

Abstract

The intonational phonology of Paraguayan Guarani proposed by Jun & Zubizarreta's (2022) in the AM framework has a tritonal pitch accent, HLH*, realized over two syllables, as a falling tone on the pretonic syllable and a rising tone on the tonic syllable.

This paper investigates the phonetic realizations of the tritonal pitch accent by systematically varying the stress location, the word length, and the inter-stress interval.

We found that the first H of HLH* typically starts at the onset of the pretonic syll but can vary between the pretonic and the pro-pretonic sylls depending on the stress location and the speaker's age/sex. Additionally, the medial L was often realized right after the onset of the tonic syllable, suggesting the tonal category would be H+LH*.

Background

Paraguayan Guarani (PG)

- PG is a Tupi-Guarani language. Together with Spanish, it's an official language of Paraguay.
- Lexical stress, typically on word-final syllable. When a word has multiple stresses underlyingly, the last one is realized.
- Stress is marked orthographically only when it's non-final or on a nasalized vowel.

Previous Studies of PG Intonation

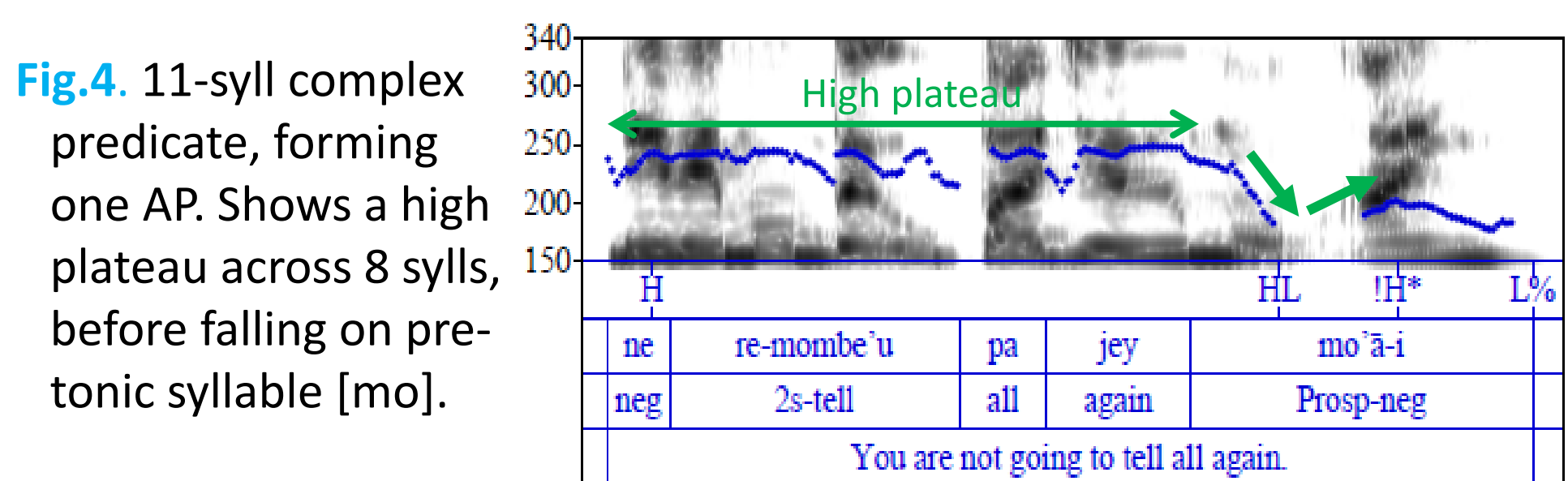
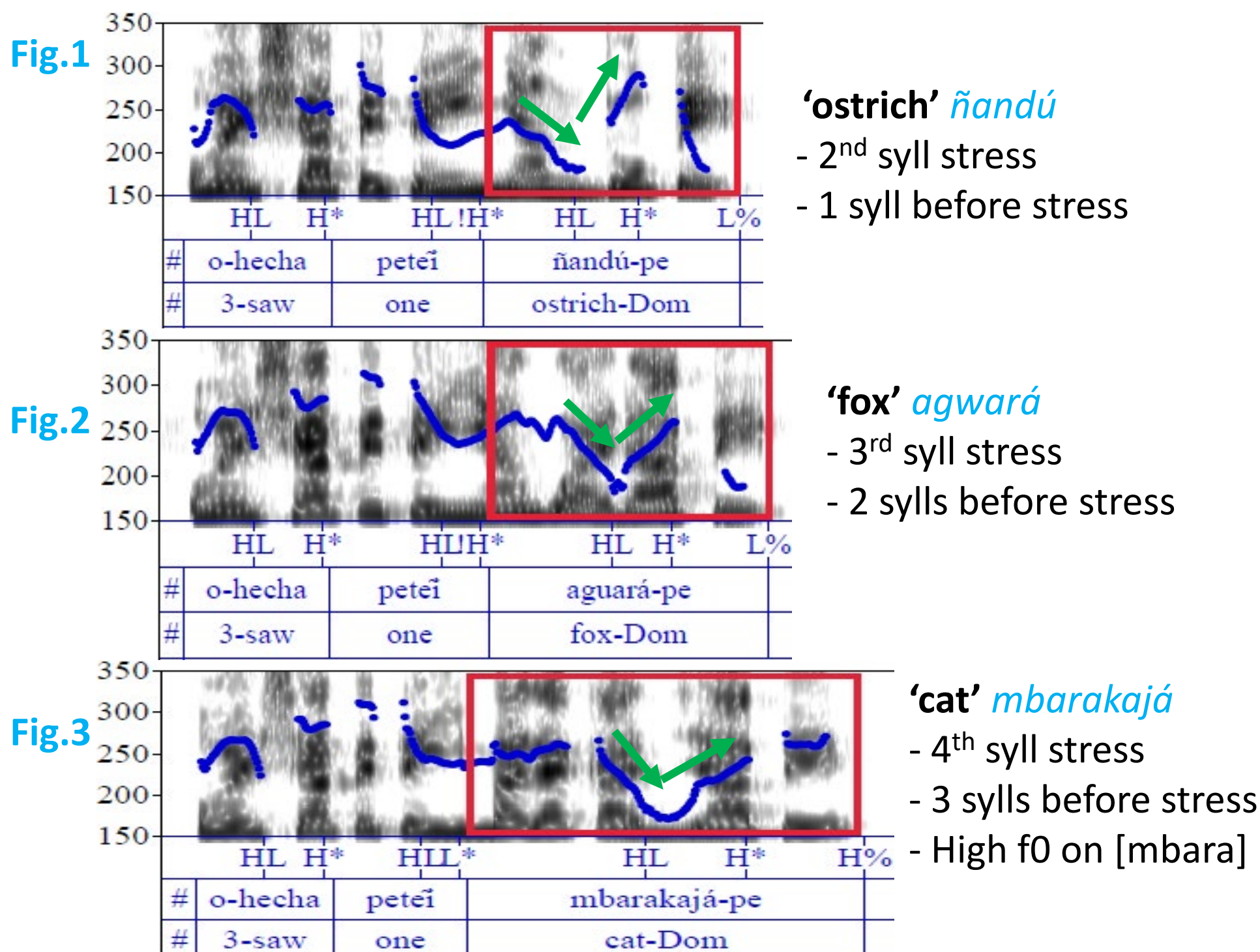
- Clopper & Tonhauser (2011, 2013); Burdin et al. (2015)**
 - Examined *focus prosody* based on *two-word utterances* (SV)
 - Findings: two types of f0 contours
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- found a *high plateau* between the two pitch accents => Not expected in the Two Peak pattern. Solution was left for future research
 - no prosodic unit between Word and Intonational Phrase (IP)
 - Burdin et al. found tone-segment alignment in pitch accents not distinctive; L*+H -> LH, H+L* -> HL

Jun & Zubizarreta (2022)

- Examined intonation of complex sentences, varying the length of words/sentences; study prosody-syntax interface
- Findings
 - PG has one pitch accent, HLH*
 - PG has an *Accental Phrase (AP)*: whose edges are marked by a H boundary tone, /H HLH* Ha/. AP-final H (Ha) is typically higher than H*. But AP boundary tones are visible only when there is an unstressed syllable before or after the tritonal pitch accent.
 - AP has only one pitch accent. When AP has multi-words, the last word's stressed syllable carries the pitch accent.
 - Tone-syllable alignment of HLH*: a falling tone (HL) on the pretonic syll and a rising tone (LH) on the tonic syll.
 - H* of HLH* can be
 - L* when IP-final, ending in L%, or when it's post-focus
 - H* when IP-medial or before IP-final L%.

