A Structured Approach to Obstruent+Approximant+Vowel Strings in Hindi

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1. Introduction. Over the past two decades, a body of research has strived to diminish the formal distinction between phonology and phonetics by reducing the role of structured representations. For example, syllables, which are inherently hierarchical, have been abandoned by some scholars (e.g., Steriade 1999) in favour of an approach where segments are ordered to maximize their perceptibility (e.g., Wright 2004). In this paper, we motivate a structured view of the syllable, drawing on data from Hindi. We show that: (i) phonetically similar strings respect different phonotactic constraints, which motivates different syllabifications; (ii) the same surface string can be subject to alternative syllabifications, one of which motivates the positing of phonetically empty nuclei.

Phonotactic constraints regulate the shapes of syllable constituents (e.g., Selkirk 1982, Steriade 1988, Harris 1994). In languages that permit consonant+approximant+vowel (CAV) strings, two analyses are observed, based on sonority and place constraints that hold between C and A or between A and V. When A is a liquid, it typically forms a complex onset with the preceding C (Clements 1990); see [Ia] in Table I. Alternatively, A can be in the nucleus, forming a diphthong with the following V (Vata /l/; Kaye 1985); see [Ib]. When A is a glide, [Ia] and [Ib] are both commonly attested: A can either belong to a complex onset (English /w/; Davis & Hammond 1995) or it can belong to the nucleus, forming a diphthong with the following V (French /w/; Klein 1991).

In this paper, we propose four alternative representations for CAV strings in Hindi: CA may form a complex onset [Ia]; AV may form a light diphthong [Ib]; A may simultaneously be part of a complex onset and light diphthong [Ic]; or C and A may be separated by an empty nucleus [Ie]. We first show that place and sonority constraints holding for CAV in Hindi motivate [Ia], [Ib], and [Ic] for both liquids and glides, regardless of position in the word, depending on the liquid or glide implicated (§§2-3). Second, we turn to another type of sequence found in medial position: /CəAV/, which optionally undergoes schwa deletion, yielding CAV. Ohala (1983, 1999) proposes that the resulting CAV is analysed with CA as coda+onset, shown in [Id] (see also Pierrehumbert & Nair 1996). This analysis, however, is hard to motivate because other CAV strings, with the *same* type of A, are syllabified as part of complex onsets [Ia] (see §§2-3). We propose, contrary to Ohala, that the outputs for /CəAV/, both with and without schwa, contain a nucleus between C and A as in [Ie], where Ø represents the deleted /ə/. We show that there is evidence for [Ie] from stress, even when the nucleus surfaces as phonetically empty (§4).

2. Initial CAV. We propose that three representations hold for initial CAV in Hindi. /l, r/ form part of a complex onset [Ia]; /j/ and /r_i/, a rhotic that only appears before /i/, form part of a diphthong [Ib]; and /w/ has a dual representation: it forms part of a complex onset and diphthong [Ic].

As alluded to above, evidence for syllabification of CAV comes from phonotactic constraints on sonority and place: more constraints hold between C and A when CA forms a complex onset [Ia]; few constraints hold between C and A when a constituent break interrupts C and A, i.e., when A forms a diphthong with V [Ib]. Considering sonority for word-initial CAV, (1i-iii) show that when A = /l, r, w/, the onset head (C) must be an obstruent, a constraint that holds of complex onsets in most languages (Kaye et al. 1990). If C is higher in sonority, a nasal, the cluster is ill-formed. (1iv-v) show that when A = /r_i, j/, this constraint does not hold. C *can* be nasal, consistent with a constituent break between C and A in these forms (i.e., /r_i, j/ forms a diphthong with V).

(1) Sonority:

A in complex onset:	i.	A = /l/		ii.	A = /r/		iii.	A = /w/
		[pliːhaː] ‘spleen’			[krod^h] ‘anger’			[twəʧaː] ‘skin’
		*[mlV]			*[mrV]			*[nwV]
A in nucleus:	iv.	A = /r_i/		v.	A = /j/			
		[krijaː] ‘act’			[kjũːki] ‘because’			
		[mrig] ‘deer’			[mjaːn] ‘sheath’			

Considering place, (2i-ii) shows that when A = /l, w/, place agreement between C and A is not permitted. (2iii) shows that this does not hold of /j/. This is consistent with CA forming a complex onset [Ia] when A = /l, w/ and with AV forming a diphthong [Ib] when A = /j/. (We set /r, r_i/ aside in (2i-ii) and (4ii) as rhotics never respect place constraints in complex onsets, across languages.) Additionally, (2iv) shows that when A = /l, r/, A can be followed by any V, consistent with a complex onset analysis; (2v-vi) show that when A = /j, w/, place agreement between A and V is not permitted, consistent with a diphthong analysis. Crucially, (2ii) and (2vi) motivate a dual representation for /w/ [Ic], as /w/ shows place constraints with the preceding C *and* following V.

