Indo-European "secondary mobility" and its implications for accentedness

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Word stress in ancient Indo-European

- Word stress in Vedic Sanskrit (Indic) and Hittite (Anatolian) inherited from Proto-Indo-European (PIE) a word-prosodic system in which stress was phonologically unpredictable — e.g., (1–2):

(1) Vedic Sanskrit:

a.	*yúj-as*	‘yokes’	b.	*yuj-ás*	‘of the yoke’

(2) Hittite:

a.	*uddar*	‘word’	b.	*uddār*	‘words’
	[út:ar]			[ut:á:r]	

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- Two overarching questions for today:
  - (i) How was word stress in Vedic and Hittite (and PIE) determined?
  - (ii) What are the implications of their stress systems for how phonologically unpredictable stress is grammatically encoded?

Word stress in ancient Indo-European

- Empirical focus — an intraparadigmatic prosodic alternation attested in Hittite and Vedic (and standardly reconstructed for PIE) in which:
  - Final /V/ of polysyllabic stem is stressed in "strong" cases (NOM, ACC).
  - Stem-final /V/ is deleted and inflectional endings stressed in prevocalic "weak" cases.

(3) Hittite:

	STRONG		WEAK	
a.	[pisé꞉n-os]	:	[pisn-á꞉s]	(man-ACC.PL/GEN.SG)
	pišēnuš		[*p*]*išnāš*	
b.	[χ^{w}ort꞉-á꞉i-s]	:	[χ^{w}ort꞉-j-á꞉s]	(curse-NML-ANIM.NOM.SG/GEN.SG)
	ḫurdāiš		*ḫurtiyaš*	

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(4) Vedic Sanskrit:

	STRONG		WEAK	
a.	*ukṣáṇ-as*	:	*ukṣṇ-ás*	(ox-M.NOM.PL/GEN.SG)
b.	*dā-tā́r-am*	:	*dā-tr-ā́*	(give-AGT-M.ACC.SG/INSTR.SG)

Analyzing word stress in ancient Indo-European

- Broadly, two competing analyses of this prosodic alternation.

(i) Templatic (e.g., "Erlangen Model;" Schindler 1969 *et seq.*, Rix 1992):

- Alternations in nominal paradigms determined by morphophonological templates, which specify different phonological properties (stress, vocalism) in different morphological environments (strong/weak cases).
- Relevant prosodic alternation specified by "hysterokinetic" class.

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- Relevant prosodic alternation specified by "hysterokinetic" class.

(ii) "Compositional" (Kiparsky and Halle 1977, Kiparsky 1982 *et seq.*):

- Alternation derived from interaction of:
  - Lexical contrast between stress-preferring (ACCENTED) and stress-neutral (UNACCENTED) morphemes.
  - Phonological preference for left-edge word stress.
  - A (morpho)phonologically conditioned vowel deletion process.

Goals of the talk

- Two empirical claims w.r.t. prosodic alternations of type in (3–4):

  (i) In Vedic and Hittite (and PIE), stress mobility depends crucially on elimination of stem-final syllable by deletion (cf. Kiparsky 2010).

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- Building on Kiparsky and Halle (1977), develop an analysis of Vedic (and Hittite) that captures (i) (and (ii)).

  - **Proposal:** Accented morphemes contain a foot edge in their lexical representation (cf. Inkelas 1999) which is preserved in the output due to high-ranking faithfulness (ANCHOR; cf. Özçelik 2014, Yawney 2018).

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- Analytic comparison:

  - Traditional "hysterokinetic" analysis fails to capture (i).
  - Analyses that assume an autosegmental representation of lexical accentedness (Revithiadou 1999, 2007, Alderete 2001, *i.a.*) fail to account for these alternations in systems with (ii).

Stress mobility and vowel deletion in IE

- Important observation of Kiparsky (2010) w.r.t. Vedic polysyllabic nouns with stem-final stress in strong cases — two contrastive types:
  - Deletion of stem-final /a/ and stressed inflectional endings in prevocalic weak cases — e.g., e.g., (5a–d).

(5)

	STRONG		WEAK	
a.	*ukṣáṇ-as*	:	*ukṣṇ-ás*	(ox-M.NOM.PL/GEN.SG)
b.	*mūrdhā́n-am*	:	*mūrdhn-ás*	(head-M.ACC.SG/ABL.SG)
c.	*pitár-am*	:	*pitr-é*	(father-M.ACC/DAT.SG)
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e.	*brahmā́ṇ-as*	:	*brahmáṇ-as*	(priest-M.NOM.PL/GEN.SG)
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⇒ Intraparadigmatic stress mobility of this type **depends upon deletion** — thus referred to as **"secondary mobility"** by Kiparsky (2010).

“Secondary mobility” in IE — synchronic evidence

- Same stress (non-)mobility contrast observed synchronically within certain Vedic noun classes, such as M *–man*-stems:
  - Non-deletion ⇒ fixed stem-final stress — e.g., (6a–b) (= (5e–f)).

