

Phrase-level prosody of Akan-Twi in spoken and whistled modalities

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Whistled languages

- Modality of language found across the world.
- In these communities, people can communicate by whistling.
- Varying degrees of productivity
 - Whistled Hmong is formulaic and non-productive for regular conversation (Busnel et al. 1989)
 - Akan and Chinantec can fully express any utterance using whistling (Sicoli 2016)
 - Some languages like isiXhosa seem somewhere in between (Claughton 1992:12)

Meyer, Julian.
2021.
Environmental
and Linguistic
Typology of
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*Annual Review of
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Map showing
various attested
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alongside natural
environmental
data.

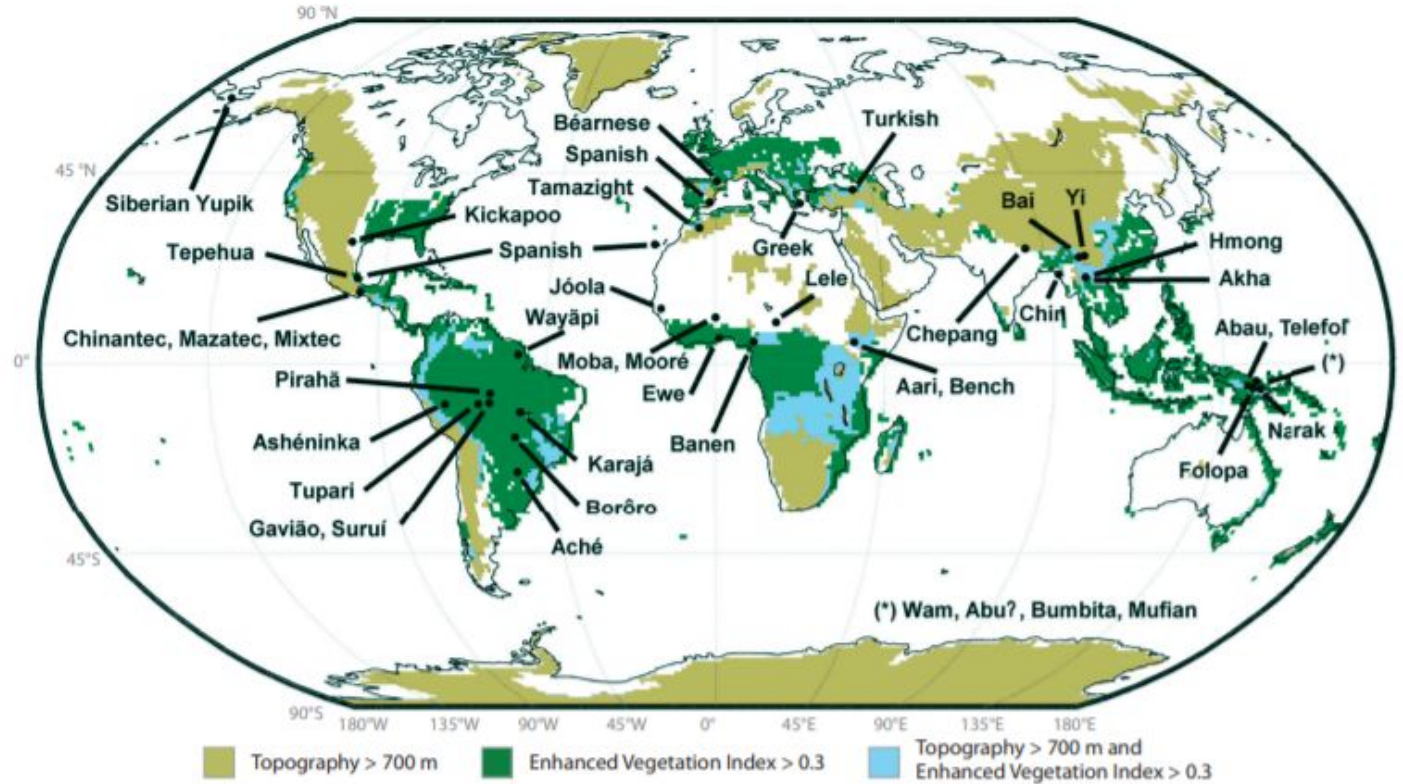


Figure 1

Map of the attested whistled languages in the world including indications of environmental features associated with mountainous and forested areas (topography, vegetation cover). Topographic data from Atmospheric Infrared Sounder/Aqua Level 3 Monthly Standard Physical Retrieval (AIRS + ASMU), Goddard Earth Science Data and Information Services Center (GES DISC). Vegetation data from MODIS/Terra Monthly Vegetation Indices Global 1°1°, NASA NEESPI Data and Services Center. Figure adapted from Meyer (2015).

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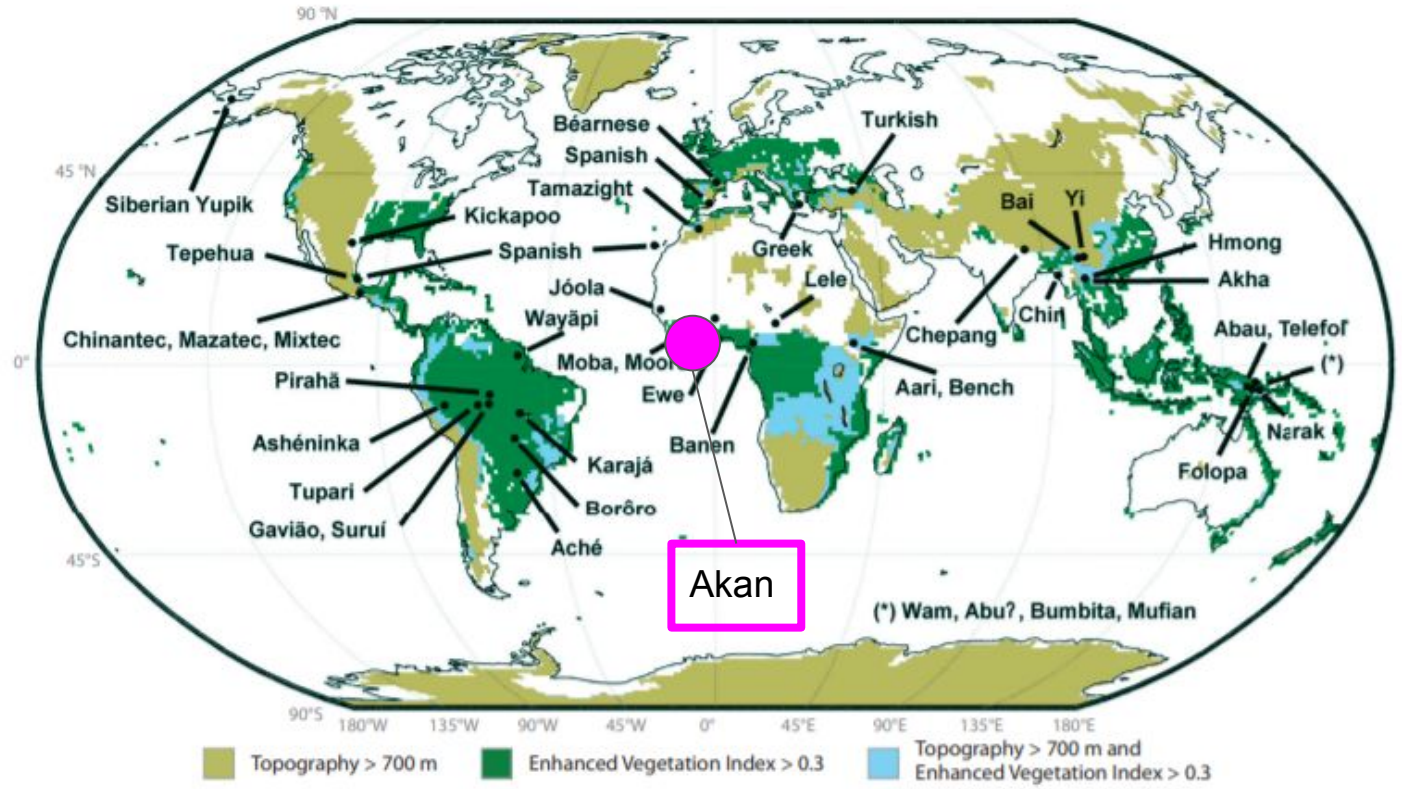


