been made in the literature to explain the data presented in Section 1. In the following, I discuss the relevant proposals on the development of voiced fricatives. For a thorough overview on the topic, see Malzahn (2001).

Probably the most disputed and still unsolved is the development of word-final **-as* that yields Vedic *-o* before voiced consonants and *-a* before vowels (as opposed to *e* word-internally). In Avestan the outcome of **-as* is *-ō* (and *-ə̄*) (for proposals, see Bartholoae 1888, Marsh 1941, Allen 1962, Lazzeroni 1969, Malzahn 2001).

One of the influential proposals explains the final *-o* (<**az*) as resulting from a diphthong **au̯* with the change of **-z* to **-u̯* (cf. AiG I, 338; Allen 1962). This proposal challenges the assumption that *-o* is the result of compensatory lengthening. The major advantage of the assumption of **z* to **u̯* is that it avoids a pre-Vedic stage with **au̯* on the one and **ō* <**az* with lengthening on the other hand that later merge into *o*. Under other accounts, such a reconstruction is always necessary.

This proposal (**-z* > **-u̯*), however, faces several difficulties. First, after the long vowel *ā*, **z* does not yield **u̯* in word-internal position (e.g. *śaśādhi* from the root √*śās* and not ***śaśaudhi*) or word-finally (e.g. *párvatā nināme* for *párvatāḥ nināme* and not ***párvatau nināme*).[8] Under the assumption of unconditioned **-z* > **-u̯*, we would expect same outcomes as in case of the etymological **u̯*: *yónau ní*. Nevertheless, it can be argued that **-z* develops to **-u̯* only after short vowels.

More problematic is the fact that the assumed **u̯* (<**z*) does not behave the same as the etymological **u̯* even after the short vowel *a*. Although **az* and **au̯* both yield *o* before voiced consonants, they show different outcomes in the position before vowels. Thus, **au̯* V yields *av* V, whereas **az* V yields *a* V without a glide, e.g. *sūnav āhuta* for *sūno āhuta* vs. *ádeva āpad* for *ádevaḥ āpat*. The same is true for compounds: *pura-etí̄-* for **puras-etí̄-* vs. *gav-iṣá-* for **gau̯-iṣá-*.

The only context in which **z* and **u̯* do show the same outcome in the pre-vocalic position is before the short vowel *ă*, e.g. *vo amba* for *vaḥ amba* vs. *vādhvaryo ándhasaḥ* for *va vādhvaryo ándhasaḥ*. Both also show variants with the initial *a* dropped, the so-called abhinihitasandhi, e.g. *no 'vitá̄* for *naḥ avitá̄* and *vaso 'smá̄n* for *vaso asmá̄n*. This is clearly a later development which is also confirmed by the meter (cf. AiG I, 323-324), since *-o '-* (<**az a* and **au̯ a*) is scanned as two short syllables 1462-times out of 1883 occurrences (77.6%) in the metrically restored text (cf. van Nooten and Holland 1994: v).[9] Disyllabicity and quantity were thus preserved as suggested by the metrical evidence, but later the newly introduced *-o* was scanned as long (421 occurrences or 22.4%). The same is true for the sandhi of *-e + a-*: *e* is scanned short 549-times and long 173-times (see van Nooten and Holland 1994: v). Presumably, the abhinihitasandhi *-e '-* and *-o '-* are the results of contraction with an inter-mediate stage **ee̯e* and **oo̯o* (Allen 1962:37-45). This

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[7]Only rarely is lengthening in the literature explained by an intermediate stage of **z* to *i̯* (**iz* > **ii̯* > *ī*) or to *u̯* (**uz* > **uu̯* > *ū*).

[8]Word-final **āz* and and **āu̯* yield different outcomes in the position before vowel as well, e.g. *áyā iva* for *áyāḥ iva* vs. *sámitāv iva* for *sámitau iva*. However, before the vowel *ŭ* the outcome is the same, because *v* in *āv* is dropped. *v* is also dropped in the Maitrāyaṇi-Saṃhitā (AiG I, 326).

[9]Further evidence that the original sandhi outcome before *a* was same as before any other vowel (i.e. *-a* V- for *-e* V-; *-av* V- for *-o* V-, and *-a* V- for *-aḥ* V-) can be seen from the sandhi RV 8.72.5 *stótava ambyàm* for *stótave ambyàm* where the original outcome is assumed to be preserved. On the other hand, *-o* for **az* before *a* is sometimes spread to positions before vowels, e.g. in compounds *gó-r̥jīka-* and *gó-opaśa-* (cf. AiG I, 324-325). This *o* is in both compounds scanned as short: the first compound is attested in the break and the latter in the cadence.

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explanation has advantage over the one that assumes analogical transfer of *-e* and *-o* from positions before voiced consonants after the elision of *a-*, mainly because of accentuation. The contracted vowel gets the svarita accentuation (*yajñò 'yám* for *yajñáḥ àyám*), which speaks strongly in favor of Allen's (1962:37-45) assumption. In any case, this outcome is clearly secondary and not decisive for a historical account.

According to the explanation with the glide intermediate stage (*-aṷ* <*-az*), the word-internal outcome of *-az*, *e* (e.g. *edhí* for *-az-dhí*) can also be explained via an intermediate stage with a diphtxhong *-az* > *-aị* > *e*. However, it is difficult to motivate why *z* would yield *ị* word-internally and *ṷ* word-finally. Additionally, RV 1.34.5d *sū́re duhitā́* for *sū́raḥ duhitā́* *z* suggests that *e* can be the outcome of *-az* also word-finally.

Allen (1962) assumes that *-az* yields *-ay* in the pre-vocalic position (e.g. *-az* V- > *-ay* V- > *-a* V-), whereas pre-consonantally the *-az* sequence yields *-av*, from where it is analogically transferred to positions before *a-* (according to his assumption *-e-* <*-ay a-* would be the expected outcome).

Bartholomae (1888:572-573) assumes *e* and *o* to be the regular outcomes of *aς* before voiced consonants. This *aς* is transferred from the pausa position, where it was a pre-stage of the later visarga, therefore something like a weakened sibilant. The color of the vowel *e* vs. *o* is assumed to either depend on the preceding consonantal context or on the accent. However, no further explanation for such a distribution is given.

A problematic explanation is given in Marsh (1941), where it is assumed that word-final and word-internal *-az* yields *e* (through *-aị*), whereas word-final and word-internal *-aẓ* yield *o* (through the intermediate stage *-ɔ̄*). Thus, all word-final *-o* (<*-as*) are explained by an assumption that *-az* was developed to *-aẓ* before all voiced phonemes. Not only is this explanation phonetically unmotivated, the regular development of *-aẓ* (unless after *ṷ*) is not *o*, but rather *ā* (as has been shown in Lubotsky 2000).

