

Glottalization in Highland Totonac

Marc Garellek (UCSD)

Osbel López-Francisco (UNAM)

Ashlinn Barber-Woeltjen and Lexi Ricasata (UCSD)

Jonathan D. Amith (Gettysburg College)

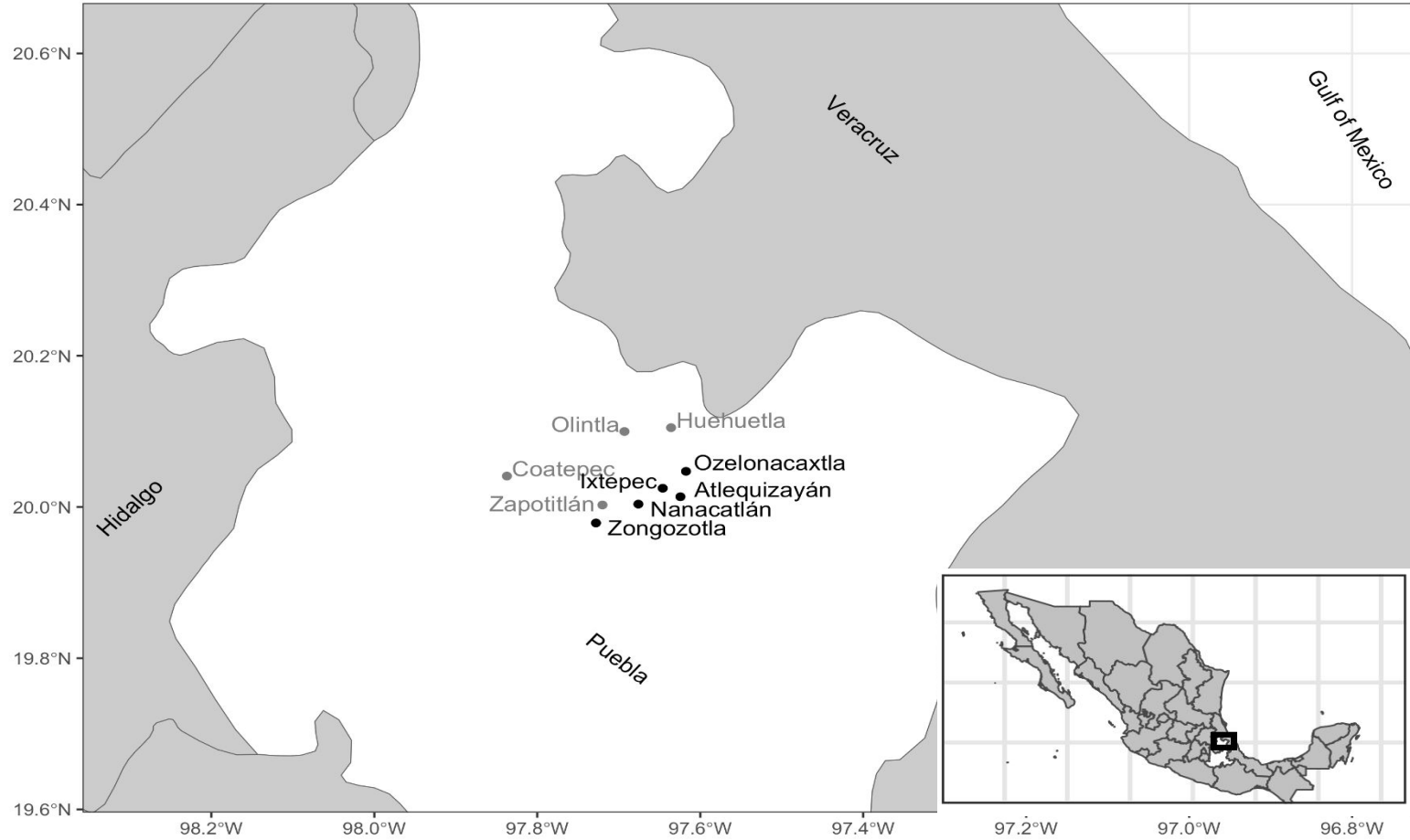


Goals of presentation

1. Describe the phonetic realization of **glottalization** – both **glottal stops [ʔ]** and **glottalized** (‘laryngealized’) **vowels [V̥]** – across Totonac language varieties
 - a. Implications for synchronic analysis and understanding of sound change
 - b. Implications for orthography development
2. Our study is part of NSF-funded project (Jonathan D. Amith, PI) whose main goal is to document ethnobotanical terms across Totonac and other Indigenous languages of Mexico

Highland Totonac (*totonaco de la sierra*)

1. Highland Totonac (ISO 639-3: **tos**, glottocode: **high1243**) is a cluster of Totonac languages spoken mainly in Puebla State (Mexico) by about 120,000 people
2. Totonac languages belong to the Totonacan (“Tepehua-Totonac”) family, with possible links to Mixe-Zoquean languages (Brown et al. 2011) and Chitimacha (Brown et al. 2014)
3. The variety of Highland Totonac spoken in Zapotitlán is the most described, with several publications, including a Spanish-Totonac dictionary (e.g. Aschmann 1946, Aschmann & Wonderly 1952, Aschmann 1983)



Typical vowel/phonation inventory in Highland Totonac (e.g. Zapotitlán)

1. Vowel qualities /i a u/, with [e o] are allophones of /i u/ adjacent to uvulars (and sometimes glottals)

i: ị: i ị	u: ụ: u ụ
(e: ẹ:) (e ẹ)	(o: ọ:) (o ọ)
	a ạ a: ạ:

2. Contrastive length < V V:> and phonation < V **V'**>

3. Vowels within a word can differ in phonation:

/ʃkuta/ *x**cu**ta* ‘lo *desata*, s/he unties it’

