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The class of semivowels in Sanskrit*

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Abstract

In Sanskrit, both liquids /l r/ and glides /j w/ alternate with their syllabic counterparts and form a single class of semivowels in the traditional grammar. The four semivowels, however, show distinct behaviors in various phonological processes. That is, in consonant clusters, /w/ but not the others may occur before another semivowel in the onset. As a target of sandhis, final /r/ merges with the dental sibilant /s/ in most contexts. As a trigger of sandhis, /l/ shows comparable behaviors to oral stops in causing oral gesture assimilation while /r/ tends to cause debuccalization of the preceding consonant. In gemination, /w/ and /l/ may become the target instead of the adjacent non-continuant while /r/ is excluded from the target. In Middle Indo-Aryan assimilation and initial cluster simplification, the four semivowels show different degrees of resistance to loss.

Asymmetrical behaviors of semivowels are attributed to the phonetic differences of these four sounds instead of the universal feature system, sonority, or the prosodic structure. The phonetic properties that lead to idiosyncratic behaviors are: /l/ with a lingual contact in parallel with stops, /w/ realized as a voiced fricative instead of an approximant, and /r/ with a wider aperture than the other three semivowels. These articulatory properties lead to the hierarchy /l/ < /w/ < /j/ < /r/ with an ascending order of vocalicity, which in turn dominates their phonological behaviors.

Keywords: Sanskrit, semivowels, phonotactics, sandhi, gemination

1. Introduction

Consonants that belong to the same classes by the manners of articulation, which include liquids and glides or semivowels, generally show phonetic similarity, behave in a parallel fashion in various phonological processes, and are arranged within a syllable in accordance with the sonority of each class. On the other hand, a number of studies have shown lack of class uniformity and variability in phonological behaviors.

In the traditional grammar of Sanskrit, the class of semivowels subsumes liquids /l r/ and glides /j w/ (usually transliterated as *y* and *v*, respectively), both of which have vocalic

counterparts, i.e. high vowels for glides and syllabic liquids for liquids (Allen 1953; Cardona 2003; Scharf and Hyman 2012). Although they share the property of having a syllabic counterpart, each member of the four semivowels in Sanskrit shows heterogeneous behaviors in phonotactics, sandhi processes, gemination, and consonant cluster changes in Middle Indo-Aryan. This paper argues that the asymmetry is attributed to the phonetic differences of these four sounds instead of the universal feature system, sonority, and the prosodic structure. More specifically, /l/ has a lingual contact and in this respect more consonantal than the other semivowels. The phonetic realization of Sanskrit /w/ is a labiodental fricative and thus more consonantal than the other glide /j/. Various pieces of evidence show that /r/ has a wider aperture and thus is more vocalic than the other three semivowels. These articulatory features lead to the hierarchy /l/ < /w/ < /j/ < /r/ in the ascending order of vocalicity, which in turn is realized in different phonological behaviors of the four semivowels.

In what follows, section 2 gives an inventory of consonants in Sanskrit and discusses phonetic properties of semivowels. The next four sections discuss different phonological behaviors of semivowels: phonotactics in section 3, sandhis in section 4, gemination in section 5, and developments of consonant clusters in Middle Indo-Aryan in section 6. Finally, section 7 provides conclusions.

2. Status and properties of Sanskrit semivowels

The table in (1) below gives a list of consonants in Sanskrit. In the traditional grammar there are three major classes of consonants, i.e. (i) oral and nasal stops with five places and five series, (ii) semivowels, and (iii) sibilants as well as the voiced glottal fricative and two non-phonemic sounds, i.e. visarga that derives from *s* or *r* and anusvāra that derives from nasal stops (Whitney 1889:§75; Macdonell 1910:§4; Allen 1953:20; Masica 1991:157–61; Cardona 2003:110; Kobayashi 2004:§11).

(1)		velar	palatal	retroflex	dental	labial	no specific oral place
	Stops						
	voiceless plain	k	c	ʈ	t	p	
	aspirate	k ^h	c ^h	ʈ ^h	t ^h	p ^h	
	voiced plain	g	j	ɖ	d	b	
	aspirate	g ^h	j ^h	ɖ ^h	d ^h	b ^h	

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nasal	ñ	ñ̄	ṇ	n	m	
Semivowels		y	r	l	v	
(Vowels that alternate with semivowels)		i	ṛ	ḷ	u	
Sibilants		ś	ṣ	s		
voiced fricative						h
voiceless fricative						ḥ (visarga)
nasal						ṁ (anusvāra)

As already stated, semivowels alternate with syllabic counterparts such as *pitṛb^his* ‘father, ins.pl.’ vs. *pitṛā* ‘father, ins.sg.’; *akḷpat* ‘he was able’ vs. *kalpate* ‘he is able’; *mad^hu* ‘honey’ vs. *mad^hvasti* ‘it is honey’; *vāri* ‘water’ vs. *vāryatra* ‘water here’. In the traditional grammar, semivowels are placed between oral and nasal stops, on the one hand, and sibilants and consonants without a specific oral place on the other, in accordance with the degree of aperture (Allen 1953:24–6; Straka 1964:301–2, 313; Scharf and Hyman 2012:128–9, 132–9). The class is called *antaḥsthā* ‘standing between’, that is, between vowels and consonants due to the shared vocalic/consonantal variability or between stops and sibilants in the order of consonants (Whitney 1889:§51a; Allen 1953:29; Mishra 1972:147–8).

