Pre-Pausal Glottalization in Chicontepec Nahuatl

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ABSTRACT

This paper analyzes the distribution of glottalization associated with pauses in Chicontepec Nahuatl (ChN), a variety of Eastern Huasteca Nahuatl, which is a Uto-Aztecan language spoken in Veracruz Mexico. This paper contributes to the literature on glottal effects at prosodic boundaries by describing a pattern in ChN that is distinct from other documented phenomena, such as phrase-final creak. This glottalization is analyzed as a [+constricted glottis] suprasegmental feature that marks the end of phrases. Data gathered in the field suggest that the realization of utterance-final glottalization is sensitive to the phonological status of the final consonants. In addition, for a subset of speakers, there is a pattern of phrase-final devoicing, such that glottalization moves leftward to the nearest voiced syllable, suggesting that it is a suprasegmental feature associated with prosodic boundaries.

Keywords: Nahuatl, utterance-final glottalization, suprasegment, glottal stop.

1. INTRODUCTION

Glottal effects at prosodic boundaries, including phenomena such as prosodic strengthening, phrase-initial glottal stops, phrase-final creak, phrase-final boundary tone truncation by devoicing, etc., have been of interest in the literature. In this paper I describe a distinct glottal effect found in Chicontepec Nahuatl (ChN): glottalization (realized as both glottal stops and voiced glottalization) that is associated with pauses. I analyze these glottal stops as a [+constricted glottis] suprasegmental feature that marks the end of a prosodic unit. While pausal glottalization is found both utterance-medially and finally, this paper focuses on the utterance-final context. I first establish the canonical realization of utterance-final pausal glottalization as a glottal stop after vowel-final words. Then, I show how pausal glottalization is realized when cooccurring with utterance-final consonants, and show that the realization of this [+constricted glottis] feature is sensitive to phonological status. Finally, I describe a pattern in which utterance-final pausal glottalization moves left to the nearest voiced syllable, suggesting that this type of glottalization is a suprasegmental feature associated with a prosodic unit.

Nahuatl is the Southernmost Uto-Aztecan language with varieties spoken from west and central Mexico, as far south as El Salvador, and in diaspora communities across the United States. It is spoken by roughly 1,651,958 speakers in Mexico [1]. ChN is a variety of Eastern Huasteca Nahuatl, spoken in Chicontepec de Tejeda, Veracruz and surrounding communities by about 32,428 speakers [2].

This description is based on data gathered through fieldwork conducted with ten speakers (six female and four male) in Zacatecas, Mexico. They are native Nahuatl speakers who grew up in the municipality of Chicontepec. All speakers were between the ages of 25-45. The sentences that were analyzed in this study were drawn from a combination of data gathered through elicitation and directed tasks using carrier sentences, as well as natural conversations and narrative texts. Data were recorded in the field in mono with a Marantz PMD660 solid-state recorder and an Audio-Technica AT897 shotgun microphone.

1.1. Laryngeal Sounds in Nahuatl

Across Nahuatl varieties, there is typically one contrastive laryngeal sound. In Classical Nahuatl and other central varieties of Nahuatl, the contrastive sound is a glottal stop /ʔ/. In many other varieties of Nahuatl, including ChN, the corresponding laryngeal sound is the glottal fricative /h/, such that a word like 'medicine' will be something like [paʔt͡ɬi] in some varieties and [paht͡ɬi] in others. ChN is a laryngeally rich language in that it has contrastive /h/, as well as a number of phonologically derived surface glottal fricatives from underlying coda /w/, word-final nasals, and /k/ in a number of contexts [3]. In ChN, glottal stop is not a contrastive sound; however, glottalization is widely distributed in a number of contexts: prefix-stem boundary, stem-stem boundaries, hiatus contexts and in pre-pausal contexts. In this paper, I focus on the pre-pausal context for glottalization.

