

On the empirical basis and formal derivation of penultimate stress systems

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What are penultimate stress systems?

system of prosodic organization in which the rightmost non-final X is assigned greater prominence

- X may = syllable, heavy syllable, non-schwa vowel...
- Prominence = greater intensity and/or duration, and/or tone peak or trough

Mongolian: stress the rightmost non-final heavy syllable, else a final heavy syllable, else the initial (Poppe 1970:47)

LH´H morió:ro: ‘by means of his own horse’

LH´ galú: ‘goose’

L´L áxa ‘elder brother’

Why are penultimate systems interesting?

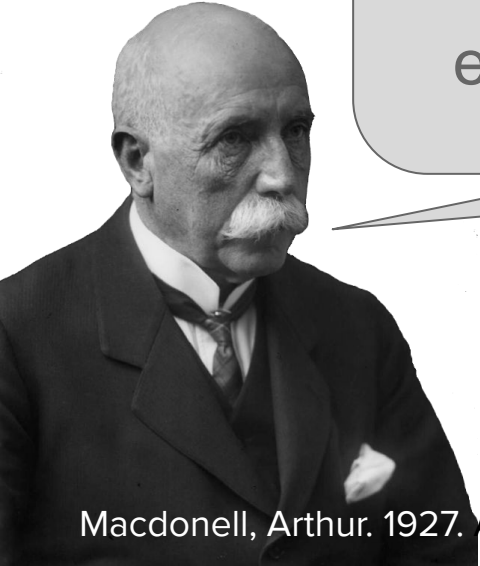
Systems of this type have received a fair amount of attention in the phonological literature (e.g. Walker 1995, Gordon 2000, Kager 2012) bc of questions such as:

- How to get penultimacy: syllable or foot extrametricality? Clash deletion (as in Armenian dialects)? Nonfinality requirement for stress? Or is there not a unified explanation?
- How to get rightmostness without gradient evaluation triggering midpoint pathology? (McCarthy 2003 vs Jacobs 2003)
- What are the leftward limits on rightmostness? (stress windows, ternarity...)
- How is the picture affected by our new phonetically and perceptually informed skepticism of the traditional armchair descriptions of individual stress systems from which existing typological stress databases are constructed?

Today we will address these sorts of questions via the Classical Sanskrit system:...

Classical (not Vedic!) Sanskrit stress

Stress is laid on a long penultimate (Kālidāsa), on the antepenultimate when followed by a short syllable (Himālaya), and on the fourth from the end when two short syllables follow (kārayati).



Why is this interesting?...

Why is the Classical Sanskrit system interesting?

We expect a Sanskrit-type system to be possible given the elements of Halleian stress theory: extrametricality, ternary footing, rule-based algorithms--so its absence would perhaps be surprising (modulo learnability considerations; Stanton 2016, Samuels et al 2017).

On the other hand, foot-inventory-based frameworks (Hayes 1995, Prince and Smolensky 1993, McCarthy 2003, etc.) cannot generate this sort of system.

Why is this? One reason:...

Kager 2012

In a metrical window language, the syllable with the highest degree of prominence is restricted to lodge in a small area, comprising two or maximally three syllables adjacent to the edge of a domain, typically the word. (1454)

The status of four-syllable stress windows in word-final position is too weak to constitute counterevidence to the three syllable maximum. All attested cases of pre-antepenultimate stress can be analyzed without setting up a metrical domain of four syllables. (1466)



**The Sanskrit system with its apparent four-syllable stress window is
∴ of great theoretical and empirical interest.**

Today's plan

Basics of Sanskrit stress

Formal analysis

- Keydana 2016 on Classical Sanskrit
- my bracketed grid analysis of the Sanskrit system
- FIB treatments of penultimate systems that allow preantepenultimate stress

Empirical basis

- can/should systems that can assign preantepenultimate stress be adduced as problems or advantages for particular stress theories?...
- closer look at the empirical basis of the Classical Sanskrit system

Basics of Sanskrit stress

Definitions for Classical Sanskrit

The stress system crucially depends on a binary syllable weight distinction:

σ type	= σ ending in:	types	examples
light (L)	short vowel	a i u ṛ	á.su.ra 'spiritual' (LLL) kṛ.ti 'doing' (LL)
heavy (H)	long vowel	ā ī ū ṛ	du.hi.tṛ.ṇām 'sister.gen.pl' (LLHH) ṛk.ṣa.rú.pī 'in the form of a bear' (HLHH)
	diphthong (short)	<e> /ai/, <o> /au/	de.vo.pá.sa.ka 'worshipper of the gods' (HHLL) báu.dha 'relating to Mercury' (HL)
	diphthong (long)	<ai> /āi/, <au> /āu/	dái.va 'celestial' (HL)
	consonant		áp.sa.ras 'nymph' (HLH), vápra 'rampart' (HL)

- <ph th ṭh kh ch bh dh ḍh gh jh> represent single aspirated phonemes
- no Onset Maximization, so all /VCCV/ → [VC.CV]

The data, part 1

Working generalization: stress heavy penult, else heavy antepenult, else preantepenult (antepenult in trisyllables, penult in disyllables).

