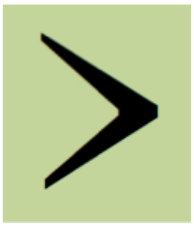
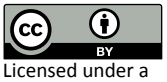


Papers in Historical Phonology
http://journals.ed.ac.uk/pihph
ISSN 2399-6714
Volume 8, 16–37
DOI: 10.2218/pihph.8.2023.8934



Vṛddhi traces in Hindi denominal derivation

Michael Ramsammy
University of Edinburgh

Abstract

This paper considers vṛddhi as an inherited feature in Modern Standard Hindi. As a phenomenon, vṛddhi is most commonly discussed in reference to Old Indo-Aryan (OIA), particularly with a focus on inflectional patterns in Sanskrit. However, the inherited pattern in New Indo-Aryan (NIA) languages presents specific analytical challenges and its status as a morpho-phonological feature in the present-day languages is not straightforward to establish. In this paper, the focus is given to the operation of vṛddhi in denominal derivations in both OIA and present-day Hindi. This leads to a discussion of the evolution of vowel systems in the history of Indo-Aryan. Regarding the question of how synchronic vṛddhi-alternations can be accounted for theoretically, I present two possibilities: (i) that vṛddhi constitutes a phonologically active process of vowel lowering/tensing in Hindi; and (ii), that vṛddhi is a suppletive phenomenon synchronically, and thus, not derived by phonological rule.

1 Introduction

This working paper discusses a set of vowel alternations that occur in Hindi denominal derivations. In the present-day language, the alternations of concern are chiefly qualitative in nature. Non-low vowels in nominal bases like [senɑ] 'army' and [jog] 'yoga' lower under affixation: e.g. [sɛnɪk] 'soldier', [jɔgɪk] 'relating to the practice of yoga'. Height features are unaffected in low base vowels like /ʌ/. However, an alternation to what is best described as a tense correspondent is instead observed: e.g. [dʱʌrm] 'law, rule, the spiritual concept of *dharma*' vs [dʱɑrmɪk] 'relating to *dharma*'.

In aiming to account for this phenomenon, it is necessary to consider the historical origin of the synchronic patterns, namely alternations in vowel *quantity* that evolved in OIA from an older Indo-European (IE) pattern: i.e. *vṛddhi*. In this connection, the paper contributes a discussion

around the status of the qualitative alternations in Modern Standard Hindi that is situated in a broader context of diachronic morpho-phonological change and the *life cycle of phonological processes*.

I first discuss vṛddhi in §1.1 with a focus on extensions of the IE pattern that were innovated in OIA. Thereafter, the inherited patterns in NIA are presented in §1.2. §2 considers the consequences for vṛddhi of phonological changes that affected vowels through OIA, MIA and into NIA with a focus on the shift from quantity to quality contrasts. I then set out two possible approaches to the Hindi data. The first (§3.1) assumes that the alternations arise from the operation of synchronic neutralisation. The second (§3.2) proceeds from the assumption that the historical phonological patterns have completed their life cycle and have morphologised in the transition from OIA to Hindi. Under this view, the inherited vṛddhi alternations in the present-day language are suppletive in nature. Whilst these analytical sketches are preliminary, I suggest that the second approach offers a more parsimonious and cohesive solution to the specific analytical challenges that the Hindi data present. §4 concludes the paper.

1.1 Vṛddhi in OIA

Vṛddhi ('increase, growth') refers to a pattern of vowel lengthening whose operation in Classical Sanskrit and proto-IE is well known. In the IE literature, vṛddhi is considered to represent a *lengthened vowel grade* in a paradigmatic system that also recognises a normal or *full grade* (i.e. unlengthened) alongside a reduced or *zero grade* (cf. Meier-Brügger 2003: 148). In the Sanskritist tradition, by contrast, the IE zero grade is taken to be basic (Allen 1953: 12–13), with the full grade (i.e. *guṇa*) representing a first augmentation, and vṛddhi, a double augmentation.

(1) Sanskrit vowel gradation

basic grade	/a/ /ā/	/i/ /ī/	/u/ /ū/	/ṛ/ /ṝ/	/ḷ/ /ḹ/
guṇa grade	/a/ /ā/	/e/	/o/	/ar, ra/	/al, la/
vṛddhi grade	/ā/	/ai/	/au/	/ār, rā/	/āl, lā/

Both philological and historical phonological studies have typically focused on vṛddhi in inflectional paradigms, particularly in verbal patterns. This is illustrated in (2) below with data from the widely discussed sigmatic aorists (Whitney 1896: §874ff.; Narten 1964; Mayrhofer 1978:

§144; Drinka 1991, 1995).[1]

(2) Vṛddhi in Classical Sanskrit: 3SG aorist forms

	root		*aorist (INDIC)*	
a.	dā	'give'	a-dāt	
b.	bʰū	'be'	a-bʰūt	
c.	gam	'go'	a-gamat	
d.	sic	'sprinkle'	a-sicat	
	root		*aorist (INDIC)*	*aorist (MID)*
e.	bʰaɟ	'divide'	a-bʰ**ā**kṣīt	a-bʰakta
f.	nī	'lead'	a-n**ai**ṣīt	a-neṣṭa
g.	rudʰ	'block'	a-r**au**tsīt	a-ruddʰa
h.	juɟ	'tie'	a-j**au**kṣīt	a-jukta

In the regular aorist forms in (2a–d), there is no alternation in vowel length. Thus, the long root vowels in /dā/ and /bʰū/ also occur in [adāt] and [abʰūt], respectively. Note here also the operation of vowel sandhi where the suffix /-at/ truncates to [t] after long vowels in the base: i.e. /a-bʰū-at/ → [abʰūt]. In (2c–d), the short root vowels are preserved in the corresponding aorist forms and the suffix vowel in /-at/ is not a target for truncation since both *gam* and *sic* display a root-final consonant.

Conversely, the sigmatic aorists display vṛddhi in indicative forms. In (2e), the root vowel /a/ lengthens to /ā/ in the aorist. In (2f), incrementation of /ī/ yields the diphthong /ai/; and likewise, incrementation of root /u/ in (2g–h) yields /au/. In the middle-voice forms, vṛddhi is not observed. The basic/zero grade of the root is reflected in (2e, g–h)—i.e. in aorist middle forms built on bases containing short vowels—whereas the long root vowel /ī/ in (2f) maps to its guṇa-grade value in [aneṣṭa].[2]

In addition to verbal alternations, vṛddhi also occurs in denominal forms. Examples of this type have been reconstructed for proto-IE: e.g. /d**e**i̯u̯ó-/ 'sky god' from /di̯eu̯-/ 'day, sky' (cf. Meier-Brügger 2003: 284). Derivations of this kind took on new life in Indo-Iranian and expanded

---

[1] With the exception of vowel length, the forms in (2) are given in IPA: i.e. /j/ represents य, not ज, etc. Although short अ is known to have had a reduced quality in weak environments (transcribed elsewhere as /ɐ/ or /ə/), I use /a/ here for simplicity.

