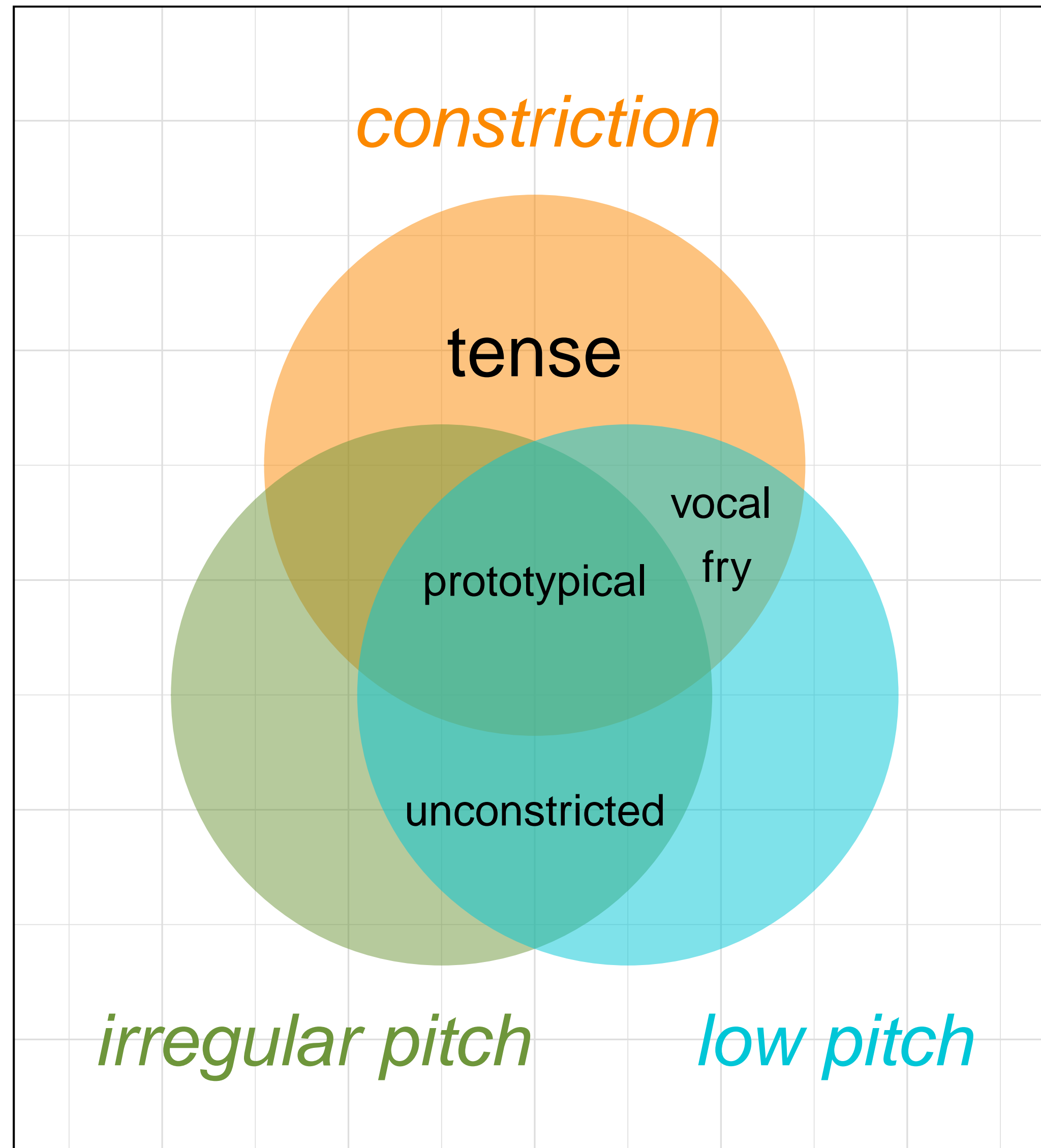


Introduction

'Creaky voice' has distinct **subtypes** [8]:



(After Garellek 2019: Fig. 4.3) [6]

Tense (or 'pressed') voice is **constricted**, but usually **regular** and **high** in f0.

