An Updated Treatment of Recessive Accentuation in Attic-Ionic Greek: Optimizing the Golstonian Analysis

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1 Goals and Background on Ancient Greek Prosody

1. **Today's Goal:** Develop a constraint-based phonological analysis for the assignment of "recessive accentuation" in Attic-Ionic Greek within an Autosegmental-Metrical (AM) framework.

    - See Section **2.** and Appendix A on defining "recessive accentuation" and the situation of its place in the larger word-level prosody of Attic-Ionic.
    - Constraint-Based: Optimality-Theoretic (OT; Prince and Smolensky 1993 [2004]) implementation, though constraints are assumed to possess continuous weights (i.e., Harmonic Grammar, MaxEnt Grammar, or similar).
    - Autosegmental-Metrical: prosodic structures, their relations of prominence, and their edges define the sites of association for intonational elements (tunes potentially consisting of tones, pitch accents, and boundary tones).
        - See Arvaniti and Fletcher 2020 for a brief introduction, in more detail in Ladd 2008 (esp. Ch. 2, 4, 8).
        - On the implementation of AM-like analyses for the association of tone to prosodic structure in constraint grammars, see Gussenhoven 2004: Ch. 8.

2. **Why Attic-Ionic?**

    - Easy Answer: it is essentially for this dialect group of the 1st millennium BCE for which we have extensive evidence concerning its prosodic system (see Probert 2006b: Ch. 1 for a survey of this evidence).
    - What may be said about the recessive accent of Attic-Ionic likely applies to at least Lesbian, too (see Probert 2003: 159–60, Probert 2006b: 72–3).
    - A distinct "Doric" word-prosody evidently existed, which differed slightly from the Attic-Ionic system (see Probert 2003: 160–2, Probert 2006b: 71–2).
        - Treatment of the "Doric" data in Sandell 2023: 616–22 concludes that the differences vis-à-vis Attic-Ionic are largely explicable by reference to one prosodic parameter: final consonant extrametricality (active in Attic-Ionic, not in Doric).

3. **Basic Assumptions about the Prosodic Typology of Attic-Ionic Greek**

    - Three major features:
        a. Metrically governed and obligatory stress (stress window at the right edge of the word).
        b. Pitch accents (= starred tones in AM) automatically inserted and obligatory in each prosodic word (ω) = "prominence tone".
        c. Privative lexical contrast between lexical entries marked with High tone, /H*/, versus no tone, /∅/.
    - Parallel: Stockholm Swedish (Riad 2012, Riad 2014) and other varieties of Swedish and Norwegian.

- Stress present (though not restricted to a window), default word-level pitch accents ("prominence tone"), privative lexical tonal contrast (Accent 1 vs. Accent 2).
- On obligatory word-level pitch accents, compare Hellmuth 2007 on Egyptian Arabic (metrically determined stress with LH* intonation in every ω).

4. That the "recessive" pattern constitutes the operation of "default" word-level prosodic rules in Attic-Ionic has been evident since at least Steriade 1988: 272–81.

   - The high type frequency of recessively accented lexemes, and the fact that entire large classes of words are almost exceptionlessly accented recessively, make this conclusion intuitively attractive.
   - Arguments from diachronic accent-shift at the level of individual lexemes adduced by Probert (2006a, 2006b: Ch. 5; 289–300) and Yates (2022: 258–9) further support this assumption.

5. Questions for analysis:

   a. How is the position of (default) stress calculated?
   b. What default word-level intonation should be posited?
   c. What is the relationship between stress and tone?

   ☞ Providing an analysis that answers these questions then constitutes an account of recessive accentuation.

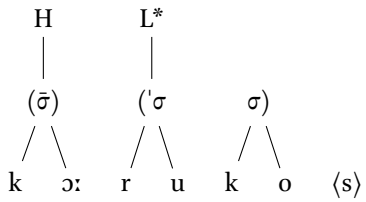
6. Answers given by Golston (1990) to questions in **5.**:

   - Primary stress falls on the rightmost moraic trochee, given final consonant extrametricality (i.e., a final VV- or VCC-syllable, else the penult).

     (1) Foot Construction for /kɔːrukos/ 'leather sack' (κώρυκος)
     a. Final Consonant Exametricality: kɔː.ru.ko⟨s⟩
     b. Moraic Trochee Formation 1: kɔː.(ru.ko)⟨s⟩
     c. Moraic Trochee Formation 2: (kɔː).(ru.ko)⟨s⟩

   - Prosodic words without lexical tone bear a HL* intonation.
   - L* associates to the primary stress, H to its immediate left.

     (2) κώρυκος = [(kɔ́ː).(ˈrù.ko)⟨s⟩]



7. **Why "optimize" Golston's analysis?**

   - Golston himself is not fully explicit on how the position of H is to be determined in a handful of possible patterns.
   - No fully explicit constraint-based implementation of the metrical stress constraints and tone-to-stress mappings of Attic-Ionic yet exists in the literature (partial work in Kiparsky 2003, Blumenfeld 2005).
   - Now possible to exploit advances in the typology of "pitch-accent" systems, constraints governing stress assignment, and constraints on tonal association to develop an analysis of "default" word prosody.

   ⇒ This lays the groundwork for treating "exceptional" (i.e., non-recessive) word-prosodic patterns in Attic-Ionic.

   - Not addressed today: accentuation of enclitic sequences.

8. **Roadmap:**

   - Defining "recessive accentuation": What does the relevant data look like? (Section 2)
   - Sketching the Golstonian analysis of recessive accentuation: What does Golston (1990) explicitly predict? (Section 3)
   - Optimizing the Golstonian analysis: How can we improve? (Section 4)
   - Appendix A: More data on recessive accentuation
   - Appendix B: Existing analytical alternatives to the Golstonian analysis
   - Appendix C: Constraint definitions

2 Defining "Recessive Accentuation"

9. **Basic Definition**

   (3) Recessive Accent: A word form is recessively accented if the H tone occurs as far to the left as permitted by the Law of Limitation (LoL).

   ⇒ Two questions:
   - What is a proper definition of the LoL?
   - What exactly is counted in determining the range of "as far to the left"?

10. On the Law of Limitation

    (4) Law of Limitation: High tone (acute or circumflex accent) is restricted to the rightmost two syllables of a prosodic word (ω) if the final syllable is heavy (= VV or VCC), and is restricted to the rightmost three syllables of a word if the final syllable is light (= V(C)).

    - See Appendix A for a more explicit definition and further examples.

    (5) Ungrammatical Structures under the LoL
    a. Preantepenultimate High Tone: *[σ́ σ σ σ]
    b. Antepenultimate High Tone when final is heavy: *[σ́ σ VV], *[σ́ σ VCC]

11. **(Potentially) Recessive Accent Patterns**

    a. Word of three of more syllables:
        · acute on antepenult (e.g., ἄνθρωπος).
        · circumflex on VV-penult before a V̆CC-final (e.g., πολυπῖδαξ; Lex σωτῆρα).
        · acute on penult before a VV-final (e.g., ἀλκίμους).

    b. Disyllables:
        · circumflex on VV-penult before a V(C(C))-final (e.g., κῆρυξ)
        · Acute on a V-penult (e.g., πόλις)

    c. Monosyllables: circumflex (e.g., μῦς)

    ☞ Among monosyllables there are credible reasons to think that the circumflex is the "unmarked" intonational pattern.
        · Contrasts like πούς 'foot' vs. μῦς 'mouse' or κήρ 'fate' vs. κῆρ 'heart' obviously cannot be due to a difference in *stress*, but only a difference in *tone/intonation*.
        · Monosyllabic verbs with VV nucleus are almost exceptionlessly circumflex, e.g.: βῆ 'go:aor.3sg', θοῦ 'put:aor.ipv.mid.sg'); cf. Vendryes 1904 [1945]: 111.

    ⇒ Further implication: an intonational pattern that can generate a circumflex on monosyllables should be assumed to be present in all recessive words.

12. Caution: All surface accent patterns (except circumflex on monosyllables) can also reflect faithful realization of a lexical accent (/H*/).

    ⇒ Whether a word form's accentuation is truly due to the default pattern must be determined based on paradigmatic knowledge.

3 The Analysis of Golston 1990

13. The treatment of recessive accentuation and accentuation in enclitic sequences offered in Golston 1990 departs from the assumption that word-level metrical structure (= foot construction) plays a crucial role in determining the position of Attic-Ionic High tone.

    · Golston shares this basic assumption with and builds upon work in Sauzet 1989 and Steriade 1988, which in turn trace the assumption of a role for stress in Attic-Ionic prosody back to Allen (Allen 1966a, Allen 1973: 333–4).

    · Steriade, Sauzet, and Golston all further share some specific features in their approach to recessive accentuation, outlined in (6).

    (6) Shared analytical assumptions of Steriade 1988, Sauzet 1989, and Golston 1990
        a. Word-final consonants are extrametrical (NonFinality-ϝ ≫ Parse-C)
        b. Feet are trochaic (Trochee ≫ Iamb)
        c. Feet are constructed from right to left (All-Feet-Right ≫ All-Feet-Left)
        d. The rightmost foot receives the primary prosodic prominence (Rightmost ≫ Leftmost)

14. Golston's approach differs from Steriade's and Sauzet's analyses on several crucial points, however:

    - Steriade and Sauzet take the feet to be quantity insensitive (syllabic trochees), whereas Golston operates with moraic trochees.
    - Steriade stipulates that final light syllables – [V̆] or [V̆C] – are further subject to final syllable extrametricality.
    - Steriade holds that the foot receiving primary prosodic prominence receives an H*, whereas Sauzet and Golston presume a tonal sequence H+L*: the L* tone docks to the stressed syllable, leaving the H tone to be aligned with the immediately preceding syllable, where possible.

