What is a lexical accent?
Indo-European evidence for a metrical representation

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Word stress in lexical accent systems

▶ In languages with LEXICAL ACCENT (LA), word stress is determined by interactions between phonology and morphology.

▶ Broad theoretical question posed by LA systems:

> ○ How is the relationship between word stress and morphology encoded in the grammar?

Lexical accent (LA) in ancient Indo-European (IE)

▶ Oldest ancient IE languages had protoypical LA systems — stress was:

    (i) CULMINATIVE and OBLIGATORY — i.e., every word had exactly one most prominent (= stressed) syllable (Hyman 2006; van der Hulst 2014, *i.a.*).

    (ii) FREE — i.e., its position was not predictable on basis of word's purely phonological properties:

(1) Vedic Sanskrit (Indic):

a. *yújas*	'yokes' (NOM.PL)	*yujás*	'of the yoke' (GEN.SG)
b. *ápasas*	'work' (GEN.SG)	*apásas*	'working' (GEN.SG)
c. *bráhmanā*	'with the sacred formulation' (N.INS.SG)	*brahmánā*	'with the priest' (M.INS.SG)
d. *rā́japutrā*	'having kings as sons' (F.NOM.SG)	*rājaputrā́*	'sons of a king' (M.NOM.DU)

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    (ii) FREE — i.e., its position was not predictable on basis of word's purely phonological properties:

(2) Ancient Greek:

  a. *tómos* 'slice' (M.NOM.SG)   *tomós* 'sharp' (M.NOM.SG)

  b. *pʰóros* 'tribute' (M.NOM.SG)   *pʰorós* 'bearing' (M.NOM.SG)

  c. *hargápē* 'hook' (F.NOM.SG)   *hargapḗ* 'seizure' (F.NOM.SG)

  d. *litʰóbolos* 'stone-throwing' (M.NOM.SG)   *litʰobólos* 'struck by stones' (M.NOM.SG)

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(3) Vedic Sanskrit *–ta*-participles ⇒ suffixal stress:

a.	*uk-tá-s*	'spoken' (NOM.SG)	⇐	*vac–*	'speak'
b.	*śru-tá-s*	'heard (of)' (NOM.SG)	⇐	*śru–*	'hear'
c.	*tap-tá-s*	'heated' (NOM.SG)	⇐	*tap–*	'heat'
d.	*jñā-tá-s*	'known' (NOM.SG)	⇐	*jñā–*	'know'

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(4) Vedic Sanskrit *–as*-stem N nouns ⇒ pre-suffixal stress:

a.	*vác-as*	'word' (N.NOM/ACC.SG)	⇐	*vac–*	'speak'
b.	*śráv-as*	'fame' (N.NOM/ACC.SG)	⇐	*śru–*	'hear'
c.	*táp-as*	'heat' (N.NOM/ACC.SG)	⇐	*tap–*	'heat'
d.	*bhā́s-as*	'light' (N.NOM/ACC.SG)	⇐	*bhās–*	'shine'

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(5) Hittite (Anatolian) *–atar*-stem N nouns ⇒ 1σ suffixal:

   a. *lātar*   'releasing' (N.NOM/ACC.SG) ⇐ *la–*   'release'
      [l-áːtar]

   b. *aggātar*   'death' (N.NOM/ACC.SG)   ⇐ *ak(k)–*   'die'
      [akː-áːtar]

   c. *antuḫšātar*   'humanity' (N.NOM/ACC.SG) ⇐ *antuḫša–* 'man'
      [antoχs-áːtar]

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(6) Hittite *–ul*-stem N nouns ⇒ suffixal:

a. *takšūl*   'peace (treaty)' (N.NOM/ACC.SG) ⇐ *takš–*   'fashion'
   [taks-úːl]

b. *āššūl*   'favor' (N.NOM/ACC.SG)   ⇐ *āššu–*   'good'
   [aːsː-úːl]

c. *immiūl*   'mixture' (N.NOM/ACC.SG)   ⇐ *immiye/a–* 'mix'
   [imːij-úːl]

Ancient IE and the theory of LA

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     ○ What morphophonological principles govern stress assignment in ancient IE languages?

     → How stress is determined in LA systems cross-linguistically.

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    (e.g.) Morphologically conditioned stress tends to be replaced by phonologically determined stress in words that undergo lexicalization in Greek (Probert 2006), Sanskrit (Lundquist 2015; Sandell 2015), and Anatolian (Yates 2015).

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  + LA is reconstructible for proto-language and preserved in its oldest daughters.

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▶ **But today**:

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  ▶ This synchronic lexical representation offers insight into diachronic development of ancient IE languages.

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(7) a. [nə́-təw] 'I saw' 　　b. [nə-pə́w] 'my friend'

　　　　　↑　　　　　　　　　　　　↑

　　　　/nə-təw/　　　　　　　　/nə-pə́w/

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▶ Specific question addressed today:

> ○ What is a lexical accent?

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

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

Hypothesis (i) — lexical accent as autosegment

▶ A lexical accent is an underlying prominence (∗), autosegmentally
linked to a vocalic peak (Revithiadou 1999, 2007, Alderete 2001a, *i.a.*):

(8)   a.   <u>UNACCENTED ROOT</u>   b.   <u>ACCENTED ROOT</u>

/CVCV/   /CV́CV/
                                          |
                                          ∗

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

(9)   a.   /CVCV-CV/   → $_\omega$(CV.$_{\Sigma_{HD}}$(CV́.CV))   *(default)*
                                        |
                                        ∗

      b.   /CV́CV-CV/   → $_\omega$($_{\Sigma_{HD}}$(CV́.CV).CV)   *(non-default)*
            | |
            ∗   ∗

Hypothesis (ii) — lexical accent as metrical structure

▶ A lexical accent is a metrical head foot directly specified in the input (Inkelas 1999, Özçelik 2014, *i.a.*):

(10) a. <u>UNACCENTED ROOT</u>
        /CVCV/

      b. <u>ACCENTED ROOT</u>
        $/_{\Sigma_{HD}}(CVCV)/$

▶ Head foot is preferentially preserved in output and "accented vowel" stressed as the foot's head — e.g., assuming right-aligned trochees:

(11) a. /CVCV-CV/   → $_{\omega}(CV._{\Sigma_{HD}}(C\acute{V}.CV))$ *(default)*

     b. $/_{\Sigma_{HD}}(CVCV)\text{-}CV/$ → $_{\omega}(_{\Sigma_{HD}}(C\acute{V}.CV).CV)$ *(non-default)*

Lexical accents are underlying foot edges

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- ▶ Metrical representation of accentedness makes it possible to reconcile two seemingly contradictory patterns within inflectional paradigms:

  - ▶ A general preference for left edge stress.
  - ▶ Rightward stress shifts when accented syllable peaks are eliminated in the output ("secondary mobility"; Kiparsky 2010).

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

Roadmap

अहन्नहिमन्वुपस्तंतर्द

áhann áhim ánu apás tatarda

'(Indra) slew the serpent. He bored out the waters.' (RV I.32.1c)

- ▶ Vedic Sanskrit (~1500–1000 BCE) — spoken mostly in modern Pakistan and northern India.
- ▶ *Rigveda* (RV) — large collection of orally-transmitted texts that represent the oldest stage of Sanskrit (see Jamison and Brereton 2014).
- ▶ Vedic texts provide direct evidence for word stress:
    - ▶ Falling pitch (*svarita* 'sounded') is marked (with _ in RV).
    - ▶ High pitch (= stress; *udātta*) occurs on immediately preceding syllable.

What is Hittite?

- ▶ Hittite — deciphered by Hrozný (1917) just over a century ago — is the major representative of the (now extinct) Anatolian branch of IE.

- ▶ Official language of the kingdom of Ḫatti.