/ʃkuta/ *x**cu**’ta* ‘agrio, sour’

/ʃkutạ/ *x**cu**ta’* ‘lo *desatas*, you (singular) untie it’

Why study Totonac glottalization?

1. Most Totonac languages are described as having a **vocalic phonation contrast** (modal vs. ‘laryngealized’)
 - a. Of these, some **also** have a **glottal stop** /ʔ/ in consonant inventory
2. But (phonetic) glottal stops [ʔ] are commonly transcribed, difficult to analyze:
 - a. Sometimes as **part of the realization of /V/**, e.g. [Vʔ] or [Vʔ] (among other realizations)
 - b. Sometimes a **phrase-final marker**
3. MacKay & Trechsel (2018: 55): “The key question that must be addressed in any reconstruction of [Proto-Totonac-Tepehua] concerns the status of laryngealized vowels and glottalized consonants in the protolanguage.”

Different realizations of $\langle V' \rangle$ in Zongozotla by position

1. Garellek et al. (in press *LabPhon*): Phrase-final $\langle V' \rangle$ is **phonetically [V?]**
 - a. Phrase-medially, word-final $\langle V' \rangle$ is realized as **[V(:)]**
 - b. In no position is word-final $\langle V' \rangle$ realized as [V̥]
2. Word-medial $\langle V' \rangle$ is [V̥], **never [V?]**
 - a. Word-medial $\langle V' \rangle$ remains [V̥] regardless of phrasal position

Examples of phonation contrast for words in isolation (from Osbel López-Francisco, Zongozotla variety)

MODAL	GLOTTALIZED (‘LARYNGEALIZED’)
[^h tʃa:n] <i>cha:n</i> ‘cocido, cooked’ 	[^h tʃa̰:n] <i>cha:’n</i> ‘hormiga, ant’ 
[^h ʔkaka̰] <i>lhkak(a)</i> ‘picozo, spicy’ 	[^h ʔkaka̰ʔ] <i>lhka’ka</i> ‘ceniza, ash(es)’ 

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[ʔlkakə] <i>lhkak(a)</i> ‘picozo, spicy’	[ʔlkakəʔ] <i>lhka’ka</i> ‘ceniza, ash(es)’

