Towards a Prosodic History of Indic: A Parametric Analysis of the "Classical Sanskrit Stress Rule"

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This article considers the presently available evidence for and develops a formal analysis of a "Classical Sanskrit stress rule." I organize and summarize the direct testimony for such a rule gathered in the 19th century, and briefly survey some of the indirect evidence from variant Sanskrit forms and segmental developments found in the Middle and Modern Indic languages (esp. Gujarātī). I cautiously conclude that this material points towards a stress grammar with a four-syllable window for primary stress, in which primary stress is most frequently found on the rightmost non-final heavy syllable (though final stress may have been allowed in certain disyllables), else the initial or antepenultimate syllable, depending on the total number of syllables in the word. A parametric metrical stress grammar in the style of Hayes 1995 captures the patterns assumed to be valid. For the larger study of the history of prosodic change in the Indo-European languages, the present case parallels developments in, e.g., Italic or Germanic, in which the inherited, Vedic-like lexical accent system was replaced by a metrical stress system.

1 Introduction: Vedic and Non-Vedic Word Prosody

For scholars interested in the reconstruction of Indo-European word prosody, the general features of and specific rules for the assignment of word-level prosodic prominence ("accent" or "stress") in Vedic Sanskrit (~ 1200–500 BCE) have long occupied pride of place. That so much is known about the details of the Vedic word-prosodic system, to allow for relatively fine-grained description of its general features (see Wackernagel 1896:284–95 or Macdonell 1910:76–107), its confident employ in the reconstruction of Indo-European (too numerous to cite; but see, e.g., Kuryłowicz 1968:7–21 or Jasanoff 2017:7–10), and the development of detailed formal analyses (e.g., Kiparsky 2010, Sandell 2015:Ch. 7, Perry and Vaux 2018, Yates 2020, Sandell 2023:Ch. 4) is a stroke of great luck. Without the unbroken oral tradition that placed great value on the accurate transmission of prosodic features (described in the *prātiśakhyas* for individual Vedas; see Whitney 1869 for an

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overview of their testimony on accentuation), upon which a much younger manuscript tradition rests, and the development of extensive rule systems for the proper assignment of Vedic accentuation in the indigenous grammatical tradition beginning with Pāṇini (cf. von Böhtlingk 1845), the further descriptions and analyses—synchronic and diachronic alike—developed in the 19th and 20th centuries would be unthinkable.

In contrast, as concerns the word prosody of Sanskrit after the Vedic period (Classical Sanskrit) or the attested descendants of Vedic varieties (i.e., the Prākrits), virtually no direct information that can securely be traced back to the latter half of the 1st millennium BCE has been transmitted down to the present day (see further Section 2). Some indications exist that might be interpreted as evidence for word-prosodic systems in flux among Indic languages of the 1st millennium BCE. Haug (1874:100–1) and Leumann (1892), for instance, argued that peculiarities of accentual marking in the *Śatapathabrāḥmana* (cf. the summary in Macdonnell 1910: 79–80) could be attributed to innovations in rules of prominence assignment. How, exactly, the word prosody of post-Vedic Sanskrit or of any of the Prākrits functioned is simply not securely known. Nonetheless, if indeed the system of Vedic prosody known from the *saṃhitās* and grammarians (Pāṇini, Patañjali) was demonstrably not inherited unchanged into all Indic varieties of the 1st millenium BCE and the Prākrits, yet another case of systemic prosodic change among older Indo-European languages could be brought to light (as is evident for, e.g., Germanic or Italic). The crucial first step is to describe a grammar of stress assignment for a post-Vedic Indic language.

This paper aims to advance our overall understanding of prosody and prosodic change, specifically in the domain of word-level stress, in the history of the Indic languages. Its immediate objectives are, however, relatively modest: to organize the little available data from direct reports of the position of stress in pronunciation of Sanskrit from the 19th century (given in Haug 1874:99 and Bühler 1883:Schrifttafel), and to demonstrate that this data, even if it wants for unambiguous independent confirmation and the antiquity of the patterns that it evinces cannot be established, is at least compatible with a phonologically coherent analysis as a predictable metrical stress system. Section 2.2 offers a systematic presentation of this evidence and seeks to draw generalizations from it. For reasons of space, a thorough assessment of potentially relevant indirect testimony from the Prākrits and Modern Indic languages is not possible here, but what credible material may be extracted seems largely to accord with the sparse direct evidence; see Section 2.3 below. Section 3 then introduces two existing analyses of similar data (Keydana 2016 and Vaux 2021), before developing a novel parametric analysis in the

framework of Hayes 1995 in Section 4. Finally, Section 5 sets forth further work, both empirical and theoretical, that must be undertaken in pursuit of a solution to the present problem.

Before delving into an exposition of evidence for an innovative, non-Vedic word-prosodic system, some comments on the possible age and scope of such a system are in order. The reader should keep in mind that no neat line of linguistic descent links the most archaic Vedic Sanskrit, Classical Sanskrit, and Middle Indic. As Oberlies (2007:163) nicely puts it: "the MIA [Middle Indo-Aryan] languages are not younger than ('classical') Sanskrit. And a number of their morphophonological and lexical features betray the fact that they are not direct descendants of Rigvedic Sanskrit, the main basis of 'Classical' Sanskrit; rather they descend from dialects which, despite many similarities, were different from Rigvedic and in some regards even more archaic." Compare also Brereton and Jamison 2020:177–9 on traces of Middle Indic-like elements in the *Ṛgveda*. The evidence of some phonologically predictable stress rule to be discussed here is therefore probably rather to be understood as a stress rule that developed in certain varieties of "vulgar Indic" during the 1st millennium BCE, perhaps already predominating in at least some Old Indic dialects on the path to their Middle Indic descendants. For convenience, I will however continue to speak of a "Classical Sanskrit stress rule," though this prosodic development may well precede the historical boundary between Vedic and the grammatically fixed Classical Sanskrit by some centuries; compare further the discussion in Burrow 1973:115.

2 (The Absence of) Direct Testimony for a "Classical Sanskrit Stress Rule"

2.1 Absence of Evidence?

Direct reports concerning the word-prosodic systems of Indic languages that postdate the Vedic language are meager at best. First, already most non-*saṃhita* texts of Vedic, as well as manuscripts of the epics Mahābhārata and Rāmāyaṇa, to say nothing of Classical Sanskrit texts, are completely devoid of any diacritic indications as to stress, tone, or intonation. Furthermore, as Wackernagel (1896:283; 296–7) observes, Pāṇini and his interpreters in the Indian grammatical tradition (e.g., Patañjali, Śāntanava) exclusively discuss the accentuation of Vedic, whereas later grammarians of Sanskrit (e.g., Kātantra) usually say nothing concerning accentuation whatsoever. Only in the *Phiṭsūtra* of Śāntanava (edition by Kielhorn 1866) do we find a (perhaps accidental) exception: although Śāntanava purports to offer rules for the accentuation of Vedic, some of his rules do not match the facts

of Vedic, but instead appear compatible with a predictable metrical stress system. Of particular note in this regard is Rule II.19, which in the translation of Kielhorn (1866:36) states: "Die schwere Sylbe eines überzweisylbigen Wortes [ist udâtta], auf die eine oder zwei leichte Endsylben folgen."[1] That no such processes for the assignment of the *udātta* (= stress assignment) existed in Vedic is self-evident, but Śāntanava's statement fits well with other evidence for a post-Vedic stress assignment process. See also Kazama 1975:53–6 for discussion of the relation between the *Phiṭsūtra* and a possible Classical Sanskrit stress rule.

