## Orthography triggers gradient phonological weight effects in L2 stress perception Chao Zhou<sup>1</sup> & Guilherme D. Garcia<sup>2</sup>

<sup>1</sup>Universidade de Lisboa, <sup>2</sup>Université Laval & CRBLM

zhouchao@edu.ulisboa.pt, guilherme.garcia@lli.ulaval.ca

**Background.** Word-level prominence in Mandarin is correlated with the durational difference between syllables (Qu 2013). When Mandarin native speakers learn lexical stress in a weight-sensitive language like Portuguese, where heavy final syllables CVV and CVN attract stress (Carvalho 1989), one would expect them to transfer L1 durational cues for prominence (Garcia 2020), drawing on syllable weight to locate Portuguese stress.

In a previous experimental study (authors, 2023), L1-Mandarin speakers (n=21) with moderate English proficiency showed a gradual sensitivity to Portuguese syllable weight in a stress identification task using Portuguese nonce words: the heavier the final syllable, the more accurate at locating final stress participants were. While the duration in the stimuli could partially explain the advantage of heavy (vs. light) syllables, it cannot explain why participants were more accurate with final syllables containing a diphthong (LHvv) than with final syllables containing a nasal coda (LHn), given that these two profiles had almost identical duration in the task. One factor that could be affecting these results is the presence of vowel reduction in the stimuli. In addition, given the potential role of orthographic information (Ruiz 2002), an open question is whether this type of visual cue could also impact participants' accuracy.

**Experiment.** Naïve L1-Mandarin listeners (n=95) without prior knowledge of Portuguese (thus representing the Mandarin phonology) participated in an auditory stress identification task with disyllabic pseudo-words in Portuguese displaying final or penultimate stress (n=60). While this is a partial replication of the study mentioned earlier, the stimuli were carefully redesigned and rerecorded to avoid potential phonotactic confounds and to counterbalance the presence of vowel reduction between conditions. 10 stimuli had two light syllables (LL), 10 ended with a nasal coda (LHn), and 10 had a final diphthong (LHvv). Given the previous experimental results, we hypothesized that L1-Mandarin participants would perform better with Portuguese final stress if the final syllable is heavy. During the identification task, some participants (n=44) received only auditory input while the others (n=51) received both auditory and orthographic input. This critical manipulation allows us to see whether orthography (3 characters in heavy syllables vs. 2 in light syllables) contributes to learners' use of syllable weight.

**Results & Discussion.** Bayesian mixed-effects regressions revealed an effect of syllable weight **only** for the auditory-orthographic group. As shown in Figure 1, the heavier the final syllable, the more accurate learners were at identifying final stress ( $b_{LL:stressU}$ = -0.74, 95% HDI [-1.32, -0.16];  $b_{LHvv:stressU}$ = 0.56, 95% HDI [0.02, 1.08]).

This orthography-induced gradient weight effect cannot be attributed directly to learners' L1 Mandarin, where syllable type doesn't correlate with word prominence, nor to the experimental input in the target language, as none of the examined acoustic correlates (duration, mean pitch, the presence of pitch accent and intensity) in the stimuli reliably cued the difference between LHvv and LHn. We speculate that orthography reduces the perceptual opacity of syllable shapes in a new language, thus enhancing speakers' ability to establish phonological representations from word endings perceived as "stronger".



Figure 1: Main results: accuracy (y-axis) by stress and weight profile. Gradient weight effect in final (U) syllables positively affects accuracy.

Following Hamann & Colombo (2017), we assume that, during the experiment, the written input is converted by naïve listeners as phonological surface forms (e.g. LL as /CV.CV/, LHn as /CV.CVN/ and LHvv as /CV.CVV/) via their L1 Mandarin Grapheme-to-Phoneme Conversion rule. These forms are then evaluated by the Mandarin phonological grammar in terms of well-formedness. Given that weight computation in Mandarin is based on tone criterion (only heavy syllable can bear a full tone; Qu 2013) and tonal syllables are perceived to be more prominent than toneless syllables, one may advocate that the Mandarin stress assignment is determined by the presence of underlying tone, thus not directly correlated with syllable type. The question is how our participants decide on syllable weight when receiving the Portuguese input, which lacks any lexical tone. One possibility is that Mandarin listeners have access to the sonority-based weight scale VV > VC > V, which is widely attested crosslinguistically (Gordon 2006). The effect of this scale is arguably masked in Mandarin stress assignment by the decisive role of tone on syllable weight, but may emerge in the acquisition of a non-native sound system where lexical tones are absent (the emergence of the unmarked; Broselow et al. 1998). The sensitivity to the ternary weight scale, which in our case is not driven by acoustic evidence, may be part of innate linguistic knowledge or it can be indirectly generalized based on sonority, which plays an important role in many domains (e.g. syllable well-formedness) in Mandarin phonology.

## References

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