- ▶ Attested 16th–13th centuries BCE in multi-genre administrative texts, the majority on clay tablets excavated from the royal archives at Ḫattuša near modern Boğazkale in central Turkey.

What is Hittite?

- Hittite is written in a cuneiform mixed syllabic-logographic script.

- Syllabic signs may have the value *CV, VC, V,* or (less commonly) *CVC*.

- Hittite texts provide indirect evidence for stress:

  - Long vowels optionally marked with "plene writing" (= redundant identical *V* sign; cf. Kimball 1999:55).

  - Stressed vowels strongly tend to lengthen and unstressed vowels to reduce (see Yates 2017b:Ch. 3) — e.g.:

<i-da-a-lu>	*idālu*	[itáːlu] 'evil'	(N.NOM/ACC.SG)
<ša-a-ak-ki>	*šākki*	[sáːkːi] 'knows'	(3SG.NPST.ACT)

Core data — Vedic

- Prosodic contrast in Vedic nominal (and verbal) inflection between two stem types:
    - IMMOBILE: stress fixed on stem throughout inflectional paradigm.
    - MOBILE: stress alternates between stem in the "strong" cases (NOM, ACC), and inflectional endings in the other "weak" cases.

- Compare IMMOBILE monosyllabic stems in (12) with MOBILE (13):

		STRONG		WEAK	
(12)	a.	*nár-as*	:	*nár-as*	(man-M.NOM.PL/GEN.SG)
	b.	*gā́v-as*	:	*gáv-ā*	(cow-NOM.PL/INS.SG)
(13)	a.	*yúj-as*	:	*yuj-ás*	(yoke-M.NOM.PL/GEN.SG)
	b.	*pā́d-am*	:	*pad-ā́*	(foot-M.ACC.SG/INS.SG)

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- Compare IMMOBILE disyllabic stems in (14) with MOBILE (15):

		STRONG		WEAK	
(14)	a.	*rā́jān-am*	:	*rā́jñ-as*	(king-M.ACC/GEN.SG)
	b.	*marút-as*	:	*marút-su*	(Marut-M.NOM.PL/LOC.PL)
(15)	a.	*pánthā-m*	:	*path-ás*	(path-M.ACC/GEN.SG)
	b.	*púmāṃs-am*	:	*puṃ-sú*	(male-M.ACC.SG/LOC.PL)

- ▶ Vedic contrast between IMMOBILE and MOBILE stems can be derived from interaction of:

    - ▶ A lexical contrast between accented and unaccented morphemes.
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    - ▶ A phonological preference for the single stress-bearing syllable to coincide with the word's left edge — i.e., Kiparsky and Halle's (1977) BASIC ACCENTUATION PRINCIPLE:

(16) **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.

Core data — Vedic

- ▶ Vedic IMMOBILE and MOBILE stems contrast in accentedness.
    - ▶ MOBILE stems are lexically unaccented.
    - ▶ IMMMOBILE stems are lexically accented.

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

    a. Ved. /pad-am/   → *pā́d-am*   'foot' (foot-GEN.SG)

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

(18) Unaccented stem + accented ending ⇒ ending attracts stress:

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

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

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(19) Accented stem + unaccented ending ⇒ stem attracts stress:

   a. Ved. /gáv-as/ → *gā́v-as* 'cows' (cow-NOM.PL)
   b. Ved. /marút-as/ → *marút-as* 'Maruts' (Marut-NOM.PL)

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

   a. Ved. /gáv-ā́/ → *gáv-ā* 'with the cow' (cow-INS.SG)
   b. Ved. /marút-sú/ → *marút-su* 'among the Maruts' (Marut-LOC.PL)

Core data — Hittite

- ► Same preference for left edge stress (= BAP) observed in Hittite inflectional stress (Yates 2015, 2016, 2017b).
- ► Evidence is more robust in the verbal system, but same prosodic contrast obtains in nouns — compare IMMOBILE (21) vs. MOBILE (22):

		STRONG		WEAK	
(21)	a.	*ḫāranan* [χáːran-an]	:	*ḫāranas* [χáːran-as]	(eagle-ANIM.ACC/GEN.SG)
	b.	*šīwaz* [síːwat͡s]	:	*šīwattas* [síːwatː-as]	(day-ANIM.NOM/GEN.SG)
(22)	a.	*pātu*[*š*] [páːt-os]	:	*pat-ān* [pat-áːn]	(foot-ANIM.ACC/GEN.PL)
	b.	*tēkan* [téːkan-∅]	:	*takn-ás* [takn-áːs]	(earth-N.ACC/GEN.SG)

Core data — Hittite

- Hittite IMMOBILE vs. MOBILE contrast can be analyzed in the same way:
    - Unaccented stem + unaccented ending ⇒ default leftmost, e.g., (23a).
    - Unaccented stem + accented ending ⇒ attraction to ending, e.g., (23b).
    - Accented stem + accented ending ⇒ leftmost accented wins, e.g., (23c).

(23) a. Hitt. /pat-os/ → [(páː.tos)] 'feet' (foot-ANIM.ACC.PL)
  pātu[š]

  b. Hitt. /pat-án/ → [pa.(táːn)] 'of the feet' (foot-GEN.SG)
  patān

  c. Hitt. /χáran-ás/ [(χáː.ra).nas] 'of the eagle' (eagle-GEN.SG)
  ḫāranaš

Analyzing core data — default leftmost stress

▶ Vedic (and Hittite) show default leftmost stress — e.g.:

(24) Ved. /pad-am/ → *(pá.dam)* 'foot' (foot-M.ACC.SG)

▶ This pattern falls out from interaction of:

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

(28)

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

Analyzing core data — accented → stressed

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

(29) a. Ved. *pa.(dā́)* (foot-M.INS.SG)   b. Hitt. *patān* (foot-GEN.PL)
                                                        [pa.(táːn)]

○ **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. (30a) vs (30b):**

  (30) a. <u>UNACCENTED ACC.SG</u>
           Ved. /-am/

        b. <u>ACCENTED INSTR.SG</u>
           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.,** (31):

  (31) 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:

(32)

a. CV.(CV́.CV)
    ⌇   ↑
  /CV(CV-CV/
    ✓
  (trochaic)

b. (CV́.CV).CV
    ⟍   ↑
  /CV(CV-CV/
    ✗
  (trochaic)

c. CV.(CV.CV́)
    ⌇   ↑
  /CV(CV-CV/
    ✓
  (iambic)

d. (CV.CV́).CV
    ⟍   ↑
  /CV(CV-CV/
    ✗
  (iambic)

Proposal

▶ Two components of the proposal (cf. Özçelik 2014, Yawney 2018):

    ▶ **Underlying foot is preserved in output due to high-ranking faithfulness — i.e., (31):**

  (31) 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 is violated only if a syllable peak intervenes between left edge of input/output foot:

    (32) e. CV.CV.(CV́C)   f. CV.(CV́.CVC)
            ↑   ↑
       /CVCVC-(VC/   /CVCVC-(VC/
           ✓   ✗

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

   (33) Ved. /pad-(ā/ → *pa.(dā́)* 'with the foot' (foot-M.INSTR.SG)

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

(34)

	/pad-*i*(ā́)/	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*).

Analyzing core data— leftmost wins

▶ Leftmost wins in Vedic (and Hittite) — e.g.:

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

▶ This pattern generated by ranking already established:

(36)

	/$_i$(gav-$_j$(ā̄/	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.

"Secondary mobility" in Vedic and Hittite

▶ Both Vedic and Hittite exhibit stress alternations involving what Kiparsky (2010) terms "secondary mobility:"

  ▶ An accented vowel is eliminated in output by resyllabification or deletion.

  ▶ Accent associated with eliminated vowel appears to shift **rightward** and attract stress to following syllable.

