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 at 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

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How different motions affect lexical access and linguistic structure in a spontaneous speech task

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According to dual task experiments motion plays a detrimental role for cognitive performance (Lamberg & Muratori 2012), because resources need to be shared to fulfil the two tasks. However, it has also been shown that motions are beneficial for lexical access (Krauss 1998), for associative selection of words (Oppezzo & Schwartz 2014) and for learning and memorize a new language (Schmidt-Kassow et al. 2013). We combine both views by ,suggesting that motion facilitates lexical access of content words, but has some drawbacks on the syntactic complexity. Moreover, we suggest that different limbs movements (legs vs. arms, right hand vs. left hand) may affect syntax and lexical access to different degrees.
Three experiments were carried out involving a spontaneous speech task: in experiment 1 we compared leg motions (biking) with different degrees of effort, in experiment 2 we studied arm versus leg motion using a minibike, and in experiment 3 we compared right versus left arm motions in right handers. In all experiments the dual tasks were also compared with single tasks. Motion, breathing and speech acoustics were recorded simultaneously. Motion and breathing frequency, syntactic complexity (number of clauses, conjunctions for main and embedded clauses) and the used vocabulary (number of content and function words; single word classes) were analysed. The results are in agreement with our predictions.

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