[2] The outcome of consonantal sandhi in some of these forms masks the presence of /ṣ/. In the middle forms, there is an obligatory repair to sequences of three consonants: e.g. /a-bʰaɟ-ṣ-ta/ reduces to [abʰakta]; and /a-rudʰ-ṣ-ta/ resolves into a geminate, hence [aruddʰa].

in a way that is unknown in other IE language families. The examples in (3) illustrate a common pattern in Classical Sanskrit, namely vṛddhi in derived nominals terminating in /-ika/.

(3) Vṛddhi in Classical Sanskrit: denominal derivations in /-ika/

	base		*derived form*	
a.	dʱarma	'dharma; rule, law'	dʱārmika	'dharmic; righteous'
b.	kāla	'time, season'	kālika	'timely, seasonal'
c.	dina	'day'	dainika	'daily'
d.	ʋīɳā	'Indian lute'	ʋaiɳika	'lutenist'
e.	mukti	'spiritual liberation'	mauktika	'striving for liberation'
f.	sūci	'needle'	saucika	'tailor'
g.	deʃa	'region, province'	daiʃika	'regional, provincial'
h.	ʋeda	'knowledge; Veda'	ʋaidika	'Vedic'
i.	senā	'army'	sainika	'warrior'
j.	loka	'world, space'	laukika	'worldly'
k.	soma	'Soma juice'	saumika	'relating to Soma juice'

The forms in (3a–f) exemplify the alternations described in (1). In (3a) and (3b), base /a/ and /ā/, respectively, correspond to /ā/ in the derived forms. Similarly, /i/ and /ī/ correspond to /ī/ in (3c–d), and /u/ and /ū/ to /ū/ in (3e–f). The base forms in (3g–k) contain the guṇa-grade vowels, /e/ and /o/. Nevertheless, in the same way as (a–f), suffixation of /-ika/ triggers vṛddhi lengthening in derived contexts.

In addition to the alternations themselves, these data illustrate how guṇa and vṛddhi were conceived of by early Indian grammarians, namely as /a/-incrementation. The guṇa grade arises through prefixation of /a/ to the basic qualities, and vṛddhi, through prefixation of /a/ to the guṇa qualities. Thus, [e] and [o] are understood to be reflexes of pre-Sanskrit †/a-i/ and †/a-u/, and vṛddhi-grade [ai, au] reflect historical /āi, āu/. Guṇa-grade /a/ and /ā/ are different. As Whitney (1896: §235) puts it "in all gunating processes अ a remains unchanged—or, as it is sometimes expressed, अ a is its own guṇa; आ ā, of course, remains unchanged for both guṇa and vṛddhi".

Regarding the status of vṛddhi in nominal forms, there is relatively little to draw on in the philological literature. Burrow (1955: §20) traces derivational vṛddhi to the late Indo-Iranian period, remarking that it "developed rapidly in the pre-Vedic period of Indo-Aryan and continued to extend during the historical development of Sanskrit". Burrow also points out that nominal vṛddhi generating [ā] is the oldest type: examples like [ʃʋaʃura] 'father-in-law' and [ʃʋāʃura] 'relating to ones father-in-law' oc-

cur frequently in early texts like the Ṛgveda. By contrast, forms with what Burrow refers to as *secondary vṛddhi* (i.e. augmented forms with [ai] and [au]) occur with lower frequency than those with [ā]. Analogy is identified as the source of secondary vṛddhi and examples such as those listed in (3) reflect the pattern that had become established by the time of the classical period.[3]

A specific mechanism through which the nominal /a, ā/ → [ā] pattern generalised to /i, ī/ and /u, ū/ has not been identified. I return to this point briefly in §3. However, proposing an analysis of the Sanskrit alternations is not something that I am aim for here. Instead, the main issue I wish to focus on is the *residue* of OIA denominal vṛddhi that has survived in present-day NIA languages.

1.2 Vṛddhi as an inherited feature in NIA

(4) lists nominal pairs from Hindi that exemplify a set of regular vowel alternations. Two general points can be made on the basis of these data. Firstly, despite changes to the phonological shape of these words—e.g. the change from Sanskrit vowel-final forms to Hindi consonant-final ones that occurs through apocope of short /a/—the historical operation of OIA vṛddhi is still very much visible synchronically (cf. Kachru 1990: 57–58). Secondly, however, the nature of the augmentation is different. This is the result of a major diachronic shift whereby the quantitative vowel contrasts of OIA evolved into quality-based contrasts by the NIA stage.[4]

In the base forms here, we see only short vowels (which are also all lax: further details in §2). (4a) shows a low back vowel in [dʱʌrm] which corresponds to [ɑ] in the derived form, [dʱɑrmɪk]. The simple noun form in (4b) contains [ɪ] where the corresponding derived form has [ɛ]. Similarly, (4c–e) show a base∼derivative correspondence between [e] and [ɛ]. The same is true of the back-vowel qualities. (4f) parallels (4b): the derived from here shows a different suffix from the other examples, namely /-jʌ/. This is the synchronic version of Sanskrit /-ja/ which, as already mentioned, triggered vṛddhi in the same way as /-ika/. In the case of [sɔkʰjʌ],

---

[3] In addition to the /-ika/ forms in (3), Burrow (1955) lists a number of other vṛddhi-triggering denominal suffixes. This includes patronymic suffixes (e.g. /-ājana/) and other frequently occurring suffixes denoting possession or general attribution like /-ja/ (cf. Appendix). Examples terminating in /-aka/ and /-uka/ as well as /-ika/ are attested, though vṛddhi is observed most commonly with /-ika/.

[4] There are of course parallels to this development in other language families, including Germanic, Romance and Slavic.

the open-mid vowel corresponds to the high vowel [ʊ] in [sʊkʰ]. Likewise, base forms with [o] display lowering to [ɔ] in derived forms, as in (4g–h).

(4) Vṛddhi traces in Hindi denominal derivations

	base		*derived form*	
a.	dʱʌrm	'dharma'	dʱɑrmɪk	'related to dharma'
b.	dɪn	'day'	dɛnɪk	'daily'
c.	deh	'body'	dɛhɪk	'bodily'
d.	ʊed	'knowledge; Veda'	ʊɛdɪk	'Vedic'
e.	senɑ	'army'	sɛnɪk	'soldier'
f.	sʊkʰ	'happiness'	sɔkʰjʌ	'state of happiness'
g.	lok	'world, universe'	lɔkɪk	'worldly'
h.	jog	'yoga'	jɔgɪk	'relating to yoga'

The apparent lowering/tensing in derived contexts that Hindi inherited from the OIA vṛddhi alternations raises a number questions. As discussed in more detail below, the quantity-based contrasts of OIA and MIA are no longer primary in Hindi or any present-day NIA language (Masica 1991: 111). Nevertheless, the alternations in (4) must still be acquired by present-day learners of the language. This gives rise to the question of what the nature of these alternations is synchronically and whether they represent a productive pattern. These issues are the focus of §3. Before tackling them, however, it is fitting first to consider relevant changes that affected the vowel system of OIA over the course of its development into NIA.

