
The plausibility of feet in two stress languages

Guilherme D. Garcia¹ and Heather Goad²

¹Université Laval, ²McGill University

guilherme.garcia@lli.ulaval.ca • heather.goad@mcgill.ca

30th Manchester Phonology Meeting

May 2023



Intro

(Brazilian) Portuguese and English have similar stress patterns (primary and secondary)

☞ Only English offers strong evidence for metrical feet

1. Word-minimality
 2. Indeterminacy of foot types
 3. Antepenultimate weight effects
- Despite surface similarities between the two languages, the systems are formally different

Stress in non-verbs:

- Right-to-left moraic trochees + final syllable extrametricality

agenda [∂_{μ} ($\widehat{d\int\epsilon}_{\mu}$ n_{μ}) $\langle d\partial_{\mu} \rangle$]_{PWd} *Canada* [$\langle k\ae_{\mu}$ $n\partial_{\mu} \rangle$ $\langle d\partial_{\mu} \rangle$]_{PWd}

- Binary feet also regulate minimal word size

chemistry → [kɛm], * [kɛ] *Elizabeth* → [lɪz], * [lɪ]

☞ No subminimal (CV_μ) lexical words

Truncation and hypocorization never result in (CV_μ)

In line with notion that lexical words must contain ≥ 1 binary foot

(McCarthy and Prince 1986)

Portuguese

Stress in non-verbs:

- Right-to-left moraic trochees capture regular stress patterns

papel [pa_μ ('pɛ_μ l_μ)_{Ft}]_{PWd}

'paper'

sapato [sa_μ ('pa_μ to_μ)_{Ft}]_{PWd}

'shoe'

☞ Subminimal words tolerated & generated productively

Lexical words

Hypocorization

pá [pa] 'shovel'

Fernanda → [fe]

- ☞ ≈70% of possible CV words are real words

Portuguese

Stress in non-verbs:

- Regular stress: H] or XL]
- Exceptional stress:
 - LL] (3%)
 - XH] (11%)
 - XXX] (12%)

(See Garcia 2017)
papél ‘paper’, *sapáto* ‘shoe’

café ‘coffee’
nível ‘level’
patético ‘pathetic’

☞ This has led authors to propose **different** foot types:

Trochees

(Bisol 1992)

Trochees and iambs

(Lee 2007)

Trochees, iambs, and dactyls

(Wetzels 2007)

Proposal

Stress without feet?

- Aside from extrametricality, Portuguese stress is similar to English stress

But two important differences:

1. Violations of word-minimality
2. Indeterminacy of foot type

(Bisol 2000; Vigário 2003)

- 1-2 may challenge the foot as a prosodic domain in Portuguese

Proposal

Stress without feet?

Today: a **third** difference

3. **Weight effects**

reveal more problems for the foot in Portuguese, but further motivate it for English

Weight effects in antepenultimate (APU) syllables

- APU stress in 12% of Portuguese non-verbs
Previous studies: **exceptional extrametricality**

(Bisol 1992)

patético [pa_μ ('tɛ_μ ti_μ) <ko_μ >]

'pathetic' (ÍLL)

fósforo [('fɔ_μ s fo_μ) <ro_μ >]

'match (n)' (HLL)

Weight effects problematic in APU position

Marked metrical structure unavoidable

- **HLL** → (H́L) <L> (uneven trochee)
- **HLL** → (H́)L <L> (medial unfooted syllable)
- ☞ cf. **ÍLL** → (ÍLL) <L>

Weight effects in antepenultimate (APU) syllables

Trisyllabic shortening

- English

sane → *sanity*

serene → *serenity*

(Prince 1990; Hayes 1995)

*[('se_μɪ_μ)nɪ_μti_μ], [('sæ_μnɪ_μ)ti_μ]

*[sə_μ('ri_μμ)nɪ_μti_μ], [sə_μ('rɛ_μnɪ_μ)ti_μ]

Shortening is consistent with metrical optimization (moraic trochees)

👉 **No similar process observed in Portuguese**

Weight effects in APU syllables

Predictions

☞ **If Portuguese and English build feet:**

Should not find $\acute{H}LL \succ \acute{L}LL$

Weight-sensitivity should **not** be present in APU syllables

☞ **If Portuguese and English don't build feet:**

Weight-sensitivity should not be blocked in APU syllables

Questions

- Which profile – $\acute{H}LL$ or $\acute{L}LL$ – do native speakers favour?
- How do Portuguese and English compare?

