Lexical accents are underlying foot edges:
Evidence from Vedic Sanskrit[*]

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1.   Introduction

This paper is concerned with the lexical representation of accentedness — i.e., the property by which certain morphemes attract word-level prominence (= STRESS) in languages in which its surface distribution is not phonologically predictable. One such language is Vedic Sanskrit (Indic, Indo-European), which exhibits prosodic minimal pairs like (1)–(2):[1]

(1)   *yúj-as* 'yokes' (yoke-M.NOM.PL)   (2)   *yuj-ás* 'of the yoke' (yoke-GEN.SG)

Since Kiparsky and Halle (1977) this prosodic contrast has been explained by assuming that the GEN.SG inflectional ending is lexically stress-preferring (ACCENTED) /-ás/, whereas the segmentally identical NOM.PL ending is stress-neutral (UNACCENTED) /-as/. The accented morpheme attracts stress in (2), but since no accented morpheme is present in (1), stress surfaces in its phonologically preferred position at the word's left edge (cf. Kiparsky 1973, 2010; see further 3.2 below).[2]

    The principal aim of this paper is to contribute to an ongoing theoretical debate about the lexical representation of the property that characterizes an accented morpheme — i.e., of a LEXICAL ACCENT. I focus here on two prevalent theories found in recent literature on this topic. Both maintain the view that an accent is a prosodic element affiliated with an accented morpheme, but disagree with respect to its precise representation, advocating the competing hypotheses in (3):

[1]All Vedic Sanskrit examples are presented in IAST (underlying forms in roman script, surface forms in italics). Primary stress (in Sanskrit terms *udātta*; see 3.1 below) is therefore marked with an acute accent; the same notation is also used to indicate lexical accentedness.

[2]This paper deals only with stress assignment in Vedic inflectional paradigms (i.e., stem + inflectional endings). Additional assumptions are needed to model the competition between derivational morphemes to determine the accentual properties of the stem; see further Kiparsky (2010, 2018) and Yates (2017:25–9).

(3)   *What is a lexical accent?*

    a.   An abstract prominence autosegmentally linked to an input vocalic peak, which is thus preferentially incorporated into metrical structure (Revithiadou 1999, 2007, Alderete 2001, *i.a.*).

    b.   Metrical structure directly pre-specified in the input (Inkelas 1999, McCarthy 2000a,b, Özçelik 2014, *i.a.*).

The major claim advanced in this paper is that of the two possible representations of lexical accentedness in (3) only the metrical representation in (3b) can account for the distribution of word stress in Vedic Sanskrit inflection. More precisely, I contend that only under (3b) is it possible to reconcile two seemingly contradictory patterns within Vedic inflectional paradigms — on the one hand, a phonological preference for left edge word stress; and on the other, apparent rightward stress shifts when accented vocalic peaks are eliminated in the output (termed "secondary mobility" by Kiparsky 2010). In addition, I argue for a specific way in which metrical structure is encoded in the input and preserved in the output. I propose that accented morphemes contain a single foot edge in their lexical representation, the position of which is preserved in the output due to high-ranking faithfulness (ANCHOR; cf. Özçelik 2014, Yawney 2018).

This paper is structured as follows. Section 2 more closely examines the metrical hypothesis in (3b) and lays out my proposal. Section 3 provides some background on Vedic, establishes the basic left-edge oriented stress assignment pattern observed within inflectional paradigms, and develops an optimality-theoretic analysis of this pattern. The crucial cases of "secondary mobility" are then treated in section 4, where I show that this data is predicted by constraint ranking already established if the metrical representation is adopted. Section 5 compares this metrical analysis with an autosegmental analysis, which is argued to fail on the same "secondary mobility" data. Section 6 concludes.

2.   A metrical representation of lexical accentedness

2.1   Lexical accents as metrical structure

This paper offers an empirical argument from Vedic Sanskrit for the hypothesis, proposed by Inkelas (1999) in her study of lexical stress in Turkish, that a lexical accent is metrical structure directly specified in the input. On this view, accented morphemes are affiliated with a metrical foot (Σ) in the input, thereby contrasting with unaccented morphemes, which have no such affiliation. High-ranking faithfulness constraints ensure that any lexical feet in the input are preserved in the output even when the result is a non-default (or "exceptional") stress pattern — i.e., stress surfacing in a position other than what would be expected on the basis of the word's (ω) purely phonological properties.

(4) illustrates the effects of underlying metrical structure in a language with right-aligned trochaic feet. When underlying metrical structure is absent as in (4a), a foot is built in its phonologically preferred position at the right edge of the word, and primary stress surfaces on the head of this trochaic foot, the word's penultimate syllable. In (4b),

in contrast, the underlying foot is preserved despite being non-adjacent to the word's right edge; the head of the trochaic foot is again assigned stress, but in this case it falls on the antepenultimate syllable.