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Prior literature

J.H. Kwabena Nketia, a celebrated musicologist, in 1962:

In Ashanti (Akan area), people are discouraged from singing or whistling while bathing . . . It is not considered proper that women should whistle, for fear that they might get too involved with the men: learning to whistle means learning to use the '**whistle language**' . . . In the capital of Akuapim, whistling at night is prohibited.

Nketia, J.H. 1962. *African Music in Ghana*. Accra: Longmans. Page 5.

No further work seems to exist.

Whistled Akan Examples

1. Ánàné bìsá.

Anane asks.



3. Ánàné bìsá sìká èné.

Anane asks for money today.



2. Ánàné bìsá sìká.

Anane asks for money.



4. Yàw fì

Àkyèmf

ò



Yaw comes from Akyemfo

Typology of whistled languages

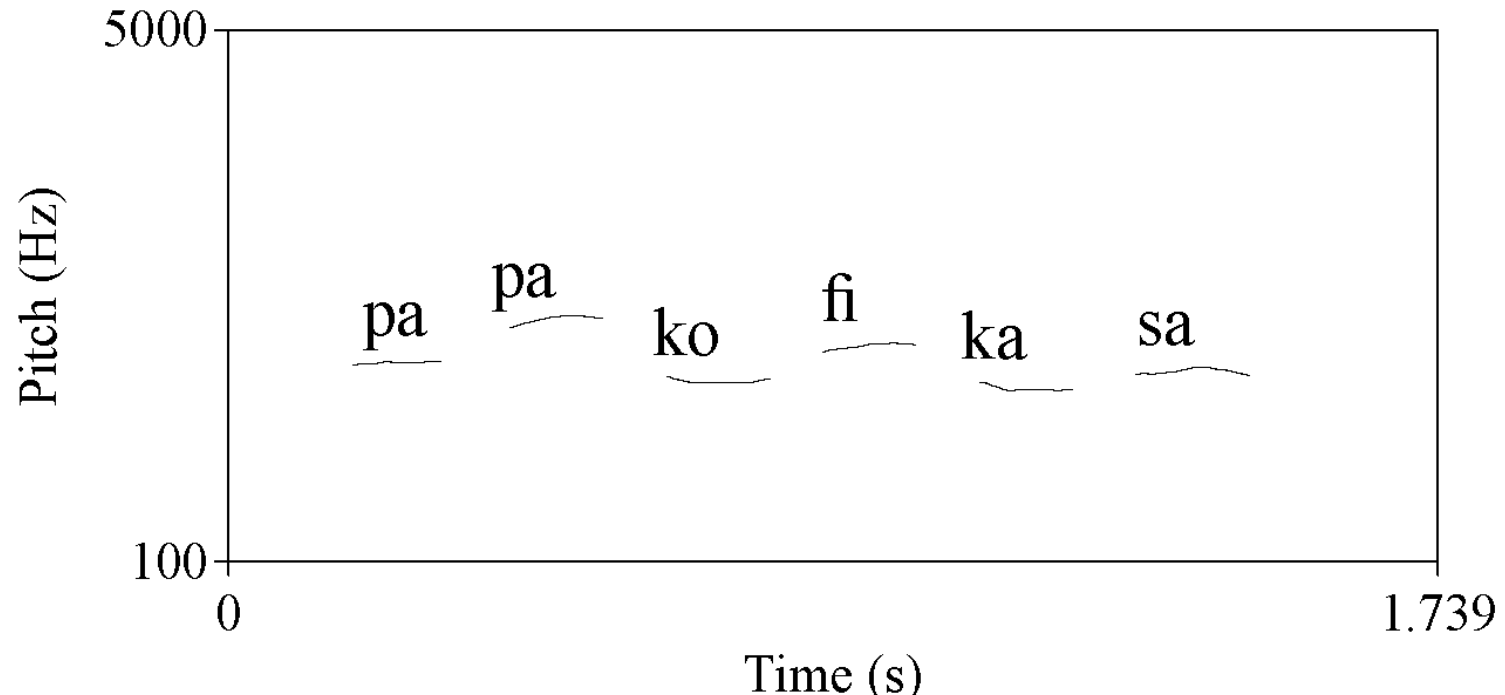
-if a language has lexical tone, the whistled register will encode the tonal contrasts.

-if not, the language will encode consonant and vowel contrasts.

Busnel & Classe 1976:12

Akan-Twi has lexical tone, which it represents in whistling.

This is an example of an alternating low-high sequence.



Talking Drums for Akan

Akan-Twi has a drummed modality which is fully intelligible and productive.

The two pitches represent the phonemic high/low tone split, and strike count distinguishes between light and heavy syllables (McPherson 2019).

The drum pitches are fixed which entails that phonetic details like downdrift, downstep, and all sorts of pitch effects are not represented..

