Effects of phrasal accent on tongue movement in Slovak

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This study examines the effect of phrasal accent on tongue movement for vocalic and consonantal nuclei in Slovak using ultrasound.

The main difference between vowels and consonants is grounded in their syllabic affiliation in that vowels always occupy the nuclear position while consonants occupy the onset or coda position. Prosody is another domain that divides vowels from consonants, in that, broadly speaking, vowels carry the prosodic and consonants the lexical information. Slovak has two syllabic consonants, /l/ and /r/, which can also occupy the nucleus of a stressed syllable. This enables us to examine the implementation of phrasal accent on vowels and consonants in a lexically stressed nucleus, the position where prosodic effects are expected to be most prominent.

Previous research has revealed two strategies on how prosodic prominence is produced. The first is `sonority expansion`, which is achieved by expanding the oral cavity, usually by lowering jaw and tongue (Beckman et al., 1992). The second one is `hyperarticulation` (De Jong, 1995). For many vowels, these two strategies go by and large hand in hand because hyperarticulation would lead to an even wider opening of the oral cavity, which would also enhance sonority. For consonants, on the other hand, hyperarticulation would predict a tighter constriction, which requires a movement opposite to what would be required for sonority expansion.

In the current paper we want to examine whether phrasal accent is implemented on consonantal nuclei as it is on vowels. We analyze the nucleus of the first syllable of the two phonologically valid nonsense words *p**e**pap* (vocalic nucleus /e/) and *p**l**pap* (consonantal nucleus /l/). Word stress in Slovak is fixed on the first syllable. Fundamental frequency is a robust indicator for phrasal accent in Slovak (Král', 2005) and was used to control whether speakers correctly produced the phrasal accent. The two target words were inserted in two carrier phrases to elicit the two accent patterns:

Accented targetword
Pozri, ved' on mi ***pepap*** dal.
(Look, he even gave me pepap.)

Unaccented targetword
Pozri, aj **Ron** mi *pepap* dal.
(Look, also Ron gave me pepap.)

To see whether the implementation of phrasal accent can be observed on vocalic, as well as consonantal nuclei, we first want to examine whether there are:

1. Differences between the F1 and F2 movement throughout the nucleus,
2. Differences in tongue contours at the beginning, midpoint and endpoint of the nucleus

for the two accent patterns, separately for vowels and consonants.

Slovak has a dark /l/, which consists of two gestures: the *consonantal* tongue tip movement and the *vocalic* tongue back movement (Sproat and Fujimura, 1993). If prosody is to be carried by vowels, we expect weaker tongue tip constriction in the accented position and a more prominent retraction of the tongue body. To test whether prosody is carried only by vowels, we want to look at

1. Whether the tongue tip constriction is present,

2. Whether the tongue tip constriction is present only at the beginning or end of the nucleus,

3. Whether both gestures are influenced by accentuation if they are present.

We present acoustic and articulatory data for one speaker. In Figure 1 the movement of F1 and F2 throughout the target nucleus are visualized. Figures 2 and 3 show the tongue contours at the beginning, midpoint and end of the two target nuclei. The nucleus has been defined acoustically, starting with the beginning of voicing after the burst of the preceding /p/ and ending with the closure for the following /p/.

We see accent induced contrasts for vowels and consonants in the formant movement as well as the tongue contours.

For the vocalic nucleus, F1 is flat with a slight fall towards the end for the unaccented condition. F2 has a shorter flat part followed by a steeper fall and is overall lower for the unaccented condition. The tongue contours are slightly further back for the unaccented condition, but in terms of vertical tongue position, the accented /e/ is lower. This is consistent with the sonority expansion hypothesis.

The tongue contours for the consonantal nucleus show that the tongue tip constriction is already present before the release of the /p/, but there is no distinction in tongue tip position for the two accent conditions. From the current representation of the tongue contours it is not possible to tell whether there is actually a strong tongue tip constriction. A previous experiment on Slovak found that /l/ in nuclear position retains the tongue tip gesture (Pouplier and Beňuš, 2011), so we expect it to be the case here as well. A slightly more retracted tongue back and slightly lower tongue body when accented is again in agreement with the sonority expansion hypothesis, but also with hyperarticulation, since for the vocalic gesture they go hand in hand. In sum, there is evidence for hyperarticulation in both gestures of /l/, even for the tongue tip constriction in which hyperarticulation goes against sonority expansion.

