MORPHOLOGY AND PHONETIC REALIZATION: LEXICAL VS MORPHOLOGICAL PRENASALIZATION IN SÀ'ÁN SÀVǏ ÑÀ ÑUÙ XNÚVÍKÓ (MIXTEC)

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ABSTRACT

This paper investigated the realization of the prenasalized stop /^{n}t/ and the prenasalized affricate /^{n}t͡ʃ/ in Sà'án Sàvǐ ñà ñuù Xnúvíkó (Mixtepec Mixtec, Otomanguean). These phonemes appear in native lexical items, and for many of these they can be traced back to proto-Mixtec. More recently, however, due to processes of segmental erosion triggered by grammaticalization, morphological prenasalization has become widespread in the language. Data from 5 speakers elicited in the field is analyzed in this study to investigate whether the nature of the prenasalization (lexical or morphological) has an effect on the realization of these two segments. Results show longer duration of the nasal closure when prenasalization is the result of morphological processes, which we suggest reflects the marked status of these forms.

Keywords: prenasalization; grammaticalization; Mixtec; voicing; morphology

1. INTRODUCTION[1]

Sà'án Sàvǐ ñà ñuù Xnúvíkó (Mixtepec Mixtec, Otomanguean, ISO693-3: mix) is spoken by approximately 9,170 speakers ([3]) in the municipality of San Juan Mixtepec, in the district of Juxtlahuaca, Oaxaca, Mexico. However, the number of speakers in diaspora community, mainly in Northern Mexico and the USA, is unknown ([11], [15]).

Just like other Otomanguean languages, Sà'án Sàvǐ ñà ñuù Xnúvíkó presents a contrast between plain and prenasalized stops (/p/ vs. /^{n}p/, /t/ vs. /^{n}t/, /k/ vs. /^{n}k/, and /k^{w}/ vs. /^{n}k^{w}/) and affricates (/t͡s/ vs. /^{n}t͡s/, and /t͡ʃ/ vs. /^{n}t͡ʃ/). These phones are commonly described as prenasalized, often voiced, segments ([3], [7], [13], [14]) or post-oralized nasal stops ([4], [9]) as opposed to consonant clusters ([10]) or a syllabic nasal stop, although there has not been any systematic study to support this. Evidence that these phones constitute the onset of syllables and cannot be separated was found in a related language, Zenzontepec Chatino ([2]). This study used play language syllable transposition as evidence for syllable structure and found that prenasalized segments indeed behave as single units, rather than clusters. We refer to these segments as prenasalized by convention, but whether these segments are to be analyzed as prenasalized oral stops or post-oralized nasal stops is outside of the scope of the present paper.

The present study compares the realization of prenasalized segments in Sà'án Sàvǐ ñà ñuù Xnúvíkó when they are lexical as opposed to when the result of morphological processes. In some lexical items, the prenasalization can be traced back to Proto-Mixtec ([6]) and is therefore part of the segmental composition of a lexical item (i.e., present-day [^{n}du^{3}t͡ʃi^{14}] 'bean' from proto-Mixtec *^{n}*duti*ʔ). However, processes of segmental erosion ([4]) triggered by grammaticalization have also given rise to a different category of prenasalization that is morphological in nature. This newer prenasalization is currently widespread in Sà'án Sàvǐ ñà ñuù Xnúvíkó.

There are three main environments for morphological prenasalization: the prospective, the perfective verbal aspects, and irrealis negation (see Table 1).

C	English	nC	English
kítsáá [ki^{4}t͡sa:^{44}]	IPFV.start	*kú nkìtsáá* [ku^{4ŋ}gi^{1}t͡sa:^{44}]	PROSP.start
cháa [t͡ʃa:^{43}]	IPFV.write	*nchàa* [^{n}d͡ʒa:^{13}]	PFV.write
katsí [ka^{3}t͡si^{4}]	POT.eat	*nkǎtsí* [^{ŋ}ga^{13}t͡si^{4}]	NEG.POT.eat

Table 1: Table showing prenasalization in the prospective aspect ('start'), the perfective aspect ('write') and the irrealis negation ('eat') in Sà'án Sàvǐ ñà ñuù Xnúvíkó.