Experimental design

- Two forced-choice auditory tasks involving nonce words (based on Garcia 2019)

Speakers of Brazilian Portuguese ($n = 26$) and English ($n = 25$)

Minimal pairs of nonce words with different stress location

- Antepenult (APU) vs. penult (PU) stress
- Portuguese ($n = 240^1$) English ($n = 180$)

☞ Three weight profiles: **LHL, HLL, LLL**

Por: [gu.pla.ro] (LLL) [bron.da.le] (HLL) [bo.gren.da] (LHL)
Eng: [ki.mɛ.sər] (LLL) [lm.sɛ.kəf] (HLL) [tɛ.priŋ.kəl] (LHL)

¹Also included penult vs. final stress

Experimental design

Example from English experiment

Which of these two words sounds more natural?

[¹ki.mɛ.sər]

[ki.¹mɛ.sər]

Experimental results and analysis

1. Replicate results from Garcia (2019): $\acute{H}LL \succ \acute{L}LL$ → **positive** weight effects
2. Different pattern for English: $\acute{H}LL \approx \acute{L}LL$ → **no positive** weight effects

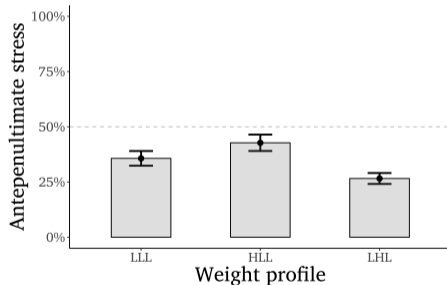


Figure 1: Portuguese

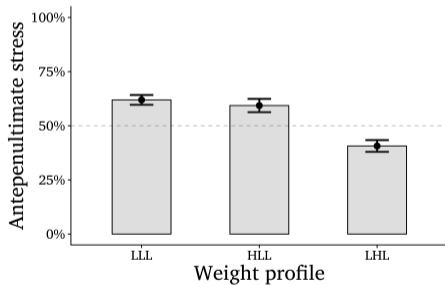


Figure 2: English

Experimental results and analysis

- Hierarchical logistic regressions using Stan in R

(Carpenter et al. 2017)

```
response ~ weight +  
(1 + weight | speaker) +  
(1 | word)
```

By-speaker random effect + by-item random intercept

Experimental results and analysis

- Trends **confirmed** by models: positive HLL effect for Portuguese, not English