Some proposals allow dialectial origins to underlie the different outcomes of *-az* (*e* and *o*) (Kobayashi 2004:49), probably on the basis of the distribution of *-e* and *-o* in Middle Indo-Aryan. The dialectal origin hypothesis is less successful in explaining the systematic phonological context differences between the two outcomes.[10]

Recently, a new account of the development of Indo-Aryan *-o* was proposed in Smith (2010), which takes the allophonic variation of visarga as the source of the different outcomes (*e* and *o*). According to this assumption, *z* yields *ị*, *ẓ* yields *r* and the voiced counterpart of upadhmānīya (*φ*) yields *ṷ*. The latter outcome is then analogically transferred to positions where the first outcome would be expected. According to Smith (2010), there are some remnants of the first outcome in RV 1.34.5d *sū́re duhitā́* and in Middle-Indo-Aryan languages. However, this account has problems explaining why we have *vódhar-* <*ṷáẓdʰar-* instead of **ṷárdʰar-*. Likewise, the development of the fricatives to *ị*, *ṷ*, and *r* does not happen after long vowels for *ị* and *ṷ*, but it does occur after long vowel for *r*. Also, the fact that *-az-* before the *bh*-cases appears as *o* (and *-ẓbh-* as *-rbh-*) is not a strong argument in favor of this account, since the *bh*-cases often feature analogical outcomes from the nominative case.[11]

Sandell (2014) proposes a different analysis. According to Sandell (2014), the regular outcome of both *-az* (*-əz*) and *-aẓ* (*-əž*) is Vedic *e*. Unlike Lubotsky (2000), Sandell (2014) considers *tṛṇedhu* to be the only regular outcome of *-aẓ*, while all outcomes with *ā* are considered analogical. As we be argued in this paper, the *ā* outcome of *aẓ* is phonetically motivated and thus does not require analogical explanations. Additionally, *tṛṇedhu* has two convincing explanations (Milizia 2004, Sandell 2014).

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[10]The assumption that *e* and *o* represent the lengthened vowels *ĕ* and *ŏ* (<PIE *e* and *o*) before they merged to *a* (Bloomfield 1882) is improbable.

[11]See also the discussion on jihvāmūlīya and upadhmānīya below.

3 A new proposal

3.1 Evidence for *ɔ and *ɛ

As already mentioned, there are two sources for IIr. *$z̩$ in word-internal position: either *$z̩$ is the result of the ruki-rule or the result of the sequence palatal + voiced stop. In the first case, only *i*, *u*, and *r̩* can be lengthened, because they are the only short vowels that cause the ruki-rule. In the latter case, however, we also get lengthening of the short vowel *a*. The result of this lengthening can either be *ā*, *o*, or *e*, e.g. *sā́dhar-* <*sáz̩d̩har- <*seĝʰter-; *vódhar-* <*u̯áz̩d̩har- <*u̯eĝʰter-; *tr̩nédhu* <*tr̩náz̩d̩u <*(s)tr̩neĝʰtu. As it was shown in Lubotsky (2000), the regular outcome is *ā*. It is thus clear that for the loss of *$z̩$ no intermediate stage with glide (*$i̯$ or *$u̯$) is possible. However, beside *ā*, there is also an attestation of *e* in the imperative form once in the Atharvaveda, e.g. *tr̩nédhu*, which is probably analogical to other imperatives in *edhí*, *d(h)ehí* (thus Lubotsky 2000).

On the other hand, we also can have the regular outcome *o* if *$u̯$ precedes the sequence *$az̩$ (e.g. *vódhar-*). This development proves that Vedic *o* is not necessarily the result of monophthongization, but can as well be the result of compensatory lengthening of *a* [ə] (under certain conditions). In this case, *$u̯$ obviously caused the following vowel in the sequence *$az̩$ [əz̩] to be backed and rounded *[ɔz̩] which after the lengthening yielded *o* [ɔ̄] (Lubotsky 2000 and the literature therein). This also shows that we have to posit a stage in pre-Vedic with *$au̯$ and *ɔ̄ that later merged.

The *(v)o* <*u̯az̩ development cannot be explained through a diphthongal intermediate stage with *$au̯$. It is clear that *$z̩$ does not develop into a glide, at least not to *$i̯$ or *$u̯$, since the regular outcome of *$az̩$ is *ā* (e.g. in *sā́dhar-*). The only possible scenario would be to assume an ad hoc unexplained dissimilation of *$z̩$ to *z, which would yield *$i̯$ and further to *$u̯$ because of the preceding *$u̯$. This, however, is unlikely, as such dissimilation is never found elsewhere (e.g. *véda* <*u̯ái̯da). The *(v)o* <*u̯az̩ development thus shows that Proto-Vedic *a* [ə] can get colored to *ɔ and then lengthened to *ɔ̄ after the loss of the voiced sibilant.[12] The coloring of *a* which gets lengthened to *o* is a crucial independent evidence for our proposal which will derive different outcomes in Vedic and Avestan via vocalic coloring.

Parallel to the development of *o*, we can now assume *e* to be the result of compensatory lengthening of *ɛ̄ <*az̩ that later gave the same outcome as the monophthongization of *$ai̯$, i.e. Ved. *e* (e.g. *edhí*).

3.2 A unified account

Vedic word-final *-s* regularly yields *-ḥ* in the pausa position, as well as before velars and labials if not in close syntactic position. Elsewhere, *s* is preserved in Vedic. The same lenition is attested in Iranian, but there the change is not limited to word-final position: *s* > *h* (Av. *həntī*, OP. *haⁿtiy* < *santi). Word-finally, *-h* is actually lost both, in Avestan and Old Persian, whereas it is generally preserved in the word-internal or word-initial position.

The only place where we have an Indo-Iranian word-final *-s* preserved with only minor modifications in Iranian is before the dental *t* (Avestan), palatal *c* (Avestan and Old Persian), and *n* (Avestan) in close syntactic positions, e.g. Av. *kas-tē*, *kas-cīt*, OP. *kaš-čiy*,[13] Av. *kas-nā*. This closely resembles the Vedic situation, where *-s* or *-ś* is the regular outcome before *t(h)* and *c(h)*, respectively. The difference is that in Vedic *-s* is sometimes preserved also before *k(h)* and *p(h)*,[14] whereas this is never the case in Iranian.

Given the similar outcomes of Iranian *s* > *h* and Vedic *-s* > *-ḥ*, we can posit that lenition of *s* first targets word-final position in both Vedic and Iranian. In Iranian the tendency of sibilant lenition then spread

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[12] Vedic *a* can also be lengthened to *o* in a reciting pronunciation, e.g. TS III 2.9.5 *móda ivéti* for *máda ivéti* (Hoffmann 1975), but this will not be of great importance for the discussion here.

[13] Here, the sibilant is *š* and not *s*, similar to Vedic *-ś c-* for *-s c-*.

[14] For a detailed study on sequences *-s p(h)-* and *-s k(h)-*, see Hale (1990).

from the word-final position to word-internal position,[15] whereas in Vedic, the tendency of lenition spread to word-final *-ṣ (that develops to -ḥ),[16] but not to word-internal sibilants.[17] We can thus assume that Indo-Iranian word-final fricative was lost in Iranian precisely because it was lenited considerably earlier than the sibilant *s in word-internal and initial position.[18] On the other hand, In Indo-Aryan, the tendency of lenition spread to word-final *-ṣ instead. This could also happen late in the pre-Vedic period.

