Exploring sonority-driven stress in Brazilian Portuguese codas

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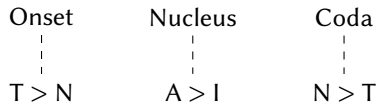
Syllable weight

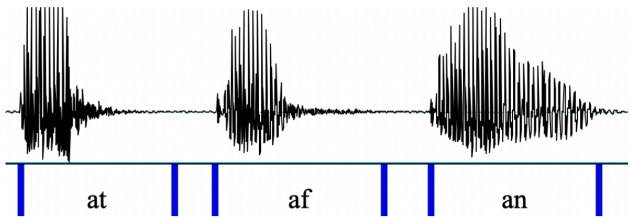
- Two most common criteria for binary weight
  1. {VV, VC} > V
  2. VV > {VC, V}
- Less commonly, sonority affects weight
  - **Rime**: more sonorous → heavier
    - **Nucleus**: lower → heavier
    - **Coda**: more sonorous → heavier
  - **Onset**: *less* sonorous → heavier

☞ **Schematically**



Sonority and weight

- Greater sonority = more perceptual energy
  - E.g., three equally long syllables:



- Total energy can be phonologized as weight (Gordon 2002)
- But then why the reversal in the onset, where T ≥ N?

☞ With low-sonority onsets...

1. rimes sound louder (Goedemans 1998, Gordon 2005)
2. p-centers tend to occur earlier (Ryan 2014)

Sonority-driven stress

- For **stress** in particular, sonority sensitivity
  - was once fairly widely accepted (E.g., Kenstowicz 1997, de Lacy 2004, 2006)
  - but is nowadays more controversial, e.g.
    1. Shih (2016): "Sonority-driven stress does not exist"
    2. Shih and de Lacy (2019): "there is no reliable evidence that metrical feet are attracted to or repelled by segments of particular sonority levels"
    3. Rasin (2018): "The distribution of stress is never conditioned by segmental features" (including sonority)
- Classic cases were argued to be
  1. misreported (E.g., Shih 2018, Bowers 2019 on Gujarati)
  2. misanalyzed (E.g., Rasin 2018 on Kobon and Nanti)

☞ Nevertheless, this literature has focused almost exclusively on **vowel sonority**

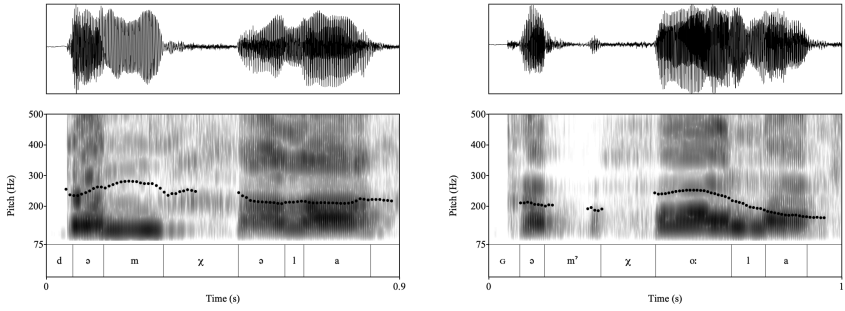
Coda sonority and stress

- Some reports in grammars, but largely underdocumented (Recent review in Paramore 2025)
  1. **Inga Quechua** (Levinsohn 1976): VN ultima said to attract stress, but rare word shape; only a handful of examples provided; no discussion of phonetics; no corroborating evidence or sources
  2. **Lamang** (Chadic; Wolff 1983): similarly dubious
  3. **Paipai** (Yuman; Joel 1966): similarly dubious
  4. **Orya** (Foja Range, Papuan; Fields 1991): similarly dubious
  5. **Yahi** (dialect of Yana; Hinton and Luthin 2002): statistical tendency, judging by Sapir's 1915 field notes
  6. **Huehuetla/Pisaflores Tepehua** (Totonacan; MacKay and Trechsel 2010, Kung 2007): more promising per Ryan (2025)
  7. **Kwak'wala** (Wakashan): also more promising...

