The effect of phrasal accent on vocalic and consonantal nuclei in Slovak

In Slovak, the consonants /l/ and /r/ can occupy the syllable nucleus. In nuclear position, these consonants also contrast in phonemic quantity. This enables us to examine the effect of phrasal accent and phonemic length on vowels and consonants occupying the syllable nucleus.

Previous studies have revealed that prosodic emphasis on vowels is achieved by sonority expansion and hyperarticulation. But these studies only looked at vowels for which these strategies often go hand in hand. By comparing consonantal and vocalic nuclei it is possible to investigate whether prosodic emphasis has the effect of enhancing the contrast between nucleus and syllable edge positions in terms of sonority rather than just inducing hyperarticulation. The contrast enhancement hypothesis predicts a weakening of consonantal constrictions in the nucleus in order to increase their sonority, whereas hyperarticulation predicts articulatory strengthening of the nucleus, regardless of its vocalic or consonantal identity.

Our previous acoustic analysis of the present data has revealed that phrasal accent has an effect on the acoustic duration of long nuclei but not on short nuclei. The phonemic length contrast is enhanced under phrasal accentuation for both, vocalic and consonantal nuclei. We further want to test whether phrasal accent and phonemic length show an effect in terms of quality. Although according to standard literature on Slovak phonemic length does not affect vowel quality except for /a/, a more recent study [1] has observed some centralization of phonemically short vowels. The study only looked at accented words, but results can be interpreted that short vowels are articulatory undershot. Given the fact that phrasal accent only affects the duration of long nuclei, it raises the question whether phrasal accent has a stronger effect on long vowels, and whether comparable effects can be observed on consonantal nuclei.

Functional linear mixed models (FLMM) [2] were used for formant analysis separately for /l/ and /e/ in the nucleus and F1 and F2 separately as a function over normalized time. Phrasal accent and phonemic length were covariates and speaker, item and interaction of speaker, item and repetition were random factors. At this point we use our ultrasound recordings mainly for qualitative confirmation of the formant analyses.

While for /e/ both, phrasal accent and phonemic length have an effect on F1 and F2, for /l/ the only significant effect is on F1, caused by phrasal accent. F1 is significantly higher for the accented condition for both /e/ and /l/, confirming the sonority expansion hypothesis. For /e/, F1 is also higher for phonemically long condition. F2 is significantly higher for both conditions as well. Ultrasound data revealed that for the accented as well as phonemically long condition /e/ is fronted, whereby the oral cavity is expanded at the back, enabling simultaneous hyperarticulation and sonority expansion. The effects add up, and long accented /e/ has the highest F1 and F2. A weakening of the tongue tip constriction in /l/ would result in a lowering of F2, which is not the case. As can be seen in the ultrasound data, the tongue tip constriction is held in all conditions while in the accented condition the posterior part of the tongue is further retracted, lowering only the tongue body. This lowering of the tongue body enables sonority expansion without interfering with hyperarticulation.

References

[1] Beňuš, Š. and Mády, K., *Effects of lexical stress and speech rate on the quantity and quality of Slovak vowels*, Proceedings of the 5th International Conference on Speech Prosody, 2010.

[2] Cederbaum, J., Pouplier, M., Hoole, Ph. and Greven, S. *Functional linear mixed models of irregularly for sparsely sampled data*, Statistical Modelling 16, 67-88, 2016.