15. Crucially, Golston (following Sauzet) allows for primary *stress* to be disassociated from the F0 peak of the word defined by the H portion of the default H+L* intonation.

    - An acute accent in a recessively accented word can thus usually be understood as preceding the syllable with primary stress.
    - Recessively accented words with a circumflex accent might be interpreted as associating the entire H+L* intonation with a single syllable.

16. In terms of a parametric stress grammar modeled on Hayes 1995, Golston's analysis looks as in (7).

    (7) Parametric Stress Grammar for Attic-Ionic Greek (after Golston 1990: 74)
        a. **Foot Shape:** Moraic Trochee (ƒ = – or ⏑ ⏑)
        b. **Extrametricality:** Final Consonant
        c. **Direction of Parsing:** Right-to-left
        d. **End Rule:** Right

17. Derivations in the table under (8) illustrate foot construction and the assignment of primary stress in a number of recessively accented nominal forms according to the grammar in (7).

    - After stress assignment, L* associates to the metrically prominent syllable, then H associates immediately before it.
    - I will represent tone association here as linking to syllables for consistency with the analysis under Section 4.
    - Note Golston's (1990: 72) statement: "[Rule] (16c) maps L* onto the prominent *syllable* and maps H onto whatever [vocalic?] *mora* precedes that syllable."

(8) Derivations of Stress and Pitch Accent Assignment after Golston 1990

tʰɔ:.ra:ks 'armor:NOM.SG'	al.ki.mos 'mighty:NOM.SG'	al.ki.mo:s 'id.ACC.PL'	an.tʰrɔ:.po: 'man:GEN.SG'	pai.do.trips 'trainer:NOM.SG'	**Syllabified Input**
tʰɔ:.ra:k⟨s⟩	al.ki.mo⟨s⟩	al.ki.mo:⟨s⟩	—	pai.do.trip⟨s⟩	Final C ExM
(tʰɔ:).(ra:k)⟨s⟩	(al).(ki.mo)⟨s⟩	(al).ki.(mo:)⟨s⟩	(an).(tʰrɔ:).(po:)	(pai).do.(trip)⟨s⟩	Moraic Trochees R-to-L
(tʰɔ:).(ˈra:k)⟨s⟩	(al).(ˈki.mo)⟨s⟩	(al).ki.(ˈmo:)⟨s⟩	(an).(tʰrɔ:).(ˈpo:)	(pai).do.(ˈtrip)⟨s⟩	End Rule Right
H L* (σ̄) (ˈσ̄) tʰɔ: ra:k⟨s⟩	H L* (σ̄) (ˈσ σ) al ki mo⟨s⟩	H L* (σ̄) σ (ˈσ̄) al ki mo:⟨s⟩	H L* (σ̄) (σ̄) (ˈσ̄) an tʰrɔ: po:	H L* (σ̄) σ (ˈσ̄) pai do trip⟨s⟩	L* Association
H L* (σ̄) (ˈσ̄) tʰɔ: ra:k⟨s⟩	H L* (σ̄) (ˈσ σ) al ki mo⟨s⟩	H L* (σ̄) σ (ˈσ̄) al ki mo:⟨s⟩	H L* (σ̄) (σ̄) (ˈσ̄) an tʰrɔ: po:	H L* (σ̄) σ (ˈσ̄) pai do trip⟨s⟩	H Association
H L* (σ̄) (ˈσ̄) tʰɔ: ra:k⟨s⟩ θώρᾱξ	H L* (σ̄) (ˈσ σ) al ki mo⟨s⟩ ἄλκιμος	H L* (σ̄) σ (ˈσ̄) al ki mo:⟨s⟩ ἀλκίμους	H L* (σ̄) (ˈσ̄) (ˈσ̄) an tʰrɔ: po: ἀνθρώπου	H L* (σ̄) σ (ˈσ̄) pai do trip⟨s⟩ παιδότριψ	**Output**

- Heavy final syllables build a bimoraic foot, receive stress, and produce a high tone on the penult. H may associate with a heavy syllable, a light syllable in the weak part of a foot, or an unfooted syllable.
- Light final syllables either remain unparsed or build the weak part of a trochaic foot. High tone then falls on the antepenult.

18. Within orthotonic words, the treatment in Golston 1990 straightforwardly handles most, but not all, possible patterns.

(9) Unproblematic:

a. [VV(C)], e.g., μῦς 'mouse:NOM.SG'
b. [V VCC], e.g., κόρᾰξ 'crow:NOM.SG'
c. [V VVCC], e.g., πίθηξ 'dwarf:NOM.SG'
d. [VV VVCC], e.g., θώρᾱξ 'armor:NOM.SG'
e. [σ_1 V V(C)], e.g., ἄλκιμος 'mighty:NOM.SG'
f. [σ_1 VV VC], e.g., ἄνθρωπος 'man:NOM.SG'
g. [σ_1 V VV(C)], e.g., ἀλκίμους 'mighty:ACC.PL'
h. [σ_1 VV VV(C)], e.g., ἀνθρώπου 'man:GEN.SG'
i. [σ_1 V VCC], e.g., παιδότριψ 'trainer:NOM.SG'

(10) Less clear:
   a. [V V(C)], e.g., φίλος 'friend:NOM.SG',
   b. [VV VCC], e.g., κῆρῠξ 'herald:NOM.SG'
   c. [σ_1 VV VCC], e.g., πολυπῖδᾰξ 'having many springs:NOM.SG'

19. In the unproblematic cases in (9), the position of the H tone directly falls out from the position of the primary stress: the rightmost heavy syllable or trochaic sequence of two light syllables receives primary stress, L* associates to that stressed syllable, and H to the immediately preceding syllable.

    · In monosyllables, the only syllable available hosts both tones, thus producing a circumflex (if the form is not already lexically prespecified as associated with a high tone [= acute]).

20. The less clear cases in (10) are of two sorts: 1) forms with a VV penult preceding a V̆CC final (κῆρῠξ, πολυπῖδᾰξ); 2) disyllables of just two morae predicted to have stress on the initial syllable.

    · The latter issue is explicitly addressed: "…the L* has been delinked because contour tones are not allowed in AG on monomoraic segments" (Golston 1990: 75).
    This observation can potentially be captured through a suitable ranking of constraints on Tone-to-TBU and TBU-to-Tone association, tone preservation, and markedness constraints on tonal association.

    · The former issue is not mentioned. In a derivational framework that treats the LEX σωτῆρα as a process that transforms H → HL, foot formation and tone association could proceed as normal.
    In a non-derivational framework, this is harder without employing an *ad hoc* markedness constraint such as *μμ́.μ]$_\omega$ "no high tone on the second mora of a penultimate syllable if the final is monomoraic" (as in Kiparsky 2003).

    · In precisely cases like κῆρῠξ and πολυπῖδᾰξ, it is tempting to think that the entire H+L* sequence is associated with the penultimate rather than the final syllable.

    · But if so, the forms would pose problems in two different ways:
      1. Why is L* not associated with the rightmost heavy syllable (^{X}κήρῠξ, ^{X}πολυπίδαξ)
      2. In forms like πολυπῖδᾰξ specifically, if L* is associated with the penult, why does H not fall on the antepenult (as in ἄνθρωπος)?

21. Possible explanation for the type κῆρῠξ / πολυπῖδᾰξ: another tone!

    · Specifically, a word-level low-boundary tone, L% (better: L_ω).

    · First suggested by Devine and Stephens (1994: 180, 187–9), argued for in detail in Gunkel 2023.

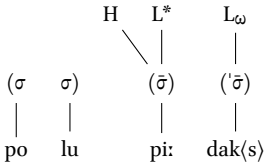
    · Phonological evidence: LEX σωτῆρα (as here), "lulling" (grave formation).

    · Musical evidence: setting of proparoxytones (Devine and Stephens), turning points between falling and rising melody (Gunkel).

    · Three connected hypotheses about the L_ω tone:
      1) must be linked to the final syllable (∼ vocalic mora) of every (recursive) prosodic word;
      2) should not (normally) be crowded onto a syllable with a short vowel with other tones;
      3) L% should not not stand directly adjacent to a High tone on the tonal tier.

    · The tonal associations for a form like πολυπῖδαξ could then look as in (11). Note, however, that a one-to-one association of the primary stress and the L* pitch accent is then broken.

(11) πολυπῖδαξ ‘having many springs:NOM.SG’ with L_ω tone



- Conceivable upshot: L* is not present in inputs to the phonology at all, but is instead an epenthetic tone, inserted, where possible, to satisfy *[H L_ω] (“no adjacency of H and L_ω on the tonal tier”).
- But why not retract H to the antepenult in cases like πολυπῖδαξ (^{X}πολύπιδαξ) or create a circumflex antepenult in cases like ἄνθρωπος (^{X}ἀνθρῶπος)?
- If only *vocalic* morae matter, these word shapes ought to behave identically – but obviously they do not.