This virtual silence concerning word prosody in both the textual and indigenous grammatical sources for Classical Sanskrit has occasionally led some scholars to assume that Classical Sanskrit and the Prākrits simply lacked word stress or word-level pitch accents altogether (e.g., Bloch 1915:§32). Such an inference, however, mistakenly takes the absence of evidence as evidence of absence and would furthermore inhibit any uniform explanation for some segmental facts assembled below. Furthermore, the first-hand knowledge of Sanskrit won by Martin Haug and Georg Bühler through study with *paṇḍits* in India offers direct indications that it was the practice of their informants to regularly produce stress on each word, apparently according to the number of syllables and their weight. The earliest such description to appear in print is in Haug 1874:99 (quoted just below), though Bühler (1883:Schrifttafel) offers a richer set of examples. Bühler explicitly asserts that "alle indischen Brahmanen gebrauchen … bei der Aussprache des Sanskrit einen Ictus-Accent, der von dem … musikalischen Accente (*svara*) [des Veda] zu unterscheiden ist."[2] Bühler's description of stress patterns in the pronunciation of

1 "The heavy syllable of a word with more than two syllables is *udātta*, upon which one or two light final syllables follow." Compare further Jacobi 1898:567–8 and his list of further specific cases in which Śāntanava prescribes an *udātta* that is at odds with directly attested Vedic forms.

2 "all Indian Brahmins use … a stress-accent in their pronunciation, which is … to be distinguished from the musical accent (*svara*) [of the Veda]."

Unfortunately, more precise information on the speakers of Sanskrit with whom Haug and Bühler had close contact is not readily forthcoming. Haug served as "Superintendent of Sanscrit and Professor of Sanscrit" at Poona College (present-day University of Pune) between 1859 and 1866, and also undertook an expedition through Gujarat in 1863 (Eilers 1969:91). Wilhelm's (2012) brief history of Indology at the University of Munich, where Haug was Lehrstuhlinhaber from 1868, mentions only Ramakrishna Gopal Bhandarkar as a friend (who was, however, younger than Haug), and otherwise notes only that Haug maintained close contact with Brahmin priests (207). Bühler, for his part, was present in India between 1863 and 1880: he first held an appointment as Professor of Oriental Languages at Elphinstone College in Bombay (Mumbai) between 1863 and 1869, during which time he also undertook manuscript-seeking journeys in Maharashtra and Karnataka; in the period 1869–1880 he took on the position of Educational

Classical Sanskrit were, apparently, taken over by further Western pedagogical works of Sanskrit (e.g., Perry 1885:229–30 [who directly translates Bühler], Thumb and Hauschild 1958:43–4, Gonda 1963:10, Mayrhofer 1978:25–6), though these often provide less detail and fewer examples.

> Wenn nun behauptet worden ist, dass das Sanskrit, wenn gesprochen, keinen Accent mehr zeige, sondern ganz monoton klinge, so ist diess nicht ganz richtig. Gewisse Sylben werden auch jetzt noch beim Sprechen mit mehr Nachdruck als andere hervorgehoben; es sind vorzugsweise die langen Sylben, denen sich der Ton zuwendet; auch wird er mehr nach vorne geworfen, bei mehrsylbigen Worten gern auf die drittletzte Sylbe. So wird z. B. *madhyándina*, *vājasanéyi*, *taittirī́ya*, *déva*, *brā́hmaṇa*, *kā́rayati*, *pratíṣṭha*, *ágni*, *gáta*, *dátta* u. s. w. gesprochen.[3]
>
> (Haug 1874:99)

In the following section (2.2), I present the stress data from Bühler 1883, supplemented by the forms from Haug 1874 found in the quotation immediately above,

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Inspector in Gujarat (based primarily at Surat), though also searched for manuscripts in Kashmir during the latter part of this tenure (Natu 2020:11–4). Both Haug and Bühler were thus primarily present in Maharashtra and Gujarat, and one might therefore assume that most of the Sanskrit-speakers with whom they worked might otherwise have mainly spoken Marathi and Gujarati. If this assumption is correct, it holds interesting implications for the source of the "Classical Sanskrit stress rule," since Pischel (1897, 1898) argued that Māhārāṣṭrī-Prākrit largely maintained lexical stress matching the position of the Vedic *udātta*, and Turner (1916:231–51) aimed to show that Marathi, in its historical phonology, exhibits a number of developments that depend on the maintenance of this same lexical stress. The implication would then be that the stress rules applied in Sanskrit spoken in the 19th century were independent of the word prosody of the local Indic languages.

3 "If it has been claimed that Sanskrit, when spoken, no longer exhibits any accent, but rather sounds entirely monotonous, this is not entirely correct. Certain syllables are still, even at present, emphasized more than others in speech with greater force; it is preferentially the long [i.e., heavy; RS] syllables towards which the tone is applied; it is also happily thrown further forward, in the case of polysyllabic words, onto the antepenultimate syllable. Thus, for instance, [the following words] are spoken …."

All of the forms given by Haug, with the exception of *kā́rayati*, *dátta*, and perhaps *gáta*, are uninflected stem forms. Since, as will be seen below, the final syllable usually does not appear to affect the position of primary stress, changes in the weight of the final syllable brought on by inflection would not impact stress assignment (except perhaps in the case of *gáta-*, if Haug here means a past participle and not an inflected 2PL form of *gam-*; see the treatment of disyllables with light initial syllables). Otherwise, only the example *vājasanéyi-* is somewhat peculiar, in that this form is strictly a compositional form (e.g., in *vājasaneyisāṃhita-*); perhaps Haug means that the penultimate syllable of this stem has primary stress even in the compounds in which it occurs, or that it is perceptibly stress-bearing within that portion of the compound.

and draw some initial generalizations. Section 2.3 then briefly surveys the nature and types of indirect evidence available for a "Classical Sanskrit stress rule."

2.2 Direct Evidence: Bühler's and Haug's Data

Bühler 1883:Schrifttafel (see also Perry 1885:229–30) presents four rules for the accentuation of words (stress assignment) in Classical Sanskrit, supported by about thirty examples between two and five syllables in length; one of these rules concerns the accentuation of compounds, which I will not discuss here.[4] All of the forms are marked for primary stress (with acute), and some for secondary stress as well (with grave, only to the left of the primary stress). In order to avoid any potential confusion with the *udātta* of Vedic, I instead use the IPA stress diacritics here (ˈ marks primary stress, ˌ marks secondary stress), and also explicitly mark syllable boundaries; keep in mind that any consonant in a syllable coda renders the syllable heavy. In addition, forms whose primary stress is identical with the position of the Vedic *udātta* are marked with a preceding superscript ^{V}; words not so marked either disagree with Vedic *udātta* or are simply unattested in accented Vedic texts.