Does whistling behave like drumming?

Image: Sheihu Salawatia 2022.



What intonational information is whistled in Akan?

- Genzel 2013 investigated lexical tone in spoken Akan with token sentences stratified by length and tonal contour (all high tone, all low tone, alternating high-low, alternating low-high)
- We replicated her study to look at the same variables:
 - **Declination:** average F_0 decreases over the course of an utterance
 - **Downstep:** high tones preceded by low tones are lower than high tones before that
 - **Pre-Low raising:** high tones before low tones are raised
 - **Lookahead raising:** longer sentences start with higher F_0 (in anticipation of declination)
 - **Question/statement:** Akan question intonation raises the whole sentence and adds a long drop at the end

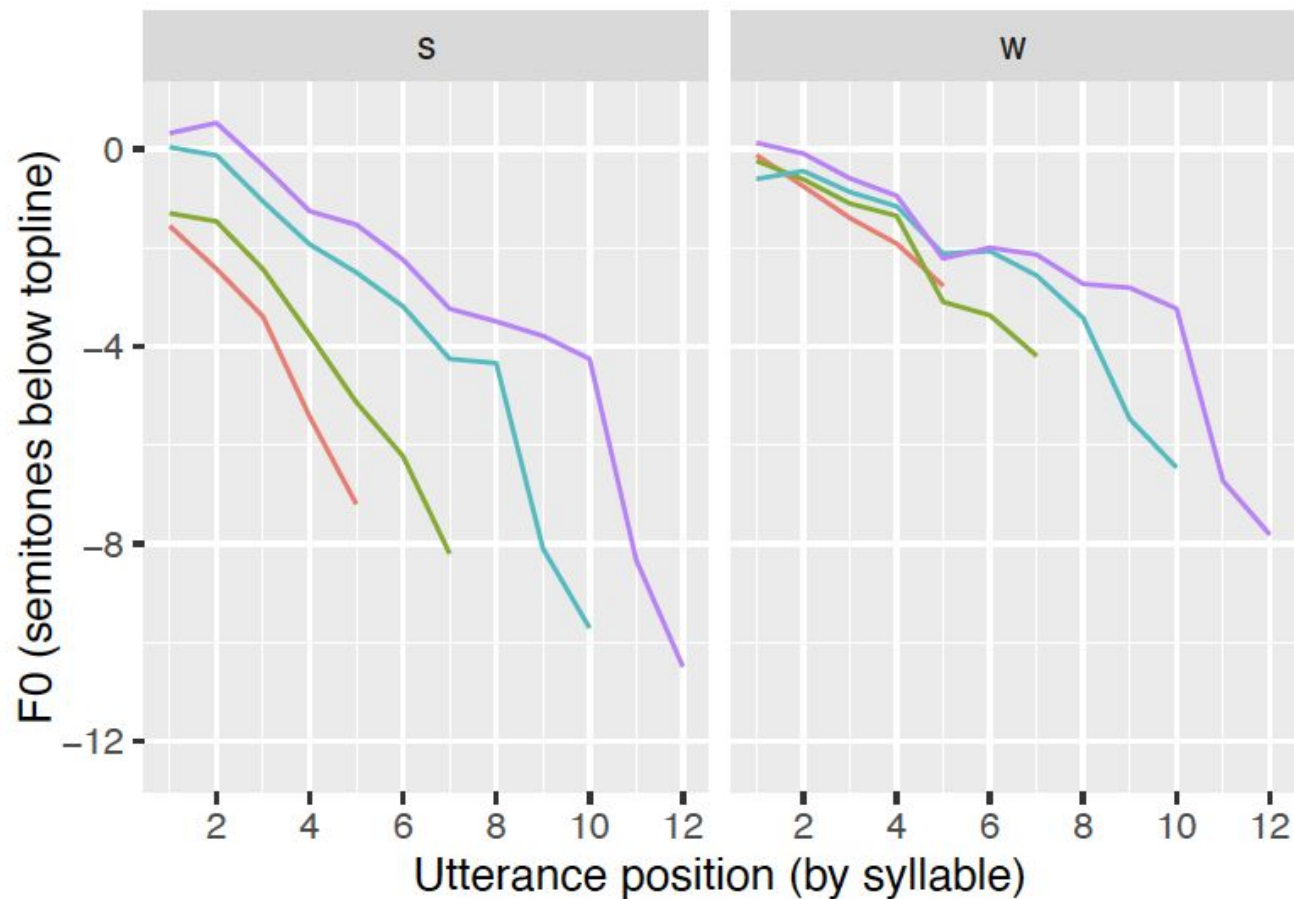
Our Study

- Replication of the Genzel 2013 study on spoken Akan intonation in both modalities
- 6 male native whistlers/speakers of Akan were recorded in the Boston University Phonology Lab
- 4 tone patterns x 4 utterance lengths x q/s x 3 reps = 96 sentences
- Sentences randomized then presented in two blocks: first whistled, then spoken
- Analyzed with linear mixed models implemented with lmerTest package (Kuznetsova, et al. 2020)
- **First finding:** Reading 96 sentences in normal speech is easy. Whistling 96 sentences in a row is quite tiring.

Finding 2:

Declination happens
in both modalities.

