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How freely can German pitch accents be combined?

The nowadays well accepted autosegmental-metrical theories of intonation suggest that an utterances' intonation contour is composed of a sequence of pitch accents, phrase accents and boundary tones. In theory, any pitch accent can be combined with any other pitch accent or phrase accent (Pierrehumbert, 1980). For American English, this unlimited compositionality has been challenged by a corpus study: Dainora (2006) has shown that there are certain combinations of pitch accents and boundary tones that are more frequent than others. Conceivably, frequently occurring intonational tunes are linked to specific intonational meanings that need not be decomposed as independent meanings of accent types and boundary tones (for a compositional approach to intonational meaning see Pierrehumbert & Hirschberg 1990).

We first investigated the accent type combinations in the prosodically annotated part of the Kiel Corpus of Spontaneous Speech (Kohler et al., 1997), focusing on declarative (falling) utterances with two pitch accents (736 intonation phrases in total). The Kiel Corpus distinguishes between accents with early peaks (GToBI H+L*, H+!H*, henceforth 'e-accents'), medial peaks (GToBI L+H*, H*, 'm-accents') and late peaks (GToBI L*+H, 'l-accents'), ignoring upstep. Furthermore, the transition between accents is coded as falling, mid, or level. Hence chance occurrence of a contour is 1/27 (3.7%). We found three frequent contours, l-accent followed by e-accent with high transition in between them: l.h.e, 12.9%), m-accent followed by early accent with high transition (m.h.e, 16.0%) and m-accent followed by m-accent with dipping transition (m.d.m, 14.5%). The combination l.d.m (6.5%) was rarer, but also above chance.

Second, we conducted an imitation experiment to investigate whether frequently occurring combinations of pitch accents are imitated with less errors and shorter onset latencies than less frequent combinations of accents, suggesting storage as tunes rather than a sequence of tones. To this end, a female German native speaker recorded eight sentences with two noun phrases in eight different intonation contours, crossing the accent type of the prenuclear accent (m or l) with the accent type of the nuclear accent (m or e) and the transition between them (high or dipping, henceforth 'h' or 'd'). Sixteen native German speakers imitated these 64 utterances together with 64 filler sentences (8 sentences produced by eight different female speakers). Importantly for our question, results for correctness (logistic regression model) showed a significant three-way interaction between all three factors ($z=2.9$, $p<0.005$), see Table 1. Onset latency analyses showed an interaction between prenuclear and nuclear accent ($p<0.01$). These interactions suggests that speech processing is related to tunes, not just to individual accents. Frequency of occurrence in the Kiel Corpus was closely related to response latencies ($r=0.6$, $p=0.08$). Discrepancies are confined to the transition, possibly owing to differences in lexico-semantic content: while dipping transitions were less frequent than high transitions in the Kiel Corpus, utterances with dipping contours were better imitated than those with high transitions,

Hat pattern contours	% correct imitation (latency)	Dipping contours	% correct imitation (latency)
m.d.e	63.8 (356ms)	**m.h.e**	**59.4 (342ms)**
m.d.m	**77.3 (341ms)**	m.h.m	38.8 (363ms)
l.d.e	71.6 (347ms)	**l.h.e**	**71.4 (322ms)**
l.d.m	**46.8 (349ms)**	l.h.m	49.4 (391ms)

Table 1. Percentage correct imitation and onset latencies in imitation experiment (above chance occurrence in Kiel corpus marked in bold)

Hence, in German, as in American English, certain combinations of accents with one another are more frequent than others. The processing data (imitation) mirror these frequencies quite well.

References

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