22. Issues for a word-level low boundary tone

- Words ending in a sequence [$\breve{\sigma}$V(C(C))] (παιδότριψ, ποικιλόθριξ, φίλος) must have some kind of non-optimal configuration: deletion of L_ω; adjacency of H and L_ω; or crowding of L* and L_ω onto a syllable with a short vowel.
  - Ungrammatical: ^{X}παίδοτριψ, ^{X}ποικίλοθριξ.
  - Devine and Stephens (1994: 191) indicate possible linkage of L* and L_ω to a single syllable in some cases.
  - Revithiadou (2019) tentatively suggests that the final vowel in cases like ποικιλόθριξ ‘spotted’ might of been lengthened to avoid tonal crowding.
  - However, no direct evidence exists that the prosodic distinction between [-VCC] and [-V:(C)] finals was ever neutralized.
  - Indeed, the study of Ryan (2019: 149–52) on the distribution of such sequences in dactylic hexameters (Homer) finds that [VCC] sequences effectively behave as lighter than [VV] sequences.
- Consistent boundary tones for prosodic categories as small as the ω are cross-linguistically less common.
- Other evaluations of the musical testimony have failed to find positive evidence for a word-level boundary tone (Gunkel and Ryan 2022; graves not distinct from unaccented syllables).
- No study of musical material has yet attempted to systematically disambiguate word-level L_ω from possible boundary tones associated with higher-level prosodic constituents (e.g., L_φ%).
  - Gunkel (2023: 16) does, though, exclude troughs immediately before or after any punctuation mark, since these constitute plausible boundaries of larger prosodic constituents that might introduce other boundary tones.
- Most troublesome issue: if “lulling” applies only at the right edge of the recursive prosodic word, but the position of the High on orthotonic words never shifts depending upon whether the word is followed by an enclitic or not, then accentuation in an orthotonic word (including application of the Lex σωτῆρα) cannot be dependent upon any low boundary tones.
  - L_ω% remains a plausible justification for “lulling”, and musical tone-tune setting might yet provide solid empirical evidence.
  - But attributing “lulling” and the Lex σωτῆρα to the same source creates a potential contradiction.
  - This contradiction might be avoided if one allows for cyclic construction of recursive prosodic words with shift of L_ω to the last syllable, always preserving the accentual output of the previous cycle.

⇒ Accentuation in orthotonic words (including the Lex σωτῆρα) should perhaps best be explained without reference to a word-level boundary tone.

- The Lex σωτῆρα may be considered partly epiphenomenal (= cases where default H+L* associates to a single syllable).
- But if a L_ω tone cannot be safely assumed, the association of H+L* to a long-voweled penult requires some other motivation.

- Assuming L_ω keeps the analysis of stress fairly simple (primary stress can always be on the rightmost heavy syllable), but adds more entities to manage at the tonal level.

4 Optimizing the Golstonian Analysis

23. **Relevant Questions:**

- How does tone relate to stress, and what is the tone-bearing unit (TBU)?
- What foot structures, if any, are present, and how do they relate to the calculation of primary stress and tonal association?
- What types of intonational events (starred tones or pitch accents, boundary tones) are present?

24. **Relation of Tone and Stress**

- I treat the *syllable*, σ, as the tone-bearing unit (TBU), rather than the *mora* (μ) for two reasons:
  a. since stress is a property of syllables, Tone-to-TBU mapping is simplified if stressed syllables play a role in determining the placement of tone;
  b. the need for the μ as TBU to appropriately describe the distribution of contour tones is itself under debate (Zhang 2003, Zhang 2004, Kaplan 2020).
- Stressed syllables (ˈσ and ˌσ) constitute preferred hosts for phonologically specified tones, including pitch accents (T and T*).
- Constraints penalize failure of (starred) tones to associate to (primary) stressed syllables, and vice-versa.

  (12) Stress-to-Tone and Tone-to-Stress mapping constraints over pitch accents, tone, and stress:
  a. T* → ˈσ (starred tone to primary stress): Assign one violation * for every starred tone in the output that is not associated with a syllable bearing primary stress.
  b. ˈσ ← T* (primary stress to starred tone): Assign one violation for * each syllable bearing primary stress in the output that is not associated with a starred tone.
  c. ˈσ ← T (primary stress to tone): Assign one violation for * each syllable bearing primary stress in the output that is not associated with any tone.
  d. ˌσ ← T (stress to tone): Assign one violation * syllable bearing any degree of stress in the output that is not associated with any tone.

- A high ranking of either (12)a. or b. will ensure that primary stress and starred tones regularly align. **Here, (12)a. and b. will regularly be collapsed into a mutual association, T* ⇔ ˈσ.**

25. **Tonal Inventory**

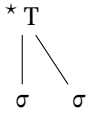
- For recessively accented words, Sauzet and Golston's HL* will suffice.
- Non-recessive lexemes can plausibly be assumed to be marked with a lexical /H*/ (but play no further role here).

26. **What is the HL* exactly?**

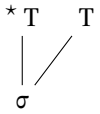
- The answer determines what constraints on tonal association and faithfulness are relevant when H and L* appear to be distributed over multiple syllables.
- I adopt a binary pitch accent: H+L*.

- H+L* would not normally incur violations of NoSpread in (13), but could in principle allow for outputs in which either H or L* is deleted.
- The fact that H exceptionlessly occurs on the surface would point towards high-ranked Max-H.
- In addition, a binary pitch accent would yield violations of NoCrowd in (14) in cases in which both tones associate to a single syllable.

(13) NoSpread: Assign one violation * for each additional TBU above 1 with which a tone is associated.



(14) NoCrowd: Assign one violation * for each additional tone above 1 associated to a single TBU.



- If it is a unary pitch accent (contour tone HL*), a single faithfulness constraint, Max-HL* would make it so that the entire tone is either present, or not, in an output.
- Assuming a unary pitch accent means that, in most recessively accented forms, NoSpread would be violated.

27. What is the source of stress?

- Arguments from meter and allomorph selection (Golston 1990, Golston and Riad 2000, Golston and Riad 2005, Gunkel 2010: Ch. 1-2, Gunkel 2011) support **moraic trochees**.

  ⇒ Foot structure constitutes a plausible basis for the Law of Limitation.
- Although Golston's analysis assumes exhaustive parsing of syllables into feet, determining the placement of primary stress usually requires only a single foot in the word, at most two.
- No more than one syllable need ever intervene between the right edge of the word and the right edge of a foot ⇒ undominated All-Feet-Right × 2.
- Deviation from Golston's analysis: stress is preferred on VV-nuclei to VC nuclei.

  (15) Main → VV (cf. Ryan 2019: 36–7): Primary stress should fall on a long vowel or diphthong. Assign one violation * if a syllable containing a long vowel or diphthong is footed and does not bear the primary stress in a word.

- Consequence: primary stress possible on a VV-penult over a VCC-final if a ranking Main → VV ≫ Rightmost holds.
  - If correct, Ancient Greek would seem to fall among among languages that exhibit the weight scale V < VC < VV for purposes of stress, including Chickasaw, Finnish, Hupa, Klamath, Mam, Tamil, among others (see further Ryan 2019: 22–9).

28. **Analysis 1: Basic Reproduction of Golstonian Stress (with Modifications)**

- Reproducing the parametric stress analysis from (7) is fairly trivial.
- Final consonant extrametricality arises from the avoidance of the alignment of the right edge of a foot with the right edge of a prosodic word: an unparsed consonant intervenes between the rightmost foot and right edge of the word.

(16) Basic Ranking for Final Consonant Extrametricality: NonFinality-ϝ ≫ Parse-C, Align(ϝ, R, ω, R)

- When feet are disyllabic, prominence is on the leftmost syllable of the foot.

(17) Basic Ranking for Trochaic Feet: Trochee ≫ Iamb

- Rightward alignment of foot construction and assignment of primary stress follows from ranking all rightward-oriented constraints above their left-edge mirror images.

(18) Basic Ranking for Rightward Foot and Stress Alignment: All-Feet-Right, (Rightmost) ≫ All-Ft-Left, (Leftmost), Align(ϝ, L, ω, L)

- Only pure moraic trochees of the forms (–) or (⏑⏑) result if heavy syllables should receive stress and light syllables trapped between two heavies or the right edge of a word may remain unparsed.

(19) Basic Ranking for Moraic Trochees: WSP, Rh-Contour ≫ Parse-σ

- If foot parsing is assumed to be exhaustive within the ω, then the ranking Parse-σ ≫ All-Feet-Right holds.
  - But since stress and pitch accents only necessarily point to a single foot per word, it might be the case that the reverse ranking holds.
  - Heavy syllables might still be footed outside of the rightmost position if WSP ≫ All-Feet-Right holds.
  - Below, I will introduce reasons to believe that foot parsing may well be non-exhaustive.

☞ Since no foot whose right edge stands farther to the left than the penult is ever needed, I tentatively posit a self-ganging of All-Feet-Right: **All-Feet-Right×2 bans any foot that ends farther to the right than the penult.**

(20) All-Feet-Right×2: Assign one violation * if more than two syllables stand between the right edge of the ω and the right edge of any foot (i.e., if the right edge of a foot would incur at least two violations of standard All-Feet-Right).

- Tableaux illustrating stress assignment alone for ἄλκιμος, ἀλκίμους, and κῆρυξ shows the essential rankings of the necessary constraints.