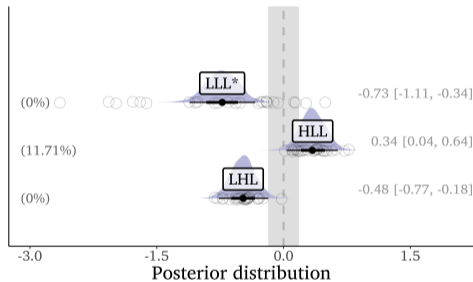


Figure 3: Portuguese

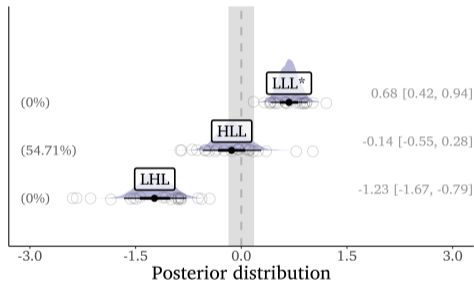


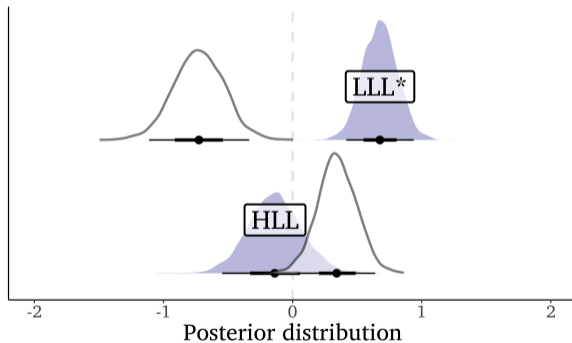
Figure 4: English

- Figures show % of posterior distribution found within ROPE (gray area), mean $\hat{\beta}$, 95% HDI

Experimental results and analysis

Direct HLL comparison

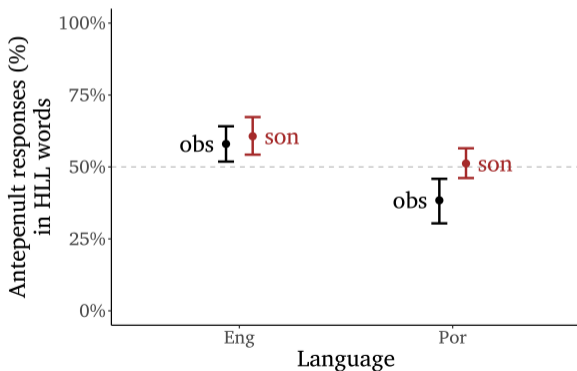
- HLL posterior distributions: almost entirely positive for Portuguese (**white**)



Experimental results and analysis

Sonority effects

- Positive sonority effects in Portuguese ($\hat{\beta} = 0.40$, 95% HDI = [0.00, 0.82]), but not in English
- **Sonorant** (vs. obstruent) codas in APU position → APU stress favoured more often



Discussion and conclusion

English

consistent with **foot-based** approach

- $\acute{H}LL \sim \acute{L}LL$
- No subminimal words
- No APU sonority effects captured
- ☞ Weight effects regulated by moraic trochees + extrametricality

Portuguese

questions **foot-based** approach

- $\acute{H}LL \succ \acute{L}LL$
- Subminimal words
- APU sonority effects captured
- ☞ Weight effects seemingly not regulated by footing (see also gradual weight effects)

Discussion and conclusion

- Questioning phonological universals:

- features
- syllable
- foot (e.g., French, Turkish)
- prosodic word (e.g., Vietnamese)
- constraints

(Pierrehumbert 2003; Blevins 2004)

(Pulleyblank 2006; Mielke 2008)

(Kaye et al. 1990; Steriade 1999)

(French: Jun and Fougeron 2000; Turkish: Özçelik 2017)

(Newell 2017; Vietnamese: Schiering et al. 2010)

(Hayes 1999)

- Questioning relationship between stress and feet:

- Feet and lexical stress are **independent**
- Alternatives to feet (grid-based approaches, Accent-First Theory)

(Vaysman 2009)

(Gordon 2002; Kager 2012; van der Hulst 2012)

Thank you!

Thanks to Natália Brambatti Guzzo and Jeff Lamontagne.

This research was supported by FRQSC and SSHRC.