A cursory overview of Bühler and Haug's examples permit some intial hypotheses about the features of a Classical Sanskrit stress rule to be formulated:

- No minimal stress pairs occur in the data (i.e., there are no words of identical prosodic shape but with a different stress pattern) ⇒ stress is neither lexically contrastive nor sensitive to morphological structure.
- Stress rarely falls on a final syllable, and then only in disyllables with a light initial syllable and long-voweled final syllable (i.e., [L ˈ*V̄(C)*]) ⇒ some form of extrametricality likely holds at the right edge of the word.
- Primary stress occurs within a window of four syllables at the right edge, and secondary stress, when given, only occurs to the left of the primary stress ⇒ primary stress is likely assigned to the rightmost foot constituent (F) constructed within a word.

More concretely, the following stress patterns occur across the available data. First, in disyllabic words, if the initial syllable is light and the final syllable contains a long vowel or diphthong, primary stress falls on the final syllable; see example (1).

4 See the Appendix on Bühler's rules.

(1) [L $\bar{V}(C)$] → [L ˈ $\bar{V}(C)$]

a. ^{V}*ja.* ˈ*gau* 'go:PERF.3SG' (= [L ˈ $\bar{V}$])

b. *a.* ˈ*yāt* 'go:IMPF.3SG' (= [L ˈ $\bar{V}C$])

Outside of disyllabic forms like these, stress never occurs on final syllables.[5] In turn, regardless of the properties of the final syllable and total number of syllables, if the penultimate syllable is heavy, the penult bears primary stress, as shown in (2).

(2) Heavy penultimate syllables receive primary stress

a. Disyllable: ˈ*tas.thau* 'stand:PERF.3SG' (= [ˈH $\bar{V}$])[6]

b. Trisyllable: *ut.* ˈ*kr̥ṣ.ṭam* 'attracted:ACC.SG' (= [H ˈH *VC*])

c. Four-syllable: *du.hi.* ˈ*tr̥̄.ṇām* 'daughter:GEN.PL' (= [L L ˈH $\bar{V}C$])

d. Five-syllable: *vā.ja.sa.* ˈ*ne.yi-* (= [H L L ˈH *V*]); from Haug 1874:99

In cases in which neither the penult nor the antepenult is heavy, the position of primary stress instead appears to depend primarily on the total number of syllables in the word. The data on four- and five-syllable forms is, however, sparse: between Bühler and Haug, only two four-syllable forms and one five-syllable form of this sort are provided. See example (4).

(4) Light penult and light antepenult → primary stress on the leftmost syllable in two- to four-syllable words, antepenultimate stress in five-syllable words

a. Disyllable: ˈ*ga.ta* 'come:IMP.2PL' (= [ˈL *V*]); from Haug 1874:99

b. Trisyllable: ˈ*kṣi.pa.si* 'hit:PRS.2SG' (= [ˈL L *V*])

c. Four-syllable: ˈ*du.hi.ta.ram* 'daughter:ACC.SG' (= [ˈL L L *VC*])

d. Five-syllable: ^{V}ˌ*u.pa.* ˈ*ga.ma.tam* 'approach:AOR.IMP.2DU' (= [ˌL L ˈL L *VC*]

5 Unfortunately, neither Bühler nor Haug presents any disyllables of the shape [L *VC*] (light syllable followed by a closed final syllable with a short vowel). From their data alone, whether all closed final syllables behave identically to final syllables with long vowels for the purposes of stress (or not) is impossible to determine.

6 This form appears to contradict one of the rules explicitly formulated by Bühler, namely, that stress should occur to the left of a root syllable (in this case, -*s.thau*) only if the root syllable is light.

The data seen in (2)–(4) thus admit of the following generalizations: in words of three or more syllables, if the word contains exactly one heavy non-final syllable up to the preantepenult, that syllable receives primary stress, as shown in (5); if two heavy non-final syllables fall within the four-syllable window, then the rightmost of those will bear primary stress, as seen in (6).

(5) The only non-final heavy syllable receives primary stress

a. Penult: *ka.ra.ˈṇe.na* ‘doing:INST.SG’ (= [L L ˈH *V*])

b. Antepenult: *a.ˈnuṣ.ṭhi.tam* ‘performed:ACC.SG’ (= [L ˈH L *VC*])

c. Preantepenult: *ˈkā.ra.ya.ti* ‘make:CAUS.PRS.3SG’ (= [ˈH L L *V*])

(6) The rightmost heavy non-final syllable receives primary stress

a. Penult: *bo.ˈdhā.vaḥ* ‘observe:PRS.1DU’ (= [H ˈH *VC*])

b. Antepenult: *gār.ˈgyā.ya.nī* ‘patronymic from *gārgya-* :F’ (= [H ˈH L $\bar{V}$])

The totality of the testimony from Bühler and Haug is then summarized in Table 1. All occurring abstract prosodic patterns in terms of number of syllables, sequence of heavy and light syllables, and exact composition of the final syllable are given here.

Table 1. Prosodic Patterns and Stress in the Data of Bühler (1883:Schrifttafel) and Haug (1874:99)[7]

Final syllable	Two-syllable	Three-syllable	Four-syllable	Five-syllable
V	[ˈL *V*]^{H}	[ˈL L *V*]		
	[ˈH *V*]^{H}	[ˈH L *V*]		[ˌL L ˈH L *V*]
		[L ˈH *V*]	[L L ˈH *V*]	
			[ˈH L L *V*]^{H}	
			[H L ˈH *V*]^{H}	[H L L ˈH *V*]^{H}
VC		[ˈL L *VC*]	[ˈL L L *VC*]	[ˌL L ˈL L *VC*]
		[L ˈH *VC*]		
		[ˈH L *VC*]	[L ˈH L *VC*]	
	[ˈH *VC*]	[H ˈH *VC*]		
$\bar{V}$	**[L ˈ$\bar{V}$]**	[ˈL L $\bar{V}$]		
	[ˈH $\bar{V}$]		[H ˈH L $\bar{V}$]	
$\bar{V}C$	**[L ˈ$\bar{V}C$]**	[ˈL L $\bar{V}C$]		
			[L L ˈH $\bar{V}C$]	
		[ˈH L $\bar{V}C$]		

7 Prosodic patterns found only in Haug’s data are indicated with a trailing superscript ^{H}.

From the available data, the exceptional behavior of disyllables with a long vowel or diphthong in the final syllable stands out; the two relevant patterns that admit of stress on the final syllable are shown in boldface. How to account for the usual avoidance of final stress, but its admissibility in words of the shape [L *V̄(C)*] will be revisited in Section 4. Most important for present purposes is the conclusion that no reference to lexical properties or morphological structure appears to be necessary to capture the patterns; *pace* Bühler, whose rules (cf. the Appendix) regularly refer to the "root syllable" in determining the position of stress, mere knowledge of syllable weight and the number of syllables in a word seems to suffice.

2.3 Indirect Evidence: Segmental Changes in Classical Sanskrit, Prākrits, and Modern Indic Languages

Although the material offered by Bühler and Haug appears internally coherent and thus constitutes a solid basis for a phonological analysis of a Classical Sanskrit stress rule, it leaves us with issues both empirical and epistemological. Empirically, both more data in total and evidence for the position of stress in words of certain prosodic shapes not found in the data discussed above would be desirable, in particular: a disyllable of the shape [L *VC*], a five-syllable word of the shape [σ H L L σ], and words with six or more syllables. Epistemologically, the fact that Bühler and Haug's data stem from the 19th century simply means that, without an independent *terminus ante quem*, exactly when such an innovative stress grammar arose must remain uncertain. The *Phiṭsūtra* discussed above might provide such evidence, but its dating is uncertain (likely post-Pāṇinian but older than 500 CE), and in any case, offers merely suggestive corroboration of some of the generalizations that can be drawn from the data above.[8] Therefore, independent confirmation of a stress pattern fitting Bühler and Haug's material must be sought elsewhere.