L	á	as in “a a” (Pāṇini 8.4.68)	LLL	ásura	demon
H	strī́	woman	LLH	Hánumān	pn R
LL	gája	elephant	LHL	Avánti	pn MBh
LH	ámbā	pn MBh	LHH	Ahályā	pn MBh
HL	śúci	clean.n.sg.neut	HLL	Árjuna	pn MBh
HH	ágne	fire.voc.sg	HLH	Ámbikā	pn MBh
			HHL	gandhárva	celestial being
			HHH	Atréyī	pn MBh

The data, part 2

Working generalization: stress heavy penult, else heavy antepenult, else preantepenult (antepenult in trisyllables, penult in disyllables).

LLLL	Údayana		HLLL	Píṅgalaka	MBh2
LLLH	Mádanikā		HLLH	Dvāravatī	MBh2
LLHL	Anirúddha	MBh2	HLHL	Ambarīṣa	MBh2
LLHH	Abhisārī	MBh2	HLHH	Nācikétas	MBh2
LHLL	Adhókṣaja	MBh2	HHLL	Airāvata	MBh2
LHLH	Arúndhatī	MBh2	HHLH	Carmāṇvatī	MBh2
LHHL	Sadasyórmī	MBh2	HHHL	Dāmoṣṇīṣa	MBh2
LHHH	Sadānīrā	MBh2	HHHH	[none found]	

My analysis

Analysis in the Halle-Idsardi framework

effect	mechanism	technical implementation
final syllable unstressed	extrametricality	RLR edge marking, Avoid (x#)
heavy syllables prioritized	bracket projection	H → (H
right-edge stress window	right-headed Line 1	Line 1: Edge RRR, Heads R
trisyllabic stress window	ternary footing	ICC:R→L; Avoid (xx)

Analysis a la Idsardi Latin (1992:54)

Line 0: Avoid (x#, (xx)

Project: L

Edge: RLR

ICC:R→L

Heads: L

Line 1:

Edge: RRR

Heads: R

Project	x x x L L L ásura	x x x L L H Hánumān	x(x x L H L Avánti	(x x x H L L Ārjuna	(x (x x H H L gandhárva	x x x L(H H Ahályā	(x x x H L H Āmbikā	(x (x x H H H Atréyī
Edge	x x)x L L L	x x)x L L H	x(x) x L H L	(x x)x H L L	(x (x) x H H L	x(x)x L H H	(x x)x H L H	(x (x)x H H H
ICC	--	--	--	--	--	--	--	--
Heads Line 1	x x) x x)x L L L	x x) x x)x L L H	x x) x(x) x L H L	x x) (x x)x H L L	x x) (x (x) x H H L	x x x(x)x L H H	x x) (x x)x H L H	x x x) (x (x)x H H H

Analysis a la Idsardi Latin (1992:54)

Line 0: Avoid (x#, (xx)

Project: L

Edge: RLR

ICC: R→L

Heads: L

Line 1:

Edge: RRR

Heads: R

Project	x x x x L L L L Údayana	(x x x x H L L L Píṅgalaka	x x x x L L L H Mádanikā	x x x x x L L L L L arápacana	(x x x x x H L L L L aṁsáphalaka	(x(x x x x H H L L L udvéjayati
Edge	x x x)x L L L L	(x x x)x H L L L	x x x)x L L L H	x x x x)x L L L L L	(x x x x)x H L L L L	(x(x x x)x H H L L L
ICC	(x x x)x L L L L	--	(x x x)x L L L H	x(x x x)x L L L L L	(x (x x x)x H L L L L	--
Heads Line 1	x x) (x x x)x L L L L	x x) (x x x)x H L L L	x x) (x x x)x L L L H	x x x(x x x)x L L L L L	x x x (x (x x x)x H L L L L	x x x (x(x x x)x H H L L L

OT analysis?

Keydana 2016 on Classical Sanskrit stress

constraints:

- FOOTBIN: Feet are binary, either $[\sigma\sigma]$ or $[\mu\mu]$.
- WSP: Weight-to-Stress-Principle: Heavy syllables bear stress.
- TROCHEE: Feet are trochaic (left-headed).
- ALIGN-L(FT,PRWD): The left edge of a foot coincides with the left edge of the prosodic word.

ranking:

- FootBin, WSP, Trochee >> Align-L(Ft,PrWd).

Sample derivations:...



derivations



/~~~~/	Mádanikā, Údayana	FootBin	WSP	Trochee	AlignL(Ft,PrWd)
☞ [□~]~			*		
[~□]~			*	*	
~[□~]			*		*
[□~~]		*	*		

~ ≡ H
 ~ ≡ L
 ~ ≡ X (H or L)

/~_~/	Sarásvatī, Vasántaka	FootBin	WSP	Trochee	AlignL(Ft,PrWd)
☞ ~[_~]					*
[□_~]			*		
~[_□]			*		*



/~_~/	Śakaṭāra, Abhisārī	FootBin	WSP	Trochee	AlignL(Ft,PrWd)
☞ ~[_~]					*
[□~]_~			*		

But does this ranking actually work for the entire Sanskrit system?...