Pitch track examples

- Figs. 1-3: 'He saw one ostrich' (Fig.1), 'fox' (Fig.2), and 'cat' (Fig.3), (under the tree)'
- The final word (marked in red box) shows a HLH* pitch accent, with HL (falling arrow) on pretonic syll and H* on tonic syllable.



Methods

- Four native speakers of PG, all Guarani-Spanish bilinguals
 - M1 in his late 30s, F1, in her mid 30s, F2 in her early 50s, F3 in her early 60s
- Each speaker produced 84 sentences twice.
- For *tone-syllable alignment of the pitch accent*, sentence-medial target word, varied in stress location and no. of unstressed sylls.
 - Final stress: S, sS, ssS, sssS, ssssS (S=stressed, s=unstressed)
 - Penultimate stress: Ss, sSs, ssSs, ssssSs
- Annotation conventions for vowel intervals
 - V: stressed vowel, v: unstressed vowel
 - v#: the location of unstressed vowel relative to the stressed one i.e., v1, v2, v3, v4 (v1 = immediately before stressed vowel, ..., v4 = 4th vowel before stressed vowel)
 - C: onset consonant of the stressed syllable
- Collected mean f0 of each vowel in the target word; maxf0 and min f0 in v1; and the time point for C onset and min f0 between v1 and V.
- Hz converted to semitone by $F0(\text{semitone}) = 12 * (\log_2(f_1/f_2))$, where f_2 is the mean f0 value (Hz) for each speaker. Stats and plots in R.

Results

Realization of HLH*

Fig.5. Example pitch track showing approx. mean f0 of each vowel up to the stressed vowel (v3, v2, v1, V) when stress is penultimate of wd/AP