2. PRE-PAUSAL GLOTTALIZATION

There is a regular pattern in which glottalization aligns with pauses in ChN. A pause is defined as a period of silence, a perceptible and physical break in the speech stream, that may or may not align with other prosodic boundaries. Utterance-medially, this glottalization is typically realized as a canonical

phonetic glottal stop in which glottalization can be seen both leading into the pause and out of the pause. The glottal stop is thus the period of silence. Utterance-finally, this pausal glottalization is realized as a canonical glottal stop after vowel-final words, with some amount of noticeable irregular pulsing leading to a period of silence, followed by some degree of breathy noise in the release of the glottal stop. Because neither a detailed intonational model for, nor a syntactic analysis of ChN is yet available, I focus on utterance-final pauses which necessarily align with two prosodic boundaries: a *phrase* and the *utterance*. The *utterance* is defined as a breath group that is a phonetic string that is bounded by breaths.

Utterance-final glottalization is a robust pattern. In particular, if the utterance-final word is vowel-final, all utterances trigger a glottal stop. The waveforms and spectrograms in Figures 1–2 show two equivalent sentences: one in which there is noun incorporation and the utterance ends verb-finally (Figure 1), and one in which the utterance ends in an unincorporated noun (Figure 2). Glottalization occurs after both final vowels, demonstrating that glottalization is not a feature of a particular lexical item, but rather an articulation associated with the end of an utterance.

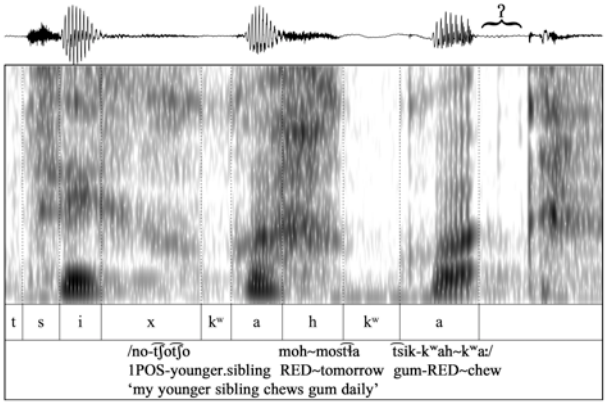

Figure 1: Utterance-final glottalization, as marked by "ʔ" over the waveform, on final verb[1]

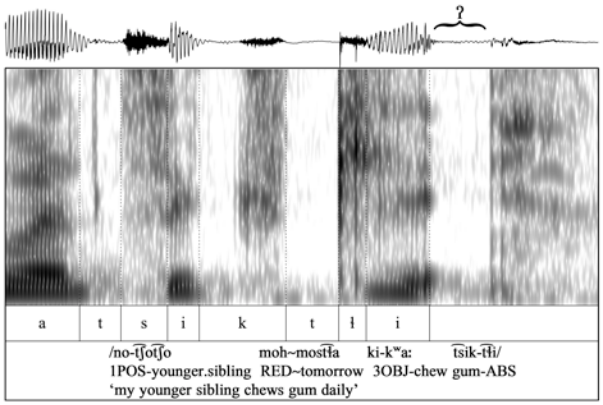

Figure 2: Utterance-final glottalization, as marked by "ʔ" over the waveform, on final noun

2.1. Utterance-final consonants

Glottalization has been shown to have variable realization across and within languages [4, 5, 6]. As expected, the phonetic realization of glottalization in ChN ranges from canonical glottal stops to varying degrees of creaky phonation on adjacent voiced sounds. In the vowel-final context, glottalization is realized as a canonical glottal stop. In utterances that are consonant-final, glottalization is realized as creaky phonation. In this study, creaky phonation is identified visually in the spectrogram [7] as irregular pulsing, which is often accompanied by other features such as pitch-halving, or interruption of pitch tracking altogether. Figure 3 shows how glottalization is realized when the utterance-final word is consonant-final: creaky phonation during the final vowel.

