Realization of F0 on vocalic and consonantal nuclei in Slovak

Lia Saki Bučar Shigemori[1], Marianne Pouplier[2]
[1]*Alpine Laboratory of Phonetic Sciences, Free University of Bozen – Bolzano*
[2]*Institute of Phonetics and Speech Processing, Ludwig Maximilian University of Munich*

The aim of this study is to investigate how F0 is realized in syllables with consonantal nuclei. While it is known that the F0 peak can be on the sonorant consonant preceding or following the accented nucleus [4], languages which allow consonantal nuclei to occupy the stressed syllable have been studied less. Cross-linguistically, a preference for certain nucleus types over others as carriers of stress and accent can be observed. For example, low vowels are more likely to occupy the nucleus of a stressed syllable than high vowels [5]. In German or English, syllabic consonants occur only in unstressed syllables. In Tashlhiyt Berber all kinds of consonants can occupy the nucleus, but it has been observed that the F0 peak can shift to a more sonorant nucleus, even from a sonorant consonant to a vowel [3].

To further our knowledge of the extent to which consonantal nuclei may act as carriers of prosody, we investigate Slovak, in which stress is fixed on the first syllable of the word and is usually marked by a raised F0 when accented [6]. The nucleus can be occupied by syllabic consonants /l/ or /r/ which, like vowels, can be phonologically short or long. In a previous study it has been shown that the acoustic duration of consonantal nuclei does not differ from vocalic nuclei and they pattern likewise as an effect of nuclear pitch accent [1].

Read speech of six native speakers of Slovak was analysed. The target words consisted of disyllabic phonotactically valid nonsense words, in which the nucleus of the first syllable was either vocalic (p**e**pap) or consonantal (p**l**pap, p**r**pap) and phonologically long or short. These target words were presented in two different carrier phrases to elicit two accentuation patterns:

Pozri, ved' on mi ***plpap*** dal.	Pozri, aj **Ron** mi *plpap* dal.
(Look, he even gave me plpap.)	(Look, also Ron gave me plpap.)

F0 was extracted from 30ms before the beginning of the target word to the end of the vowel in the second syllable. The statistical analysis was carried out using functional linear mixed modelling [2]. To do this, the time points were mapped onto a time interval from 0 to 1 resulting in time-normalized curves. During the voiceless segments the F0 curves were interpolated (see Figure 1). The model consisted of three covariates: NUCLEAR PITCH ACCENT (unaccented, accented), PHONEMIC QUANTITY (short, long) and NUCLEUS TYPE (vocalic /e/, consonantal /l, r/) and pair-wise interaction effects, resulting in six effects. The reference mean corresponded to the mean F0 curve of the unaccented target word with a short vocalic nucleus. The most prominent effect was the effect of nuclear pitch accent. When accented, the F0 during the nucleus of the first syllable was significantly higher than in the unaccented condition. Regarding the nucleus type, there was a significant interaction effect with nuclear pitch accent. The effect of accent on F0 was even greater when the nucleus was consonantal than vocalic.

Our results show that at least for Slovak, the F0 contour, which is the main correlate of phrasal accent, is produced robustly on syllables with consonantal nuclei. To discuss our results, we also take into account what is known about intrinsic f0 and intrinsic pitch.

References:
[1] Bučar Shigemori, L. S., Pouplier, M., & Beňuš, Š. (2015). Phonemic length and phrasal accent in Slovak consonantal and vocalic nuclei. In *Proceedings of the 18th International Congress of Phonetic Sciences*.
[2] Cederbaum, J., Pouplier, M., Hoole, P., & Greven, S. (2016). Functional linear mixed models for irregularly or sparsely sampled data. Statistical Modelling, 16 (1), 67–88.
[3] Grice, M., Ridouane, R., & Roettger, T. B. (2015). Tonal association in Tashlhiyt Berber: Evidence from polar questions and contrastive statements. *Phonology*, 32(02), 241–

266.

[4] Jilka, M., & Möbius, B. (2006). Towards a comprehensive investigation of factors relevant to peak alignment using a unit selection corpus. In *Annual Conference of the International Speech Communication Association.*

[5] Kenstowicz, M. (2004). Quality-sensitive stress. *Optimality Theory in Phonology: A Reader,* 191–201.

[6] Král', Á. (2005). *Pravidlá slovenskej výslovnosti: systematika a ortoepický slovník.* Matica slovenská.
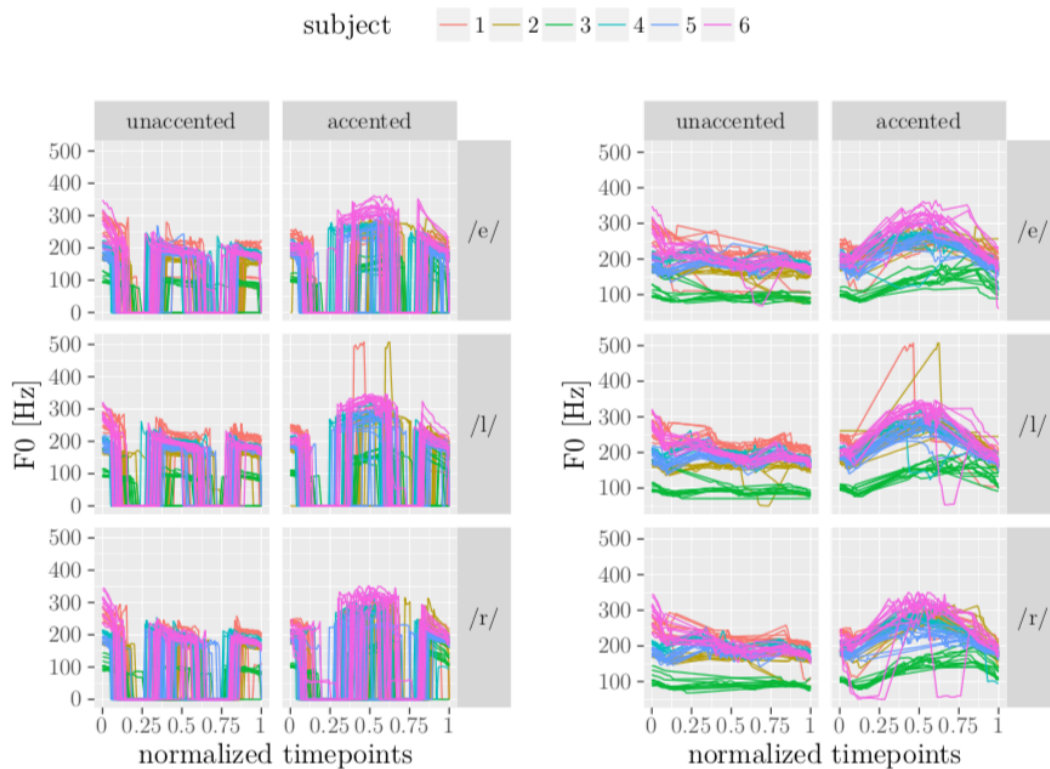
Figure 1 On the left F0 as extracted from the data over normalized time, before interpolation, on the right after interpolation: from top to bottom by nucleus type (vocalic /e/, consonantal /l/ and /r/), separately for the two accent conditions, colour coded by speaker. The visualized data include both phonologically short and long nuclei.