8 Concerning the dating of the *Phiṭsūtra*, see Kielhorn 1866:1–11 and Devasthali 1967:39–43 for convincing arguments that it is post-Pāṇinian. Kielhorn (1866:10) further suggests, with less confidence, that it was not known to Patañjali; Devasthali (1967:42 n.96) allows that Patañjali may allude to the *Phiṭsūtra* in one instance. Aussant (2009:200, 210–11) has, meanwhile, adduced evidence indicating that the *Phiṭsūtra* was known at the time of the composition of the *Cāndravyākaraṇa* (Candragomin's grammar of Sanskrit, likely to be dated to 300–400 CE). Given the consensus that Patañjali lived sometime between 100 and 300 CE, the *Phiṭsūtra* might then be dated to around 300 CE. That the contents of the *Phiṭsūtra* indeed point to the existence of a Classical Sanskrit stress rule in the same form outlined in this paper remains something of a leap, however.

Already Jacobi (1893, 1898) attempted to provide just such a firmer evidential basis. Specifically, Jacobi claimed that (sporadic) patterns of syncope, vowel lengthening, vowel shortening, and consonant gemination found in Pāli and the Prākrits (and in some cases, in Epic or Classical Sanskrit) vis-à-vis their (Vedic) Sanskrit preforms can be best understood if primary stress were assumed to have stood in the position predicted by Bühler's data. Some examples of the types of segmental changes mustered by Jacobi (1893) are listed in (7); syllabified forms with IPA stress marks represent virtual Sanskrit forms with presumed stress, where syllables in boldface are affected by a segmental change. On seeming effects of stress generated by Bühler's rules in Pāli, see also Geiger 1916:47–9.

(7) Stress-conditioned (sporadic) segmental developments posited by Jacobi (1893)

a. Syncope of non-tonic syllables in Sanskrit: Ved. *bhagínī-** 'sister; woman' > *ˈbha.**gi**.nī-* > *bha**g**nī-* (Dvirūpakoṣas)[9]

b. Vowel lengthening of tonic syllables in Sanskrit: Ved. *músala-* 'pestle' > *ˈ**mu**.sa.la* > ***mū**sala-* (Dvirūpakoṣas)

c. Vowel lengthening of tonic syllables in Pāli: *ˈ**a**.nu.bha.va-* 'perception; experience' > Pāli ***ā**nubhava-*

d. Vowel shortening of non-tonic syllables in Pāli: ***ā**.ˈgā.ra-* 'apartment' > Pāli ***a**gāra-*

e. Consonant gemination of a tonic syllable in Pāli: *ˈ**ku**.na.dī-* 'name of a small river' > Pāli ***kun**nadī-*

f. Syncope of non-tonic syllables in Prākrits: Ved. *pácāmahe* 'cook: PRS.MID.1PL' > *pa.ˈcā.**ma**.he* > Śaurasenī *paca**m**ha** (but see n.12 below)

g. Vowel lengthening of tonic syllables in Prākrits: Ved. *subhága-* 'lucky' > *ˈ**su**.bha.ga-* > Māhārāṣṭrī ***sū**haya-*

h. Vowel shortening of non-tonic syllables in Prākrits: Epic Skt. ***nā**rāca-* '(iron) arrow' (Mahābhrārata) > ***na**rāya-* (Hemacandra 8.1.67)[10]

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9 The reconstructed *udātta* for *bhagíni-* can be regarded as secure: the noun is a feminine in *-ī-* built to an adjective in *-ín-* (where this adjectival suffix is always *udātta*-attracting), in turn built to an *a*-stem (*bhága-* 'happiness'). Compare similarly the derivation of F *vājínī-* to *vājín-* 'having *vā́ja-*' from *vā́ja-* 'strength; prize (from a competition)' (all RV).

10 Note, however, that the form *narāya-* given by Jacobi (1893:582) is not entirely consistent with the form printed in the editions of Pischel (1877:13) or Vaidya (1928:13), who instead give *narāo*. Perhaps Jacobi has tacitly corrected an unexpected °*o* to expected °*ya* (< Skt. °*ca* / *V*__).

If the totality of Jacobi's examples were secure and indeed without other plausible explanations, they would make for convincing confirmation of the stress positions predicted by Bühler's data and indicate that such a stress rule likely emerged during the 1st millennium BCE. However, Pischel (1897, 1898) instead argued that the developments found in much of the data presented by Jacobi—at least for Pāli and the Prākrits—can instead be attributed to either stress that continues the position of the Vedic *udātta* or sound changes unrelated to stress altogether. Therefore, only when two conditions are met can a datum be interpreted as a useful indicator of the effects of a "Classical Sanskrit stress rule." First, the position of stress predicted by the rule must differ from the position of the Vedic *udātta*; second, in cases of supposed syncope, no alternative segmental development must be possible. When these two evidential principles are consistently applied to Jacobi's collection, most of his material unfortunately proves to be largely equivocal (e.g., (7b) above could be attributed to either stress in the position of the Vedic *udātta* or stress assigned by an innovative rule). In particular, most of Jacobi's Prākrit data comes from Māhārāṣṭrī, in which consonant lenition and vowel contraction, rather than syncope, may be responsible for a reduction in number of syllables (e.g., Ved. *kumbhákāra-* 'potter' > M. *kumbhāra*, where the [k] in the onset of the penultimate syllable is lenited, allowing the penultimate and antepenultimate vowels to coalesce).

Since, for reasons of space, a thorough assessment of potentially relevant material from Sanskrit variants, Pāli, Prākrits, and Modern Indic languages is not possible here, I will discuss merely a handful of forms that are both reasonably secure and provide a meaningful expansion or confirmation of Bühler and Haug's data. These forms are given in Table 2 below. The first group includes three variant forms found in Sanskrit that appear to be missing one syllable; *bhagnī-* establishes that a syllable that originally bore the *udātta* could be subject to syncope (cf. n.9), while *hiraṇvatī-* and *hiraṇmaya-*, if interpreted as showing syncope of the original antepenult, suggest a primary stress on the heavy preantepenult of a five-syllable word.[11]

11 One alternative account for these two forms, namely, that they exhibit shortening of the stem by deletion of a stem-formant *-a-* in the first member of a compound (cf. Macdonell 1910:147) is perhaps not impossible, but does not particularly recommend itself. First, such shortening of the first member of a compound is known to occur to *-a-* alone, but not *-ya-*. Second, *híraṇyavatī-* itself is not a compound (though could arguably have been influenced by *hiraṇmaya-*). A further, more difficult complication is that the earliest attestation of *hiraṇmáya-* (TS 5.2.7.2) is itself still marked with an *udātta*, in a position that would admit of interpreting the loss of *-ya-* as pretonic syncope.

