Syllable weight effects on L2 Portuguese stress identification may be sonority-driven

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Structure of the talk

I. Literature review and motivation

II. Methods

III. Results

IV. Discussion

V. Conclusion

(English) lexical stress by L1-Mandarin

I

- Acoustic correlate of lexical stress:

  Pitch, duration and intensity, vowel quality.

- Stress perception by L1-Mandarin learners
  (Mixed findings due to participants' different English proficiency levels)

  - Pitch (Archibald 1997; Wang 2008)

  - Vowel quality > other cues (Zhang & Francis 2010)

  - **Duration** (Qin et al. 2017; Garcia 2020)

Why L1-Mandarin can use duration as a cue?

I

- Qu (2013):

Word-level prominence in Mandarin Chinese is cued by the durational difference between syllables, which correlates with the tone carried by the syllable (T0 < T3 < T1/T2/T4)

DONG (T1) XI (T1) vs. DONG (T1) xi (T0)

Heavy (H) Heavy (H) Heavy (H) Light (L)

duration > pitch , intensity (Lin 1985)

Portuguese Lexical stress

I

Over 70% Portuguese non-verbs (Garcia 2014):

a. Heavy final syllable → final stress

ma.CAU	a.ve.LÃ
CVV	CVN
(H)	(H)

Duration is the main cue (d'Andrade & Viana 1989; Shih 2023)

b. Light final syllable → PU stress

ca.VA.lo	sal.SI.cha
CV	CV
(L)	(L)

- Duration ~ Syllable weight (Portuguese; Garcia 2017)

Portuguese stress by L1-Mandarin

I

Research question: How well do L1-Mandarin speakers perceptually identify the location of Portuguese lexical stress?

A. Fairly well

- Cue-based transfer: learners can (re)use acoustic correlates employed in their L1 to acquire a novel L2 structure (Francis et al. 2000; Escudero & Boersma 2004)

B. Not well (stress deafness)

- Phonological weight (syllable shape) does not matter in Mandarin (Duanmu 2007)
- Duration is not the main cue (Pitch: Archibald 1997; Wang 2008)

Methods

II

Participants: 21 L1-Mandarin with moderate English (mean LexTALE score 30, SD = 7.23; 0–100 scale) and **no knowledge of Portuguese**

Task: auditory identification of stress location in Gorilla

请选择刚听到的单词中，哪个音节是重读音节（大写字母表示重读）。

请按 **"A"** 键选择左侧的选项，按 **"L"** 键选择右侧的选项，按 **"空格键"**如果你不清楚。

Please indicate which option contains the stressed syllable (uppercase) that you just heard.

Press **"A"** for the option on the left, **"L"** for the option on the right and **"Space"** if you are not sure.

JOfo

我不清楚～
I don't know

joFO

Methods

II

Stimuli: 30 2-syl pseudo-words in Portuguese

30 items with final stress: 10 LL, 10 LHn, 10 LHvv

Easier identification if the final syllable is heavy (H)