(6)

	STRONG		WEAK	
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c.	*mahi-mā́n-am*	:	*mahi-mn-é*	(great-NML-M.ACC/DAT.SG)
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- (Non-)deletion of stem-final /a/ in (6) attributable to phonotactics.
  - Non-deletion in (6a–b) where it would produce an illicit onset (^{x}[.mn]).
  - Otherwise deletion as in (6c–d).

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- (Non-)deletion of stem-final /a/ in (6) attributable to phonotactics.

⇒ In Vedic, stem-final non-high vowels were regularly targeted by a deletion process in weak cases.

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- Intraparadigmatic ablaut — incl. deletion of stem-final vowels — often eliminated within (pre)histories of individual IE languages.
- Same diachronic development observed in all nominals with historical “secondary mobility:”
  - **Loss of stem-final *V*-deletion ⇒ fixed stem-final stress.**

“Secondary mobility” in IE — diachronic evidence

- Compare (e.g.) stress-alternating Vedic agent nouns in (7a–b) with cognate class in Greek (7c–d) with non-deletion/fixed stem-final stress:

(7)

	STRONG		WEAK	
a.	*dā-tā́r-am*	:	*dā-tr-é́*	(give-AGT-M.ACC.SG/DAT.SG)
b.	*han-tā́r-am*	:	*han-tr-ā*	(kill-AGT-M.ACC.SG/INS.SG)
c.	*dot-é́r*	:	*dot-êr-i*	(give-AGT-M.NOM.SG/DAT.SG)
d.	*bo-té́r*	:	*bo-têr-os*	(herd-AGT-M.NOM/GEN.SG)

⇒ **Loss of stem-final *V*-deletion ⇒ fixed stem-final stress.**

“Secondary mobility” in IE — diachronic evidence

- Compare (e.g.) stress-alternating Hittite *–ai*-stem nouns in (8a–b) with cognate class in Greek (8c–d) with non-deletion/fixed stem-final stress (cf. Yates 2019b):

(8)

	STRONG		WEAK	
a.	*ḫurdāiš*	:	*ḫurtiya*	(curse-NML-ANIM.NOM.SG/DAT.SG)
	[χʷort:-á:i-s]		[χʷort:-j-á:]	
b.	*linkāuš*	:	*linkiyaš*	(swear-NML-ANIM.ACC.PL/GEN.SG)
	[liŋk-á:(y)-os]		[liŋk-j-á:s]	
c.	*peitʰ-ṓ*	:	*peitʰ-oũs*	(persuade-NML-F.NOM.SG/GEN.SG)
d.	*pʰeid-ṓ*	:	*peitʰ-õi*	(spare-NML-F.NOM/DAT.SG)

- Greek pattern partially obscured by sound change, but:

NOM.SG *–ṓ* < *[-ó:i], GEN.SG *–oũs* < *[-ój-os], DAT.SG *–õi* < *[-ój-i]

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⇒ **Loss of stem-final *V*-deletion ⇒ fixed stem-final stress.**

“Secondary mobility” in IE — diachronic evidence

- Loss of intraparadigmatic ablaut also occurs within attested history of Hittite, with consequences for stress.
- (e.g.) Hittite stress-alternating *–ai*-stem nouns in (9a–b) (= (8a–b)) develop innovative weak stem forms with non-deletion and fixed stem-final stress (cf. Yates 2019b):

(9)

	STRONG		OLD WEAK		NEW WEAK
a.	*ḫurdāiš*	:	*ḫurtiya*	:	*ḫurtāi*
	[χʷortː-áːi-s]		[χʷortː-j-áː]		[χʷortː-áː(j)-i]
b.	*linkāuš*	:	*linkiyaš*	:	*lingayaš*
	[liŋk-áː(y)-os]		[liŋk-j-áːs]		[liŋk-áːy-as]

⇒ **Loss of stem-final *V*-deletion ⇒ fixed stem-final stress.**

“Secondary mobility” in IE — summary

- Thus convergent synchronic and diachronic evidence for “secondary mobility:”

  ⇒ Any viable account of Vedic/Hittite(/PIE) prosody must account for this dependence of stress mobility on deletion.

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- **Now** — develop an optimality-theoretic analysis that captures this relationship.

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- Thus convergent synchronic and diachronic evidence for “secondary mobility:”

  ⇒ Any viable account of Vedic/Hittite(/PIE) prosody must account for this dependence of stress mobility on deletion.

- **Now** — develop an optimality-theoretic analysis that captures this relationship.
- Two properties of this analysis:

  (i) “Secondary mobility” predicted by same phonological preference for left edge stress which explains “primary mobility” — i.e, stress alternations in Hittite and Vedic inflection independent of deletion.