Table 2. Plausible examples of stress-induced syncope in Sanskrit, Śaurasenī, and Gujarātī

Prosodic shape	Vedic form	Stressed Sanskrit preform	Attested form	Gloss
[L H L L σ]	*híraṇyavatī-* (RV)	*hi.ˈraṇ.ya.va.tī-*	Skt. *hiraṇvatī-* (MBh. 5×)	‘possessing gold (river name)’
[L H L L σ]	*hiraṇyamáya-* (ŚB 13.2.10.2)	*hi.ˈraṇ.ya.ma.ya-*	Skt. *hiraṇmáya-* (TS 5.2.7.2)	‘made of gold, golden’
[L L σ]	*bhagínī-**	*ˈbha.gi.nī-*	Skt. *bhagnī* (Dvirūp.)	‘sister; woman’
[H L L σ]	—	*ˈpū.ga.pha.la-*	Ś. *popphalī*	‘betel-nut’
[L H L σ]	*pácāmahe*	*pa.ˈcā.ma.he*	Ś. *pacamha*	‘cook:PRS.MID.1PL’ > ‘cook:IPV.1PL’
[L *VC*]	*jalám*	*ˈja.lam*	G. *ˈjaḷ*	‘water’
[L H σ]	*áraṇyam*	*a.ˈraṇ.yam*	G. *ˈrāṇ*	‘wilderness’
[L L L σ]	—	*ˈku.ma.la.kam*	G. *kumḷo*	‘lotus fiber’ (?) [a]
[L H L L σ]	*cáturguṇakaḥ** (cf. *cáturguṇa-*, ŚB 3.3.2.9)	*ca.ˈtur.gu.ṇa.kaḥ*	G. *ˈcōgṇo*	‘four(fold)’
[L L L L σ]	*pári ṇayati*	*ˌpa.ri.ˈṇa.ya.ti*	G. *ˈparne* [b]	‘lead around:CAUS.3SG = marry’

Table 2 continued

a I have been unable to locate any exact form *kumḷo* (કુમળો) in any lexical resources on Gujarātī, for which reason I assume that Turner's transcription deviates from the transliteration that would usually be applied to the intended form. Working backwards from Turner's Sanskrit reconstruction, perhaps the easiest point of departure is Skt. *komalaka-* 'lotus fiber', which would require assuming a variant *kumalaka-*, with *u* for *o*; such variation between *o* and *u* in this form might find support in *sukumala-* 'very tender' (Pañcatantra) as a variant of *sukomala-*, which contains the adjective *komala-* 'tender' underlying *komalaka-*.

b Turner admits in this case of a stress retraction from the final syllable (*par.ˈne*) to the penult (*ˈpar.ne*), in line with the known trajectory of developments in Gujarātī prosody during the 20th century. However, a virtual Sanskrit *ˈpa.ri.ˌṇa.ya.ti*, with initial primary stress and secondary stress on the antepenult, would fit the segmental developments equally well.

The second group contains potential cases of apparent pretonic shortening in Śaurasenī: the geminate [-pp^{h}-] in *popphalī* (with F *-ī* for M *-a* in the Sanskrit *pūgaphala-*) must reflect assimilation from a virtual **pūgphala-*, while the inflectional ending *-mha* (perhaps comparable to *-mhase* in Pāli; cf. Geiger 1916:107) would follow from the placement of stress on a long antepenult in the 1PL of any Class 1 present followed by *-mahe* (if syncope is the correct explanation for *-mha* at all).[12]

Rather more convincing overall is the treatment in Turner 1916:213–30 of syncope in the historical phonology of Gujarātī. Turner aims to show that the syllable assigned stress by Bühler's rules in a Sanskrit preform is always preserved in

12 Whether a syncopated form of the MID.1PL ending *-mahe* really underlies any attested inflectional endings of Pāli or the Prākrits is far from clear. The first issue is that no living functional category of MIDDLE, with inflectional endings that would call for derivation from the Vedic endings, is present in either Pāli or the Prākrits. In the Prākrits, an ending *-mha* is attested primarily in Śaurasenī, Māgadhī, and Ḍhakki, where it functions as a 1st plural imperative ending (Pischel 1900:333); functionally, an original MID.1PL in mutual hortative use is believable, though Pischel prefers to derive this *-mha* from (*s-*)aorist precatives/injunctives of the type *jeṣma* (to *ji* 'conquer'). In addition, such an ending is also occasionally found as a 1st plural indicative ending, though Pischel regards this usage as erroneous (Pischel 1900:323, citing mainly forms from the *Abhijñānaśakuntalam*). Pischel's account (followed by von Hinüber 2001:281; 283) is rejected by Oberlies (2019:404 n.3), who instead holds that *-mha* reflects a crossing of the final sequences °*āma* / °*ema* with °*aha*; see further Oberlies 2001:370 n.44. As far as Pāli is concerned, an attested ending *-mhase* is found on optative forms (cf. Oberlies 2019: 391; 426) and might, on the account of Geiger (1916:107), result from a combination of **-mhe* (reported in Kaccāyana 3.1.2) < syncopated *-mahe* with *-mase* (built analogically from ACT.1PL *-masi*). That Geiger's explanation is correct is not clear, however; Oberlies (2019:426) instead suggests that optative *-emase* was blended with an *h* from singular middle endings.

Gujarātī, and usually still bears primary stress itself. The patterns present in Turner's data further substantiate and on no points contradict Bühler and Haug's material, given that some ancestor of Gujarātī (often presumed to be similar if not identical to Śaurasenī Prākrit; cf. Ollet 2012:274) assigned stress according to the principles seemingly operative in the data treated under 2.2.[13]

If taken at face value, the derivations from Sanskrit to Gujarātī given by Turner both provide evidence for stress of disyllables of the shape [L *VC*], not present in Bühler and Haug's material, and otherwise appear to further substantiate the position of stress in four- and five-syllable words. More generally, many of the Gujarātī forms would require stress in a position different from that of the Vedic *udātta*, and thus strongly suggest that the lexical accents of Vedic were not faithfully preserved. Of greatest utility is G. *ˈjaḷ* 'water', which probably points to stress on the initial syllable of a virtual Sanskrit *ˈja.lam*, indicating that words of the shape [L *VC*] had initial stress. A full account is, however, somewhat more complicated. Although an immediately pre-tonic short *a* may be deleted (as in G. *ˈrān* 'wilderness' < Skt. *a.ˈraṇ.yam*), such deletion typically did not occur if the initial syllable had an onset. Furthermore, although stress on the final syllable of polysyllabic words was apparently permitted in Gujarātī at Turner's time, present-day Gujarātī seems to have developed persistent penultimate stress (Bowers 2019), and even Turner reckons with a retraction from the final to the penult in some cases (e.g., Skt. *ˌpa.ri.ˈṇa.ya.ti* > *par.ˈne* > *ˈpar.ne* 'marry'). A virtual *ja.ˈlam*, with final stress, thus might have ultimately produced G. *ˈjaḷ*, if a comparatively late deletion of the then unstressed final is allowed. All things considered, the form falls out more straightforwardly from a Sanskrit preform with initial stress.[14]

To be sure, further careful linguistic and philological investigation into the testimony of the Prākrits and Modern Indic languages is needed to firmly establish the likely prosody of their immediate Old Indic ancestors. Nevertheless, much of the available data may reasonably be interpreted as supporting the details of Bühler and Haug's testimony, and fills out the picture on two points: disyllables of the shape [L *VC*] probably had initial stress (*ˈja.lam*), while five-syllable words

13 Although Pischel held that most Prākrits maintained a lexical accent system like Vedic, he also expressed the view that some (in particular, Śaurasēnī, Māgadhī, and Ḍhakki) emerged from varieties of Old Indic in which some form of the "Classical Sanskrit stress rule" did hold (Pischel 1900:48).