The Indo-Iranian stage and the corresponding developments to Indo-Aryan and Iranian are represented in the Table 1.

Table 1: Voiceless sibilants in Indo-Iranian

	Indo-Iranian		Indo-Aryan		Iranian	
	*s	*š	*s	*š	*s	*š
word-internally[19]	*s	*š	s	ṣ	h	š
word-finally[20]	*s/ɕ	*š	h	h	*h> ∅	š

The lenition of *-s is difficult to chronologically estimate in the two branches. Here, I propose that word-final *-s can potentially weaken to *-h (or a pre-stage of *-h) already at the Indo-Iranian stage. Despite the external evidence that I provide here, this cannot be definitely proven. It is also possible that the *-s > *-h sound change operated independently in the two branches.

External evidence for the chronology is somewhat problematic. In Assyrian we find a god name ᵈas-sa-ra ᵈma-za-áš (Lipp 2009:319). We see that the internal sibilant is preserved as such and written with the double geminate -ss-. On the other hand, the final sibilant is written with -š. This -š could potentially have represented a pre-stage of the Iranian weakened *-h, perhaps a palatal *ɕ.[21] The Assyrian ᵐᵃᵗPar-su-aš (in Streck 1900:308) potentially support such a reconstruction with <-š> representing a weakened variant of [s]. If the word goes back to Iranian nominative form *pārćuas and its <š> is not influenced by Kassite iaš 'land'[22], the š could indeed represent a weakened *-s, probably a fricative articulated somewhere between [s] and [h] (perpahps a palatalized fricative). Because Ir. *ć in ᵐᵃᵗPar-su-aš would have already developed to the sibilant *s,[23] the final *-s also had to already have undergone lenition. Thus, Assyrian assara mazaš could represent something like *asura mazdāɕ that later develops to the fully debuccalized *asura mazdāh. Sound changes that turn a dental or alveolar into post-alveolar sibilant are well attested in Kümmel (2007), both in the coda position or unconditioned. The fact that Parsuaš has also a more frequent variant Parsua could exemplify the loss of *-h. External evidence for the chronology of *-h is thus not definite, but can

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[15] Sibilant s word-internally is in Old Persian preserved before stops. In Avestan, it is preserved before stops and n and after t that is later lost (cf. Brandenstein and Mayrhofer 1964:42; Hoffmann and Forssman 2004²:104). Elsewhere, *s is lenited to h.

[16] Before k(h) or p(h), ṣ is preserved in 7.5% of instances in the Rigveda, whereas in other 92.5% it is lenited to -ḥ. Before a following t(h)- ṣ can either appear as ṣ or s. The ratio of -ṣ ṭ(h)- vs. -s t(h)- in external sandhi is 23.6% vs. 76.4% in the Rigveda (Beguš 2012). For a detailed study, see also Hale (1990).

[17] Occasionally, the development of s > h is found also in Indo-Aryan branch in later languages, e.g. Aśoka dāhiṃti, dāhāmi for Skt. dāsyāmi, Māgadhī kāmāha for Skt. kāmasya. However, the distribution and conditions are unclear (see von Hinüber 2001²:178).

[18] That lenition of Iranian *s to h is not a recent development is shown by the fact that s is not lenited in positions (i) after dental t that is later lost because of the TS-cluster simplification, e.g. Av. masiia- <*matsiia-, stauuas <*stauuats; (ii) before a dental that is later lost because of simplification of word-final clusters, e.g. ās <*āst; and (iii) s that is the result of a deaffrication of PIE palatal, e.g. satəm <*tsatam <*ḱm̥tom. This means that the lenition is earlier than all these three phenomena.

[24] With the exception of positions before stops and before n.

[20] Before k(h) and p(h) with the exception of close syntactic positions and in pausa position.

[21] Bartholomae (1888:571) suggests that weakening to what he reconstructs as *aɕ is already an Indo-Iranian phenomenon, but does not provide the external evidence. He remains agnostic about the phonetic value of this *ɕ.

[22] For the explanation with nominative, see (Jensen 1894:476); for explanation with Kassite iaš 'land', see Streck (1908:256).

[23] For treatment of the form and argumentation that Assyrian s here goes back to sibilant, see Lipp (2009:322).

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potentially suggest that word-final *-s in weakened to a post-alveolar or palatal fricative which represent the first step in the development towards the fully debuccalized *-h. Regardless of whether the lenition is a common innovation or happens independently on the two branches, the newly proposed account still explains the data equally well.

Another change occurred in the history of Indo-Iranian: word-final voicing. Establishing its chronology is not trivial either. Voicing of consonants is attested in the word-final position in both branches in compounds. It is reasonable to assume that voicing was already an Indo-Iranian phenomenon in compounds. However, it is not clear whether this was also the case in external sandhi. Avestan and Old Persian generally never show voicing in external sandhi, but this can also be due to the pada-pāṭha-like transmission of the texts. There are few examples in Avestan that seems to show voicing, e.g. *ad-āiš* < *aṯ āiš* (Hoffmann and Forssman 2004[2]:112). However, the particle *aṯ* probably goes back to ablative of a demonstrative which had a voiced dental *ad* (see EWAia I:163). On the other hand, for *īžā-* and *yūžə̄m* it is clear that voicing must have occurred, but it uncertain whether the voicing here indeed originates in external sandhi. On the other hand, if Av. *ciθə̄ṯ* goes back to *cīṯ īṯ*, it would speak against voicing in external sandhi in Avestan. The evidence is, however, sparse and no strong conclusion can be made. Again, the exact chronology of final voicing does not crucially affect our proposal as long as it is active after the lenition of *-s.

Given all these facts, we can thus assume that the Indo-Iranian stage with word-internal *-s-, word-final *-s (that further weakens to *-ç/h), word-internal *-š-, and word-final *-š (see the Table 1) continued unchanged into the Indo-Aryan period, except that the lenition of word-final *-s to *-h is completed by Indo-Aryan. Word-internally, there were also voiced counterparts to these sibilants (*-z- and *-ž-) in the position before a voiced consonant. From a certain point on, I argue that final voicing targeted not only stops, but word-final sibilants and *-h as well.[24] I propose that we can reconstruct voiced *-ɦ and *-z (voiced variants of -h and *-s) besides the voiced *ž (counterpart of -ṣ) which remains unweakened in the word-final position. I assume that voiced *-z was the regular outcome of the word-final *-s in close syntactic positions and before the dental *d(h)*, which would be exactly parallel to -s in close syntactic positions and before *t(h)* in non-voicing environments. On the other hand, just like -ḥ was the outcome in pausa and before *k(h)* and *p(h)*, I reconstruct *-ɦ to be the outcome before *g(h)* and *b(h)*, as well as before vowels, nasals and glides (because of the final voicing) in non-close syntactic positions. Table 2 shows the assumed system for Indo-Aryan. Note that this voiced *-ɦ (<*h) did not merge with voiced *h* (<*ĝʰ). At the time of *-ɦ (<*-h), *ǰʰ (<*ĝʰ) was probable still an affricate. When, however, *-ɦ was regularly lost, *ǰʰ deaffricated and filled the empty slot in the phonological system.

