

# Pitch peak timing differences in ternary quantity in North Sámi varieties

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Ternary consonantal quantity contrast, as opposed to a more common binary contrast or a ternary vowel quantity opposition, is a cross-linguistically rare phonological feature, attested only in a handful of languages that belong to the Uralic language family (e.g., Estonian, Livonian, Ingrian and some of the Sámi languages; Ladefoged & Maddieson, 1996; Türk, 2018). In this work we investigate this phenomenon in North Sámi, a phonetically under-documented and endangered language spoken in the Northernmost part of Europe.

The studies of quantity patterns traditionally concentrate on the durational aspects of the relevant length oppositions. In North Sámi, the contrast between the two shorter quantity degrees (Q1 vs. Q2) is phonetically robustly realized using segmental durations, while the phonetic differences between the two longer degrees (Q2 vs. Q3) are much more subtle in terms of durational differences of the relevant segments (Magga, 1984; Karlsson et al., 2008; Baal et al., 2012; Hiovain, et al., 2020). These differences are manifested (i) by an increase in duration of the primary consonantal locus of the quantity opposition (C2, the intervocalic consonant at the centre of the first disyllabic foot of a word) with increasing quantity degree, (ii) by a compensatory shortening of the preceding first-syllable vowel, and, consequently, (iii) by the appropriate changes in the consonant-vowel durational ratio, see, e.g., Sammallahti, 1998.

Interestingly, the phonetic details of the quantity contrast realization, in particular regarding the difference between the two longer quantities (Q2 vs. Q3) differ between the varieties of North Sámi (as well as depending on the age of speakers suggesting an ongoing change). The North Sámi speakers from Finland realize the opposition considerably more robustly than the speakers from Norway, both in terms of C2 duration and consequently, the surrounding vowel durations (Hiovain, et al., 2020).

For several quantity languages it has been suggested that other features beyond duration, namely related to fundamental frequency also play a role in signalling quantity oppositions (Lippus, 2011; Suomi, 2003; Vainio et al., 2010; Prehn, 2012). A recent evaluation of contribution of this type of prosodic features to quantity opposition suggests that while the North Sámi speakers from Finland mostly rely on the durational cues, the North Sámi-Norwegian bilinguals utilize fundamental frequency over C2 and the preceding vowel to co-signal the differences between the two higher quantity degrees (Hiovain-Asikainen & Šimko, under review). For speakers of this variety, the first syllable vowel is produced with higher  $f_0$  ranging over a greater interval in Q3 than in Q2.

In this work we extend these findings by evaluating temporal aspects of  $f_0$  realizations in phrase-medial target words from six speakers of the two varieties of North Sámi (ca. 1250 tokens altogether). As extracting fundamental frequency on consonantal segments is unreliable, we concentrate on  $f_0$  contours over the first syllable vowel participating in opposition signalling. Our results suggest that while the relative timing of  $f_0$  peak within the vocalic interval is not influenced by the C2 quantity for Finnish North Sámi variety, the Norwegian-North Sámi bilinguals systematically vary the shape of the  $f_0$  contour in dependence of C2 quantity degree. We discuss these phenomena in relation to the tonal characteristics of Norwegian language, and conceptualization of tonality as a potential decoupling between intensity and fundamental frequency used for signalling phonological oppositions.

Keywords: North Sámi, ternary quantity opposition, prosody, fundamental frequency

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