(4)   *Default vs. "exceptional" stress in a language with right-aligned trochaic feet:*
      a.   /CVCVCV/ $\rightarrow$ $_\omega$(CV.$_\Sigma$(CV́.CV))   (*default penultimate*)
      b.   /$_\Sigma$(CVCV)CV/ $\rightarrow$ $_\omega$($_\Sigma$(CV́.CV).CV)   (*"exceptional" antepenultimate*)

Previous analyses that adopt a metrical representation of accentedness all share these basic mechanics. They diverge, however, in exactly how metrical structure is encoded in the lexicon and, more significantly, in how faithfulness to underlying metrical structure is enforced in the output. These issues are the subject of 2.2.

2.2   Faithfulness to a foot edge: a proposal

In this section I propose a new approach to the analysis of lexical accent, which builds especially on Özçelik (2014) and subsequent work on Turkish stress (Yawney 2018). Central to Özçelik's analysis is the idea that what is pre-specified in the lexical entry of accented morphemes are the edges of metrical feet; the output position of these foot edges — and accordingly, the shape of the foot — are then determined by an interaction between correspondence-based prosodic faithfulness constraints and ordinary markedness constraints (e.g., TROCHAIC in (15b) below). This idea is also at the core of the proposal advanced here, which has two components.

The first is that accented morphemes contain a single left foot edge in their lexical representation. The contrast between (e.g.) unaccented and accented disyllabic roots would therefore be represented as in (5):

(5)   a.   UNACCENTED ROOT: /CVCV/   b.   ACCENTED ROOT: /$_\Sigma$(CVCV/

In pre-specifying just a single foot edge I depart from Özçelik (2014) (and, e.g., Inkelas 1999, McCarthy 2000b), who assumes that both foot edges are specified. This modification is intended to capture the insight of Idsardi (1992) (developed in subsequent work on Simplified Bracketed Grid theory) that a single left or right boundary is sufficient to define a prosodic grouping, such as a metrical foot. More generally, too, it is consistent with the widely held view that only unpredictable information is stored in the lexicon (cf. Steriade 1995); if the position of the foot's opposite edge can be derived from well-formedness constraints on its shape, then it does not need to be stored. In sections 3–4 below I will show that stress assignment in Vedic Sanskrit inflection can be correctly predicted by specifying only a single foot edge. Note, however, that nothing in this proposal excludes the possibility that both edges are lexically specified in other languages, if this additional information is necessary to account for the distribution of stress.[3]

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[3]Yawney (2018) has shown that most of Özçelik's (2014) Turkish data can be accounted for by specifying only a single right foot edge. However, there are two cases that do seem to require ANCHOR constraints

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The second component of the proposal is that faithfulness to underlying foot edges is enforced by ANCHOR constraints (McCarthy and Prince 1995) — specifically, ANCHOR-L_Σ in (6). This formulation is identical to that of Özçelik (2014) except for one novel tweak — namely, an explicit statement that the constraint is violated only when a syllable peak intervenes between an input foot edge and its output correspondent (see further below).

(6)   ANCHOR-L_Σ: The left edge of every foot in the input corresponds to the left edge of a foot in the output. Assign a violation (*) if a syllable peak intervenes.

The effects of ANCHOR-L_Σ in (6) are illustrated schematically in (7), where an un-accented CV prefix attaches to an accented root like (5b) above. This constraint requires faithfulness to the position of the left foot edge, while leaving the foot shape and rhyme type to be determined by independent principles in the grammar. It is fully satisfied when the foot edge maintains its position between V_1 and V_2, with rightward construction of a metrical foot — trochaic in (7a) or iambic in (7c) — from this edge. Yet if the left foot edge shifts leftward to encompass the preceding vocalic peak V_1 within the foot as in (7b) or (7d), ANCHOR-L_Σ would be violated.