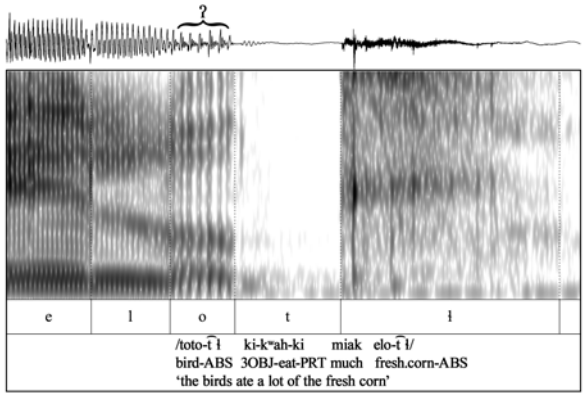

Figure 3: Utterance-final glottalization realized as creaky phonation on C-final word

While it is articulatorily possible to realize a glottal stop after or during the final consonant, for utterances ending in a consonant, glottalization instead is realized on the final vowel of the utterance, perhaps because here it would be more acoustically salient. This supports an analysis that glottalization is a floating feature associated with the end of a phrase or utterance, and that it must anchor to a final vowel.

The occurrence of glottalization in this context is much more variable than vowel-finally. I attribute this to perhaps differences in intonational structure or as an artifact of the methodologies employed. While glottalization seems to be absent in this context in many tokens gathered, it is realized overtly much more regularly in the naturalistic data from conversations.

2.2. Utterance-final [h] and phonological sensitivity

The distribution of /h/ in ChN is such that it almost exclusively occurs in the coda position. This is an interesting distribution since it has been shown that the glottal fricative /h/ is more perceptually salient in the onset position and is not expected to have such a

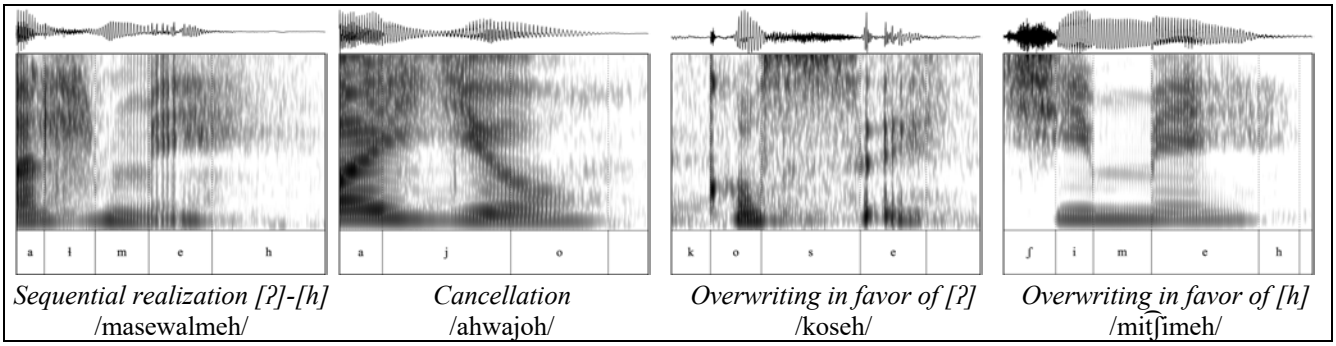

Figure 4: Realizations of utterance-final glottalization with final [h]

distribution [8]**.** In addition, word-final [h] not only corresponds to the contrastive underlying /h/ in the inventory, but also to nasals (/m/ and /n/) and the labiovelar glide /w/. This is because phonological processes of neutralization target word-final nasals and coda /w/s.

Utterance-final glottal fricatives provide an interesting context for the realization of utterance-final glottalization since, following Ladefoged's Continuum model of phonation [9, 10, 11], [h] and [ʔ] are articulatorily opposites. However, in ChN, both occur utterance-finally, in a "stacked" prosodic position (glottalization at the utterance-level, [h] word-level). Possible outcomes for the realization of both the word-final [h] and utterance-final glottalization (schematized here as [ʔ]) include: 1) sequential realization [ʔ]-[h]; 2) sequential realization in the reverse order [h]-[ʔ]); 3) cancellation such that neither is realized; 4) overwriting in favor of [ʔ] (/h/→Ø); and 5) overwriting in favor of [h] (/ʔ/→Ø). A survey of 554 tokens with final [h]s from underlying /h/, /n, m/, and /w/ showed that surface realization was variable. Note that nasal-final words are less frequent than /h/-final words, and /w/-final words are even less frequent, which is reflected in the number of tokens available to survey. Table 1 summarizes the distribution of realizations by underlying representation (UR).