2 Vowel systems

(5) below shows the vowel systems of Sanskrit and Hindi alongside those of the pre-Sanskrit Indo-Iranian parent language and synchronic Bangla (Khan 2010), which are included for purposes of comparison. Pre-Sanskrit had a classic triangular vowel system with a length contrast at each point on the periphery. An change to this system occurred in early Sanskrit, namely the emergence of the short mid vowels, /e/ and /o/. As already mentioned, these developed from monophthongisation of the pre-Sanskrit diphthongs, /ai/ and /au/.

A number of further changes took place in the transition from Sanskrit to MIA (not illustrated in (5)). Pāli (northwestern MIA) is the best documented of the early varieties. Regarding its vowels, a feature of relevance is the elimination of OIA diphthongs, the outcome of which varies:

/ai/ > /e/ or /i/; /au/ > /o/ or /u/ (Oberlies 2001: §2; 2003: 168). One important consequence of these changes was the 'undoing' of OIA vṛddhi in some cases, e.g. Sanskrit /aiʃʊarja/ > Pāli *issariya* 'royal power, kingship'. Thus, whereas Pāli shares the same vowel system as that shown in (5) for Classical Sanskrit (with which it also overlapped temporally), the frequency of diphthongs is considerably lower in Pāli.

(5)

	Pre-Sanskrit				Cl. Sanskrit				Hindi				Bangla		
	long		*short*		*long*		*short*		*tense*		*lax*				
[high]	ī	ū	i	u	ī	ū	i	u	i	u			i	u	[high]
											ɪ	ʊ			
							e	o			e	o	e	o	[Ø]
									ɛ	ɔ			ɛ	ɔ	
[low]	ā		a		ā		a			ɑ		ʌ	a		[low]

However, the contribution that Pāli can make to our understanding of the development of vṛddhi in NIA languages like Hindi is somewhat limited due to the fact that Hindi itself developed from later MIA, i.e. from (unwritten) Śaurasenī and Central Apabhraṁśa (Bubenik 1996: 16–20). There are other noteworthy complications too. Bubenik (1996: 27), for example, reconstructs late MIA as already having the height distinctions and tense∼lax contrast shown for Hindi in (5). Sen (1960: §41) notes, relatedly, that monophthongisation of OIA /ai/ and /au/ yielded mid vowels in some MIA dialects that were probably low in quality, i.e. /ɛ/ and /ɔ/. He also suggests a possible allophonic alternation between longer monophthongs occurring in open syllables vs shorter monophthongs in closed ones (cf. examples from the Aśokan inscriptions and various manuscripts, pp. 38–39; see also Bubenik 1996: §2.1.3).

Whilst attempting to piece together these various complexities into a clear pathways of change through OIA, MIA and into early NIA is rather a tall order, what can firmly be established is that the vowel systems of present-day NIA languages display remarkably wide variation. In other words, the complex diachronic divergences that have affected IA vowel systems over time have yielded an abundant synchronic microtypological diversity.

In fact, Masica (1991: 109–113) catalogues vowel inventories across the present-day languages that contain between five and ten vowels. Of these, the Hindi and Bangla systems shown in (5) represent just two. In Bangla specifically, collapse of the OIA/MIA quantity contrasts yielded a

seven-vowel system. Some evidence for the mergers that led to this is still to be found in the orthographic system: for example, the written forms ⟨dina⟩ 'day' and ⟨dīna⟩ 'poor, miserable' are synchronically homophonous, i.e. /din/ (Dasgupta 2003: 355). Interestingly enough, despite the extensive reduction in vocalic contrasts that has taken place historically, Bangla preserves the diphthongal quality of OIA /ai/ and /au/ arising from vṛddhi in non-low-vowel contexts: e.g. /ʃena/ 'army', /ʃɔinik/ 'soldier'.[5] This is the case too in other present-day NIA languages, such as Marathi, which has a six vowel inventory (e.g. /səinik/ 'soldier'; cf. Masica 1991: 109; Dhongde & Wali 2009: 9).

By contrast, Hindi preserves all contrasts that existed in Classical Sanskrit in spite of the elimination of quantity distinctions. (5) reflects the vowel inventory established in Ohala (1983, 1994). Unlike Bangla and Marathi in which merger was the major force behind the historical restructuring of the vowel system over time, Hindi exemplifies a classic case of cue shifting (in the sense of e.g. Ohala 1993). Thus, whereas length was a primary phonetic cue to contrast historically, over time, probably driven by gradual deperipheralisation of the short vowels, there was a reanalysis of the system. At some point in time, learners came to associate the historical *long*∼*short* contrast with *peripheral*∼*non-peripheral* qualitative distinctions, i.e. *tense*∼ *lax*.[6] Under the assumption that synchronic Hindi contrasts tense and lax vowels in this way, it is important to note that /ɛ/ and /ɔ/ pattern as low tense vowels. This is of direct relevance given that these vowels commonly occur in inherited vṛddhi forms.

3 Towards an analysis

In this section, I consider the central question of what inherited vṛddhi really is as a phonological feature of Hindi. The aim here is not to present

---

[5] /ɔ/ is the synchronic reflex of OIA short /a/ in Bangla. For this reason, Dasgupta (2003) transcribes it as /a/, which also reflects its status as the default, inherent vowel in the writing system (cf. Klaiman 1990: 76). The low front vowel, /ɛ/, is also sometimes transcribed as /æ/ (cf. Kar 2010: 12–13).

[6] Ohala (1983: 7) chooses not to describe this distinction in terms of *tense*∼*lax*, commenting that "the physical correlates of 'tenseness' are still controversial". The proposed alternative, i.e. [±long], has its own problems, not least that putative [+long] vowels like /ɛ/ and /ɔ/ are not necessarily longer than the [–long] counterparts (i.e. /e/ and /o/) in fluent colloquial speech. I opt for *tense*∼*lax* here in agreement with Bubenik's (1996) approach to late MIA. It should also be emphasised that currently available data on Hindi do not allow for alternative possibilities to be convincingly assessed (for instance, those based on more concrete phonetic properties like ATR or RTR).

a fully worked analysis, but rather to lay out some possibilities. In §3.1, I consider the operation of inherited vṛddhi under the assumption the alternations in (4) arise from the operation of a synchronically active phonological processes. §3.2 approaches the problem from the opposite angle, proceeding from the assumption that inherited vṛddhi represents a phonologically 'static', suppletive process.