(7)   a. $/CV_1\text{-}_\Sigma(CV_2CV_3/ \rightarrow {}_\omega(CV_1._\Sigma(C\acute{V}_2.CV_3))$ *(trochaic; no violation)*
       b. $/CV_1\text{-}_\Sigma(CV_2CV_3/ \rightarrow {}_\omega(_\Sigma(C\acute{V}_1.CV_2).CV_3)$ *(trochaic; V_1 violates)*
       c. $/CV_1\text{-}_\Sigma(CV_2CV_3/ \rightarrow {}_\omega(CV_1._\Sigma(CV_2.C\acute{V}_3))$ *(iambic; no violation)*
       d. $/CV_1\text{-}_\Sigma(CV_2C\acute{V}_3/ \rightarrow {}_\omega(_\Sigma(CV_1.C\acute{V}_2).CV_3)$ *(iambic; V_1 violates)*

The specific way in which ANCHOR-L_Σ is assessed becomes relevant in a case like (8), where an accented suffix $/\text{-}_\Sigma(VC/$ attaches to an unaccented consonant-final root $/CVC/$. In nearly all languages, this would cause resyllabification of the root-final C into the onset of the next syllable. Incorporating this C into the lexical foot associated with the ending would not violate ANCHOR-L_Σ as defined in (6), although it would be violated if the foot edge shifted still further to incorporate V_1 in the stem — i.e., (8a) vs. (8b):

(8)   a. $/(CV_1C\text{-}(VC_2/ \rightarrow {}_\omega(CV_1._\Sigma(C\acute{V}_2C))$ *(trochaic; no violation)*
       b. $/(CV_1C\text{-}(VC_2/ \rightarrow {}_\omega(_\Sigma(C\acute{V}_1.CV_2C))$ *(trochaic; V_1 violates)*

For the present I leave open the theoretical question of why ANCHOR-L_Σ only "cares" about syllable peaks in this way, and make just one relevant observation: while cases like (8) seem to be common in languages with lexical accents (including Vedic and Turkish),[4]

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to reference both input foot edges and cannot instead be attributed to a general preference for left edge foot alignment (which is independently necessary under Özçelik's analysis, where it is implemented with ENDRULE-L): (i) adjacent pre-stressing suffixes; (ii) adjacent weak and pre-stressing suffixes. The former at least are apparently in variation with forms that are consistent with a left edge preference. If the latter could be otherwise explained, then a single foot edge might be sufficient for Turkish as well.

[4]This issue arises in Turkish examples like /gel-(indʒe)-(de)/ → [ge.(lín.dʒe).de] 'also when (s)he comes'. Özçelik (2014:246 n. 8) assumes that ANCHOR is assessed at the word level and that the root-final conso-

I am not aware of any in which there is evidence for exceptional syllabification of the root-final consonant in the output (i.e., [VC-.$_\Sigma$(V]), nor any in which the accented suffix fails to attract stress because of resyllabification (which would violate a "stricter" version of ANCHOR-L$_\Sigma$).[5] In other words, there does not appear to be any cross-linguistic evidence that ANCHOR-L$_\Sigma$ "cares" about consonants; the assumption that it is violated only by syllable peaks is therefore motivated on empirical grounds.

3.   Stress assignment in Vedic Sanskrit inflection — core data

3.1   Background on Vedic Sanskrit

Vedic Sanskrit was probably spoken between 1500 and 500 BCE primarily in what is now Pakistan and northern India. The major witness to this language is the Ṛgveda (RV), a large collection of orally-transmitted religious poetry that represents the oldest stage of the Sanskrit language (cf. Jamison and Brereton 2014:3–5). The RV comprises 1028 hymns, divided unevenly into ten books (*maṇḍalas* 'circles'), which together contain about 150,000 words. Like other Vedic texts (but unlike the later classical language), the RV provides direct evidence for word stress — i.e., the single word-level high pitch (*udātta*). The properties that are actually marked orthographically are the falling pitch (*svarita*) on the immediately following syllable, and low pitch (*anudātta*) on preceding syllables.

3.2   Vedic inflection and the Basic Accentuation Principle

Vedic Sanskrit has a prosodic contrast within inflectional paradigms between two types of stems: (i) IMMOBILE stems, which show fixed stress on the same stem syllable throughout their inflectional paradigm; and (ii) MOBILE stems, which in noun paradigms show stress alternations between the stem in the so-called "strong" cases (NOM, ACC.SG/DU) and inflectional endings in the other "weak" cases.[6] This contrast is exemplified in (9)–(10):[7]

(9)   *Strong vs. weak case forms of* IMMOBILE *noun stems:*

    a.   *nár-as* 'men' : *nár-as* 'of the man'   (man-M.NOM.PL/GEN.SG)

    b.   *gā́v-as* 'cows' : *gáv-ā* 'with the cow'   (cow-NOM.PL/INS.SG)

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nant is then resyllabified into the onset of the following stressed syllable post-lexically. This stipulation is unnecessary if ANCHOR is formulated as in (6).

  [5]If ANCHOR-L$_\Sigma$ were violated by such resyllabified consonants, one might expect to see in such cases the emergence of default stress, which would similarly incur a violation but better satisfy markedness constraints.