▶ Such stress alternations occur in different morphological contexts:

  ▶ Three distinct types are observed in Vedic.

  ▶ One of these types is also found in Hittite.

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▶ Such stress alternations occur in different morphological contexts:

    ▶ Three distinct types are observed in Vedic.

    ▶ One of these types is also found in Hittite.

▶ **Now** — examine the three types (in order of increasing robustness).

- In a first type of "secondary mobility" in Vedic:
  - Stem contains a final accented high vowel, which attracts stress away from word's left edge — e.g., in NOM.SG.
  - Accented high vowel is resyllabified before **unaccented** vowel-initial strong case ending ⇒ stress surfaces on ending — e.g., in NOM.PL/DU.

(37)

	NOM.SG		NOM.PL/DU	
a.	*arí-s*	:	*ary-ás*	(friend-NOM.SG/PL)
b.	*paśú-s*	:	*paśv-ā́*	(livestock-NOM.SG/DU)
			(RV X.106.3b)	

- In a first type of "secondary mobility" in Vedic:
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(37)

	NOM.SG		NOM.PL/DU		
a.	*arí-s*	:	*ary-ás*	(friend-NOM.SG/PL)	**ár-yas*
b.	*paśú-s*	:	*paśv-ā́*	(livestock-NOM.SG/DU)	**páśvā*
			(RV X.106.3b)		

★ Non-initial stress on NOM.PL/DU requires a lexical accent, but this ending is underlyingly **unaccented** (NOM.PL /-as/, DU /-ā/).

⇒ Stem-final accent has shifted rightward onto ending.

▶ In a second type of "secondary mobility" in Vedic:

  ▶ Initial accented /á/ of disyllabic stem attracts stress in strong cases.
  ▶ Accented /á/-vowel is deleted in weak cases ⇒ stress surfaces on **unaccented** stem vowel to its right.

(38)

	STRONG		WEAK	
a.	*sā́nu(-∅)*	:	*snú-ṣu*	(back-N.NOM.SG/LOC.PL)
b.	*dā́ru(-∅)*	:	*drú-ṇā*	(wood-N.NOM.SG/INS)

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(38)

	STRONG		WEAK		
a.	*sā́nu(-∅)*	:	*snú-ṣu*	(back-N.NOM.SG/LOC.PL)	**snu-ṣú*
b.	*dā́ru(-∅)*	:	*drú-ṇā*	(wood-N.NOM.SG/INS)	**dru-ṇā́*

★ Failure of accented weak ending to attract stress requires a lexical accent to its left, but stressed stem vowel is **unaccented** (/u/).

  ⇒ Stem-initial accent has shifted rightward onto stem-final vowel.

- In a third type of "secondary mobility" in Vedic:
    - Final /á/ of polysyllabic stem stressed in "strong" cases.
    - Stem-final /á/ is deleted and inflectional endings stressed in prevocalic "weak" cases.

(39)

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

- Third type of "secondary mobility" is also found in Hittite:
    - Final /é, á/ of polysyllabic stem stressed in strong cases.
    - Stem-final /é, á/ is deleted and inflectional endings stressed in prevocalic weak cases.

(40)

		STRONG		WEAK	
a.	Hitt.	[piséːn-os]	:	[pisn-áːs]	(man-NOM.PL/GEN.SG)
		pišēnuš		[p]*išnāš*	
b.	Hitt.	[χʷortː-áːi-n]	:	[χʷortː-j-áːs]	(swear-NML-ANIM.ACC.SG/GEN.SG)
		ḫurdāin		*ḫurtiyaš*	

- ▶ Third type of "secondary mobility" is also found in Hittite:
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a.	Hitt.	[piséːn-os]	:	[pisn-áːs]	(man-NOM.PL/GEN.SG)
		pišēnuš		[*p*]*išnāš*	
b.	Hitt.	[χ^wortː-áːi-n]	:	[χ^wortː-j-áːs]	(swear-NML-ANIM.ACC.SG/GEN.SG)
		ḫurdāin		*ḫurtiyaš*	

- ⋆ Ending attracts stress in preference to accented stem to its left:
    - ⇒ Stem accent is deleted when vowel is deleted (but cf. types 1, 2).
    - ⇒ Or stem accent has shifted rightward onto inflectional ending.

Implications of "secondary mobility"

- Two claims advanced below w.r.t. "secondary mobility:"

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Implications of "secondary mobility"

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(i) Can be captured under metrical representation of accentedness.

   ▶ Emerges from same constraint ranking that accounts for core data.

(ii) Cannot be captured under autosegmental representation of accentedness — basic problem:

   ▶ "Secondary mobility" requires that lexical accents reassociate rightward when vocalic host is eliminated.
   ▶ But rightward reassociation is inconsistent with general preference for left edge stress.

Analyzing Vedic "secondary mobility" — type 2

▶ Deletion of accented stem-initial /á/ in weak cases triggers "secondary mobility:"

(41) Ved. /(sanu-(su/ → *(snú.ṣu)* 'on (their) backs' (back-N.LOC.PL)

(42)

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

▶ Candidate (a) (faithful modulo deletion) is ruled out by CULMINATITY.

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

  ⇒ ALL-FT-L selects (b) as winner, which satisfies ANCHOR-L w.r.t. underlying foot at word's left edge.

Analyzing "secondary mobility" — type 1

- ▶ Resyllabification of accented high *V* triggers "secondary mobility:"

  (43) Ved. /ar(i-as/ → *ar.(yás)* 'friends' (friend-M.NOM.PL)

- ▶ Resyllabification driven by constraint against hiatus:

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

(45)

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

- ▶ (b) satisfies ANCHOR-L by resyllabifying $\acute{V}$ into onset of head foot.
- ▶ Whereas loser (c) (with "leftward reassociation") violates it.

Analyzing "secondary mobility" — type 3

▶ Deletion of accented stem-final /á/ in weak cases triggers "secondary mobility:"

(46) Ved. /uk(ṣaṇ-(as/ → *uk.(ṣnás)* 'of the ox' (ox-M.GEN.SG)

(47)

/uk*i*(ṣaṇ-*j*(as/	CULM	ANCH-L	ALL-FT-L	MAX-V
a. *i*(úk).*j*(ṣnás)	*!	*	***	*
b. ☞ uk.*ij*(ṣnás)			*	*
c. *ij*(úk.ṣnas)		*!*		*

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

   ⇒ (b) wins by satisfying ANCHOR-L.

Analyzing "secondary mobility" — type 3

▶ Deletion of accented stem-final /á/ in prevocalic weak cases triggers "secondary mobility:"

(46) Ved. /uk(ṣaṇ-(as/ → *uk.(ṣnás)* 'of the ox' (OX-M.GEN.SG)

(47)

/uk$_i$(ṣaṇ-$_j$(as/	CULM	ANCH-L	ALL-FT-L	MAX-V
a. $_i$(úk).$_j$(ṣnás)	∗!	∗	∗∗∗	∗
b. ☞ uk.$_{ij}$(ṣnás)			∗	∗
c. $_{ij}$(úk.ṣnas)		∗!∗		∗
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.

► Deletion of accented stem-final /á/ in prevocalic weak cases triggers "secondary mobility:"

   (46) Ved. /ukṣaṇ-(as/ → *uk.(ṣnás)* 'of the ox' (OX-M.GEN.SG)

(47)

/uk*ᵢ*(ṣaṇ-*ⱼ*(as/	CULM	ANCH-L	ALL-FT-L	MAX-V
a. *ᵢ*(úk).*ⱼ*(ṣṇás)	*!	*	***	*
b. ☞ uk.*ᵢⱼ*(ṣṇás)			*	*
c. *ᵢⱼ*(**ú**k.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.