(21) Fundamental Ranking for Stress Assignment and Final Consonant Extrametricality: Trochee, All-Ft-R×2, Main → VV ≫ WSP ≫ Rightmost, All-Feet-Right, Parse-σ, NonFinality-ϝ ≫ Parse-C

a. ἄλκιμος

/alkimos, H+L*/	Trochee	All-Ft-R×2	Main → VV	WSP	Rightmost	All-Ft-R	Parse-σ	NonFin-ϝ	Parse-C
a. ☞ al.('ki.mo)⟨s⟩				*			*		*
b. al.ki.('mos)				*			**!	*!	
c. (al).('ki.mo)⟨s⟩		*!				**			*
d. al.(ki.'mos)	*!			*			*	*	

b. ἀλκίμους

/alkimoːs, H+L*/		Trochee	All-Ft-R×2	Main → VV	WSP	Rightmost	All-Ft-R	Parse-σ	NonFin-ϝ	Parse-C
a.	al.(ˈkiˌmoː)⟨s⟩				**!			*		*
b. ☞	al.ki.(ˈmoː)⟨s⟩				*			**		*
c.	(al).ki.(ˈmoː)⟨s⟩		*!				**	*		*
d.	al.(ki.ˈmoː)⟨s⟩	*!			*			*		*

c. κῆρυξ

/kɛːruks, H+L*/		Trochee	All-Ft-R×2	Main → VV	WSP	Rightmost	All-Ft-R	Parse-σ	NonFin-ϝ	Parse-C
a. ☞	(ˈkɛː).(ˌruk)⟨s⟩					*	*			*
b.	(ˌkɛː).(ˈruk)⟨s⟩			*!			*			*
c.	kɛː.(ˈruk)⟨s⟩			*!	*			*		*
d.	(ˈkɛː).ruk⟨s⟩				*!		*	*		*

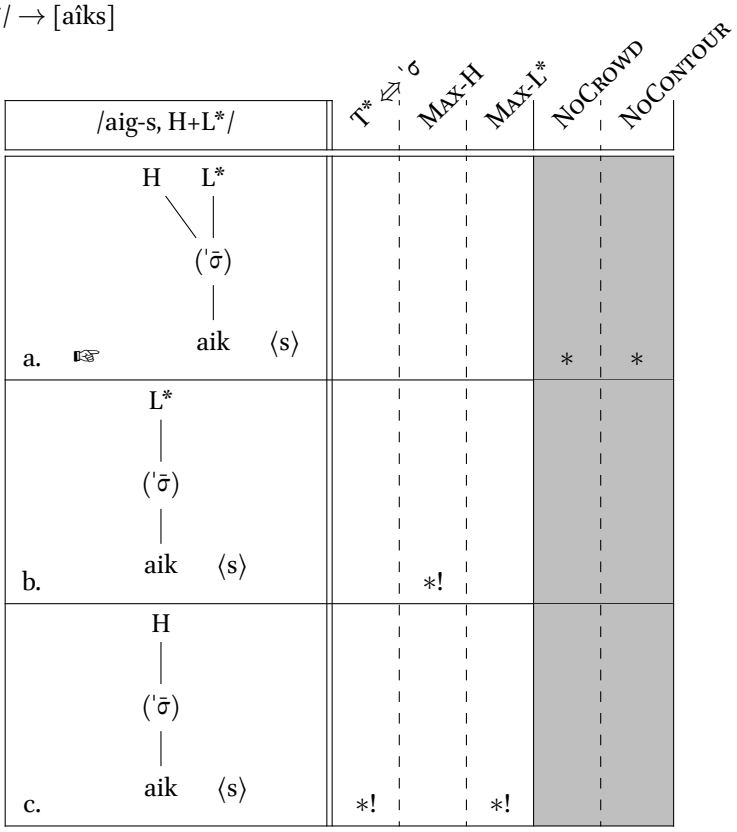
29. **Analysis 2: Circumflex Monosyllables and Tonal Preservation**

- Associating tones in the input is generally preferable to not associating them: Max-T ≫ NoAssociation.
- Preserving both H and L* seems to outweigh any penalty for associating two tones to a single TBU (NoCrowd), as well as for creating surface contour tones (NoContour).
- At the same time, creating contour tones on a TBU whose nucleus contains just a single short vocalic nucleus is not permitted: *Contour/Short (cf. Li 2003: 178).

  (22) *Contour/Short: No contour tone is allowed on a short vocalic nucleus. Assign one violation * for each instance of a TBU associated with a tone having multiple distinct targets or associated with at least two tones having different targets, if that TBU dominates a simplex vocalic nucleus.

- A form like αἶξ 'goat:nom.sg' demonstrates that formation of contour tones on VV-syllables is generally permitted.
- The tone-to-TBU constraints given above in (12), could, in principle, all be satisfied by L* alone, which clearly requires that Max-H dominate NoCrowd and NoContour.
- The relative ranking of Max-L* is less clear, given that tone-to-TBU constraints to enforce its preservation and association are active.

(23) αἶξ: /aig-s, H+L*/ → [aîks]



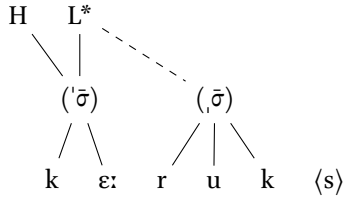
30. **Analysis 3: Disyllables of the Type κῆρυξ**

- This type helps to better establish the stress relations in words with a VV-penult but a VCC-final.
- Premise: Primary stress is on the penult, not the final; were primary stress on the final, association of starred tone and primary stress would predict ^{X}κήρυξ [(ˌkéː).(ˈruk)⟨s⟩] (compare ἀνθρώπου).
  - West (1990: XLVIII), in fact, argues for the accentuation *κήρυξ instead (and similarly *φοίνιξ instead of usually accepted φοῖνιξ), on the basis of the fact that we know the vowel υ (∼ ι) to be long in other case forms of the relevant words (thus, e.g., GEN.SG κήρῡκος, φοίνῑκος).
  - However, there are other lexical items, such as πῖδαξ 'well', αἶθοψ 'fiery, sparkling', or βοῦκλεψ 'cattle-thief', which have a consistent short vowel throughout their paradigms.
  - Following Probert (2003: 84), there is no real justification for doubting Herodian's claim (cf. Lentz 1867: 352) that κῆρυξ and φοῖνιξ have a circumflex.
  - Rather, κῆρῠξ and φοῖνῐξ may be indicative of a shortening of long high vowels in closed final syllables, at least in polysyllabic forms:

    (24) High Vowel Shortening in Final Syllables
    $\begin{bmatrix}\text{+syllabic}\\ \text{+high}\end{bmatrix} \rightarrow [\text{–long}] \,/\, \sigma_1 \_\_\text{CC}]_\omega$

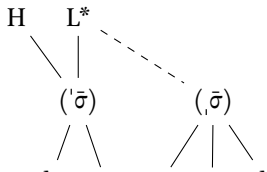
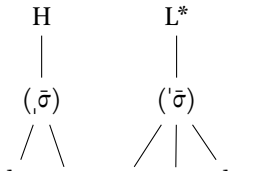
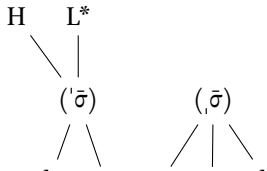
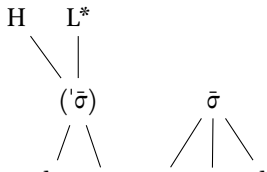
- Tonal association should then look as in (25).
  Whether the final is *also* associated with L* depends on whether it is footed at all in such cases and whether ˌσ ← T ("all stressed syllables must be associated with a tone") dominates NoSpread.

(25) κήρυξ: /kɛːru(ː)k-s, H+L*/ → [(ˌkɛ̂ː).(ˈruk)⟨s⟩]



- If only stress and foot structure are considered, then the final syllable *ought* to be footed, since there is no penalty for doing so: stress on final syllables is not categorically avoided, and building a foot around a final heavy syllable incurs no violations of All-Feet-Right.
  - Leaving the final syllable unfooted, conversely, would incur gratuitous violations of Weight-to-Stress and Parse-σ.
  - Only in the event that both ˌσ ← T and NoSpread outrank WSP and Parse-σ could leaving a final VCC-syllable unparsed be justified.
- The crucial conclusion here is that Main → VV must indeed dominate constraints that word prefer for primary stress to stand farther to the right (All-Feet-Right, Rightmost).

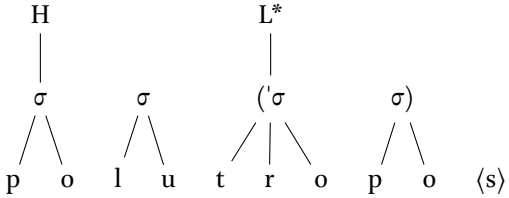
(26) κήρυξ: /kɛːru(ː)k-s, H+L*/ → [(ˌkɛ̂ː).(ˈrùk)⟨s⟩]

	T* ⇎ =ˈσ	ˌσ ← T	Main → VV	WSP	Parse-σ	NoSpread	Rightmost	All-Ft-R
a. ☞ 						*	*	*
b. 			*!					*
c. 		*!					*	*
d. 				*!	*			*

31. **Analysis 4: Restricting Tonal Association**

- Grounding Question: Why must H in H+L* remain close to the L* (i.e., fall on the same TBU or the immediately preceding one) ?
- Association of L* is controlled by T* ⇔ ˈσ.
- What prevents H from associating to a TBU farther to the left?
  - For instance, if ALIGN(H, Left, ω, Left) played a significant role, H would always be found on the leftmost TBU of a ω (e.g., ˣπόλυτροπος, as shown in (27).