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We analyze Zongozotla Totonac word-final <V'> as /V?/

1. Glottal consonants alternate with **zero**
2. Word-final <V'> is [V(:)] in phrase-medial position, but [V?] phrase-finally
 - a. E.g. <lhka'ka'> 'ceniza, ash(es)': phrase-**final** [ʰḳaka?] vs. phrase-**medial** [ʰḳaka(:)]
3. The same applies for word-final /Vh/
 - a. <qaxtah> 'cal, lime' is either [ʰqaʃtah] or [ʰqaʃta(:)]

We analyze Zongozotla Totonac word-final <V'> as /V?/

1. /?/ **never** alternates with /Ṽ/, even when we might expect an alternation
2. Word-final [Ṽ] occurs in derived environments, when word-final /Ṽh/ → [Ṽ(:)] phrase-medially
 - a. <skujma'h> 'está trabajando, s/he is working' → ['skuhmã(:)] when phrase-medial
3. Compare <chichí'> 'perro, dog':
 - a. Phrase-finally [tʃi'tʃiʔ]
 - b. Phrase-medially [tʃi'tʃi(:)], *[tʃi'tʃĩ(:)]

Across Highland Totonac, word-final <V'> is often transcribed as /Vʔ/ and not /Ṽ/

VARIETY	MODAL <i>lhkaka</i> 'picoso, spicy'	GLOTTALIZED (‘LARYNGEALIZED’) <i>lhka'ka</i> ‘ceniza, ash(es)’
Zapotitlán (Aschmann 1983)	^h ʔkaka	^h ʔkaka̰
Zongozotla (Garellek et al. <i>in press</i>)	^h ʔkaka	^h ʔkaka̰ʔ

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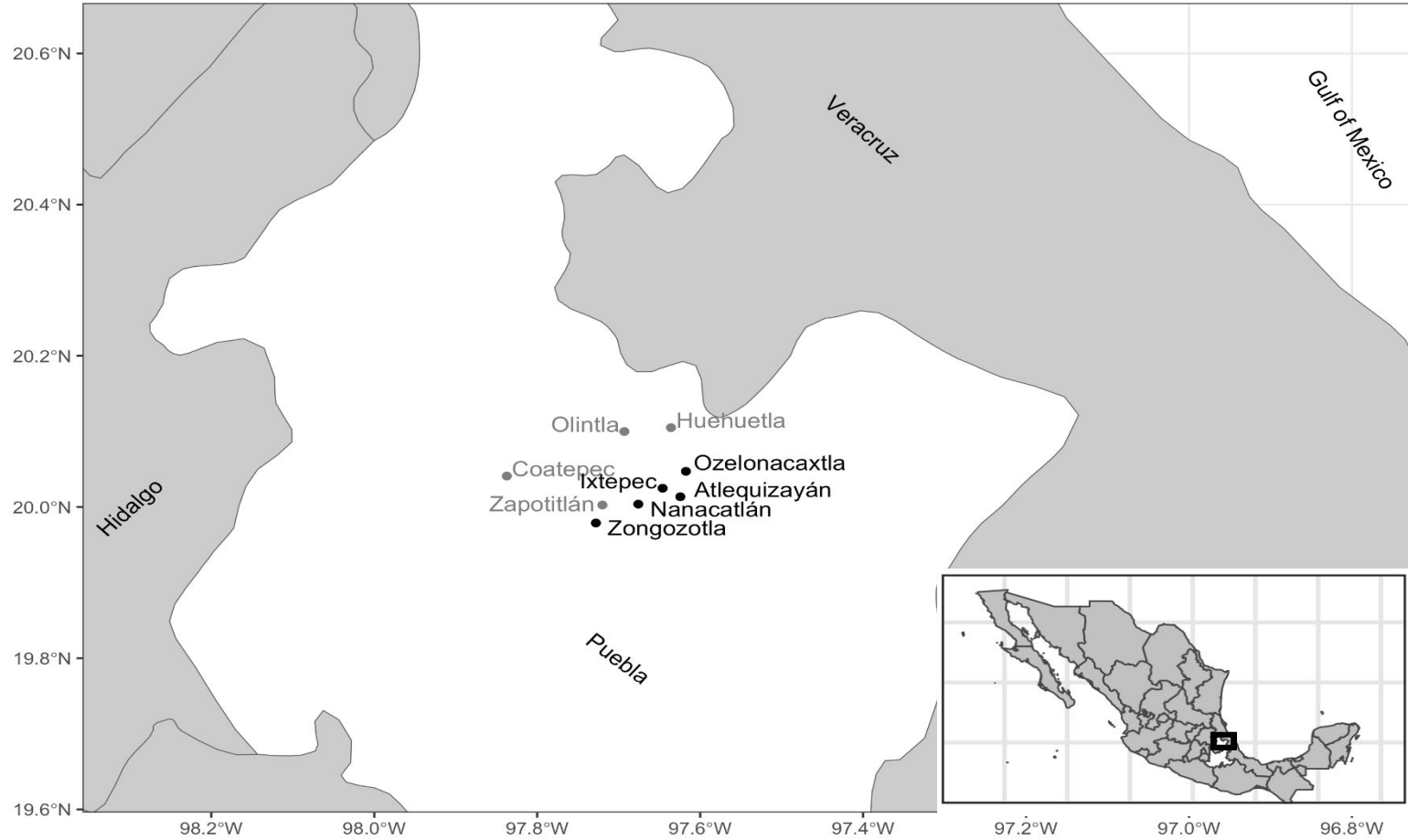
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Coatepec (McQuown 1990)	^h ʔkaka	^h ʔḳạḳạʔ