Kwak’wala (Wakashan)

- Stress on the leftmost syllable containing a full vowel or (non-glottalized) sonorant coda

(Boas 1947, Zec 1995, Bach et al. 2005, etc.; figure from Noguchi et al. 2012)



- But possibly phrasal prominence rather than word-level metrical stress

(Elfner 2023)

Coda sonority and weight: beyond stress

- VN > VT in other weight-sensitive systems
  1. Poetic meter (Ryan 2019b on Finnish, Greek, Tamil)
  2. End-weight (type "thick and thin"; Ryan 2019a with refs.)
  3. Syllable size restrictions (E.g., in Kwak'wala, coda N cannot follow a full vowel; Bach et al. 2005)
  4. Compensatory lengthening (E.g., only a coda sonorant triggers it in Huehuetla Tepehua; Kung 2007)
  5. Tone licensing (E.g., Zhang 2004, but is not necessarily related to metrical weight)

This talk

Brazilian Portuguese (BP)

- BP stress is **weight-sensitive:** both nuclei and codas are relevant to stress in non-verbs
  - We focus on **codas** → *jornál* 'newspaper', *pomár* 'orchard', *armazém* 'warehouse', *matríz* 'matrix'
- So-called **regular stress** in non-verbs is typically final if H] and penultimate otherwise
- Exceptions include words with antepenultimate stress: *patético* 'pathetic'

☞ Two tasks to examine whether stress is affected by coda sonority

Experimental design

Two tasks involving nonce words

- **Participants:** Brazilian Portuguese speakers living in Canada ($n = 28$)
- Online experiment using Gorilla targetting **coda sonority**: (Anwyl-Irvine et al. 2020)
  - `son` = {N, l, r} vs. `obs` = {s}: all nonce words were singular

Task 1: forced-choice task ($n = 86$) with 4 weight profiles (HLL, LHL, LLH, LLL*)

- \+ beep → written + audio form
- ☞ *Which version do you prefer?*

`nulquibe`: ['nuwkibe]-[nuw'kibe]

`first` | `second`

Task 2: orthographic with no audio ($n = 50$) with 3 weight profiles (HLL, LHL, LLL)

☞ *The _____ will be released at the end of the month*

`DIpante` `diPANte`

Results

Task 1: weight

- **Sanity check:** do results align with typical findings about Portuguese stress?
- Penultimate stress (PU) overall favoured in all but one condition: LLH (*so, yes*)

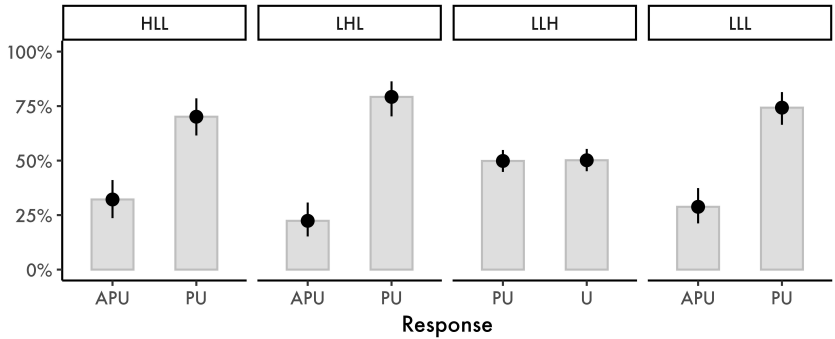


Figure 1: Main results for task 1

Analysis

Task 1: weight (hierarchical logistic regression)