jofo pabem dacai

30 items with PU stress: 10 LL, 10 LHn, 10 LHvv

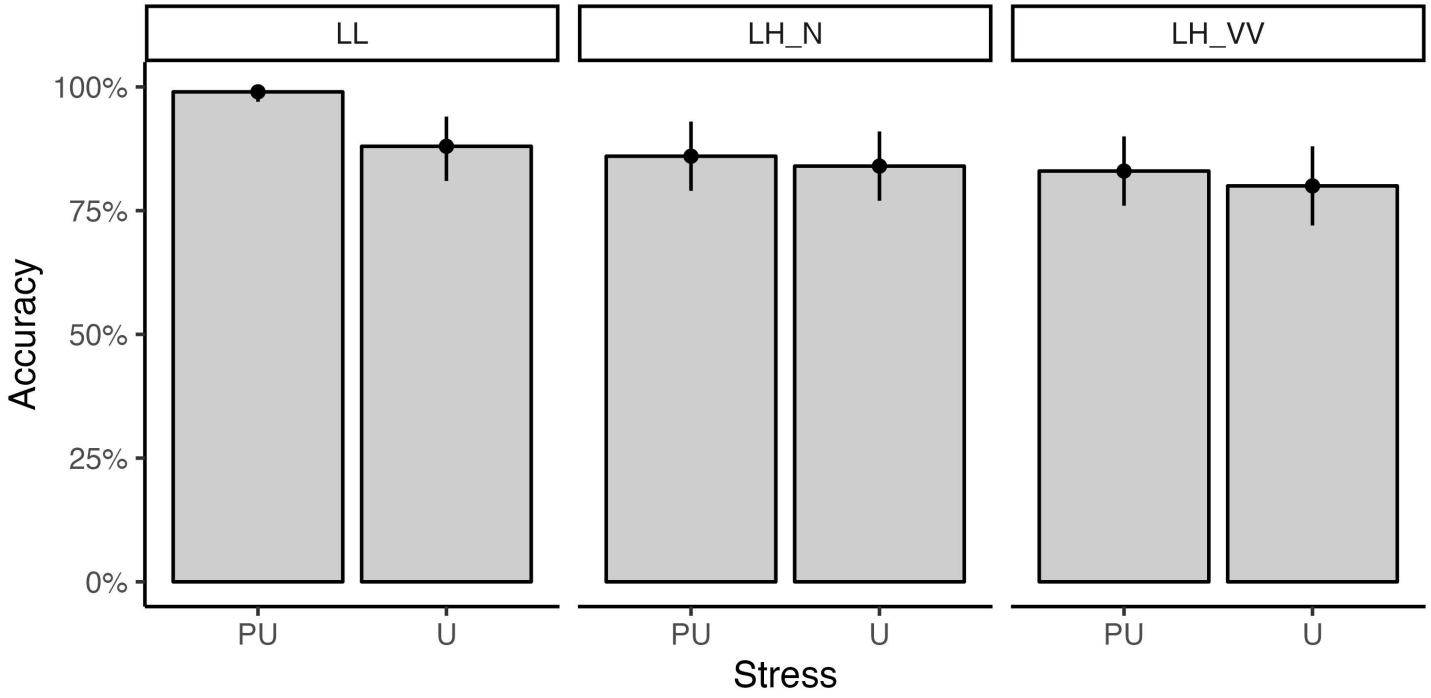
Harder identification if the final syllable is heavy (H)

