Cues to Perceptual Prominence of Prenuclear Pitch Accents – Evidence from German Spontaneous Speech

O. Niebuhr, B. Schroeter and S. Baumann

The present study investigates the relation between different degrees or levels of perceived prominence and the prosodic cues causing this auditory difference. Our specific question is whether a distinction in accent strength, which was done independently of an acoustic analysis, can nevertheless be systematically correlated with particular acoustic and phonological profiles.

We used the Kiel Corpus of Spontaneous Speech (appointment-making scenario; Peters 2005) as a testbed for our study, as all pitch accents are annotated for prominence at three levels: secondary (reduced) accent (=1), default (fully-fletched) accent (=2), emphatic accent (=3). The annotation was done by trained research assistants and was purely based on their perceptual judgments. For our investigation, we selected a frequent and clearly defined prosodic pattern: the target accent was in prenuclear position and concatenated through F0 valleys with fully-fletched pitch accents on both sides. In this context frame, we measured how the vowel segments of target accents with prominence levels 1 and 2 differed in terms of F0, duration and intensity (RMS). Additionally, we counted the frequency of pitch-accent categories, which was determined based on the phonological analysis contained in the corpus annotation PROLAB (Peters & Kohler 2004). A script-based search for the three-peak patterns in the corpus yielded a sample of 738 items. In a following step, a PRAAT script was used to exclude 127 items for which F0 in the target accent could not be reliably determined. So, a total of 611 items remained; 221 items with prominence level 1, and 390 items with prominence level 2 on the target accent. We ensured that the two sub-samples did not differ significantly with respect to speaker gender and vowel phonemes.

The results of our analyses revealed no significant difference between the mean F0 levels of the vowels in prominence-1 and prominence-2 target syllables. However, the F0 standard deviation was significantly larger for prominence-2 than prominence-1 target syllables ($t[606.95]=-3.56$, $p<0.001$, Cohen's $d=0.28$). Moreover, target vowels in the prominence-2 condition had longer durations ($t[627.56]=-3.55$, $p<0.001$, Cohen's $d=0.27$) and higher intensity levels ($t[527.27]=-2.21$, $p<0.05$, Cohen's $d=0.17$) than in the prominence-1 condition. The results of a χ^2 test further showed that pitch-accent categories are differently distributed between the two prominence levels. While the medial-peak (i.e. (L+)H*) accent is the most frequent category at both prominence levels, rising accents (L*+H) occur more often with level-2 and falling accents (H+L*) with level-1 prominences, which is in line with the recent finding for German that rising accents are intrinsically more prominent (Baumann & Röhr 2015).

In sum, our corpus analysis showed that the two prominence levels are associated with significantly different prosodic profiles. These profiles include all known prominence cues, as well as pitch-accent type. As an additional confirmation of our analysis, Kügler et al. (2015) found that prominence levels 1 and 2 can be reliably annotated. Taken together, the findings suggest that it is appropriate and useful to distinguish between fully-fletched and reduced pitch accents in intonational modeling. Follow-up analyses should address this prominence- level difference in phrase-final (i.e. nuclear or postnuclear) position as well, assuming that "reduced accents" are not restricted to postnuclear prominences.

References

Baumann, S. & Röhr, C. (2015). The perceptual prominence of pitch accent types in German. In: Proceedings of 18th ICPhS, Glasgow, Scotland.

Kügler, F., Smolibicki, B., Baumann, S., Niebuhr, O., Wagner, P., Peters, J., Schweitzer, A., Jannedy, S., Grice, M. & Braun, B. (2015). DIMA - Annotation guidelines for German intonation. In: Proceedings of 18th ICPhS, Glasgow, Scotland.

Peters, B. (2005). The Database 'The Kiel Corpus of Spontaneous Speech'. AIPUK 35a, 1-6.

Peters, B. & Kohler, K. J. (2004). Trainingsmaterialien zur prosodischen Etikettierung mit dem Kieler Intonationsmodell KIM. URL: http://www.ipds.uni- kiel.de/kjk/pub_exx/bpkk2004_1/TrainerA4.pdf