 = winner IRL
 = predicted winner

No--Problem #1: $(H_n)L_nX, n>3$



Keydana's system produces initial rather than preantepenultimate stress in words consisting of only light syllables (and indeed $H_n, H_nL_n, H_nL_nH_n$, etc.). For example:

/~~~~/	FootBin	WSP	Trochee	AlignL(Ft,PrWd)
 ~[~]~				*
 [~]~				
~[~]~				*

This is empirically incorrect for words of more than four syllables:

atítipathi 'host' (<https://en.wiktionary.org/wiki/अतिथिपति>)

arápacana 'a mystical collective name of the 5 Buddhas' (Canepari 2020)

 = winner IRL
 = predicted winner

Problem #2: ...LH

Does not produce the required extrametricality of the final syllable:



~ _	FootBin	WSP	Trochee	AlignL(Ft,PrWd)
 [□ ~] _		*!		
 ~ [_]				*

This is empirically incorrect for words such as:

́LLH: Álakā ‘a celestial pond’ (Mahābhārāta book 2), Hānumān ‘divine monkey companion of Rāma’ (Ratnāvalī 486)

́LLH: Mádānikā ‘a palace maid, lit. ‘intoxicating’ (Ratnāvalī 93)

We need an extrametricality constraint ranked somewhere above WSP.

 = winner IRL
 = predicted winner

Problem #3: no window

Picks the leftmost heavy syllable anywhere in the word, rather than within four syllable window at the right edge. An example:

LHLLLL	FootBin	WSP	Trochee	AlignL(Ft,PrWd)
 LH(L'L)LL		*!		*
 L(H')LLLL				*

Summary of (some of the) problems with Keydana's analysis

1. Incorrectly generates initial stress in L_n , H_n , $H_n L_n$, $H_n L_n H_n$, etc.
2. Does not produce the required extrametricality of the final syllable
3. Does not generate stress window effect.

There are several more problems with Keydana's analysis, but the above should suffice for present purposes.

Can analyses of preantepenultimate stress in other languages account for the Sanskrit facts?

**Can analyses of
preantepenultimate stress
in other languages account
for the Sanskrit facts?**

Analyses we will consider

Binary preantepenultimacy in RBP: Hayes 1995 on Palestinian Arabic

Binary preantepenultimacy in OT: Jacobs 2003 on Plautine Latin

Ternarity in OT: Kager 2012 on all languages

All of these are in the Foot-Inventory Based (FIB) framework

- Only footing options: moraic trochee (H, LL; +HL for Jacobs) or unparsed

(Not considered here for time reasons: Hayes 1995 on Palestinian Arabic, Prince and Smolensky 1993, Walker 1997, McCarthy 2003, Apoussidou and Boersma 2003, Sen 2012)

**binary preantepenultimacy in RBP:
Hayes 1995**

Hayes 1995:125-6 on Palestinian Arabic

Stress final superheavy syllable (a), else heavy penult (b), else heavy antepenult (c), else preantepenult if light in 4-syllable word (d), else antepenult (e) (penult in disyllables (f)).

(a) darást I studied

(b) máktab office

(c) ʕállamat 'she taught'

(d) ɖárabato 'she hit him'

(e) ʕallámato 'she taught him', šaʕjarátuhu 'his tree'

(f) kátab 'he wrote'

analysis:...

Analysis (Hayes 1995:127-30)

form moraic trochees L→R, degenerate feet forbidden

right-peripheral foot extrametrical: Foot → <Foot> / _]_{word}

Word Layer Construction: End Rule Right

Sample derivation for LLLL form:

(x)

(x .) < (x .) >

˘ ˘ ˘ ˘

ḍ á r a b a t o 'she hit him' (→ [ḍárbato])

*And for
LLLLL and
HLLL:...*

LLLLL and HLLL stress antepenult

(x)

(x .) (x .)

˘ ˘ ˘ ˘ ˘

š a ĵ a r á t u h u 'his tree'

(x)

(x) (x .)

- ˘ ˘ ˘

ŕ a l l á m a t o 'she taught him'

Problems:...

Problems with Hayes's analysis

All forms of $2(n+1)$ light syllables or a heavy followed by $2(n+1)$ light syllables are predicted to stress the preantepenultimate, but according to generalization (e) they stress the antepenultimate (cf. Jacobs 2003:406 on XLLL):

(x)

(x)

(x .) (x .) < (x .) >

(x) (x .) < (x .) >

L L \acute{L} L L L

H \acute{L} L L L

predicted

L L L \acute{L} L L

H L \acute{L} L L

actual

Can Hayes's model be adapted Sanskrit?

Let us ignore for now the problems just identified in modeling the Palestinian Arabic system, and see if Hayes's model can generate the Sanskrit system.

We already know that his PA scheme won't work in Sanskrit for HLLL, LLLLL, and forms with superheavy final, because the stress patterns for these are different in Skt than in PA.

Let us try the equivalent of our Halle-Idsardi-style analysis in Hayes's framework:...

Can Hayes's model be adapted Sanskrit?

right-peripheral syllable extrametrical: $\sigma \rightarrow \langle \sigma \rangle / _]_{\text{word}}$

Form moraic trochees R→L, degenerate feet forbidden

Hayes's way of getting ternarity is Weak Local Parsing (1995:308): **when a foot has been constructed**, align the window for further parsing by skipping over \sim where possible.