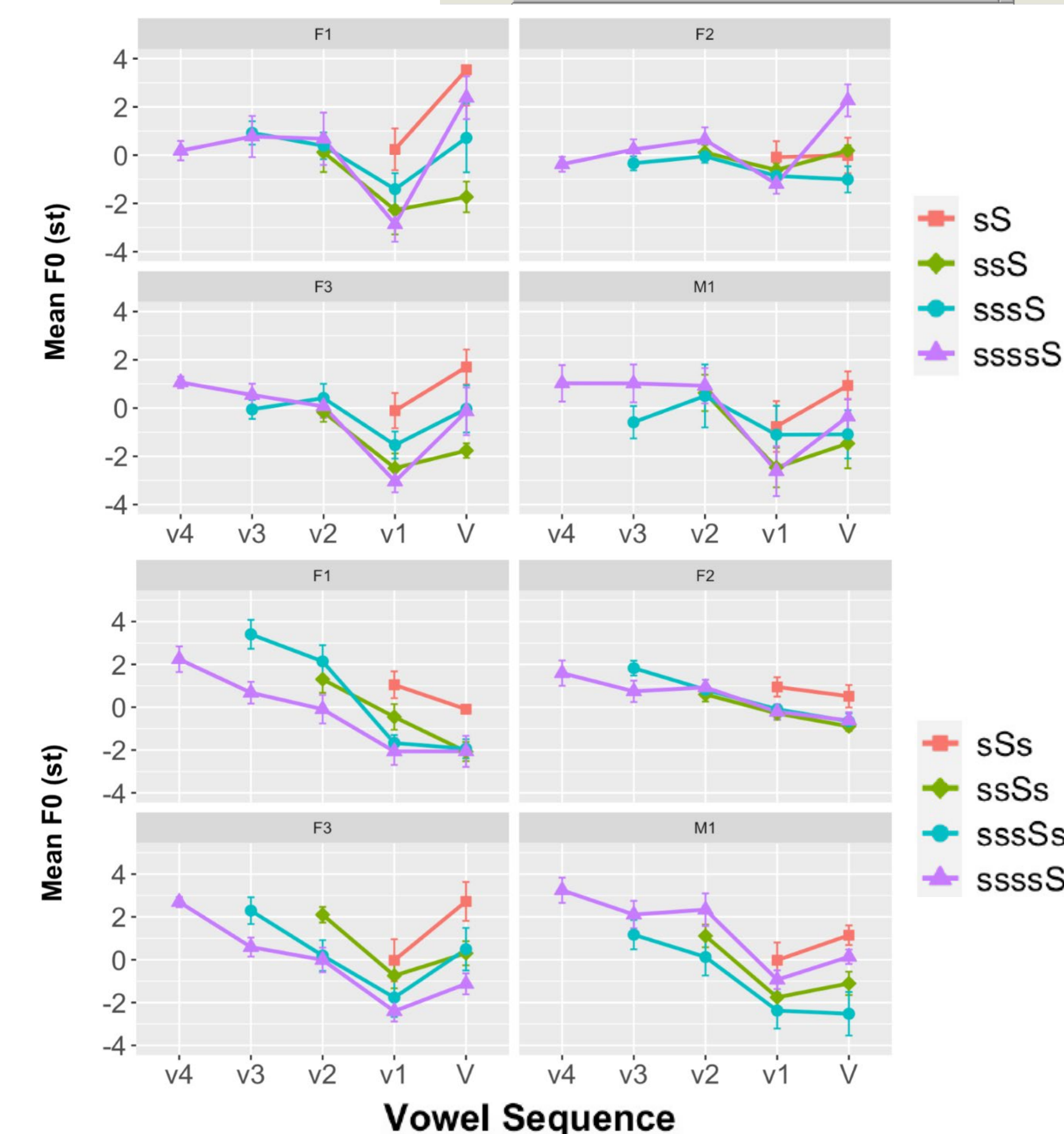
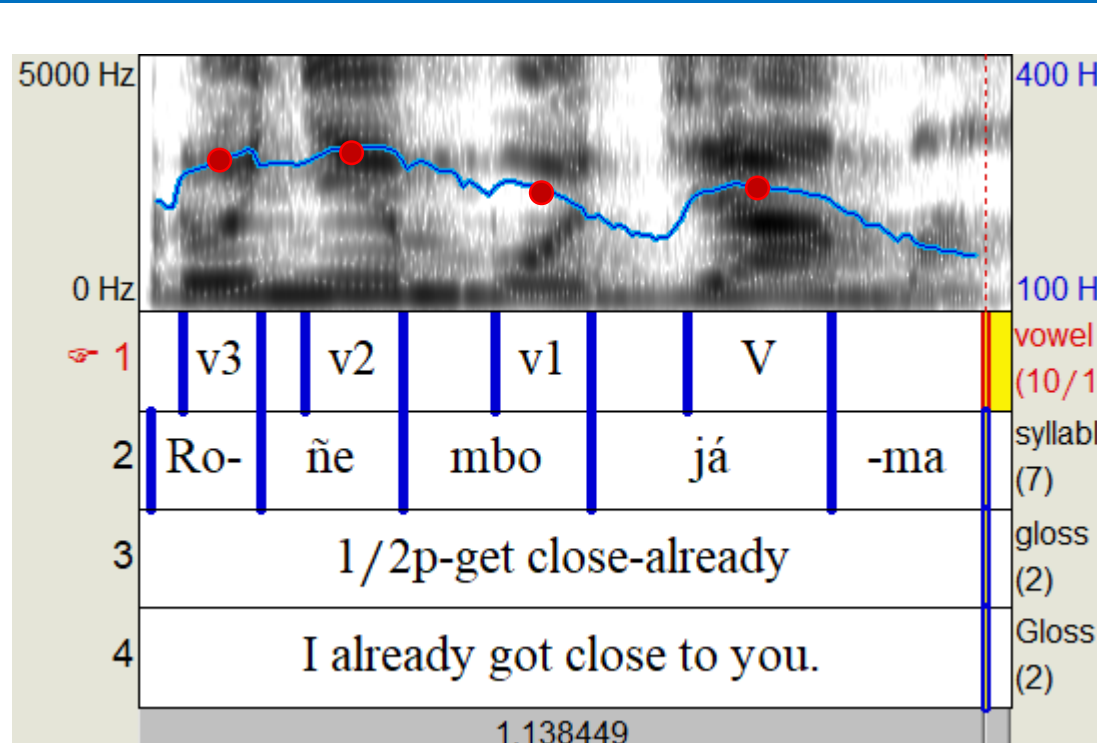


Fig.6. Mean f0 values (in semitone) of each unstressed vowel up to the stressed vowel (V) when stress is final (top) and penultimate (bottom) for each speaker.