$\mathscr{M}_1$

```
PU ~ weight +
(1 + weight | id) +
(1 | item)
```

- Unsurprisingly, word-final effects

☞ Wd-internally, trends in expected direction

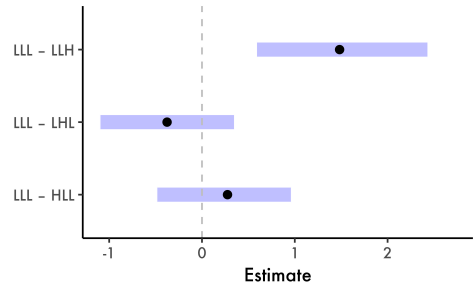


Figure 2: Posterior estimates (log-odds) of PU stress. Positive values mean PU is more likely in the first weight profile than in the second.

Results

Task 2: weight

- Apparent weight effect in HLL words in task 2

(E.g., Garcia 2019; Garcia and Goad 2024)

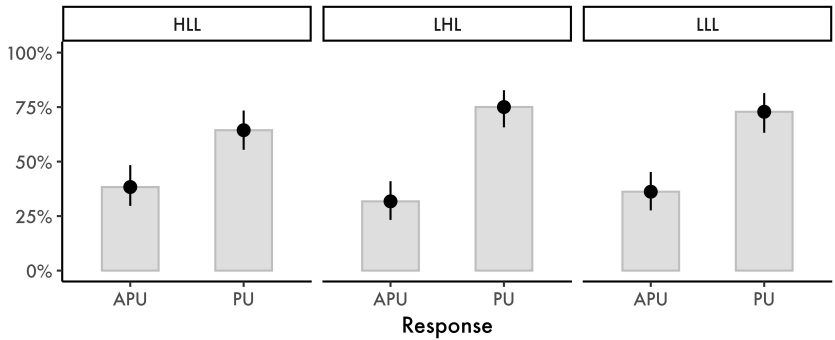


Figure 3: Main results for task 2

Analysis

Task 2: weight (hierarchical logistic regression)

$\mathscr{M}_2$

```
PU ~ weight +
(1 + weight | id) +
(1 | item)
```

- HLL effects
- LHL trends in expected direction

(Garcia 2019)

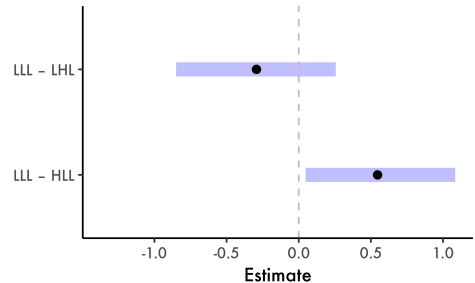


Figure 4: Posterior estimates (log-odds) of PU stress. Positive values mean PU is more likely in the first weight profile than in the second.

Results

Task 1: sonority

- Clear effect of coda sonority on participants' stress preferences in LLH words
- No apparent effect for HLL and LHL

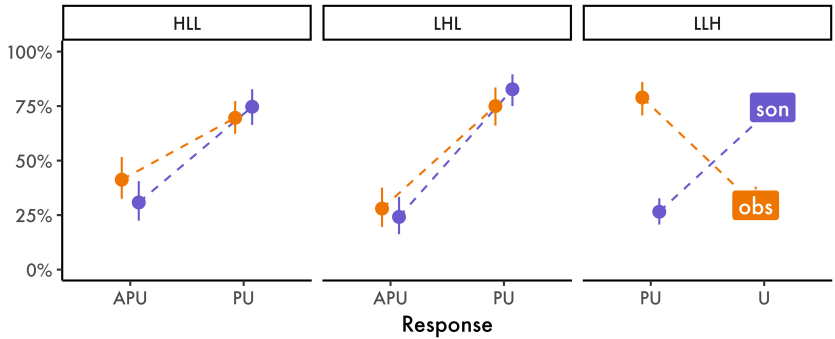


Figure 5: Task 1 by sonority profile of coda consonant

Results

Task 1: sonority

- No apparent difference within sonority class (sonorant consonants)