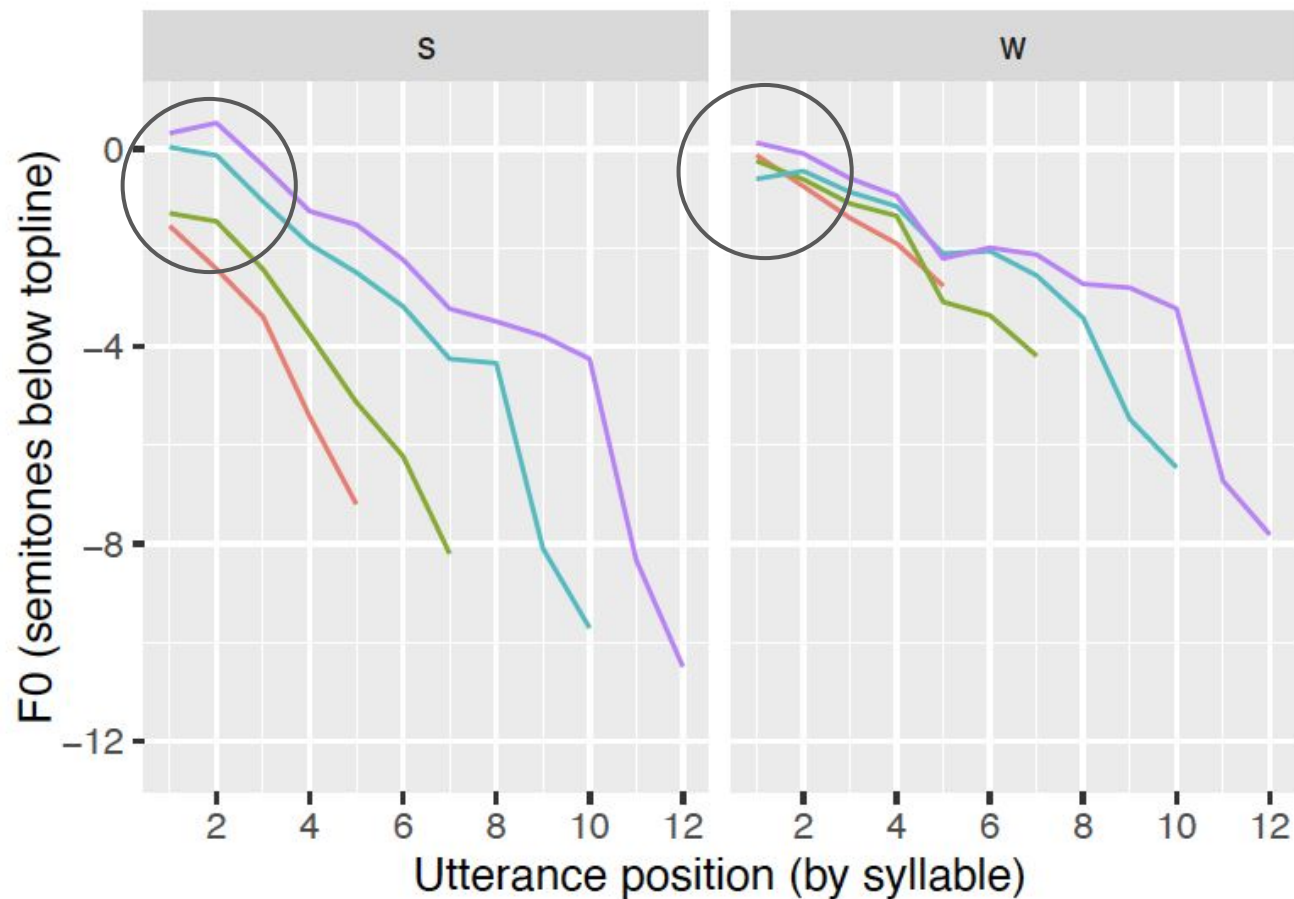
Pitch decreases by 1.1
semitones per syllable
when speaking, but
only by 0.4 semitones
when whistling.
 $p < .001$



Finding 3:

Look-ahead raising
happens in both
modalities.
(i.e. longer sentences
start at higher pitch)

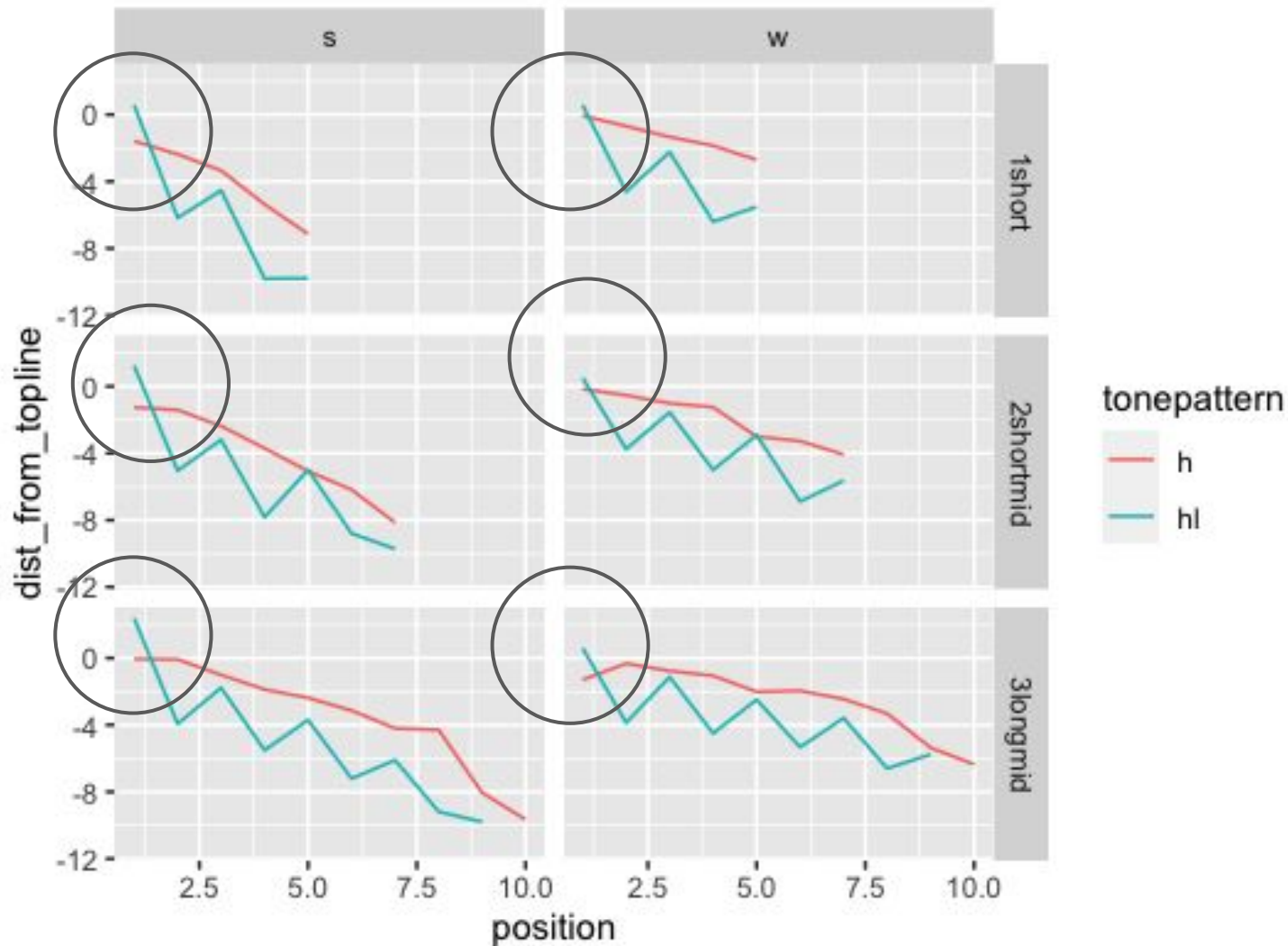
Mid sentences start 1.9
semitones higher (0.8
for whistling); long
sentences start 2.4
semitones higher (1.6
for whistling)
 $p < .001$



Finding 4:

Pre-Low raising
happens in both
modalities.

