Grammar trumps lexicon

Typologically inconsistent weight effects are not generalized

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Phonological learning

Can speakers acquire subtle phonological patterns in the lexicon?

- ○ Not all patterns learned are in the lexicon   (Poverty of the stimulus)
- ○ **Not all patterns in the lexicon are learned**   (Surfeit of the stimulus)
    E.g.: Unnatural patterns → harder to learn   (Hayes et al. 2009)

▶ What if such patterns **contradict typology**?

Phonological learning

Mismatches between lexicon and grammar

Typologically contradictory lexical patterns

▶ Initial-σ Faithfulness: 'life' → 'lives'   (Becker et al. 2012)

  ○ Monosyllables > polysyllables in the English lexicon
  ○ Monosyllables = polysyllables in wug test

▶ Sonority Sequencing Principle in initial clusters   (Jarosz 2017)

  ○ Sonority plateaux > sonority rises in the Polish lexicon
  ○ Sonority rises favoured by children

Phonological learning
This presentation

Typologically contradictory lexical patterns

▶ Weight effects on stress
- ○ **Negative** for antepenult stress in the Portuguese lexicon
- ○ **Positive** for antepenult stress in experimental data

▶ **Bottom line:**
- ○ Speakers learn subtle lexical (sub)patterns (Q1)
- ○ But not a pattern that contradicts typology (Q2)
- ○ **Crucially:** speakers generalise the **opposite** pattern
  - *i.e., the expected pattern given the typology*

Weight & stress

Weight-sensitive languages:

Ⓐ Stress is affected by weight, i.e., rhyme shape
Ⓑ Most cases: categorical weight: heavy (H) or light (L)
Ⓒ Heavy syllables attract stress:

...H́... better than ...Ĺ...

Weight effects in Portuguese...

... are gradient, not categorical (cf. Ⓑ)

... are negative for antepenult stress: Ĺ better than H́ (cf. Ⓒ)

☞ **Do speakers ignore, generalise or repair these facts?**

Background   **Stress in Portuguese**
Data and analysis   Questions
Final remarks   Lexical baseline

Stress in Portuguese non-verbs

Traditional approaches: categorical

▶ Traditional generalisation: $\boxed{\textbf{X\'H]}_{Wd} \textbf{ else } \textbf{\'XX]}_{Wd}}$

1. Stress is **final (U)** if final syllable is heavy   *pomár* 'orchard'
2. Stress is **penult (PU)** otherwise   *macáco* 'monkey'
3. **Antepenult (APU)** stress is irregular   *patético* 'pathetic'

∴ Weight effects are constrained to the word-final syllable

Background · **Stress in Portuguese**
Data and analysis · Questions
Final remarks · Lexical baseline

Stress in Portuguese non-verbs

Probabilistic approach (**?**)

- ▶ **Categorical** approaches miss important sub-patterns

- ▶ These sub-patterns can be captured in a **probabilistic** analysis

  In a comprehensive corpus of Portuguese (n=154,610):

1. Weight effects are **gradient**: $H_3 < H_2 < H_1$

2. **All three** syllables in the domain are weight-sensitive

3. Antepenult syllables show a **negative** effect:
   ĹLL is statistically better than ḦLL   ← *today's talk*
       Inconsistent with the typology
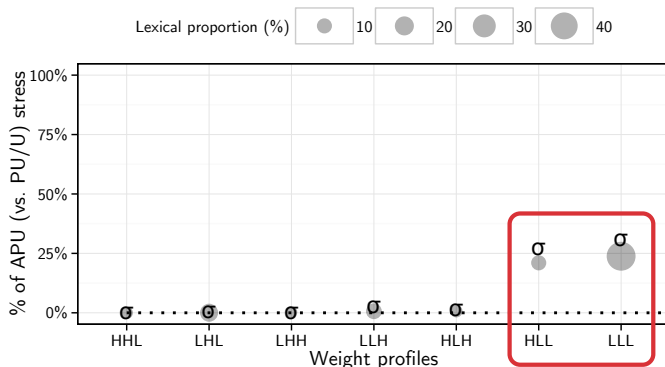
Notation: $\mathbf{H}_3 \ \mathbf{H}_2 \ \mathbf{H}_1]_{Wd}$

Background   **Stress in Portuguese**
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Stress in Portuguese non-verbs

Probabilistic approach (**?**)

σ = probabilisitic approach
● = actual data
... = categorical approaches

Background
Data and analysis
Final remarks

Stress in Portuguese
Questions
Lexical baseline

Questions

1. **How do speakers' grammars generalise weight effects?**
   Do they capture the subtle weight effects in the domain?