(27) ˣπόλυτροπος

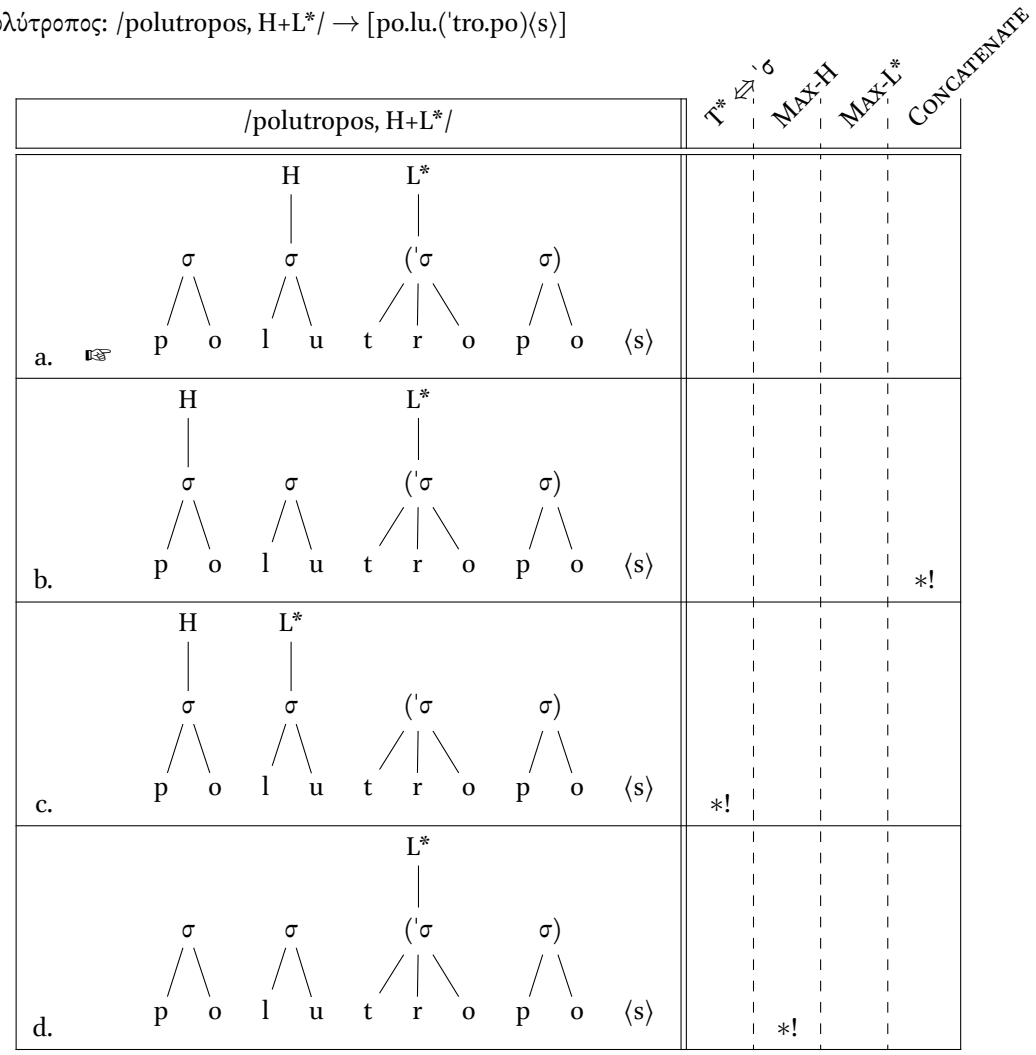


  - In East Norwegian, for instance, the bitonal pitch accent L*+H is frequently "splayed" over a wide range (Kristoffersen 2000: Ch. 9–10, Gussenhoven 2004: 219–21), with the latter component
- Some undominated constraint evidently prevents the H of Attic-Ionic's H+L* from migrating far away from L*.
- Appropriate here is CONCATENATE, defined in (28); see Riad 1998: 89, Gussenhoven 2004: 150.

(28) CONCATENATE: Tones in bitonal morphemes are aligned with each other. Assign one violation * if any TBU intervenes between a TBU with which Tone A is associated and a TBU with which Tone B is associated, where A+B constitutes a bitonal morpheme in the input.

- Tableau (29) then shows that all high-ranking constraints on tonal association are satisfied only by associating the H with the antepenult.

(29) πολύτροπος: /polutropos, H+L*/ → [po.lu.('tro.po)⟨s⟩]



32. **Analysis 5: Two-Syllable Stress Window with Tonal Assignment**

- Primary stress is permitted only on the final syllable (always if VV, otherwise if heavy and the penult is not VV) or the penult (always if the final is light, otherwise if VV and the final is VCC).
- Forms like κῆρυξ indicate that primary stress may be attracted away from the rightmost foot, however, due to Main → VV ≫ All-Ft-R, Rightmost.
  - In words of more than two syllables with a VV-syllable to the left of the penult, where both penult and final are light, Main → VV does not appear to exercise any real effect.
  - Consider: βούλομαι [bó:.('lò.ma)⟨i̯⟩] , not ˣβοῦλομαι [('bô:).(ˌlo.ma)⟨i̯⟩].

  ⇒ Stress cannot occur outside of the rightmost two syllables.
- ⋆Lapse-Right ("no more than one syllable without stress at the right edge of the word") is inadequate: ⋆Lapse-Right could be satisfied by a secondary stress, allowing primary stress to fall on a VV-syllable farther to the left.

- In turn, because a foot may be built around a VV-penult to satisfy Main → VV while incurring a violation of All-Feet-Right, All-Feet-Right alone does not suffice to keep primary stress away from VV-antepenults, VV-preantepenults, etc.
- Solution: Self-ganging of All-Feet-Right.
  - In practice, more than a single violation of All-Feet-Right is fatal.
  - For simplicity here, implemented as a duplicate constraint: All-Feet-Right×2, outranking Main → VV.
  - Theoretically, this behavior is properly to be implemented with weighted constraints (Legrendre et al. 1990, Potts et al. 2010), where two or more violations of All-Feet-Right outweigh a violation of Main → VV.
- The tableau in (30) illustrates how the constraints on stress assignment and tonal association behave where a VV-syllable occurs outside of the two-syllable stress window.

(30) βούλομαι: /boːlomaį, H+L*/ → [bóː.(ˈlò.ma)⟨i̯⟩]

/boːlomaį, H+L*/	T* ⇏ ˌσ	ˌσ ← T	All-Ft-R×2	Main → VV	WSP	NoCrowd	NoContour	NoSpread
a. ☞ H L* (ˈσ̄) (ˈσ σ) b oː l o m a ⟨i̯⟩				*	*			
b. H L* (ˈσ̄) (ˌσ σ) b oː l o m a ⟨i̯⟩		*!	*!			*	*	
c. H L* (ˌσ̄) (ˈσ σ) b oː l o m a ⟨i̯⟩			*!	*				
d. H L* (ˈσ̄) (ˌσ σ) b oː l o m a ⟨i̯⟩			*!			*	*	*

33. **Analysis 6: Words of the Type πολυπῖδαξ versus ἄνθρωπος**

- In the case of κῆρυξ above, the emergence of a circumflex on the penult falls out from the fact that the H portion of H+L* has no place else to go.
- In longer words with an identical sequence of VV-penult and VCC-final, a different problem arises: why can the H not link farther to the left?
- The obvious contrast is with words of the type ἄνθρωπος: these *also* have primary stress on a VV-penult, but instead show an acute on the antepenult .
  - A circumflex penult in such cases (*ἀνθρῶπος) can be excluded by avoidance of contour tones (NoContour, NoCrowd).
  - But forms like πολυπῖδαξ precisely violate NoContour!
  - Why no *πολύπιδαξ?
  - Analogy to base πῖδαξ not credible: morphologically simplex stems like καταῖθυξ 'leather helmet' (*Il.* 10.258)or the καλαῦροψ 'shepherd's staff' (Herodian) exhibit the same behavior.

  ⇒ Some other high-ranking constraint prevents H from associating to the antepenult in such cases.
- This issue touches on the underlying nature of the Law of Limitation. In recessive words...
  - H may be on the antepenultimate or penultimate σ.
  - H may be on just the third-to-last mora (ποφπόλυκι 'bubble:dat.sg, ποικιλόθριξ) or back on the fifth-to-last mora (ἄνθωπος).
  - H may be on the third-to-last vocalic mora (ποφπόλυκι, πολυπῖδαξ) or back on the fourth-to-last (ἄνθρωπος).
  - A heavy penult (whether VV or VCC) tells us that H *must* be on the penultimate σ, how to derive this behavior from a single constraint or interaction of constraints in the case of πολυπῖδαξ is puzzling.
- Steriade (2014) uses *LapseRσ̄: no more than one stressless syllable at the right edge of the word if the final syllable is heavy.
  - For Steriade, both ἀνθρώπου and πολυπῖδαξ have stress on the penult because the final is heavy (syllable with acute or circumflex).
  - Circumflex is the norm on a VV-penult, acute VV-penult is created when the final is VV because a fall to L after H may only be followed by one further vocalic mora.
  - Two Critiques: 1) Quantity-sensitive lapse constraints untested in broader stress typologies; 2) relation of H–L sequence to word edge here is stipulative (neither obviously motivated by other empirical facts, nor emergent from other constraints).
- **Two other conceivable stipulations:** a restriction based on feet or a restriction based on tonal association.