While liquids and glides form a single phonological class in Sanskrit, the two are normally independent classes especially because liquids are not syllabic in a number of languages. However, the two classes share exclusively certain articulatory properties and are characterized as ‘approximants’ or ‘frictionless continuants’ (Spencer 1996:14). In phonotactics, both classes serve as the second member of common initial clusters (Wright 2004; Proctor 2009:23–5; Parker 2012b). On the other hand, it has been observed cross-linguistically that the rhotic is more vocalic than the liquid and that the liquid may behave as non-continuants (Ladefoged and Maddieson 1996:216; Kirchner 2001:111–2; Mielke 2005; Proctor 2009:38–45).

In spite of the shared property of vocalic/consonantal alternation, the four semivowels in Sanskrit do not necessarily share the property of sonorancy and differ in a number of respects as will be shown below and Allen (1953:27) considers the classification as phonological. The following descriptions of Sanskrit semivowels are ascribed to native grammarians and may involve dialectal variations (Whitney 1889:§§51–8; Wackernagel 1896:§§178–96; Macdonell 1910:§§49–52; Varma 1929:6–8; Allen 1953:53–5, 57; Mishra 1972:147–54;

Renou 1975:§5; Masica 1991:160–1; Cardona 2003:109; Kobayashi 2004:§§65–6; Scharf and Hyman 2012:65, 71–2).

Of the two liquids, *r* is characterized as retroflex as given in (1), but is variously described as retroflex, dental, or alveolar depending on the phonetic treatises. The Sanskrit rhotic *r* is unique among semivowels in that it does not occur in geminate nor is nasalized. In sandhis it behaves in parallel with the sibilant *s*: see section 4 below. On the other hand, *l* is dental to alveolar or postdental in place and behaves partly in parallel with oral stops and partly with glides. In prehistoric stages, the two liquids merged in either one or the distinction was retained depending on the dialects (Burrow 1973:83–5; Masica 1991:161). The attested stages have both, but, possibly as a remnant of the earlier stages, there is only one root with syllabic *l*, i.e. *kḷp-* ‘be able’, and the syllabic *l* has no long counterpart \bar{l} (Whitney 1889:§26; Wackernagel 1896:§31; Allen 1953:55). On the other hand, syllabic *r* is not uncommon and there is a long counterpart \bar{r} (e.g. *pitṛn* ‘fathers, acc.pl.’) although rare.

Of the two glides, *y* is palatal and may alternate with the voiced palatal stop *j* by strengthening. The labiodental *v* historically derives from bilabial *w* and not *b*, but is described as a voiced fricative and may be strengthened or confused with the bilabial stop *b*. Both glides have different realizations depending on the context: e.g. ‘heavy’ when initial and after a nasal, *h*, or *r* and ‘light’ in word-final position (Varma 1929:126–36; Allen 1953:28–9). In contrast to liquids, glides occur only in the onset but are vocalized in the coda except for geminates that strand over the sequential coda and onset, e.g. *śayyā* ‘bed’, *vavvola-* ‘acacia arabica’.

The next four sections show heterogeneous behaviors of Sanskrit semivowels and argue that they are to be attributed to the phonetic properties as described in this section.

3. Phonotactics

Sonority, which is defined based on classes of sounds as in (2), has generally been accepted as a notion that governs the order of segments within a syllable under the following generalization called the Sonority Sequencing Principle: consonants in onset clusters are arranged so that the sonority rises towards the nucleus and that in the coda forms a mirror image (Hooper 1976:206; Selkirk 1984:116; Clements 1990; Blevins 1995:210–2; Hall 2006:330; Zec 2007:177–9; Parker 2011:116–2, 2012b).

the conventional classification in terms of sonority in (2).

Phonotactics as are given can only be accounted for in terms of both phonological classes and phonetic properties that affect consonant sequencing. The apparently anomalous pattern follows from the phonetic property of Sanskrit *v* that it is realized as a fricative. Studies have shown that perceptual cues of fricatives are robust enough to be salient in pre-consonantal position (Kawasaki-Fukumori 1992; Ohala and Kawasaki-Fukumori 1997; Wright 2001, 2004). In this respect initial *v*-semivowel clusters are comparable to fricative-semivowel clusters: *śy-*, *śr-*, *śv-*; *sy-*, *sr-*, *sv-*; *hr-*, *hl-*, *hv-* where *v* may also occur as the second member of the cluster as a semivowel. That is, on the one hand, *v* is fricative-like in that it may precede another semivowel in initial clusters. On the other hand, it is a semivowel in that it occurs as the second member of initial clusters after a stop or a fricative, e.g. *kva* ‘where’, *dva* ‘two’, *śveta-* ‘white’, *svādu-* ‘sweet’, *hvayati* ‘he calls’. Due to its phonological characterization and phonetic realization, therefore, *v* is ambivalent in Sanskrit phonotactics.

On the other hand, examination of medial clusters in Masica (1991:161–2) and Turner and Turner (1971) shows that there are apparently no coda clusters that indicate distributional differences among semivowels in lack of clusters of two distinct liquids such as *r̥l*. In final position only one consonant is allowed: underlying consonant clusters are simplified by deleting all but the first, e.g. *tudants* ‘pressing (pr.ppl., nom.sg.)’ > *tudan*, except for *r̥C* clusters such as *ūr̥k* ‘strength’ and *amār̥ṭ* ‘wiped clean’ (Whitney 1889:§150; Wackernagel 1896:§261; Burrow 1973:100–1; Renou 1975:§29; Masica 1991:162; Cardona 2003:115). As a final consonant, *l* may occur although rare but *r̥* must be devoiced and debuccalized: see section 4.1 below (Whitney 1889:§144; Wackernagel 1896:§260c).