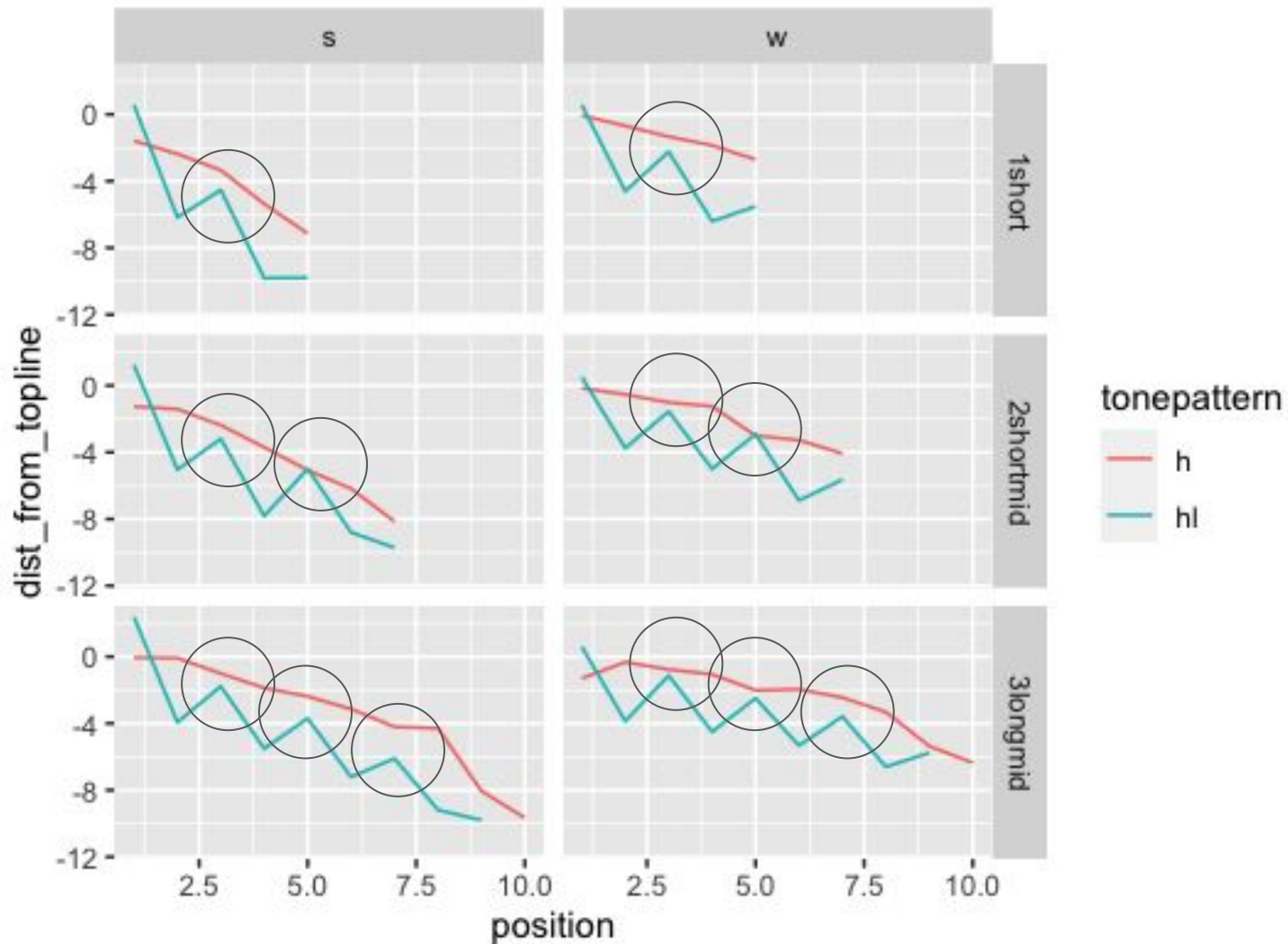
(i.e. initial high tone
in an all-high
sentence is
not as high as the
high before a low)



Finding 5:

Downstep happens
in both modalities.

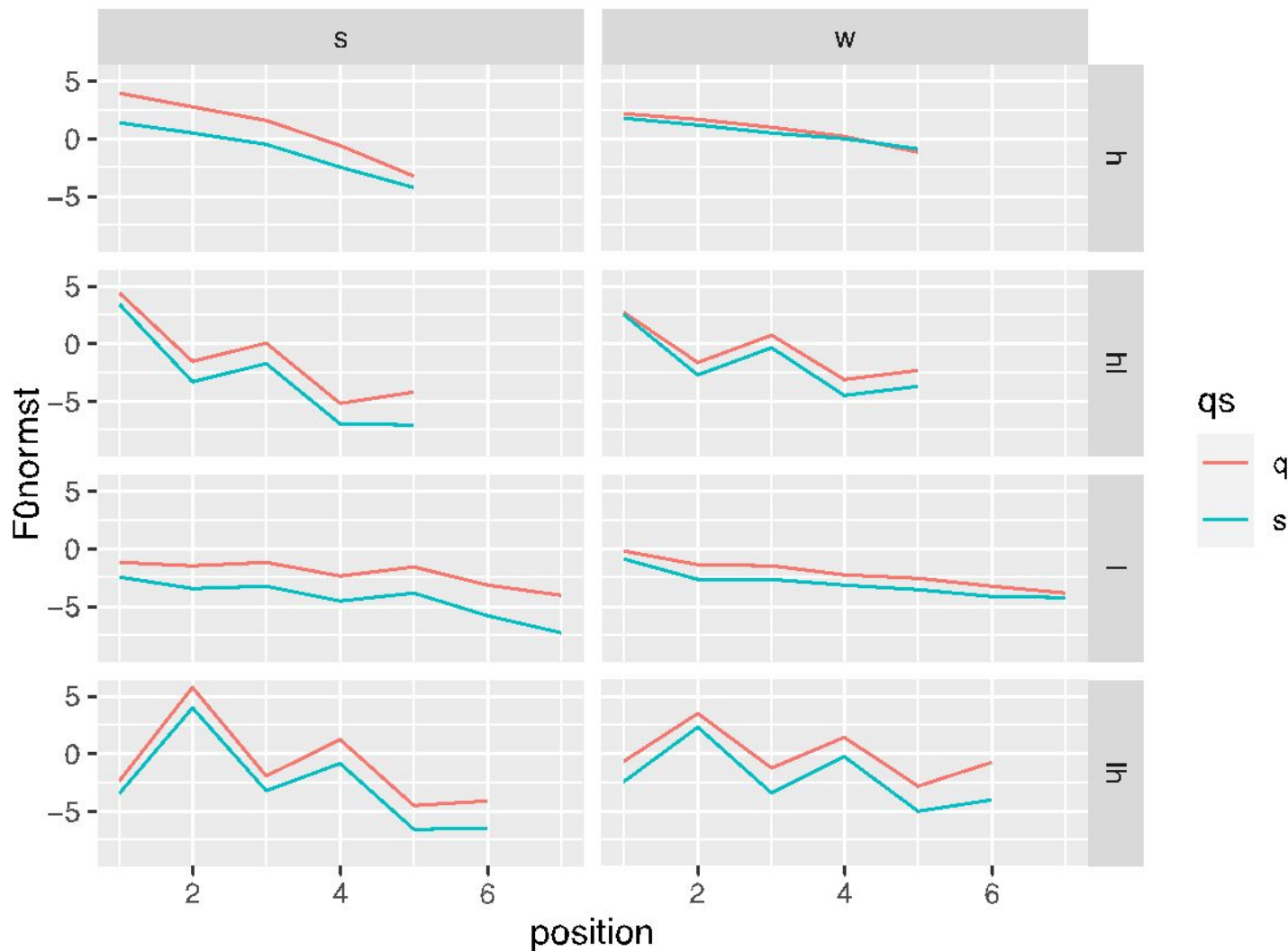
(i.e. low tones
between high tones
make following high
tones lower)