☞ Foot-based restriction: the tonal window is maximally two feet, such that no tone may be realized outside a window of two feet at the right edge of the word.

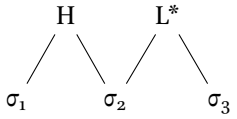
- Thus: if a word contains a single foot, a tone may be associated to its left; if it contains two feet, no tones may be associated farther to left, the outside of the second (leftmost) foot.
- But this is just a restatement of the LoL on H in foot-based terms.

☞ Tonal alignment restriction: H and L* must be completely associated with completely adjacent syllables.

- In effect, associating entirety of H+L* to a total of three (or more) syllables is not permitted.
- This behavior could be conceived of as a restriction on the total number of targets for a tonal morpheme ("the number of TBUs to which a tonal morpheme is linked may not exceed the number of tones in the tonal morpheme").

- Or, it could be a restriction on the alignment of TBUs associated with tone: "every TBU (σ) associated with some (non-boundary) T must be aligned with the edge of every other TBU linked to a (non-boundary) T".
- The configuration shown in (31) could then be illicit either because the two tones of bitonal H+L* are associated with three TBUs, or because the right edge of σ_1 is not immediately adjacent to the left edge of σ_3 (intervening σ_2 prevents perfect alignment of all T-associated TBUs).

(31) Illicit Trisyllabic Association of H+L*



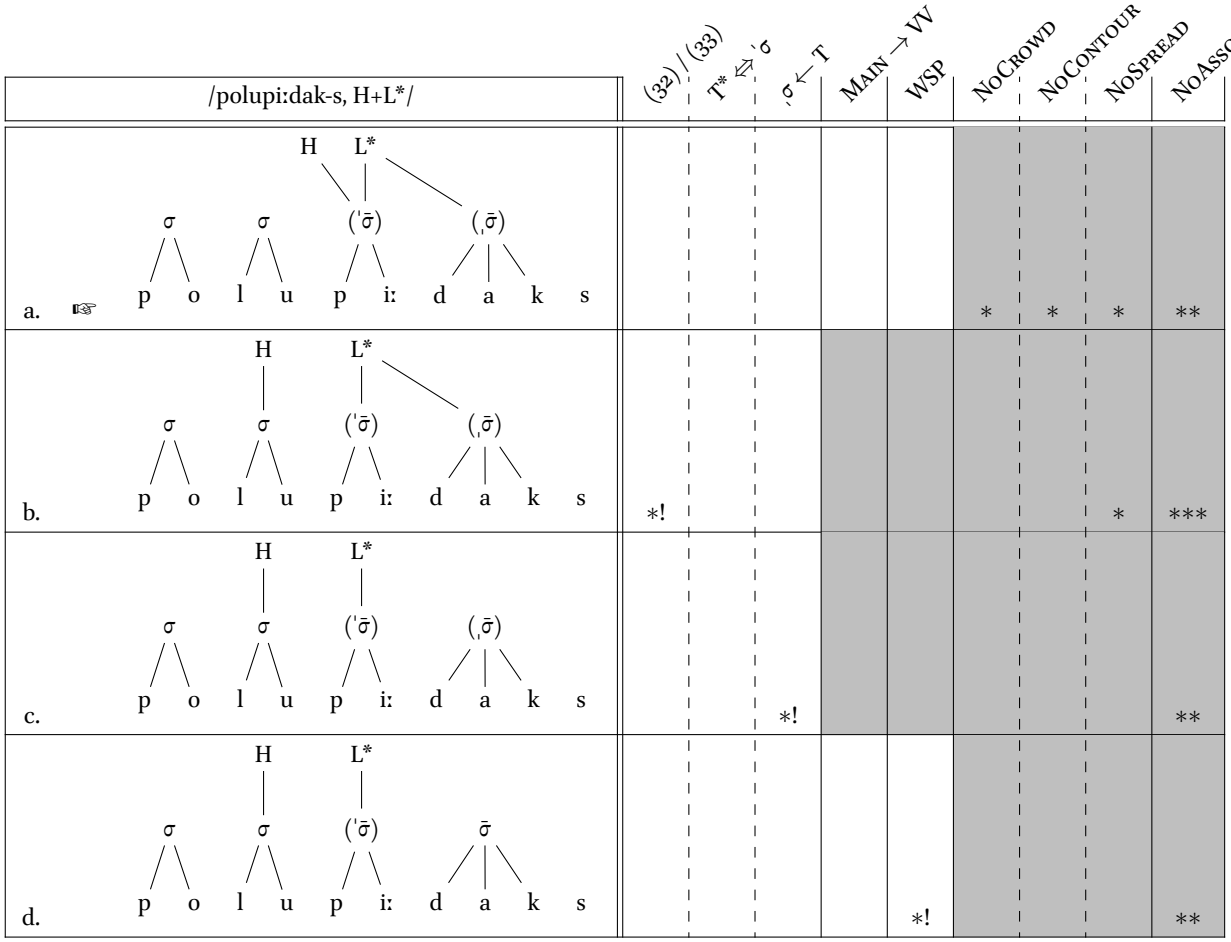
- The constraint in (32) encodes the former sort of restriction, (33) the latter.

(32) NoSpread-Tune: Assign one violation * if the number of TBUs to the which the tones of a tune are linked exceeds the total number of tones contained in the tune.

(33) Concatenate-TBU: For every tuple (TBU_1, TBU_2) to (TBU_{N-1}, TBU_N) that may be composed out of the set of tone-linked TBUs, where TBU_1 is leftmost in a string and TBU_N is rightmost, assign one violation * if the right and left edges of the members of the tuple are not aligned.

- Tableau (34) illustrates how one of the constraints from (32) and (33) rules out H on the antepenult when constraints on stress and tone-to-stress association are likewise satisfied.

(34) πολυπῑ̂δαξ: /polupi:dak-s, H+L*/ → [po.lu.(ˈpîː).(ˌdak)⟨s⟩]



- **In short:** the need for both the final and penultimate syllables to bear stress when heavy, and the need for every stressed syllable to be associated with tone, effectively "maxes out" the associational space of stress and tone when a word ends in two heavy syllables.

34. **Analysis 7: Disyllables without a Heavy Syllable and Trochaic Shortening**

- Given φίλος, what feet are present and what happens to L*?
- When considering only recessively accented forms, three analyses are possible, and the choice comes down to the relative ranking of T* ⇔ ˈσ versus FootBinarity.
  - If the mutual association between primary stress and starred tone is truly inviolable, and L* must be realized, then a monomoraic foot with primary stress must be posited, in violation of FootBinarity: [pó.(ˈdà)].
  - If FootBinarity is inviolable, and L* must be realized, then L* may associate to the unstressed final syllable: [(ˈpó.dà)].
  - Note that delinking/deletion of L* is not predicted to occur, since an output that does not realize L*, [(ˈpó.da)] still violates T* ⇔ ˈσ and is thus harmonically bounded by [(ˈpó.dà)].

  - Words of the shape [C_0ŏC_0ŏC] could also instead treat the final syllable as heavy (violating NonFinality-ƒ, which is violated in VV-final words anyway) in order to avoid violating either T* ⇔ ˈσ or FootBinarity.
    But in recessive words of the shape [C_0ŏC_0ŏ], violating either one or the other remains inevitable.

- Perhaps surprisingly, the morphologically restricted trochaic shortening treated in Gunkel 2011 is also compatible with either analysis!
  - Regardless of whether monomoraic feet are permitted or not, though, the preference of forms like χύμα [kʰú.(ˈmà)] over χεῦμα [(ˈkʰeû).ma] 'act of pouring' would not be motivated by satisfaction of Parse-σ, but rather either All-Ft-R or NoContour: All-Ft-R clearly rules out alternative [(ˈkʰeû).ma].
  - As long as feet of the shape (– ⏑) are independently excluded by undominated Rh-Contour, limited trochaic shortening in Attic-Ionic fundamentally driven by All-Ft-R.
- Tableaux (35) and (36) show that selection of the short-vowel allomorph /kʰu–/ is possible under two different rankings of FtBin and T* ⇔ ˈσ.

(35) /{kʰeu-, kʰu-}, -ma, H+L*/ → [kʰú.(ˈmà)]

/{kʰeu-, kʰu-}, -ma, H+L*/	T* ⇔ ˈσ	Rh-Contour	WSP	All-Ft-R	Parse-σ	NoCrowd	NoContour	FtBin
a. ☞ kʰú.(ˈmà)					*			*
b. (ˈkʰeû).ma				*!	*	*	*	
c. (ˈkʰú.mà)	*!							
d. (ˈkʰeû.ma)		*!						
e. kʰeú.(ˈmà)			*!					*

(36) /{kʰeu-, kʰu-}, -ma, H+L*/ → [(ˈkʰú.mà)]

/{kʰeu-, kʰu-}, -ma, H+L*/	FtBin	Rh-Contour	WSP	All-Ft-R	T* ⇔ ˈσ	Parse-σ	NoCrowd	NoContour
a. kʰú.(ˈmà)	*!					*		
b. (ˈkʰeû).ma				*!		*	*	*
c. ☞ (ˈkʰú.mà)					*			
d. (ˈkʰeû.ma)		*!						
e. kʰeú.(ˈmà)	*!		*					

☞ Relationships of harmonic bounding make it more plausible that words of the shape [C_0ŏC_0ŏ(C)] realize both H and and L*. The exact metrical structure of words of these prosodic shapes remains indeterminate.