Keating et al. (2015) left open the possibility for **non-high** tense voice. This would be a type of creaky voice characterized only by glottal **constriction**.

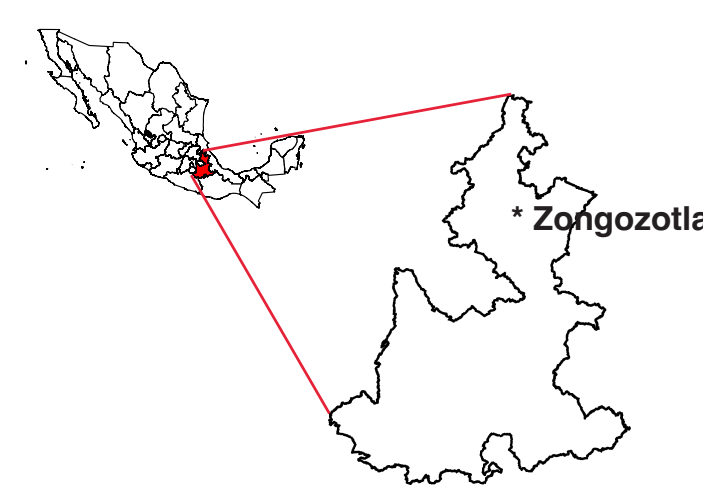
We claim that, in Zongozotla Totonac, 'glottalized' vowels are characterized only by increased constriction.

Zongozotla Totonac

Totonac (< Tepehua-Totonac or 'Totonacan') is spoken in the Sierra Madre Oriental, Mexico.

Zongozotla (Puebla, pop. ~10,000) Totonac (glottocode high1243) belongs to the Sierra subgroup, near the better described Totonac of Zapotitlán de Méndez [2].

Vowels /i(:), u(:), a(:)/ contrast in terms of phonation (except word-finally in open syllables). They can be modal or **glottalized** ('laryngealized').



Glottalized vowels are only **weakly creaky**, esp. when short.

Across Totonac: phonation contrasts have **few minimal pairs** (e.g. [11]).

Glottalized vowels are reconstructed at least for Proto-Totonac [3, 10]. But some Totonac varieties have only modal vowels [12].

The phonetic characteristics of glottalized vowels are understudied (cf. for more distant varieties, [1, 5]).

The data

Stimuli

- Words with modal vs. glottalized vowels
- Controlled for vowel length, stress, word type