The negative form is very common in fast speech, but speakers tend to produce the unpacked *mà* + V in careful speech (that is, *mà kǎtsí* instead of *nkǎtsí*, see Table 1). In addition, since the prospective forms of verbs include a prefix that may be variably realized as [ku^{4}], [u^{4}], or [ũ^{4}], thus presenting potential difficulties for acoustic measurements, the perfective form of verbs is taken to represent morphological prenasalization in this study.

The perfective forms in the language may be expressed in different ways, all of which can be seen as different stages of grammaticalization, in which a prefix *nì-* has eroded and affected the tonal melody of the word to different degrees. In fact, the prefix surfaces in the negative forms of these verbs (see Table 2).

IPFV	PFV	NEG.PFV	English
kíxi [ki^{4}ʃi^{1}]	***nì**kìxì* [ni^{1}ki^{1}ʃi^{1}]	*kuě **ní**kìxì* [k^{w}e^{14}ni^{4}ki^{1}ʃi^{1}]	Sleep
tsíka [t͡si^{4}ka^{3}]	***n**tsìka* [^{n}d͡zi^{1}ka^{3}]	*kuě **ní**tsìka* [k^{w}e^{14}ni^{4}t͡si^{1}ka^{3}]	Walk
né'ě [ne^{4}ʔe^{14}]	*nè'ě* [ne^{1}ʔe^{14}]	*kuě **ní**nè'ě* [k^{w}e^{14}ni^{4}ne^{1}ʔe^{14}]	Get

Table 2: Imperfective, perfective, and negative perfective forms of the verbs ‘sleep’, ‘walk’, and ‘get’ in Sà'án Sàvǐ ñà ñuù Xnúvíkó illustrating the segmental erosion of the prefix *nì-* giving rise to these three different verbal paradigms.

This study aims to determine whether lexical and morphological prenasalization are phonetically realized differently by speakers of Sà'án Sàvǐ ñà ñuù Xnúvíkó. We hypothesize that there may be a difference in: a) longer relative duration of the nasal closure, and b) longer relative duration of voicing of the oral closure.

2. METHODOLOGY

2.1. Participants

Six participants, 3 females and 3 males, between the ages of 20 to 60 took part in this elicitation task. All participants were self-identified native speakers of Sà'án Sàvǐ ñà ñuù Xnúvíkó. Due to the presence of background noise, data from one speaker was dropped from the analysis, resulting in a sample of 5 speakers: 3 females and 2 males.

2.2. Materials and experimental procedure

As Mixtec is predominantly an oral language and most speakers are not used to reading it, nor is there a well-established writing system, the task consisted of watching and listening to a video presenting 40 stimuli sentences accompanied by pictures illustrating the meaning of a target word (see Fig. 1) and repeating the target word embedded in a carrier sentence twice, one repetition after the other.

The second author, also a speaker of Sà'án Sàvǐ ñà ñuù Xnúvíkó, recorded all stimuli sentences in one recording session using a Tascam DR-40X audio recorder and a Shure WH20XLR Dynamic Headset microphone. The first author used Audacity to process the audios and PowerPoint to create the video stimuli.

Figure 1: Screenshot of the video stimuli for the target word *ntà'vǐ* [^{n}taʔ^{1}βi^{14}] ‘broke’.

All target words begin with either the prenasalized stop [^{n}t] (20 sentences) or the prenasalized affricate [^{n}t͡ʃ] (20 sentences), and the type of prenasalization in each target word is either lexical (10 words per consonant) or morphological (10 words per consonant). The carrier sentence (*vàtsi tù'un kávi-rà ___ sàtă iin líbrù* [βa^{1}t͡si^{3}tũ^{1}ʔũ^{3}ka^{1}βi^{3}ɾa^{1} | __ | sa^{1}ta^{14}ʔĩː^{3}li^{4}βɾu^{1}], which translates to *X appears in the words he is reading in this presentation*) was designed to avoid any nasal or nasalized segment occurring adjacent to the initial prenasalized segments of the target words, as well as to place all target words in the same focus structure. The stimuli sentences presented the target word in context to make sure that speakers knew the exact word they needed to repeat, avoiding confusion with minimal pairs. The sentences were also accompanied by pictures that illustrated the meaning of the target word. All stimuli sentences and the carrier sentence were designed by the authors themselves.