As a nucleus, there is a clear asymmetry between the two liquids as stated in section 2 above: there are good number of instances of *r̥*, rarely those of *r̥̄* and *l̄*, and none of *l̄̄*. Although the asymmetry may be a result of historical confusion of the two liquids, it may suggest that *r̥* is more vocalic than *l̄* and thus is a better candidate for the nucleus than *l̄*.

In sum, productive *vy-* and *vr-* initial clusters suggest that *v* is more consonantal than at least *y* and *r̥* while a few words have *vl-* cluster. This property of *v* apparently follows from its phonetic value as a fricative and can hardly be accounted for in terms of sonority. On the other hand, the presence of the final *r̥C*-clusters as well as the frequency of syllabic *r̥* as opposed to *l̄* suggests that *r̥* is closer to vowels than the other semivowels. The cross-linguistic asymmetry between *r̥* and *l̄* has been noted by earlier literature such as Proctor (2009) and Proctor and Walker (2012). Although it may be possible to attribute the

asymmetry to the higher sonority of *r* than *l*, such a proliferation of the sonority hierarchy is a questionable move.

4. Sandhis involving semivowels

4.1. Semivowels as targets

The consonants that are allowed in word-final position and thus are targets of external sandhis form a subset of those given in (1). Of the four semivowels, glides do not occur finally, *l* is rare and unchanged (see section 3 above), and only *r* is subject to various sandhi processes depending on the contexts. Final *r* merges with *s* in most contexts, which is the only sibilant that occurs word-finally. The merger of *r* and *s* is reasonable in that they both have lingual stricture in the dental/alveolar region (Kobayashi 2004:§104). The alternation is supported by the phonetic realization of the rhotic as a voiced retroflex fricative in Mandarin Chinese (Spencer 1996:19; also Proctor 2009:7–8) and rhotacism of *s* in voiced environments in some languages such as Latin and Proto-Germanic, leading to synchronic alternation of the two (Hock 1991a:81–2; Wiese 2011:724–5).

As a target of sandhi processes, both *r* and *s* tend to be realized as *r* when followed by a voiced sound, on the one hand, and a sibilant or visarga when followed by a voiceless sound or a pause, on the other hand (Whitney 1889:§§164–79; Wackernagel 1896:§§284–7; Allen 1953:100–1, 1972:70–9; Renou 1975:§§28, 36–9; Cardona 2003:117–9; Kobayashi 2004:§104). As in (4a), *r* before a voiced sound is unchanged except before *r* where it is dropped with a compensatory lengthening of the preceding vowel. The only difference between *r* and *s* is the outcome of *s* after short *a* and before a voiced sound: as in (4b) final *-as* becomes *-o* and the following vowel is dropped if it is short *a* but remains unchanged otherwise. However, i.e. after vowels other than short *a*, the outcomes of the final *s* are the same as those of *r*: compare (4c) with (4a).

(4) a. *punar rakṣati* > *punā rakṣati* ‘he protects again’

punar jayati (no change) ‘he wins again’

punar atra (no change) ‘again here’

b. *devas rakṣati* > *devo rakṣati* ‘the god protects’

devas jayati > *devo jayati* ‘the god wins’

devas atra > *devo 'tra* 'the god is here'

c. *kavis rakṣati* > *kavi rakṣati* 'the poet protects'

kavis jayati > *kavir jayati* 'the poet wins'

kavis atra > *kavir atra* 'the poet is here'

Loss of *r* before *r* is attributed to lack of geminate *r* in Sanskrit. The change of *-as* to *-o* implies vocalization of *-s* to *-u* in a voiced context with a subsequent monophthongization of *-au* to *-o*.

When followed by a voiceless sound or in utterance-final position, both *r* and *s* are realized as a voiceless fricative as in (5). The outcome agrees in place when the following stop is coronal, but otherwise, i.e. when followed by labial or velar consonants or in utterance-final position, it is a glottal fricative or visarga. Before sibilants, the outcome may either be a visarga or the same sibilant.

(5) a. *punar carati* > *punaś carati* 'he wanders again'

punar tatra > *punas tatra* 'again there'

punar karoti > *punaḥ karoti* 'he makes again'

punar sīdati > *punaḥ sīdati* ~ *punas sīdati* 'he sits again'

punar > *punaḥ* 'again'

b. *devas carati* > *devaś carati* 'the god wanders'

devas tatra > *devas tatra* 'the god is there'

devas karoti > *devaḥ karoti* 'the god makes'

devas sīdati > *devaḥ sīdati* ~ *devas sīdati* 'the god sits'

devas > *devaḥ* 'the god'

While the behavior of *r* as a target of external sandhi cannot be compared with that of the other three semivowels that do not or barely occur in the same environments, loss of final *r* before the following *r* to avoid geminates is an idiosyncrasy of *r*. On the one hand, other consonants that lack the geminate counterpart are *h*, visarga, and anusvāra, the latter two of which do not occur in the onset (Wackernagel 1896:§96; Macdonell 1910:§30; Kobayashi 2004:§66). The fact that these three lack a specific oral gesture suggests that *r* has a wider

aperture than the other consonants with an oral stricture. On the other hand, prohibition of geminate *r* is comparable to avoidance of hiatus by vowel merger or devocalization of high vowels as in *c^hāyā atra* > *c^hāyātra* ‘a shade is here’, *mad^hu atra* > *mad^hvatra* ‘honey is here’ (Whitney 1889:§§125–38; Wackernagel 1896:§§267–74; Allen 1972:29–45; Renou 1975:§§25, 40–2; Cardona 2003:111–4). Lack of geminate *r* in any position is in sharp contrast with the presence of geminates of *s*, whether it is originally *s* or *r*, e.g. *punas sīdati* in (5a) and *devas sīdati* in (5b), or geminates of the other semivowels.