Word Layer Construction: End Rule Right

Desired LLLL form:

(x)		
(x	.	x	<x>
˘	˘	˘	˘
Ú	da	ya	na

Problem:

No foot has been constructed at the point where one needs to skip over the light syllable.

Summary of the problem

Hayes can get syllable extrametricality, leftward construction of moraic trochees, and ternarity...

...but his mechanism for producing ternarity, weak local parsing, doesn't work well in the Sanskrit case because the parse needs to begin with an extrametrical syllable followed by a skipped syllable.

We can patch this by extending the WLP parameter to target extrametrical elements as well as feet...

...but $\acute{L}LL$ forms will be a problem in this scheme, because the first L can't be a degenerate foot (i.e. $(\acute{L})L<L>$). And if we allow $(\acute{L}L)<L>$ here, then $\acute{H}LLL$ becomes a problem--we'd expect $*(H)(\acute{L}L)<L>$.

So let's try an OT implementation of FIB:...

**binary preantepenultimacy in OT:
Jacobs 2003**

Jacobs 2003 on Plautine Latin

Empirical generalization:

- Heavy penult, else heavy antepenult, else light preantepenult, else antepenult (or penult in disyllables).

Constraints:

- NonFin: a foot may not be final
- W/L: align L edge of word with a foot
- H/R: align R edge of word with the head-foot
- ParseSyll: syllables are parsed by feet

Derivations:...

Plautine derivations

LLLH bálineum	NonFin	W/L	H/R	ParseSyll
L(<u>LL</u>)H		$\sigma!$	σ	**
👉(<u>LL</u>)LH			$\sigma\sigma$	**
LLLLH malefícium				
👉(LL)(<u>LL</u>)H			σ	*
L(<u>LL</u>)LH		$\sigma!$		***
(<u>LL</u>)(LL)H			$\sigma\sigma!\sigma$	*
HLLL [no examples given]				
👉(H)(<u>LL</u>)L			σ	*
(<u>H</u>)LLL			$\sigma\sigma!\sigma$	***

Retrofit Jacobs 2003 to Sanskrit?

Sanskrit has $\acute{H}LLX$, not $H\acute{L}LX$ as in Latin. Can Jacobs' model be tweaked to get this effect?

“For Early Classical Latin, there is no direct way in which foot extrametricality and a moraic trochee can reach the preantepenultimate syllable in quadrisyllable words with a final heavy syllable, given that the final heavy syllable will form a foot on its own (viz. $L(LL)\langle(H)\rangle$.” (Jacobs 2003:408)

His model is therefore ill-suited to the Sanskrit system and its Píṅgalaka, etc.

A further problem is that not all preantepenultimate stress cases are $LLLX$ in Plautin Latin, e.g. $\acute{o}r\acute{a}t\acute{i}o\acute{n}em$ (Plautus, Captivi 2.1 lines 21-22).

So let's try an OT implementation of FIB with ternarity...

windows + ternarity:
Kager 2012

Kager 2012 on Weak Layering + Extrametricality

“In many languages, stress is required to fall within a certain fixed distance from a word edge. Kager (2012) refers to these kinds of systems as metrical window systems and identifies four types: right-edge with a window of two syllables, right-edge with a window of three syllables, left-edge with a window of two syllables, and left-edge with a window of three syllables.”

(part of) his proposal: typology of stress window systems best accounted for with Weak Layering:...

Kager 2012 on ternarity

“Ultimately, an explanation of three syllable windows that hard-wires ternarity into metrical representations may seem to be defective, as ternarity is not derived from independent principles; yet, weakly layered feet are well supported by independent evidence, such as the analysis of ternary rhythm (Dresher and Lahiri, 1991; Rice, 1992; Kager, 1994), as well as for phenomena that are not stress-based, in particular the 'loose minimal word' template of prosodic morphology (Itô and Mester, 1992; Hewitt, 1992; McCarthy and Prince, 1993).” (1488)

Ternarity in OT: Weak Layering (Kager 2012)

shapes of the Weakly Layered foot (Kager 2012:1482, Kager, René and Martínez-Paricio 2018)

	head + adjunct	adjunct + head
binary head, trochee	$ \begin{array}{c} Ft' \\ / \quad \backslash \\ Ft \quad \sigma \\ / \quad \backslash \\ [\quad] \quad \sigma \\ \quad \\ \sigma \quad \sigma \end{array} $	$ \begin{array}{c} Ft' \\ / \quad \backslash \\ \sigma \quad Ft \\ \quad / \quad \backslash \\ \quad [\quad] \\ \quad \quad \\ \quad \sigma \quad \sigma \end{array} $
binary head, iamb	$ \begin{array}{c} Ft' \\ / \quad \backslash \\ Ft \quad \sigma \\ \quad / \quad \backslash \\ \quad [\quad] \quad \sigma \\ \quad \quad \\ \quad \sigma \quad \sigma \end{array} $	$ \begin{array}{c} Ft' \\ / \quad \backslash \\ \sigma \quad Ft \\ \quad \quad / \quad \backslash \\ \quad \quad [\quad] \quad \sigma \\ \quad \quad \quad \\ \quad \quad \sigma \quad \sigma \end{array} $
unary head	$ \begin{array}{c} Ft' \\ / \quad \backslash \\ Ft \quad \sigma \\ / \quad \backslash \\ [\quad] \quad \sigma \\ \quad \\ \sigma \quad \sigma \end{array} $	$ \begin{array}{c} Ft' \\ / \quad \backslash \\ \sigma \quad Ft \\ / \quad \backslash \\ [\quad] \quad \sigma \\ \quad \\ \sigma \quad \sigma \end{array} $

