

Speaker variation in the realization of phrase-final glottalization in Italian

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This study explores how speakers realize glottalization, here intended as a glottal gesture (Dilley *et al.* 1996), at the end of utterance-internal phrases in Tuscan and Roman Italian read speech. Glottalization, characterized by creak (Vayra 1994; van Santen & D’Imperio 1999; Stevens *et al.* 2002; Di Napoli in press), breathiness (van Santen & D’Imperio 1999) or even glottal stop (Stevens *et al.* 2002), has been reported to occur in the final portion of word-final vowels which are also phrase-final in the language. This study examines speech from seven native speakers of Italian, first determining the type of glottalization present in phrase-final vowels and then performing acoustic measures to estimate the glottal contact over the course of the vowel, in order to better understand how speakers use voice quality to mark utterance-internal phrase edges.

The speech material consisted of six vowel-final target words which are near-minimal pairs for stress (*e.g.* *faro* – *farò* ‘lighthouse’ – ‘I will make’) produced in carrier phrases to elicit a phrase boundary following. Target vowels were first labeled for glottalization, involving a perceptual impression of glottalization as well as acoustic evidence of this in the signal (Dilley *et al.* 1996). In a second step, the *type* of glottalization was determined by examining the acoustic signal for evidence of one of five classes of voicing irregularity – creak, diplophonia, aperiodicity (Redi & Shattuck-Hufnagel 2001), breathiness or glottal stop. Finally, target vowels were extracted from the signal and subjected to spectral analysis. The relative amplitudes of the first and second harmonics, $H1^*/H2^*$ – a correlate of open quotient (Kreiman *et al.* 2012), were calculated in VoiceSauce (Shue *et al.* 2011) and averaged over three time points and across the entire vowel.

Results for type of glottalization show that glottalized vowels from different speakers display different acoustic characteristics, not unlike the findings in Redi & Shattuck-Hufnagel (2001) for English. One speaker’s tokens were characterized primarily by diplophonia, while others made much more use of creak. Breathiness occurred to a more limited extent across speakers and tended to be present at a higher frequency only for two speakers (both female). Across all speakers, glottal stop is used most frequently between two vowels (*i.e.* where the target words were followed by a vowel-initial word), particularly when the target vowel is stressed (as in *farò*). This suggests a role for prominence in the strength of the glottal gesture applied (*c.f.* Garellek 2014).

Results for the acoustic measures show that, overall, glottalized phrase-final vowels are characterized by an *increase* in glottal contact as compared to modal vowels (reflected in small but significant decreases in $H1^*/H2^*$ values), particularly in the second half of the vowel. This shows that the phrase-final glottalization studied here is distinct from glottalization at the end of an utterance (Kohler 2000) which can result from a *decrease* in glottal contact when the end of an utterance coincides with the end of a breath (Slifka 2006).

Together, these findings provide insights into the way speakers use voice quality to mark utterance-internal phrase boundaries in Italian.

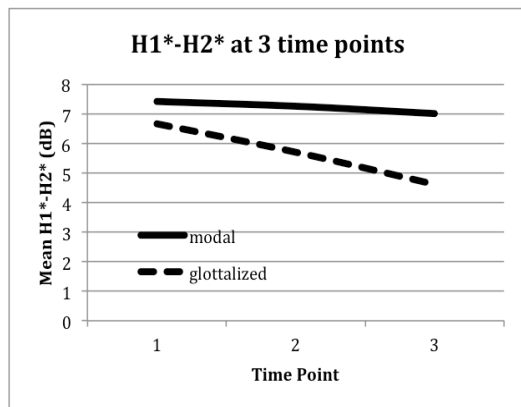


Figure 1. Mean H1*-H2* at 3 time points for modal and glottalized vowels, Speaker 1 (Roman Italian).

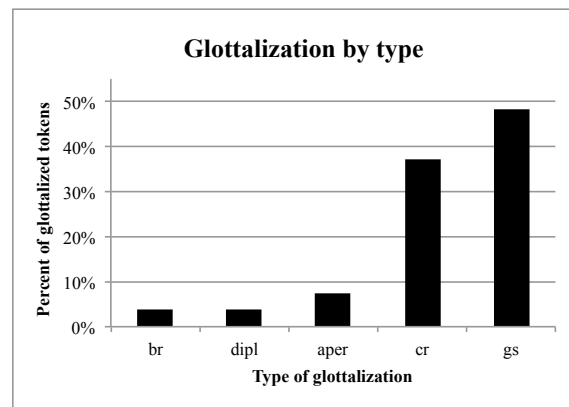


Figure 2. Proportion of glottalized tokens by type of irregularity (**breathiness**, **diplophonia**, **aperiodicity**, **creak**, **glottal stop**), Speaker 1 (Roman Italian).

References:

- Dilley, L., S. Shattuck-Hufnagel and M. Ostendorf. 1996. "Glottalization of word-initial vowels as a function of prosodic structure." *Journal of Phonetics* 24: 423-444.
- Di Napoli, J. In press. "Glottalization at phrase boundaries in Tuscan and Roman Italian." *The Phonetics/Phonology Interface: Sounds, representations, methodologies*, ed. by J. Romero and M. Riera. Amsterdam: John Benjamins.
- Garellek, M. 2014. "Voice quality strengthening and glottalization." *Journal of Phonetics* 45: 106-113.
- Kohler, K. J. 2000. "Linguistic and paralinguistic functions of non-modal voice in connected speech." *Proceedings of the 5th Seminar on Speech Production: Models and Data*, Kloster Seeon, Germany, 121-124.
- Kreiman, J., Y.-L. Shue, G. Chen, M. Iseli, B. R. Gerratt, J. Neubauer and A. Alwan. 2012. "Variability in the relationships among voice quality, harmonic amplitudes, open quotient, and glottal area waveform shape in sustained phonation." *Journal of the Acoustical Society of America* 132(4): 2625-2632.
- Redi, L. and S. Shattuck-Hufnagel. 2001. "Variation in the realization of glottalization in normal speakers." *Journal of Phonetics* 29: 407-429.
- Shue, Y.-L., P. Keating, C. Vicenik and K. Yu. 2011. "VoiceSauce: A program for voice analysis." *Proceedings of the 17th International Congress of Phonetic Sciences*, Hong Kong, 1846-1849.
- Slifka, J. 2006. "Some physiological correlates to regular and irregular phonation at the end of an utterance." *Journal of Voice* 20(2): 171-186.
- Stevens, M., J. Hajek and M. Absalom. 2002. "Raddoppiamento sintattico and glottalization phenomena in Italian: a first phonetic excursus." *Proceedings of the 9th Australasian International Conference on Speech Science and Technology*, Melbourne, 154-159.
- van Santen, J. and M. D'Imperio. 1999. "Positional effects on stressed vowel duration in Standard Italian." *Proceedings of the 14th International Congress of Phonetic Sciences*, San Francisco, 1: 241-244.
- Vayra, M. 1994. "Phonetic explanations in phonology: laryngealization as the case for glottal stops in Italian word-final stressed syllables." *Phonologica 1992: Proceedings of the 7th International Phonology Meeting*, ed. by W. U. Dressler, M. Prinzhorn and J. R. Rennison, 275-293. Torino: Rosenberg & Sellier.