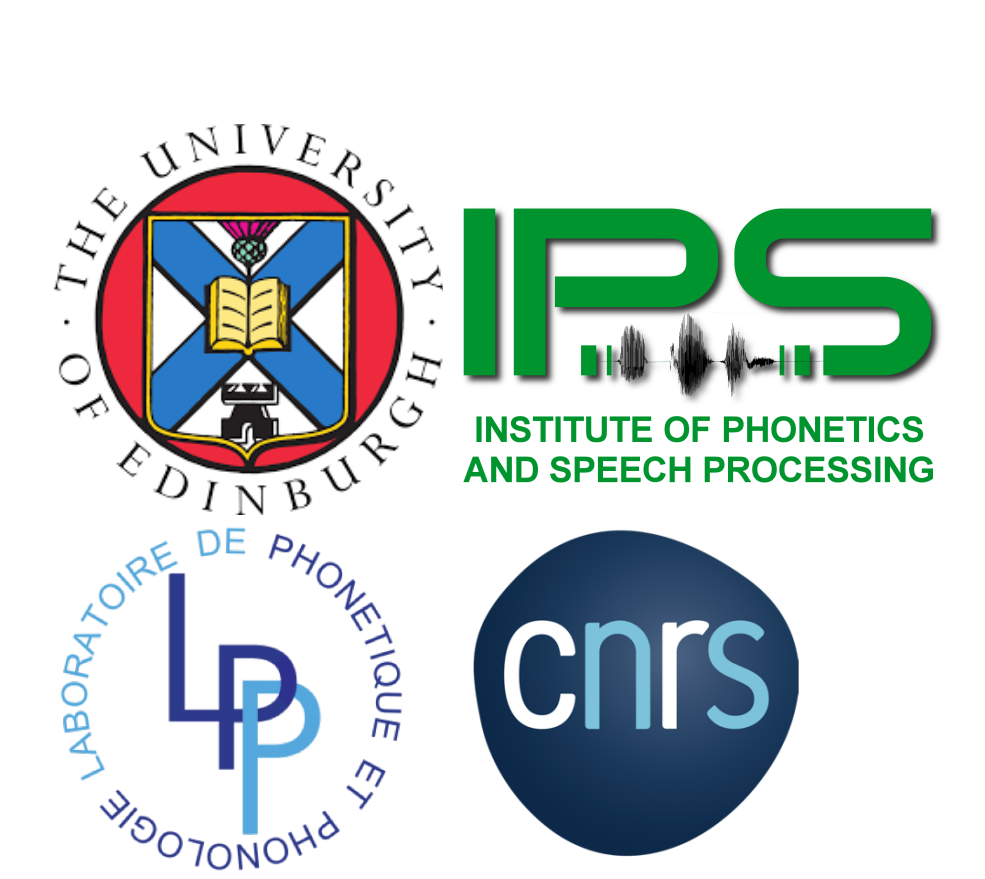


Intrinsic fundamental frequency in two tonal Austronesian languages.



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Intrinsic fundamental frequency (IF0)

- A near-universal phenomenon: high vowels have higher F0 than low vowels [1, 2]
- Mean crosslinguistic difference in F0 of /i, u/ vs /a/ = 1.65 ST [2]
- *Biomechanical hypothesis*: IF0 is an automatic process caused by an interaction of the articulatory and phonatory systems [2, 3]
 - IF0 should be relatively small when compared with F0 differences between lexical tones
 - IF0 is larger in the high F0 than the low F0 range
- *Speaker control hypothesis*: IF0 may be enhanced/attenuated based on phonological profile
 - Languages with large vowel inventories may enhance IF0 to maximise distinctions [4]
 - Languages with tone may attenuate IF0, as F0 already has a contrastive function [1, 5]
- An emerging consensus: IF0 has a mixed basis ([1, 6]). There is a biomechanical foundation of IF0; but it is also under speaker control, and may vary by language, dialect, or speaker