Table 2: Sibilants in Indo-Aryan

	word-internally		word-finally			
			close syntactic position and before t(h)/d(h)		elsewhere	
	*s	*š	*s	*š	*s	*š
voiceless	s	ṣ	s	ṣ[25]	h	*ṣ
voiced	*z	*ẓ	*z	*ẓ	*ɦ	*ẓ

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[24] We could also assume voicing first (*s > *z and *š > *ž) and then lenition *z > *ɦ, but this is probably less likely.

[25] The outcome of -ṣ can also appear as dental *s* before *t(h)*. This is probably a later assimilation. The ratio of -ṣ vs. -s in this case is much higher to that of -ṣ vs. -h before *k(h)* and *p(h)* in the Rigveda: 23.6% vs. 7.5% (cf. Beguš 2011). See also fn. 16.

[30] Before occlusives and *n*, *ṣ is preserved as *s*.

[27] Avestan word-final *ž is seen only in compounds and never in external sandhi.

Table 3: Sibilants in Avestan

	word-internally		word-finally			
			occasionally in close syntactic position before t, c, and n		elsewhere	
	*s	*š	*s	*š	*s	*š
voiceless	h[26]	š	s	š	?	š
voiced	z	ž	/	/	?	ž̌[27]

In the following, I reconstruct the development from the Indo-Aryan stage (Table 2) to the attested Vedic system. The crucial difference from the prior explanations (as in AiG I) is that I propose an early lenition of *-s to -ḥ which consequently gives two voiced outcomes of *-s: *-z and *-ɦ. I argue that this reconstructions explains the peculiar vocalic outcomes (-e and -o) better than alternative approaches.

The voiceless series (in the Table 1) generally remains unchanged. The final *-ṣ is, however, lenited to -ḥ if not in close syntactic position. This can be understood as spreading the tendency of final sibilant lenition from *-s to *-ṣ.

3.3   Coloring

All reconstructed fricatives in the voiced series (*z, *ẓ, and *ɦ; Table 2) are lost without exception in the pre-consonantal position with compensatory lengthening of the preceding vowel. The outcome of the lengthening of the preceding vowel depends crucially on the place feature of the lost voiced fricative. The high vowels and ṛ do not change their quality. Also, the long vowel ā remains unchanged. Short ă [ə], however, gets colored according to the following consonant: (i) a [ə] is fronted to [ɛ] before dental *z and yields e [ɛ̄] after lengthening; (ii) before glottal *ɦ, a [ə] is backed to [ɔ] that yields o [ɔ̄] after lengthening; and (iii) a [ə] before *ẓ does not change the place feature, since the retroflex *ẓ is central enough (middle stage between *z and *ɦ) for a to be preserved and lengthened to ā. If, however, *aẓ is preceded by *u̯, a [ə] gets also backed, which again yields o [ɔ̄].[28] Before the retroflex -r (i.e. homorganic to *ẓ) in front of the following r-, a is lengthened to ā without the change of quality, which is precisely the same outcome as in lengthening before *ẓ.

There is a clear phonetic motivation for the proposed coloring. Pongweni (1983) shows that in Shona (Bantu), breathy vowels that result from the preceding [ɦ] cause F2 to decrease, especially in central vowels. In other words, breathiness of [ɦ] causes backing of the vowel. Similarly, Samely (1991) shows that breathy vowels are more back than modal vowels in Kedang, an unrelated Austronesian language (see also Kuang 2011). Esposito et al. (2021:375) give a potential phonetic explanation: "During breathy phonation, the larynx may be lowered, lengthening the vocal tract and, thus, lowering formant frequencies." This is precisely what is reconstructed for Vedic: *-ɦ < *-h causes breathyness of the preceding vowel, which in turn causes backing of a [ə] to [ɔ], similarly to the backing of [ə] to [ɔ] under the influence of *u̯ in vódhar-. Lotto et

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[28]Osthoff (1884:37) assumes visarga to be analogically transferred from positions before k(h) and p(h) to positions before voiced consonants where it was voiced to *ḥ (voiced laryngeal counterpart to visarga), which probably further developed to *u. My explanation differs in the assumption that visarga was not necessarily analogically transferred, but can be the result of earlier lenition of word-final *-s. Moreover, no development to *u is needed, although this possibility is not completely abandoned in my analysis. Also, in my opinion, the proposed explanation here better captures the differences in quality of vowels. Osthoff (1884) also assumes that *az and *aẓ (or *aẓ, respectively) yield *ai̯, which is different from my assumption. Especially improbable is the assumption that both *z as well as *ẑ yield the same outcome i̯ (see the discussion above).

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al. (1997) additionally show that breathiness also affects perception: breathy vowels are perceived as higher than non-breathy vowels, which would again point support our proposal. The assumed small phonetic variation (*ə > *ɔ / _*ɦ) is lost except when compensatory lengthening causes the lengthening of the colored *ɔ vowel. The coloring of *ə to *ɛ is motivated by coarticulatory effects: tongue moves further towards the front in anticipation of the dental articulation, which causes fronting effects on the preceding vowels.

The proposal above has the advantage of explaining the distribution of word-internal *e* vs. word-final *o* <*az* in the pre-consonantal position. Thus, we have *edhí* for *ɛzdhí <*azdhí* and *áśvo náyamāno* for *aśvoɦ náya○ <*aśvaɦ náya○*. Moreover, we know that -*s* was not lenited to -*ḥ* in close syntactic positions and before *t(h)*. This further means that in these positions after the voicing, we only have *-z* (and not *-ɦ*). As a consequence, we can now explain the unusual outcome -*e* in the external sandhi in RV 1.34.5d *sū́re duhitā́* for *sū́raḥ duhitā́*. This unusual sandhi was probably a remnant of the *sū́rɛz duhitā́ <*sū́raz duhitā́* where *z* is preserved before *d* like *s* is preserved before *t(h)*. This would be the only case of this kind in the Rigveda,[29] which means that later the outcome -*o* from 'elsewhere' (i.e. non-close syntactic positions) was generalized. However, that -*e* <*-az* was once much more spread could also be suggested by some Prākrits which generalize the close sandhi and *d(h)*-outcomes -*e* to other positions (e.g. Māgadhī). Others generalize the -*o* variant (Pāli, Māhārāṣṭrī; cf. von Hinüber 2001[2]).[30]

As already mentioned, examples like *sā́ḍhar-* <*sázḍhar-* and *antā́ ródasī* for *antár ródasī* show that *ẓ* and *r* were central enough not to cause any changes on the preceding vowel, unless it was preceded by *u̯*, which yields the expected *vóḍhar-* <*u̯óẓḍhar-*. Also, the long vowel *ā* after *z*, *ẓ* or *ɦ* does not undergo any changes. This is, however, expected, since it was a low vowel and probably articulatory strong enough not to undergo any fronting or backing.