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Zapotitlán (Aschmann 1983)	^h lkaka	^h lkak̚a
Zongozotla (Garellek et al. <i>in press</i>)	^h lkaka	^h lkak̚aʔ
Coatepec (McQuown 1990)	^h lkaka	^h lkakaʔ
Huehuetla (Troiani 2007)	^h lkaka + phrasal [ʔ]	^h lkakaʔ

Our study

1. We investigate the phonetic realization of word-medial and word-final <V'> across five Highland Totonac varieties:
 - a. Atlequizayán
 - b. Ixtepec
 - c. Nanacatlán (*municipio de Zapotitlán*, described by Aschmann 1983)
 - d. Ozelonacaxtla (described previously by Román 2008)
 - e. Zongozotla
2. Wordlist with potential (near-)minimal pairs recorded in the field by Osbel López-Francisco with Jonathan D. Amith (Zongozotla, May 2022) and Ceferino Salgado (other villages, July 2023).
3. Zongozotla: 8 speakers; other varieties each had 4 (gender-balanced)



Our questions

How does the purported phonation contrast differ across variety?

1. Across varieties, is **word-medial** $\langle V' \rangle$ realized with weakly-constricted tense voice $[\underline{v}]$?
2. Across varieties, is **phrase-final** $\langle V' \rangle$ realized more like $[\underline{v}]$ or more like $[v?] ?$