2. **How do speakers deal with an inconsistent pattern?**
   Do they ignore, generalise or repair APU effects?

Background   Stress in Portuguese
Data and analysis   Questions
Final remarks   **Lexical baseline**
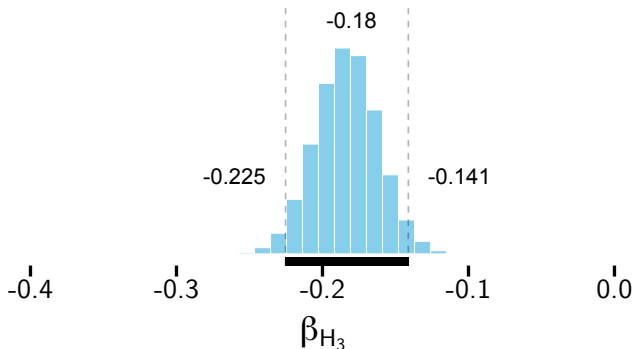
Lexical baseline

Input *vs.* lexicon
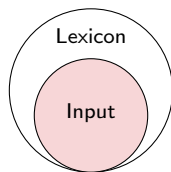
▶ Is the negative H_3 effect realistically in the input?
  ○ If not, then speakers' lexica will have no negative effects
  ○ E.g., the negative effect could stem from rare words

▶ Three methods to evaluate how realistic the effect is:
  1. Examine distribution of credible effect sizes
  2. Simulate smaller sublexica
  3. Model ≈20,000 most frequent words only

Background
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Stress in Portuguese
Questions
Lexical baseline

Lexical baseline: **HLL** vs. **LLL**

Entire corpus ($n = 81{,}299$): Markov Chain Monte Carlo simulation

▶ Posterior distribution with estimated mode and 95% HDI
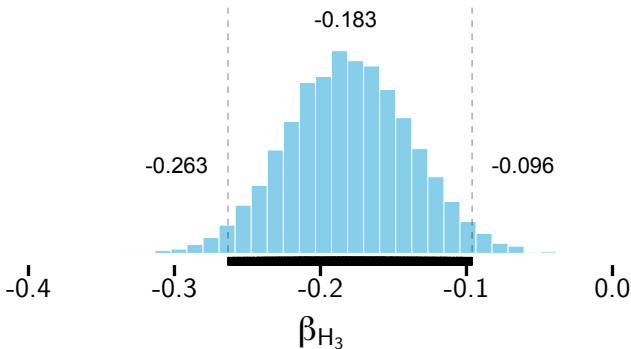
▶ All credible effects of H_3 are **negative**:[1]

β_{H_3}

─────────────────

[1]Bayesian logistic regression (MCMC)

Background   Stress in Portuguese
Data and analysis Questions
Final remarks   Lexical baseline

Lexical baseline: **HLL** *vs.* **LLL**

Sublexica simulation ($n = 10,000 \times$ 25,000 words [with replacement])

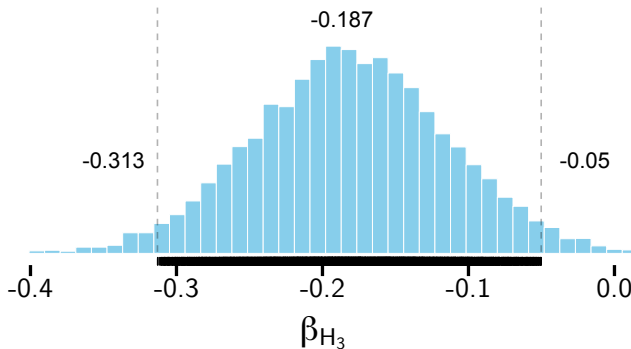▶ Effect of H_3 is **negative** in all simulations:[2]

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[2]Simple logistic regressions

Background | Stress in Portuguese
Data and analysis | Questions
Final remarks | Lexical baseline

Lexical baseline: **HLL** *vs*. **LLL**

Sublexica simulation ($n = 10,000 \times$ 10,000 words [with replacement])

