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Acoustics of non-modal consonants in SiSwati: the case of nasals

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1. Introduction

SiSwati (S43, Guthrie) is a southern Bantu language spoken by about 3 million people in South Africa and Swaziland. It is an official language in both South Africa and Swaziland, and the language is taught at K-12 institutions as well as universities. Even so, there are still gaps in the description in the acoustics of SiSwati consonants, concerning the voice quality. This study aims to fill this gap by reporting on the acoustic of non-modal consonants, in particular focusing on labial and coronal nasals in SiSwati.

In general, SiSwati consonants are reported to have breathy voice that also triggers depression of the tone following these consonants (cf. Bradshaw 1999, Taljaard et al. 1991). The language has both modal nasals and breathy nasals. Results from four speakers (two male and two female) reveal that labial nasals with a breathy release have a longer duration than other nasals, which is due to the presence of a morpheme boundary. Results from Electroglottograph (EGG) are also shown for coronal nasals.

2. Data collection

2.1. Participants

All participants come from the Mpumalanga province in the eastern part of South Africa, where majority of SiSwati speakers live. The participants were completing their degree in SiSwati at University of Venda in Thohoyandou. All of them reported that they speak SiSwati with their family members as well as with SiSwati speaking acquaintances. Most participants also spoke English, a language used to communicate with them. The knowledge of other languages in the Limpopo area by the speakers was limited. Sessions for acoustic recordings were held in August 2016. Recordings using the electroglottography (EGG) were conducted in July 2018.

2.2. Stimuli

A set of stimuli was created to test the voice quality of SiSwati consonants. The complete stimuli list contains 93 words, which are composed of 31 target consonants with three different items for each type. For the purpose of this study, a subset of stimuli as in (1) was selected for further analysis.

(1) List of target stimuli (in SiSwati orthography; acute accent marks high tone)

a. modal voice nasals

madvú ‘cat’, mákotí ‘bride’, mabasa ‘april’ (labial)

kúnaba ‘extend’, nángábe ‘even if’, nakhóna ‘although’ (coronal)

b. breathy voice nasals

umhobholo ‘selfish’, make ‘my mother’, umholi ‘a leader’ (labial)

násé ‘if then’, naso ‘that one’, nakadzeni ‘even in the past’ (coronal)

2.3. Data processing

Three repetitions were recorded for each item and the duration of the nasals was extracted using Praat scripts. The beginning and the end of the nasal, as well as preceding and following vowels were annotated. EGG data was annotated using Praat and processed using Eggnog v. 0.3 (Villegas 2018). Measurements were plotted using R.

3. Results

3.1. Acoustics

The results in figure 1 show that labial breathy nasals are longer than other types of nasals. This finding is unexpected in that breathiness is not known for contributing a difference in duration.

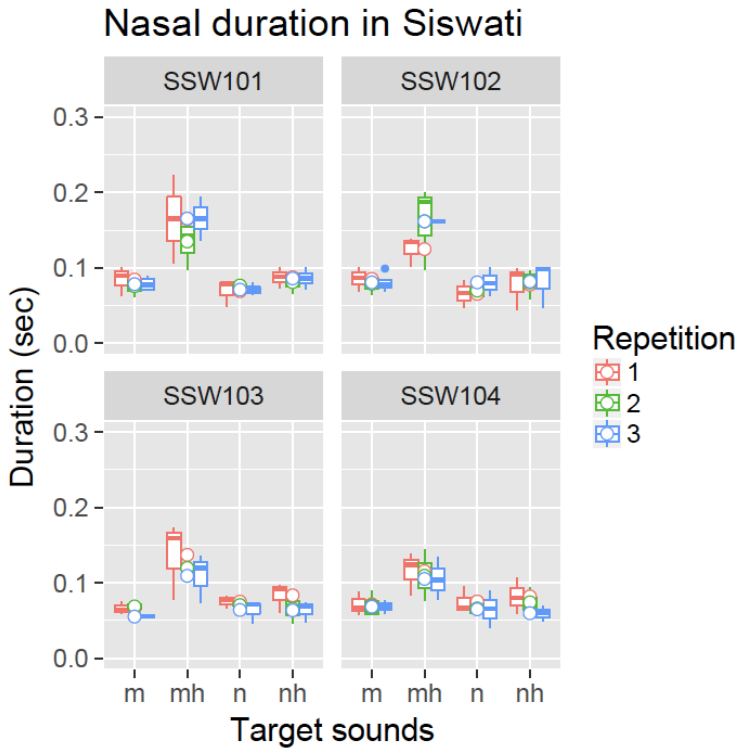

Figure 1: Duration of modal nasals [m, n] and breathy nasals ‘mh, nh’.