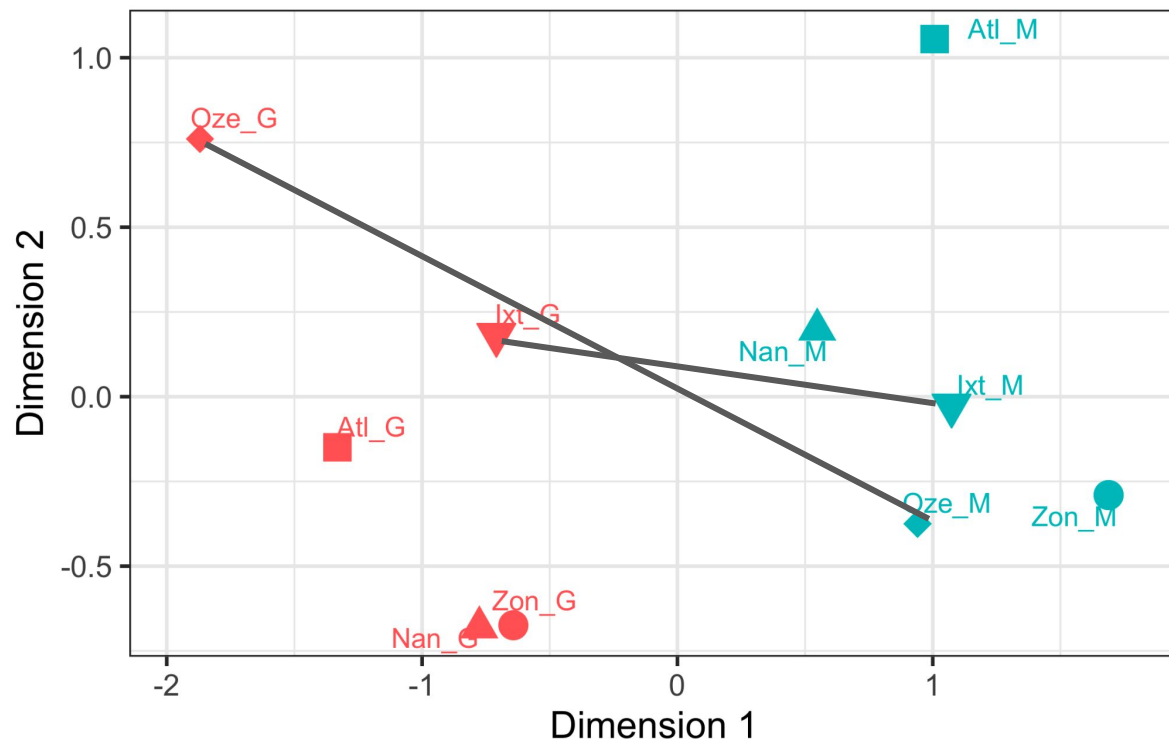
Processing and analysis of recordings

1. The three UCSD authors together determined narrow transcription of recordings for each speaker → a phonemic/orthographic representation of each word
2. In some cases, our transcriptions differ from other published sources
 - a. We're making these (along with audio) freely available to Totonac speakers and research communities

Does word-medial <V'> differ phonetically by variety?

1. We focus here only on **word-medial** vowels found in 7 (near-)minimal pairs in all varieties, such as: <lh**ka**> vs. <lh**k**'ka'>; <x**k**ut(a/i)> vs. <x**k**u'ta>
2. They were analyzed in VoiceSauce for 17 common phonation measures
 - a. Harmonic spectral levels (e.g. **residual H1***, **H1*-A1***)
 - b. Noise (e.g. **CPP**)
 - c. Energy (e.g. **SoE**)
 - d. F0
3. All measures were standardized within speaker
4. Means by Variety and Phonation were then used as input to multi-dimensional scaling (MDS), which maps out a “phonation space” (cf. Keating et al. 2023)

