Durational and Spectral Cues to Language Rhythm in four German Varieties

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Although rhythm (class) differences between languages seem non-controversial per se, the typological classification of individual varieties, and especially the phonetic correlates of rhythm, are still under discussion. A rather promising approach to account for rhythmic differences between varieties seems to be to contrast reduction patterns [1]. Word-timed languages (e. g. (Northern) Standard German) reduce unstressed syllables in duration and quality [2]. Syllable-timed languages, however, seem to maintain unstressed syllables without reduction. The aim of this study is to align four varieties of German (Eastern and Western Central Bavarian, and the corresponding regional standards) on a continuum from word- to syllable-timed languages. We expect the regional standard varieties to lean towards word-timed, given their close relation to Northern Standard German. We expect the dialects to still display the syllable-timed phonology of Old High German [3]. In previous analyses, we examined differences between these varieties regarding the durational reduction in trochaic $C_1V_1C_2V_2$ sequences: To this end, we subtracted the duration of the unstressed syllable from the duration of the stressed syllable. The results suggest that the dialectal varieties display less durational reduction between the stressed syllable and the unstressed syllable than their corresponding standard variety. We interpreted this as an indicator that the dialect varieties display a reduction pattern commonly associated with syllable-timed languages.

The current contribution is based on the same data and aims to combine durational features with formant frequencies. Our data comprises 15 trochaic $C_1V_1C_2V_2$ sequences with phonologically long and short vowels in the stressed syllable and /ɐ/ or /iː/ in the unstressed syllable, produced by 80 speakers of the four varieties. /iː/ occurs in both stressed and unstressed position – we expected the unstressed position to be more centralized (i. e. more reduced) than the stressed position, and we expected this effect to be stronger in the standard varieties than in the dialects. /ɐ/ can only occur in unstressed position. We expected /ɐ/ to be more centralized in the standard varieties than in the dialects.

To quantify vowel quality, we calculated the first two formants (F_1 and F_2) using the emuR package [4] and Praat [5] and extracted the peak in the 20%–60% region (where there was no major effect of formant transitions). Centralization in the high front vowels is evidenced by a lower F_2, and in the low vowels by a lower F_1. Vowels can be centralized either due to reduction processes or due to short duration (which itself may result from reduction processes, but it can also result from faster speaking rate or other confounds). To minimize phonetic confounds when analyzing the formants of a set of vowels, we either compared them to the formants of another set of vowels of the same speaker group or against token duration.

Commensurate with Fig. 1, we found significant differences between the stressed and unstressed /iː/ for both standard varieties and Eastern Central Bavarian, with only Western Central Bavarian speakers displaying no vowel reduction. The reduction found in the Viennese standard was not stronger, yet

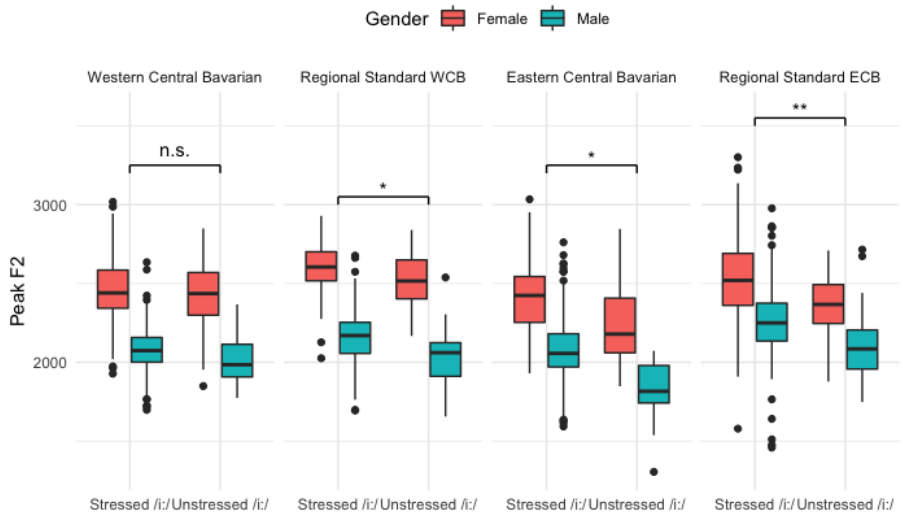

Figure 1: *Reduction of F2 peak (in Hz) in stressed and unstressed /iː/. Significance levels based on LME model with speaker and target word as random factor, taken from post-hoc pairwise comparisons averaged across the levels of gender. Gender has a signficant main effect but is not involved in any interaction.*

statistically more significant (p<.01), than in Eastern Central Bavarian (p<.05). For [ɐ], the results remain inconclusive: There was no clear pattern of one variety centralizing the /ɐ/ more than another, even after accounting for durational differences.

Our results suggest that reduction patterns differ with regard to the phonetic correlates involved: As far as the temporal dimension is concerned, dialect varieties reduce both short /a/ phonemes in stressed syllables and /ɐ/ in unstressed syllables less than the corresponding standard varieties. Yet, our results remain unclear pertaining to formant frequencies: While we found differences between the varieties regarding the spectral reduction of the vowel /iː/ (West Central Bavarian vs. East Central Bavarian and the standard varieties), we did not find an unambiguous reduction pattern for /ɐ/. Still, we found evidence for our claim that the dialect varieties are more syllable-timed than the regional standard varieties, although the contrast between dialect and standard might be less pronounced in the two Eastern varieties.

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