14 Note, though, that the analysis presented in Section 4 would in fact be somewhat simpler if [L *VC*]-words were assumed to have final stress. In that case, no reference to final consonant extrametricality would be necessary.

of the shape [σ H L L σ] probably bore primary stress on the preantepenult (*hi.ˈraṇ.ya.va.tī*).

3 Existing Analyses of the Classical Sanskrit Stress Rule: Keydana 2016 and Vaux 2021

Although formal analyses in contemporary phonological frameworks of stress assignment in older Indo-European languages (e.g., Latin, Ancient Greek, Vedic Sanskrit, Old English) abound, a treatment of any version of a stress rule for Classical Sanskrit was, until recently, wanting. Within the last several years, however, Keydana (2016) and Vaux (2021) have presented analyses based on various statements found in handbooks and in editions of Classical Sanskrit texts that provide indications as to stress.[15] The analysis presented by Keydana is ultimately wanting in several respects (as already pointed out by Vaux); Vaux's treatment, on the other hand, correctly generates the data that it wants to explain, but makes assumptions on the position of stress in five-syllable words that diverge somewhat from the interpretation of available data offered in Section 2 above.[16] I briefly describe these two analyses here before proceeding to my own analysis in Section 4.

Keydana's treatment is a simple Optimality-Theoretic analysis given by the ranking in (8) (see Kager 1999:Ch. 4 on constraints for metrical stress). This analysis predicts that feet are obligatorily binary and trochaic, and that all heavy syllables are footed; when syllable weight plays no role, feet will stand as close to the left edge of the word as possible. One first issue is that no provision for avoiding stress on final syllables is encoded: hence, any final syllable containing a long vowel, if there are no other heavy syllables in the word, would be predicted to bear stress. Second, in case a word contains more than one heavy syllable, since all heavy syllables should be stressed, no provision is made for determining which should receive primary stress. In a sequence containing up to four light syllables, stress is correctly predicted to fall on the leftmost syllable, and likewise, in words with a light final syllable and only one heavy syllable, stress will be assigned to the only heavy syllable. In words of five or more syllables, however, primary stress is in no way held within a four-syllable window: a word like *ˌu.pa.ˈga.ma.tam* would instead be predicted to have stress on its initial syllable (× *ˈu.pa.ga.ma.tam*).

15 Thanks to Bert Vaux for sharing his unpublished work and for discussion of the data.

16 Bert Vaux (p.c.) informs me that the forms used in his analysis were taken from texts printed in the Clay Sanskrit library, and that the individual editors of the texts were permitted by the series editors (Gombrich and Benson) to assign stresses according to their own understanding of a stress rule.

(8) Constraint ranking for the analysis of Classical Sanskrit stress in Keydana 2016:

FOOTBINARITY, WEIGHT-TO-STRESS PRINCIPLE, TROCHEE ≫ ALL-FEET-LEFT

The analysis in Vaux 2021, meanwhile, is a successful implementation in the framework of Halle and Isardi 1995 (Simplified Bracketed Grid Theory = SBG), but makes two assumptions that do not directly accord with what is reported by Bühler (1883):

- words of five or more syllables with no heavy non-final syllables are assigned stress on the preantepenult (thus *a.ˈra.pa.ca.na-* 'collective of the five Buddhas', contrary to Bühler's *ˌu.pa.ˈga.ma.tam*);[17]
- stress never falls on the final syllable, regardless of its weight (contrary to Bühler's *a.ˈyāt* and *ja.ˈgau*).

Except in these cases, Vaux's analysis is adequate for handling Bühler and Haug's data. Briefly summarized: left constituent brackets are projected to the left of non-final heavy syllables on line 0 of the grid; a right constituent bracket is projected to the left of the rightmost syllable (which rules out the possibility of stress on the final syllable);[18] iterative constituent construction proceeds from right to left, crucially allowing for ternary (trisyllabic) constituents; the leftmost syllable of a constituent is then projected onto line 1; and finally, on line 1, a right constituent bracket is placed to the right of the rightmost grid mark, and the rightmost grid mark in this constituent is projected as the head onto line 2. The complete structure built for *aṃ.ˈsa.pha.la.ka-* 'shoulder-blade' is given in (9), where Vaux assumes preantepenultimate stress; I would instead assume the correct stress, compatible with Bühler's data, to be *aṃ.sa.ˈpha.la.ka-*.[19]

17 It may be the case that some editors of the Clay Sanskrit Library have interpreted Bühler as claiming that stress should always fall on the preantepenult if the penult and antepenult are both light. However, Bühler's formulation is not so stringent, nor does such an assumption unproblematically fit Bühler's examples.

18 Indeed, because of how extrametricality is implemented in the Simplified Bracketed Grid model (namely, as an "all or nothing" parameter), cases like *ja.ˈgau*, with final stress, must either be suppressed or attributed to non-phonological factors. The same critique applies to the analysis in Section 4, for which reason a constraint-based analysis is probably necessary.

19 To be fair, Bühler's data contains no form of the shape [H L L L σ], but the available five-syllable forms that I regard as credible evidence, whether from Bühler, Jacobi, or Turner, indicate that the weight of the initial syllable in such cases is irrelevant, and, if the preantepenult is light, that primary stress would fall on the antepenult. Vaux does not explicitly provide a derivation of any words of the shape [L L L L σ] (like *ˌu.pa.ˈga.ma.tam*), but his analysis predicts that they

(9) Metrical structure of *aṃsa'phalaka-* 'shoulder-blade' in the SBG analysis of Vaux (2021)

Line 2			×					
Line 1	×		×)					
Line 0	(×		(×		×	×	×)	×
	H		L		L	L	L	
	aṃ		*sa*		*pha*	*la*		*ka-*

Crucial to the entire analysis is the construction of ternary constituents and the avoidance of including final syllables in constituents.

4 A Provisional Parametric Stress Grammar

In light of the fact that Vaux's analysis both requires ternary constituents and, more importantly, does not fully correspond to the most secure data available—the direct reports of Bühler and Haug—an alternative analysis is in order.[20] Here, I construct a provisional parametric stress grammar modeled on Hayes 1995. A full analysis in a constraint-based grammar would, however, be better able to capture the full range of stress distributions discussed in Section 2.