Recordings performed by a trained female speaker of European Portuguese

Results

III

Native controls

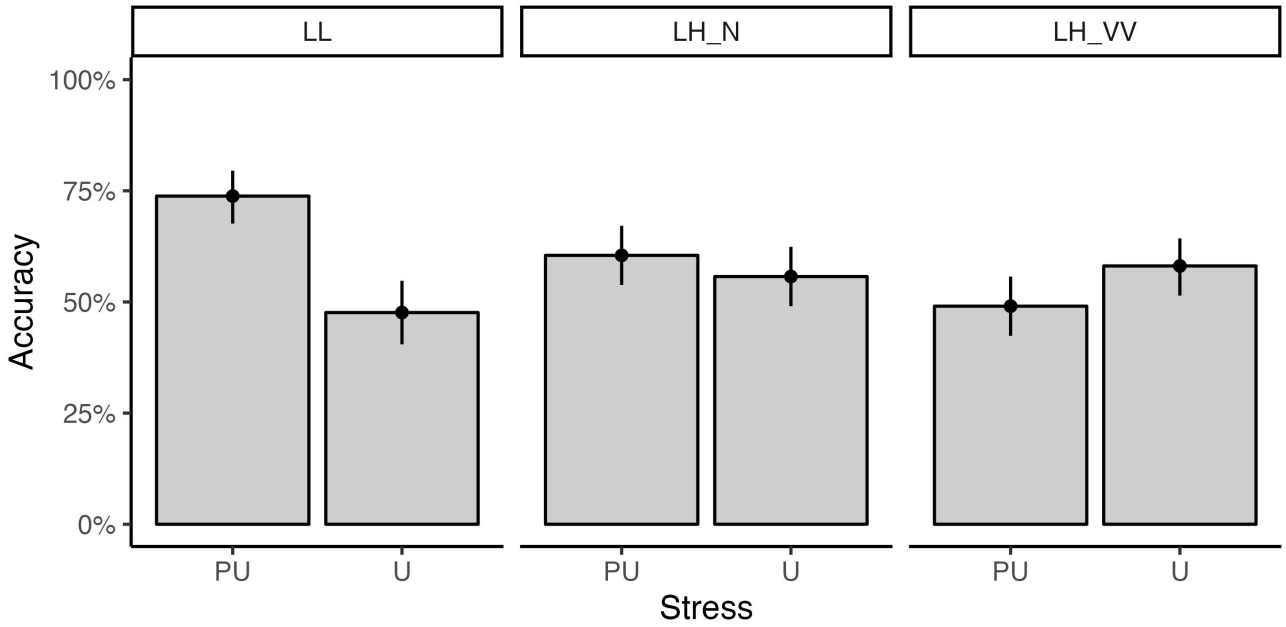


Only the most regular pattern (LL) is at ceiling, no weight effect.

Results

III

L1-Mandarin



Gradient sensitivity to weight

Accuracy on Penultimate stress (PU): LL > LH_N > LH_VV Weight hinders

Accuracy on final stress (U): LH_VV> LH_N> LL Weight helps

Results

III

L1-Mandarin

Maximal Bayesian mixed-effects regression

Accuracy ~ stress location * weight + (stress location * weight | participant) + (stress| item)

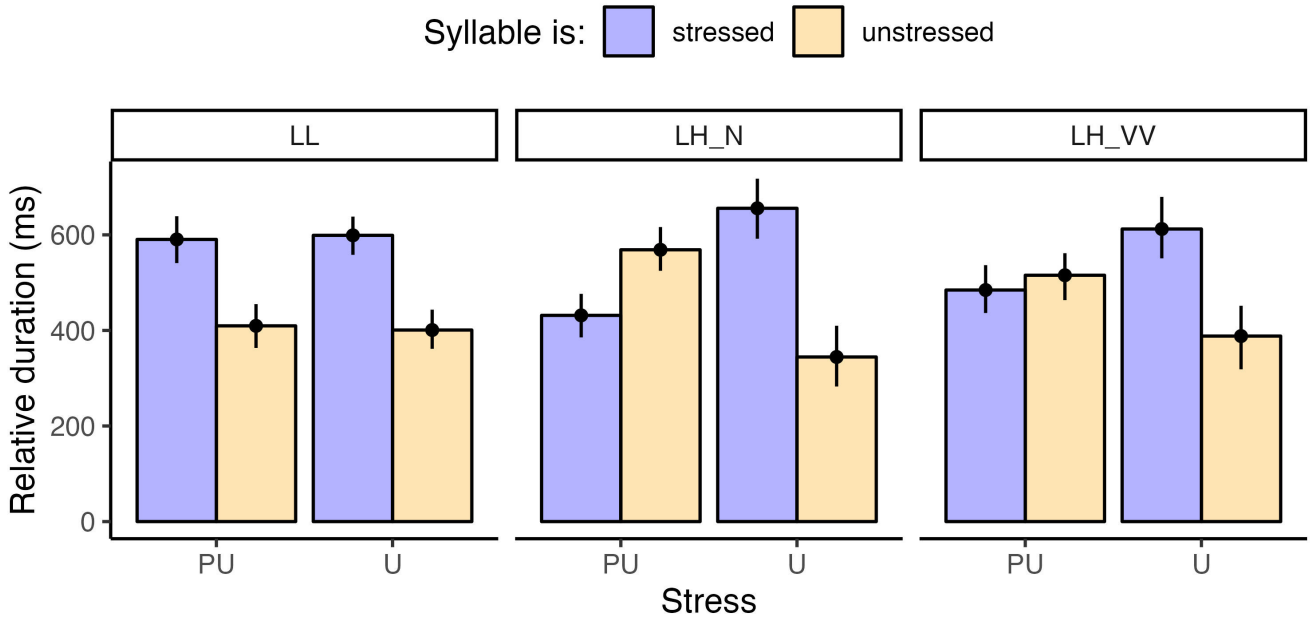
Stress location = {PU, U} Weight = {LL, LH_N, LH_VV}