Finding 6:

Questions in Akan are **raised** for both modalities.

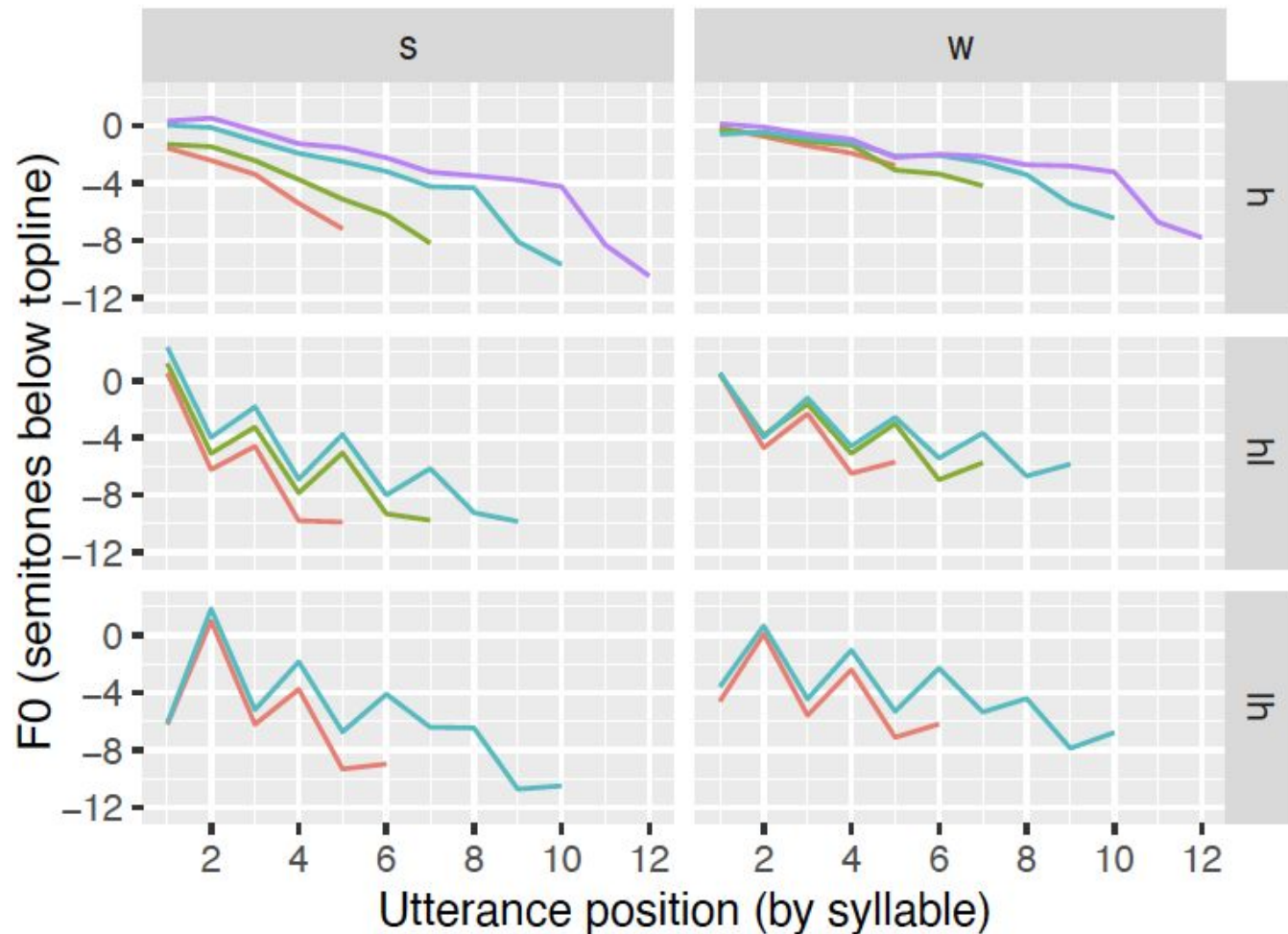
Questions are 1.4 semitones higher for speaking, and 0.9 semitones higher for whistling. $p < .001$



Finding 7:

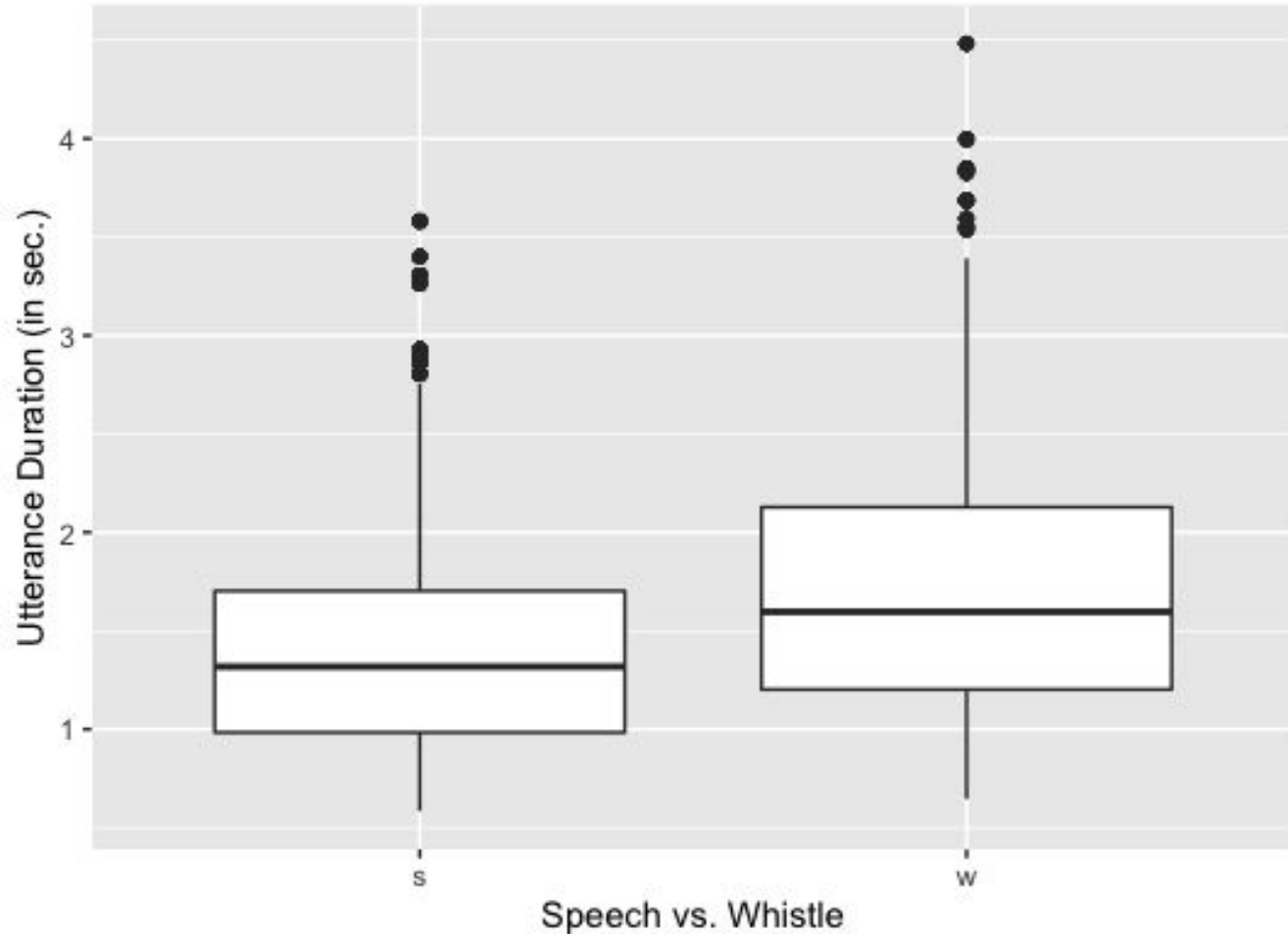
Pitch range (in semitones) of whistled utterances is **narrower**. High tones are 4.7 semitones higher than Low tones for speaking, but only 4.0 semitones higher for whistling. $p < .001$

Unexpected, c.f. Whistled Sizang Chin (Myanmar) as reported by Stern 1957:496



Finding 8:

Whistled utterances are 25% **longer** (in seconds) on average than corresponding spoken utterances. $p < .05$



Conclusion

- Whistled Akan encodes a large number of prosodic features found in spoken Akan including **declination**, **pre-Low raising**, **downstep**, **question raising**, **look-ahead raising**.
- Pitch range is **narrower** for whistling than for speaking. Why? Could production or perception constraints be at play?
- Akan also has a ‘talking drum’ modality which is similarly productive. The drums have two immovable pitches (McPherson 2019), entailing that downstep, declination, and lookahead raising cannot occur. Therefore, the encoding mechanism cannot be the same as for whistling.
- F_0 is rich in the whistled register, and is replicating surface phonetics rather than only underlying contrasts (c.f. the drums)

Further questions

- Claim: when whistling tone languages, only tones are whistled (Cowan 1948, among many). Is this true for Akan? Current follow-up study investigates segmental information (vowels and consonants).
- One speaker had breathy prosody at the end of spoken questions. Are there correlates in whistling? (Rialland 2005:264, Moba, Burkina Faso)
- Why is pitch range narrower? Is this an articulatory constraint or because perception of that pitch range is easier?

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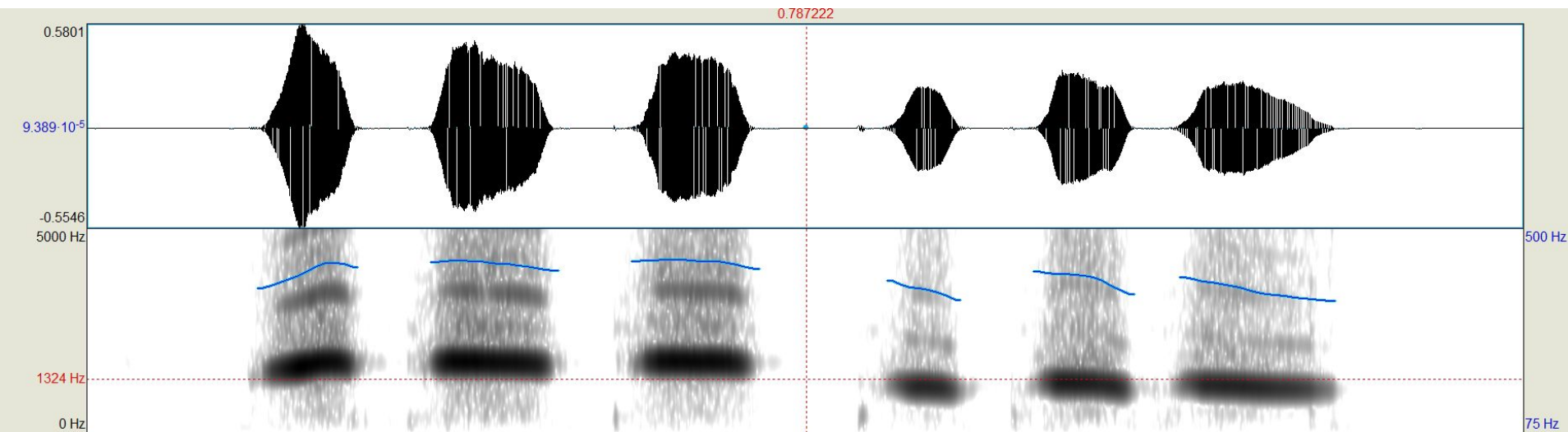
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Outlier: speaker 4 lowers register across a boundary



Kukuoba
pot

papa
good

no
the

The good little pot



Another whistler, for reference.

