Head Movements, Eyebrows, and Phonological Prosodic Prominence Levels in Stockholm Swedish News Broadcasts

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1 Background and Research Question

A growing body of evidence suggests that hand, head, and eyebrow movements are aligned with pitch accents in speech and in this way contribute to the production and perception of prosodic prominence [e.g., Swerts and Krahmer 2010, and references therein]. Swerts and Krahmer [2010] found in a study on visual prosody of Dutch newsreaders that the more accented a word was on an auditory scale (no accent, weak accent, strong accent), the more likely it was that the word was also accompanied by a head or eyebrow movement, or both (most common in the strongly-accented words). A way of interpreting these findings is that head and eyebrow movements have equivalent, cumulative functions as building blocks of prominence.

This study is part of a project investigating how verbal and visual prosody interact in encoding levels of multimodal prominence in Swedish, and how these prominence levels are employed by speakers and listeners in the (de-)coding of information structure. Inspired by Swerts and Krahmer [2010], this contribution presents a first analysis of the distribution of head and eyebrow movements as a function of verbal prominence levels in Swedish news broadcasts. In our study, we make use of the fact that Swedish has two phonological prosodic prominence levels, which can be distinguished rather easily when inspecting the fundamental frequency contour. Thus, our point of departure is the question whether phonological prominence levels – which often, but not always necessarily reflect perceptual prominence levels – have an effect on the distribution of head and eyebrow movements.

Unlike so-called intonation languages like English and German, Swedish is a pitch-accent language, employing pitch contrasts at the lexical level. In particular, Swedish has a binary distinction between two word accents (Accent 1, Accent 2), i.e., two different pitch accents assigned to words by means of lexical/morphological rules. In addition, words can be highlighted at the sentence level, just as in English or German. For Stockholm Swedish, a phonological distinction is generally assumed between the non-focal, accented realization of a word (tonal pattern in Stockholm Swedish: H[igh]-L[ow]; with a different timing of the HL for Accent 1 and 2) and a focal realization of a word (HLH, i.e., an additional H[igh] tone). Note: While the non-focal vs. focal accents represent two different phonological prominence levels, no difference in prominence is generally assumed between the two word accents (Accent 1 vs. 2). Therefore, our hypothesis was that focally accented words would coincide with head or eyebrow movements more often than non-focal words, while the word accent category (Accent 1 vs. 2) should have no effect of the distribution of head or eyebrow movements.

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2 Method, Results, and Conclusions

A corpus of newsreadings from Swedish Television, comprising speech from four speakers (two female) and 986 words in total, was annotated for focal accents, head, and eyebrow movements, independently by three annotators. A 'double head beat' was annotated if two beats were clearly distinguishable within a single word. In the analysis, an annotation was counted as such in the event of an agreement between at least two annotators.

In our study, about equally many head movements were annotated (229 of 986 words) as in the Dutch data in [Swerts and Krahmer 2010] (228 of 985 words). However, we annotated far fewer eyebrow movements (67 vs. 303), i.e., about two, on average, per piece of news. This suggests that eyebrow movements were used rather sparsely by the speakers, presumably mostly restricted to words representing the (absolutely) most important information.

Results of χ^2-tests revealed a dependency of the distribution of movements on the one hand and focal accents on the other, confirming our hypothesis (for eyebrows: $\chi^2 = 42.24, p < .01$; head: $\chi^2 = 209.11, p < .01$). Also, no consistent effects of the word accent type on eyebrow and head movements were found. However, there was an effect of the word accent type on the annotations of 'double' head movements ($\chi^2 = 8.46, p < .01$). This effect might be explained as follows: Only nine words in the entire corpus were annotated with a double head movement (to be compared with 220 annotations of simple head movements), of which seven were Accent 2 words, all of which were compounds. Compounds are characterized by a complex lexical stress pattern, containing a main and a secondary stress. In addition, focal Accent 2 words are produced with two pitch peaks. Thus, the results suggest an association of a head beat movement with a linguistic/phonetic prominence. The fact that simple head beats occur frequently in the corpus (in 220 of 986 words) further supports the idea that head beats in general (simple or double) might have a closer association to lower-level prominence and phonological-prosodic structure, while eyebrow movements might be more restricted to higher-level prominence and information-structure coding.

To conclude, this study suggests that head and eyebrow movements can represent two quite different modalities of prominence cuing, both from a formal and a functional point of view, rather than just being cumulative prominence markers.

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References

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