

Quantifying coarticulation versus invariance in German

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Coarticulation, defined as varying degrees of articulatory overlap between segments, is a very important source of variability in speech. However, finding reliable methods allowing for the quantification of coarticulation versus invariance has remained an empirical challenge.

Recently, Iskarous et al (2013) suggested to view coarticulation and invariance as the two ends of the scale indicating how permeable or resistant to coarticulation a segment is. The position of a segment on this scale, or the degree to which it resists coarticulation with neighboring segments is determined with Mutual Information (MI). MI measures the amount of information about segment B that is present during the production of segment A. The MI values for different aspect of segment production (e.g. various points on the tongue, lips, jaw) indicates which of them are crucial for segment production and which can vary, thus shedding light on the connection between articulatory complexity and variance in speech production.

In our study, we applied MI calculation to ultrasound data. We ask whether MI values for German consonants obtained from ultrasound data correspond to the ones found using electromagnetic midsagittal articulography (EMA) in Iskarous et al (2013) study. Although ultrasound imaging presents practical advantages in terms of data acquisition ease, the nature of data poses quantification challenges due to absence of fixed reference points. In our study, we compared MI results derived from the highest point of the tongue to those from the whole tongue as described with FDA.

References

1. Iskarous, K., Mooshammer, T., Recasens, D., Hoole, Shadle, C., Saltzman, E, and Whalen, D.H. (2013). The Coarticulation/Invariance Scale: Mutual Information as a measure of coarticulation resistance, motor synergy, and articulatory invariance, *JASA*, 134, 1271-1293.