	/h/	**/N/**	**/w/**
Sequential [ʔ]-[h]	58 [.20]	27 [.15]	17 [.19]
Sequential [h]-[ʔ]	0	0	0
Cancellation	45 [.16]	15 [.09]	3 [.03]
Overwriting [ʔ] (/h/→Ø)	20 [.07]	6 [.03]	3 [.03]
Overwriting [h] (/ʔ/→Ø)	165 [.57]	128 [.73]	66 [.73]
Total	288	176	90

Table 1 Realization of [h] and [ʔ] by UR.
Proportion of total tokens in brackets.

The distributions of realizations for overt glottalization and glottal fricatives by underlying representation all follow the same general trends. Glottalization is more often deleted than realized overtly in the context of [h] (overwriting /ʔ/→Ø). If glottalization surfaces, the most likely realization is for it to occur *sequentially* in a [ʔ]-[h] sequence as seen for other utterance-final consonants (e.g., Figure 3), though there is a less frequent pattern of *overwriting* of [h] in favor of [ʔ]. Finally, *cancellation* occurs less than sequential realization. Note that the contrast between /Vh/ and final /V/ is maintained, as the latter are always realized with glottalization as shown in Figures 1-2. Examples of each type of attested surface realization are given in Figure 4, all with words with underlying final /h/. There were no cases of glottalization occurring after the glottal fricative.

Looking at overt glottalization only, there appears to be a subtle difference in the realization of glottalization by UR, suggesting that the phonetic implementation of the stacked final [h] and utterance-final glottalization is sensitive to phonological status. It can be argued that [ʔ] is realized more strongly when co-occurring with /h/ than with /N/ and /w/: overwriting in favor of [ʔ] occurs twice as often for tokens with underlying /h/ than for /N/ and /w/; and, overwriting in favor of [h] occurs more often for /N/ and /w/ than for /h/. Cancellation also occurs at a higher rate for /h/ than for /N/ and /w/. Taken together, the distribution of [ʔ] and [h] realizations suggests that [h] that is underlyingly /h/ is more likely to be reduced compared to [h] that is underlyingly /N/ or /w/. In other words, [h] that is underlyingly nasal or /w/ is more persistent. The persistence of [h] that is derived from an underlying nasal or /w/, in light of a pressure to reduce in the context of [ʔ], in effect ensures that the derivational phonological information is not lost.

2.3. Utterance-final glottalization as a suprasegmental

That utterance-final glottalization can move inward from the edge supports the analysis that it is a floating [+constricted glottis] feature specified to occur near the end of an utterance. For a subset of speakers

(4/12), there is a marginal pattern of devoicing utterance-final syllables. This may be partially driven by coarticulation with voiceless consonants, declination, and/or perhaps the anticipation of the open-glottis gesture associated with an intake of breath [12, 13, 14]. When the final syllable is devoiced, glottalization is realized on the penultimate syllable rather than the final syllable. Figure 5 shows glottalization realized on the utterance-penultimate syllable when the final syllable is devoiced.

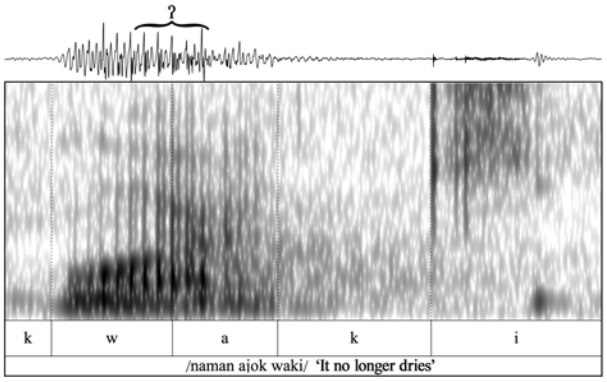

Figure 6: Glottalization when final syllable is devoiced

What is of interest here is that glottalization that marks the end of a phrase can be realized before the end of the segmental string. This suggests that this laryngeal target moves leftward to the nearest possible anchor point: a sonorant. This supports the analysis that this is a suprasegmental [+constricted glottis] associated with the utterance/phrasal boundary, since it can move in from the edge depending on the context.