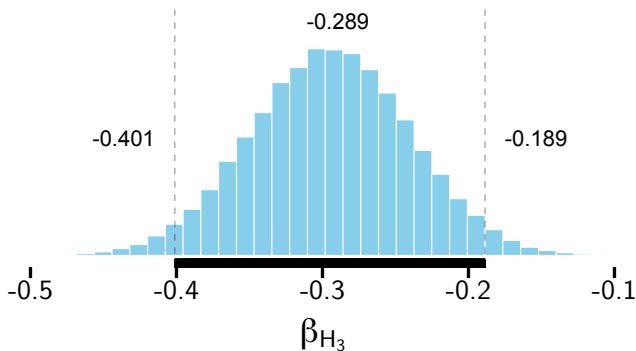▶ Effect of H_3 is **negative** in 99.7% of all simulations:[3]

$$\beta_{H_3}$$

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[3]Simple logistic regressions

Background
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Stress in Portuguese
Questions
Lexical baseline

Lexical baseline: **HLL** *vs.* **LLL**

Most frequent non-verbs (based on Tang 2012): $n = 22{,}634$

▶ All credible effects of H_3 are **negative**:[4]

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[4]Bayesian logistic regression (MCMC)

Background | Stress in Portuguese
Data and analysis | Questions
Final remarks | Lexical baseline
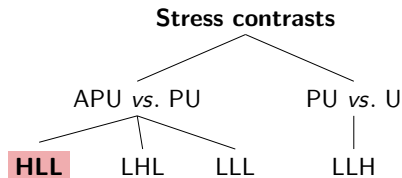
Lexical baseline: **HLL** *vs*. **LLL**

- ▶ Negative effect of H_3 is reliable in the lexicon
- ▶ This contradicts the typology of weight effects
- ☞ **How do speakers' grammars deal with such effects?**

Background
Data and analysis
Final remarks

Design
Q1: Weight gradience
Q2: APU stress (H_3)

Experimental design

- ▶ Nonce words ($n = 240$) with different weight profiles
    - ○ Stimuli generated with script
    - ○ Filtered by phonotactic probability

        (Garcia 2015)

- ▶ Auditory forced-judgment task involving minimal pairs:

    Same word in each pair; different stress position

    | "Which word sounds better to you?" E.g., HĹL or ĤLL |

Stress contrasts

APU *vs.* PU   PU *vs.* U

HLL   LHL   LLL   LLH

Background
Data and analysis
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Design
Q1: Weight gradience
Q2: APU stress (H₃)

Experiment

- ▶ Stimuli recorded by phonetically trained native speaker (f)
- ▶ Version Ⓐ 27 speakers
- ▶ Version Ⓑ 32 speakers (replication of Version A)

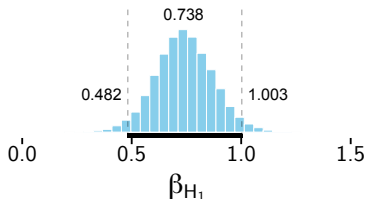 *All participants are native Brazilian Portuguese speakers*

- ▶ **Analysis:**
  - ○ Bayesian Logistic Regressions (MCMC simulation)
  - ○ By-speaker random intercepts
  - ○ stress ∼ weight

Background
Data and analysis
Final remarks

Design
Q1: Weight gradience
Q2: APU stress (H₃)

Q1: How do speakers' grammars generalise weight effects?

H_1 effects (LLH words): penult *vs.* final stress

Data

Version A

0.738
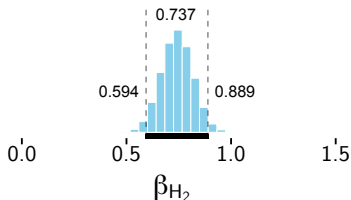
0.482   1.003

0.0   0.5   1.0   1.5

β_{H_1}

Version B

0.614

0.343   0.873

0.0   0.5   1.0

β_{H_1}
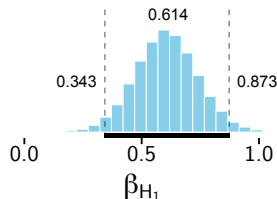
LLH: Penult *vs.* final stress: $U \succ PU$

Background
Data and analysis
Final remarks

Design
Q1: Weight gradience
Q2: APU stress (H_3)

Q1: How do speakers' grammars generalise weight effects?
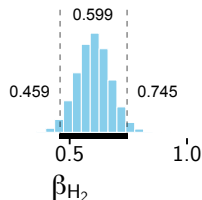
H_2 effects (LHL words): antepenult *vs.* penult stress

Data

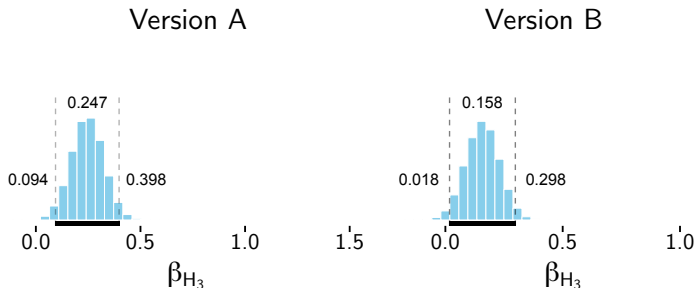Version A   Version B

LHL: Antepenult *vs.* penult stress: PU $\succ$ APU

Background
Data and analysis
Final remarks

Design
Q1: Weight gradience
Q2: APU stress (H_3)

Q2: How do speakers' grammars deal with APU stress?