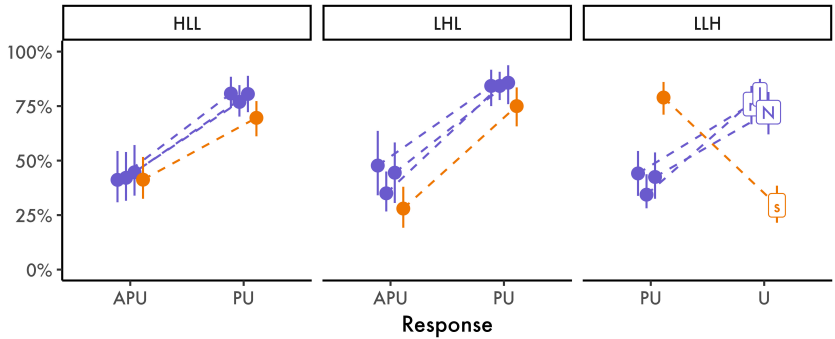


Figure 6: Task 1 by coda consonant

Analysis

Task 1: sonority (hierarchical logistic regression)

$\mathscr{M}_3$

```
PU ~ weight * sonority
(1 + weight * sonority | id) +
(1 | item)
```

- Strong effects in LLH syllables
- Effects for LHL in expected direction
- Effects for HLL in unexpected direction

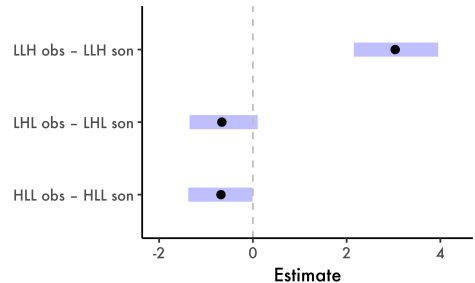


Figure 7: Posterior estimates (log-odds) of PU stress. Positive values mean PU is more likely in the first weight profile than in the second.

Results

Task 2: sonority

- Aligned with task 1, no apparent effects word-internally (*no sonority effects will be reported*)

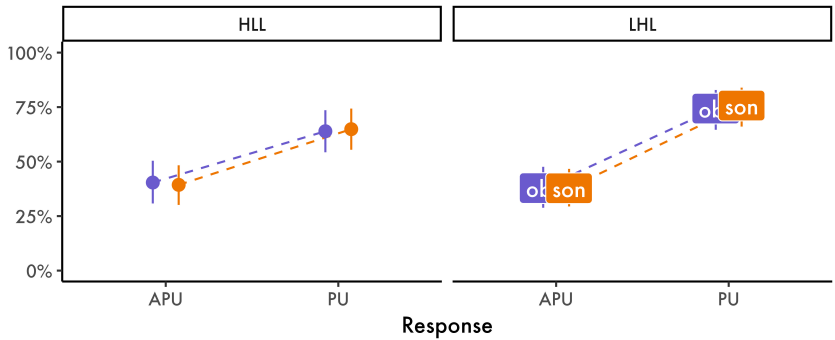


Figure 8: Task 2 by sonority profile of coda consonant

Morphology?

Lexical statistics

- Could these results be explained only by morphology?
- Patterns found in the lexicon where all words are **monomorphemic**

(Garcia 2014)

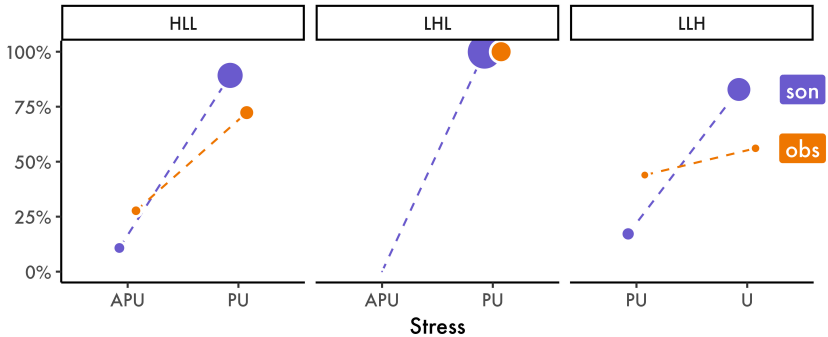


Figure 9: Patterns in the lexicon. Circle size = representativeness in lexicon

Morphology?