Linear Regression

Random effects:

| Groups | Name | Variance | Std.Dev. | Corr |
|----------|-------------|----------|----------|-------|
| speaker | (Intercept) | 1.895 | 1.376 | |
| | spwhw | 1.432 | 1.197 | -0.60 |
| Residual | | 4.354 | 2.087 | |

Number of obs: 5193, groups: speaker, 6

Fixed effects:

| | Estimate | Std. Error | df | t value | Pr(> t) |
|-----------------------|----------|------------|------------|---------|--------------|
| (Intercept) | 1.41505 | 0.57391 | 5.38231 | 2.466 | 0.0534 . |
| labell | -4.65307 | 0.14679 | 5167.99935 | -31.700 | < 2e-16 *** |
| position | -1.08061 | 0.01748 | 5168.03122 | -61.827 | < 2e-16 *** |
| length2shortmid | 0.31677 | 0.12409 | 5168.01862 | 2.553 | 0.0107 * |
| length3longmid | 1.87707 | 0.10601 | 5168.00029 | 17.707 | < 2e-16 *** |
| length4long | 3.15778 | 0.15368 | 5168.27679 | 20.548 | < 2e-16 *** |
| qss | -1.40687 | 0.08192 | 5168.10113 | -17.174 | < 2e-16 *** |
| spwhw | -0.16528 | 0.51409 | 5.95513 | -0.322 | 0.7588 |
| labell:position | 0.30716 | 0.02656 | 5168.01299 | 11.565 | < 2e-16 *** |
| labell:spwhw | 0.57550 | 0.13451 | 5168.07622 | 4.278 | 1.92e-05 *** |
| position:spwhw | 0.37807 | 0.02321 | 5168.01777 | 16.288 | < 2e-16 *** |
| qss:spwhw | 0.56151 | 0.11608 | 5168.05565 | 4.837 | 1.36e-06 *** |
| length2shortmid:spwhw | -0.04351 | 0.17637 | 5168.06736 | -0.247 | 0.8051 |
| length3longmid:spwhw | -1.14516 | 0.15116 | 5168.14793 | -7.576 | 4.21e-14 *** |
| length4long:spwhw | -1.61535 | 0.21338 | 5168.12942 | -7.570 | 4.39e-14 *** |

Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

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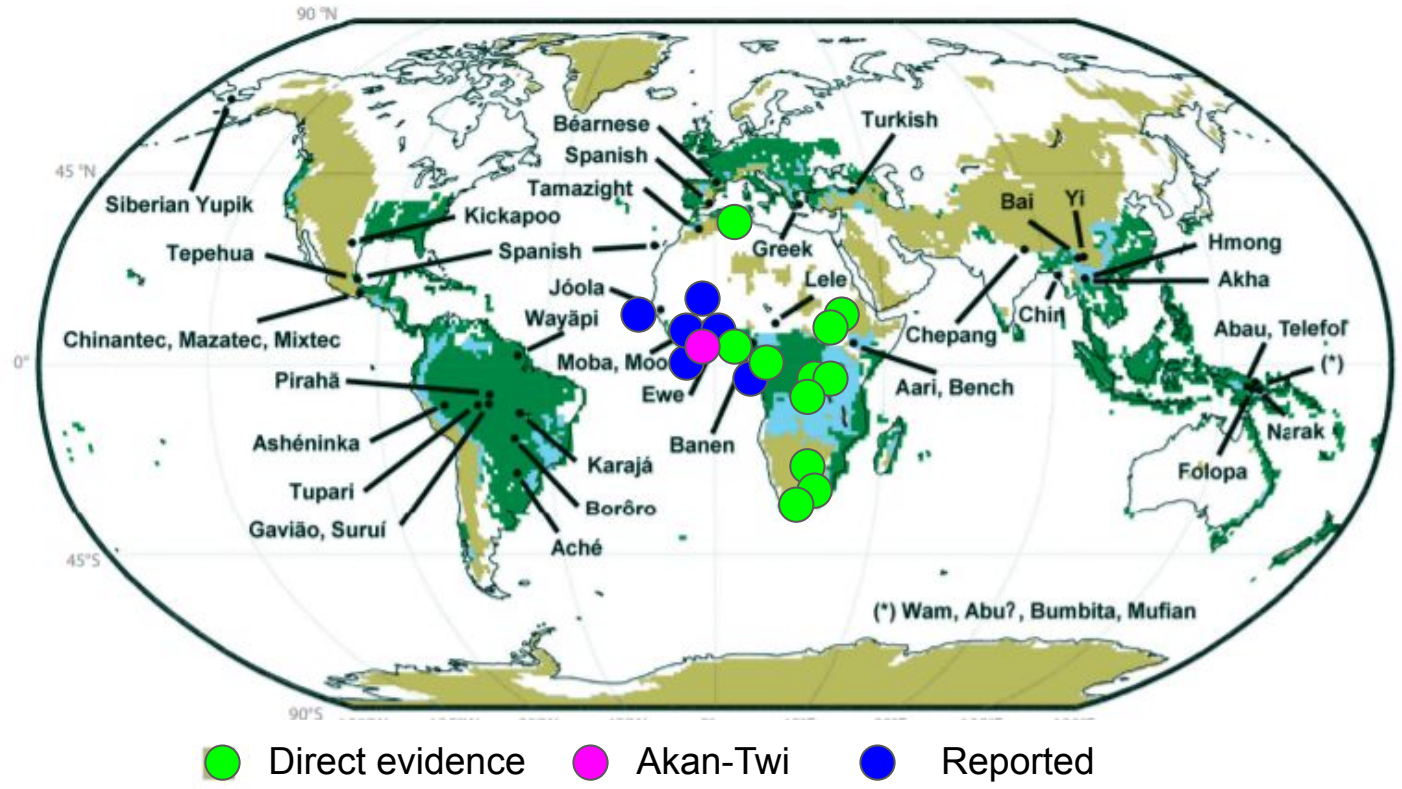


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