Loss of voiced sibilants and *ɦ* with compensatory lengthening regularly occurs in the pre-consonantal position, which means not only before voiced stops, but also before nasals and glides. This is confirmed by examples like *dū-ṇáśa-* <*duz-náśa-*. Later, the outcome with *r* was analogically transferred to these positions from the pre-vocalic position (thus already AV 5.11.6b *durnáśa-*). Vedic *dū-ṇáśa-* is perhaps the only certain example of this development in the Rigveda. Another possible instance in the Rigveda could be a very early attested RV 5.7.8b *svádhitīva* for *svádhitiḥ (i)va*. It is unclear, however, which variant of the *iva/va*[31] particle is underyling here. Turner (1970) points out that Middle Indo-Aryan languages show more such examples where the original outcome has not been replaced by the pre-vocalic outcome *r*, e.g. Pkt. *ṇī-ṇēi* vs. *ṇiṇṇaya-* for Skt. *nirṇaya-*.[32] However, these forms could perhaps be the result of simplification of geminates and compensatory lengthening. In any case, the evidence from the compound *dū-ṇáśa-* is strong enough to assume pre-consonantal loss with compensatory lengthening, which includes all consonants, i.e. also nasals and glides.

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[29]Migron (1999) reports another such instance: RV 6.18.14 *divé jánāya*. Traditionally, *divé* is parsed as dative, whereas the translation with genitive clearly has advantages. Word-final *-az* (and not *-aɦ*) here could be the consequence of close syntactic relation (note also the formulaic character) or due to the fact that the following initial consonant *j-* goes back to the affricate *ǰ* [ɟ] that could trigger the retention of *-z* (like -*ś* is retained before *c(h)*- and -*s* before -*t(h)*). However, since the philological status of *divé jánāya* is not yet established with great certainty, I will leave this example out of the main argumentation. For discussion, see also Malzahn (2001:140), where apud Insler and Schindler a possibility of *divé-dive* as *diváz divai̯* (ablative and dative) is given.

[30]Some prakrits even have both. Thus in Ardhamāgadhī, -*e* is the outcome in the nom. sg. forms of *a*-stems, whereas -*o* is the outcome elsewhere (cf. von Hinüber 2001[2]:99).

[31]For a thorough treatment of *iva* and *va* variants, see Malzahn (2001). If the particle was *va*, we would have an archaic external sandhi outcome, i.e. the regular loss of pre-consonantal *ẓ* with compensatory lengthening. If, however, the particle was *iva*, we would assume a unique irregular loss of *ẓ* in the pre-vocalic position (attested only in such instances) and a later contraction of *-i i-* (double sandhi). This double sandhi does occur in the Rigveda (e.g. *vṛṣabhéva* for *vṛṣabháḥ iva*), but the difference in this case is that the loss of (*-ɦ*) here is regular. Another such example could be RV 9.96.15d *urv iva* for *urúḥ iva* (cf. AiG I, 337), but this is a much latter attestation. Here, we would have to assume a reintroduction of *iva* in the place of *va* if we do not want to assume again an irregular pre-vocalic loss of *ẓ*. RV 9.61.10b *bhū́my ā́* is probably a locative (see AiG I, 337; Oldenberg 1912:164).

[32]Cf. also M. *nivaḷ* for *nī-mala-* <*niz-mala-*, Kalasha *niála-* for *nī-yāta-* *niẓ yāta-*(Turner 1970).

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3.4 Loss in the intervocalic position

In the pre-vocalic position, the outcomes differ from the pre-consonantal position.[33] Apparently, *-ɦ was lost without any trace (*ɦ > ∅ / V_V), e.g. *nára ājā́* for *náraḥ ājā́* (*nárɔɦ ājā́*). Also, the preceding short vowel -*a* was not backed, because it was not lengthened and the allophonic variant *[-ɔɦ] was probably lost after the condition (*-ɦ) was lost. The loss without lengthening is the regular result both in compounds and in external sandhi, e.g. *pura-etŕ̥-* (*purɔɦ-etŕ̥-*), *ádeva āpad* for *ádevaḥ āpat* (*ádevɔɦ āpat*)—as opposed to the pre-consonantal positions where sibilants are lost with compensatory lengthening. The metrical evidence also suggests that loss without lengthening was the regular outcome also before the short vowel *a* (*-ɔɦ a- > *-a a-*).

Likewise, *z yields a very different result in the pre-consonantal position from that of the pre-vocalic position. Pre-vocalically, it was rhotacized to *r*, e.g. Ved. *írā-*, (cf. Av. *īžā-*), *dur-itá-* (*duẓ-itá-*), *agnír adāt* for *agníḥ adāt* (*agníz adāt*), etc. The development *z > r includes only an increase of sonority—other features such as place of articulation [+retroflex] and continuity [+continuant] remain unchanged. Rhotacism is typologically often limited to the inter-vocalic position (cf. Kümmel 2007:80-81). Moreover, there are further indications to show that the development *z > r in Vedic was limited to the inter-vocalic position. The later post-Rigvedic[34]) development of *ḍ(h) > ḷ(h) is very similar to that of *z > r. If we connect these two developments, we notice that all voiced retroflex sibilants in Vedic (*ẓ, ḍ, and ḍh) were assimilated to the vocalic environment by increasing sonority. Other features, however, remained the same. Thus, continuant *z became continuant *r*, whereas non-continuant *ḍ* and *ḍh* became non-continuant *ḷ* and *ḷh*. Apparently, this tendency first started on the sibilant *z, and was later spread to the other two voiced retroflex consonants, but was in both cases clearly limited to the inter-vocalic position.

From the inter-vocalic position, the outcome with *r* was spread to positions before all voiced consonants, e.g. *dur-gáha-*, *agnír bhavati* for *agníḥ bhavati*, etc.[35] Only a few compounds and some Middle Indo-Aryan languages preserve the outcome with loss and compensatory lengthening (see above).

The question remains open, what happened to word-final pre-vocalic *z. The instances of inter-vocalic *z were probably very rare. We would expect them only in close syntactic positions before words beginning with vowels. Thus, the reflexes (if they were distinct), were most probably lost.

The fact that some Prātiśākhyas include jihvāmūlīya (ẖ) and upadhmānīya (ẖ) as allophonic variants of the visarga[36] is not problematic for our proposed analysis. To challenge our proposal, we would have to assume that upadhmānīya ([ɸ]; a voiceless bilabial fricative in the position before a voiceless labial) got its voiced counterpart without any intermediate stage, which would prevent *a* [ə] from backing because of its front place of articulation. However, it is unlikely that word-final *-s and *-z would be directly lenited to *-ɸ and *-β in the position before labials *p(h)* and *b(h)*. It was much more likely that *-s was first lenited to -*h* (and then voiced to *-ɦ) and only then further assimilated to the following consonants in external sandhi (-ɸ or -x, respectively, for -*h* or -*ḥ*). We can assume that during this stage, *-ɦ had already been lost, which means that it could not be assimilated to *-β. Also, the fact that not all Prātiśākhyas recognize the allophonic variation of visarga and that there are some deviations in their descriptions, could speak in favor of the assumption that the allophonic variation was a later development.