	$\hat{\beta}$	**Est.Error**	**95% CrI**	
LH_VV:stressU	0.63	0.32	-0.01	1.22
LL:stressU	-1.21	0.41	-2.05	-0.41

Discussion

IV

What underlies the gradient weight effects (LH_VV > LH_N > LL): *duration?*

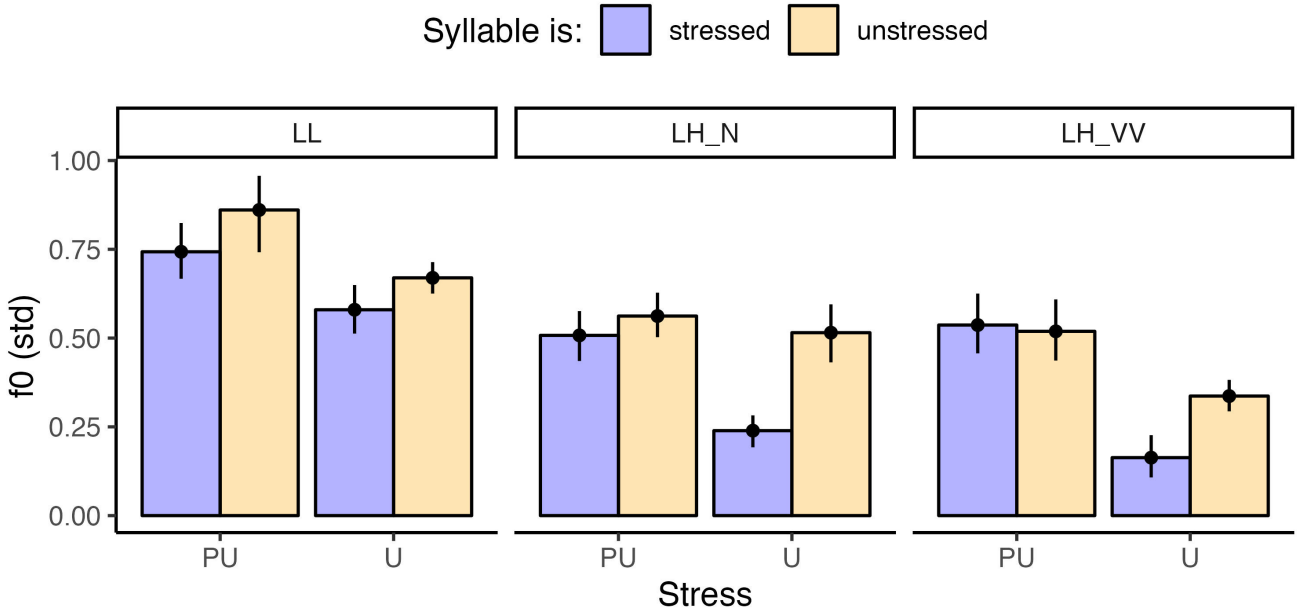


Durational difference explains LH > LL,
but not LH_VV > LH_N

Discussion

IV

What underlies the gradient weight effects (LH_VV > LH_N > LL): *f0 (standardized and centred)*