First, all data seen above (cf. Tables 1 and 2) is compatible with the generalization that primary stress is assigned to the head of the rightmost moraic trochee (i.e., a foot consisting of a single heavy syllable, or a sequence of two light syllables with left prominence). In addition, final syllables appear to be treated as extrametrical (i.e., not parsed into feet) in most configurations; only in the configuration [L ˈ*V̄(C)*] is final stress permitted. The motivation for this exception would seem to lie with the fact that, if the final syllable were marked as extrametrical in such disyllables, the only possible foot that could be constructed would be degenerate, consisting of a single light syllable. Thus, final syllable extrametricality is permitted only when subsequent foot parsing would leave enough material for at least one

would behave just like four-syllable [L L L σ]-words (thus ˣ*u.ˈpa.ga.ma.tam*). Furthermore, if the form *aṃsaphalaka-* is instead subject to compound stress, Bühler's Rule 4 concerning compound accentuation (see the Appendix) would also seem to predict antepenultimate stress (i.e., primary stress of the compound in the position of the primary stress of the second member in isolation), thus *aṃ.sa.ˈpha.la.ka-*.

20 Note, however, that ternary constituents are generally admissible in SBG and thus pose no theory-internal problem. I view the admissibility of such structures instead as a weakness of the model. See Golston 2021 for arguments that some well-known cases of stress systems that have been analyzed with ternary feet (Chugach Alutiiq Yupik, Tripura Bangla, Cayuvava) can be adequately handled with non-recursive binary feet alone.

well-formed moraic trochee. Words of the shape [L *VC*], such as *ˈja.lam* (> G. *jaḷ*) also pose an issue, in that the final syllable seems to behave as light; it appears that a structure [(ˈja.la)⟨m⟩], with final-consonant extrametricality, applies in such cases. Allowing final-consonant extrametricality to apply across the board will lead to no issues, since final-syllable extrametricality will, in all words of three or more syllables, render the final syllable unparsable regardless.

In longer sequences of light syllables alone, such as *ˌu.pa.ˈga.ma.tam*, a left-to-right parsing into two moraic trochees, [(ˌu.pa).(ˈga.ma).⟨ta⟨m⟩⟩], will produce a primary stress on the rightmost foot and a secondary stress to its left. Interesting then are cases with a heavy preantepenult followed by two light syllables, such as *hi.ˈraṇ.ya.va.tī-*. Crucially, primary stress on the antepenult must be avoided (**hi.ˌraṇ.ˈya.va.tī-*), even though the light antepenult and penult could build a well-formed moraic trochee. To account for this behavior within the parametric, deviational approach employed here, I posit that destressing in clash above a light syllable following a heavy syllable on Line 1 of the stress grid occurs. This destressing must crucially apply prior to the end rule that selects the rightmost foot as the head foot of the word (determining primary stress). The parameters that can generate the stress data for Classical Sanskrit are given in (10).

(10) Parametric Stress Grammar for Classical Sanskrit

a. **Foot Shape**: Moraic Trochee ($_{F}$ = – or ⏑)

b. **Extrametricality**: Final Consonant and Final Syllable (but the latter not if only a single light syllable or no other syllable would remain—look-ahead problem)

c. **Direction of Parsing**: Left-to-right

d. **Destressing in Clash**: $\times \rightarrow \varnothing \; / \; \times \underset{- \; \smile}{\_\_}$ on Line 1

e. **End Rule**: Right

Stated in prose, this grammar constructs feet and assigns stress as follows: “Ignore final consonants in the calculation of syllable weight; then form moraic trochees from left-to-right, ignoring the final syllable (unless only a single light syllable or no other syllable would remain); delete a stress on Line 1 above a light syllable if immediately preceded by a stress on Line 1 above a heavy syllable; assign primary stress on Line 2 to the rightmost stress on Line 1.”

Illustrative derivations are shown for two- and three-syllable forms in Table 3, then for four- and five-syllable forms in Table 4.

Table 3. Illustrative derivations of Classical Sanskrit stress (two- and three-syllables)

Syllabified input	*ja.lam*	*ja.gau*	*tas.thau*	*bi.bhṛ.ta*	*ut.kṛṣ.ṭam*
Final *C* extrametricality	*ja.la⟨m⟩*	—	—	—	*ut.kṛṣ.ṭa⟨m⟩*
Final σ extrametricality	—*	—*	*tas.⟨thau⟩*	*bi.bhṛ.⟨ta⟩*	*ut.kṛṣ.⟨ṭa⟨m⟩⟩*
Moraic trochees L-to-R	(ˌ*ja.la*)⟨*m*⟩	*ja.*(ˌ*gau*)	(ˌ*tas*).⟨*thau*⟩	(ˌ*bi.bhṛ*).⟨*ta*⟩	(ˌ*ut*).(ˌ*kṛṣ*).⟨*ṭa⟨m⟩⟩*
Destressing in Clash	—	—	—	—	—
End Rule Right	(ˈ*ja.la*)⟨*m*⟩	*ja.*(ˈ*gau*)	(ˈ*tas*).⟨*thau*⟩	(ˈ*bi.bhṛ*).⟨*ta*⟩	(ˌ*ut*).(ˈ*kṛṣ*).⟨*ṭa⟨m⟩⟩*

Table 4. Illustrative derivations of Classical Sanskrit stress (four- and five-syllables)

Syllabified input	*du.hi.ta.ram*	*hi.raṇ.ya.va.tī*	*u.pa.ga.ma.tam*	*u.pa.gac.cha.ti*
Final *C* extrametricality	*du.hi.ta.ra⟨m⟩*	—	*u.pa.ga.ma.ta⟨m⟩*	—
Final σ extrametricality	*du.hi.ta.⟨ra⟨m⟩⟩*	*hi.raṇ.ya.va.⟨tī⟩*	*u.pa.ga.ma.⟨ta⟨m⟩⟩*	*u.pa.gac.cha.⟨ti⟩*
Moraic trochees L-to-R	(ˌ*du.hi*).*ta.*⟨*ra⟨m⟩⟩*	*hi.*(ˌ*raṇ*).(ˌ*ya.va*).⟨*tī⟩*	(ˌ*u.pa*).(ˌ*ga.ma*).⟨*ta⟨m⟩⟩*	(ˌ*u.pa*).(ˌ*gac*).*cha.*⟨*ti⟩*
Destressing in Clash	—	*hi.*(ˌ*raṇ*).(*ya.va*).⟨*tī⟩*	—	—
End Rule Right	(ˈ*du.hi*).*ta.*⟨*ra⟨m⟩⟩*	*hi.*(ˈ*raṇ*).(*ya.va*).⟨*tī⟩*	(ˌ*u.pa*).(ˈ*ga.ma*).⟨*ta⟨m⟩⟩*	(ˌ*u.pa*).(ˈ*gac*).*cha.*⟨*ti⟩*

In all forms in both sets of examples, final-consonant extrametricality plays no substantial role except in the case of *ˈja.lam*, where its application makes the formation of a well-formed moraic trochee out of two syllables possible. Conversely, in all cases except *ˈja.lam* and *ja.ˈgau*, final-syllable extrametricality removes the last syllable from foot construction; the non-application of final-syllable extrametricality by "looking ahead" to ensure that at least one heavy or two adjacent light syllables would remain is marked with an asterisk. Otherwise, feet of the shape (–) or (⏑) are built up from left to right, with the result that light syllables immediately preceding the final syllable remain unparsed in cases like [(ˈdu.hi).ta.⟨ra⟨m⟩⟩] or [(ˌu.pa).(ˈgac).cha.⟨ti⟩]. Destressing in clash is relevant only in the case of *hi.ˈraṇ.ya.va.tī-*, where the foot constructed around the light penult and antepenult has its stress on Line 1 (indicated with a secondary stress diacritic) deleted. In cases in which multiple feet have been constructed and more than one stress on Line 1 remains (*ˌut.ˈkr̥ṣ.ṭam*, *ˌu.pa.ˈga.ma.tam*, *ˌu.pa.ˈgac.cha.ti*), the rightmost foot and its head then receive the primary stress.