References I

- Bisol, L. (1992). O acento e o pé métrico binário. *Cadernos de Estudos Linguísticos*, 22:69–80.
- Bisol, L. (2000). O troqueu silábico no sistema fonológico (um adendo ao artigo de Plínio Barbosa). *DELTA: Documentação de Estudos em Linguística Teórica e Aplicada*, 16(2):403–413.
- Blevins, J. (2004). *Evolutionary phonology: the emergence of sound patterns*. Cambridge University Press, Cambridge, UK.
- Carpenter, B., Gelman, A., Hoffman, M., Lee, D., Goodrich, B., Betancourt, M., Brubaker, M., Guo, J., Li, P., and Riddell, A. (2017). Stan: a probabilistic programming language. *Journal of Statistical Software, Articles*, 76(1):1–32.
- Garcia, G. D. (2017). *Weight effects on stress: lexicon and grammar*. PhD thesis, McGill University.
- Garcia, G. D. (2019). When lexical statistics and the grammar conflict: learning and repairing weight effects on stress. *Language*, 95(4):612–641.
- Gordon, M. (2002). A factorial typology of quantity-insensitive stress. *Natural Language & Linguistic Theory*, 20(3):491–552.
- Hayes, B. (1995). *Metrical stress theory: principles and case studies*. University of Chicago Press, Chicago.
- Hayes, B. (1999). Phonetically-driven phonology: the role of Optimality Theory and inductive grounding. In Darnell, M., Moravcsik, E., Newmeyer, F. J., Noonan, M., and Wheatley, K., editors, *Functionalism and formalism in linguistics, Volume I: general papers*, pages 243–285. Benjamins.

References II

- Jun, S.-A. and Fougeron, C. (2000). A phonological model of French intonation. In Botinis, A., editor, *Intonation*, pages 209–242. Springer, Dordrecht.
- Kager, R. (2012). Stress in windows: language typology and factorial typology. *Lingua*, 122(13):1454–1493.
- Kaye, J., Lowenstamm, J., and Vergnaud, J.-R. (1990). Constituent structure and government in phonology. *Phonology*, pages 193–231.
- Lee, S.-H. (2007). O acento primário no português: uma análise unificada na Teoria da Otimalidade. In Araújo, G. A., editor, *O acento em português: abordagens fonológicas*, pages 120–143. Parábola, São Paulo.
- McCarthy, J. and Prince, A. (1986). Prosodic Morphology. Manuscript.
- Mielke, J. (2008). *The emergence of distinctive features*. Oxford University Press, Oxford.
- Newell, H. (2017). There is no word: implications for the phonology-syntax interface. Presented at GLOW 40, Leiden University, March.
- Özçelik, Ö. (2017). The foot is not an obligatory constituent of the prosodic hierarchy: “stress” in Turkish, French and child English. *The Linguistic Review*, 34(1):157–213.
- Pierrehumbert, J. (2003). Probabilistic phonology: discrimination and robustness. In Bod, R., Hay, J., and Jannedy, S., editors, *Probability theory in linguistics*. MIT Press, Cambridge, MA.

References III

- Prince, A. (1990). Quantitative consequences of rhythmic organization. *CLS*, 26(2):355–398.
- Pulleyblank, D. (2006). Minimizing UG: constraints upon constraints. In *Proceedings of the 25th West Coast Conference on Formal Linguistics (WCCFL 25)*, volume 25, pages 15–39, Somerville, MA. Cascadilla Proceedings Project.
- Schiering, R., Bickel, B., and Hildebrandt, K. A. (2010). The prosodic word is not universal, but emergent. *Journal of Linguistics*, 46(3):657–709.
- Steriade, D. (1999). Alternatives to syllable-based accounts of consonantal phonotactics. In Fujimura, O., Joseph, B., and Palek, B., editors, *Proceedings of the 1998 Linguistics and Phonetics Conference*, pages 205–242. Karolinum Press, Prague.
- van der Hulst, H. (2012). Deconstructing stress. *Lingua*, 122(13):1494–1521.
- Vaysman, O. (2009). *Segmental alternations and metrical theory*. PhD thesis, Massachusetts Institute of Technology.
- Vigário, M. (2003). *The prosodic word in European Portuguese*, volume 6. Walter de Gruyter, Berlin.
- Wetzels, W. L. (2007). Primary word stress in Brazilian Portuguese and the weight parameter. *Journal of Portuguese Linguistics*, 5:9–58.