4.2. Semivowels as triggers

Because all the four semivowels may occur initially, they may condition assimilatory processes of the preceding word-final sounds. The observed phonological patterns show the two types of contrasts: first, *r* as opposed to the other three and, second, *l* as opposed to the other three.

The earlier stage shows the contrast between *r* and the other three with respect to the outcome of the preceding labial nasal. In certain Vedic traditions final *m* becomes a nasalized semivowel before semivowels *y l v* by regressive assimilation of the oral gesture as illustrated in (6) (Whitney 1889:§§71c, 213d; Wackernagel 1896:§283c; Macdonell 1910:§75.4; Allen 1972:80–1; Cardona 2003:116–7; Suzuki 2013).¹

- (6) *yam yam yujam kṛṇute brahmaṇaspatīs* > *yaṃ yaṃ yujān kṛṇute brahmāṇaspatih*
 ‘whomever Brahmaṇaspati makes an ally’ (RV 2.25.1d)
tam lokam > *taḷ lokam* (VS 20.25) ‘that world’
agnim dūtam vṛṇīmahe > *agnin dūtaṃ vṛṇīmahe* (RV 1.12.1a)
 ‘We choose Agni as messenger.’

On the other hand, *m* before *r* becomes anusvāra by debuccalization as well as before fricatives as in (7) (Whitney 1889:§213e; Wackernagel 1896:§283d; Macdonell 1910:§75.3; Allen 1972:81–3; Cardona 2003:116; Suzuki 2013).

- (7) *aham rakṣāmi* > *aham̐ rakṣāmi* ‘I am protecting’
aham śāye > *aham̐ śāye* ‘I am lying’
aham hasāmi > *aham̐ hasāmi* ‘I am laughing’

In later Sanskrit, *m* is debuccalized and becomes anusvāra before glides as well as *r*: see (8d, e) below. Only *l* causes assimilation of *m* as is given in (6) or may optionally become anusvāra: see (8a) below.

Among the four semivowels, *l* but not the others tends to trigger the type of assimilation of the preceding consonant that stops do. More specifically, dental and labial nasals and dental stops undergo assimilation of oral gesture to the following *l*, leaving only nasality behind, as in (8a). The processes are parallel with those before coronal stops where dental and labial nasals and dental stops undergo assimilation in place as in (8b). In contrast, before *r*, *y*, and *v*, the dental nasal remains unchanged, the labial nasal is debuccalized, and oral stops assimilate only in voice as in (8c–e) (Whitney 1889:§§202, 206, 213; Wackernagel 1896:§§276d, 281, 283b, c; Macdonell 1910:§§75–7; Allen 1953:39, 1972:80–1, 83–4, 91–3; Cardona 2003:115–7; Suzuki 2013).

- (8) a. *b^havān lunāti* > *b^havāl̄ lunāti* ‘you cut’
 tam lunāti > *tal̄ lunāti* ~ *taṁ lunāti* ‘he cuts him’
 tat lunāti > *tal lunāti* ‘he cuts that’
- b. *b^havān jayati* > *b^havāñ jayati* ‘you win’
 tam jayati > *tañ jayati* ‘he wins him’
 tat jayati > *taj jayati* ‘he wins that’
- c. *b^havān rakṣati* (no change) ‘you protect’
 tam rakṣati > *taṁ rakṣati* ‘he protects him’
 tat rakṣati > *tad rakṣati* ‘he protects that’
- d. *b^havān yajati* (no change) ‘you sacrifice’
 tam yajati > *taṁ yajati* ‘he sacrifices him’
 tat yajati > *tad yajati* ‘he sacrifices that’
- e. *b^havān vindati* (no change) ‘you find’
 tam vindati > *taṁ vindati* ‘he finds him’
 tat vindati > *tad vindati* ‘he finds that’

Of the four semivowels, therefore, the degree of causing debuccalization of the preceding sound is: $r > y > v > l$ in the descending order while the degree of causing assimilation of the oral gesture is the reverse of this hierarchy. Together with lack of geminate r as well as h , the difference is best attributed to the degree of oral aperture: r is most likely to cause debuccalization and does not cause assimilation in oral gesture because it has a greater aperture and is more vocalic than the other semivowels. In contrast, l is most likely to cause assimilation in oral gesture and is least likely to cause debuccalization because it has a lingual contact in parallel with stops. The glides, i.e. $y > v$, are between these two. As has been shown, the four semivowels do not form a natural class as a trigger of sandhis.