  (ii) Relies crucially on a metrical representation of lexical accentedness.

Stress assignment and “primary mobility”

- Vedic and Hittite also show strong/weak stress alternations within inflectional paradigms in which no deletion occurs — e.g., (11–12):

		STRONG		WEAK	
(11)	Ved.	*pā́d-am*	:	*pad-á́*	(foot-ACC.SG/INS.SG)
(12)	Hitt.	*pātu*[*š*]	:	*patān*	(foot-ACC/GEN.PL)
		[pá:t-os]		[pat-á:n]	

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- Kiparsky and Halle (1977) propose these alternations emerge from:
  - A lexical contrast between stress-attracting (ACCENTED) or stress-neutral (UNACCENTED) morphemes.
  - A phonological preference for left edge word stress — i.e., (13):

(13) **BASIC ACCENTUATION PRINCIPLE (BAP)**:
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.

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- On Kiparsky and Halle’s (1977) analysis:
  - Unaccented root + unaccented strong endings ⇒ default leftmost stress.
  - Unaccented root + accented weak case endings ⇒ ending attracts stress.

Analyzing inflectional stress — primary mobility

- Default leftmost stress falls out from interaction of:

(14) CULMINATIVITY: A prosodic word has exactly one stressed syllable.
(15) TROCHAIC: Feet have initial prominence.
(16) ALL-FEET-LEFT: Feet must be aligned with the left-edge of the prosodic word. Assign one violation (*) for each intervening syllable peak.

(17)

/pad-am/		Culm	Troch	All-Ft-L
a.	pā.dam	*!		
b.	(pā.dám)		*!	
c. ☞	(pā́.dam)			
d.	pā.(dám)			*!

Analyzing inflectional stress — primary mobility

- Accented weak case endings attract stress in Vedic and Hittite — e.g.:

(18) a. Ved. *pa.(dā́)* (foot-M.INS.SG)

b. Hitt. *patān* (foot-GEN.PL) [pat-á:n]

- **How is this stress-attracting property encoded in the lexicon?**

Proposal

- Two components of the proposal (cf. Özçelik 2014, Yawney 2018):
  - **Accented morphemes contain the left edge of a head foot in their lexical representation — e.g. (19a) vs (19b):**

(19) a. UNACCENTED ACC.SG
Ved. /-am/

b. ACCENTED INSTR.SG
Ved. /-(ā/

Proposal

- Two components of the proposal (cf. Özçelik 2014, Yawney 2018):
  - **Underlying foot is preserved in output due to high-ranking faithfulness — i.e., (20):**

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

- ANCHOR-L enforces faithfulness to location of left foot edge; foot shape/rhyme type are independently determined:

(21)

a. CV.(CÝ.CV)
/CV(CV-CV/
✓
(trochaic)

b. (CÝ.CV).CV
/CV(CV-CV/
✗
(trochaic)

c. CV.(CV.CÝ)
/CV(CV-CV/
✓
(iambic)

d. (CV.CÝ).CV
/CV(CV-CV/
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- ANCHOR-L is violated only if a syllable peak intervenes between left edge of input/output foot:

(21) e. CV.CV.(CV́C)

/CVCVC-(VC/ ✓

f. CV.(CV́.CVC)

/CVCVC-(VC/ ✗

Analyzing inflectional stress — primary mobility

- Accented morphemes attract stress in Vedic (and Hittite) — e.g.:

(22) Ved. /pad-(ā/ → *pa.(dā́)* ‘with the foot’ (foot-M.INSTR.SG)

- This pattern emerges if ANCHOR-L dominates ALL-FEET-L.

(23)

/pad-*i*(ā/	Culm	Troch	Anchor-L	All-Ft-L
a. ☞ pa.*i*(dā́)				*
b. *i*(pá.dā)			*!	
c. *i*(pa.dā́)		*!	*	
d. pa.dā	*!			

- (b–c) violate ANCHOR-L because a σ intervenes.

  ⇒ (a) wins by satisfying ANCHOR-L (i.e., no intervening σ).

“Primary mobility” vs. immobility — leftmost wins

- In Vedic (and Hittite) inflectional paradigms with strong/weak stress alternations contrast with structurally comparable paradigms with fixed root stress — e.g., (24) (= (11) above) vs. (25):

		STRONG		WEAK	
(24)	Ved.	*pā́d-am*	:	*pad-á́*	(foot-ACC.SG/INS.SG)
(25)	Ved.	*gā́v-am*	:	*gáv-ā*	(cow-ACC.SG/INS.SG)

- This prosodic contrast attributable to accentual contrast in roots (/pad/ vs. /(gav/) and phonological preference for left edge stress.
  - Leftmost accented wins ⇒ fixed root stress in (27):

(26) Ved. /pad-(ā/ → *pa.(dā́)* ‘with the foot’ (foot-M.INS.SG)

(27) Ved. /(gav-(ā/ → *(gá.vā)* ‘with the cow’ (cow-ANIM.INSTR.SG)

Analyzing inflectional stress — leftmost wins

- Leftmost wins in Vedic (and Hittite) is generated by ranking already established — e.g., (28) (= (27) above):

(28)

/$_i$(gav-$_j$(ā/		Culm	Troch	Anchor-L	All-Ft-L
a.	$_i$(gá).$_j$(vā́)	*!			*
b. ☞	$_{ij}$(gá.vā)			*	
c.	ga.$_{ij}$(vā́)			*	*!
d.	$_{ij}$(ga.vā́)		*!	*	

- (b) and (c) each have one mis-anchored foot (violating ANCHOR-L).

