

THE ROLE OF PREASPIRATION DURATION IN THE VOICING CONTRAST IN  
 SKOLT SÁMI

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ABSTRACT

This paper summarizes the results of an acoustic analysis of preaspiration duration in Skolt Sámi, an Eastern dialect of Sámi (a Finno-Ugric language). It will show that the characteristic durational patterns associated with disyllabics belonging to different structural types remain the same, regardless of whether preaspiration is present or not. In Skolt Sámi, durational ratios rather than absolute durational values are significant in signalling differences between the main structural types in the language [3,4]. These durational ratios remain constant, regardless of the durational values associated with preaspiration.

It will be argued that the voicing contrast of stop and affricate consonants in word-medial position is not to be considered as one between voicing and voicelessness, but rather as a contrast due to the manifestation of preaspiration.

INTRODUCTION

Preaspiration in Skolt Sámi occurs before voiceless stops and affricates. A detailed account of the durational characteristics of preaspiration associated with voiceless stops is given in [5]. Here I shall provide a summary of preaspiration duration before stops and affricates relative to the gradation system in the language: i.e., the durational characteristics of the two relevant grades (Grade II and Grade III) of consonants will be given (Table 1). It will be shown that there is an inverse relationship between prevocalic and preaspiration duration (Table 2). These two interdependencies -- between consonant duration and preaspiration duration on the one hand, and prevocalic duration and preaspiration duration on the other -- will be summarized in Figures 1 and 2.

A comparison between word-medial voiceless stops and affricates with the so-called half-voiced mediæ in Skolt Sámi will show (Figures 3 and 4) that half-voiced mediæ are consonants associated with a short period of voicing, identifiable as VOffT (2), or, in not a few cases, voiceless consonants without preaspiration..

Previous research on preaspiration, especially in Icelandic, has raised several issues concerning properties associated with preaspiration [6]. I shall show that Sámi preaspiration confirms predictions made concerning the duration of preaspiration, as well as the occurrence of preaspiration in languages where there is no contrast between voiced and voiceless stops. In connection with the first such prediction, Skolt Sámi preaspiration has an average duration of 64.7 msec for Grade II disyllabics and 82.2 msec for Grade III disyllabics, thus confirming the presumption that preaspiration is to be treated differently from postaspiration. The other prediction, that the presence of preaspiration implies the lack of voicing contrast, is also supported in Skolt Sámi, for, as indicated above, the so-called half-voiced consonants are actually consonants with an average of 35 msec VOffT duration (Fig. 4), or

they may manifest themselves as voiceless consonants without preaspiration.

THE EXPERIMENT

The experiment consisted of 322 disyllabic test-words placed in a sentence frame spoken by two Skolt Sámi speakers. Each test-word was repeated three times (at different recording sessions) by both speakers. The recording was made with a Scully Full-Track Broadcast Machine tape recorder; the tape speed was 7.5" per second. The material was recorded on Ampex Audio Mastering Tape (7" reel). The MacSpeech Lab Version 2 software was used for final evaluation of the data. Broad-band spectrograms were made, segment boundaries being identified on the basis of spectrographic discontinuities. Durational measurements were made of the first syllabic vowel, the preaspiration following it (when relevant), and the word-medial consonant.

Table 1 summarizes the results of the measurements made of word-medial voiceless stops and affricates in Grade II and Grade III, together with respective preaspiration durational values. Table 2 shows prevocalic duration in relation to preaspiration duration. Mean duration ( $\bar{x}$ ) and standard deviation (SD) are given for each segment.

Table 1. *Duration of preaspiration, and duration of voiceless stops and affricates in Grade II and Grade III disyllabics*

	Preaspiration duration		Duration of the following consonant	
	$\bar{x}$	SD	$\bar{x}$	SD
GRADE II	64.7	13.6	144	21.4
GRADE III	82.2	12.2	275.6	26.3

Table 2. *Duration of preaspiration, and duration of the preceding vowel*

	Preaspiration duration		Duration of the preceding vowel	
	$\bar{x}$	SD	$\bar{x}$	SD
GRADE II	64.7	11.4	197.5	21.3
GRADE III	82.2	11.5	108.6	13.5

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Figures 1 and 2 illustrate the durational relationships between (a) preaspiration and word-medial consonant duration in Grade II and Grade III, and (b) preaspiration and prevocalic duration.