H_3 effects (HLL words): antepenult *vs.* penult stress

Data

Version A

Version B

HLL: Antepenult *vs.* penult stress: APU ≻ PU

Background
Data and analysis
Final remarks

Design
Q1: Weight gradience
Q2: APU stress (H_3)

Summary

1. **How do speakers' grammars generalise weight effects?**

   Do they capture the subtle weight effects in the domain?

☞ **Yes: $H_{3<2<1}$ all affect stress**

2. **How do speakers deal with an inconsistent pattern?**

   Do they ignore/generalise/repair APU effects in the lexicon?

   ○ Ignore → ĤLL = ĹLL   (cf. Becker et al. 2012)
   ○ Generalise → ĹLL ≻ ĤLL
   ○ Repair → ĤLL ≻ ĹLL

☞ **H_3 positively affects APU stress**

   Contra lexical patterns, but consistent with weight typology

Thoughts on representing weight effects

$H_{3<2<1}$ all affect stress

- ▶ Weight effects are gradient
- ▶ Crucially: they depend on position of σ in word   (cf. Ryan 2011)
- ▶ Speakers are sensitive to this dependency
- ▶ WEIGHT-TO-STRESS Principle   (Prince 1983)

> **WSP$_n$**
>
> An unstressed heavy syllable in position n is penalised

Portuguese: $WSP_3 < WSP_2 < WSP_1$

Phonological learning
Final remarks

Can speakers acquire subtle phonological patterns in the lexicon?

- Not all patterns learned are in the lexicon (Poverty of the stimulus)
- **Not all patterns in the lexicon are learned** (Surfeit of the stimulus)

▶ What if such patterns **contradict typology**?

☞ **They can be repaired to conform to the typology**

$$\boxed{\text{ĹLL} \succ \text{ H́LL}} \rightarrow \boxed{\text{H́LL} \succ \text{ĹLL}}$$

Lexicon   Grammar

References I

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Acknowledgments

Fonds de recherche
Société et culture
Québec

Thank you ○ Obrigado

Appendix i

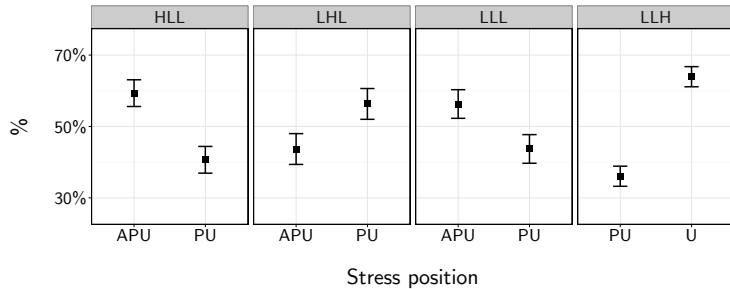Data results: Version A ($n = 27$)

Stress position
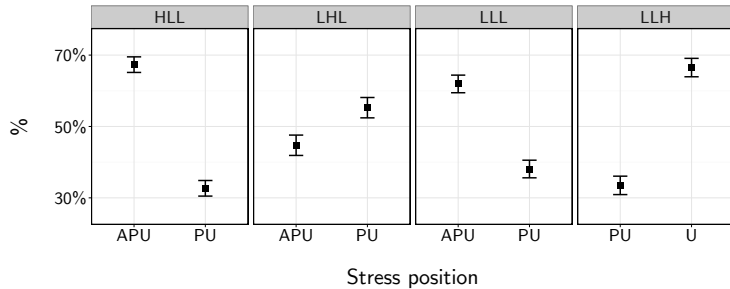
Appendix i

Data results: Version B ($n = 32$)

Stress position

Appendix ii
Why is weight gradient in Portuguese?

Three important facts about stress in the language:

1. Stress is highly correlated with duration (Major 1985)
   - ∴ heavy σs are usually longer
2. Unstressed vowels are reduced (Moraes 1998)
3. Secondary stress is only possible pre-tonically