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[33]The fact that *r* is the regular outcome of *z only in the pre-vocalic position has already been established in the literature—"[s]*icher lautgesetzlich ist* r *für* ẓ *nur vor Vokalen*" (AiG I, 337). Moreover, Brugmann (1897:892) states that "*ž ging vor den Sonorlauten in irgend welchem Umfang, jedendalls vor Vocalen lautgesetzlich in* -r *über,*"which shows that the development to -*r* is not uniformly and strictly limited to the pre-vocalic position everywhere in the literature.

[34]For the discussion on the chronology of the Vedic *ḷ(h)*, see Witzel (1989:165-168).

[35]The pre-vocalic outcome with *r* was spread also to positions before *n*. This *n* in turn was first regularly developed into a retroflex *ṇ* in compounds. However, later in the classical language, the retroflexisation is not operative anymore and we have a dental *n* attested in such instances. The tendency of non-retroflexisation starts already in the Rigveda, where we have one such compounds attested fairly late: *dur-niyántu-* in RV 1.135.9f and in RV 1.190.6b (Beguš 2012:72; cf. AiG I, 190).

[36]For a discussion on visarga and its variants, see Fry (1941) and the literature therein.

The lenition of word-final -ṣ to -ḥ in Vedic probably occurred later than word-final voicing. Otherwise, we would expect **-iɦ V and **-uɦ V to yield **-i V and **-u V instead of the attested -ir V and -ur V (<*-iẓ V and *-uẓ V).

With the established model above, we can also explain the peculiar abhinihitasandhi outcome. The fact that the outcome of the contraction is *o* (and *e*) can give additional evidence that the ă before *ɦ was colored to *ɔ and preserved as such, until it yielded *o* after the contraction (*-ɔɦ a- > *-ɔ ɔ- > *-ɔ̄-; see the discussion above and in Allen 1962:37-45). To be sure, we also have to assume that *i̯ and *u̯ colored the preceding ă, which in turn would yield the same outcome. If we assume *i̯ to be the regular outcome of *-aẓ in the pre-vocalic position, however, we would expect the abhinihitasandhi **-e- and not -o-, as it is attested.[37]

3.5 Summary

In sum, I argue that the lenition of *s to *h started in word-final position, possibly already at the Indo-Iranian stage. After the voicing in word-final position, *h got its voiced counterpart *ɦ. The two other voiced sibilants that already existed in the system were *z and *ẓ. In the pre-consonantal position, these voiced sibilants were lost in Vedic with compensatory lengthening. The preceding short vowel *a* [ə] changed its frontness according to the place of articulation of the following fricative: (i) before *z it was fronted to *ɛ (after lengthening *ɛ̄); (ii) before *ɦ it was backed to *ɔ (after lengthening *ɔ̄); and (iii) before *ẓ and *r* it remained unchanged *a* (after lengthening ā), since the retroflex consonants were central enough not to cause backing or rounding. I have also argued that in close syntactic positions and before *d(h)*, the sibilant was *z, whereas elsewhere it was *ɦ (parallel to -s vs. -ḥ). This explanation has a strong phonetic motivation.

In the pre-vocalic position, on the other hand, the outcomes were quite different. I argue that *ɦ was lost without a trace and that *ẓ yielded *r* that later spread to all positions before voiced consonants with only a few exceptions. This situation (especially for *ɦ) is reminiscent to that of PIE laryngeals that colored neighboring vowels, caused compensatory lengthening in the pre-consonantal position and loss inter-vocalically. However, this is only a typological parallel.

I argue that the loss of *z, *ẓ, and *ɦ proceeded without an intermediate stage with glides.[38] While we cannot completely exclude the possibility that *z and *ɦ were lost through some intermediate stage of *i̯ and *u̯, ie. glides with 'lighter' articulation (laghuprayatna) that merged with the weakened glides in word-final position (*i̯ and *u̯ <*i̯ and *u̯), I argue that this is a less likely explanation. It is true that there are a few sporadic instances from various sources of the post-Rigvedic literature (including some manuscripts) that seem to retain the glide *y* <*z, e.g. *dhī́ray emi* for *dhī́raḥ emi* (Oldenberg 1888:457-459; cf. Weber 1858:252; Witzel 1989:190), but they are probably of secondary origin. Most of the reported instances with *y* are followed by a high vowel *i* or *e*, which speaks in favor of the assumption that the glide *y* here is secondary, caused by the high vowel in the hiatus and not the original remnant of *-z.[39] Witzel (1989:190) also lists a development in the Maitrāyaṇi Saṃhitā and Kapiṣṭhala-Kaṭha Saṃhitā in which final

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[37]Of course one could claim that -o- was analogically transferred from positions before voiced consonants, but for the assumption proposed here, this step is not necessary.

[38]The loss of *ẓ occurred without any inter-mediate stage with glides (see the discussion above).

[39]E.g. *apay iṣya hotar*, *abhibhūyamānay iva*, *nay ehi* (Oldenberg 1888:457), *anāmay edhi*, *tāy imam* (Weber 1856:252, see also Witzel 1989:190). This was observed already in Hillebrandt (1889:417), where *y* is explained as a prothetic consonant, i.e. an influence of the later language, e.g. Pāli *yeva*, *yidaṃ*, Prākrit *jjeva* (cf. also AiG I, 338). Examples from the Sāmaveda, however, show *y* also before initial ă, e.g. *śūkrāy āhutaḥ* for *śukraḥ āhutaḥ*. It is unusual, that *y* here is attested even after the long ā: *saprāthāy āsai* for *saprathāḥ asi* (Oldenberg, ib.). We would expect *y* <*-z to be lost after the long ā, as it is the case in word-internal position. This again suggests a secondary origin of *y* here. Also, it would be problematic to consider phonetic data from the Sāmaveda as decisive for historical analysis. The glide *y* before ă could thus be analogically generalized from positions before *i*, *e*, (Hillebrandt, ib.), or is due to the general tendency of the later language to prevent hiatus by inserting a secondary *y* (for the treatment of such glides in Middle Indo-Aryan, see von Hinüber 2001[2]:208).

