When transfer fails:
Positional bias and weight-sensitivity in English stress

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GALANA, 2018
Indiana University, Bloomington
1. 40% of world’s languages WEIGHT-SENSITIVE (Ryan to appear)
   Heavier syllables are more likely to attract stress
   Pattern $\mathcal{P}$ (stress) is affected by factor $\mathcal{A}$ (weight)

2. General assumption in SLA: L1 transfer (White 1989)

   Helpful if L1 and L2 weight-sensitive
Today: what if more than one factor seem to affect $P$

- **Weight** and **position** in English stress
- Two typologically distinct L1s: **Portuguese** & **Mandarin**
Stress in English

Factor A: Weight

- English stress is partially determined by weight

- Regular stress in non-verbs
  - Heavy penultimate syllable $\rightarrow$ penultimate (PU) stress
  - Light penultimate syllable $\rightarrow$ antepenultimate (APU) stress
    - agénda vs. Cánada
    - arizóna vs. América

- Different patterns for verbs and non-verbs

(Hayes 1982)
Stress in English

Factor A: Weight

% of words with APU stress in the CMU Dictionary (cmudict)

<table>
<thead>
<tr>
<th>Weight profile</th>
<th>PoS</th>
<th>%</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>HLL</td>
<td>Adj</td>
<td>69.54</td>
<td>ábsolute</td>
</tr>
<tr>
<td>HLL</td>
<td>N</td>
<td>74.17</td>
<td>ábstinence</td>
</tr>
<tr>
<td>LHL</td>
<td>Adj</td>
<td>0</td>
<td>–</td>
</tr>
<tr>
<td>LHL</td>
<td>N</td>
<td>2.49</td>
<td>gálaxy</td>
</tr>
<tr>
<td>LLL</td>
<td>Adj</td>
<td>68.65</td>
<td>gérneral</td>
</tr>
<tr>
<td>LLL</td>
<td>N</td>
<td>75.05</td>
<td>précedence</td>
</tr>
</tbody>
</table>

Sample of 4,573 words (H = heavy; L = light)
Stress in English

**Factor B: Position**

1. Most non-verbs $\rightarrow$ PU or APU stress
2. Most common words in English are **short** ($\leq 4$ syllables)

- Disyllables and trisyllables will often have **initial stress**
Stress in English

Factor $B$: Position

Bias towards initial stress in English is well-known: (Cutler 2012)
50% polysyllabic words have initial stress
< 10% polysyllables with weak initial syllable (Cutler and Carter 1987)

Stress as cue to word boundary in English

Naturally useful to learners
Weight vs. position

- Two possible predictors of stress location:
  Weight and position highly correlated in common words

Could position conceal weight-sensitivity?
Stress in Mandarin

▶ Stress & weight are disputed in the language:

a. No stress  
   (Hyman 1977)

b. Weight-*insensitive*  
   (Feng 1995)

c. Weight-sensitive*
   (Duanmu 1990; Qu 2013)

* Like English, correlation between duration and weight
* Unlike English, weight not sensitive to syllable shape
**Stress in Mandarin**

*(Qu, 2013)*

- Qu (2013, p. 71): four-way weight distinction
- Based on durational differences across tones

<table>
<thead>
<tr>
<th>Tone</th>
<th>Weight</th>
<th>Pitch</th>
</tr>
</thead>
<tbody>
<tr>
<td>$T_{1/2/3/4}$ in isolation</td>
<td>Super-heavy</td>
<td></td>
</tr>
<tr>
<td>$T_1$: $mā$</td>
<td>‘mother’</td>
<td>High level</td>
</tr>
<tr>
<td>$T_2$: $má$</td>
<td>‘helm’</td>
<td>High rising</td>
</tr>
<tr>
<td>$T_4$: $mà$</td>
<td>‘scold’</td>
<td>High falling</td>
</tr>
<tr>
<td>$T_3$: $mǎ$</td>
<td>‘horse’</td>
<td>Light</td>
</tr>
<tr>
<td>$T_0$: $ma$</td>
<td>‘question marker’</td>
<td>Weightless</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Low falling</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Low level</td>
</tr>
</tbody>
</table>
Stress in Portuguese


- Different patterns for verbs and non-verbs (Wetzels 2007)

- Unlike English, Portuguese stress typically not initial
  (Most words → 3–4 syllables; penultimate stress)
Stress in Portuguese

☞ **Stress in non-verbs:**

- Heavy final syllable $\leadsto$ final stress  
  anzól, cacáu
- Light final syllable $\leadsto$ penultimate stress  
  ánta, gáto
- Light final and penultimate syllable $\leadsto$ antepenultimate stress  
  patético, ótimo
  ‘pathetic’, ‘great’
Interim summary

In English, Mandarin, and Portuguese:

- stress more likely on longer/heavier syllables
- L2ers could transfer this correlation (weight-sensitivity)

But position can be a good predictor of stress location too

Could position conceal weight-sensitivity?
Interim summary

Collinearity between two variables

1. Syllable weight
2. Initial stress

- Take 3-syllable words
  - Light penult → initial stress
  - Heavy penult → non-initial stress

- If position is a more salient predictor...
  - ... it could conceal weight effects in the L2

☞ How salient is salient enough?
  - E.g., Tolerance Principle

(Yang 2016)
Methods

Experiment

▶ Forced-choice task using Praat

3-syl nonce words (English) auditorily presented (N = 180)
Response + certainty level (1–6) + reaction time

▶ Participants: En (n = 13), Ma (n = 24), Pt (n = 25)
Upper-intermediate to advanced adult L2ers