  [6]I exclude from consideration here the GEN.PL ending's allomorph /-nā́m/, which shows idiosyncratic prosodic behavior (cf. Kiparsky 2010:146 n. 13). The same MOBILE vs. IMMOBILE contrast is also found in Vedic verbal stems; see Kiparsky (2010, 2018) and Yates (2017:179–83) for discussion.

  [7]Disyllabic stems like (10c) and (10d) with stem-initial stress in their strong cases and stressed inflectional endings in their weak cases are very rare in Vedic. The stem allomorphy seen in these forms is due to (historical) vowel deletion processes of the type discussed in 4.2 below. Note, also, that some Vedic morphemes — e.g., /gáv/ in (9b), /pad/ in (10b) — show vowel length alternations ([aː] ∼ [a]), which result historically from BRUGMANN'S LAW; these are ignored here, but for a possible synchronic analysis see Kiparsky (2010).

c. *rā́jān-am* 'king' : *rā́jñ-as* 'of the king'   (king-M.ACC/GEN.SG)

d. *marút-as* 'Maruts' : *marút-su* 'among the Maruts' (Marut-M.NOM.PL/LOC.PL)

(10) *Strong vs. weak case forms of* MOBILE *noun stems:*

     a. *yúj-as* 'yokes' : *yuj-ás* 'of the yoke'   (yoke-M.NOM.PL/GEN.SG)

     b. *pā́d-am* 'foot' : *pad-ā́* 'with the foot'   (foot-M.ACC.SG/INS.SG)

     c. *pánthā-m* 'path' : *path-ás* 'of the path'   (path-M.ACC/GEN.SG)

     d. *púmāṃs-am* 'male' : *puṃ-sú* 'among males'   (male-M.ACC.SG/LOC.PL)

Kiparsky and Halle (1977) derive the contrast between (9) and (10) from a lexical contrast between accented and unaccented morphemes and a phonological preference for left edge stress, which they implement with the BASIC ACCENTUATION PRINCIPLE:

(11) BASIC ACCENTUATION PRINCIPLE (BAP) (cf. Kiparsky 2010):
     If a word has more than one accented vowel, word stress is assigned to the leftmost.
     If a word has no accented vowel, word stress is assigned to the leftmost syllable.

On their analysis, MOBILE stems are lexically unaccented. When these unaccented stems combine with unaccented strong case endings, the word receives default left edge stress by the BAP, as in (12). The weak case endings, however, are accented, and so they attract stress when they are added to the same stems, as in (13). Finally, IMMOBILE stems are immobile — i.e., exhibit fixed stem stress — because they are accented; they thus receive stress on the accented syllable of the stem rather on the accented weak case endings as in (14) because it is closer to the left edge of the word (i.e., "leftmost wins" by the BAP).

(12) *Unaccented stem + unaccented ending ⇒ default leftmost stress:*

     a. /pad-am/ → *pā́d-am* 'foot' (foot-M.ACC.SG)

     b. /pumas-am/ → *púmāṃs-am* 'male' (path-M.ACC.SG)

(13) *Unaccented stem + accented ending ⇒ ending attracts stress:*

     a. /pad-ā́/ → *pad-ā́* 'with the foot' (foot-INS.SG)

     b. /pumas-sú/ → *puṃ-sú* 'among males' (male-LOC.PL)

(14) *Accented stem + accented ending ⇒ leftmost accented (=stem) wins:*

     a. /gáv-ā́/ → *gáv-ā* 'with the cow' (cow-INS.SG)

     b. /marút-sú/ → *marút-su* 'among the Maruts' (Marut-LOC.PL)

3.3   A metrical analysis of Vedic inflectional stress

This section develops a metrical analysis of the stress assignment patterns observed discussed in 3.2 above. A useful starting point for this analysis is the observation that Vedic

exhibits default left edge stress, which is *prima facie* evidence that it has a preference for left-aligned trochaic feet. Implementing this pattern requires the three constraints in (15):[8]

(15) a. CULM(INATIVITY): A prosodic word has exactly one stressed syllable.
      b. TROCH(AIC): Feet have initial prominence.
      c. ALL-F(EE)T-L(EFT): Feet must be aligned with the left-edge of the prosodic word. Assign one violation (*) for each intervening syllable peak.

The tableau in (16) illustrates how the constraints in (15) interact to yield default left edge stress in (e.g.) (12a) above. The effect of CULMINATIVITY, which is undominated in Vedic, is to ban unstressed words like candidate (a). I assume that TROCHAIC is also undominated, ruling out candidate (b) with a left-aligned iambic foot. The winning candidate (c) is then preferred to loser (d) because its left-aligned foot satisfies ALL-FT-L, which is violated by the right-aligned foot in (d).