  ⇒ Implications for diachrony of IE vowel deletion?   (cf. Yates 2019a,b)

IE inflectional stress assignment — interim summary

▶ Under a metrical representation of lexical accentedness, it is possible to account for:

   ✓ Stress assignment in Vedic and Hittite inflection in general.

   ✓ All three types of "secondary mobility" adduced by Kiparsky (2010).

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► Now — analytic comparison:

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✓ Stress assignment in Vedic and Hittite inflection in general.

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▶ Now — analytic comparison:

○ **Can this data be accounted for under an autosegmental representation of lexical accentedness?**

Analytic comparison — an autosegmental analysis

- Consider Kiparsky's (2010) ruled-based, autosegmental analysis, which illustrates the central problem.
- Per Kiparsky elimination of accented syllable peaks triggers:
  - (48) SECONDARY MOBILITY (2^{RY}M): "When a syllable is eliminated, its accent shifts to the next syllable."
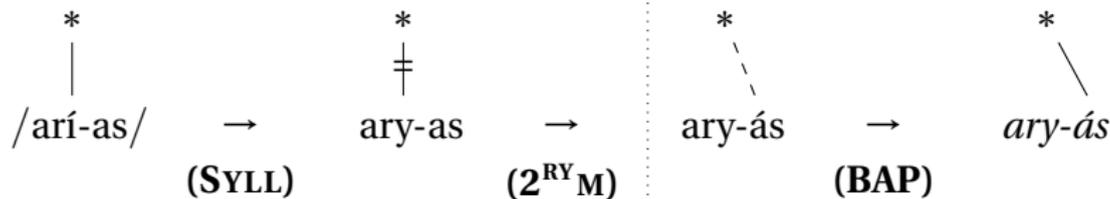
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► Type 1 "secondary mobility" would thus be derived stepwise:
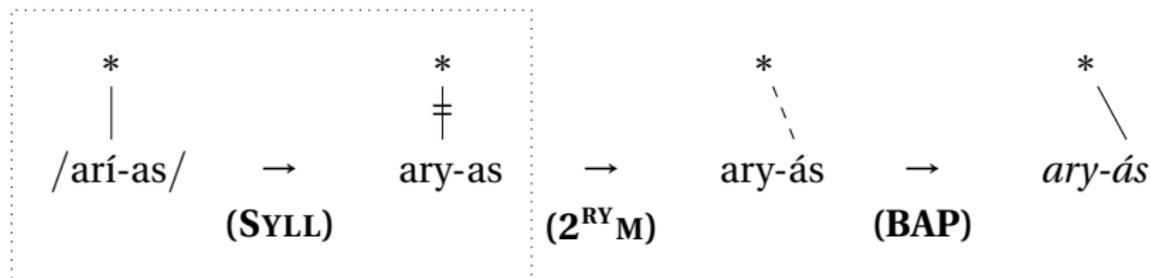
STEP 1: Accented σ eliminated by resyllabification ($/i/ \rightarrow$ [j]).

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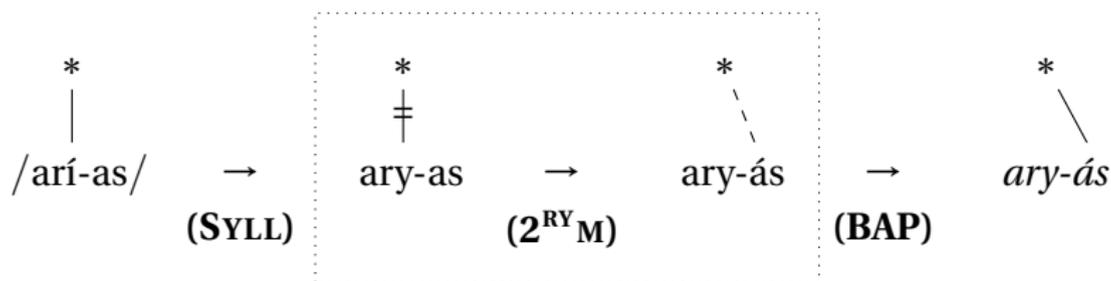
STEP 2: Floating suffixal accent reassociates rightward via 2^{RY}M.

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► Type 1 "secondary mobility" would thus be derived stepwise:

*		*		*		*
$\mid$		$\ddagger$		$\diagdown$		$\diagdown$
/arí-as/	→	ary-as	→	ary-ás	→	*ary-ás*
	(SYLL)		**(2^{RY}M)**		**(BAP)**	

STEP 3: Reassociated accent is assigned stress via BAP.

▶ Problem arises after resyllabification frees accent to reassociate:

```
    *                        *
    |                        ‡
 /arí-as/        →        ary-as
           (SYLL)
```
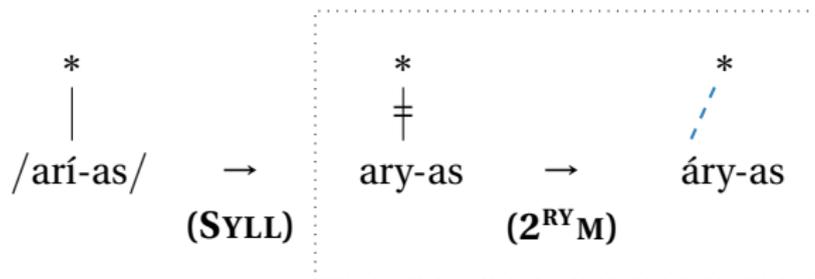
- ▶ Problem arises after resyllabification frees accent to reassociate:
    - ▶ **Rightward migration** can be stipulated in a rule-based analysis.

$$
\begin{array}{ccccc}
* & & * & & * \\
| & & \neq & & \diagdown \\
\text{/arí-as/} & \rightarrow & \text{ary-as} & \rightarrow & \text{ary-ás} \\
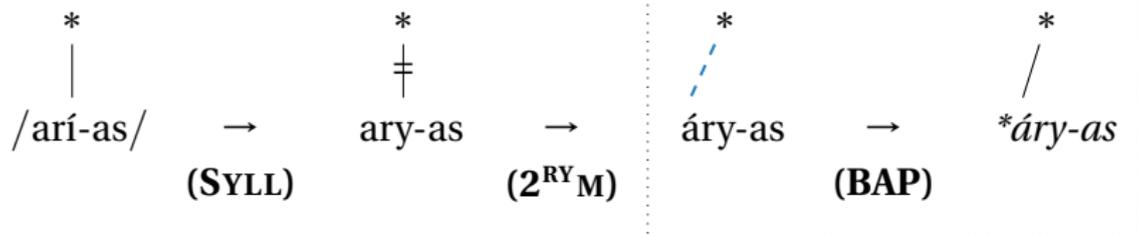& \textbf{(SYLL)} & & \textbf{(2}^{\textbf{RY}}\textbf{M)} &
\end{array}
$$

Analytic comparison — an autosegmental analysis

▶ Problem arises after resyllabification frees accent to reassociate:

  ▶ Rightward migration can be stipulated in a rule-based analysis.