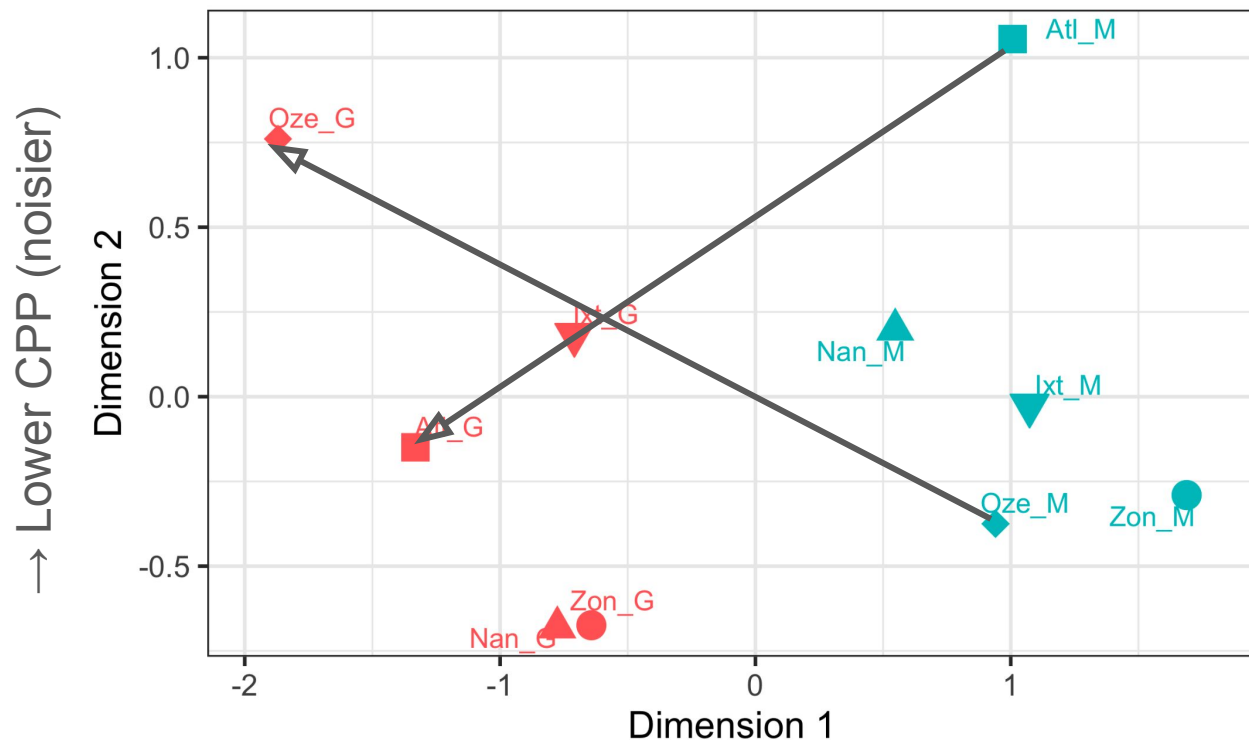
Phonetics of the word-medial phonation contrast



- Clear differentiation by **phonation** along Dimension 1
- Dimension 1 is strongly correlated with residual H1* (strength of f0), H1*-A1* (spectral tilt), and SoE (voicing intensity)

← Lower residual H1*, H1*-A1*, and SoE (more constricted, weaker voicing)

Phonetic realization of the word-medial phonation contrast



- Some **varieties** additionally make use of Dimension 2
- Dimension 2 is most strongly correlated with CPP → noise
- But direction of phonation effect on Dimension 2 differs by variety

Summary of results: word-medial <V'>

1. Word-medial <V'> is weakly to moderately creaky [V̤],
never [Vʔ]
2. MDS analysis shows differentiation by phonation that is similar across all varieties
 - a. Residual H1*, spectral tilt, and voicing intensity matter most
 - i. Similar to our findings from more detailed analysis of Zongozotla
 - b. For some varieties, CPP (noise) also plays a role

What about phrase-final $\langle V' \rangle$?

1. In all varieties word-final $\langle V' \rangle$ has [ʔ] when word is also phrase-final
2. Atlequizayán: words ending in **either** $\langle V \rangle$ or $\langle V' \rangle$ have glottal stop in phrase-final position

Realization of phrase-final < V' > by variety

VARIETY	MODAL <i>lhkaka</i> ‘picozo, spicy’	GLOTTALIZED <i>lhka’ka</i> ‘ceniza, ash(es)’
Zongozotla	[^h lkak̠a] 	[^h lk̠ak̠aʔ] 
Ixtepec	[^h lkak̠a] 	[^h lk̠ak̠aʔ] 
Nanacatlán	[^h lkak̠a] 	[^h lk̠ak̠aʔ] 
Ozelonacaxtla	[^h lkak̠a] 	[^h lk̠ak̠aʔ] 
Atlequizayán	[^h lkak̠aʔ] 	[^h lk̠ak̠aʔ] or? [^h lk̠ak̠aʔ] 

