Quantifying hyper-and hypo/articulation

Interactional-communicative factors in connected speech, such as hyper-and hypo/articulation, have long been noted and widely investigated as reduction of less important tokens in relation to the more important ones (Howes 1967, Fowler and Housum 1987, Lindblom 1990, Greenberg and Fossler-Lussier 2000, Anderson and Howarth 2002, Mitterer and Ernestus 2006). Despite previous scholarship on H&H, the way to quantify reduction itself has not been a matter of debate yet. Thus, the study reports the results of an acoustic analysis of vowel reduction of the /i:/ vowel, considering all three aspects of vowel reduction, i.e. duration and formant frequencies in read speech produced by twelve native speakers of English. Reduction was induced by including subsequent tokens of the same word in a text as the speaker adjusts his articulation according to the needs of the listener. With regard to the H&H effect, it was hypothesized that the new information contained in the first, introductory token (token 1) of the word *key* will be reduced in its subsequent tokens, numbered 2, 3 and 4 and carrying old/given information. An unexpected finding was that the speakers tend to hyperarticulate the last token (number 4) which may be an attention-related effect.

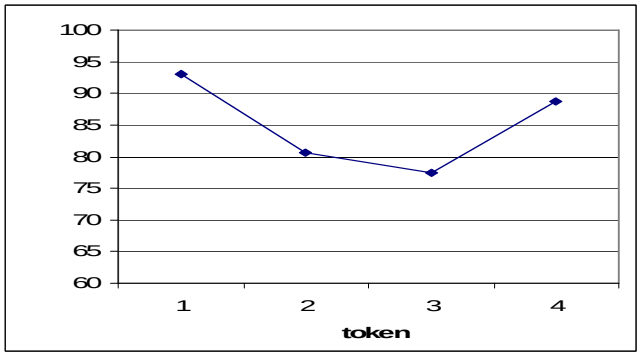

Figure 1: An example of reduction for duration (msec) (Speaker 10)

Starting from the observation that the standard literature considers only duration as a proxy for overall reduction (Jurafsky et al.1998; Bell et al. 2003; Aylett and Turk 2004, Sanford 2008; Bell et al 2009; Baker and Bradlow 2009), the primary aim of the study is to verify whether duration, F1 and F2 exhibit reduction to the same degree across tokens, whereas the secondary aim consists in establishing whether duration and formant frequencies are linearly correlated by means of Pearson correlation coefficient.

Regarding the former, the study has yielded mixed results as only five speakers out of twelve exhibited consistent trends in reduction across all three parameters of vowel reduction, with seven speakers varying widely in reduction patterns across duration, F1 and F2. This lack of uniformity can be explained as either individual strategies or interspeaker variability.

As for the latter, the *r* test revealed the lack of a robust correlation between duration and formant frequencies, the highest value (for the five consistently behaving speakers) being 0.63 (the correlation between duration and F1) and 0.69 (the correlation between duration and F2).

In light of the results, this study seeks to establish a gradual scale of vowel reduction. It combines the spatial and the temporal aspects of vowel reduction by means of averaging the distances between the least and the most reduced tokens across duration, F1/F2 on an equal basis (i.e. assuming that duration contributes 50% to the overall degree of reduction, whereas F1 and F2 together contribute the remaining 50%). The resulting degree of reduction can be expressed on a scale, ranging from 0 to 100 per cent (for schwa absorption) which makes a

considerable refinement of the ordinal reduction scale (full vs. reduced) in that the degree is more precise and considers all three parameters according to the role they play.

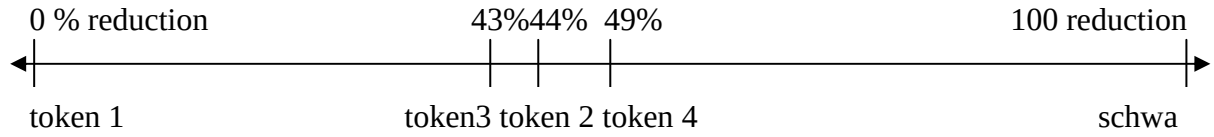

Figure 2: An example of a gradual scale of reduction (for speaker 5)

This method will allow future work on spontaneous speech to be based on a considerably more fine-grained and comprehensive way to measure reduction.

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