  ▶ But **leftward migration** is expected to satisfy general phonological preference for left edge stress.

$$
\begin{array}{ccccc}
* & & * & & * \\
| & & \ddagger & & / \\
/\text{arí-as}/ & \rightarrow & \text{ary-as} & \rightarrow & \text{áry-as} \\
& (\textsc{Syll}) & & (\textbf{2}^{\textsc{ry}}\textsc{m}) &
\end{array}
$$

Analytic comparison — an autosegmental analysis

▶ Problem arises after resyllabification frees accent to reassociate:

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$$
\begin{array}{ccccccc}
* & & * & & * & & * \\
| & & \ddagger & & {\Large /} & & {\Large /} \\
\text{/arí-as/} & \rightarrow & \text{ary-as} & \rightarrow & \text{áry-as} & \rightarrow & \textit{*áry-as} \\
& \textbf{(SYLL)} & & \textbf{(2}^{\textbf{RY}}\textbf{M)} & & \textbf{(BAP)} &
\end{array}
$$

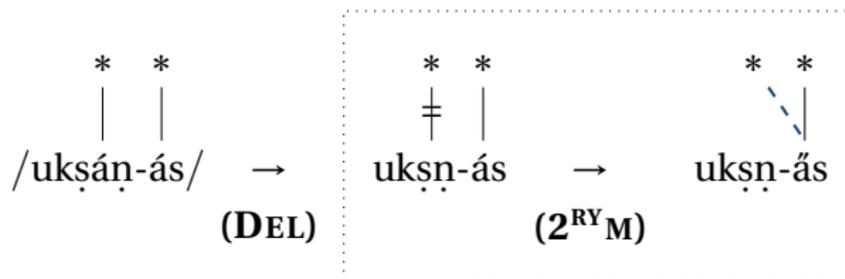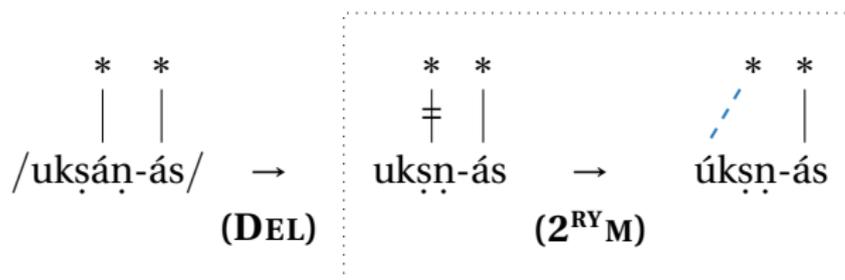⇒ Constraint-based autosegmental analysis wrongly predicts initial stress in type 1.

Analytic comparison — an autosegmental analysis

▶ Same problem in type 3 after deletion frees accent to reassociate:

$$
\begin{array}{ccc}
\overset{*}{\mid}\ \overset{*}{\mid} & & \overset{*}{\ddagger}\ \overset{*}{\mid} \\
/\text{ukṣáṇ-ás}/ & \rightarrow & \text{ukṣṇ-ás} \\
& \textbf{(DEL)} &
\end{array}
$$

- Same problem in type 3 after deletion frees accent to reassociate:
    - **Rightward migration** can be stipulated in a rule-based analysis.

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  ▶ But **leftward migration** is expected to satisfy general phonological preference for left edge stress.

$$\begin{array}{c c c c c}
* \quad * & & * \quad * & & * \quad * \\
| \quad | & & \ddagger \quad | & & \diagup \quad | \\
/\text{uk\d{s}\'{a}\d{n}-\'{a}s}/ & \rightarrow & \text{uk\d{s}\d{n}-\'{a}s} & \rightarrow & \text{\'{u}k\d{s}\d{n}-\'{a}s} \\
& (\textsc{Del}) & & (2^{\textsc{ry}}\textsc{m}) &
\end{array}$$

▶ Same problem in type 3 after deletion frees accent to reassociate:

    ▶ Rightward migration can be stipulated in a rule-based analysis.

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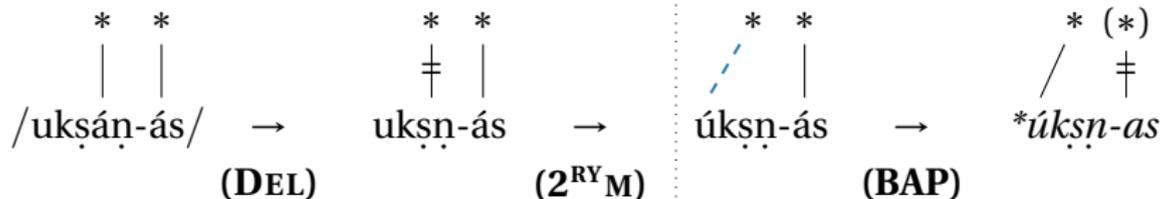
⇒ Constraint-based autosegmental analysis wrongly predicts initial stress in type 3.

Analytic comparison — an autosegmental analysis

▶ Analyses that adopt an autosegmental representation of accentedness (Revithiadou 1999, 2007, Alderete 2001a, *i.a.*) standardly enforce faithfulness with constraints like:

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

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

▶ Consider the derivation below:

$$
\begin{array}{ccc}
* & & * \\
| & & | \\
/\text{pad-}\acute{\text{a}}/ & \rightarrow & pa.(d\acute{a})
\end{array}
$$

✓ no violations

Analytic comparison — an autosegmental analysis

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$$
\begin{array}{ccc}
* & & *\ (*) \\
| & & \vdots\ \ \ \ddagger \\
/\text{pad-á}/ & \rightarrow & \textit{(pá.dā)}
\end{array}
$$

    ✗ violates MAX-PROM, DEP-PROM

Analytic comparison — an autosegmental analysis

▶ Analyses that adopt an autosegmental representation of accentedness (Revithiadou 1999, 2007, Alderete 2001a, *i.a.*) standardly enforce faithfulness with constraints like:

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

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

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

▶ Consider the derivation below:

$$\begin{array}{ccc} * & & * \\ | & & \diagup' \ddagger \\ /\text{pad-}\acute{\bar{\text{a}}}/ & \rightarrow & \textit{(pá.dā)} \end{array}$$

✗ violates *FLOP-PROM.

Analytic comparison — an autosegmental analysis

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$\chi_1 \mathcal{R} \chi_2$ and $\zeta_1 \mathcal{R} \zeta_2$,

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

★ Under formulation in (51), accentual migration does not violate *FLOP-PROM when $\acute{V}$ lacks an output correspondent.

▶ Both type 1 and 2 "secondary mobility" **require** this assumption.

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.

$$\textbf{METRICAL:} \quad \text{CULM} \quad \gg \quad \text{ANCHOR-L} \quad \gg \quad \text{ALL-FEET-L}$$
$$\updownarrow$$
$$\textbf{AUTOSEGMENTAL:} \quad \text{CULM}, \{ \text{*FLOP-PROM} \gg \text{MAX-PROM} \} \gg \text{ALL-FEET-L}$$

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:

(52)

$\overset{*}{\underset{\mid}{/\text{pad-á}/}}$	*FLOP-PROM	MAX-PROM	ALL-FT-L
a. ☞ $\overset{*}{\underset{\mid}{\text{pa.(dá)}}}$			*
b. $\overset{*\;(*)}{\underset{\mid\;\;\ddagger}{\text{(pá.dā)}}}$		*!	
c. $\overset{(*)}{\underset{\diagup\;\ddagger}{\text{(pá.dā)}}}$	*!		

▶ But this ranking fails to capture type 1 "secondary mobility" in Vedic:

(53)

* | /arí-as/	*VV	*FLOP	MAX-PROM	ALL-FT-L

a.   *
   |
   a.(rí.as)
	*!			*

b.   ●   *
     ′
   (ár.yas)				

c.   ☺   *
     \
   ar.(yás)
				*!

d.   * (*)
   |
   (ár.yas)
			*!	

▶ *FLOP is irrelevant when input $\acute{V}$ lacks corresponding V in output.

► But this ranking fails to capture type 1 "secondary mobility" in Vedic:

(53)

	*VV	*FLOP	MAX-PROM	ALL-FT-L
$\overset{*}{\vert}$ /arí-as/				
a. $\overset{*}{\vert}$ a.(rí.as)	*!			*
b. 💣 $\overset{*}{\diagup}$ (ár.yas)				
c. ☹ $\overset{*}{\diagdown}$ ar.(yás)				*!
d. $\overset{* \, (*)}{\vert}$ (ár.yas)			*!	

► Freed to migrate, the accent is predicted to shift **leftward** as in (b).