Participants were recorded individually in one session in their houses by the second author using a Tascam DR-40X audio recorder and a Shure WH20XLR Dynamic Headset microphone. Participants were first explained what the task consisted of and given an example stimulus to make sure they understood the task. After that, the same video was played for all participants, containing 20-second-long pauses in between stimulus sentences so that they could repeat the carrier sentences with the target words.

2.3. Measurements

The recordings were then analyzed using Praat ([1]), measuring the duration of both the nasal and the oral closure of the initial prenasalized segments of the target words (see Figures 2 and 3), as well as the duration of voicing in the oral closure. In addition, each target word was coded for speaker, order (first or second time uttering the carrier sentence), as well as the vowel following the prenasalized segment and the number of syllables of the word.

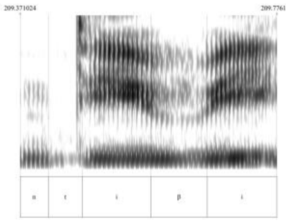

Figure 2: Segmented spectrogram for the word *ntivǐ* [^{n}di^{3}βi^{14}] 'egg' produced by a male speaker.

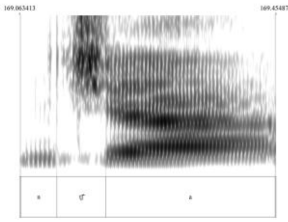

Figure 3: Segmented spectrogram for the word *ncháá* [^{n}d͡ʒa^{44}] 'blue' produced by a male speaker.

The duration measurements were converted into percentages to facilitate comparison (i.e., how much of the total duration of the segment corresponds to either the nasal or the oral closure).

2.4. Statistical analysis

Using R Studio ([9]) we tested for significant differences in the relative duration of the nasal closure and the relative duration of voicing in the oral closure for lexical and morphological prenasalization. Since /^{n}t/ and /^{n}t͡ʃ/ behaved significantly differently, two separate analyses were conducted. Four linear models, two for /^{n}t/ and two for /^{n}t͡ʃ/, were constructed with the following independent variables: the nature of the prenasalization (lexical or morphological), the order of utterance (first or repetition), the vowel quality, the nasal quality of the vowel (oral or nasal), the number of syllables of the word (from one to four), and Speaker.

3. RESULTS

For /^{n}t/, we constructed a linear model to test if the nature of prenasalization (lexical or morphological) significantly predicted the relative duration of the nasal closure in the prenasalized segment. The fitted regression model was: Relative duration of the nasal closure for lexical prenasalization = 47.87 + 7.65** (for morphological prenasalization). The overall regression was statistically significant (R^2=.25, F(10, 189) = 7.746, p<0.001). It was found that the nature of the prenasalization significantly predicted the duration of the nasal closure of the prenasalized segment (β = 7.65, p<0.001). This trend is clear across speakers (see Fig. 4).

We also constructed a linear model to test if the nature of prenasalization (lexical or morphological) significantly predicted the relative duration of voicing in the oral closure of the prenasalized segment. The overall regression was statistically significant (R^2=.07, F(10, 189) = 2.498, p<0.05), with morphological prenasalization showing slightly longer duration of voicing in the oral closure (β = 8.78, p<0.05) (see Fig. 5).