Participants

- 8 speakers (incl. co-author O. López-Francisco)
- Gender balanced

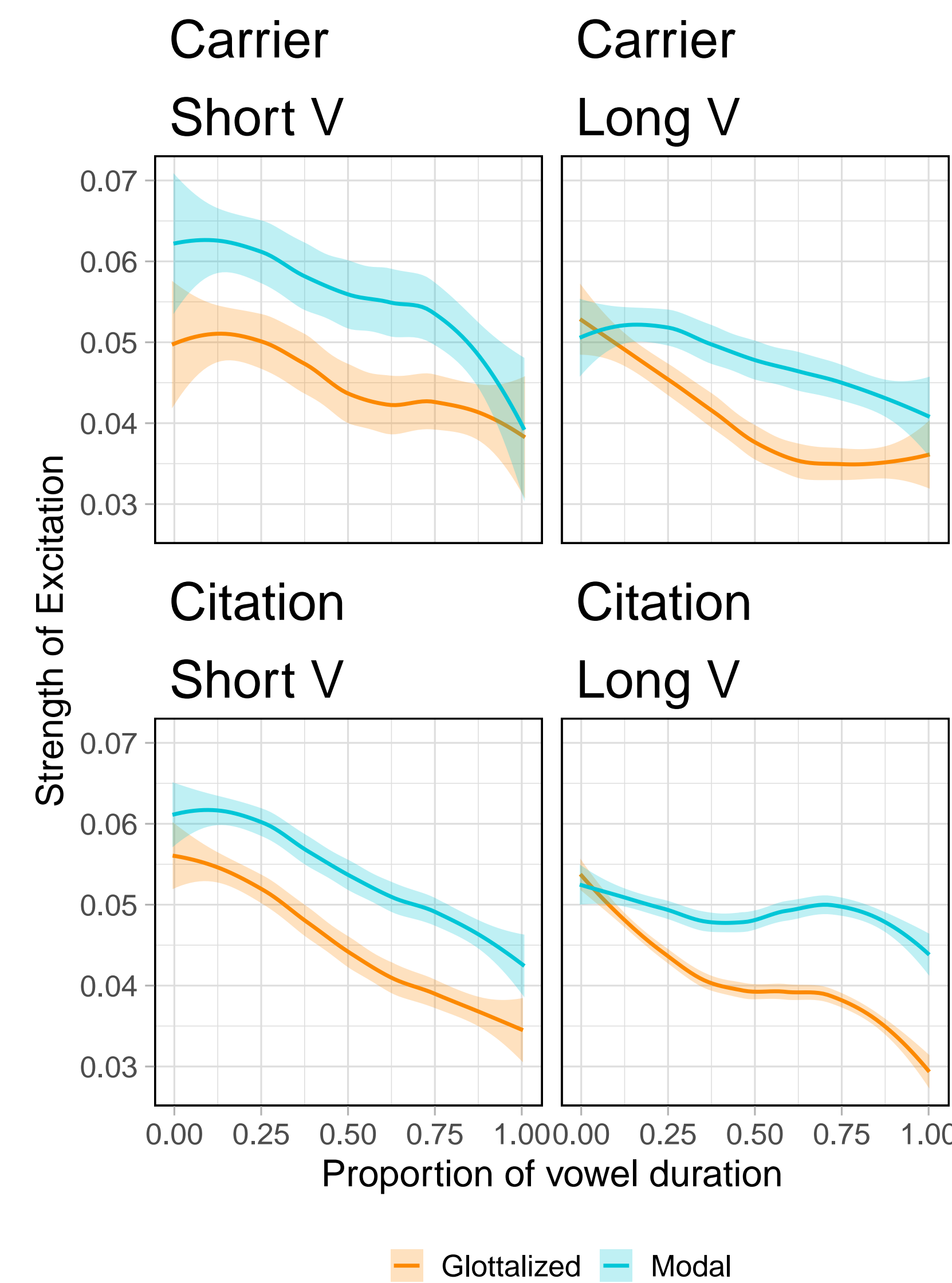
Task and recording

- Words were recorded 3x in isolation
- Then once in carrier 'X *iyma n t'achiw'i:n'* 'X is a word.'
- Recordings were done in Zongozotla by latter two co-authors.

Modal			Glottalized		
[ˈʃanat]	<i>xanat</i>	'flower, flor'	[ˈʃanát]	<i>x'anat</i>	'sweat, sudor'
[ˈʃkut]	<i>xkut</i>	'coati, tejón'	[ˈʃkuta]	<i>xk'uta</i>	'bitter, agrío'
[ˈpaqʔ]	<i>paqlh</i>	'it blossomed, floreció'	[ˈpaqʔ]	<i>p'aqlh</i>	'(s)he broke it, lo quebró'
[ˈkiɬniʔ]	<i>kilhni'</i>	'mouth, boca'	[ˈkiɬniʔ]	<i>k'ilhni'</i>	'you scolded him, lo regañaste'
[ˈpaqja]	<i>paqxa</i>	'hit, golpe (onomat.)'	[ˈpaqja]	<i>p'aqxa</i>	'(s)he shells it, lo desvainó'
[pa'ska:t]	<i>paská:t</i>	'woman, mujer'	[ka'kay:t]	<i>kak'á:t</i>	'cut it!, ¡córtalo!'
[ˈtʃa:n]	<i>cha:n</i>	'cooked, cocido'	[ˈtʃa:n]	<i>ch'a:n</i>	'ant, hormiga'
[ama:tʃaʔ]	<i>ama:chá'</i>	'(s)he's lying over there, <i>allá está acostado</i> '	[ama:tʃaʔ]	<i>am'a:chá'</i>	'(s)he goes there, <i>va por allá</i> '