3.1 Inherited vṛddhi as active neutralisation

If vṛddhi is to be considered a 'live' phonological process in the synchronic grammar of Hindi, then it must clearly be neutralising in nature. As the data in (4) illustrate, only three vowel qualities are permitted in derived nominal stems, namely the tense low vowels, /ɑ/, /ɛ/ and /ɔ/. I will ultimately make the claim that an approach based on active neutralisation (i.e. the *neutralisation hypothesis*) is not a particularly good fit for the data. Nevertheless, there are good reasons for considering a neutralisation analysis as a possibility.

For example, in addition to the alternations under discussion, there is independent evidence that /ɛ/ and /ɔ/ have a special status in Hindi. In the formation of causative verb stems, bases containing /i/, /u/ and /ɑ/ undergo laxing: e.g. [ʧin] 'snatch' vs [ʧɪn-ɑ] 'cause to snatch'; [puʧʰ] 'ask' vs [pʊʧʰ-ʊɑ] 'cause to be asked'; [lɑd] 'load' vs [lʌd-ʊɑ] 'cause to be loaded'. However, bases with /ɛ/ or /ɔ/ escape this neutralisation: e.g. [pʰɛl] 'stretch' vs [pʰɛl-ɑ] 'extend'; [dɔɽ] 'run' vs [dɔɽ-ɑ] 'drive, urge on' (further examples in Ramsammy 2022). This is relevant for the vṛddhi alternations because the outcome is precisely the opposite. Whereas vowel neutralisation in causative derivations favours lax vowels (with the exception of /ɛ/ and /ɔ/) Hindi appears to enforce a prohibition on lax vowels in derived nominals: hence, [dʱ**ɑ**rmɪk], *[dʱ**ʌ**rmɪk].

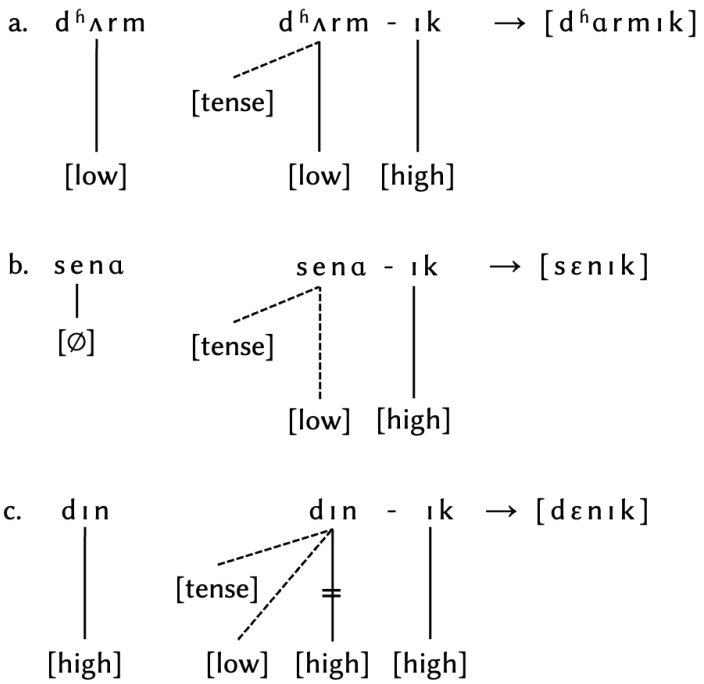
Proceeding from the assumption that the alternations could represent a case of synchronic neutralisation, (6) provides an illustration of dissimilatory nature of the pattern. Under this approach, examples like (6a) represent the simplest cases. Here, the target vowel, /ʌ/, is underlying specified as [low]. Suffixation of /-ɪk/, which contains a lax vowel, triggers tensing of the base vowel (through epenthesis of [tense], as shown here, or some equivalent). The outcome is a tenseness contour over the surface VCCV-sequence.

(6b) is more complex in that the analysis relies on truncation and a double dissimilation. The /e/ of the base in this example is underlyingly specified neither for height nor tenseness. Concatenation of /-ɪk/ in the

derived form triggers deletion of the final /ɑ/ and then both tenses and lowers the medial base vowel by assignment of [tense] and [low].

Cases like (6c) are also complex, but in a different way. Here, /ɪ/ is underlyingly [high]. This means that a height dissimilation process operating in the complex form would delink this feature and replace it with [low]. Tenseness dissimilation, as in (6a–b), would further require insertion of [tense].

(6)



The neutralisation hypothesis entails the assumption that height dissimilation must operate in some way like this: there is simply no alternative for cases like (6c). However, it is worthwhile to consider what factors could condition the alternations in tenseness. One possibility is that this could be metrically driven.[7] (7) shows the foot structure of inherited vṛddhi forms assuming that both tense and lax vowels are monomoraic in the present-day language. This is in accordance with the

[7] As discussed in the Appendix, this approach connects to the noted tendency for Sanskrit tri- and tetrasyllabic derived forms to be maximally footable.

claim that there is no synchronic quantity contrast in vowels in Hindi, either in terms of length or weight.[8]

Under this analysis, the base forms in examples like (7a–c) are fully footable into a bimoraic template. This is also the case for the corresponding derived forms if word-final consonants only contribute weight where necessary to complete the bimoraic template. Thus, the word-final consonants in [dɛnɪk], [jɔgɪk] and [sɛnɪk] are extrametrical. A similar situation arises in [dʱʌrm] in (7d). However, note here that the derived form [dʱɑrmɪk] is bipedal: in this case, word-final /k/ projects a mora in order to avoid a unfooted, monomoraic word-final syllable (*[$_{\Sigma}$dʱɑ$^{\mu}$r$^{\mu}$]⟨mɪ$^{\mu}$k⟩). [sʊkʰ] and [sɔkʰjɑ] pattern differently, however. In this case, augmentation cannot be directly related to a requirement for derived forms to be fully footable.[9]

(7) Foot structure in nominal forms

	base	*derived form*
a.	[$_{\Sigma}$dɪ$^{\mu}$n$^{\mu}$]	[$_{\Sigma}$dɛ$^{\mu}$.nɪ$^{\mu}$⟨k⟩]
b.	[$_{\Sigma}$jo$^{\mu}$g$^{\mu}$]	[$_{\Sigma}$jɔ$^{\mu}$.gɪ$^{\mu}$⟨k⟩]
c.	[$_{\Sigma}$se$^{\mu}$.nɑ$^{\mu}$]	[$_{\Sigma}$sɛ$^{\mu}$.nɪ$^{\mu}$⟨k⟩]
d.	[$_{\Sigma}$dʱʌ$^{\mu}$r$^{\mu}$⟨m⟩]	[$_{\Sigma}$dʱɑ$^{\mu}$r$^{\mu}$][$_{\Sigma}$mɪ$^{\mu}$k$^{\mu}$]
e.	[$_{\Sigma}$sʊ$^{\mu}$kʰ$^{\mu}$]	[$_{\Sigma}$sɔ$^{\mu}$kʰ$^{\mu}$]⟨jʌ$^{\mu}$⟩