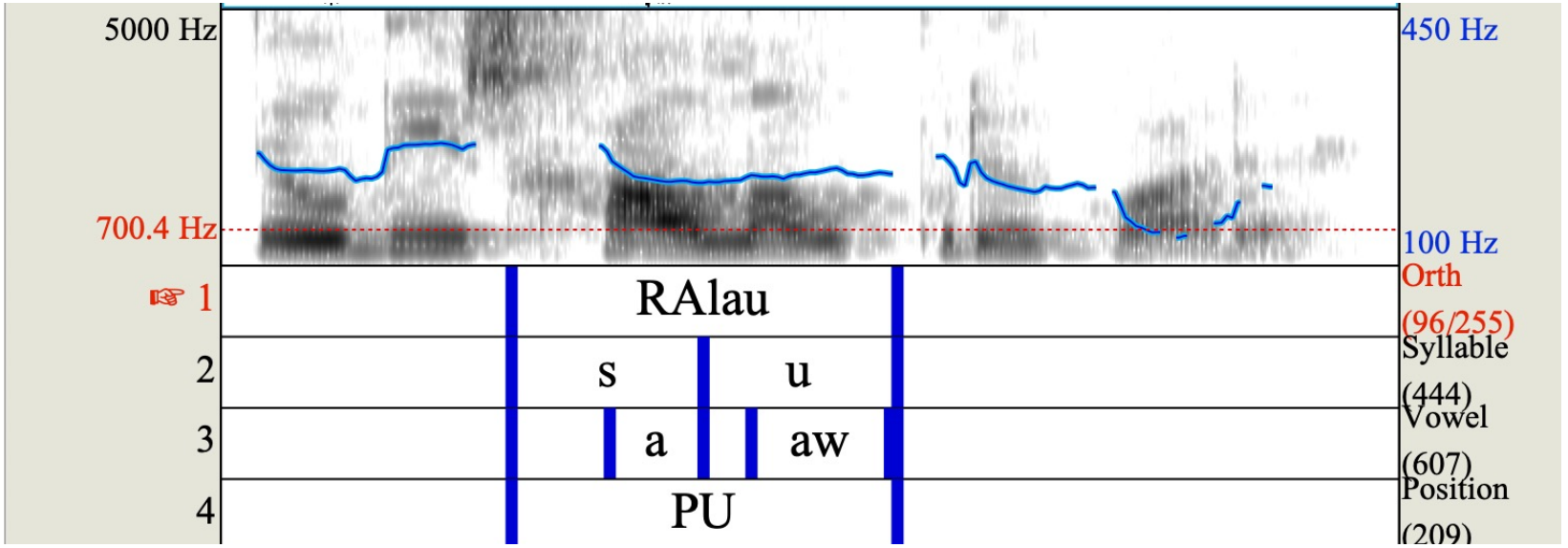
mean F0 does not seem to be a cue for European Portuguese stress (d'Andrade & Viana 1989; Shih 2023)

Discussion

IV

What underlies the gradient weight effects (LH_VV > LH_N > LL): *pitch contour*

Ele diz _____ por agora.