(16)

	/pad-am/	CULM	TROCH	ALL-FT-L
a.	pā.dam	*!		
b.	(pā.dám)		*!	
c. ☞	(pá.dam)			
d.	pā.(dám)			*!

Attraction of stress to word-internal accented inflectional ending in (e.g.) (13a) is due to ANCHOR-L$_\Sigma$ in (6), which ensures that the position of the lexical foot associated with the ending is preserved in the output. To generate this pattern, ANCHOR-L$_\Sigma$ must dominate ALL-FT-L. This results in the faithful candidate (a) winning over (b), which better satisfies ALL-FT-L but violates higher-ranked ANCHOR-L$_\Sigma$. Note that (a) does not incur a violation of ANCHOR-L$_\Sigma$ when it incorporates the stem-final consonant into the onset of the stressed syllable because ANCHOR-L$_\Sigma$ is violated only by intervening syllable peaks.

(17)

	/pad-(ā/	CULM	TROCH	ANCHOR-L$_\Sigma$	ALL-FT-L
a. ☞	pa.(dá́)				*
b.	(pá.dā)			*!	
c.	(pa.dá́)		*!	*	
d.	pa.dā	*!			

Finally, the "leftmost wins" pattern seen in (e.g.) (14a) falls out from the ranking already established. The only way to satisfy ANCHOR-L$_\Sigma$ with respect to both underlying

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[8](15a) is employed here as a cover constraint to enforce both the culminative ("at most one") and obligatory ("at least one") properties of Vedic word stress.

feet is by violating CULMINATIVITY, which eliminates candidate (a). That leaves (b) and (c), each of which violates ANCHOR-L$_\Sigma$; (b) is then preferred because its left-aligned trochaic foot better satisfies low-ranked ALL-FT-L than the right-aligned foot in (c).

(18)

/$_i$(gav-$_j$(ā/	CULM	TROCH	ANCHOR-L$_\Sigma$	ALL-FT-L
a. $_i$(gá).$_j$(vā́)	*!			*
b. ☞ $_{ij}$(gá.vā)			*	
c. ga.$_{ij}$(vā́)			*	*!
d. $_{ij}$(ga.vā́)		*!	*	

4. Stress assignment in Vedic inflection — "secondary mobility"

Having established that the basic stress assignment patterns observed in Vedic inflection can be captured under a metrical representation of lexical accentedness, I turn now to some more complex cases — specifically, those that involve what Kiparsky (2010) has termed "secondary mobility." This data is more interesting because while the core data in 3.2 is compatible with either lexical representation of accentedness, certain types of "secondary mobility" are problematic for an autosegmental analysis (see 5.2 below). The capacity of a metrical analysis to handle "secondary mobility" is thus a crucial argument in its favor.

At least three distinct sub-types of "secondary mobility" can be observed in Vedic. The feature common to all three types is that a vowel attracts stress in some paradigmatic forms, but in other forms is eliminated on the surface and stress appears to shift one syllable to the right. In this section, these three types are examined (in order of increasing empirical robustness) and shown to be compatible with the metrical analysis developed thus far.

4.1 Type 1 "secondary mobility" — glide formation

The first type of "secondary mobility" is unique in that it involves intraparadigmatic stress alternations between two strong case forms, the NOM/ACC.SG and the NOM.PL, rather than the strong/weak case alternations seen in the core data above or in the other two types of "secondary mobility" discussed below. This type is securely instantiated by a single lexical item in Vedic, the word for 'friend': NOM.SG *arí-s*, ACC.SG *arí-m*, NOM.PL *ary-ás*.[9]

That the stem-final high vowel attracts stress away from the word's left edge in the NOM/ACC.SG indicates that it bears a lexical accent (i.e., /ar(i-/). In the NOM.PL, however, the addition of the unaccented inflectional ending /-as/ to the stem forces the accented stem-final high vowel to be resyllabified as a glide (/i/ → *y*). When glide formation occurs, stress appears to shiftward and surfaces on the unaccented ending (i.e., *ar-yás*).

This pattern can be accounted for straightforwardly under the metrical analysis, which requires only adding the constraint against hiatus in (19) to the established ranking. This

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[9]One other possible example is the word for 'herd animal' with NOM.SG *paśú-s*, ACC.SG *paśú-m*, and hapax NOM.DU *paśvā́* (RV X.106.3b). Like NOM.PL /-as/, the NOM.DU ending is unaccented /-ā/.

constraint rules out the faithful candidate (a) with adjacent vowels. Of the other candidates, (c) with left-aligned foot is preferred by ALL-FT-L, but by shifting the underlying foot edge leftward to encompass the stem-initial *a*-vowel it violates ANCHOR-L$_\Sigma$; candidate (b), on the other hand, satisfies this higher-ranked faithfulness constraint by syllabifying the stem-final high vowel into the onset of the stressed syllable, and therefore wins.

