

## Analyzing patterns of glottalization in German stops

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This paper presents a new method of analyzing and quantifying glottalization patterns in speech sounds, demonstrated through an analysis of glottalized stops in Standard German. Acoustic studies have shown that instances of stop glottalization, in which the glottis is assumed to be constricted, can have a range of acoustic correlates, including glottal stops and stretches of irregularity in fundamental frequency or amplitude. While most acoustic studies have focused on the identification and classification of glottalization, this paper presents a method through which such instances, despite their apparent acoustic diversity, can be quantified and compared using the parameter of relative vocal fold contact duration (Contact Quotient, or CQ). The study is based on Laryngographic recordings from eight speakers of Standard German. The materials contain fortis stops in vowel-stop-nasal, lateral-stop-nasal and nasal-stop-nasal contexts, in which stop glottalization has been previously observed (Kohler 1994). Data are analyzed using a threshold-based CQ (Scherer et al. 1995), and CQ changes were tracked through cycle-by-cycle measurements of the Laryngographic signal. Maximum CQ values in each stop were then used for statistical analysis of data samples. Of the eight subjects analyzed, four produced glottalized stops to varying extents, while the other four subjects did not produce any. With the former group it emerged that in nasal-stop-nasal contexts, glottalization occurred far more frequently than in the other contexts, and the constriction was also more extensive, that is, vocal fold contact duration was maintained for longer. The findings suggest that speakers of Standard German not only differ in terms of the presence or absence of glottalized stops but that speakers who produce glottalized stops also apply different extents of glottal constriction to different phonetic contexts. A suggested explanation for this observed variation is the timing constraints in the synchronization of glottal and supra-glottal articulation associated with different phonetic contexts.

### References

- Kohler, K. J. (1994). Glottal stops and glottalization in German—data and theory of connected speech processes, *Phonetica* 51: 38-51.
- Scherer, R. C.; Vail, V. J. & Rockwell, B. (1995). Examination of the laryngeal adduction measure EGGW. In F. Bell-Berti & L. J. Lawrence (eds.), *Producing Speech: Contemporary Issues*. New York: American Institute of Physics Press: 269-289.