☞ Given outstanding uncertainties, I omit a final total constraint ranking here.

35. **Summary**

- The core insights of the analysis of recessive accentuation in Attic-Ionic developed in Golston 1990 mostly transfer well to a constraint-based implementation.
  - Except for words of three or more syllables ending in sequences [-VVC$_0$V̆CC] (πολυπῑ̂δᾰ̃ξ) or disyllables of the shape [C$_0$V̆C$_0$V̆(C)], description in almost exactly Golston's original terms is mostly possible.
- Conclusion 1: Assuming a role for Main → VV allows for the Lex σωτῆρα (in recessive words, at least) to be treated an epiphenomenon of the association of the H+L* pitch accent.
- Conclusion 2: The patterns of recessive accentuation are open to analysis treating (stressed) syllables as TBUs, and makes better sense of the tone–stress relationships assumed by Golston.
- Conclusion 3: A central role for a mutual association between primary stress and starred tone (T* ⇔ ˈσ), plus a requirement for the tones of bitonal morphemes to occur on the same or contiguous TBUs, and avoidance of contour tones, suffices to capture most patterns.
- Conclusion 4: Contrast between antepenultimate acute (ἄνθρωπος) and penultimate circumflex (πολυπῑ̂δαξ) may be explained as a requirement that the H portion of H+L* never occur more than one syllable to the left of the rightmost syllable to which L* is associated (given spreading of L* over the final and penult in cases like πολυπῑ̂δαξ).
- Conclusion 5: What foot structure is employed for short disyllables (πόδα, πόλις) remains uncertain; limited trochaic shortening is non-diagnostic.
- Questions to Investigate:
  - Empirical evidence for the stress pattern (including stress clash!) in cases like [(ˈkɛː).(ˌruk)⟨s⟩]?
  - Is it possible to distinguish between association of L* versus a low boundary tone L$_\omega$% in the same set of cases?
  - Do alternations of H attributable to lexical /H*/ (πόδα vs. ποδί) shed any light on the metrical structure of disyllables?

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Appendix A: Restrictions on the Position of H in Attic-Ionic

1. Listed below are general restrictions on the distribution of High Tone (acute or circumflex accent) in Attic-Ionic Greek.

   A. A minimal prosodic word ($\omega_{[+\text{min}]}$) – equivalent to an orthotonic word without any proclitics or enclitics – contains at least one and at most one high tone (H).

   B. Only $\begin{bmatrix} \text{+syllabic} \\ \text{–consonantal} \end{bmatrix}$ segments may host this H (but see Probert 2003: XX for discussion of possible evidence that t syllables containing [+sonorant] coda segments may also have been capable of supporting more than one tone).

   C. In syllables with a long vowel, [V:], or diphthong, [VV], the H may be realized as part of a falling tone (HL) sequence ("circumflex") or as H alone ("acute").

   D. The position of the H is restricted by the Law of Limitation (LoL; also *Dreimorengesetz*)

      1. In prosodic words of three or more syllables (containing three or more vocalic peaks), the H is limited to occurring within a window of the three rightmost syllables.

         a. Grammatical: [ánt$^{\text{h}}$rɔ:pos] 'man:NOM.SG', [ant$^{\text{h}}$rɔ́:po:] 'man.GEN.SG', [podô:n] 'foot.GEN.PL'

         b. Ungrammatical: $^{\text{X}}$[póluant$^{\text{h}}$raks] 'having much coal:NOM.SG', $^{\text{X}}$[poíkilot$^{\text{h}}$riks] 'having dappled hair/feathers:NOM.SG

2. If the final syllable contains a long vowel, [V:], certain diphthongs, [VV], or a vowel followed by two[1] consonants, [VCC], then the
   H must fall on the penultimate or final syllable.[2]
   a. Grammatical: [antʰrɔ́:po:], [poluántʰraks]
   b. Ungrammatical: [X][ántʰrɔ:po:], [polúantʰraks]
3. If the final syllable contains merely a short vowel, [V̆], or short vowel followed by a single consonant, [V̆C] (including most diphthongs in [-oi] and [-ai]), then the
   H may fall on any of the antepenultimate, penultimate, or ultimate syllable.

E. If the penult contains a long vowel, [V:], or diphthong [VV], and the final syllable contains a short vowel, [V̆], followed by any number of consonants, the penult may *not* contain an acute (σωτῆρα RULE / LEX σωτῆρα).
   a. σωτῆρα ← /sɔ:-té:r-a/ 'savior.ACC.SG'
   b. πολυπῖδαξ ← /polu-pi:dak-s/ 'having many fountains.NOM.SG'
   c. κῆρυξ ← /kɛ:ruk-s/ 'herald.NOM.SG'

2. Two further restrictions on the Law of Limitation.
   a. A High-toned VV-nucleus on a penult preceding a final with a short vowel (V) nucleus, regardless of any following consonants, must be circumflex, never acute (= LEX σωτῆρα);
   b. High tone on an antepenult may only ever be acute, never circumflex.

(37) LEX σωτῆρα:
   a. σωτῆρα 'savior:ACC.SG' ([X]σωτήρα)
   b. πολυπῖδαξ 'having many springs:NOM.SG' ([X]πολυπίδαξ)

(38) VV-Antepenults only allow acute
   a. δαίδᾰλος 'cleverly made:NOM.SG' ([X] δαῖδᾰλος)
   b. κώρῠκος 'leather sack:NOM.SG' ([X]κῶρῠκος)
   c. ῥήγνῡμι 'break:PRS.1SG' ([X]ῥῆγνῡμι)

3. "As far to the left": defined in terms of syllables (σ), what?
   a. Any acute or circumflex on a *final* syllable is, by definition, not recessive.
   b. Any acute on an antepenult is within the scope of recessive accentuation.
   c. Due to the LEX σωτῆρα, acute and circumflex on VV penults are in complementary distribution, so either an acute or a circumflex on the penult, as long as the penult genuinely counts as heavy, is by definition within the scope of recessive accent.
   d. Caution: a circumflex penult often reflects lexical accent (σωτήρ vs. σωτῆρα).
   In disyllabic forms of the shape [C_0VVC_0V{k,p}s] (e.g., κῆρυξ 'herald:NOM.SG'), how exactly to interpret the circumflex is not entirely clear (see discussion below).

[1]Theoretically also more than two, but in practice the only consonant cluster sequences allowed at the right edge of a word in Attic-Ionic are [ks] and [ps].

[2]This restriction is violated in a few instances, in particular the GEN.SG of *i*-stems such as πόλις [pólis] 'city', e.g., GEN.SG πόλεως [póleɔ:s]. Historically, such forms contained a penultimate syllable with a long vowel and a final syllable with a short vowel, thus *[pólɛ:os], in which the position of the high tone obeys the conditions here.

e. What about disyllables with V(C) final? What about monosyllables?

4. Bimoraic Disyllables and Monosyllables

   - Under a usual intuitive understanding, word forms like πόλις or φίλος are recessive, since the acute penult is the only option besides an acute final.
   - Monosyllables exhibit a lexical contrast between acute and circumflex (πούς and ῥίς vs. μοῦς and αἶξ).
     - Within the nominal system, most monosyllables with acute underlyingly end in a sequence /-Cs/, while monosyllables ending in /-VV(C)/ usually have a circumflex, so the acute-circumflex contrast there might, at least in part be derivable from segmental conditions.
     - But there are exceptions in both directions (e.g., αἶξ, though also attested with acute in the κοινή; cf. Schwyzer 1938 [1953]: 377; and θώς, θωός 'jackal').
     - There are also some adverbs ending in /-VV(C)/ with acute contrasting with the more common circumflex (e.g., πρώ 'early (in the day)' vs. νῦν 'now').
   - There are credible reasons to think that the circumflex is the "unmarked" member of the pair (especially that monosyllabic verbs with VV nucleus are almost exceptionlessly circumflex, e.g.: βῆ 'go:AOR.3SG, θοῦ 'put:AOR.IPV.MID.SG); cf. Vendryes 1904 [1945]: 111.
     - But this latter contrast obviously cannot be due to a difference in *stress*, but only a difference in *tone/intonation*.

5. In the Greek lexicon, in terms of lexical marking of prosodic properties, there is thus a basic two-way distinction: vocabulary items that are unmarked (here: no tone) and vocabulary items are marked (here: prespecified linkage of /H*/).