This glottalization pattern in ChN parallels other suprasegmental phenomena. Devoicing has been shown to cause pitch-accent to shift in Japanese [15, 16]. Similarly, edge or boundary tones, which mark the ends of the prosodic phrases, have been shown to move and appear before the phrase edge or move to an epenthesized vowel when no voiced nucleus is available in Tashlhiyt Berber [17, 18]. Similar in position and behavior to Tashlhiyt Berber boundary tones, ChN glottalization behaves like a boundary target analogous to tone, but involving vocal fold constriction rather than stretching. The more conservative analysis taken here is of a floating [+constricted glottis] feature associated with utterance (or loosely-defined phrasal) boundaries. Figure 6 schematizes the movement of glottalization anchor points.

3. DISCUSSION AND CONCLUSION

In this paper I show how glottalization, realized as both canonical glottal stops and voiced glottalization, is associated with pre-pausal contexts, utterance-medially and finally. I analyze utterance-final glottalization as a [+constricted glottis] suprasegmental feature that marks the end of a phrase given that it can move leftward from the edge to the nearest possible anchor point. The realization of this suprasegment is sensitive to the phonological status of the U-final consonant such that it is more strongly realized with utterance-final [h] that is underlyingly /h/ compared to [h] derived from underlying /N/ or /w/.

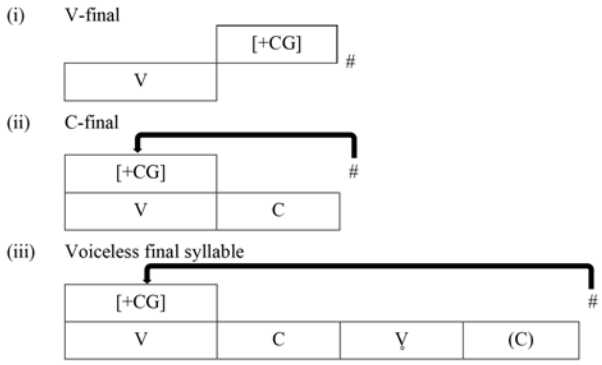

Figure 5: Anchoring points for suprasegmental [+CG]

Laryngeal articulations associated with utterance boundaries, and presumably phrase boundaries, are not unprecedented. In Choguita Rarámuri, utterance-final vowels with falling tones are rearticulated, such that a word like /naʰpô/ 'prickly pear' surfaces as [naʰpóʔò] [19, 20, 21]. In Warekena, a glottal fricative with a copy vowel /-hṼ/ is reported in pre-pausal and utterance-final vowels [22]. In Cahuilla, words with "moveable" glottal stops are reported to occur most reliably in specific phrasal contexts such as phrase-finally and in isolation [23]. In Dagbani, glottal stops are reported to mark phrasal boundaries utterance-medially (pauses) and utterance finally [24]. Similarly in Lahu (Tibeto-Burman), a phrase-final glottal stop is associated with the imperative construction [25].

These patterns from diverse language families suggest that laryngeal articulations associated with prosodic boundaries, and specifically that are not physiological or aerodynamic in origin, may be more common than previously documented in the world's languages. More locally, this raises the question for future investigations of how representative this pattern is of other Nahuatl varieties.

This work is important for a number of reasons. First, it has implications for prosodic typology in that it has the potential to expand our definitions of "intonation" to include other laryngeal articulations beyond f0. Second, it is a first step towards an intonational analysis of ChN. Finally, it contributes to the limited literature on the phonetics of Nahuatl and other Uto-Aztecan and Indigenous American languages in general.

4. ACKNOWLEDGEMENTS

Miac tlazcamati, special thanks to my teachers, notlamachtianiwah: Catalina Cruz de la Cruz, Faustino Cruz de la Cruz, Sabina Cruz de la Cruz, Ofelia Cruz Morales, Victorino Francisco de la Cruz, Eduardo de la Cruz Cruz, Marcelina de la Cruz Cruz, Rosa de la Cruz Cruz, Delfina de la Cruz de la Cruz, my other Nahuatl teachers, and the Instituto de Docencia e Investigación Etnológica de Zacatecas. I am also grateful to Marc Garellek, Gabriela Caballero, and September Cowley for your helpful comments.

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