Ternarity in OT: Weak Layering (Kager 2012)

constraints for weakly-layered model (fig (67) p. 1482):

1. HD-BIN Heads are binary under syllabic or moraic analysis.
2. ALIGN-HD-L Heads are left-aligned with feet.
3. ALIGN-HD-R Heads are right-aligned with feet.
4. HD=TROCHEE Heads begin with strong syllable.
5. HD=IAMB Heads begin with weak syllable.
6. PARSE-SYL Syllables are parsed by feet.
7. ALIGN-WORD-L Words are left-aligned with a foot.
8. ALIGN-WORD-R Words are right-aligned with a foot.
9. NON-FINALITY Stress must not fall on the final syllable.
10. FAITH-ACCENT A lexical accent should be realized as primary stress.

Ranking for final 3-syllable window:...

Final 3-syllable window (1484)



Final three syllable window, default on the antepenult:

- ALIGN-WORD-R » FAITH-ACCENT » PARSE-SYL, HD=TROCHEE, ALIGN-HD-L



For a reduced three syllable window (i.e. window = antepenult+penult):

- NON-FINALITY » FAITH-ACCENT

Derivations:...

 = winner IRL
 = (a) predicted winner

Derivation of Skt a la Kager

/LLLL/	AlignWdR	NonFin	FaithAccent	ParseSyll	Trochee	AlignHdL
 (́LL)(LL)						
 (LL)(́LL)						
(́LL)LL	*			**		
L(́LL)L	*			**		
([́LL]L)L	*			*		
(L[́LL])L	*			*		*
L([́LL]L)				*		

Problems:...



Derivation of Skt a la Kager

/LLLL/	AlignWdR	NonFin	FaithAccent	ParseSyll	Trochee	AlignHdL
👉(´LL)(LL)						
💀(LL)(´LL)						
([´LL]L)L	*			*		
(L[´LL])L	*			*		*
L([´LL]L)				*		

Problem 1: (´LL)(LL) and (LL)(´LL) tie

Problem 2: doesn't produce the three-syllable window Kager claimed.

Maybe DepFt can address both problems?...

 = winner IRL
 = predicted winner

Tweaks to Kager

/LLLL/	DepFt	AlignWdR	NonFin	ParseSyll	AlignHdL
(<u>́</u> L)(LL)	**				
(LL)(<u>́</u> LL)	**				
 ([<u>́</u> LL]L)L	*	*		*	
(L[<u>́</u> LL])L	*			*	*
 L([<u>́</u> LL]L)	*			*	

- DepFt inserted to favor single weakly layered foot over two binary feet
- AlignWdR favors one of the two remaining candidates, but the wrong one: L([́LL]L).
- We actually need sort of the opposite of AlignWdR, namely Jacobs' version of NonFin, which requires the right edge of the PrWd to not align with a foot (henceforth NonFinFt to avoid confusion).

But can we use Jacobs' version of NonFin?...

Kager 2012 on Weak Layering + Extrametricality

“Crucially, a weakly layered foot model of stress windows should not be combined with extrametricality (of the final syllable unparsability type) as this would incorrectly predict four syllable window systems. (See Everett, 1988:233 for a similar argument based on Pirahã.)” (1481)



Summary of problems with Kager 2012

Kager's model is, by design, unable to generate a stress system of the Classical Sanskrit type, because he is unwilling to take the required step of combining ternarity and extrametricality.

(There are further empirical and conceptual problems with Kager's model (q.v. e.g. Stanton 2016, Samuels et al. 2017), but we won't have time to consider these here.)

To that the extent that this system actually exists, then, the validity of Kager's typology and constraint system come into question.

Summary so far

The Halle-Idsardi model can generate the Classical Sanskrit system, using a combination of extrametricality and ternary footing, each of which is independently required for a genetically diverse range of languages.

The currently dominant foot-inventory-based (FIB) models are not able to generate the Classical Sanskrit system.

This is largely by design: the typological focus of these models leads them to prioritize excluding the existence and generatability of quaternary systems and midpoint pathologies.

Do we actually require this power to capture Sanskrit, in which case we may be inclined to favor the Halle-Idsardi model? The FIB model leads us to question the validity of the Sanskrit “data”, and this may not be unreasonable...

Plan for the rest of today

What exactly is the evidence for the Classical Sanskrit stress system?

What exactly was the Classical system?

Most secondary sources say something like “heavy penult, else heavy antepenult, else preantepenult”...