"Secondary mobility" under an autosegmental analysis

▶ But this ranking fails to capture type 1 "secondary mobility" in Vedic:

(53)

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

▶ But the attested form is (c) with **rightward** reassociation.

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

★ Same problem modeling type 3 (see Appendix I for tableau).

Analytic comparison — summary

▶ Under a metrical representation of lexical accentedness, it is possible to account for:

  ✓ Stress assignment in Vedic and Hittite inflection in general.

  ✓ All three types of "secondary mobility" adduced by Kiparsky (2010).

▶ Under an autosegmental representation of lexical accentedness, it is possible to account for:

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- ⇒ Synchronic analysis of Vedic and Hittite provides support for a metrical representation of lexical accents.

- ▶ **Now** — diachrony.

Predicting morphophonological change in IE

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▶ **Proposal:** Synchronic stress grammar constrains set of possible prosodic innovations in ancient IE languages with lexical accent.

  ⋆ By capturing (i–ii) metrical analysis makes correct predictions about recurring patterns of morphophonological change in IE.

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- ▶ IE languages exhibit certain clear diachronic tendencies in morphophonological change.
- ▶ Intraparadigmatic ablaut — incl. deletion of stem vowels — often eliminated within (pre)histories of individual IE languages.
- ▶ Same diachronic development observed in all nominals with historical "secondary mobility:"
    - ▶ **Loss of stem *V*-deletion ⇒ fixed stem stress on accented vowel.**

"Secondary mobility" in IE — diachronic evidence

- Compare (e.g.):
  - Vedic agent nouns in (54a–b) with type 3 "secondary mobility."
  - Cognate class in Ancient Greek (54c–d) with non-deletion/fixed stem-final stress (^ = HL on bimoraic vowel/diphthong; H = stress):

(54)		STRONG		WEAK	
a.	Ved.	*dā-tā́r-am*	:	*dā-tr-é*	(give-AGT-M.ACC.SG/DAT.SG)
b.	Ved.	*han-tā́r-am*	:	*han-tr-ā́*	(kill-AGT-M.ACC.SG/INS.SG)
c.	AGk.	*do-tḗr*	:	*do-têr-i*	(give-AGT-M.NOM/DAT.SG)
d.	AGk.	*bo-tḗr*	:	*bo-têr-os*	(herd-AGT-M.NOM/GEN.SG)

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(55)

		STRONG		WEAK	
a.	Hitt.	*ḫurdāiš*	:	*ḫurtiya*	(curse-NML-ANIM.NOM.SG/DAT.SG)
		[χʷortː-á:i-s]		[χʷortː-j-á:]	
b.	Hitt.	*linkāuš*	:	*linkiyaš*	(swear-NML-ANIM.ACC.PL/GEN.SG)
		[liŋk-á:(j)-os]		[liŋk-j-á:s]	
c.	AGk.	*peitʰ-ố*	:	*peitʰ-oûs*	(persuade-NML-F.NOM.SG/GEN.SG)
d.	AGk.	*pʰeid-ố*	:	*peitʰ-ôi*	(spare-NML-F.NOM/DAT.SG)

- Greek pattern partially obscured by sound change, but:

NOM.SG *–ố* < *[-ó:i], GEN.SG *–oûs* < *[-ój-os], DAT.SG *–ôi* < *[-ój-i]

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b.	Hitt.	*linkāuš*	:	*linkiyaš*	(swear-NML-ANIM.ACC.PL/GEN.SG)
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⇒ **Loss of stem-final *V*-deletion ⇒ fixed stem-final stress.**

- Loss of deletion also occurs within attested history of Hittite, with consequences for stress.
- (e.g.) Hittite stress-alternating –*ai*-stem nouns in (56a–b) (= (55a–b)) develop innovative weak case forms with non-deletion and fixed stem-final stress (cf. Yates 2019c):

(56)		STRONG		OLD WEAK		NEW WEAK
a.		*ḫurdāiš*	:	*ḫurtiya*	:	*ḫurtāi*
		[χʷortː-á:i-s]		[χʷortː-j-á:]		[χʷortː-á:(j)-i]
b.		*linkāuš*	:	*linkiyaš*	:	*lingayaš*
		[liŋk-á:(j)-os]		[liŋk-j-á:s]		[liŋk-á:j-as]

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▶ Similar situation for type 2 "secondary mobility" in Vedic — examples like (57) show stem-initial /á/-deletion and stress shift in weak cases:

(57)

	STRONG		WEAK	
a.	*sā́nu(-∅)*	:	*snú-ṣu*	(back-N.NOM.SG/LOC.PL)
b.	*dā́ru(-∅)*	:	*drú-ṇā*	(wood-N.NOM.SG/INS)

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cf. AGk.		*gónu*	:	*gnú-si*	(knee-N.NOM.SG/LOC.PL)
				(*h.Merc 152*)	

- Older pattern is clearly deletion, traces of which are seen in Greek.

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b.	*dā́ru(-∅)*	:	*drú-ṇā*	cf.	*sā́nu-nā*	(wood/back-N.NOM.SG/INS)
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Constraining prosodic change

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(59)		STRONG		WEAK	
a.	Hitt.	[liŋk-áːj-os]	:	[liŋk-j-áːs]	(swear-NML-ACC.PL/GEN.SG)
>	Ps.-Hitt.	[liŋk-áːj-os]	:	ˣ[liŋk-aj-áːs]	cf. Hitt. [liŋk-áːj-as]
b.	Ved.	*sā́nu(-∅)*	:	*snú-ṣu*	(back-N.NOM.SG/LOC.PL)
>	Ps.-Ved.	*sā́nu(-∅)*	:	ˣ*sānú-ṣu*	cf. Ved. *sā́nu-ṣu*

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► Changes like (59) in principle possible by intraparadigmatic analogy.

  ► Bidirectional leveling? (often invoked in IEist lit.; see Garrett 2011)

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- ▶ Changes like (59) in principle possible by intraparadigmatic analogy.
- ▶ **Claim**: These are ruled out by synchronic stress grammar.

Constraining prosodic change — Hittite/Vedic

▶ Stress ranking in Hittite (and Vedic) predicts two outputs in weak prevocalic cases of type 3 depending on whether deletion applies.

(60)

link-$_i$(aj-$_j$(as	CULM	ANCH-L	ALL-FT-L
a. ☞ liŋ.(kjáːs)			∗
b. $_{ij}$(líŋ.kjas)		∗!∗	
c. liŋ.$_{ij}$(káː.jas)		∗!	∗
d. liŋ.ka.$_{ij}$(jáːs)		∗!	∗∗
e. $_{ij}$(líŋ.ka).jas		∗!∗	

▶ Deletion applies regularly in early Hittite:

⇒ (a) with "secondary mobility" preferred to (b) by satisfying ANCHOR-L.

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e. $_{ij}$(líŋ.ka).jas		∗∗!	

▶ Deletion fails to apply in later Hittite:

⇒ (c) with stem-final stress preferred to (d) with stressed ending by ALL-FT-L.

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d. liŋ.ka.$_{ij}$(jáːs)		$*$	$**!$
e. $_{ij}$(líŋ.ka).jas		$**!$	

★ (d)-like candidates (i.e., mobility without deletion) cannot arise while Hittite(/Vedic) stress grammar is stably maintained.

Constraining prosodic change — Greek

- ▶ Inheritance of Hittite/Vedic-like stress grammar into Greek would explain emergence of fixed stem-final stress in nominals that historically showed type 3 "secondary mobility."
- ▶ Type 3 "secondary mobility" clearly inherited into Greek:
  - ▶ Only non-deletion/stem-final stress in agent nouns — e.g., (62a–b) .
  - ▶ But deletion/mobility preserved in kinship terms — e.g., (62c–d) .