Although this kind of approach to the the Hindi data yields forms that are mostly metrifiable in a consistent way—if, indeed, we proceed from the assumption that complete footing is a relevant condition for this alternation at all—there are cases that present additional problems. In particular, some examples show a kind of 'long-distance' vṛddhi, both in Sanskrit and in inherited items in Hindi. This occurs in prefixed forms, such as Sanskrit [ʊaidʱarmika] 'unlawful', and in other examples like [prāʊeʃika] 'relating to an entrance'. In these examples, suffixation of /-ika/ does not cause the vṛddhi grade of the base vowels in /dʱarma/ or /ʊeʃa/ 'entrance' to surface. Instead, it is the prefix vowel that displays

[8] An alternative would be to consider tense vowels to be bimoraic. This would accord with Pandey's (1989; 2021) approach to Hindi, and related analyses, such as Hayes (1995: 162–167), which are based on a formal, 'Sanskritised' register of the language. This may be an appropriate choice here, since some of the Hindi forms under consideration are strongly associated with spiritual practices. However, other items like [sɛnɪk] represent common vocabulary that it is more likely to occur in everyday conversation.

[9] Derived forms in /-ja/ may have been exceptional since Sanskrit (cf. Appendix).

augmentation: i.e. /ʊ**i**-dʱarma-ika/ → [ʊ**ai**dʱarmika] and /pr**a**-ʊeʃa-ika/ → [pr**ā**ʊeʃika].[10]

Examples like these exist in Hindi too, and they present a problem for an analysis assuming that dissimilatory requirements condition alternations in tenseness. Whereas in the analysis shown in (6) it is the vowel immediately preceding the suffix vowel that tenses, assuming that cases like [ʊɛdʱʌrmɪk] are productively derived by dissimilation requires an account of why /ʌ/ is skipped and the prefix vowel (/ɪ/ underlyingly) tenses instead. A further complication is that other prefixes show different behaviour in Sanskrit, as in /a-dʱ**a**rma-ika/ → [adʱ**ā**rmika] 'without law, unlawful', for instance. Here, it is the base vowel rather than the prefix vowel that shows vṛddhi incrementation (just as in [dʱ**a**rma]∼[dʱ**ā**rmika]).

Whilst examples like these are relatively numerous in Classical Sanskrit, particularly with the /ʊi-/ prefix, they are rarer in Hindi. Theorising why vṛddhi appears to skip the vowel in the base in Sanskrit prefixed forms is beyond the scope of this paper. However, there are other considerations which render the neutralisation hypothesis particularly unsatisfactory. Not least is the fact that inflectional operations in Hindi do not give rise to dissimilatory effects like those shown in (6). For example, a verbal base containing a lax vowel like /kʰel/ 'play' shows no changes in height or tenseness under affixation: /kʰel-i/ → [kʰeli] 'play.PERF.F', /kʰel-ɪe/ → [kʰelɪe] 'play.IMP.HON', *[kʰɛl-] in both cases.

Regarding the former problem, it is of course possible that surface-vowel differences in learned items like [ʌdʱɑrmɪk] and [ʊɛdʱʌrmɪk] have simply been lexicalised in Hindi, even if more commonplace examples like [sɛnɪk] are productively derived. Regarding the latter, some solution could be sought through which derivational operations trigger phonological processes that inflectional operations do not (e.g. via stratification). Nevertheless, in view of these issues, I now turn to consider an alternative approach in §3.2 below.

3.2 Inherited vṛddhi as suppletion

An alternative to the neutralisation hypothesis is to assume that there is no active phonology involved in the inherited vṛddhi patterns in Hindi. This section explores the *suppletion hypothesis*: i.e. the possibility that pairs like [senɑ]∼[sɛnɪk] instead represent a suppletive pattern synchronically.

---

[10] Here, /ʊi-/ is roughly equivalent to English /un-/ or /in-/. /pra-/ is 'before, in front of'.

First and foremost, it must be highlighted that the suppletion hypothesis makes very different assumptions about the diachronic trajectory of vṛddhi than the neutralisation hypothesis. On the one hand, an approach based on active neutralisation assumes that the phonological restriction that forbade the occurrence of short vowels before a specific set of derivational suffixes in Classical Sanskrit survived the quantity-to-quality reanalysis of the OIA vowel system, as set out in §2. Thus, in the same way that qualitative distinctions have become the primary carrier of phonological contrast, the nature of the conditions favouring augmentation in OIA would have had to evolve to target qualitative properties (height, tenseness) rather than quantitative ones. On the other hand, the suppletion hypothesis entails the claim that vṛddhi evolved from a purely phonological phenomenon in OIA to a morphological one in NIA. This means that the reanalysis of the vowel system from a quantity-based system in OIA to a quality-based system in NIA may have impacted vṛddhi itself, causing it to advance further in its life cycle.

At this juncture, it will be useful to recall the core claims of the life cycle as a model of phonological change (cf. Bermúdez-Otero & Trousdale 2012; Roberts 2012; Bermúdez-Otero 2015; Ramsammy 2015; Sen 2016; Turton 2016; Iosad 2020). To summarise: this model defines a uni-directional pathway of change that encompasses successive stages of *phonologisation*, *stabilisation*, *domain narrowing* and *morphologisation* or *lexicalisation*. In the earliest stages, all language-internal phonological innovations come from phonetics: i.e. innovations begin life as gradient, epiphenomenal effects that are below the level of speaker awareness and beyond speakers' cognitive control.[11] Phases of *phonologisation* and *stabilisation* involve an innovation transcending the level of speaker awareness and a change in its status from gradient to categorical (i.e. the innovation evolves into an alternation that operates on specific phonological categories). *Domain narrowing* refers to further changes in status whereby a phonological innovation may become increasingly dependent on morpho-syntactic structure as it ages, such that its *domain of application* may progressively shrink over time. The final stage in the life cycle involves *lexicalisation*, whereby the innovation is encoded directly in underlying representations, or *morphologisation*, whereby the innovation's occurrence is governed by morphological operations.

---

[11] By *language-internal* is meant phonological changes that arise naturally in language where actuation is not dependent on external forces such as language contact.

Seen in this connection, inherited vṛddhi has characteristics of a phenomenon that has undergone morphologisation historically. The tense∼lax alternations in Hindi bear a clear resemblance to vocalic patterns in other languages that are typically argued to involve alternation between lexically listed allomorphs. For example, Vennemann (1972) discusses correspondences between vowels in German verbs and deverbal nouns: e.g. of the type *reiten*∼*Ritt* 'ride', *schneiden*∼*Schnitt* 'cut'. In these forms, the [aɪ]∼[ɪ] alternation is the mirror image of the Sanskrit guṇa and vṛddhi grades in examples like [dina]∼[dainika].[12] Similarly, Spanish has *tener*∼*tiene* (have.INF∼3SG) and *contar*∼*cuento* (count.INF∼1SG) in verbal inflection, as well as denominal examples like *diente*∼*dental* 'tooth, dental', *bueno*∼*bondad* 'good, goodness' and *puerta*∼*portal* 'door, hallway': cf. Tiersma (1978); Bermúdez-Otero (2006). Interestingly, Spanish adjectives in /-iko/ display only monophthongs, whereas related verbal forms have diphthongs (in certain cases): e.g. *sónico* 'sonic' vs *suena* 'sound.3SG'. Like the German examples, this is a superficial mirror image of the Classical Sanskrit pattern in derived forms with /-ika/.