  ⇒ (b) is preferred because it better satisfies lower-ranked ALL-FEET-L.

Analyzing “secondary mobility”

- Same analysis extends to nominals with “secondary mobility.”
- Stem-final accented vowel + unaccented strong endings ⇒ stem-final stress in strong cases — e.g., (29):

(29)

a.	Ved.	/uk(ṣaṇ-as/	→	*uk.(ṣá.ṇas)*	‘oxen’ (ox-M.NOM.PL)
b.	Ved.	/dā-(tar-am/	→	*dā.(tā́.ram)*	‘giver’ (give-AGT-M.ACC.SG)
c.	Hitt.	/pis(en-os/	→	[pi.(séː.nos)] *pišēnuš*	‘men’ (man-ANIM.ACC.PL)
d.	Hitt.	/χwertː-(ai-s/	→	[χ^{w}ort.(táːis)] *ḫurdāis*	‘curse’ (curse-ANIM.NOM.SG)

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d.	Hitt.	/χwertː-(ai-s/	→	[χ^{w}ort.(táːis)] *ḫurdāis*	‘curse’ (curse-ANIM.NOM.SG)

- More complex interaction in weak cases:
  - Accented stem-final /(V/ competes with accented weak ending for stress.
  - Stem-final vowel is targeted by deletion.

Analyzing "secondary mobility" — non-mobility

- Established ranking predicts fixed stem-final stress when deletion fails to apply — e.g., (30):

(30)

brah$_{i}$(maṇ-$_{j}$(as	SSP	CULM	ANCH-L	ALL-FT-L	MAX-V
a. brah.$_{i}$(má).$_{j}$(ṇás)		*!		***	
b. ☞ brah.$_{ij}$(má.ṇas)			*	*	
c. brah.ma.$_{ij}$(ṇás)			*	**!	
d. brah.$_{ij}$(mṇás)	*!			*	*
e. $_{ij}$(bráh).ma.ṇas			**!		

- (d) with deletion ruled out by Vedic requirement that syllable margins to conform to SSP in (31) (⇒ *[.mn]).

(31) SONORITY SEQUENCING PRINCIPLE (SSP): Sonority must increase between syllable margins and the nucleus.

Analyzing "secondary mobility" — non-mobility

- Established ranking predicts fixed stem-final stress when deletion fails to apply — e.g., (30):

(30)

brah$_i$(maṇ-$_j$(as	SSP	CULM	ANCH-L	ALL-FT-L	MAX-V
a. brah.$_i$(má).$_j$(ṇás)		*!		***	
b. ☞ brah.$_{ij}$(má.ṇas)			*	*	
c. brah.ma.$_{ij}$(ṇás)			*	**!	
d. brah.$_{ij}$(mṇás)	*!			*	*
e. $_{ij}$(bráh).ma.ṇas			**!		

- (d) with deletion ruled out by Vedic requirement that syllable margins to conform to SSP (⇒ *[.mn]).
- Winner (b) preferred to loser (c) because it better satisfies phonological preference for left edge stress — i.e., leftmost wins.

Analyzing “secondary mobility”

- Same ranking also predicts stress shift to inflectional endings when deletion eliminates stem-final syllable in weak cases — e.g., (32):

(32)

/uk$_{i}$(ṣaṇ-$_{j}$(as/		CULM	ANCH-L	ALL-FT-L	MAX-V
a.	$_{i}$(úk).$_{j}$(ṣṇás)	*!	*	***	*
b. ☞	uk.$_{ij}$(ṣṇás)			*	*
c.	$_{ij}$(úk.ṣṇas)		*!*		*

- (c) with left edge stress is ruled out by its (double) violation of ANCHOR-L.

  ⇒ (b) wins by satisfying ANCHOR-L.

Analyzing “secondary mobility”

- Same ranking also predicts stress shift to inflectional endings when deletion eliminates stem-final syllable in weak cases — e.g., (32):

(32)

/uk$_i$(ṣaṇ-$_j$(as/	CULM	ANCH-L	ALL-FT-L	MAX-V
a. $_i$(úk).$_j$(ṣṇás)	*!	*	***	*
b. ☞ uk.$_{ij}$(ṣṇás)			*	*
c. $_{ij}$(úk.ṣṇas)		*!*		*
d. uk.$_{ij}$(ṣá.ṇas)		*!	*	

★ Deletion in (b) is prosodically optimizing — it allows two underlying feet to stand in perfect correspondence with single output foot.

