

Effect of glottalization position and duration in perceiving glottalized phonation in Zapotec

Introduction. Yatee Zapotec (zty) is a variety of Sierra Norte Zapotec spoken in the Sierra Norte region of Oaxaca. This language features three contrastive phonations: modal, rearticulated, and checked. Rearticulated and checked phonations both have glottalized phonation, but they differ in the phasing of the glottalization in the vowel. Rearticulated phonation has glottalization in the middle of vowel, whereas checked phonation has glottalization in the vowel end (Chai et al., 2023). In addition, rearticulated vowels has longer duration than checked vowels. Our overarching research question is to test what acoustic cues do listeners attend to when differentiating modal, rearticulated, and checked phonations. The two variables we tested are the phasing of glottalization and the duration of vowels.

Stimuli and Method. First, in terms of the phasing of glottalization, while we know that rearticulated phonation and checked phonation has vowel-middle and vowel-final glottalization, we are still unclear about the exact position that listeners expect the glottalization to be. When the glottalization is earlier or later than the middle position, will listeners still perceive a rearticulated phonation? When the glottalization is slightly before the end of the vowel, will listeners still perceive a checked phonation? To determine the effect of glottalization position on the perception of the phonation in Zapotec, we thus created five conditions for glottalization position by dividing the vowel into five equal intervals, and jittering the pitch and amplitude of each interval to create a glottalized percept. In addition, we added two more conditions, one is modal vowel without glottalization throughout, the other is modal vowel followed by a period of silence plus a glottal stop release.

Second, in terms of the duration of vowel, we created three duration conditions, because rearticulated vowels tend to be longer than modal vowel, and modal vowels tend to be longer than checked vowels. Thus, we created three duration conditions: 150 ms, 225 ms, and 300 ms. The 150 ms condition is based on the average duration of the productions of the checked vowel in the stimuli. The 300 ms condition is based on the average duration of the productions of the rearticulated vowel in the stimuli. The 225 ms is the duration in the middle.

We have 21 conditions in total (3 durations * 7 glottalization positions). The spectrograms of the stimuli with 225 ms duration, varying in seven glottalization positions are in Figure 1. We conducted an identification task, providing the participants with five options of words varying in the phonation and tone. The tone are either high or rising tone. The f_0 of the stimuli is kept constant at the value and contour in the middle of the high and rising tone.

Results. Our current results show that checked responses is mostly elicited in the 150 ms condition. The no glottalization, 1/5, and glottal stop release conditions consistently elicit checked vowel responses. The mid-positioned glottalization consistently elicit rearticulated vowel responses. For the 225 ms condition, the 2/5, 3/5, and 4/5 glottalization position conditions consistently elicit rearticulated vowel responses. For the 300 condition, the 2/5, 3/5, 4/5, and 5/5 glottalization positions consistently elicit rearticulated vowel responses. Our results indicate that duration is a more reliable cue than final glottalization for checked vowels, whereas mid-positioned glottalization is the most reliable cue for rearticulated vowels. In addition, our results suggest that the positioning of glottalization is not absolute for perceiving rearticulated vowel. While we have been describing rearticulated vowels as having mid-phased glottalization, the listeners are still able to perceive a rearticulated phonation when it is a little before or after the middle of a vowel, given that the duration is long enough.

Conclusion. Our study is among the first studies to investigate the effect of glottalization positioning in perceiving contrastive glottalized phonations. It also provides us with original data from a low-resourced language.

References

Chai, Y., Fernández, A., & Mendez, B. 2023. Phonetics of glottalized phonations in Yateé Zapotec. ICPhS 2023.

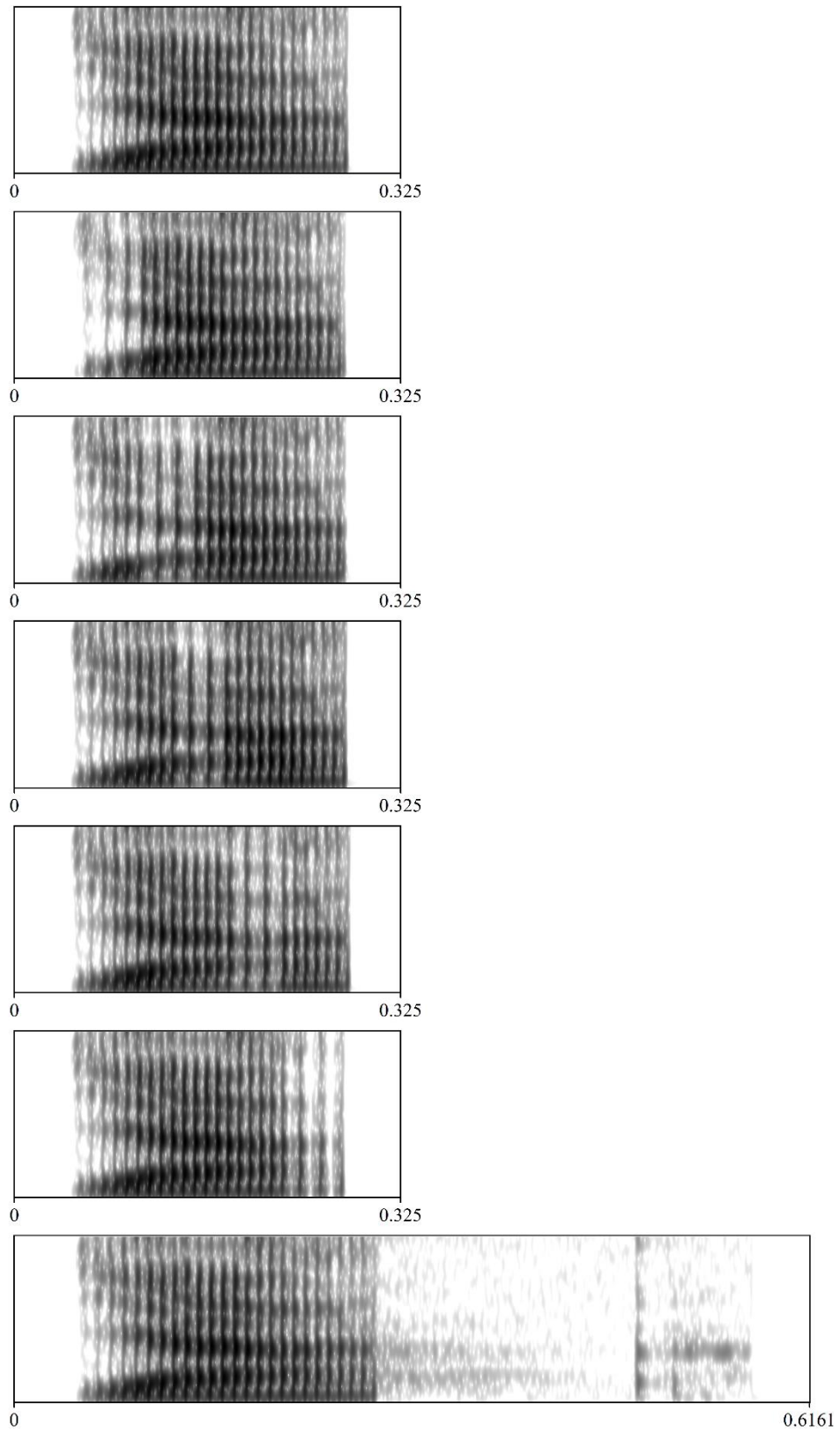


Figure 1. (from bottom to top) Stimuli with no glottalization, and glottalization at $1/5$, $2/5$, $3/5$, $4/5$, $5/5$, and glottal stop release.