In each of these cases, the alternation relies on selection of a specific stem allomorph. In German and English, this is not phonologically-driven: the existence of e.g. deverbal *Schneid* 'intrepidity' confirms that it is not phonological well-formedness that conditions laxing in *Schnitt* (Vennemann 1972: 277). Likewise for English, where pairs like *reap*∼*reaped* and *seep*∼*seeped* provide evidence that counterfactual past-tense forms like *[kʰiːpt] or *[wiːpt] (for [kʰɛpt], [wɛpt]) are not phonologically ill-formed. The situation is different for Spanish, where Bermúdez-Otero (2006) argues that the alternation between monophthongs and diphthongs is dependent on a demonstrably phonological criterion, namely stress. Thus, although selection of either a monophthongal or diphthongal form is regulated by the phonology, the fact that this is a strictly binary choice reflects lexical encoding of the allomorphy: hence the argument for underlying forms like /p{o,we}ɾt-a/ 'door', /t{e,je}n-e/ 'have', etc.

For Hindi, an approach based on synchronic lexical allomorphy relies on the assumption that vṛddhi augmentation as a phonological process completed its life cycle in the transition from OIA through MIA and into

[12] Examples from English like *keep*∼*kept* and *fool*∼*folly* (with a tense vowel in the base and a lax vowel in complex forms) also show the reverse of the Hindi pattern, as in [dɪn]∼[dɛnɪk].

NIA. In other words, whatever phonological factors governed incrementation in derived nominals historically (possibly metrical ones, see Appendix), the outcome of this alternation could have been morphologised by the NIA stage. This would lead to a scenario where free nominals like /senɑ/ and /dɪn/ exist alongside what we might conceive of as weak or quasi-bound alternants that only surface in the presence of certain affixes: i.e. /sɛn-/, /dɛn-/.[13] The critical advantage of this approach is that it circumvents the need for specific phonological operations like truncation and tenseness/height dissimilation to correctly generate the surface patterns. This is illustrated in (8–9) below.

(8) Derivation of Hindi oblique plurals by neutralisation

	/senɑ/	
	↙	↘
Input:	a. /senɑ-oN/	b. /senɑ-ɪk-oN/
truncation:	—	sen-ɪk-oN
dissimilation:	—	sɛn-ɪk-oN
other processes:	senɑõ	sɛnɪkõ
Output:	[senɑõ]	[sɛnɪkõ]

In (8), both [senɑ] and [sɛnɪk] derive from a single base through the serial application of phonological processes. Truncation applies first: this targets the /ɑ-ɪ/ sequence straddling the base-derivative suffix boundary in (8b), but note that the /ɑ-o/ base-inflectional suffix sequence in (8a) is unaffected. We might reasonably assume that this is a stratification effect, as I do in (9), whereby derivational suffixes like /-ɪk/ attached at the stem level and inflectional suffixes, like oblique plural /-oN/ here, attached at the word level. However, even in this case, some mechanism which applies truncation before dissimilation is necessary given that the [ɑɪ] sequence in a counterfactual surface form like *[senɑɪkõ] already exhibits a contour in both tenseness and height.

[13] We might also assume that a lexical relational schema (Tiersma 1978) or "via rule" (Vennemann 1972; Bermúdez-Otero 2019) links lexical alternant forms like these synchronically and encodes tacit speaker knowledge of the relationship between tense∼lax vowel pairs in inherited vṛddhi items.

(9) Derivation of Hindi oblique plurals by suppletion

	{ sena / sɛn }	
	↙	↘
	a. ⟦⟦sena⟧-oN⟧	b. ⟦⟦sɛn-ɪk⟧-oN⟧
SL:	/sena/ ↓ [sena]	/sɛn-ɪk/ ↓ [sɛnɪk]
WL:	/sena-oN/ ↓ [senaõ]	/sɛnɪk-oN/ ↓ [sɛnɪkõ]

In (9), by contrast, truncation and dissimilation play no role in the derivation. (9a) illustrates selection of the full stem form /sena/ in the absence of derivational affixes. A faithful mapping at the stem level supplies the stem [sena] to the word level onto which /-oN/ attaches. The surface form [senaõ] exhibits a derived nasal vowel but no stem-suffix truncation, as expected. In (9b), the derivational suffix /-ɪk/ triggers selection of the weak base form /sɛn/. The derivation then proceeds as in (9a): the stem level effects a fully faithful input–output mapping and attachment of the oblique suffix at the word level correctly generates [sɛnɪkõ].

If we accept (9) as a characterisation of the synchronic status of inherited vṛddhi, then the change from what was once a highly productive phonological process to a morphologically-conditioned alternation can best be understood as a consequence of vṛddhi maturing over time in a way that is consistent with the predictions of the life cycle. This is summarised in (10).

As Burrow (1955) notes, the major first innovation took place in the Classical Sanskrit period, whereby the augmentation pattern that operated in the Indo-Iranian parent language underwent expansion. The nature of this expansion is difficult to establish, but it is clear that some kind of rule generalisation (in the sense of Vennemann 1978; Ramsammy 2015) was involved. Thus, whereas stems in /a/ show the type of vṛddhi that has been reconstructed for proto-IE since Indo-Iranian (i.e. the [ʃʊaʃura]∼ [ʃʊāʃura] type), this pattern generalised to target the new Sanskrit mid-vowel phonemes, /e/ and /o/.

(10)

Language stage	Changes
IE/Indo-Iranian ↓ Classical Sanskrit ↓ MIA ↓ NIA	*Expansion of original vṛddhi through rule generalisation: target /a/ > target {a, e, o}.* ↓ *Restructuring of vowel system: quantity > quality shift.* *Morphologisation of inherited vṛddhi.*

Independent changes to the vowel system of OIA that took place in MIA would then have had an impact on vṛddhi as it existed in the late Sanskrit period. Loss of vowel length contrasts meant that vṛddhi would no longer have been acquired as a *quantitative* augmentation by speakers in the NIA period. This may then have been the critical moment whereby the qualitative alternations in items like [senɑ] ∼ [sɛnɪk] ceased to be productive. Speakers may instead have lexicalised these patterns, reanalysing them as a non-phonological operation whereby lexically listed allomorphs are predictably selected under specific morphological conditions.