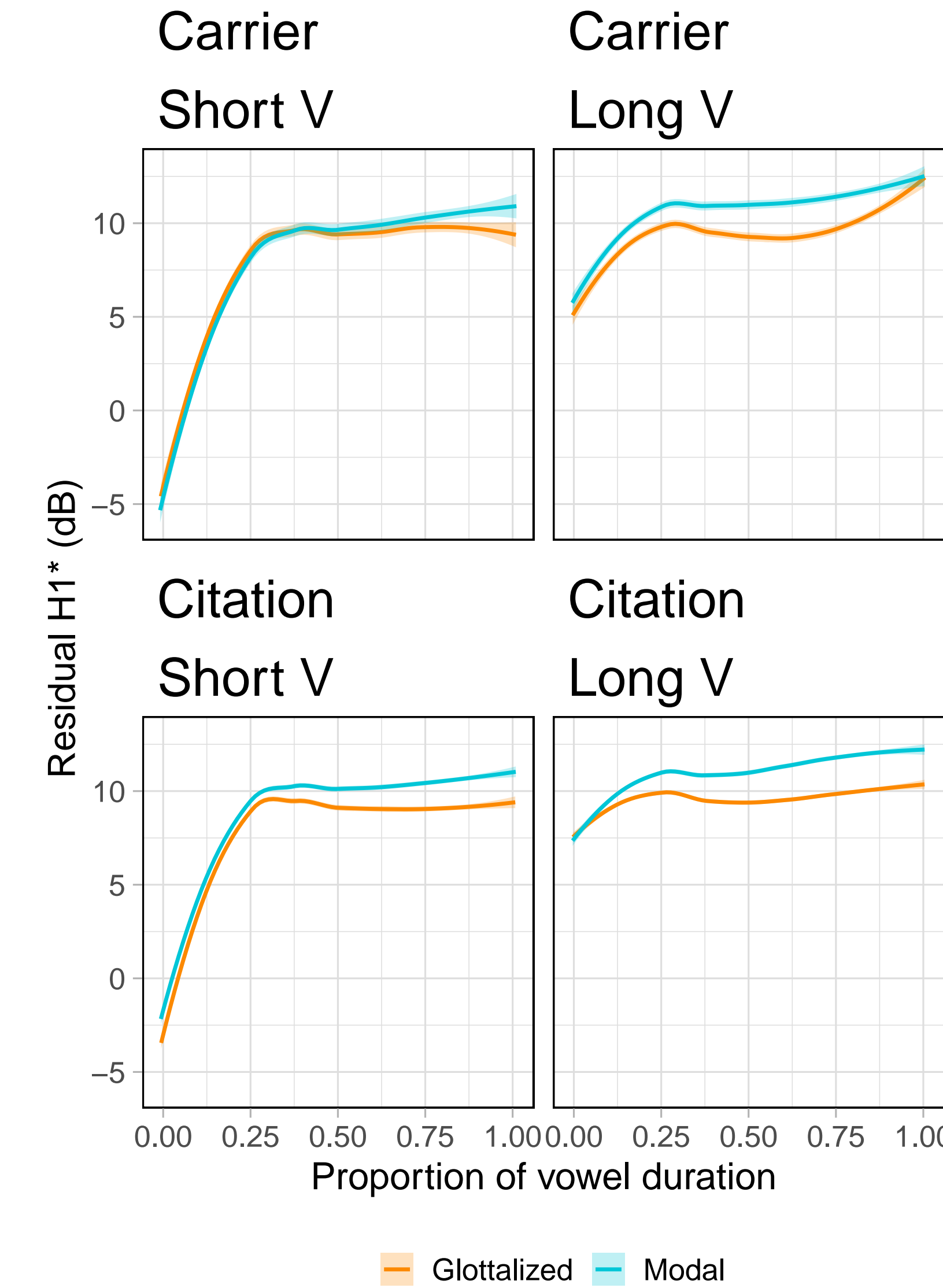
Voicing intensity (SoE [7])

Glottalized vowels have weaker voicing.