Alignment of the first H of HLH*

Fig.7. Example pitch track showing mean f0 of v2 and max f0 and min f0 of v1. If $v2 \approx v1_{max}$, H starts from v1. If $v1_{max}$ is between v2 and v1_min, H starts on v2

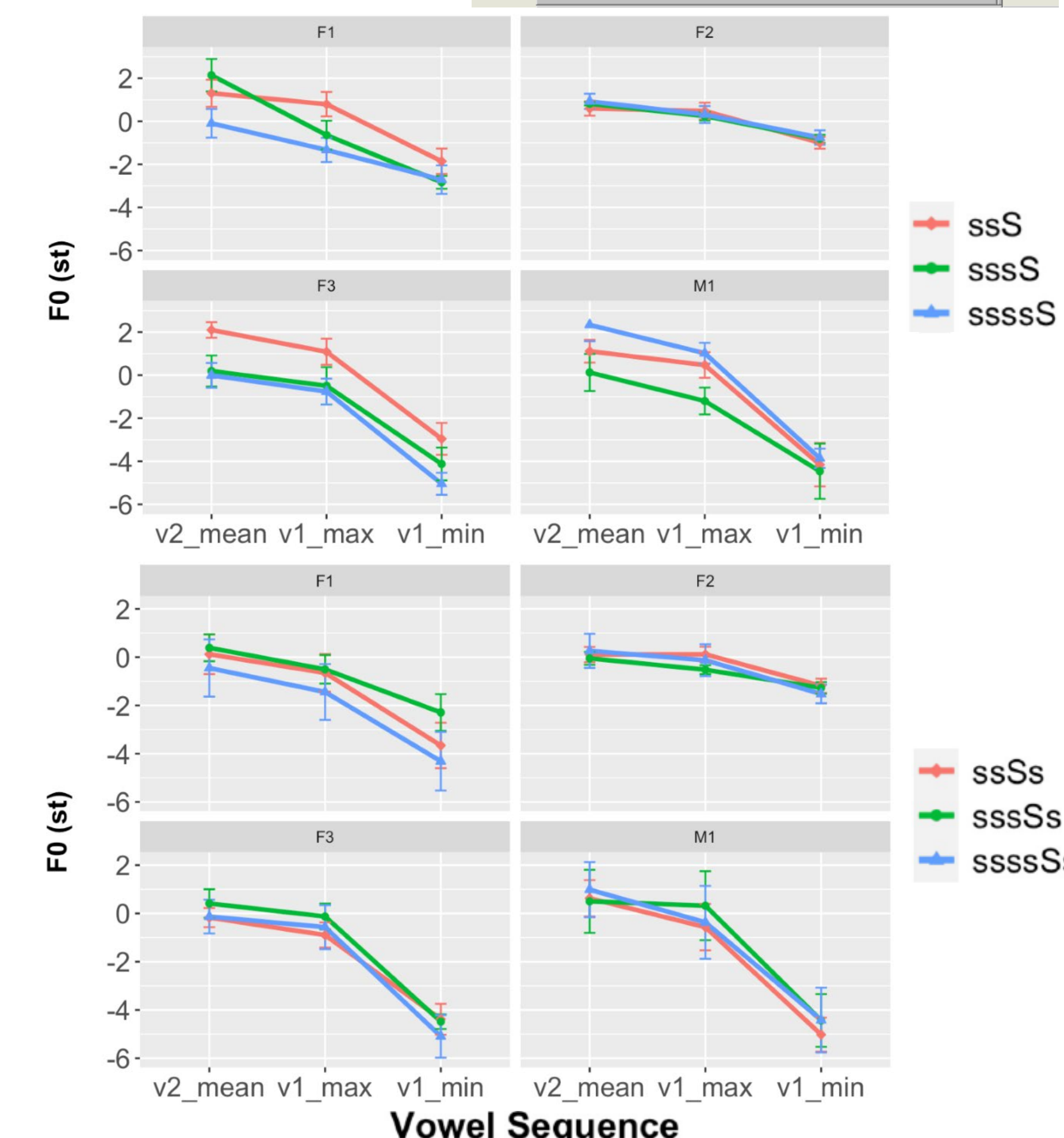
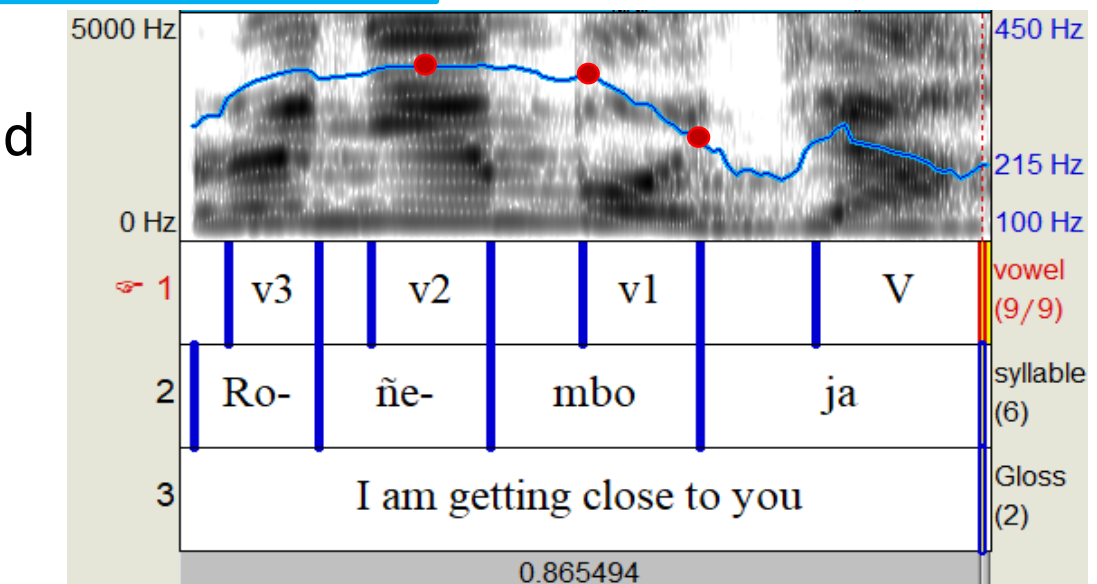
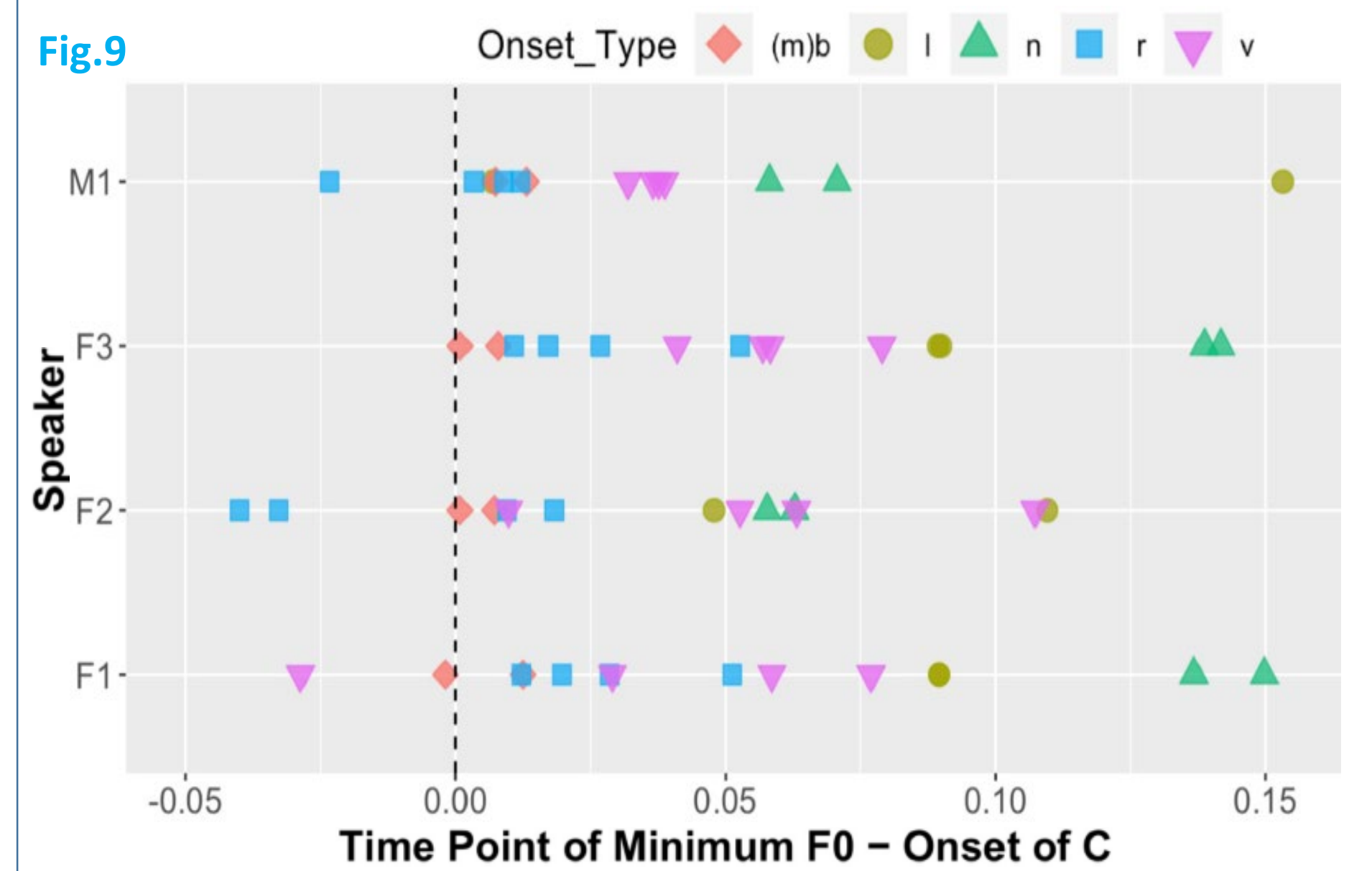