Forced-choice task using Praat

3-syl nonce words (English) auditorily presented (N = 180)
Response + certainty level (1–6) + reaction time

Boersma and Weenink 2019
Methods

Experiment

Which of these two words sounds more natural?

first  second

1 (Not certain)  2  3  4  5  6 (Certain)
Statistical analysis

- Bayesian logistic regressions (multilevel)
  \[ \text{APU} \sim \text{weight} + (1 + \text{weight} \mid \text{subj}) + (1 \mid \text{item}) \]
  weight = \{LLL, HLL, LHL\}

Three models:

a. Naïve
   No \textit{a priori} assumption

b. Weight
   Weight assumed to be transferred

c. Position
   Position assumed to drive responses

Once we observe the data, which model has the best fit?
Results

Response patterns

▶ Only controls favor APU stress < 50% in LHL words

☞ L2ers: APU stress > 50% regardless of weight profile
  ○ What we would predict if position > weight

<table>
<thead>
<tr>
<th>Language</th>
<th>Weight Profiles</th>
<th>% Antepenultimate Stress</th>
</tr>
</thead>
<tbody>
<tr>
<td>English</td>
<td>LLL, HLL, LHL</td>
<td>0%, 25%, 50%, 75%, 100%</td>
</tr>
<tr>
<td>Mandarin</td>
<td>LLL, HLL, LHL</td>
<td>0%, 25%, 50%, 75%, 100%</td>
</tr>
<tr>
<td>Portuguese</td>
<td>LLL, HLL, LHL</td>
<td>0%, 25%, 50%, 75%, 100%</td>
</tr>
</tbody>
</table>
Results

Certainty

▶ Controls’ certainty aligned with weight-sensitivity

♫ L2ers overall more certain about APU stress

[Diagram showing graph with response certainty for LLL, HLL, and LHL categories, with labels for Ant and Pen, and certainty values ranging from 3.5 to 5.0 for each category.]
Results

Reaction time

- Controls’ RT aligned with weight-sensitivity
- L2ers overall faster when choosing APU stress
Statistical analysis (naïve models)

Posterior distribution of effect sizes

-2 0 2

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When transfer fails
Model comparison
N(aïve), P(osition), W(eight)

Positive bar $\rightarrow$ X- better fit

Δ

LOO WAIC

English

Mandarin

Portuguese

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Conclusion

▶ L2ers are not using weight consistently
  Instead, they favor initial stress across the board
▶ L2ers’ certainty and reaction time aligned with responses
  Consistent with the hypothesis that position ≻ weight

**Weight-sensitivity doesn’t seem to have been acquired**

**I.e.:** Not robust enough to be generalized by L2ers (E.g., Yang 2016)

*L2 lexicon size + low frequency of LHL (common) words*

☞ **Weight model:** no better fit for L2ers; better for natives


Thank you!

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Appendix i

Syllable duration in stimuli

Garcia

When transfer fails

Appendix
Appendix ii
Statistical models

Positive → antepenultimate stress is favored (relative to LLL)

<table>
<thead>
<tr>
<th></th>
<th>MODELS’ ASSUMPTIONS AND ASSOCIATED PRIORS</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1. Naïve</td>
</tr>
<tr>
<td><strong>LLL</strong></td>
<td>Effect:</td>
</tr>
<tr>
<td></td>
<td>–</td>
</tr>
<tr>
<td></td>
<td>Prior:</td>
</tr>
<tr>
<td></td>
<td>Flat</td>
</tr>
<tr>
<td><strong>HLL</strong></td>
<td>Effect:</td>
</tr>
<tr>
<td></td>
<td>–</td>
</tr>
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<td></td>
<td>Prior:</td>
</tr>
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<td></td>
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<td><strong>LHL</strong></td>
<td>Effect:</td>
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<tr>
<td></td>
<td>–</td>
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<td></td>
<td>Prior:</td>
</tr>
<tr>
<td></td>
<td>Flat</td>
</tr>
</tbody>
</table>

transfer no transfer
### Appendix iii
(Naïve) models’ results

<table>
<thead>
<tr>
<th>GROUPS</th>
<th>English</th>
<th>Mandarin</th>
<th>Portuguese</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>LLL</strong></td>
<td>0.82</td>
<td>0.80</td>
<td>0.56</td>
</tr>
<tr>
<td>95% HDI</td>
<td>[0.53, 1.11]</td>
<td>[0.53, 1.09]</td>
<td>[0.21, 0.91]</td>
</tr>
<tr>
<td><strong>HLL</strong></td>
<td>0.02</td>
<td>-0.22</td>
<td>-0.24</td>
</tr>
<tr>
<td>95% HDI</td>
<td>[-0.61, 0.68]</td>
<td>[-0.59, 0.15]</td>
<td>[-0.50, 0.02]</td>
</tr>
<tr>
<td><strong>LHL</strong></td>
<td>-1.51</td>
<td>-0.64</td>
<td>0.01</td>
</tr>
<tr>
<td>95% HDI</td>
<td>[-2.13, -0.93]</td>
<td>[-0.93, -0.35]</td>
<td>[-0.28, 0.31]</td>
</tr>
</tbody>
</table>
Appendix iv
Posterior predictive checks

English

![Graph showing response counts for different conditions (LLL, HLL, LHL). The graph compares the counts (0, 500, 1000) for each category (PU, APU).]
Appendix iv

Posterior predictive checks

Mandarin

When transfer fails
Appendix iv

Posterior predictive checks

Portuguese