4 Conclusion

This paper set out to explore the synchronic status and diachronic development of what I have referred to as the inherited vṛddhi alternations in Hindi. Vṛddhi augmentation in denominal derivations is an ancient phenomenon, and reconstruction provides clear evidence of its operation in proto-IE. In Indo-Aryan, however, this type of vṛddhi expanded in a way that has no parallels in other IE language families. Generalisation of the rule that originally targeted only /a/ in Indo-Iranian to mid vowels—that themselves were innovated in OIA—resulted in a substantial increase in the frequency of augmentation. Whilst the driving force behind the alternations in this period (i.e. Classical Sanskrit) has not been firmly established, it has been suggested that metrical structure may have played a role.

Further development of the vowel system of OIA in the MIA period led to a situation in which primary quantitative contrasts underwent reanalysis. The outcome of this varied considerably across the Indo-Aryan dialect space. Some languages like Bangla and Marathi collapsed long∼short vowel pairs into single categories. In Hindi, by contrast, there was a shift

to a quality-based system, whereby a tense∼lax contrast was innovated from the historical length distinctions.

These changes had critical implications for inherited vṛddhi in NIA. Two approaches to conceptualising this have been presented here. Under the neutralisation hypothesis, it has been shown that is possible to analyse the Hindi patterns as the outcome of synchronic alternations in vowel height and tenseness. Whilst there is independent evidence that morphophonological operations in Hindi do condition alternations of this nature (e.g. in causative derivations), this approach relies on an ad hoc stipulation that concatenation of suffixes containing lax vowels triggers dissimilatory tensing of vowels in the base.

An alternative approach has therefore been presented which builds on the assumption that the aforementioned restructuring of the vowel system in the evolution of NIA contributed to a reanalysis of inherited vṛddhi. Under the view that vṛddhi ceased to exist as an active phonological process, approaching the vṛddhi alternations in synchronic Hindi as a case of morphologically-driven suppletion avoids the need for spurious dissimilation processes. I have argued that this approach to analysis is consistent with the core claims of the life cycle of phonological processes. Thus, the Hindi patterns represent the result of a predictable diachronic maturation of a historical phonological process into an allomorphic alternation between lexically-listed bases alternants.

Regarding the Hindi patterns, this paper has concentrated on a set of data that has received (to my knowledge) no previous attention in the theoretical literature. However, there is more to be done. The analyses presented are intended as preliminary sketches that in no way represent a final word on the patterns under discussion. More thought must be directed to the data, particularly, as noted, in connection to the questions of what factors led to expansion of OIA vṛddhi in the first place, and what phonological structural factors favoured augmentation particularly in the presence of denominal suffixes. The possibility that these patterns may be tied to optimisation of foot structure in Classical Sanskrit merits additional research. In turn, this may also lead to conceptualisations of the Hindi patterns, and of inherited vṛddhi in other NIA languages, beyond what this paper has presented.

Comments invited

PiHPh relies on post-publication review of the papers that it publishes. If you have any comments on this piece, please add them to its comments site. You are encouraged to consult this site after reading the paper, as there may be comments from other readers there, and replies from the author. This paper's site is here:

http://dx.doi.org/10.2218/pihph.8.2023.8934

Author's contact details

Michael Ramsammy
University of Edinburgh
School of Philosophy, Psychology and Language Sciences
Dugald Stewart Building
3 Charles Street
Edinburgh. EH8 9AD
United Kingdom

m.ramsammy@ed.ac.uk

Appendix

Although I do not explore the patterns in detail, some additional observations about vṛddhi in Sanskrit denominals merit mentioning. One relevant fact is that the forms listed in (3) are all trisyllabic. If we assume all Sanskrit vṛddhi grades to be bimoraic, then these examples are fully footable into a bimoraic template: [$_{\Sigma}$sa$^{\mu}$i$^{\mu}$][$_{\Sigma}$ni$^{\mu}$.ka$^{\mu}$], [$_{\Sigma}$la$^{\mu}$u$^{\mu}$][$_{\Sigma}$ki$^{\mu}$.ka$^{\mu}$], etc. This contrasts to counterfactual forms without vṛddhi: *[$_{\Sigma}$se$^{\mu}$.ni$^{\mu}$].⟨ka$^{\mu}$⟩, for example. Presumably a trimoraic foot occurs in examples like [$_{\Sigma}$ma$^{\mu}$u$^{\mu}$k$^{\mu}$][$_{\Sigma}$ti$^{\mu}$.ka$^{\mu}$]. Some tetrasyllabic examples also become maximally metrifiable under vṛddhi: e.g. [$_{\Sigma}$ʃa$^{\mu}$i$^{\mu}$][$_{\Sigma}$p$^{\text{h}}$ā$^{\mu\mu}$][$_{\Sigma}$li$^{\mu}$.ka$^{\mu}$] from underlying /ʃep$^{\text{h}}$ali/ 'shrub sp. *vitex negundo*'; [$_{\Sigma}$ʊa$^{\mu}$i$^{\mu}$][$_{\Sigma}$d$^{\text{ɦ}}$a$^{\mu}$r$^{\mu}$][$_{\Sigma}$mi$^{\mu}$.ka$^{\mu}$] 'unlawful'.

Whether or not a preference for full metrification was a guiding force behind the operation of vṛddhi historically requires further research. Interestingly, however, the operation of vṛddhi does produce a similar outcome with the majority of the other suffixes that Burrow (1955) men-

tions. For /-eja/, affixation to /ṛṣi/ 'sage' generates a fully metrifiable derivative under incrementation: i.e. [$_{\Sigma}$ā$^{\mu\mu}$r$^{\mu}$][$_{\Sigma}$ṣe$^{\mu}$.ja$^{\mu}$] 'descendant of a sage'. Examples with final /-a/ pattern likewise: e.g. [$_{\Sigma}$ma$^{\mu}$.nu$^{\mu}$] 'man' and [$_{\Sigma}$mā$^{\mu\mu}$][$_{\Sigma}$nu$^{\mu}$.ʊa$^{\mu}$] 'human', *[$_{\Sigma}$ma$^{\mu}$.nu$^{\mu}$]⟨ʊa$^{\mu}$⟩. Patronymic forms in /-ājana/ show the same behaviour: [$_{\Sigma}$kā$^{\mu\mu}$ɳ$^{\mu}$][$_{\Sigma}$ʊā$^{\mu\mu}$][$_{\Sigma}$ja$^{\mu}$.na$^{\mu}$], [$_{\Sigma}$dā$^{\mu\mu}$][$_{\Sigma}$kṣā$^{\mu\mu}$][$_{\Sigma}$ja$^{\mu}$.na$^{\mu}$].