-e V́ and *-aḥ* V́ both yielded *-ā* V́ before an accented vowel. However, as Lubotsky (1983) clearly shows, this development must have gone through an intermediate stage *-e* and *-aḥ* > *-ă̆, which was followed by the lengthening in the hiatus if this *-ă̆ was unaccented and in the position before an accented vowel. This is proven by the fact that *-ă̆ in hiatus (before *ŕ̥-*) gets lengthened even if it does not go back to *-e* or *-aḥ*. Consequently, the development *-e* V́ and *-aḥ* V́ > *-ā* V́ in Maitrāyaṇi Saṃhitā and Kapiṣṭhala-Kaṭha Saṃhitā do not show any evidence that the loss of *z* (i.e. *fi* in close syntactic constructions) had an intermediate stage *į̊. On the contrary, it shows that such seemingly archaic developments can actually be much more recent. On the basis of the fact that *y* is mostly attested before *i* and *e*, we can explain instances with *-ay* V for *-aḥ* V as a recent secondary development to avoid hiatus, rather than an archaic preservation of the 'weak' glide **į̊.

3.6 Avestan

With the proposed model above, we can also explain Avestan data, although the situation there is even more complex than in Vedic. Avestan has two reflexes for word-final **-as* (**-ah*): *-ō* and *-ə̄*. The latter is attested only in Old Avestan and in pseudo-Gāthic texts. In the Gāthās, we have eight monosyllabic and thirteen disyllabic words with final *-ə̄* <**-as* (see de Vaan 2003:429-430). Various proposals have been made in the literature. In the following, I will argue that vowel *-ō* is not a later, Young Avestan innovation, but rather a regular development. It involved backing because of the following glottal fricative, similar to Vedic *-o* <**-ɔfi*.

The assumption of inter-mediate stage with glides is problematic also for Avestan. The outcome *-ō* can in principal be derived from the short diphthong **-au̯* <**-ah*, because the etymological **-au̯* also sometimes appears as *-ō* (as opposed to the standard *-uu̯ō*), e.g. *daŋ́hō* <**dahi̯au̯* vs. YAv. *daŋ́huu̯ō* <**dahi̯au̯* (data from Hoffmann and Forssman 2004[2]:69). However, *-ə̄* cannot go back to **ai̯*, since etymological **ai̯* always yields *-ōi* or *-e*. Even more problematic for the glide assumption is the outcome of **-āh* > *-ā̊*. Etymological **āu̯* yields *-āu*. Two locative forms that go back to **-āu̯* and show *-ā̊*: *xratā̊* and *parətā̊* most likely feature a scribal error, since *ā̊* and *āu* are spelled similarly[40] (de Vaan 2003:375). There is another source for *ā̊* in Avestan, where no glides can be assumed: **ā* before nasals *n̥* and *ŋ* in sequences *n̥k, n̥c, n̥t* and *ŋh, ŋ́h, ŋ̯h*.[41] Although *ā* gets backed and rounded to *ā̊* and we get same results as in case of **-āh*, no intermediate stage with glides can be assumed here. We can thus assume that *ă̆* and *ā* are backed and rounded before the glottal **-h* to *ō* and *ā̊* independently, i.e. without the inter-mediate stage with glides.

A prominent account of the Avestan data claims that *-ə̄* is the regular outcome of **-ah*, which was replaced by *-ō* as a later, Young Avestan innovation (Beekes 1988:27-28, 32-33; de Vaan 2003:429-461; Hoffmann 1967:34; Narten 1986:273). The explanation, however, does not explain how the two variants emerged and what phonetic rationale is for the development.

According to this line of reasoning, the development Av. *-ahm-* > *-ə̄hm-* is taken as a proof that *ă̆* can yield *ə̄* before *h*, at least in some environments. This serves as the basis for the claim that thee same process spreads to to word-final **-ah* > **-ə̄h*, which would yield *-ə̄* after the loss of **h*. The development *ă̆* > *ə̄*, however, occurs only before the sequence *hm*. Elsewhere, *ă̆* is preserved before *h*. It would be more economic to assume an early loss of *h* before *m* and then the regular development of *ă̆* > *ə̄* before nasals (in this case *m*). In Old Persian, *h* is regularly lost before *m*,[42] whereas in Avestan, it is lost word-initially before *m*, e.g. *mahī* (for **smasi*). Moreover, if there really was a development *ə̄* > *ō*, we would expect precisely *ə̄* before *hm* to show *ō* in Young Avestan. This is not the case (YAv. *ahma*, OAv. *ə̄hmā*) and can speak against the assumption of *ə̄* > *ō*. Also, it is unclear why *h* would cause *ă̆* to front or at least to centralize to *ə̄*, whereas for *ā*, it would cause backing to *ā̊*.

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[40]They were probably also pronounced similarly (cf. de Vaan 2003:375).

[41]Cf. de Vaan (2003:383-386) for the treatment of *ā* before these nasals.

[42]In Old Persian, *h* is also lost before *r* and *u*, cf. Brandenstein and Mayrhofer (1964:42-43).

I propose that Av. -ō and -ā̊ are the results of backing of ă and ā, respectively, caused by the following glottal *-h. The phonetic motivation for this backing is similar to Vedic: breathiness caused by *-h causes a decrease in F2 which effectively results in backed vowels. It is impossible to determine whether the glottal fricative was voiceless (*-h) or voiced (*-ɦ) in Iranian, but in either case the fricative can cause breathiness of the preceeding vowel. Since Avestan never shows voiced consonants in word-final position, I reconstruct a voiceless variant *-h henceforth.

The backing caused by *-h could happen quite early, occurring at the time when the distinction between an early lenited word-final *-h and the preserved *s word-internally and word-finally in close syntactic positions was still present (parallel to the Vedic situation, see Table 2 above). The fact that the backing and rounding of ă and ā occur only word-finally provides additional evidence in favor this proposal. In word-internal position before h, ă and ā remain unchanged, e.g. ahī, θβāhū.[43] We thus have to assume that backing before h operated only before the early weakened, Iranian *h, whereas it was not active at the time of the later, Iranian word-internal *s > h.

According to this account, we can also explain why the short ă in monosyllabic words (pronouns) along with some disyllabic words did not undergo the rounding and backing to -ō, e.g. yə̄, kə̄ for Ved. yaḥ, kaḥ. Frequently, pronouns and monosyllabic words appear in close syntactic positions. In Vedic, for example, monosyllables are more frequently in close syntactic positions than polysyllabic words (Beguš 2012). We can assume a similar distribution also in Avestan. This would mean that pronouns often showed variants with not yet lenited *-as as opposed to other words where *-as was lenited to *-ah already at an earlier stage (Table 1). To illustrate this state of affairs, we can reconstruct *asurah u̯ai̯da vs. *kas mai̯ and *kas tai̯. The first reconstruction shows the early word-final lenition of *-s to *-h, whereas the latter two show retention of *-s in close syntactic position in monosyllables. After rounding, we get *asurɔh (in Vedic this happens only before voiced *ɦ),[44] whereas *kas mai̯ and *kas tai̯ remained unrounded. The early weakened *-h was further lost, but another lenition started to operate, i.e. weakening of word-internal *s. I propose that in constructions like *kas mai̯, *s was weakened to *h later than in examples like *asurɔh — at the same time as the lenition in word-internal position (*s > h). At that time, backing and rounding was not active anymore, therefore we get *kah mai̯, whereby *asurɔh u̯ai̯da yields ahurō vaēdā. According to this assumption, we predict that -s in *kas tai̯ does not get lenited to h, because word-internal lenition of *s to h does not affect sequences s + stop, n, and c. This is precisely what we have attested: kastē, kasnā, kascīṭ.[45]