5. Gemination

Sanskrit shows gemination in consonant clusters, typically intervocalic biconsonantal clusters, described by various phonetic treatises and attested in inscriptions and manuscripts (Whitney 1889:§§228–9; Wackernagel 1896:§96–8; Varma 1929: 63–78, 107–25; Hock 1991b: 128–32; Vaux 1992; Kobayashi 2001, 2004:§23; Cardona 2003: 120, n.d.:50–66; Suzuki 2012). As a rule, gemination affects the first consonant of the cluster or, if the first is r or h , which cannot be geminated, the second. Thus, stops and sibilants followed by a semivowel become geminates as in (9a) and consonants including semivowels preceded by r or h are geminated as in (9b).

(9) a. *adya* > *addyā* ‘today’

amuṣya > *amuṣṣya* ‘of that one’

cakra- > *cakkra-* ‘wheel’

ā tvā > *āttvā* ‘hither you’

viśvataḥ > *viśśvataḥ* ‘everywhere’

uru prat^hasva > *urup^hrat^hassva* ‘spread wide’

b. *art^ha-* > *art^hta-* ‘purpose’

darśapūrṇamāsa > *darśapūrṇamāsa* ‘new and full moon rites’

sūryasya > *sūryyasya* ‘of the sun’

bahvīḥ > *bahvvīḥ* ‘many’

When a semivowel is the first member of the cluster, there are some examples where v is

geminated before *y* as in (10a), but in the clusters of *l* and a stop and those of *v* and a nasal, the second gets geminated instead with an optional variant with gemination of the first.

(10) a. *daivyā* > *dai**v**vyā* ‘divine’

ṛt^hivyām > *ṛt^h**i**vvyām* ‘earth’

b. *kalpān juhōti* > *kal**ṣṣ**āñjuhōti* ‘offers with the kalpa mantras’ cf. *kalpāñjuhōti*

vib^hudāvne > *vib^hudā**v**ṇne* ‘who grants power’ cf. *vib^hudāvṇne*

In spite of the rule, therefore, oral and nasal stops are preferred targets of gemination over semivowels and this tendency is attributed by Suzuki (2012) to the oral closure or less aperture of stops. Among semivowels, examples in (10) show that *l* with a partial closure and *v* with a labiodental stricture are more susceptible to gemination than *y*, which in turn may geminate after *r* that lacks a geminate counterpart as in (9b). The hierarchy of susceptibility to gemination is thus: *l v > y > r* in the decreasing order, which is in accordance with the findings of the previous sections.

6. Middle Indo-Aryan consonant cluster changes

Lack of class unity among semivowels is also observed in consonant cluster changes in Middle Indo-Aryan. Middle Indo-Aryan is known for extensive total assimilation of medial clusters and simplification of initial clusters (Ghatage 1962; Pischel 1981:§§268–334; Masica 1991:171–80; Geiger 1994:§51–4; von Hinüber 2001:§§225–61; Oberlies 2001:95–105, 2003:177–9; Suzuki 2002; Bubenik 2003:217–8). The outcome of assimilation or simplification depends on the classes of consonants that form the clusters rather than the order of consonants.

In medial positions, sibilants, nasals, and semivowels assimilate to stops irrespective of their order; further, semivowels assimilate to sibilants and nasals. Initial clusters are simplified in a parallel fashion. To take some examples from Pali, in *svapna-* > *sop**ṣ**pa-* ‘sleep’ the resultant consonant is the first and not the second in both initial and medial clusters. On the other hand, in *sparśa-* > *ṣ^hassa-* ‘touch’, the second consonant is the outcome in both initial and medial clusters.² When the cluster consists of two distinct stops or nasals, then the outcome is a geminate of the second consonant by regressive assimilation, e.g. *sapta-* > *satta-* ‘seven’, *nimna-* > *ninna-* ‘deep, low’. However, when the cluster consists of two distinct

semivowels, the direction of assimilation depends not on the order but on which semivowels form the cluster as in (11) (Pischel 1981:§§286, 287, 296; Geiger 1994:§52.5, 54.6; von Hinüber 2001:§226.1, 225, 229; Oberlies 2001:99; 2003:178–9). The implied hierarchical relation is $l > v > y > r$ in the descending order of dominance in assimilation.

(11) a. Progressive assimilation	implied dominance relation
<i>bilva-</i> > <i>billa-</i> ‘fruit of Aegle marmelos’	$l > v$
<i>kalya-</i> > <i>kalla-</i> ‘ready, possible’	$l > y$
* <i>parivyaya-</i> (> <i>parivvaya-</i>) > <i>paribbaya-</i> ‘expenditure’	$v > y$
* <i>vyāta-</i> > <i>vatta-</i> ‘opened wide (of mouth)’	
<i>tivra-</i> (> <i>tivva-</i>) > <i>tibba-</i> ‘sharp’	$v > r$
* <i>vrāta-</i> > <i>vatta-</i> ‘religious observance’	
b. Regressive assimilation	
<i>durlab^ha-</i> > <i>dullab^ha-</i> ‘difficult to attain’	$l > r$
<i>sarva-</i> (> <i>savva-</i>) > <i>sabba-</i> ‘all’	$v > r$
<i>ārya-</i> > <i>ayya-</i> ‘venerable’	$y > r$

Given that the outcome of assimilation is determined by the classes of consonants rather than their order, earlier studies have proposed that the consonant that wins out is determined by the sonority hierarchy, in which case, the more sonorous assimilates to the less sonorous (Grammont 1971:185–9; Hankamer and Aissen 1974:134; Junghare 1979:126–9; Hock 1991a:64–5, 1991b; Geiger 1994:§51). However, while assimilation between different classes of consonants, i.e. stops, sibilants, nasals, and semivowels, conforms to the prediction of this analysis, assimilation between different semivowels as exemplified in (11) does not follow from the hypothesis, which would predict that glides assimilate to liquids and that the clusters of two distinct glides or liquids undergo regressive assimilation (Wetzels and Hermans 1985; Cho 1999). Thus, clusters that consist of r and a glide are to become geminate r , which is prohibited in Sanskrit, instead of geminate glides as observed in (11).