However, forms in /-ja/ are exceptional. Augmentation of /e/ in /deʊa/ 'god' gives [$_{\Sigma}$da$^{\mu}$i$^{\mu}$]⟨ʊja$^{\mu}$⟩ from /deʊa-ja/. Similarly, /soma-ja/, which is semantically equivalent to [saumika] in (3k), metrifies as [$_{\Sigma}$sa$^{\mu}$u$^{\mu}$m$^{\mu}$]⟨ja$^{\mu}$⟩ after incrementation. In the former case at least, non-operation of vṛddhi would yield a fully footed form: i.e. *[$_{\Sigma}$de$^{\mu}$.ʊja$^{\mu}$]. The exceptional status of these forms in Sanskrit may therefore account for the exceptional nature of inherited forms in Hindi, as mentioned in (7) for [sɔk^{h}jʌ].

References

Allen, William Sidney. 1953. *Phonetics in ancient India*. London: Oxford University Press.

Bermúdez-Otero, Ricardo. 2006. Morphological structure and phonological domains in spanish denominal derivation. In Fernando Martínez-Gil & Sonia Colina (eds.), *Optimality-theoretic studies in Spanish phonology*, 278–311. Amsterdam: John Benjamins.

Bermúdez-Otero, Ricardo. 2015. Amphichronic explanation and the life cycle of phonological processes. In Patrick Honeybone & Joseph C. Salmons (eds.), *The Oxford handbook of historical phonology*, 374–399. Oxford: Oxford University Press.

Bermúdez-Otero, Ricardo. 2019. Listed stem allomorphs and via-rules. Handout from Brugmann Fellow Course, Session 5: http://www.bermudez-otero.com/Brugmann5.pdf.

Bermúdez-Otero, Ricardo & Graeme Trousdale. 2012. Cycles and continua: On unidirectionality and gradualness in language change. In Terttu Nevalainen & Elizabeth Closs Traugott (eds.), *The Oxford handbook of the history of English*, 691–720. Oxford: Oxford University Press.

Bubenik, Vit. 1996. *The structure and development of middle indo-aryan dialects*. New Delhi: Motilal Banarsidass.

Burrow, Thomas. 1955. *The sanskrit language*. London: Faber and Faber.

Dasgupta, Probal. 2003. Bangla. In George Cardona & Dhanesh Jain (eds.), *The indo-aryan languages*, 351–390. London: Routledge.

Dhongde, Ramesh Vaman & Kashi Wali. 2009. *Marathi*. Amsterdam: John Benjamins.

Drinka, Bridget. 1991. Chronological stratification and the origin of the lengthened grade in the Sanskrit ṣ-aorist. In Frances Ingemann (ed.), *Papers of the mid-america linguistics conference*, 71–76. University of Kansas.

Drinka, Bridget. 1995. *The sigmatic aorist in Indo-European: evidence for the space-time hypothesis (journal of indo-european studies monograph 13)*. Washington: Institute for the Study of Man.

Hayes, Bruce. 1995. *Metrical stress theory: principles and case studies*. Chicago: University of Chicago Press.

Iosad, Pavel. 2020. The life cycle of preaspiration in the Gaelic languages. In J. Kopaczyk & R. McColl Millar (eds.), *Language on the move across domains and communities: Selected papers from the 12th triennial forum for Research on the Languages of Scotland and Ulster*, 200–230. Aberdeen: University of Aberdeen.

Kachru, Yamuna. 1990. Hindi-Urdu. In Bernard Comrie (ed.), *The major languages of South Asia, the Middle East and Africa*, 53–72. London: Routledge.

Kar, Somdev. 2010. *Syllable structure of bangla: an optimality-theoretic approach*. Newcastle upon Tyne: Cambridge Scholars Publishing.

Khan, Sameer ud Dowla. 2010. Bengali (Bangladeshi Stardard): illustration of the the IPA. *Journal of the International Phonetic Association* 40(2). 221–225.

Klaiman, M. H. 1990. Bengali. In Bernard Comrie (ed.), *The major languages of South Asia, the Middle East and Africa*, 73–96. London: Routledge.

Masica, Colin P. 1991. *The Indo-Aryan languages*. Cambridge: Cambridge University Press.

Mayrhofer, Manfred. 1978. *Sanskrit-grammatik*. Berlin: Walter de Gruyter.

Meier-Brügger, Michael. 2003. *Indo-european linguistics*. Berlin: Walter de Gruyter. (Authored in cooperation with Matthias Fritz and Manfred Mayrhofer; translated by Charles Gertmenian).

Narten, Johanna. 1964. *Die sigmatische Aoriste im Veda*. Wiesbaden: Harrassowitz Verlag.

Oberlies, Thomas. 2001. *Pāli: a grammar of the language of the Theravāda Tipiṭaka*. Berlin: Walter de Gruyter.

Oberlies, Thomas. 2003. Aśokan Prakrit and Pāli. In George Cardona & Dhanesh Jain (eds.), *The indo-aryan languages*, 161–203. London: Routledge.

Ohala, John. 1993. The phonetics of sound change. In Charles Jones (ed.), *Historical linguistics: problems and perspectives*, 237–278. Lon-

don: Longman Academic.
Ohala, Manjari. 1983. *Aspects of hindi phonology*. New Delhi: Motilal Banarsidass.
Ohala, Manjari. 1994. Hindi: illustration of the the IPA. *Journal of the International Phonetic Association* 24(1). 35–38.
Pandey, Pramod Kumar. 1989. Word accentuation in Hindi. *Lingua* 77. 37–73.
Pandey, Pramod Kumar. 2021. An optimality theoretical account of word stress in Hindi. *Lingua* 250. 1–19.
Ramsammy, Michael. 2015. The life cycle of phonological processes: Accounting for dialectal microtypologies. *Language and Linguistics Compass* 9(1). 33–54.
Ramsammy, Michael. 2022. On the diachrony of lateral epenthesis. Ms., University of Edinburgh.
Roberts, Philip J. 2012. Latin rhotacism: A case study in the life cycle of phonological processes. *Transactions of the Philological Society* 110. 80–93.
Sen, Ranjan. 2016. Examining the life cycle of phonological processes: considerations for historical research. *Papers in Historical Phonology* 1. 5–36.
Sen, Sukumar. 1960. *A comparative grammar of Middle Indo-Aryan*. Deccan College, Poona: Linguistic Society of India.
Tiersma, Peter. 1978. Bidirectional leveling as evidence for relational rules. *Lingua* 45. 65–77.
Turton, Danielle. 2016. Synchronic stratum-specific rates of application reflect diachronic change: Morphosyntactic conditioning of variation in English /l/-darkening. *Papers in Historical Phonology* 1. 130–165.
Vennemann, Theo. 1972. Rule inversion. *Lingua* 29. 209–242.
Vennemann, Theo. 1978. Phonetic analogy and conceptual analogy. In P. Baldi & R. N. Werth (eds.), *Readings in historical phonology: chapters in the theory of sound change*, 258–274. Philadelphia: Pennsylvania State University Press.
Whitney, William Dwight. 1896. *Sanskrit grammar: including both the classical language, and the older dialects, of veda and brahmana*. Leipzig: Breitkopf & Härtel 3rd edn.