- ≙Bühler 1883/Perry 1885; Jacobi 1893:574-5, Wackernagel 1896:296, Macdonell 1900, Ryder 1905:xxv, Thumb 1905:43-44, Stenzler 1915:5, Turner 1916:215, Gonda 1941, ≙Mayrhofer 1953, Krahe 1958, Allen 1973, Johansson 1973, Morgenroth 1976:41, Coulson 1981, Sargeant and Chapple 1984:7, Maurer 1995, Szemerényi 1999, Mylius 2003:385, Eck 2007:102, Ligorio 2017, Canepari 2020:48
- Preantepenult only if it's a “root syllable”: Geiger 1923 sec. 16, Lahne 2006, Della Casa 2013, Liesner 2019

...but there is a surprising number of variants, e.g.:

- Rightmost non-final long syllable, else leftmost syllable but no further than preantepenult (Ohala 1983:93)
- Leftmost non-final heavy syllable, else initial (Allen 1983)
- Rightmost non-final heavy syllable up to preantepenult (if root), else antepenult (Park 1968:106)
- Rightmost non-final heavy syllable, else initial (Trungpa 2013)
- Heavy penult else antepenult (Ingalls 2000:327, Goldman and Goldman 1999:9, Ollett 2021:33)
- First long syllable up to fourth from end starting from penult (Masica 1991; no mention of all-L words)
- All heavy syllables stressed (Ruppel 2017); all long vowels stressed, else initial (Klostermaier 2007)

...and others believe we cannot determine what the original Classical Sanskrit stress system was.

- Whitney 1869:20, Gauthiot Fin de mot 213, Bloch 51, Renou 1930:25, Stenzler 1965

What is the evidence for the Classical system?

Classical stress location often \neq Vedic accent location...

Vedic	Classical (putative)	gloss
yūthá	yúthā	herds
kṛṣṭīḥ	kṛṣṭīḥ	communities
iyarti	iyárti	arouses
Íśānaḥ	Īśānaḥ	master
ápratiṣkutaḥ	apratíṣkutaḥ (or a-prati-ṣkútaḥ?)	not repulsed

Some indologists believe that one branch of Middle Indic (> Marathi etc.) preserved the position of the Vedic accent, while another (> Hindi etc.) replaced it with something like the Classical Sanskrit stress system.

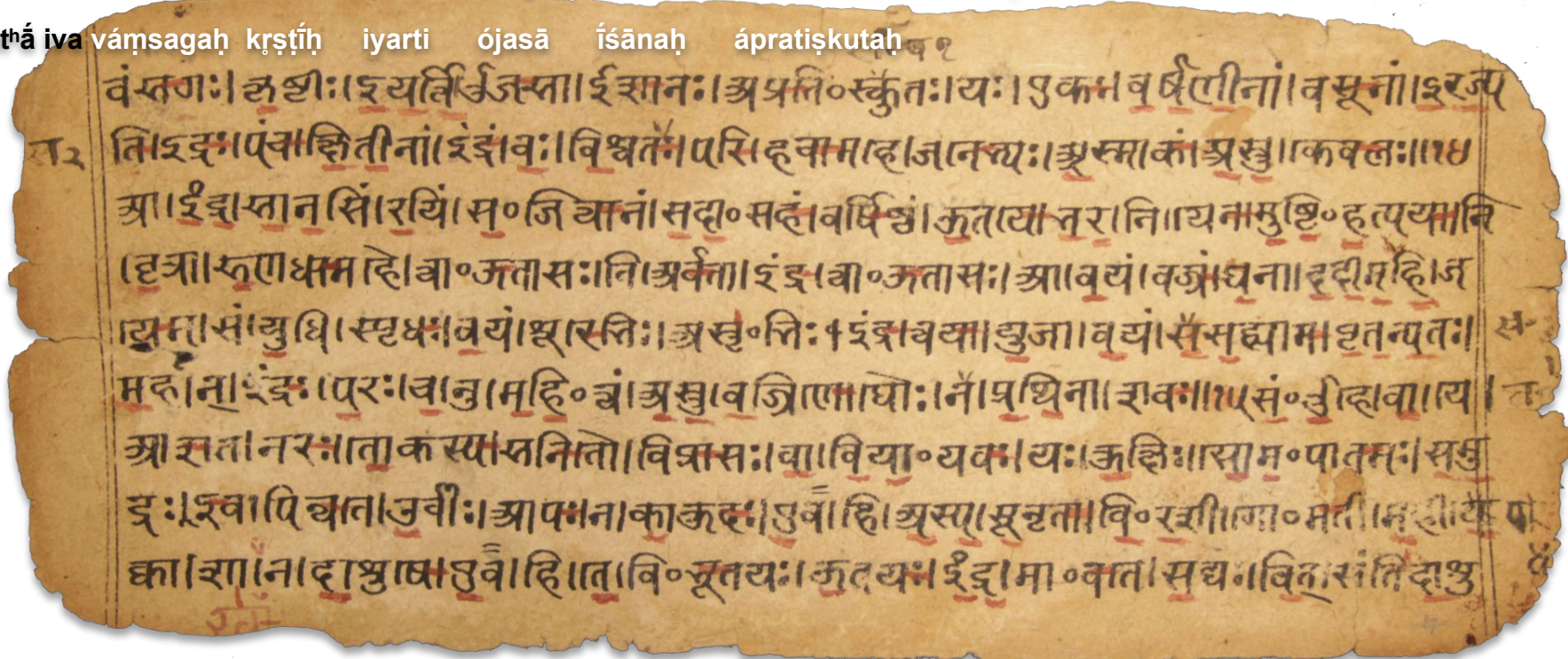
What is the evidence for the Classical system?