Vowel a in *kah mai̯ does not get rounded, which is why in close syntactic positions we have -ə̄ for *-ah. It is still unclear why the vowel in kə̄ (<*kah) and similar examples gets centralized to ə̄ rather than preserve its quality (**ā) and why *h is lost rather than preserved (as it is the case word-internally). It is true that in the positions before m, this would be the regular outcome (as in ə̄hmā for a > ə̄ / _hm and mahī for h > ∅ / #_m). Thus, in *kah mai̯ (kə̄ mōi), *h would be lost and a would regularly yield ə̄ before nasals. For other positions, however, we would not assume this development. It is possible that *-h that was weakened together with the word-internal h caused nasalization on the vowel. Spontaneous nasalization is rare, but it is particularly attested word-finally before glottal fricatives (Dąbkowski and Beguš 2024), via a phonetic process called rhinoglottophilia (for a phonetic explanation, see Matisoff 1975 and Ohala 1975). This would explain the backing of *ah to ə̄, since ə̄ is the regular development before nasals in Avestan. Rhinoglottophilia is attested in Avestan in other positions (OAv. aŋha^iti < *ahati; Hoffmann and Forssman 2004²:106). The development of *-as > -ə̄ is attested in some disyllabic words as well. However, this is not

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[43]Although ā appears as ā̊ before ŋh, this does not speak against our assumption. The backing here is due to the nasal ŋ and not h. This can be concluded from the fact that before h that does not develop to ŋ, ā remains unchanged, e.g. āhūriia-. Moreover, the nasal n̥ causes ā > ā̊ without the presence of h.

[44]However, we cannot completely exclude the possibility that h (-ḥ) also causes some phonetic backing, which would be lost because no loss and lengthening follows.

[45]With this assumption, we would expect s to be preserved also before k and p, but this never happens. However, the absence of these example does not cast serious doubt for my proposal.

surprising since disyllabic words can also appear in close syntactic constructions.

Additional evidence in favor of my proposal can also be seen from the fact that -ə̄ is also found in compounds, which often behave similarly to close syntactic position: Y 2.45.11 *tarə̄-m̨astā*, Y 1.33.4 *tarə̄-maiti-* (both precisely before *m*) and Y 2.46.19 *manə̄-vistāiš*. Moreover, -ə̄ is never attested in the pausa position, which also suggests that a close syntactic position is needed for this development. There are three words attested in the Gāthās that show variation in word-final -ə̄ and -ō, according to the position in verse. The word *vacah-* 'word' is attested as *vacə̄* once in the verse-internal position vs. *vacō* twice at the end of a verse. Likewise, *vasah-* 'wish, at will', is attested as *vasə̄* twice verse-internally and *vasō* twice verse-finally. Also *sar-* 'association' is gen./abl. sg. *sarə̄*[46] once verse-internally and *sarō* once verse-finally.[47] This is expected under my proposal, since the lenition of *-s to *-h in close syntactic constructions occurred later and did not cause backing and rounding, whereas elsewhere (including before pausa), *-h (*-ɦ) was older and consequently caused rounding and backing.

According to the proposal presented here, the less common, but original ə̄-variant was then replaced by the more common ō-variant in Young Avestan, a process that started already in Old Avestan, where -ō is indeed attested in most of the words. This is again reminiscent to the Vedic situation, where -o replaces the close syntactic variant -e (see above).

While the distribution of -ə̄ and -ō according to the verse position can provide additional evidence in favor of our proposal (-ə̄ verse-internally and -ō verse-finally), it can also result as an influence from Young Avestan. Word-final -ōi and -ə̄m from Old Avestan seem to be replaced by -ē and -əm from Young Avestan more often in verse-final position.[48] It is thus possible, that the already winning variant -ō would be additionally influenced by Young Avestan, where -ō had already won. Nevertheless, as I have tried to show in the discussion above, we still have to assume two original variants -ə̄ and -ō < *-ah.

4 Conclusion

This paper proposes a new account of a long standing puzzle in Indo-Iranian philology. I argue that *s in word-final position undergoes lenition at an early stage, potentially already at the Indo-Iranian period. The lenition of *-s to *-h spread in Vedic to word-final *-ṣ and in Avestan to word-internal *s. This early lenited word-final *-h caused rounding and backing of the preceding ă and ā in Avestan, which yielded -ō < *-ɔh < *-ah and -ā̊ < *-ā̊h < *-āh. In close syntactic constructions, word-final *-s was preserved longer and got lenited to *h together with the word-internal *-s- (but not before stops, *n* and *c*, which is why we have *kastē*, *kasnā*, and *kascīṯ*). This newly lenited *-h did not cause any backing or rounding, which is why the outcome is -ə̄ (potentially via nasalization). My proposal better explains the fact that the outcome -ə̄ is attested only in pronouns and verse-internally, whereas verse-finally we always have -ō. It, however, remains somewhat puzzling, why the outcome is a centralized -ə̄ and why the newly lenited *h is lost word-finally. I offer a potential solution via nasalization before glottal fricatives.

In Vedic, the early lenited *-h (-ḥ) was voiced in external sandhi to *-ɦ. Later, it was lost together with the two voiced sibilants *z and *ẓ. I propose that this loss occurred without the inter-mediate stage with glides, but that voiced sibilants caused qualitative changes on the preceding vowels. Vedic ă [ə] was fronted to *ɛ before *z, remained unchanged before *ẓ and was backed to *ɔ before *ɦ. I provide parallels and phonetic motivation for this shift: breathy voice from *-ɦ causes the vowels to increase in backness. After the loss and compensatory lengthening in the pre-consonantal position, the colored vowels lengthen to *ɛ̄, ā, and *ɔ̄. The first and the latter then merged with the diphthongal *e* and *o*. I have also argued that in

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[46]Parsed as infinitive in Bartholomae (1961²:1563).

[47]Word-final -ə̄ from other sources is possible in verse-final position in the Gāthās: Y 2.43.15 *ādarə̄*.

[48]For the distribution of these variants and for different explanation of -ō, see Humbach (1991:61-63); Narten (1986), de Vaan (2003:337, 462-464).

pre-Vedic, the regular outcome of word-final *-*s* before *d-* and in close syntactic positions was *-*z*, whereas elsewhere it was *-*ɦ* (parallel to the outcomes -*s* and -*ḥ*).

In the pre-vocalic position, the outcomes are different from the pre-consonantal ones. Here, *ɦ was lost without a trace and the allophonic variation -ɔ V- was lost as well (retained only in the abhinihitasandhi -*o*-). Vedic *z was either not attested pre-vocalically or the outcomes (if distinct) have been lost. Retroflex *ẓ became *r* in the pre-vocalic position. The latter development can in fact be understood simply as increasing the sonority, which later caused also the development of *ḍ(h)* to *ḷ(h)*.

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