(19)   *VV: Adjacent vowels are not permitted in the output.

(20)

/ar(i-as/	*VV	*CULM	ANCHOR-L$_\Sigma$	ALL-FT-L
a. a.(rí.as)	*!			*
b. ☞ ar.(yás)				*
c. (ár.yas)			*!	

4.2   Type 2 "secondary mobility" — stem-initial vowel deletion

In the second type of "secondary mobility," the initial /a/-vowel of a disyllabic stem is stressed in the strong cases, but in the weak cases this vowel is deleted and stress surfaces on the stem-final /u/-vowel to its right, as in (21):

(21)   *Strong vs. weak case forms of nouns with type 2 "secondary mobility":*

    a.   *sā́nu(-∅)* 'back' : *snú-ṣu* 'on (their) backs'   (back-N.NOM.SG/LOC.PL)

    b.   *dā́ru(-∅)* 'piece of wood' : *drú-ṇā* 'with wood'   (wood-N.NOM/INS.SG)

The failure of the accented weak case endings (LOC.PL /-sú/, INS.SG /-nā́/) to attract stress (i.e., [x]*snu-ṣú*, [x]*dru-nā́*) indicates the presence of a lexical accent on the stem.[10] The initial stress in the strong cases must therefore be the realization of a stem-initial accent (i.e., /(sanu/, /(daru/), and when the initial vowel is deleted in the weak cases this accent again appears to shift rightward — in this case, onto the stem-final /u/-vowel.

It is beyond the scope of this paper to account for vowel deletion in Vedic, which is morphologically conditioned.[11] I assume here that it is simply a process that applies to stem /a/-vowels in the weak cases of certain lexical items, and focus on accounting

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[10]To avoid confusion with reconstructed forms, I use "[x]" to indicate ungrammaticality. It is in principle possible that both vowels of the stems in (21) are associated with lexical accents ("/s(an(u-/", "/d(ar(u/"), but there is no other evidence for morphemes bearing multiple accents in Vedic (nor am I aware of such cases in other languages). Alternatively, the /u/-vowel could be analyzed as a suffix, but since suffixation of accented morphemes generally triggers weak allomorphy in roots (cf. n. 11 below), it would be difficult to explain why the preceding "roots" do not show their weak forms ([sn-], [dr-]) throughout the paradigm.

[11] One clear piece of evidence for the morphological character of vowel deletion in Vedic is that it applies even to accented stem vowels in stressed syllables, e.g., Ved. /pitár-bhís/ → *pitŕ̥bhis* 'with the fathers' (cf. (23b) below). Kiparsky (2010, 2018) proposes that deletion is in general conditioned by accented morphemes (thus often opaque on the surface), but a comprehensive treatment of the problem remains a desideratum.

for word stress whenever it applies.[12] Given this assumption, no additional machinery is needed to account for the stress patterns in (21); the tableau in (22) shows that the apparent rightward stress shift in the weak cases emerges from the established constraint ranking. When the stem-initial vowel is deleted, the foot associated with stem remains in place at its left edge. ANCHOR-L$_\Sigma$ cannot be satisfied for both this foot and the foot associated with the ending without violating CULMINATIVITY, which rules out candidate (a), and so (b) with its left-aligned foot wins, being preferred to (c) by ALL-FT-L.

(22)

/$_i$(sanu-$_j$(su/	CULM	ANCHOR-L$_\Sigma$	ALL-FT-L
a. $_i$(snú).$_j$(ṣú)	*!		*
b. ☞ $_{ij}$(snú.ṣu)		*	
c. snu.$_{ij}$(ṣú)		*	*!

4.3 Type 3 "secondary mobility" — stem-final vowel deletion

The third type of "secondary mobility" is by far the most robust in Vedic. In this type, the final accented /á/-vowel of a polysyllabic stem is stressed in the "strong" cases, but in the weak cases this vowel is deleted and inflectional ending gets stress — e.g., (23):

(23)   *Strong vs. weak case forms of nouns with type 3 "secondary mobility":*

  a.   *ukṣán-as* 'oxen' : *ukṣṇ-ás* 'of the ox'   (OX-M.NOM.PL/GEN.SG)

  b.   *pitár-as* 'fathers' : *pitr-é* 'to the father'   (father-M.NOM.PL/DAT.SG)

  c.   *dā-tā́r-am* 'giver' : *dā-tr-ā́* 'with the giver'   (give-AGT-M.ACC/INS.SG)