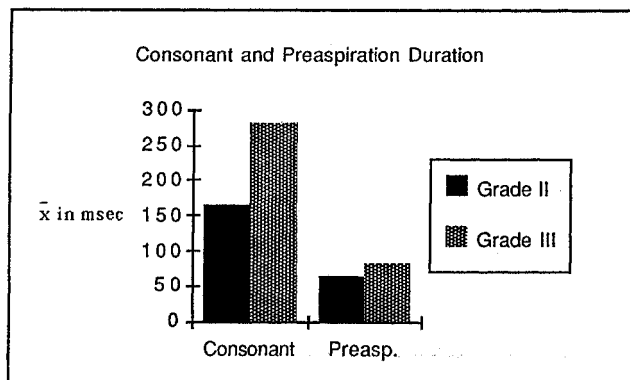


Figure 1. Duration of Grade II and Grade III consonants in relation to preaspiration

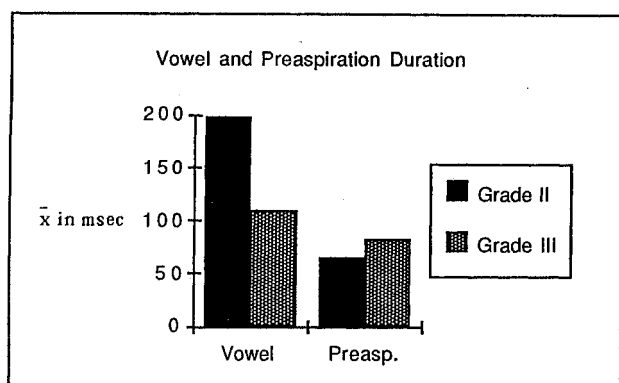


Figure 2. Vowel duration of Grade II and Grade III disyllabics in relation to preaspiration duration

#### DISCUSSION

In reviewing the durational characteristics of preaspiration in relation to prevocalic and word-medial consonantal duration, the following observations are in order:

a. The average duration of preaspiration in Grade II disyllabics is 64.7 msec, and the average duration for Grade III disyllabics is 82.2 msec. The durational difference between the two grades is approximately 20 msec, the average being 17.4 msec.

b. Longer preaspiration seems to co-occur with longer consonant duration: the duration of Grade III consonants averages 275.6 msec following a longer preaspiration duration (see above).

c. Longer preaspiration duration is associated with shorter prevocalic duration: the duration of preaspiration averages 82.2 msec following a shorter prevocalic duration (see above).

d. In Skolt Sámi there exists a compensatory relationship between the first syllabic vowel and the consonant(s) following it. Because I have discussed this relationship in considerable detail elsewhere, I will simply state this to be one of the characteristic features of Skolt Sámi prosody [3, 4]. The presence or absence of preaspiration does not affect the characteristic ratios between vowel and consonant duration, consonant duration understood here as being duration of preaspiration plus duration of the consonant.

The spectrograms shown below illustrate the difference between word-medial voiceless stops and the so-called half-voiced mediae in Skolt Sámi. In Figure 3, preaspiration is clearly to be seen with duration conforming to the average durational value indicated above. Figure 4, where no preaspiration is to be seen, shows a typical spectrogram representing all consonants where voicing differences are assumed to be primary distinctions of voiceless consonants with preaspiration: i.e., assuming a contrast between half-voiced and voiceless consonants. As these spectrograms clearly show, the presence vs. absence of preaspiration should be considered to be the primary distinction between the respective consonants.

It may be noted that although the term Voice Offset Time has been suggested instead of "preaspiration" [2], in Skolt Sámi it is more appropriate to refer with this term to the short period of voicing preceding the half-voiced mediae. Whenever preaspiration occurs, its phonetic characteristics do not include so much as even a brief period of voicing. The realization of preaspiration in Skolt Sámi is similar to that of the [h] sound, clearly showing the formant pattern of the preceding vowel, and occurring together with the characteristic friction associated with the articulation of the glottal fricative.