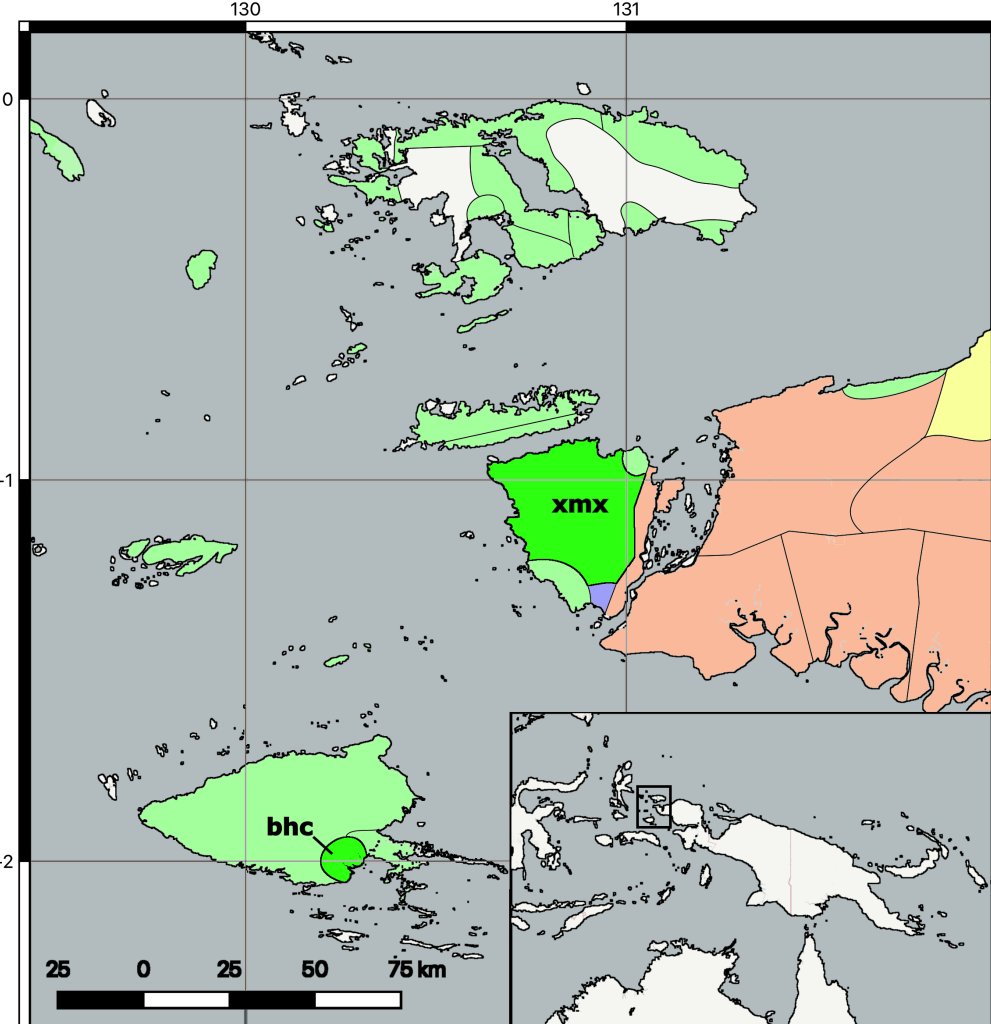
Research questions

1. Are there IF0 differences in Butlih Salawati and Biga? If so, what is the magnitude of the differences?
2. Are IF0 differences in Butlih Salawati and Biga in line with predictions based on the phonological profiles of the languages?

Methods

- Pps: 6 speakers (3M, 3F) for each language
- Target words: CV, VC, CVC monosyllables, each combination of /i (i) u a/ × 2 tones
- Position in the carrier sentence:
 - Utterance-medial: ‘I say X’ /ine jəwe (bo) X po/ (Butlih), /m bitm X apo/ (Biga)
 - Utterance-final: ‘I don’t say X’ /ine jəwe (bo) X/ (Butlih), /m bitm X/ (Biga)
- Total tokens: Butlih = 525, Biga = 703
- Data annotation using WebMAUS [7] and analyses using EMU-SDMS [8]
- F0 values extracted, converted to speaker-normalised semitones