(62)		STRONG		WEAK	
a.	AGk.	*do-têr-a*	:	*dot-êr-i*	(give-AGT-M.ACC/DAT.SG)
b.	AGk.	*bo-têr-a*	:	*bo-têr-os*	(herd-AGT-M.ACC/GEN.SG)
c.	AGk.	*patér-a*	:	*patr-í*	(father-M.NOM/DAT.SG)
d.	AGk.	*tʰugatér-a*	:	*tʰugatr-ós*	(daughter-F.ACC/GEN.SG)

⇒ Elimination of deletion/mobility in (62a–b) was a Greek innovation.

► Diachronic development of Greek agent nouns predicted if inherited stress grammar outlasts vowel deletion:

(63)

do-$_i$(tēr-$_j$(i	CULM	ANCH-L	ALL-FT-L
a. ☞ do.(trí)			∗
b. $_{ij}$(dót.ri)		∗!∗	
c. do.$_{ij}$(tê).ri		∗!	∗
d. do.tē.$_{ij}$(rí)		∗!	∗∗
e. $_{ij}$(dó).tē.ri		∗!∗	

► Pre-Greek had regular vowel deletion:

⇒ (a) with "secondary mobility" was selected (cf. Ved. *dā-tr-é*).

▶ Diachronic development of Greek agent nouns predicted if inherited stress grammar outlasts vowel deletion:

(64)

do-*i*(tēr-*j*(i	Culm	Anch-L	All-Ft-L
a. do.(trí)			∗
b. *ij*(dó͟t.ri)		∗!∗	
c. ☞ do.*ij*(tê).ri		∗	∗
d. do.tē͟.*ij*(rí)		∗	∗∗!
e. *ij*(dó͟).tē͟.ri		∗!∗	

▶ Vowel deletion eventually lost within Greek:

⇒ (c) preferred to (d) with stressed ending by All-Ft-L.

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e. $_{ij}$(dó).tē.ri		*!*	

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★ (c) is attested (AGk. *do-têr-i*), whereas (d)-like forms are unattested.

Predicting morphophonological change — summary

- Ancient IE languages with lexical accent show the same pattern of morphophonological change:

  - Loss of vowel deletion in nominals that historically showed **rightward stress shift when accented stem vowels were deleted**.
  - Emergence of fixed stress on their accented stem-vowel.

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- This recurring pattern is predicted if synchronic stress grammar observed in Hittite/Vedic is stably maintained diachronically.

  - Unattested forms with mobility but no deletion are ruled out by **phonological preference for left edge stress**.

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    - Unattested forms with mobility but no deletion are ruled out by **phonological preference for left edge stress**.

- Metrical representation of accentedness is necessary to model this synchronic grammar and thus to correctly predict these diachronic developments.

Discussion

- ▶ Analyses employing metrical or autosegmental representations of lexical accentedness make predictions that are broadly similar.
- ▶ But these predictions differ when an accented vocalic peak lacks an output correspondent (due to vowel deletion, glide formation, etc.).
- ▶ **In this special case, Vedic Sanskrit and Hittite support the metrical representation**, providing a principled explanation for simultaneous:
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    ✓ Phonological preference for left edge stress.
    ✓ Rightward stress shifts when accented syllable peaks are eliminated in the output.

▶ Diachronic development of IE word prosody also support the metrical representation of accentedness, which is necessary to:

    ✓ Correctly predict recurring patterns of morphophonological change.

Discussion

▶ Future work:

(i) Extending proposal to "pre-accenting" and "post-accenting" morphemes.

  ▶ "Pre-accenting" morphemes common in LA systems (Vedic, Cupeño, etc.) and analyzed metrically in Turkish (Özçelik 2014, Yawney 2018).
  ▶ Both types attested in Modern Greek (Revithiadou 1999, 2007).

(ii) Further empirical testing — in IE and elsewhere.

  ★ (More) languages with lexical accent and vowel deletion needed!

Thank you!

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References I

Alderete, John D. 2001a. *Morphologically Governed Accent in Optimality Theory*. New York: Routledge.

———. 2001b. Root-Controlled Accent in Cupeño. *Natural Language & Linguistic Theory* 19(3).455–502.

Baković, Eric. 2011. Opacity and Ordering. In John Goldsmith, Jason Riggle and Alan C. Yu (eds.), *The Handbook of Phonological Theory*, 40–67. Malden, MA / Oxford: Blackwell, 2 edn.

Garrett, Andrew. 2011. Verner's Law Nominal Doublets: Bidirectional Leveling or Accent Shift. Paper presented at the 30th Annual East Coast Indo-European Conference, Cambridge, MA.

Hill, Jane H. 2005. *A Grammar of Cupeño*. Los Angeles / Berkeley, CA: University of California Press.

Hill, Jane H., and Kenneth C. Hill. 1968. Stress in the Cupan (Uto-Aztecan) Languages. *International Journal of American Linguistics* 34(4).233–241.

Hrozný, Friedrich. 1917. *Die Sprache der Hethiter*. Leipzig: J.C. Hinrichs.

van der Hulst, Harry. 2014. The study of word accent and stress: Past, present, and future. In Harry Van der Hulst (ed.), *Word Stress: Theoretical and Typological Issues*, 3–55. Cambridge, UK / New York: Cambridge University Press.

Hyman, Larry. 2006. Word prosodic typology. *Phonology* 2.225–257.

Inkelas, Sharon. 1999. Exceptional Stress-Attracting Suffixes in Turkish: Representation vs. the Grammar. In René Kager, Harry van der Hulst and Wim Zonneveld (eds.), *The Prosody-Morphology Interface*, 134–187. Cambridge / New York: Cambridge University Press.

Jamison, Stephanie W., and Joel P. Brereton. 2014. *The Rigveda: The Earliest Religious Poetry of India*. Oxford / New York: Oxford University Press.

Kimball, Sara. 1999. *Hittite Historical Phonology*. Innsbruck: Institut für Sprachwissenschaft der Universität Innsbruck.

Kiparsky, Paul. 2010. Compositional vs. Paradigmatic Approaches to Accent and Ablaut. In Stephanie W. Jamison, H. Craig Melchert and Brent Vine (eds.), *Proceedings of the 21st Annual UCLA Indo-European Conference, Los Angeles, October 30-31, 2009*, 137–181. Bremen: Hempen.

Kiparsky, Paul, and Morris Halle. 1977. Towards a Reconstruction of the Indo-European Accent. In Larry Hyman (ed.), *Studies in Stress and Accent*, 209–238. Los Angeles: University of Southern California Press.

Lundquist, Jesse. 2015. On the Accentuation of Vedic –ti– Abstracts: Evidence for Accentual Change. *Indo-European Linguistics* 3.42–72.

Özçelik, Öner. 2014. Prosodic faithfulness to foot edges: The case of Turkish stress. *Phonology* 31.229–269.

Probert, Philomen. 2006. *Ancient Greek Accentuation: Synchronic Patterns, Frequency Effects, and Prehistory*. Oxford / New York: Oxford University Press.

Revithiadou, Anthi. 1999. Headmost Accent Wins: Head Dominance and Ideal Prosodic Form in Lexical Accent Systems. Ph.D. diss., Leiden University.

———. 2007. Colored turbid accents and containment: A case study from lexical stress. In Sylvia Blaho, Patrik Bye and Martin Krämer (eds.), *Freedom of Analysis?*, 149–174. Berlin / New York: de Gruyter.

Sandell, Ryan. 2015. Productivity in Historical Linguistics: Computational Perspectives on Word Formation in Ancient Greek and Sanskrit. Ph.D. diss., University of California, Los Angeles.

Yates, Anthony D. 2014. On Proto-Anatolian Verbal Ablaut: The Hittite *ašanzi*-Type Reexamined. Paper presented at the Kyoto-UCLA Indo-European Workshop, Kyoto, 24-26 March 2014 (Handout available at: http://www.adyates.com/research/).