Classical stress location often \neq Vedic accent location...

...therefore we can't rely on the orthographic indicators of (non-) accent in Vedic manuscripts:...

Vedic manuscripts are often accented

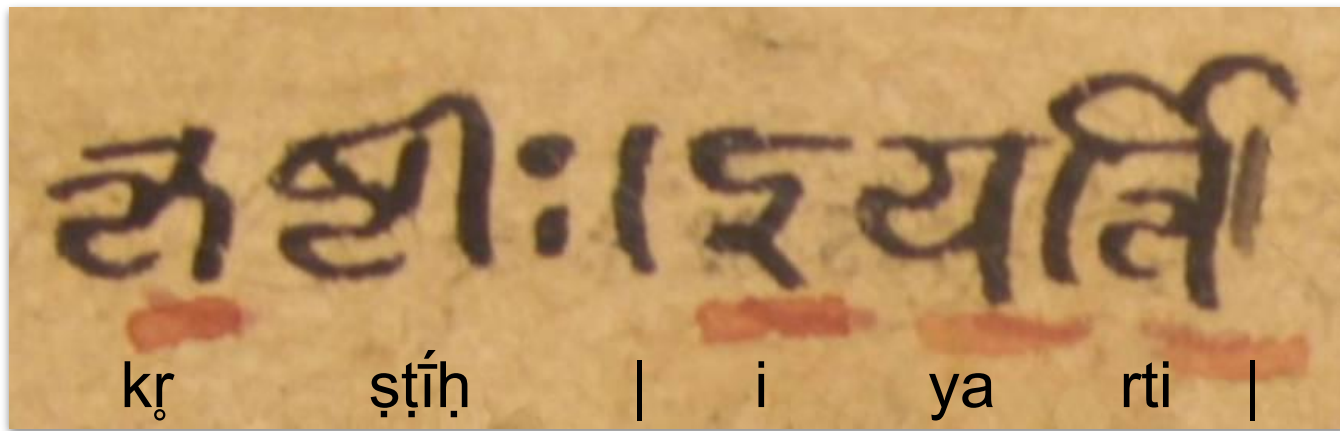
vṛṣā yūthā iva vāmsagaḥ kṛṣṭīḥ iyarti ójasā íśānaḥ ápratiṣkutaḥ



[Like a bull his herds,] the buffalo rouses the communities with his might,
since he is the master who cannot be repulsed.

(RV 1.7.8, trans. Brereton and Jamison 2014.1:98; British Library Or 4481, c. 1495-1735CE)

Vedic manuscripts are often accented



krṣīḥ

communities

iyarti

arouses

anudāṭṭa [‘not raised’] is marked with a horizontal line below the syllable...

- if it directly precedes an accented syllable, or...
- if it is the first syllable in a pada if it is anudāṭṭa. In this case all following anudāṭṭa syllables are also underlined, up to but not including the next accented syllable.

Classical manuscripts are unaccented

विरा०
२६

यिह ते सैरंधी विवरिष्ठाति सुरवमेव चरिष्ठाति सैरंध्याः पतयाः सदा ततो जग्राह केशेषु माल्यवत्सु महाबलः सकेशेषु परामृषो बलेः
नवलिनारः आक्षिप्य केशान् वेगेन व
नरसिंहयोः वसन्ते वासिताहेतोर्बलवज्र
मस्य च बालिसुश्रीवयोर्भ्रौः पुरवकः
येषां ततः मसुद्यम्य जुजौ पंचश्रीषा
ध्रुवि षोडशतौ वेगेनाभिहतौ नीमः कीच
रितः पदं ताव न्योन्यं समाक्षिप्य प्रकषे
भ्राविव तयोरासीत्सुबुभुलः सप्रहार
दृष्टयोः अत्रिपत्याश्च बाहुः न्यापयत्यु
रतासुरव सचायेन तदा नीमः प्रतिज
नवलिनारः तयोर्भुजविनिष्पेषाड्य



सैरंधी

कीचक

भीमसेन

<sai.ram.dhrī>

<kī.ca.ka>

<bhī.ma.se.na>

Sairāndhrī

Kīcaka

Bhīmasēna

द्वोजग्राह पांडव बाहु युद्ध तयोरासीत्सु दृष्टयो
जयो रिव कीचकानां तु सुरचास्य नराणां मुत्र
पिमिंहयोः अन्यान्यमत्रिसंरञ्जो धरस्परज
विवोरगो नरवदंष्ट्रा निरन्यान्यघ्नतः क्रो
केन वलीयसा स्थिरं प्रतिज्ञश्चुराणोपदात्मव
तोपरस्परं उत्रावपि प्रकाशेते प्रवृद्धौ तृष
सुदारुणः नरवदंतायुधवतो व्याघ्रयो रिव
हृदमर्षितः मातंगडवमातंगं प्रतिप्रक
ग्राहवीर्यवान् तमाक्षिपत् कीचको शबले
योर्बलिनो सदा शत्रुः समप्रवहोरोवेणुस्फो

राम
२६

What evidence do we have for the system?