Realization of phrase-final < V' > by variety

VARIETY	MODAL	GLOTTALIZED
	<i>lhkaka</i> ‘picozo, spicy’	<i>lhka’ka</i> ‘ceniza, ash(es)’
Zongozotla	[ʔkaka̠]	[ʔkakaʔ]
Ixtepec	[ʔkaka̠]	[ʔkakaʔ]
Nanacatlán	[ʔkaka̠]	[ʔkakaʔ]
Ozelonacaxtla	[ʔkaka̠]	[ʔkakaʔ]
Atlequizayán	[ʔkaka ^{a?}]	[ʔkaka ^{a?}] or? [ʔkaka ^{a?}]

Realization of phrase-final < V' > by variety

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Zongozotla	[^h lkak̚a]	[^h lk̚akaʔ] 
Ixtepec	[^h lkak̚a]	[^h lk̚akaʔ]
Nanacatlán	[^h lkak̚a]	[^h lk̚akaʔ]
Ozelonacaxtla	[^h lkak̚a]	[^h lk̚akaʔ]
Atlequizayán	[^h lkak̚aʔ]	[^h lk̚akaʔ] or? [^h lk̚akaʔ]

Realization of phrase-final < V' > by variety

VARIETY	MODAL	GLOTTALIZED
	<i>lhkaka</i> ‘picoso, spicy’	<i>lhka’ka</i> ‘ceniza, ash(es)’
Zongozotla	[ʔkaka̯]	[ʔḳakaʔ]
Ixtepec	[ʔkaka̯]	[ʔḳakaʔ]
Nanacatlán	[ʔkaka̯]	[ʔḳakaʔ]
Ozelonacaxtla	[ʔkaka̯]	[ʔḳakaʔ]
Atlequizayán	[ʔkaka̯ ^{aʔ}]	[ʔḳaka̯ ^{aʔ}] or? [ʔḳaka̯ ^{aʔ}]