⇒ (b) is preferred to a hypothetical candidate (d) with unmotivated non-deletion and stem-final stress, which violates ANCHOR-L.

Analyzing “secondary mobility”

- Same ranking also predicts stress shift to inflectional endings when deletion eliminates stem-final syllable in weak cases — e.g., (32):

(32)

/uk$_i$(ṣaṇ-$_j$(as/	CULM	ANCH-L	ALL-FT-L	MAX-V
a. $_i$(úk).$_j$(ṣṇás)	*!	*	***	*
b. ☞ uk.$_{ij}$(ṣṇás)			*	*
c. $_{ij}$(úk.ṣṇas)		*!*		*
d. uk.$_{ij}$(ṣá.ṇas)		*!	*	

★ Deletion in (b) is prosodically optimizing — it allows two underlying feet to stand in perfect correspondence with single output foot.

⇒ (b) is preferred to a hypothetical candidate (d) with unmotivated non-deletion and stem-final stress, which violates ANCHOR-L.

★ **(d)-like candidates viable in Hittite due to differing deletion conditions.**

Vowel deletion in Vedic

- To account for vowel deletion in Vedic Kiparsky (2010:146–7) posits:

  (33) ZERO-GRADE (ZG): "/a/ → ∅ before an accented morpheme."

- ZG is conditioned by underlying accents — not surface stress — and so applies whether or not the trigger attracts stress — e.g., (34a) vs. (34b):

(34) a. Ved. /pi(tar-é/ → *pit.(ré)* 'for the father' (father-M.DAT.SG)

b. Ved. /pi(tar-(bhis/ → *pi(tr̥.bhis)* 'with the fathers' (father-M.INSTR.PL)

- Interaction between ZG and stress assignment (i.e., BAP) is a case of COUNTERBLEEDING ON ENVIRONMENT opacity (cf. Baković 2011).
  - If stress were assigned first, it would bleed vowel deletion.

Analyzing “secondary mobility” — non-mobility

- Analysis rightly predicts that when (morphophonological) deletion of accented stem-final /á/ by weak case ending fails to eliminate stem-final σ (i.e., no “secondary mobility”), it retains stress:

(35)

pi$_{i}$(tar-$_{j}$(bhis		SSP	CULM	ANCH-L	ALL-FT-L	MAX-V
a.	pi.$_{i}$(tŕ̥).$_{j}$(bhís)		*!		***	*
b. ☞	pi.$_{ij}$(tŕ̥.bhis)			*	*	*
c.	pi.tr̥.$_{ij}$(bhís)			*	**!	*
d.	pitr.$_{ij}$(bhís)	*!			*	*
e.	$_{ij}$(pí.tr̥).bhis			**!		*

- Again, leftmost wins — winner (b) with fixed stem-final stress preferred to (c) with mobility because it better satisfies preference for left edge stress (cf. (30) with blocked deletion).

Vowel deletion in Hittite

- But in Hittite accented morphemes trigger deletion of a preceding non-high vowel **only if** it allows them to attract stress (Yates 2019a):

(36) a. Hitt. /pi(sen-(as/ → [pis(náːs)] 'of the man' (man-ANIM.GEN.SG)
[*p*]*išnāš*

b. Hitt. /paχː(wen-(i/ → [paχ.(χʷéː.ni)] 'in the fire' (fire-N.LOC.SG)
paḫḫweni

- Expected output for (36b) in a grammar with ZG is *[paχ.(χóː.ni)].
  - If ZG applied, stem-final accented syllable nucleus would not be eliminated (/w/ → /u/ → [o] /__χ) and so would retain stress.
- Hittite evidence is thus consistent with purely phonological deletion:

(37) PRETONIC VOWEL DELETION (PVD): /e, a/ → ∅ / ___ *σ́*
"/e, a/ is deleted before a stressed syllable." (iterative)

Vowel deletion in Hittite

- "Secondary mobility" in Hittite can be captured in classical OT (via "look-ahead") using a metrical representation of accentedness.
- Deletion is driven by (Yates 2019a; cf. Yates 2014):

(38) *PRETONIC-V (*PRE-V́): Unstressed [e, a] ([+syll, −high, −round]) in a pretonic syllable is not permitted in the output.

★ Prediction — deletion occurs in Hittite where it is prosodically optimizing.

Analyzing vowel deletion in Hittite

- Deletion in Hittite predicted if output better satisfies ANCHOR-L.