Non-default stress in the strong cases indicates that the stem-final vowel is accented (i.e., /uk(san-/, etc.). For the stressed weak case endings there are in principle two explanations. One is that the stem accent actually gets deleted when its vocalic host is eliminated, but the fact that the accent remains in the output in types 1 and 2 "secondary mobility" speaks against this. The other is that the stressed ending is the realization of the stem accent, which again appears to shift rightward when its host is eliminated. Under the metrical analysis, the same constraint ranking also correctly predicts this pattern — i.e., (24):

(24)

/uk$_i$(san-$_j$(as/	CULM	ANCHOR-L$_\Sigma$	ALL-FT-L
a. $_i$(úk).$_j$(ṣṇás)	*!	*	*
b. ☞ uk.$_{ij}$(ṣṇás)			*
c. $_{ij}$(úk.ṣṇas)		*!*	

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[12]I therefore include only candidates with deletion in the tableaux in (22) and (24), although it should be noted that in neither case would a non-deletion candidate be preferred to the winner, and in (24) it would in fact lose (cf. n. 13 below).

In (24), candidate (c) with left-aligned foot is eliminated by its (double) violation of ANCHOR-L$_\Sigma$, as it is misanchored with respect to the lexical feet associated with the stem-final vowel and the ending. The winner (b), in contrast, incurs no violations of ANCHOR-L$_\Sigma$; in this special case, deletion is in fact prosodically optimizing, allowing both lexical feet to stand in perfect correspondence with the single output foot.[13]

5.   Analytic comparison — an autosegmental representation of accentedness

The preceding section demonstrated that by adopting a metrical representation of lexical accentedness all three types of Vedic "secondary mobility" can be accounted for under the same constraint ranking that was established to account for stress assignment in Vedic inflection in general (cf. 3.3 above). This section turns to analytic comparison, testing in particular whether it is possible to account for the same data under an autosegmental representation of accentedness. I argue that while the autosegmental representation is compatible with the core data (5.1), it fails on type 1 and type 3 "secondary mobility" (5.2).

5.1   Lexical accent as autosegment and the Vedic core data

Under an influential theory developed especially by Revithiadou (1999, 2007) and Alderete (2001), a lexical accent is an abstract prominence ($*$) autosegmentally linked to an input vocalic peak. Each input prominence requires a corresponding prominence in the output (i.e., stress), and so the accented vowel is preferentially incorporated into the head of a metrical foot. This type of approach standardly assumes that the relationship between underlying and surface prominence is governed by prosodic faithfulness constraints like (25):

(25)   *Prosodic faithfulness constraints* (cf. Revithiadou 1999:52–3, Alderete 2001:461):
    a.   MAX-PROM: "A prominence in the input (= accent) must have a correspondent in the output (= stress)."
    b.   DEP-PROM: "A prominence in the output (= stress) must have a correspondent in the input (= accent)."
    c.   *FLOP-PROM "Let χ_i be an input prominence, ζ_j be a vocalic peak, S_k phonological representations
        $S_1 \mathcal{R} S_2$,
        χ_1 and $\zeta_1 \in S_1$, χ_2 and $\zeta_2 \in S_2$,
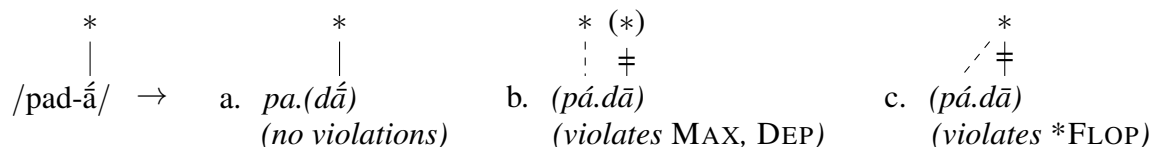 $\chi_1 \mathcal{R} \chi_2$ and $\zeta_1 \mathcal{R} \zeta_2$,
    if χ_1 is associated with ζ_1, then χ_2 is associated with ζ_2"

The effects of these constraints are illustrated in (26). In (26a), the lexical prominence is linked to the same vowel in both input and output representations. Thus none of the faithfulness constraints in (25) are violated, although realizing the accent as stress on a non-initial syllable entails constructing a foot away from the word's left edge in violation

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[13] (24b) is thus preferred by ANCHOR-L$_\Sigma$ to a hypothetical candidate ^{x}uk.(*šá.ṇas*) in which the stem-final accented vowel does not undergo deletion and gets stress.