✗	orthographic markings
✗	pronunciations by native speakers (?...)
✗	judgements by native speakers (?...)
✗/✓	contemporary descriptions (except for Phit sutras)
✓	pronunciation of Classical Sanskrit by modern brahmans and pandits
✓	Vowel reduction patterns in Middle and New Indo-Aryan and in Skt inscriptions
✓	ictus/tactus locations in Classical meters
✓	Musical performance (Felber 1912)

Contemporary descriptions

“A heavy syllable of a polysyllabic word (is accented) when followed by one or two light syllables’ (Phiṭṣutra of Śāntanava ii.19 apud Allen 1983, from Jacobi 1899:567ff)

Pronunciation by modern brahmins and pandits

“In Sanskrit as it is still spoken today by hundreds of pandits, who owe their knowledge to direct, never-interrupted tradition, [...] there is no trace of the [vedic-style] accent [...] This is all the more striking as the modern Indian languages are completely filled with genuine old Sanskrit words, and these have been in the mouths of the people for several millennia. If it is now asserted that Sanskrit no longer shows an accent when spoken, but sounds very monotonous, this is not entirely correct. Certain syllables are even now stressed more than others when speaking: it is preferably the long syllables to which the stress turns; [...] often on the third from last syllable in multi-syllable words.” (Haug 1872:99)

“In the pronunciation of Sanskrit almost all Brahmins employ, with insignificant variation, an ictus accent” (Bühler 1883/Perry 1885)

Jacobi 1893:574 “The ictus accent was not written anywhere; we first learn it in the modern pronunciation of Sanskrit.”

“According to the customary Sanskrit pronunciation in India today, the same [syllable] is stressed by roughly the same accentuation law that holds for Latin” (Thumb 1905:§55)

Vowel reduction patterns (Jacobi 1893, Grierson 1895, Turner 1916)

Post-tonic vowel deletion in Middle Indic

- Ardhamagadhi subbhi < *surbhi < súrabhi ‘fragrant’
- Ardhamagadhi deula < dévakula ‘temple’ (NB HLLL)

Pre-tonic vowel deletion in Middle Indic

- Prakrit nomāliā < *naumāliā < nàvamālikā ‘fresh jasmine’
- NB Prakrit osarai < àpa-sárati ‘goes down’, not apásarati...

ictus/stress alignment in meter

Bhaja govindam ('praise Govinda [Vishnu/Krishna, lit. 'cowherd']') by Śankara, 8th C AD

Padakulakam meter (4 x 16 moras, ictus on first mora of each pada)

nālinī-dāla-gata-jālam ati-tāralam / tadvat jīvitam ātisaya-cāpalam

The life of a person is as uncertain as rain drops trembling on a lotus leaf.

vīddhi vyādhi abhimāna-grāstaṃ / lōkaṃ śōka-hataṃ ca samāstaṃ

Know that the whole world remains a prey to disease, ego and grief.

	1´	2	3	4	5´	6	7	8	9´	10	11	12	13´	14	15	16
1	ná	li	nī		dá	la	ga	ta	já	la	ma	ti	tá	ra	la	ṃ
2	tá	d	va	j	jī		vi	ta	má	ti	śa	ya	cá	pa	la	ṃ
3	ví	d	dhi	v	yádh		ya	bhi	má		na	g	rá	s	ta	ṃ
4	ló		ka	ṃ	śó		ka	ha	ta	ṃ	ca	sa	má	s	ta	ṃ

Behavior of XLLX words in the Bhaja Govindam

1 mūḍhamate, sánnihite;

4 sphúṭatara, átiśaya, dála-gata

6 nívasati, gátavati;

13 tríjagati

...forms such as these may be taken as indirect evidence that the Classical Sanskrit stress system (or at least the version spoken by Śankara) assigned initial stress to XLLX words.

Kazama 1975 on ictus and stress in Epic Skt

“Can we expect correspondence between the word accent and ictus in ancient Indian epic verse? From the two famous epic works we choose about a thousand śloka verses and try to find the agreement in the last regular iambic foot of each verse [...] it turns out that there are three times as many matching verses as there are mismatching.”

Summary of this section

There is no direct evidence for the nature of the Classical Sanskrit stress system...

...but there are various types of indirect evidence:

- Vowel reduction in MIA and NIA descendants
- 19th century pronunciation in India (but could be transfer of NIA patterns)
- text setting patterns

...but none of these is entirely persuasive (cf. current skepticism of Plautine stress).

Summary and conclusions 1

There has only been one attempt to analyse the Classical Sanskrit system formally, and it doesn't work.

Existing analyses of other systems with right edge stress window that can extend to a fourth syllable have special conditions (e.g. only LLLL) that enable modeling with binary feet. This doesn't work for Sanskrit.

The existence of the Sanskrit sort of system is a problem for Kager's stress window typology.

I propose a grid-based analysis a la Halle and Idsardi which doesn't encounter these problems.

It also doesn't encounter the problems Kager, McCarthy, etc. are trying to avoid, especially the midpoint pathology, due to the different character of RBP vs OT, where e.g. RBP has no competition between L and R alignment.

Summary and conclusions 2

More careful inspection reveals that the empirical and conceptual bases of so-called penultimate systems--both live (Mongolian, Palestinian Arabic) and dead (Plautine Latin, Classical Arabic, Classical Sanskrit)--are suspect and need to be worked out more carefully before larger typological or theoretical conclusions can be definitively reached.

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