As an alternative, some studies have assumed that the onset-initial consonant dominates in assimilation, thus *vrāta-* > *vatta-* in (11a) where the first consonant in the cluster is onset-initial but *ār-ya-* > *ayya-* in (11b) where the second consonant is onset-initial (Wetzels and Hermans 1985:215–6; also Murray 1982; Vaux 1992; Cho 1999). However, there are

counterexamples: *l* in *l*-initial clusters such as *bilva-* > *billa-* and *kalya-* > *kalla-* in (11a) is in the coda but yet dominates assimilation. It is thus not the onset-initial consonant that dominates assimilation.

The only solution, therefore, is to assume that consonant cluster changes are governed by the hierarchy not of sonority but some sort of strength or articulatory property including aperture (von Hinüber 2001:§226; Oberlies 2001:99; Suzuki 2002:64 (II)). And this hierarchy is in accordance with the observations made in the previous three sections. The evidence of initial and final clusters examined in section 3 suggests the hierarchies $v > y > r$ and $l > r$, respectively, of occurring in peripheral positions in the syllable. Section 4 has shown that the hierarchy $l > y > v > r$ governs the likelihood of causing oral gesture assimilation or, inversely, of debuccalization. Further, section 5 has established the hierarchy $l > v > y > r$ of the susceptibility to gemination. These observations together would lead to the hierarchy: $l > v > y > r$ in the descending order of consonantality or the ascending order of vocalicity. As has been shown, the hierarchical relation of semivowels observed in medial cluster assimilation and initial cluster simplification in Middle Indo-Aryan languages can only be accounted for in light of the phonological behaviors of semivowels in Sanskrit.

7. Conclusions

While sharing the property of vocalic/consonantal alternation, the four semivowels in Sanskrit show heterogeneous phonotactic and phonological behaviors and undergo different developments in Middle Indo-Aryan. These different behaviors naturally follow from the hierarchy $l < v < y < r$ with an ascending order of vocalicity, which in turn is attributed to the various phonetic properties of semivowels, i.e. partial closure of *l*, phonetic realization of *v* as a labiodental fricative, and a wider aperture of *r*.

The proposed interpretation is couched on and provides additional evidence for the phonetically based phonology in seeking behind phonological phenomena articulatory motivations (Browman and Goldstein 1989, 1990, 1991, 1992; Blevins 2004; Proctor 2009; Proctor and Walker 2012) and perceptual motivations (Ohala 1981, 1990, 1997, 2005; Kawasaki-Fukumori 1992; Ohala and Kawasaki-Fukumori 1997; Wright 2001, 2004; Blevins 2004; Martin and Peperkamp 2011), but argues against analyses based on the abstract notions including sonority and prosodic structure.

Notes

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- 1 The underlines and grave accents represent pitch, which is irrelevant for the discussions here.
- 2 As shown in the examples given, the outcome of sibilant–stop clusters is an aspirated stop because the deleted sibilant leaves aspiration behind (Pischel 1981:§§301–11; Masica 1991:172, 177; von Hinüber 2001:§228; Oberlies 2001:98, 2003:177–8; Bubenik 2003:218). The outcome of the medial cluster *rs̄* is a dental sibilant and not palatal because the three places of sibilants merged into the dental (Pischel 1981:§227; Masica 1991:168; von Hinüber 2001:§219; Oberlies 2001:70, 2003:175; Bubenik 2003:216). These additional changes are irrelevant to the discussions here.

References

- Allen, W. S. 1953. *Phonetics in ancient India*. London: Oxford University Press.
- _____. 1972. *Sandhi: The theoretical, phonetic and historical bases of word-junction in Sanskrit*. 2nd ed. The Hague: Mouton.
- Blevins, Juliette. 1995. The syllable in phonological theory. In John A. Goldsmith (eds.), *The handbook of phonological theory*, 206–44. Cambridge, MA: Blackwell.
- _____. 2004. *Evolutionary Phonology: The emergence of sound patterns*. Cambridge: Cambridge University Press.
- Browman, Catherine, and Louis Goldstein. 1989. Articulatory gestures as phonological units. *Phonology* 6: 201–51.
- _____. 1990. Gestural specification using dynamically-defined articulatory structures. *Journal of Phonetics* 18: 299–320.
- _____. 1991. Gestural structures: Distinctiveness, phonological processes, and historical change. In Ignatius G. Mattingly and Michael Studdert-Kennedy (eds.), *Modularity and the motor theory of speech perception*, 313–38. Hillsdale, NJ: Lawrence Erlbaum.
- _____. 1992. Articulatory Phonology: An Overview. *Phonetica* 49: 155–80.
- Bubenik, Vit. 2003. Prakrits and Apabhraṁśa. In Cardona and Jain (eds.), 204–49.
- Burrow, T. 1973. *The Sanskrit language*. New and revised edn. London: Faber and Faber. [Reprinted 1977.]
- Cardona, George. 2003. Sanskrit. In Cardona and Jain (eds.), 104–60.
- _____. n.d. Developments of nasals in early Indo-Aryan: Anunāsika and anusvāra. Unpublished Ms.,