Lexical statistics

- We see **similar** trends in the lexicon, where all words are **monomorphemic**

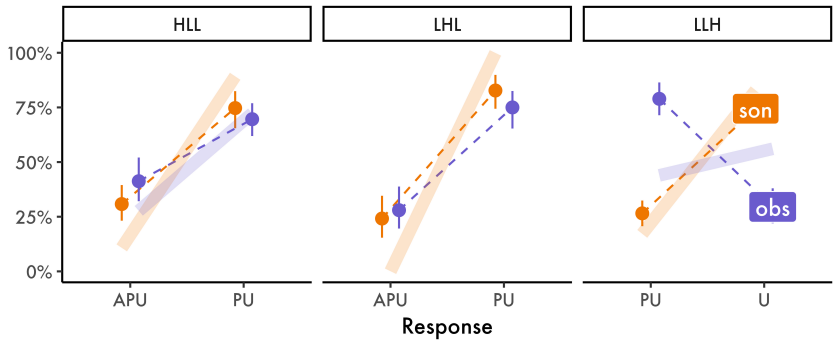


Figure 10: Patterns in the lexicon (thick lines) vs. experimental results (task 1)

Summary

- Both tasks show **weight effects** consistent with previous studies or the lexicon
- **Sonority effects** are robust in word-final syllables
- Morphology likely plays an indirect role given the existing confounds

☞ But given lexical statistics and our experimental design, there's robust evidence for an effect

Final remarks

- For obstruents, only /s/ was tested because it's the only possibility in the language
- /s/ **can** occur in monomorphemes, but is more commonly found as a plural suffix
- A plural reading is unlikely given the experimental design, *but not impossible*

☞ In the lexicon, /s/ does not attract stress as strongly as sonorants do

- Overall, word-final effects are not surprising given previous findings in the language
- In some other cases of sonority-driven stress, it is also word-final consonants that matter[1]

[1] Inga Quechua, Huehuetla Tepehua, Pisaflores Tepehua.

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☞ Slides can be found at gdgarcia.ca

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Individual variation

Task 1 ($LL\acute{H}_{obs}$)

☞ **All participants** are consistent with sonority effects

- A few are consistent with morphology effects (0% of final stress when $LL\acute{H}_{obs}$)

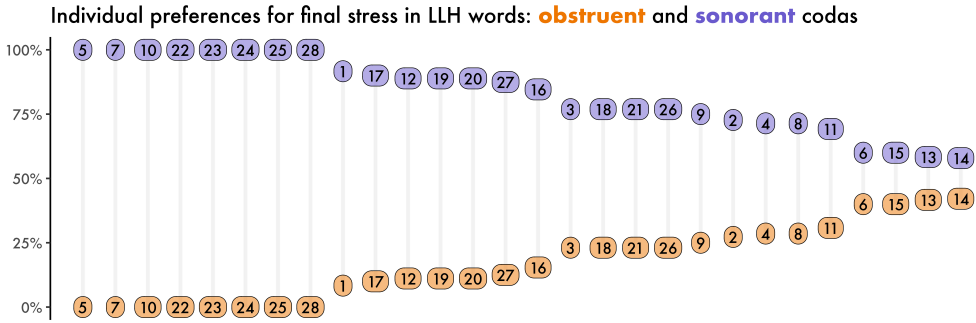

Figure 11: Sonorant ≻ obstruent codas for all participants.