(39)

pi$_i$(sen-$_j$(as		CULM	ANCH-L	ALL-FT-L	*PRE-V́	MAX-V
a.	pi.$_i$(sé:).$_j$(ná:s)	*!		***		
b.	pi.$_{ij}$(sé:.nas)		*!	*		
c. ☞	pis.$_{ij}$(ná:s)			*		*
d.	pi.se.$_{ij}$(ná:s)		*!	**	*	
e.	$_{ij}$(pí:.se).nas		*!*		*	
f.	$_{ij}$(pís.nas)		*!*		*	*

- Crucial comparison — candidates (b) vs. (c):
  - Deletion in (c) allows ANCHOR-L to be fully satisfied, violating only low-ranked MAX-V.

  ⇒ (c) thus preferred to (b) with non-deletion, which violates higher-ranked ANCHOR-L.

Analyzing vowel deletion in Hittite

- Deletion not predicted if output does not better satisfy ANCHOR-L.

(40)

paχːi(wén-j(i	SSP	CULM	ANCH-L	ALL-FT-L	*PRE-V́	MAX-V
a. paχ.i(χʷéː).j(níː)		*!		***		
b. ☞ paχ.ij(χʷéː.ni)			*	*		
c. paχ.ij(χóː.ni)			*	*		*!
d. pax.χo.ij(níː)			**!	**		*
e. ij(pχʷːéː.ni)	*!		*			*
f. ij(páx.χʷe).ni			**!	**		*

- Crucial comparison — candidates (b) vs. (c):
  - Deletion in (c) **still does not allow** ANCHOR-L to be fully satisfied.

  ⇒ (b) with non-deletion thus preferred to (c), which gratuitously violates MAX-V.

Inflectional stress in IE — interim summary

- Under a metrical representation of accentedness it is possible to account for intraparadigmatic stress alternations in Hittite and Vedic (and PIE) inflectional paradigms.
- The proposed analysis captures:
  - ✓ In Vedic and Hittite, stress alternations depend crucially on vowel deletion in polysyllabic stems with stem-final accent.
  - ✓ In Hittite, vowel deletion depends crucially on stress alternations.
- This analysis also provides a unified account of:
  - ✓ "Primary" and "secondary mobility," deriving both via same grammatical principles.
  - ✓ Polysyllabic stems with "secondary mobility" and fixed stem-final stress, deriving both from same prosodic representation.

Analytic comparison

- **Now:** — analytic comparison:
  - Autosegmental (vs. metrical) representation of lexical accentedness.
  - Templatic (vs. “compositional”) analysis (“hysterokinetic”).

Lexical accent as autosegment

- Widely accepted view (Revithiadou 1999, 2007, Alderete 2001, *i.a.*) — a lexical accent is an underlying prominence (∗), autosegmentally linked to a vocalic peak:

(41) a. UNACCENTED ROOT

/CVCV/

b. ACCENTED ROOT

/CV́CV/

∗

- Accented vowel preferentially receives primary stress by incorporation into head of word's head foot — e.g., assuming right-aligned trochees:

(42) a. /CVCV-CV/ → ω(CV.Σ_{HD}(CV́.CV)) *(default)*

∗

b. /CV́CV-CV/ → ω(Σ_{HD}(CV́.CV).CV) *(non-default)*

∗ ∗

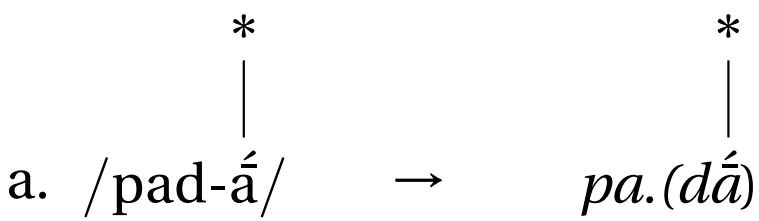
Analytic comparison — an autosegmental analysis

- Autosegmental analyses standardly enforce faithfulness with constraints like:

  (43) MAX-PROM: "A prominence in the input (= accent) must have a correspondent in the output (= stress)."

  (44) DEP-PROM: "A prominence in the output (= stress) must have a correspondent in the input (= accent)."

- Consider the derivation in (45):



✓ no violations

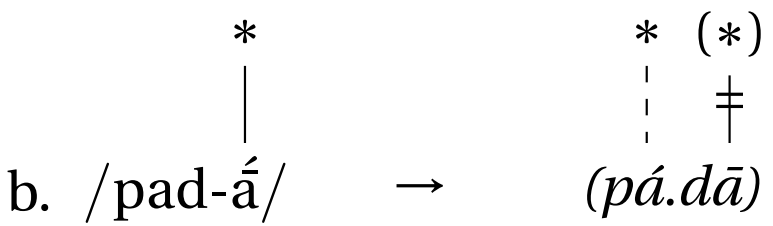
Analytic comparison — an autosegmental analysis

- Autosegmental analyses standardly enforce faithfulness with constraints like:

  (43) MAX-PROM: "A prominence in the input (= accent) must have a correspondent in the output (= stress)."

