

## The phonological status of glottal stop in Zapotec

Zapotec languages feature vowels with glottal stop in the middle ( $V^?V$ ) and in the end ( $V^?$ ). When observing a phonetic glottal stop in a vowel, to determine whether this is vowel-mid-glottalization and/or vowel-final-glottalization in a language, we need to first answer a phonological question: is the phonetic glottal stop a suprasegment or a segment? In the current study, we surveyed 20 Zapotec languages, summarized the evidence provided by the authors on whether the language has glottalization or glottal stop, and evaluated whether the evidence is sufficient for determining the status of phonetic glottal stop.

Previous studies have used both phonetic and phonological evidence to determine the phonological status of phonetic glottal stop. Phonetic evidence usually appeals to the degree of glottalization. Teodocio Olivares (2009) suggested that there is a contrast between  $V^?$  and  $V^?$  in Betaza Zapotec. The phonetic glottal stops realized with an aspirated release of the glottal closure are segmental glottal stops, whereas those without an aspirated release are suprasegmental glottalizations. We believe that phonetic evidence is not definitive when determining the status of glottalization, because the phonetic realization of glottalization and glottal stop is highly variable within and across languages (Garellek et al., 2022). Glottal stop could be realized weakly as glottalization. Glottalization could be realized in a strong form as glottal stop.

One of the phonological evidences for analyzing the phonetic glottal stop in  $V^?$  sequence as a suprasegment is that  $V^?$  behaves the same as open syllables but differently from closed syllables. In Texmelucan Zapotec (Speck, 1978), when the stem is a closed syllable, the 3rd person possessive is marked as a separate morpheme /mi/. When the stem is an open syllable, the 3rd person possessive is marked by suffix /-m/ added to the stem.  $V^?$  stems also take /-m/ suffix for 3rd person possessive forms (Example 1). This suggests that  $V^?$  is an open syllable. The phonetic glottal stop does not function as other consonant codas, but a suprasegment that is part of the vowel. We find this kind of phonological evidence convincing for determining the glottalization as a suprasegment.

Several studies determined the phonetic glottal stop in  $V^?V$  as suprasegment because  $V^?V$  shares the same phonological properties as monosyllables. In Yalálag (Avelino, 2016), Quiavini (Chávez-Peón, 2011), and San Juan Mixtepec Zapotec (Nelson, 2004),  $V^?V$  syllables carry the same or a smaller tonal inventory than monosyllables; the vowel inventory of  $V^?V$  syllables is the same or smaller than monosyllables. In Cajonos Zapotec (Nellis & Hollenbach, 1980), polysyllabic words ending in an open syllable have stress on the penultimate syllable.  $V^?V$  is counted as one single syllable in stress assignment (e.g. /'ʒwáǵé/ “pitcher”; /'bèǵé?e/ “ice”). The equivalence between  $V^?V$  and monosyllables in phonological properties and processes indicates that the glottal stop is not a segment that divides  $V^?V$  into two syllables, but is glottalized phonation realized in the middle of vowels.

We also provide original data for phonetic glottal stop in San Francisco Yateé Zapotec for being a suprasegment (Example 3). For  $V^?$ , we found that in definite forms, when the stem ends in vowel, the definite form is marked with a suffix /-n/. When the stem ends in consonant, the definite form is marked with a syllabic suffix /-ŋ/. For words [ $V^?$ ], the definite form is marked with suffix /-n/, same as open syllables. Therefore we regard  $V^?$  as open syllable as well, and glottal stop as suprasegment.

In conclusion, in this study, we proposed an evaluation system for determining whether a phonetic glottal stop is a segment or suprasegment in a language, and added original data as a case study. We recommend future studies analyzing the creaky phonation of a language to first evaluate the phonological status of the phonetic glottal stops in the language.

(1)	Root	Gloss	Underlying form	Surface form	Gloss
a.	/lo/	“face”	/lo-mi/	[lom]	“her face”
b.	/fab/	“clothes”	/fab-mi/	[fab mi]	“her clothes”
c.	/juʔ/	“house”	/juʔ-mi/	[juʔm]	“her house”
d.	/ja/	“hand”	/ja-mi/	[jam]	“her hand”

  

(2)	Root	Gloss	Underlying form	Surface form	Gloss
a.	/wí/	“orange”	/wi-ŋ/	[wĩn]	“the orange”
b.	/nis/	“water”	/nis-ŋ/	[niŋ]	“the water”
c.	/jéláʔ/	“banana”	/jéláʔ-ŋ/	[jélán]	“the banana”

#### References

- Avelino, H. (2016). Phonetics in Phonology: A Cross-Linguistic Study of Laryngeal Contrast. In H. Avelino, M. Coler, & W. L. Wetzels (Eds.), *The Phonetics and Phonology of Laryngeal Features in Native American Languages* (pp. 157–179). Brill.
- Chávez-Peón, M. E. (2011). Non-modal phonation in Quiavini Zapotec: An acoustic investigation. *Memorias Del V Congreso de Idiomas Indígenas de Latinoamérica*, 1–24.  
[https://ailla.utexas.org/sites/default/files/documents/Chavez\\_CILLA\\_V.pdf](https://ailla.utexas.org/sites/default/files/documents/Chavez_CILLA_V.pdf)
- Garellek, M., Chai, Y., Huang, Y., & Van Doren, M. (2021). Voicing of glottal consonants and non-modal vowels. *Journal of the International Phonetic Association*, 1–28.
- Nellis, D. G., & Hollenbach, B. E. (1980). Fortis versus Lenis in Cajonos Zapotec Phonology. *International Journal of American Linguistics*, 46(2), 92–105. <https://doi.org/10.1086/465639>
- Nelson, J. L. (2004). *Tone and glottalization in San Juan Mixtepec Zapotec* [Master’s thesis, University of Texas at Arlington]. <https://www.sil.org/resources/archives/9450>
- Speck, C. H. (1978). *The Phonology of Texmelucan Zapotec Verb Irregularity* [Master’s thesis, University of North Dakota]. <https://commons.und.edu/theses/2660>
- Teodocio Olivares, A. (2009). *Betaza Zapotec Phonology: Segmental and Suprasegmental Features* [Master’s Thesis, University of Texas at Austin].