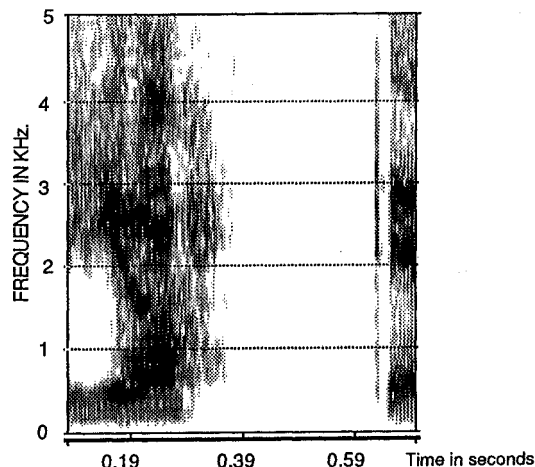


Figure 3. Broad-band spectrogram of the word [ɔht:ɛ] 'walk'. The segments measured: [ɔ] = 82.5 msec, [t] 300 msec, preaspiration: duration: 67 msec.

Two points should be mentioned here in connection with preaspiration duration. First, there is preaspiration before the so-called half-voiced palatal stops; however, the duration of preaspiration here is considerably shorter, averaging about 30 msec. It appears, then, that in connection with palatal stops, shorter vs. longer preaspiration -- not a distinction between voiced vs. voiceless segments -- signals the difference [5]. Second, following the high back vowel [u] there is either no preaspiration, or there is preaspiration of short duration. Out of the 69 relevant recordings, only 16 contain preaspiration of duration between 30-35 msec with

considerably lower intensity than preaspiration displays in general; the rest of the test-words contain no preaspiration at all. I will not go into detail here concerning the absence of preaspiration after [u], having discussed this in considerable detail in [5]). It will be in order simply to state that, on the basis of the durational measurements, it may be concluded that the temporal structure of the VC sequence ensures that the absence of preaspiration will be compensated for by longer consonant duration.

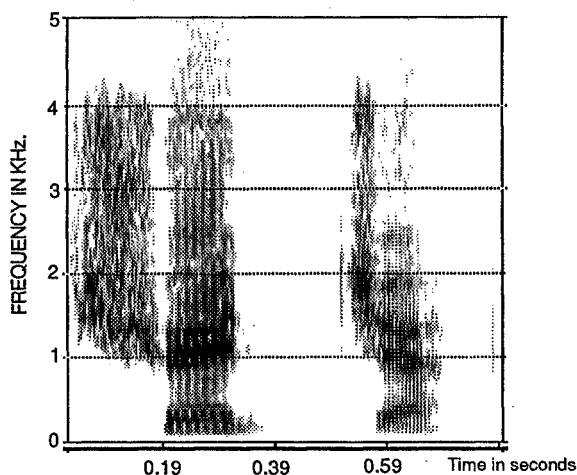


Figure 4. Broad-band spectrogram of the word [č̥uəʒ:ɔp] 'stand' Pl.1. The segments measured: [uə] = 112.5 msec., [ʒ] 225 msec. VOffT duration: 36 msec.

#### SUMMARY

In examining the durational characteristics of Skolt Sámi preaspiration, it may be concluded that the durational patterns of preaspiration do not interfere with the durational pattern of Skolt Sámi disyllabics, where it is the ratio between the first syllabic vowel and consonant(s) following that signals the different structural types. It appears that the tendency to maintain constant duration from the onset of the vowel to the onset of the consonant, is similar to what was noticed in Icelandic [1]. It is the presence vs. absence, or (in connection with palatal stops) the long vs. significantly shorter preaspiration duration), that are relevant in the manifesting of the voicing contrast in Skolt Sámi.

This paper puts forward the hypothesis suggesting that, instead of the voiceless vs. voiced status of stops and affricates, preaspiration vs. the absence of preaspiration (that may be accompanied by a brief VOffT period) could be significant in signalling linguistic contrasts. Subsequent listening tests (in preparation) may support this plausible assumption.

#### References

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