Target languages: Butlih Salawati and Biga

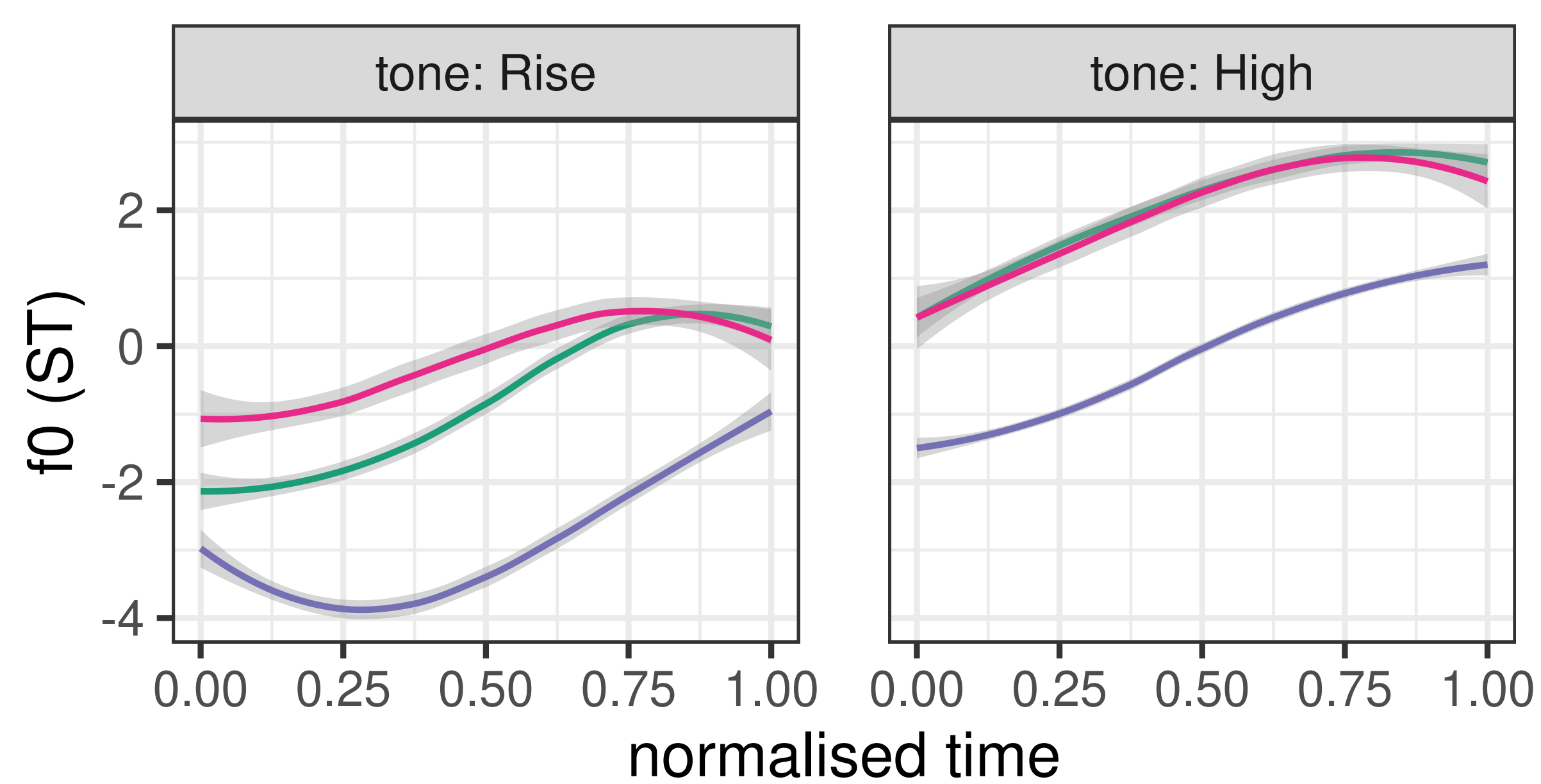


- Austronesian > South Halmahera-West New Guinea
- Butlih Salawati [xmx]:
 - /p b t d k f s m n h r l w j/, /i e a o u/ + /ə/
 - Two tones: High vs Rise (vs toneless)
- Biga [bhc]:
 - /p b t d k g f s m n r l w j/, /i i e a o u/
 - Two tones: High vs Extra-High (vs toneless)