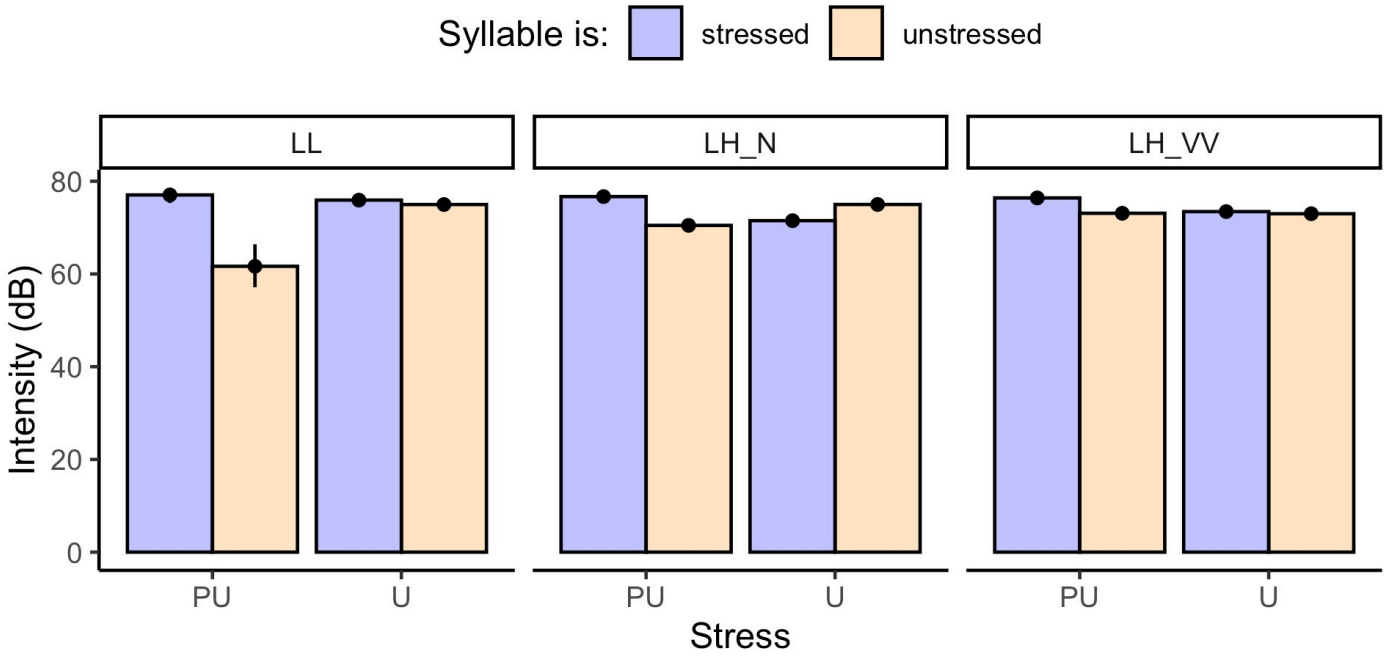


Pitch accent is rarely present in pre- and postnuclear position (Frota 2014)