Our data show that in principle consonantal constrictions in nucleus position are able to carry prosodic structure.

References

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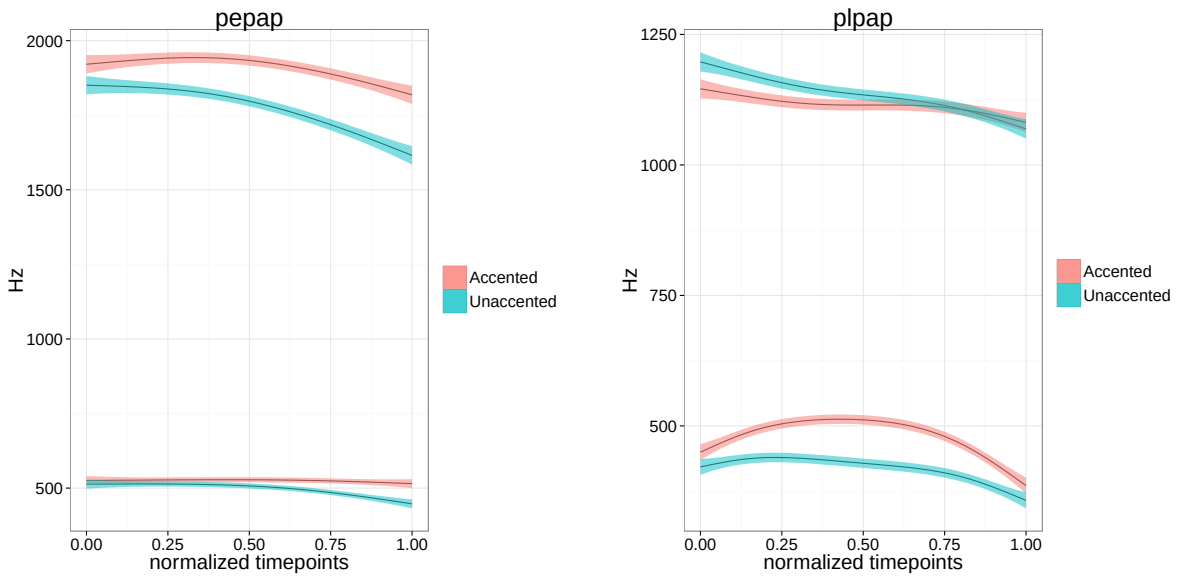

Figure 1: Smoothing Spline ANOVAs of time normalized formant movement throughout the target nucleus in *pepap* on the left and *plpap* on the right for the accented and unaccented condition

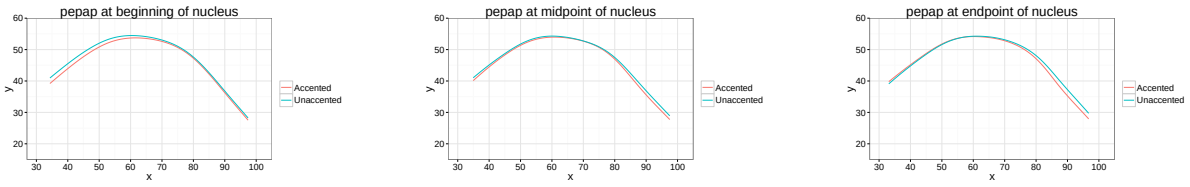

Figure 2: Mean tongue contours for pepap

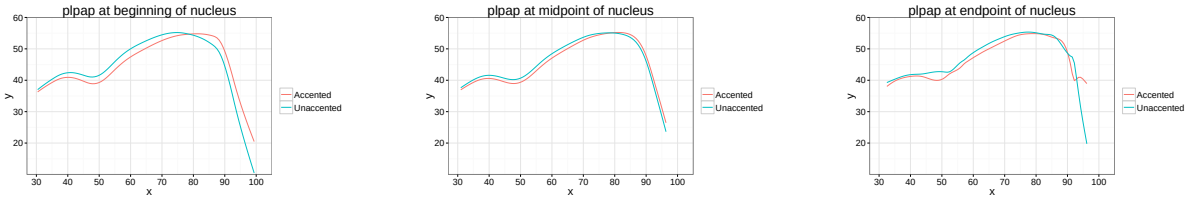

Figure 3: Mean tongue contours for plpap