Fig.8. F0 (in semitone) for v2 mean and f0 max & f0 min of v1 when stress is final (top) and penultimate (bottom) for each speaker.

- Fig. 6 shows the mean f0 values are similar across v2, v3, and v4, reflecting the *high plateau* between the beginning of the word and the pro-pretonic syllable (v2).
 - Mean f0 of the V (stressed) > mean f0 of v1 when stress is final than when penultimate. This is because more HLH* pitch accent occurs in penult stress than final stress.
 - For younger female speakers (F1, F2), v1's f0 > V's f0 when stress is penultimate. This is because they often produced L* or L+>H*, similar to Spanish prenuclear pitch accent.
- Fig. 8 shows that the alignment of the first H varies across speakers and stress location.
 - Final stress condition: for F3 and M1 speakers, v2 mean ≈ v1 max. => falling starts on the pretonic syll. For F1 and F2, v2 mean > v1max (falling starts before pretonic syll)
 - Penult stress condition: v2mean > v1max for all speakers, but especially more so for F1, the youngest female. She sometimes did not produce the first H of HLH*

Alignment of L tone relative to the Onset of C

Fig 9 shows the timing of L tone relative to the onset of the tonic syllable (vertical dotted line), when the onset consonant is sonorant (mb, l, n, r, lenited v) => L is often realized on the tonic syll.



- Also, when stress is word-initial, the stressed syll shows a rising tone, suggesting that the medial L tone is a unit with the following H* (LH*) instead of the preceding H (HL). This suggests H+LH* is a better tonal category of the tritonal pitch accent in Guarani.

Discussion & Conclusion

- Guarani has a tritonal pitch accent, H+LH*.
 - Typically, f0 falls right before the stressed syllable and rises into the stressed syllable.
 - The middle L tone is often realized closer to the stressed syllable, i.e., H+LH*, but the realization of the first H varies across speakers and stress location.
 - When stress is penultimate, the first H typically starts on the pro-pretonic syllable, i.e., v2.
 - When stress is final, the first H starts on the pretonic syll for the male speaker and F3 (the oldest female).
 - Younger female speakers (F1, F2) start H on v2, and sometimes do not produce the initial H, i.e., just a bitonal pitch accent, L+H* or L+>H*, similar to Spanish prenuclear pitch accent
- Sound change might be in progress in Guarani intonation
 - Possibly due to Spanish-Guarani contact
 - Possibly to simplify a tritonal pitch accent to a bitonal.
 - Tritonal pitch accent, especially HLH, is rare cross-linguistically.
 - LHL tritonal pitch accent is more common (e.g., several varieties of Spanish, Italian, Serbo-Croatian, and Brazilian Portuguese [Prieto et al. 2005, Gabriel et al. 2010, Garcia 2011, Froemming & Rao 2021, Gili Fivela 2004, Simljanic 2004, Yu 2008, Ferreira 2008])
- Allo-tones of the H+LH* pitch accent:
 - When stress is wd-initial or peninitial, the first H tone is often not realized, i.e., LH*; when the wd-initial stressed syll's onset is obstruent, just H* is possible.
 - H+LH* possible phrase medially or before L%, or H+L* possible before another stressed syll or before L%.
- Need data from more speakers

References

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.... [see the proceedings paper for a full reference of the LHL tritonal pitch accent languages]