Results

Butlih: F0 empirical trajectories

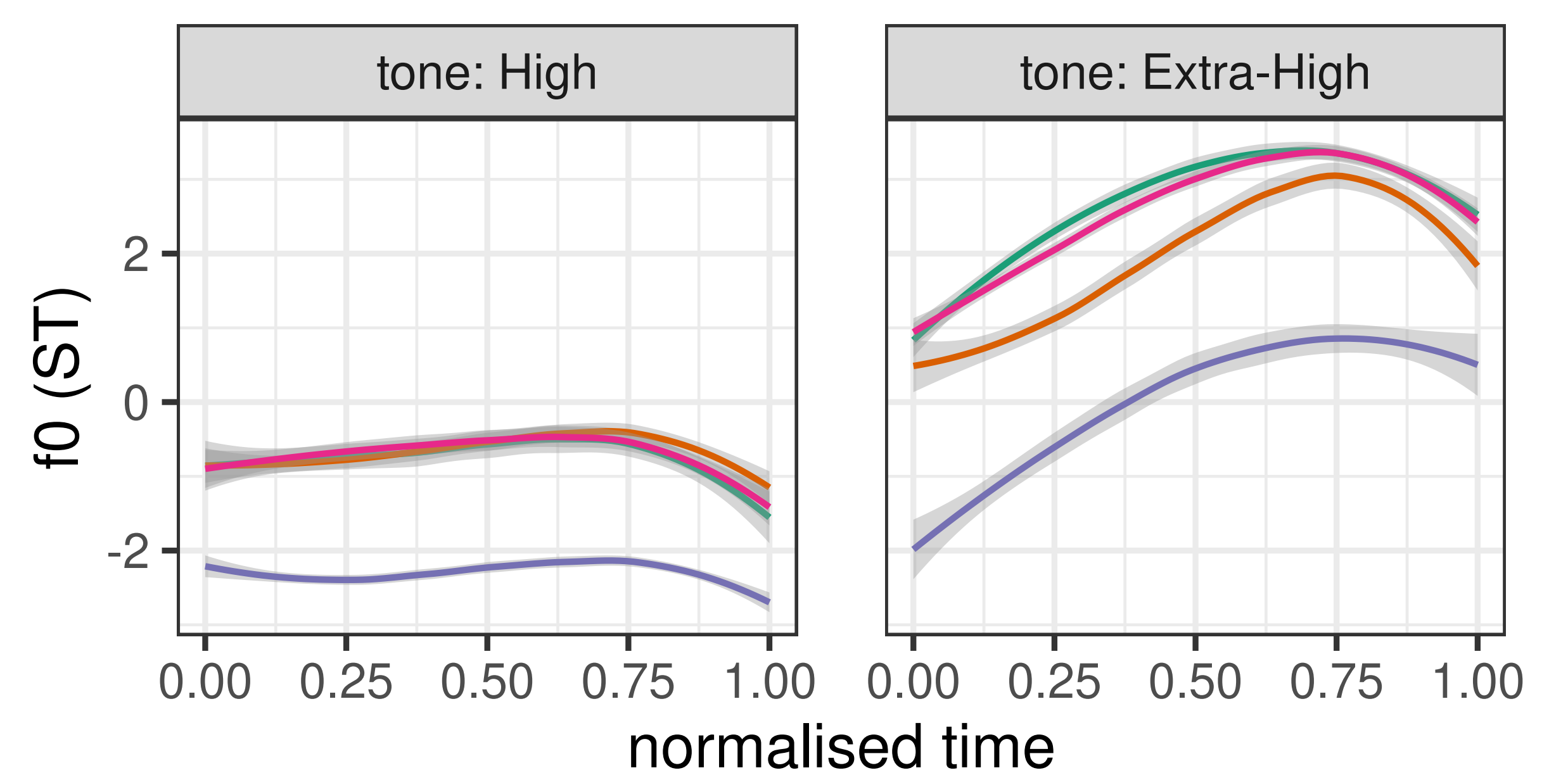
vowel — i — u — a



- LME fitted to F0 over 1/3 of the vowel (V onset or mid)
 - Main predictors: VOWEL HEIGHT, TONE, VOWEL PORTION, ONSET VOICING; Interaction terms: HEIGHT:ONSET, HEIGHT:TONE:PORTION
 - Model not improved by UTTERANCE POSITION
- Estimates:
 - Larger IF0 for High than Rising tone:
 - * for **High tone: 2.65 ST**
 - * for **Rise tone: 2.33 ST**
 - Effect of VOWEL PORTION not consistent

Biga: F0 empirical trajectories

vowel — i — ɪ — u — a



- LME fitted to F0 over 1/3 of the vowel (V onset or mid)
 - Main predictors: VOWEL HEIGHT, TONE, VOWEL PORTION, ONSET VOICING, UTTERANCE POSITION; Interaction terms: HEIGHT:ONSET, HEIGHT:TONE:PORTION:POSITION
- Estimates:
 - Larger IF0 for Extra High than High tone:
 - * for **Extra High tone: 2.51 ST**
 - * for **High tone: 1.76 ST**
 - Effect of VOWEL PORTION or UTTERANCE POSITION not consistent

Discussion

- Interpretation of the results
 - Overall, IF0 differences range from 1.7-2.7 ST depending on the language and tone—this is larger than the cross-linguistic average (1.65 ST)
 - IF0 is larger in syllables with higher tone, suggesting there is some biomechanical basis
 - No support for a strong position linking speaker enhancement of IF0 to phonological profile
- Implications
 - Synchronically, cross-linguistic IF0 variation is probably better viewed as a continuum [1]
 - Diachronic relationships between vowel height and tone are common in Austronesian (e.g. [9, 10]). Do the large IF0 differences reported here reflect more general trends in the family?

References and funding



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