(2)			
Place between C and A:	A in complex onset:	i. A = /l/ *[tlV]	ii. A = /w/ *[pwV]
	A in nucleus:	iii. A = /j/ [tjohaːr] 'festival'	
Place between A and V:	A in complex onset:	iv. A = /l, r/ followed by any V	
	A in nucleus:	v. A = /j/ followed by back or central V only	vi. A = /w/ followed by front or central V only

3. Medial CAV. Turning to CAV in medial position, phonotactic constraints parallel to those in initial position motivate the same analyses proposed above. For example, focusing on sonority, (3) shows patterns for approximants in medial position identical to those seen earlier in (1).

(3) Sonority:

A in complex onset:	i. A = /l/ [kaːkliː] 'melodious tune'	ii. A = /r/ [wipriːt] 'opposite'	iii. A = /w/ [pətwaːr] 'oar'
A in nucleus:	iv. A = /r_i/ [b^{h}uːpriʃt] 'surface of the earth'; [amrit] 'drink of the gods'	v. A = /j/ [upjogiː] 'useful'; [kaːmjaːb] 'successful'	

However, probing further, we observe unexpected patterns; see (4). Focusing on A = /l, r, w/, we find that C can be nasal, contra (1i-iii), and that place agreement can hold between C and A, contra (2i-ii). Ohala (1983) proposes that the CA strings in (4) are coda+onset [Id]. This analysis, though, does not respect cross-language sonority constraints that hold of coda+onset clusters (Vennemann 1988). To further delve into the structure that holds in (4), Ohala observes that all these words can appear with optional schwa between C and A (schwa is assumed to be present underlyingly).

(4)	i. A = /l/	ii. A = /r/	iii. A = /w/
Sonority:	[imliː] 'tamarind'	[ʤ^{h}umraː] 'blacksmith's tool'	[tənwiː] 'slender girl'
Place:	[mətləb] 'meaning'	NA; see text above (2)	[əpwaːd] 'exception'

4. Stress. One consequence of Ohala's analysis is that forms like (4) with and without /ə/ have different structures: [Ie] when /ə/ is overt; [Id] when it is not. We propose instead that the forms with and without /ə/ have the same structure, [Ie]. Evidence for our analysis comes from a pilot study on stress. Hindi stress is sensitive to three weight profiles (Pandey 1989): CVXC > CVX > CV. Stress falls on the heaviest syllable that is rightmost in a word, excluding the final syllable (unless it is CVXC). The window in which stress is assigned is four syllables (Kager 2012).

See Table II. In words like [IIa] produced without /ə/, stress should fall on the penult [IIb] if CA is coda+onset [Id], as in Ohala, as this is the rightmost visible heaviest syllable. By contrast, stress should fall on the preantepenultimate [IIc] if CA is analysed with an empty nucleus between C and A [Ie], as this is the rightmost visible heaviest syllable. In a pilot study, 4 native speakers from Mumbai produced 8 novel words like [IIa] presented in writing (schwa was written, as per Devanagari script). Words were produced both with and without /ə/. Productions without /ə/ had stress on the preantepenult 92% of the time, [IIc], consistent with the syllabification we assume.

Tables

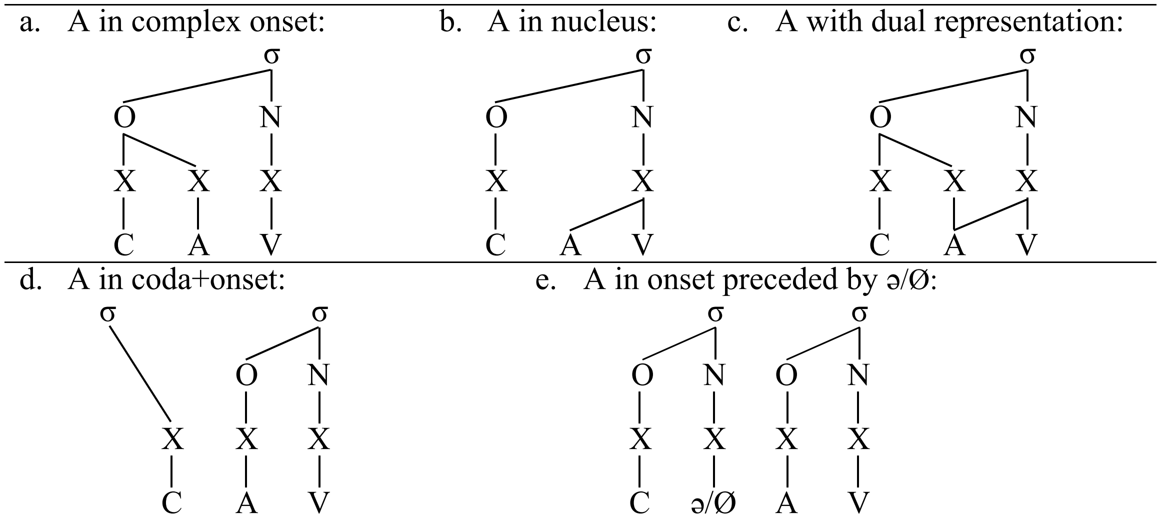

Table I. Possible representations for CAV.

a. Optional schwa:	b. Predicted stress as per [Id] (Ohala):	c. Predicted stress as per [Ie] (current analysis):
[kondet(ə)liː]	[kon.'det.liː]	['kon.de.tØ.liː]

Table II. Example stimulus and predictions for stress experiment.

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