  (44) DEP-PROM: "A prominence in the output (= stress) must have a correspondent in the input (= accent)."

- Consider the derivation in (46):



✗ violates MAX-PROM, DEP-PROM

Analytic comparison — an autosegmental analysis

- Autosegmental analyses standardly enforce faithfulness with constraints like:

(47) *FLOP-PROM (Revithiadou 1999:53):
"Let χ_i be an input prominence, ζ_j be a vocalic peak, S_k phonological representations

$S_1 \mathscr{R} S_2$,
χ_1 and $\zeta_1 \in S_1$, χ_2 and $\zeta_2 \in S_2$,
$\chi_1 \mathscr{R} \chi_2$ and $\zeta_1 \mathscr{R} \zeta_2$,

if χ_1 is associated with ζ_1, then χ_2 is associated with ζ_2"

- Consider the derivation in (48):

c. /pad-á/ → (*pá.dā*)

✗ violates *FLOP-PROM.

Analytic comparison — an autosegmental analysis

- These constraints suffice to capture core data — just substitute *FLOP-PROM ≫ MAX-PROM for ANCHOR-L in constraint ranking established in metrical analysis.

METRICAL: CULM ≫ ANCHOR-L ≫ ALL-FEET-L

↕

AUTOSEGMENTAL: CULM, { *FLOP-PROM ≫ MAX-PROM } ≫ ALL-FEET-L

Analytic comparison — an autosegmental analysis

- These constraints suffice to capture core data — just substitute *FLOP-PROM ≫ MAX-PROM for ANCHOR-L in constraint ranking established in metrical analysis — e.g., preserve underlying accents:

(49)

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

“Secondary mobility” under an autosegmental analysis

- But this analysis fails to capture “secondary mobility” in Vedic and Hittite (under definition of *FLOP in (47); Revithiadou 1999:53):

(50)

* * | | ukṣán-ás	CULM	*FLOP	MAX-PR	ALL-FT-L
a. * * | (úk).(ṣnás)	*!			*
b. ☹ (*)* / úk.(ṣnás)			*	*!
c. 💣 ** ‡ (úk.ṣnas)			*	

- As defined *FLOP is irrelevant when input *V́* lacks corresponding *V* in output, as in (a) and (c).

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(50)

* * | | ukṣán-ás	CULM	*FLOP	MAX-PR	ALL-FT-L
a. * * | (úk).(ṣnás)	*!			*
b. ☹ (*)* / úk.(ṣnás)			*	*!
c. 💣 ** ‡ (úk.ṣnas)			*	

- Freed to migrate by deletion, accent predicted to move leftward (in accordance with phonological preference for left edge stress) as in (c).

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(50)

* * | | ukṣán-ás	Culm	*Flop	Max-Pr	All-Ft-L
a. * * | (úk).(ṣnás)	*!			*
b. ☹ (*)* / úk.(ṣnás)			*	*!
c. 💣 *(*) ≠ (úk.ṣnas)			*	

✗ But the real winner is (b) with stressed inflectional ending.

“Secondary mobility” under an autosegmental analysis

- Alternatively, adopt definition of *FLOP-PROM in (51):

(51) *FLOP-PROM (Alderete 2001:24):
“For *x* a prominence, *y* a sponsor, and *z* an autosegmental link,
$\forall x\ \forall y\ \forall z$ [x and y are associated via z in $S_1 \rightarrow \exists x'\ \exists y', \exists z'$
such that $(x, y, z)\mathscr{R}(x', y', z')$ and x' and y' are associated via z' in S_2.]”
‘Corresponding prominences must have corresponding sponsors and links.’ ”

- Under this definition, *FLOP is violated by reassociation of accents whose hosts are deleted.
- This approach can handle “secondary mobility” in Vedic…

“Secondary mobility” under an autosegmental analysis

- But this analysis still fails to capture “secondary mobility” in Hittite (under definition of *FLOP in (51); Alderete 2001:24):

(52)

	*FLOP	MAX-PR	ALL-FT-L	*Pre-Ý	Max-V
* * | | pisén-ás					
a. 💣 * (*) | ǂ pi.(séː.nas)		*	*		
b. ☹ (*) * ǂ | pis.(náːs)		*	*		*!
c. *(*) ˈǂ ǂ (pís.nas)	*!	*			*

- (c) with initial stress is now properly ruled out by *FLOP.

“Secondary mobility” under an autosegmental analysis

- But this analysis still fails to capture “secondary mobility” in Hittite (under definition of *FLOP in (51); Alderete 2001:24):

(52)

	*FLOP	MAX-PR	ALL-FT-L	*Pre-Ý	Max-V
* * | | pisén-ás					
a. 💣 * (*) | ǂ pi.(séː.nas)		*	*		
b. ☹ (*) * ǂ | pis.(náːs)		*	*		*!
c. *(*) ˊǂ ǂ (pís.nas)	*!	*			*

- ✗ Yet (a) with non-deletion is now preferred to attested (b) with deletion because latter gratuitously violates MAX-V.

