

## Prosodic prominence and contextual patterns: evidence from German

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The present study focuses on the prosodic phenomenon known as prominence, studied in relation with its immediate context. *Context* in this study is understood as *prosodic environment* of units perceived as prominent (Terken 1991). Previous work has already shown that prominence perception is to a large extent predictable by listeners’ expectations, probably shaped by positional factors (Fougeron and Keating 1995), pragmatic factors (e.g. Baumann and Riester 2013, Watson 2008) as well as overall linguistic knowledge (e.g. Cole 2010, Wagner 2005). Surprisingly little is known, however, how the immediate prosodic context affects both the production and perception of prominence, although such assumptions are commonplace in phonological reasoning, e.g. by postulating constraints favouring rhythmic alternation. Evidence for this was provided by Cutugno et al. (2012), who predicted prominence placement in Italian using context-based machine learning models. Furthermore, Arnold et al. (2013) modelled some of the interactions between prominence and context, by showing that the higher the prominence was on a syllable immediately preceding a prominent one, the higher was the pitch accent amplitude of that syllable. Thus, the effort speakers (have to) invest in prominence marking is highly context dependent. The issue of how context shapes both prominence perception and production is explored further in the corpus study reported here. Our analyses were based on the Bonn Prosodic Database (Heuft 1999), consisting of read speech that has been annotated for prominence using a quasi-gradual operationalisation of prominence of 31 levels.

Our analyses immediately reveal some interesting influences of prosodic context: First, our data show that the degree of perceived prominence is to some extent proportional to the distance to the previous accent (Spearman’s- $\sigma(10684) = 0.23$ ,  $p < 0.0001$ ):

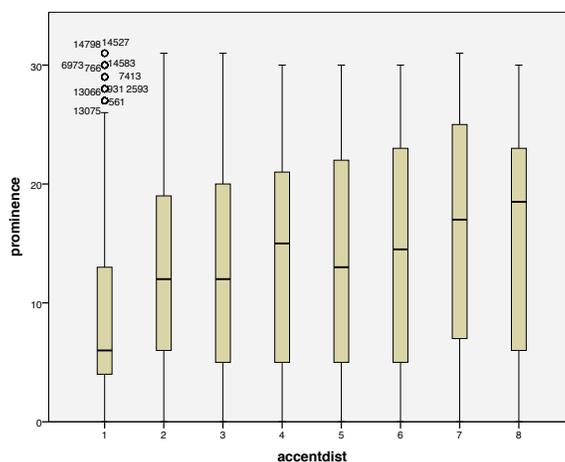


Figure 1: Relationship between degree of prominence and distance to previous accent

Second, we find, that this relationship is apparently exploited by speakers to economize their production, by making the pitch accents in prominent syllables proportionally somewhat less steep and less delayed the further away they are from accented syllables (Spearman’s- $\sigma(10684) < -0.15$ ,  $p < 0.0001$  for all variables). Interestingly though, this pattern does

not apply for syllable durations: However, accented syllables are not shortened with an increasing distance to a previous accent.

Third, we find clear evidence for an alternating pattern of perceived prominence (Pearson's  $cc(10684) = -0,47$ ,  $p < 0.0001$  for adjacent syllables), which is, however, not expressed in terms of a strictly alternating duration pattern likewise. Thus, the perception and production of alternation do not go straightforwardly hand in hand.

When building a simple model of multiple regression, the prosodic context factors “distance to previous accented syllable”, “duration and prominence of previous two syllables”, already provide a working (albeit clearly far from perfect) prediction of the level of prominence on an upcoming syllable ( $R = 0.43$ ,  $R^2 = 0.19$ ,  $F(5,6853) = 394.5$ ,  $p < 0.0001$ ). This model actually accounts for a similar amount of the variance as a regression models built on purely local properties of the syllable (accentability of syllable, duration, pitch accent amplitude, degree of rise, fall and delay of pitch) ( $R = 0.39$ ,  $R^2 = 0.15$ ,  $F(6,2675) = 79.65$ ,  $p < 0.0001$ ). We are fully aware that any prediction model taking into account *linguistic* context will outperform both of these models. Here, we are only interested in the amount of impact of local vs. contextual prosody.

Summarizing, our data shows further support for the notion that the phenomenon of “prosodic prominence” is a complex, dynamic one. Further studies should bear in mind that prominence patterns comprising prominent and less-prominent syllables have to be treated as a whole and cannot be regarded in an atomistic fashion.

## References

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