- University of Pennsylvania.
- Cardona, George, and Dhanesh Jain (eds.). 2003. *The Indo-Aryan languages*. London: Routledge.
- Cho, Young-mee Yu. 1999. *Parameters of consonantal assimilation*. München: Lincom Europa.
- Clements, George N. 1990. The role of the sonority cycle in core syllabification. In Kingston and Beckman (eds.), 283–333.
- Geiger, Wilhelm. 1994. *A Pali grammar*. Translated by Batakrishna Ghosh. Revised and edited by K. R. Norman. Oxford: Pali Text Society. [Originally published in German 1916.]
- Ghatage, A. M. 1962. The Middle Indo-Aryan assimilation. In A. M. Ghatage (ed.), *Historical linguistics and Indo-Aryan languages*, 110–30. Bombay: University of Bombay.
- Grammont, Maurice. 1971. *Traité de phonétique*. Paris: Delagrave. 9e éd.
- Hall, T. A. 2006. Syllable: Phonology. In Keith Brown (ed.), *Encyclopedia of language and linguistics*, vol. 12, 329–33. 2nd edn. Amsterdam: Elsevier.
- Hankamer, Jorge, and Judith Aissen. 1974. The sonority hierarchy. In Anthony Bruck, Robert A. Fox, and Michael W. La Galy (eds.), *Papers from the parasession on Natural Phonology*, 131–45. Chicago: Chicago Linguistic Society.
- Henke, Eric, Ellen M. Kaisse, and Richard Wright. 2012. Is the sonority sequencing principle an epiphenomenon? In Parker (ed.), 65–100.
- von Hinüber, Oskar. 2001. *Das ältere Mittelindisch im Überblick*. 2nd edn. Wien: Verlag der Österreichische Akademie der Wissenschaften.
- Hock, Hans Henrich. 1991a. *Principles of historical linguistics*. 2nd edn. Berlin: Mouton de Gruyter.
- _____. 1991b. Dialects, diglossia, and diachronic phonology in early Indo-Aryan. In William G. Boltz and Michael C. Shapiro (eds.), *Studies in the historical phonology of Asian languages*, 119–59. Amsterdam: Benjamins.
- Hooper, Joan B. 1976. *An introduction to Natural Generative Phonology*. New York: Academic Press.
- Junghare, Indira Yashwant. 1979. *Topics in Pali historical phonology*. Delhi: Motilal Banarsidass.
- Kawasaki-Fukumori, Haruko. 1992. An acoustical basis for universal phonotactic constraints. *Language and Speech* 35: 73–86.
- Kingston, John, and Mary E. Beckman (eds.). 1990. *Papers in Laboratory Phonology I: Between the grammar and the physics of speech*. Cambridge: Cambridge University Press.
- Kirchner, Robert. 2001. *An effort based approach to consonant lenition*. New York: Routledge.
- Kobayashi, Masato. 2001. Syllable rimes in Old Indo-Aryan and Dravidian. *Journal of Asian and African Studies* 62: 91–106.
- _____. 2004. *Historical phonology of Old Indo-Aryan consonants*. Tokyo: Tokyo University of Foreign Studies.
- Ladefoged, Peter, and Ian Maddieson. 1996. *The sounds of the world's languages*. Malden, MA: Blackwell.

- Macdonell, A. A. 1910. *Vedic grammar*. Strassburg: Trübner. [Reprinted 2000. With a preface by Albrecht Wezler. New Delhi: Munshiram Manoharlal.]
- Martin, Andrew, and Sharon Peperkamp. 2011. Speech perception and phonology. In van Oostendorp et al. (eds.), 2334–56.
- Masica, Colin P. 1991. *The Indo-Aryan languages*. Cambridge: Cambridge University Press.
- Mielke, Jeff. 2005. Ambivalence and ambiguity in laterals and nasals. *Phonology* 22: 169–203.
- Mishra, Vidhata. 1972. *A critical study of Sanskrit phonetics*. Varanasi: The Chowkhamba Sanskrit Series Office.
- Monier-Williams, Monier. 1899. *A Sanskrit-English dictionary: Etymologically and philologically arranged with special reference to cognate Indo-European languages*. Oxford: Oxford University Press. [New edition, greatly enlarged and improved with the collaboration of E. Leumann, C. Cappeller, et al. 1984. Delhi: Motilal Banarsidass.]
- Murray, Robert W. 1982. Consonant cluster developments in Pali. *Folia Linguistica Historica* 3: 163–84.
- Oberlies, Thomas. 2001. *Pāli: A grammar of the language of the Theravāda Tipiṭaka*. Berlin: Walter de Gruyter.
- _____. 2003. Aśokan Prakrit and Pali. In Cardona and Jain (eds.), 161–203.
- Ohala, John J. 1981. The listener as a source of sound change. In Carrie S. Masek, Roberta A. Hendrick, and Mary Frances Miller (eds.), *Papers from the parasession on language and behavior*, 178–203. Chicago: Chicago Linguistic Society.
- _____. 1990. The phonetics and phonology of aspects of assimilation. In Kingston and Beckman (eds.), 258–75.
- _____. 1997. Emergent stops. *Proceedings of the 4th Seoul International Conference on Linguistics 11–15 Aug 1997*, 84–91.
- _____. 2005. Phonetic explanations for sound patterns: Implications for grammars of competence. In William J. Hardcastle and Janet Mackenzie Beck (eds.), *A figure of speech: A festschrift for John Laver*, 23–38. London: Erlbaum.
- Ohala, John J., and Haruko Kawasaki-Fukumori. 1997. Alternatives to the sonority hierarchy for explaining segmental sequential constraints. In Stig Eliasson and Ernst Håkon Jahr (eds.), *Language and its ecology: Essays in memory of Einar Haugen*, 343–65. Berlin: Mouton de Gruyter.
- Oostendorp, Marc van, Colin J. Ewen, Elizabeth V. Hume, and Keren Rice (eds.). 2011. *The Blackwell companion to phonology*. Five volumes. Chichester: Wiley-Blackwell.
- Parker, Steve. 2011. Sonority. In Oostendorp et al. (eds.), 1160–84.
- _____. (ed.). 2012a. *The sonority controversy*. Berlin: Walter de Gruyter.
- _____. 2012b. Sonority distance vs. sonority dispersion – a typological survey. In Parker (ed.), 101–65.
- Pischel, Richard. 1981. *A grammar of the Prakrit languages*. 2nd ed. Translated by Subhadra Jha. Delhi:

- Motilal Banarsidass.
- Proctor, Michael. 2009. *Gestural characterization of a phonological class: The liquids*. Ph.D. dissertation, Yale University.
- Proctor, Michael, and Rachel Walker. 2012. Articulatory bases of sonority in English liquids. In Parker (ed.), 289–316.
- Renou, Louis. 1975. *Grammaire sanscrite*. 2nd edn. Paris: Adrien Maisonneuve.
- Scharf, Peter M., and Malcolm D. Hyman. 2012. *Linguistic issues in encoding Sanskrit*. Delhi: Motilal Banarsidass.
- Selkirk, Elisabeth. 1984. On the major class features and syllable theory. In Mark Aronoff and Richard T. Oerle (eds.), *Language sound structure*, 107–36. Cambridge, MA: MIT Press.
- Seo, Misun. 2011. Syllable contact. In Oostendorp et al. (eds.), 1245–62.
- Spencer, Andrew. 1996. *Phonology*. Oxford: Blackwell.
- Straka, Georges. 1964. A propos de la question des semi-voyelles. *Zeitschrift für Phonetik, Sprachwissenschaft und Kommunikationsforschung* 17: 301–23.
- Suzuki, Yasuko. 2002. Consonant cluster changes in Pali: Toward restricting the phonological patterns, Parts I and II. *Journal of Inquiry and Research* 75: 97–125; 76: 63–86.
- _____. 2012. Sanskrit gemination as lengthening: In relation to svarabhakti, yama, and Middle Indo-Aryan assimilation. In Jared Klein and Kazuhiko Yoshida (eds.), *Indic across the millennia: From the Rigveda to modern Indo-Aryan. Proceedings of the linguistics sessions of the 14th World Sanskrit Conference, Kyoto, Japan, September 1–5, 2009*, 193–208. Bremen: Hempen Verlag.
- _____. 2013. On characterizing Sanskrit anusvāra. Shu-Fen Chen and Benjamin Slade (eds.), *Grammatica et verba: Glamor and verve*, 282–97. Ann Arbor, MI: Beech Stave Press.
- Turner, Ralph L., and D. R. Turner. 1971. *A comparative dictionary of the Indo-Aryan languages, Volume 3: Phonetic analysis*. London: Oxford University Press. [Reprinted 1999, Delhi: Motilal Banarsidass.]
- Varma, Siddheshwar. 1929. *Critical studies in the phonetic observations of Indian grammarians*. London: Royal Asiatic Society. [Reprinted 1961, Delhi: Munshi Ram Manohar Lal.]
- Vaux, Bert. 1992. Gemination and syllabic integrity in Sanskrit. *Journal of Indo-European Studies* 20: 283–303.
- Wackernagel, Jakob. 1896. *Altindische Grammatik, Band I: Lautlehre*. Göttingen: Vandenhoeck & Ruprecht. [2., unveränderter Nachdruck, 1978]
- Wetzels, Leo, and B. Hermans. 1985. Aspirated geminates in Pali. In H. Bennis and F. Benkema (eds.), *Linguistics in the Netherlands 1985*, 213–23. Dordrecht: Foris.
- Whitney, William Dwight. 1889. *A Sanskrit grammar*. 2nd edn. Cambridge, MA: Harvard University Press. [Fifteenth issue, 1981]
- Wiese, Richard. 2011. The representation of rhotics. In Oostendorp et al. (eds.), 711–29.

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- Wright, Richard. 2001. Perceptual cues in contrast maintenance. In Elizabeth Hume and Keith Johnson (eds.), *The role of speech perception in phonology*, 251–78. New York: Academic Press.
- _____. 2004. A review of perceptual cues and cue robustness. In Bruce Hayes, Robert Kirchner, and Donca Steriade (eds.), *Phonetically based phonology*, 34–57. Cambridge: Cambridge University Press.
- Zec, Draga. 2007. The syllable. In Paul de Lacy (ed.), *Cambridge handbook of phonology*, 161–94. Cambridge: Cambridge University Press.

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