“Secondary mobility” under an autosegmental analysis

- But this analysis still fails to capture “secondary mobility” in Hittite (under definition of *FLOP in (51); Alderete 2001:24):

(52)

	*FLOP	MAX-PR	ALL-FT-L	*Pre-Ý	Max-V
* * | | pisén-ás					
a. 💣 * (*) | ǂ pi.(séː.nas)		*	*		
b. ☹ (*) * ǂ | pis.(náːs)		*	*		*!
c. *(*) ˊǂ ǂ (pís.nas)	*!	*			*

★ No motivation for deletion under this analysis — MAX-PROM is violated regardless ⇒ not prosodically optimizing!

Analytic comparison — the templatic analysis

- Traditional templatic analyses of PIE word prosody (e.g.,"Erlangen Model;" Schindler 1969 *et seq.*, Rix 1992) account for alternations in nominal paradigms with morphophonological templates.
- "Hysterokinetic" (HK) template specifies:
  - Stressed stem-final vowel (PIE */é/ > Ved. /á/) in strong cases — e.g., NOM.PL in (53a).
  - Vowel deletion + stressed endings in weak cases — e.g., GEN.SG in (53b).

(53) a. Ved. /pitar^{+HK}-as/ → *pi.(tá.ras)* 'fathers' (father-M.NOM.PL)

b. Ved. /pitar^{+HK}-e/ → *pit.(ré)* 'for father' (father-M.DAT.SG)

Analytic comparison — the templatic analysis

- But "hysterokinetic" analysis encounters empirical problems — e.g., incorrectly produces ending stress in Vedic weak INS.PL in (54a).

(54) a. Ved. /pitar^{+HK}-bhis/ → ^{x}*pi.tr̥.(bhís)* 'fathers' (father-M.NOM.PL)

cf. Ved. *pi.(tŕ̥.bhis)*

Analytic comparison — the templatic analysis

- But "hysterokinetic" analysis encounters empirical problems — e.g., incorrectly produces ending stress in Vedic weak INS.PL in (54a).
- It also misses generalizations captured by proposed analysis — in particular, **crucial dependence of stress alternations on vowel deletion in this class**.

  ⇒ Fails to predict consistent emergence of stem-final stress when vowel deletion is lost diachronically (*i.a.*) — e.g., (54b).

(54) a. Ved. /pitar^{+HK}-bhis/ → ^{x}*pi.tr̥.(bhís)* 'fathers' (father-M.NOM.PL)

cf. Ved. *pi.(tŕ̥.bhis)*

b. Ved. /dā-tar^{+HK}-e/ → *dāt.(ré)* 'for the giver' (give-AGT-M.DAT.SG)

cf. Gk. *do-têr-i* (^{x}*do-tēr-í*)

Analytic comparison — the templatic analysis

- But "hysterokinetic" analysis encounters empirical problems — e.g., incorrectly produces ending stress in Vedic weak INS.PL in (54a).
- It also misses generalizations captured by proposed analysis — in particular, **crucial dependence of stress alternations on vowel deletion in this class**.
  - ⇒ Fails to predict consistent emergence of stem-final stress when vowel deletion is lost diachronically (*i.a.*) — e.g., (54b).

(54) a. Ved. /pitar^{+HK}-bhis/ → ^{x}*pi.tr̥.(bhís)* 'fathers' (father-M.NOM.PL)

cf. Ved. *pi.(tŕ̥.bhis)*

b. Ved. /dā-tar^{+HK}-e/ → *dāt.(ré)* 'for the giver' (give-AGT-M.DAT.SG)

cf. Gk. *do-têr-i* (^{x}*do-tēr-í*)

- In addition, it wholly separates "secondary mobility" from "primary mobility" rather than deriving both from same principles.

Discussion

- Broad take-aways from analytic comparison — prosodic alternations in Hittite and Vedic inflectional paradigms are better explained:

  (i) By assuming a metrical rather than autosegmental representation of lexical accentedness.

  (ii) By a “compositional” rather than a templatic analysis.

Discussion

- Broad take-aways from analytic comparison — prosodic alternations in Hittite and Vedic inflectional paradigms are better explained:

  (i) By assuming a metrical rather than autosegmental representation of lexical accentedness.

  (ii) By a "compositional" rather than a templatic analysis.

- Questions for future research:

  - Can metrical representations handle (all) other lexical accent systems that have been analyzed in autosegmental terms?
  - Are there any IE prosodic alternations that require templates?
  - How should the differing conditions on vowel deletion in Vedic and Hittite be explained?

Thank you!

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  - UCLA American Indian Linguistics Seminar
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