5 Summary and Future Directions

First, and perhaps most importantly, the direct testimony alone from Haug 1874:99 and Bühler 1883:Schrifttafel on a "Classical Sanskrit stress rule" admits of an analysis as a predictable metrical stress system. Without any additional indirect evidence, the resulting parametric grammar would look slightly different (no evidence for final consonant extrametricality or destressing in clash), but would nevertheless clearly point towards a stress pattern without any lexically or morphologically conditioned stress assignment. The convergence of admittedly fuzzy evidence from Middle and Modern Indic—already known to Jacobi, Pischel, and Turner—adds up to the tentative hypothesis that a stress grammar similar to the one sketched in Section 4 played a role in the historical phonology of at least some Indic languages. At this point, the primary empirical challenge is to update and complete the work left unfinished by those earlier scholars: is it possible to discover fully coherent segmental developments that unambiguously require the grammar in (10) to have existed in the ancestors of some Middle Indic languages? The grammar in (10) thus constitutes an explicit working hypothesis that may require revision and refinement as testimony from the indirect evidence comes into sharper focus.

From the point of view of phonological analysis, various remarks above have indicated that the pattern modeled here would be better served by a constraint-based grammar. In particular, the apparent coexistence of both final-consonant and final-syllable extrametricality under different conditions, as well as the need

for the latter to "look ahead" in disyllables, are both features better suited to an Optimality-Theoretic treatment. Likewise, a constraint system can directly block foot construction to avoid stress clash and simultaneously favor stress on heavy syllables, rather than needing to remove stresses created by foot construction. Given the typological rarity of stress systems with a four-syllable window, presenting a fleshed-out constraint-based analysis of the same data used here is of general interest to phonologists, which I aim to fulfill in the immediate future.

Finally, with relatively secure knowledge that not all Indic languages persistently maintained a lexical accent system of some kind (in contrast to, e.g., Greek or some Slavic languages), Indic can be added to the dossier of Indo-European branches with languages that underwent a change from the "free" lexical accent of Proto-Indo-European to a "fixed" metrical stress system. This general type of development is evident in, e.g., Germanic, Lesbian Greek (see Probert 2003:159–60), or Italic (see Nishimura 2014). Investigating how and why many Indo-European languages were subject to this trajectory of prosodic change remains a problem without fully satisfying answers; see now, however, Sandell 2023 for initial attempts to attack this broader issue.

To conclude, I leave the reader, who may be most concerned with the practical question of how to apply stress when reading non-Vedic Sanskrit, with four rules of thumb for generating stress in non-compound words. Rules 1 and 4 fit the available material, though more and better data would help to substantiate them; rules 2 and 3 may be applied with relatively good confidence, though again, clearer indications of primary stress on a preantepenultimate syllable should be sought. Finally, no clear evidence concerning the position of stress in words with more than five syllables without a heavy penult or antepenult has yet come to light; the parametric stress grammar from Section 4 predicts preantepenultimate stress in six-syllable words of the shape [σ σ L L L σ], but other alternatives could be generated in a constraint-based stress grammar.

1. In disyllabic words, place primary stress on the initial syllable, *unless* it is light *and* the final syllable contains a long vowel or diphthong.

2. In words of three or more syllables, place primary stress on the rightmost non-final heavy syllable *up to the fourth-to-last* syllable.

3. In three- or four-syllable words, place primary stress on the initial syllable if the penult and antepenult are light.

4. In words of five syllables, place primary stress on the antepenult if the penult, antepenult, and preantepenult are all light.

Appendix. Rules of Bühler (1883), with Selected Examples

1. In simple verbs and their derivatives, the syllable of the root is preferentially accented, but the accent never goes back farther than the fourth syllable, and rarely farther back than the third. The accent can only stand on the fourth-to-last syllable when the antepenult and penult are light, and on the antepenult when the penult is light.

   (11) Bühler Rule 1

   a. Penult: *ka.ra.ˈne.na* 'doing:INST.SG' (= [L L ˈH *V*])

   b. Antepenult: *ˈka.ra.nāt* 'doing:ABL.SG' (= [ˈL L *V̄C*])

   c. Preantepenult: *ˈdu.hi.ta.ram* 'daughter:ACC.SG' (= [ˈL L L *VC*])

2. Nominal derivatives mostly maintain the accent of the base word ("des ursprünglichen Wortes") while observing the restrictions above. Clusters with *y* /j/ and *v* /ʊ/ usually do not make a closed (and thus heavy) syllable.

   (12) Bühler Rule 2

   a. *ˈgar.ga-* 'name of a sage' ⇒ *ˈgār.gyaḥ* 'patronymic from *garga-*:NOM.SG' ⇒ *gār.ˈgyā.ya.nī* 'patronymic from *gārgya-*:F'

   b. *C* + *y* or *v* fails to make position: *ˈprā.ba.lyam* 'superiority:ACC.SG' (= [ˈH L *VC*])[21]

3. In verbs and verbal derivatives that are attached to prepositions, as well as in augmented (i.e., with prefix *a-*) and reduplicated forms, and throughout inflection, the accent moves back (i.e., towards the left edge) if the root or stem syllable is light. Polysyllabic prepositions preserve their accent as a secondary accent.

   (13) Bühler Rule 3

   a. Stress on a heavy root syllable: *ja.ˈgau* 'go:PERF.3SG' (= [L ˈ *V̄*])

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21 This particular subrule appears to be contradicted by the syllabification of the cluster *ṇy* adotpted for assigning stress in forms like Ved. *híraṇyavatī-*, *hiraṇyamáya-*, or *áraṇyam* (cf. Table 2), in which the coda nasal *ṇ* preceding the glide *y* seems to render the syllable heavy. Since Bühler cites no data containing a cluster *ṇy*, and none of the other sources of evidence on the Classical Sanskrit stress rule considered here provide any data containing clusters *ly* or *tv*, specifically, whether Bühler's subrule is correct, incorrect, or requires modification, cannot be determined at this time.

b. Stress left of a light root syllable: *a.ˈnuṣ.ṭhi.tam* 'performed:ACC.SG' (= [L ˈH L *VC*])

c. Secondary stress on a preposition: *ˌu.pa.ˈga.ma.tam* 'approach:AOR.IMP .2DU' (= [ˌL L ˈL L *VC*])

4. In compounds, each member keeps its own accent, apart from when the first member is a monosyllable, with the accent of the head ("Hauptttheil") being the stronger.[22]

(14) Bühler Rule 4

a. First member is polysyllabic: *ˌrā.ja.ˈpu.ru.ṣam* 'royal minister:ACC.SG'

b. First member is monosyllabic: *ˈud.mu.kham* 'raising one's face:ACC.SG'

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22 Whether one should understand from Bühler's statement and examples that primary stress falls on the rightmost member of any compound—endocentric or exocentric—is unclear. If it applies only to endocentric compounds, one might presume that the general rules for non-compound stress apply to exocentric compounds.

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