   - A privative contrast between lexical entries with High tone and lexical entries not so marked is probably largely adequate, and neatly captures the rare minimal pairs between acute and circumflex that are not attributable to vowel contraction (e.g., κήρ 'fate' vs. κῆρ 'heart').
   - As correctly observed by Steriade (1988: 279–81), most derivational suffixes appear to be marked with High tone (e.g., -ίδ-, -τήρ-, -ικό-), but some few are unaccented (NML.F -ια, DIM.N -ιο-).
   - Gunkel (2014: 11) points to the endings of the aorist active infinitive and perfect mediopassive infinitive, -αι and -σθαι as endings that lexically condition an acute on the penult, but these might be endings that have a "heavy" diphthong for the purposes of accentuation, in which case their accentuation is properly recessive.
     Potentially telling as to their unique prosodic properties is the fact that at least AOR.INF -αι conditions the LEX σωτῆρα when the penult is VV (e.g., παιδεῦσαι 'teach:AOR.INF'), which would suggest that the ending is indeed light for the purposes of accentuation.

6. Thus: clearly non-recessive accentuation is usually recognizable as such, and while many words of certain prosodic shapes are *usually* accented due to the recessive default, words of the same shape can be found whose accentuation may faithfully reflect a lexical High tone.

   (39) Recessively Accented Words
   a. [σ_0 σ́ σ̆ V(C)] and [σ_0 σ́ σ̄ V(C)] — acute on the antepenult (e.g., ἄλκιμος or ἄνθρωπος)
   b. [σ_0 σ́ VV(C)] — acute on the penult preceding a VV(C) final (e.g., ἀλκίμους or ἀνθρώπου)
   c. [σ_0 σ́ VCC] — acute on a V penult preceding a VCC final (e.g., παιδότριψ or φύλαξ)
   d. [σ_0 σ̃ VCC] — circumflex on a penult preceding a VCC final (e.g., κῆρυξ or πολυπῖδαξ)
   e. [σ́ σ] — acute on a V penult of a disyllable (e.g., πόλις or φίλος)

f. [σ̃] — circumflex on a monosyllable (e.g., βῆ or μῦς)

(40) Always Non-Recessively (Lexically) Accented Words

a. [σ_0 σ́] — acute on the final (or only) syllable (ἀσπίς 'shield:NOM.SG', σωτήρ 'savior:NOM.SG')

b. [σ_1 σ̃] — circumflex on the final of a polysyllabic word (ποδῶν 'foot:GEN.PL')

c. [σ_1 σ́ V(C)] — acute on a penult preceding a V(C) final in words of three or more syllables (ἀσπίδος 'shield:GEN.SG')

- Note that an acute on a penult before a VV or VCC final *can* reflect a lexical accent: ἀσπίδων 'shield:GEN.PL'
- Note that a circumflex before a V(C) final *can* reflect a lexical accent: σητῆρα 'savior:ACC.SG'
- Even an acute on an antepenult may potentially be attributed to a lexical accent, though would also be predicted by the recessive accent: ἀσπίδ-ιον 'shield-DIM'

Appendix B: Existing Analytical Alternatives to the Golstonian Analysis

1. How to account for the distribution of word-level High Tone (H) generally in Attic-Ionic, and the behavior of the recessive accent specifically, has been the subject of repeated (semi-)formalized analyses during the last ca. 50 years, and continues to be debated.
    - Early characterization of the LoL as a "matrix" in Allen 1966b, Allen 1973: 334 (cf. discussion in Devine and Stephens 1985, Devine and Stephens 1994: 152–54; Ch. 5)
    - Metrical Analyses: Steriade 1988, Sauzet 1989, Golston 1990, Kiparsky 2003, Blumenfeld 2005, Hyde and Husic 2012, Steriade 2014
    - Tonal Analyses: (*in nuce* Garrett 2006: 141), Ito and Mester 2017, Revithiadou 2018, Revithiadou 2019
    - **Scale:** Metrical Realizational (Steriade) — Metrical Intonational (Golston) — Tonal Alignment (Ito & Mester)
2. The analysis to be developed here falls among the group of metrical analyses, and specifically builds upon the major hypotheses of Golston (1990), sharing some similarities with Blumenfeld 2005, taking some inspiration from Revithiadou 2019.
3. **Points in Favor of a Metrical Analysis**
    a. Position of High tone is restricted to a domain by reference to a word edge (i.e., exhibits metricality in the sense of Hyman 2009).
    b. Apparent Obligatoriness of High tone on virtually all content words.
    c. Morphophonological phenomena may be sensitive to foot structure (Gunkel 2011), specifically a species of trochaic shortening (cf. Zuraw 2018 for a survey of trochaic shortening across Austronesian languages).
    d. Phenomena in metrical texts may point to underlying foot structures and/or signal metrical prominence relations (Golston and Riad 2000, Golston and Riad 2005, Gunkel 2010: Ch. 2)
4. **Points against a Metrical Analysis**
    a. General: no direct reports or indirect evidence for syllables analyzed as stress-bearing exhibiting any acoustic correlates typical of stressed syllables in canonical stress languages (e.g., increased duration, greater intensity).
    b. Specific to Golston's model: "The cross-linguistically solid link between H tones and footheads (de Lacy 2002) is severed, *contra naturam*" (Ito and Mester 2017: 15).
5. If neither of these objections were possible, then the case for metrical stress that attracts a word-level H* pitch accent would be open and shut. Neither objection is particularly strong, however.
    - *Ad a.:* foot-structure that creates abstract prominence relations need not entail canonical acoustic properties of stress (Bennett 2012), the acoustic correlates of stress are cross-linguistically quite variable (Gordon and Roettger 2017), and even in canonical stress languages, native speakers may be more sensitive to Fo constrasts than to differences in duration or intensity (cf. Fry 1958, Fry 1965 with speakers of English).
    - *Ad b.:* although typologically rarer, default word-level L* pitch accents are known (e.g., in Stockholm Swedish under the analysis of Riad (2012)).

- Devine and Stephens (1994: 208–210) cite a number of further cases in which the F0 peak of prosodic words typically falls on a syllable other than the stressed syllable (Chamorro, Welsh, Malayalam, Onondaga).
- Devine and Stephens (1985, 1994) defend a view that allows for the construction of word-level metrical structure ("rhythm"), but they argue that the assignment of tone is independent of rhythm.
- D&S draw the (I think mistaken) conclusion that prominence and F0 peak in Ancient Greek must be aligned because the position of an F0 peak is not consistently predictable from the position of the stress.
  D&S seem not to consider the possibility of different pitch accent contours in lexically marked vs. unmarked words (as in Stockholm Swedish).

6. **Basic Contentions on Alternatives**:

- Syllabic trochees, as opposed to moraic trochees, are not viable for reasons argued by Golston (1990).
- Imposing a stress window of the sort "rightmost two syllables if the final is heavy, rightmost three syllables if the final is light" through use of quantity-sensitive *LAPSE constraints (Steriade 2014) is too untested in terms of its effects on the larger typology of stress systems.
- Assuming an absence of stress altogether or stress that does not interact with pitch accents is implausible in the face of metrical evidence and evident OBLIGATORINESS and CULMINATIVITY.

Appendix C: Definitions of Constraints Employed

Constraints not explicitly defined above are defined here.

(1) NonFinality-Foot (NonFin-ƒ): No foot is final the prosodic word. Assign one violation * if the right edge of a foot, ƒ, is aligned with the right edge of the prosodic word, ω.

(2) Parse-Consonant (Parse-C): All consonants should be parsed into syllables. Assign one violation * for each consonant that is not parsed into the next higher level prosodic category, i.e., the syllable (σ).

(3) Parse-Syllable (Parse-σ): All syllables should be parsed into feet. Assign one violation * for each syllable that is not parsed into the next higher level prosodic category, i.e., the foot (ƒ).

(4) FootBinarity (FtBin): Feet should be binary at either the moraic or syllabic level. Assign one violation * for each foot in the output that does not dominate any branching constituent (i.e., all feet consisting of a single light syllable).

(5) Weight-to-Stress Principle (WSP): Heavy syllables should be stressed. Assign one violation * for each heavy syllable in the output that is unstressed (i.e., parsed into the weak part of a foot or not parsed into a foot at all).

(6) All-Feet-Left/Right (All-Ft-L/R):[3] Every foot should stand at the left/right edge of the prosodic word. Assign one violation * for each syllable that intervenes between the left/right edge of a foot and the left/right edge of the prosodic word.

(7) *Clash: No stressed syllables are adjacent. Assign one violation * for each pairwise contiguous sequence of two stressed syllables.

(8) Leftmost/Rightmost:[4] The head foot should be leftmost/rightmost in the prosodic word. Assign one violation * for each syllable in the prosodic word that intervenes between the foot with primary stress and leftmost/rightmost syllable of the prosodic word.

(9) Align-(ω, Left/Right, Foot, Left/Right) (Align-Wd-L/R): Every prosodic word ω should begin/end with a foot. Assign one violation * the left/right edge of a prosodic word is not aligned with the left/right edge of a prosodic word.

(10) Trochee: Feet should be trochaic (= feet have initial prominence). Assign one violation * for each polysyllabic foot in the output which the strongest member is not leftmost in the foot.

(11) Rh-Contour: A foot must end in a strong–weak contour at the moraic level. Assign one violation * for each trochaic foot of the shape (˙ ⏑) or iambic foot of the shape (⏑ ˙).

[3] This constraint is a labeling convenience for a specific Align constraint, namely, Align-(Foot, Left/Right, ω, Left/Right); cf. Kager 1999: 163.

[4] Equivalent to Align-(Head-Foot, Left/Right, ω, Left/Right). These constraints are also labeled Edgemost in Prince and Smolensky 1993 [2004].