Discussion

IV

What underlies the gradient weight effects (LH_VV > LH_N > LL): *intensity*

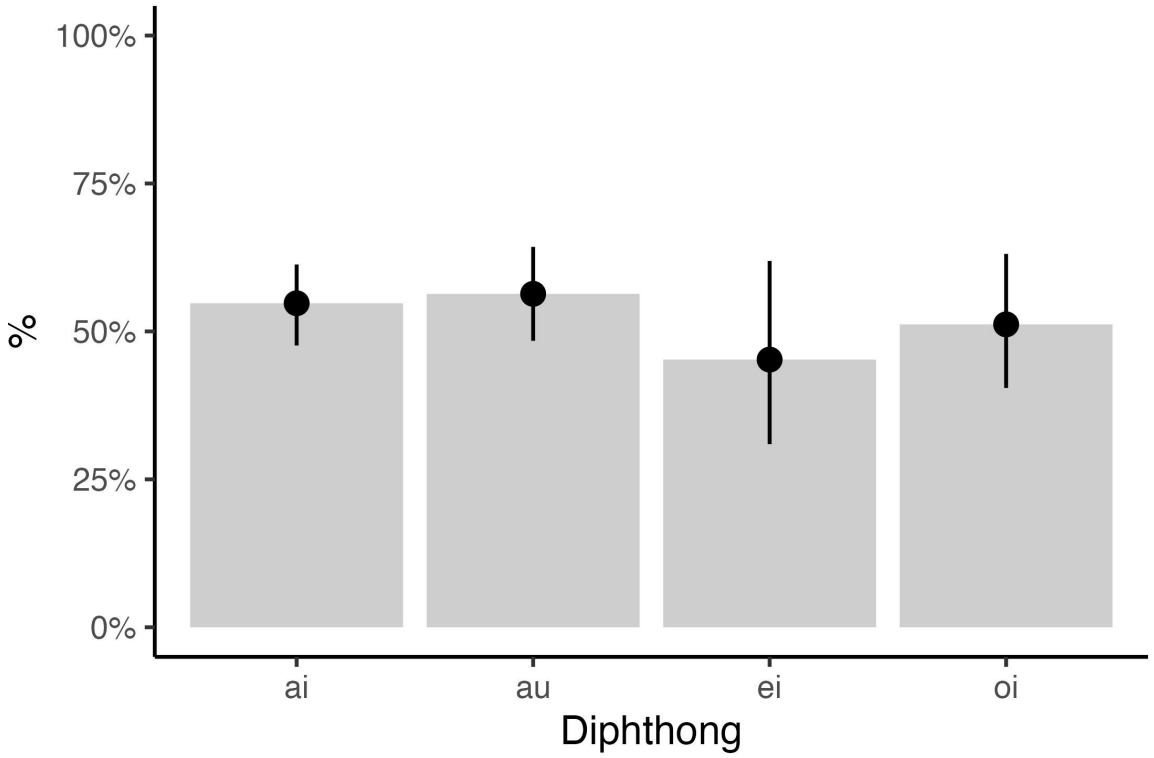


Intensity does not seem to be a reliable cue for European Portuguese stress (Shih 2023)

Discussion

IV

What underlies the gradient weight effects (LH_VV > LH_N > LL): *vowel quality*



Vowel quality (height) does not seem to influence learners' accuracy

Discussion

IV

What underlies the gradient weight effects (LH_VV > LH_N > LL)?

Duration → LH > LL

??? → LH_VV > LH_N

LH_VV: [aj], [aw], [ej], [oj]

LH_N: [ɐ̃w̃], [ẽj̃]

Discussion

IV

Gradient weight effects (LH_VV > LH_N > LL); sonority

If [ɐ̃w̃], [ẽj̃] are "faithfully" categorised as nasal diphthongs

- **Sonority**?
  oral vowel > nasal vowel (Ibrahim, 2022)

  If sonority scale is some kind of phonological universal, it is possible that all listeners may have access to it.

  Supporting evidence (Berent et al., 2007; 2009; 2010):
  Listeners prefer sonority-rising onset clusters than sonority-falling ones, even when their L1 does not contain any clusters.

Discussion

IV

Gradient weight effects (LH_VV > LH_N > LL); sonority

If [ɐ̃w̃], [ẽj̃] are categorised as /VN/, conforming to the L1 Mandarin phonotactics (Duanmu 2007)

- **Weight scale**?
  Cross-linguistically, VV tens to be the endpoint of weight scale (e.g., Gordon 2016).

  If weight scale is some kind of *phonological universal* (which can be shaped in a language-specific way, of course),it is possible that all listeners may have access to it.

Conclusion

V

- L1-Mandarin learners are not “deaf” to the lexical stress of a novel language
- Gradient weight effect in L2 Portuguese stems from both L1 cue-based transfer (duration) and phonological universals (weight hierarchy: VV > VC; sonority?)
- L2 speech perception (BiPhon, Boersma 2009; 2011)

/surface phonological form/ ← structural knowledge

↑ cue knowledge

[auditory form]

Future research

V

If cue-based approach is right, L1-Mandarin learners should also show weight sensitivity to trisyllabic words.

The same experiment with the same group of subjects:
Weight helps identify stress in the case of LLH, LHL,
but not **HLL**.

Structural constraint?
HLL → (HL) ⟨L⟩ (uneven trochee) or
HLL → (H) L ⟨L⟩ (medial unfooted syllable)

Thank you!

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