The fieldwork in 2018 revealed that the breathy nasal ‘mh’ had a morpheme boundary after the labial nasal [m]. Participants also confirmed that breathy nasals are not contrastive in labials. The longer duration in the ‘mh’ categori is due to the presence of a morpheme. As such, the longer duration in

labials is an artifact of a labial nasal [m] followed by a glottal fricative [h].

3.2. Articulatory data

Additional articulatory data was collected in July 2018 to compare the difference in the vocal cord movement between modal and breathy nasals. Data was recorded using Praat after placing two electrodes around the vocal cords of a participant. A visual comparison is reported here. In figures 2 and 3, the left panels show the nasal part and the right panels show the post-nasal vowel. Each cycle is composed of the closed phase and the open phase. The closed phase begins with an abrupt rise of the signal. The signal then starts dropping and the open phase begins when the signal is at its lowest point. In breathy voice, the percentage of glottal opening (open quotient) in a cycle is larger than that in modal voice. The Oq values in figures 2 and 3 are as follows: [n] = .38, v2 after [n] = .42, [n̤] = .37, v2 after [n̤] = .46. While the nasals themselves have not shown differences in terms of Oq, the post-nasal vowels show some differences in the Oq values, suggesting that the breathiness that may be present is not necessarily manifested in an articulatory way. The annotated data set is also processed with Eggnog 0.3 (Villegas 2018).

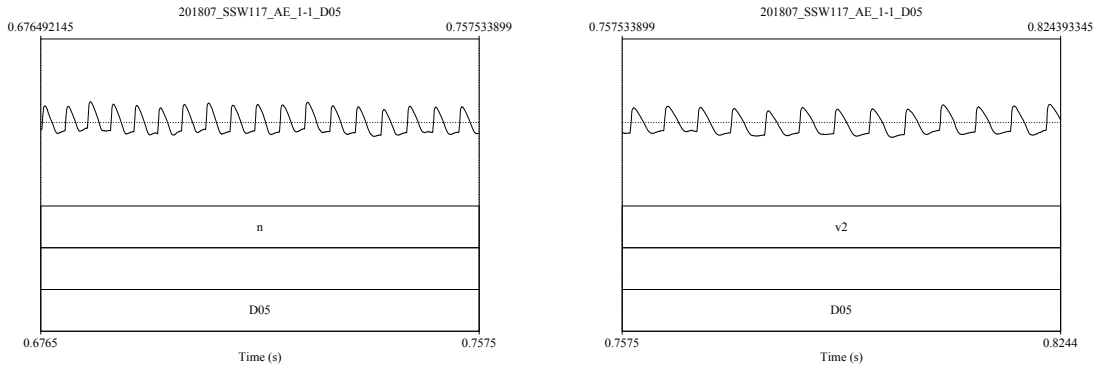

Figure 2: EGG signal of modal nasal [n] and its following vowel

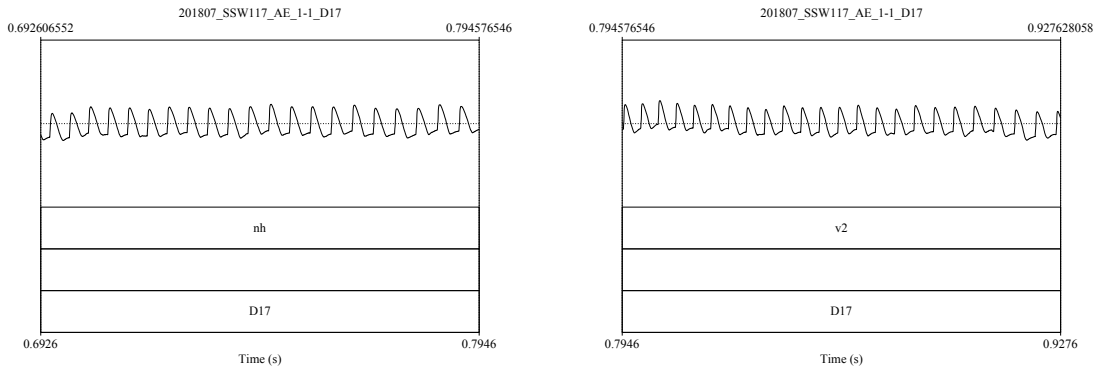

Figure 3: EGG signal of breathy nasal [n̤] and its following vowel

4. Conclusion

This paper has reported two findings of modal and breathy nasals in SiSwati. The contrast of breathy

nasals is only found in the coronals. The anomalous longer duration in labial nasals stemmed due to the presence of a morpheme boundary, immediately following the nasal.

References

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