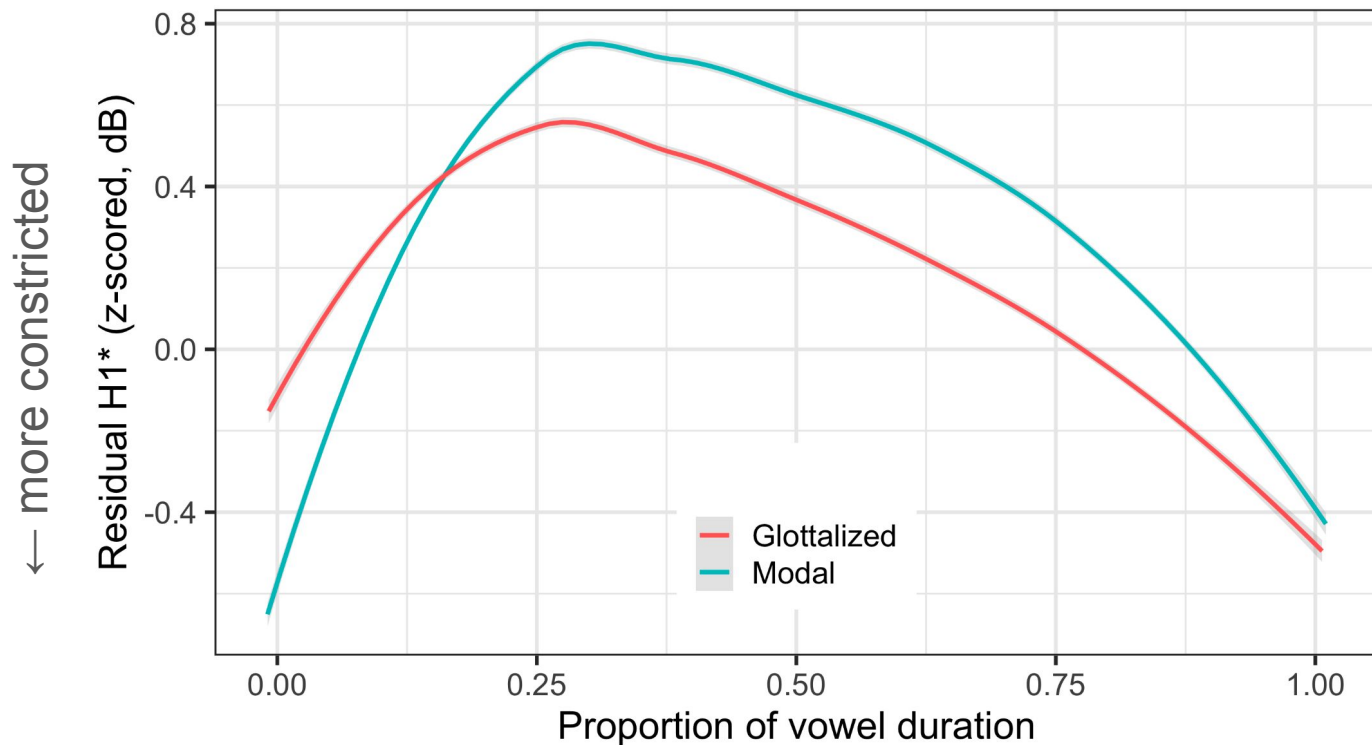


Realization of phrase-final < V' > by variety

VARIETY	MODAL <i>lhkaka</i> ‘picoso, spicy’	GLOTTALIZED <i>lhka’ka</i> ‘ceniza, ash(es)’
Zongozotla	[ʼlkak̚a]	[ʼlkak̚aʔ]
Ixtepec	[ʼlkak̚a]	[ʼlkak̚aʔ]
Nanacatlán	[ʼlkak̚a]	[ʼlkak̚aʔ]
Ozelonacaxtla	[ʼlkak̚a]	[ʼlkak̚aʔ]
Atlequizayán	[ʼlkak̚aʔ]	[ʼlkak̚aʔ] or? [ʼlkak̚aʔ]



Does Atlequizayan distinguish between phrase-final $\langle V \rangle$ vs. $\langle V' \rangle$, even when both are followed by phrasal [?]?



Summary of results

1. Across varieties, realization of word-**medial** $\langle V' \rangle$:
tense-voice to creaky-voice
2. Across varieties: realization of phrase-**final** $\langle V' \rangle$:
strongly glottalized $[Vʔ]$ or $[V̰ʔ]$
 - a. But in Atlequizayán, there is evidence that phrase-final $[ʔ]$ is **phrasal**, not lexical

Implications for diachrony

1. If we assume that word-final [V̥] is more conservative (MacKay & Trechsel 2018):
 - a. *V̥ > Vʔ in all varieties tested *except* Atlequizayán
2. But Atlequizayán *does* have [ʔ] phrase-finally, just for all vowel-final words
 - a. Does phrasal [ʔ] matter for historical reconstructions?
 - i. Davletshin (2018) posits *ʔ as coda C in PTT
 - b. What accounts for the occurrence of phrasal [ʔ]?

Representing glottalization orthographically

1. Totonac orthography tends to be surface-based, e.g. in Zongozotla:
 - a. /ɬkaka/ → phrase-**medial** [ɬkaka] > *lhkaka*
 - b. /ɬkaka/ → phrase-**final** [ɬkaka̰] > *lhkak*

2. But *phrasal glottalization* should ideally not be marked, e.g. in Atlequizayán:
 - a. /paʃa/ ‘se baña, s/he bathes’ → phrase-final [paʃ**a** ?] > *paxa*
 - b. /paʃa̰/ ‘te bañas, you bathe’ → phrase-final [paʃ**a̰** ?] > *paxa̰*

3. Phonological, esp. **phrasal**, analysis can inform orthography

Thanks!

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