———. 2015. Anatolian Default Accentuation and its Diachronic Consequences. *Indo-European Linguistics* 3.145–187.

———. 2016. Stress assignment in Hittite and Proto-Indo-European. *Proceedings of the Linguistic Society of America* 1.25/1–15.

———. 2017a. Against Root Faithfulness in Cupeño Stress. In Karen Jesney, Charlie O'Hara and Caitlin Smith (eds.), *Supplemental Proceedings of the 2016 Annual Meeting on Phonology*, 1–11.

———. 2017b. Lexical Accent in Cupeño, Hittite, and Indo-European. Ph.D. diss., University of California, Los Angeles.

———. 2019a. Hittite *paḫḫweni*, Greek πυρί, and their implications for Indo-European ablaut. Paper presented at the 38th Annual East Coast Indo-European Conference, Philadelphia, 20–22 June 2019 (Handout available at: http://www.adyates.com/research/).

———. 2019b. Indo-European "secondary mobility" and its implications for accentedness. Paper presented at the 4th Edinburgh Symposium on Historical Phonology, Edinburgh, 9 December 2019 (Handout available at: http://www.adyates.com/research/).

———. 2019c. Suffixal *o*-vocalism without "amphikinesis:" On Proto-Indo-European *–oi*-stems and ablaut as a diagnostic for word stress. In David M. Goldstein, Stephanie W. Jamison and Brent Vine (eds.), *Proceedings of the 30th Annual UCLA Indo-European Conference*, 199–221. Bremen: Hempen.

Yawney, Heather L. 2018. On the right to be faithful: The irregular stress of Turkish adverbials with *–En. Toronto Working Papers in Linguistics* 40.1–16.

▶ Established ranking also fails to capture type 3 "secondary mobility" in Vedic and Hittite:

(65)

＊ ＊ ｜ ｜ ukṣán-ás		CULM	*FLOP	MAX-PR	ALL-FT-L
a.	＊ ＊ ｜ (úk).(ṣnás)		*!			*
b.	☺	(＊)＊ ｜ uk.(ṣnás)			*	*!
c.	💣	＊ (＊) ≠ (úk.ṣnas)			*	

▶ *FLOP is irrelevant when input $\acute{V}$ lacks corresponding V in output.

- Established ranking also fails to capture type 3 "secondary mobility" in Vedic and Hittite:

(65)

		CULM	*FLOP	MAX-PR	ALL-FT-L
	* * | | ukṣán-ás				
a.	* * | (úk).(ṣnás)	*!			*
b. ☺	(*)* | uk.(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).

▶ Established ranking also fails to capture type 3 "secondary mobility" in Vedic and Hittite:

(65)

$$\begin{array}{cc} * & * \\ | & | \\ \text{uk\d{s}án-ás} \end{array}$$	CULM	*FLOP	MAX-PR	ALL-FT-L
a. $\quad\begin{array}{c} * \;* \\ \diagup\;\; | \\ (\text{úk}).(\text{\d{s}nás}) \end{array}$	*!			*
b. ☺ $\begin{array}{c} (*)* \\ | \\ \text{uk}.(\text{\d{s}nás}) \end{array}$			*	*!
c. 💣 $\begin{array}{c} *\,(*) \\ \neq \\ (\text{úk}.\text{\d{s}nas}) \end{array}$			*	

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

On "pre-" and "post-accenting" morphemes

- ▶ The metrical analysis can also be extended straightforwardly to:

    (i) "Post-accenting" morphemes, which (in a trochaic language) have a lexical left foot edge at their right edge, as in (a).

    a. /CV(-CVCV/   →   CV.(CV́.CV)   *(post-accenting prefix)*

- ▶ Accounting for "post-accenting" under this approach does not require positing empty vocalic positions (cf. Revithiadou 2007).

On "pre-" and "post-accenting" morphemes

▶ The metrical analysis can also be extended straightforwardly to:

   (i) "Post-accenting" morphemes, which (in a trochaic language) have a lexical left foot edge at their right edge, as in (a).

   (ii) "Pre-accenting" morphemes, which contain a right foot edge, as in (b).

   a.   /CV(-CVCV/   →   CV.(CV́.CV)   *(post-accenting prefix)*

   b.   /CVCV-CV)/   →   CV.(CV́.CV)   *(pre-accenting suffix)*

▶ Using a single (left) foot edge to represent foot head allows for representation of foot "tail" with the opposite (= right) edge, with both preserved in output by high-ranking faithfulness (ANCHOR-L/R).

- A major question thus far unaddressed:

- ▶ A major question thus far unaddressed:

  - ○ **What causes vowel deletion in ancient IE languages?**

Historical development of IE vowel deletion

- ▶ A major question thus far unaddressed:

  - ◦ **What causes vowel deletion in ancient IE languages?**

- ▶ Metrical analysis correctly accounts for stress assignment when deletion applies (and does not), but its motivation has been ignored.

Historical development of IE vowel deletion

- ▶ A major question thus far unaddressed:

  - ○ **What causes vowel deletion in ancient IE languages?**

- ▶ Metrical analysis correctly accounts for stress assignment when deletion applies (and does not), but its motivation has been ignored.

- ▶ Starting point — conditions on vowel deletion differ in Hittite and Vedic:

  - ▶ In Vedic deletion is morphophonological.
  - ▶ In Hittite deletion is phonological (under metrical analysis).

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

  (66) 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., (58a) vs. (58b):

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

   b. Ved. /pi(tar-(bhis/ → *pi(tŕ.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:

(68)

	pi$_i$(tar-$_j$(bhis	SSP	Culm	Anch-L	All-Ft-L	Max-V
a.	pi.$_i$(tŕ).$_j$(bhís)		*!		***	*
b. ☞	pi.$_{ij}$(tɍ̥.bhis)			*	*	*
c.	pi.tɍ̥.$_{ij}$(bhís)			*	**!	*
d.	pitr.$_{ij}$(bhís)	*!			*	*
e.	$_{ij}$(pí.tɍ̥).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 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):

(69) 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 (60b) 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:

  (70) PRETONIC VOWEL DELETION (PVD): /e, a/ → ∅ / ___ $\acute{\sigma}$
       "/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):

  (71) *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.

(72)

	pi.$_i$(sen-$_j$(as	CULM	ANCH-L	ALL-FT-L	*PRE-V́	MAX-V
a.	pi.$_i$(séː).$_j$(náːs)	*!		***		
b.	pi.$_{ij}$(séː.nas)		*!	*		
c. ☞	pis.$_{ij}$(náːs)			*		*
d.	pi.se.$_{ij}$(náːs)		*!	**	*	
e.	$_{ij}$(píː.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.

(73)

	paχ:*i*(wén-*j*(i	SSP	CULM	ANCH-L	ALL-FT-L	*PRE-V́	MAX-V
a.	paχ.*i*(χ^{w}é:).*j*(ní:)		*!		***		
b. ☞	paχ.*ij*(χ^{w}é:.ni)			*	*		
c.	paχ.*ij*(χó:.ni)			*	*		*!
d.	pax.χo.*ij*(ní:)			**!	**		*
e.	*ij*(pχ^w:é:.ni)	*!		*			*
f.	*ij*(páx.χ^{w}e).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.

Diachrony of vowel deletion in IE

- **Proposal:** In PIE vowel deletion was stress conditioned, occurring only where it was prosodically optimizing (cf. Yates 2019a,b)

    - Hittite preserves the inherited situation.
    - In PNIE phonological vowel deletion was reanalyzed as a morphophonological process (≈ "Zero-Grade") and extended into new environments (i.e., over-generalized).

- Much more work needed to determine:

    - Precise synchronic conditions for application of vowel deletion in Vedic and other NIE languages.
    - How this "over-generalization" may have occurred diachronically.