of ALL-FT-L. In (26b–c), in contrast, ALL-FT-L is satisfied at the expense of faithfulness: (b) shows deletion of the lexical prominence and insertion of an epenthetic prominence on the word-initial vowel in violation of MAX-PROM and DEP-PROM respectively, while in (c) the lexical accent reassociates with the initial vowel in violation of *FLOP-PROM, which bans such reassociation whenever the input vowel has an output correspondent.[14]

(26)   *Violations of prosodic faithfulness constraints:*

/pad-ā́/ →   a. *pa.(dā́)*   b. *(pá.dā)*   c. *(pá.dā)*
             (no violations)   *(violates* MAX, DEP*)*   *(violates* *FLOP*)*

As noted already, the Vedic core data is wholly compatible with an autosegmental analysis. The tableau in (27) shows it requires only substituting *FLOP-PROM ≫ MAX-PROM for ANCHOR-L$_\Sigma$ in the constraint ranking established for the metrical analysis in 3.3 above:

(27)

/pad-ā́/	*FLOP-PROM	MAX-PROM	ALL-FT-L
a. ☞ pa.(dā́)			*
b. (pá.dā)		*!	
c. (pá.dā)	*!		

5.2   Vedic "secondary mobility" under an autosegmental analysis

The autosegmental analysis outlined in 5.1 encounters problems, however, once the "secondary mobility" data is introduced — in particular, the type 1 and 3 patterns. The basic issue is simple: producing the apparent rightward stress shifts observed in "secondary mobility" would require lexical accents to reassociate rightward when their vocalic host is eliminated, but rightward reassociation is inconsistent with the phonological preference for left edge stress in Vedic. Thus if elimination of an accent's vocalic host frees it to reassociate (as is clearly necessary in types 1 and 2), it should reassociate leftward to better satisfy this left edge preference, contrary to fact.

This issue is evident in the tableaux in (28) and (29), which represent types 1 and 3 respectively. As defined in (25c), *FLOP-PROM permits a lexical prominence to reassoci-

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[14]For the formulation of *FLOP-PROM in (25c) see Revithiadou (1999:53). The alternative definition of Alderete (2001:461) categorically bans reassociation, and consequently cannot account for type 1 or 2 "secondary mobility," which demand that an accent remains in the output even when its vocalic host is eliminated.

ate when its input vowel lacks an output correspondent that can host it. This is the case for candidates (28b) and (28c), where the accented high vowel has become non-syllabic. The expected winner under this constraint ranking is (28b), in which the accent reassociates leftward, since it better satisfies ALL-FT-L than (28c). But this prediction is incorrect: the attested form is (28c) with rightward reassociation and non-initial stress. Similarly, candidate (29c) in which the lexical prominence associated with the deleted stem-final vowel reassociates with the initial syllable and the ending's prominence is deleted is preferred to (29b) in which the stem prominence is deleted; both violate MAX-PROM, but only (29c) satisfies ALL-FT-L. This prediction is also wrong: (29b) is the observed form in Vedic.

(28)

* ǀ /arí-as/	*VV	*FLOP	MAX	ALL-FT-L
a. * ǀ a.(rí.as)	*!			*
b. 💣 * ／ (ár.yas)				
c. ☹ * ＼ ar.(yás)				*!
d. *(*) ǀ (ár.yas)			*!	

(29)

* * ǀ ǀ /uksán-ás/	CULM	*FLOP	MAX	ALL-FT-L
a. ** ／ ǀ (úk).(ṣnás)	*!			*
b. ☹ (*)* ǀ uk.(ṣnás)			*	*!
c. 💣 *(*) ≠ (úk.ṣnas)			*	

6.   Discussion

Vedic Sanskrit provides an important testing ground for comparing analyses that employ metrical vs. autosegmental representations of lexical accentedness. A general problem encountered when comparing these analyses is that they often make the same predictions, as is the case for the Vedic core data, which can be accounted for by a metrical (3.3) or an autosegmental analysis (5.1). However, it was demonstrated above that these predictions differ when an accented vocalic peak lacks an output correspondent (due to vowel deletion, glide formation, etc.), and that only the metrical analysis captures the facts: it correctly predicts all three types of "secondary mobility" (4.1–4.3), while the autosegmental analysis fails on types 1 and 3 (5.2).

The Vedic data examined here thus constitute an empirical argument that lexical accents are pre-specified metrical structure, as well as for an approach in which faithfulness to underlying metrical structure is enforced by constraints that make reference to foot edges. I expect that an analysis founded on these premises can profitably be extended to similar word-prosodic phenomena in the (ancient) Indo-European languages, but further work is necessary in this respect, as well as in testing its predictions on a wider set of languages with lexical accents.

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