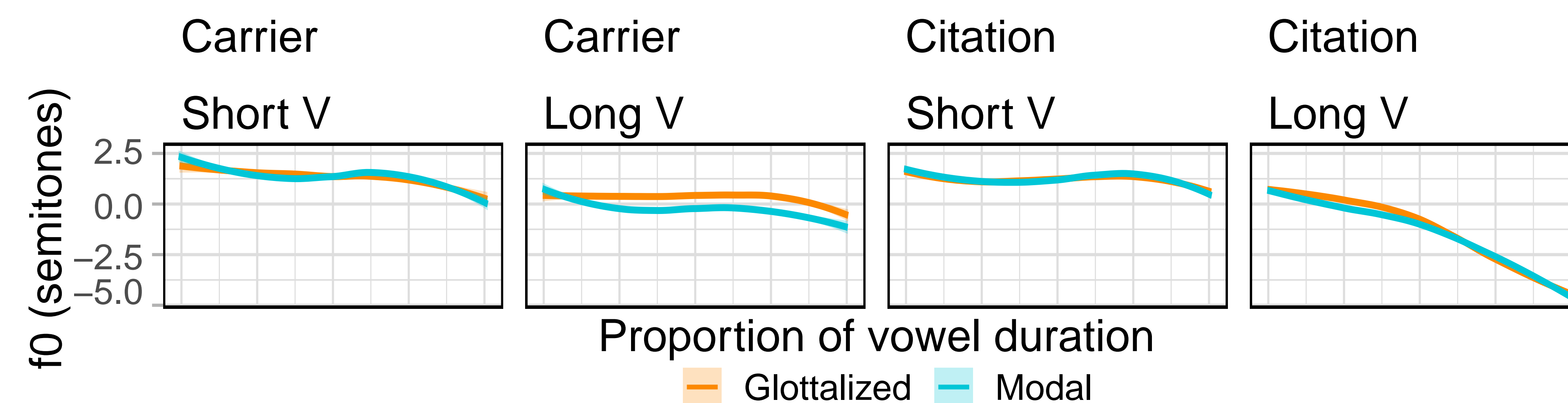


Amplitude of f0 (Residual H1* [4])

Glottalized vowels have a weaker fundamental.



Fundamental frequency (f0)



Data processing and results

Acoustic measures from **VoiceSauce** [15] → Flagged within-speaker **f0 outliers** and within-vowel **F1/F2 outliers** → Tokens with outliers were excluded from spectral tilt analyses → Logistic mixed-effects regression

Main finding: Measures that emerge as significant are correlates of **glottal constriction**: weaker voicing, and weaker fundamental.

Other common correlates related to the fundamental frequency and its periodicity during creaky voice (f0, harmonics-to-noise ratio measures) did not emerge as significant.

Discussion

The glottalized vowels of Zongozotla Totonac are best characterized phonetically as produced with a kind of **tense** voice.

→ Glottalized vowels are **constricted**, but their voicing is **regular**.

Given that they're produced with tense voice, it is surprising that the glottalized vowels show no differences in **f0**.

→ Tense voice is often, but not necessarily, higher-pitched than modal voice; supports Keating et al. (2015)'s taxonomy [8].

In Zongozotla Totonac, glottalization is phonetically strongest for long vowels, particularly in citation form.

As in other Totonac varieties, contrast might be **weakening**: glottalization's increased constriction remains, but it's not strong enough to perturb the f0 or the periodicity.

Weakening of contrast might be tied to presence of few minimal pairs, with a restricted distribution within the word.

Diachronic loss of glottalization is frequently associated with tone development, e.g. *Vʔ > V or Ṽ [9, 13].

→ The data here are more consistent with the other common path of change: loss of glottalization through gestural weakening.

Acknowledgements and references

Copy of poster available here:



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