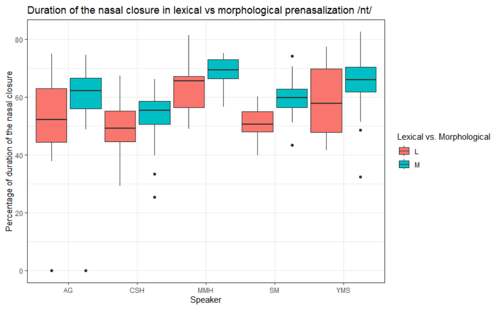

Figure 4: Relative duration of the nasal closure in /^{n}t/ by speaker and condition (lexical vs. morphological)

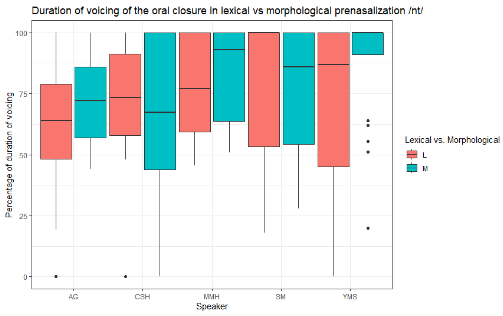

Figure 5: Relative duration of voicing in the oral closure in /^{n}t/ by speaker and condition (lexical vs. morphological)

For /^{n}t͡ʃ/, we constructed a linear model to see if the nature of prenasalization (lexical or morphological) significantly predicted the relative duration of the nasal closure in the prenasalized segment. The overall regression was statistically significant (R^2=.39, F(11, 188) = 12.52, p<0.001), but there was no significant difference in the relative duration of the nasal closure as a function of the nature of prenasalization. There were however significant differences across speakers (See Fig. 6).

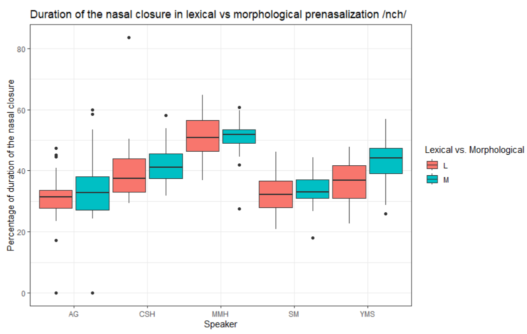

Figure 6: Relative duration of the nasal closure in /^{n}t͡ʃ/ by speaker and condition (lexical vs. morphological)

We also constructed a linear model of the relative duration of voicing in the oral closure as a function of nature of prenasalization (lexical or morphological) and speaker. This model was significant (R^2= .65, F(11, 188)=34.61, p<0.001). There was, however, no significant differences in the relative duration of voicing in the oral closure as a function of nature of prenasalization. There were, however, significant differences across speakers (see Fig. 7), and a significant difference between the first and second utterance (repetition) of the words (see Fig. 8).

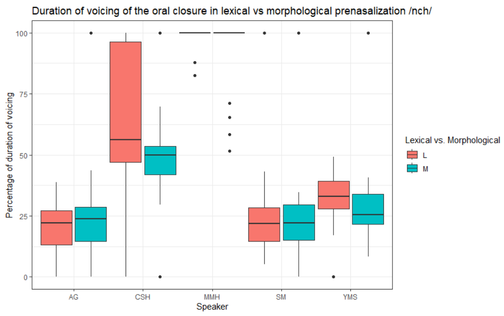

Figure 7: Relative duration of voicing in the oral closure in /ⁿt͡ʃ/ by speaker and condition (lexical vs. morphological)

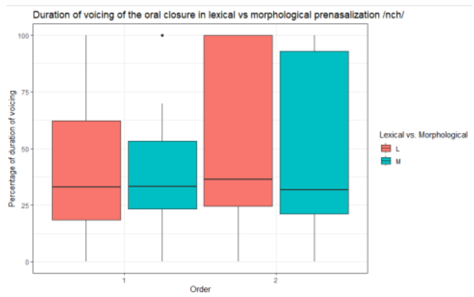

Figure 8: Relative duration of voicing in the oral closure in /ⁿt͡ʃ/ by order of utterance and condition (lexical vs. morphological)

4. SUMMARY AND DISCUSSION

The analysis of the prenasalized segments /ⁿt/ and /ⁿt͡ʃ/ in Sà'án Sàvǐ ñà ñuù Xnúvíkó revealed an interesting trend. While the number of speakers analyzed (5) and the number of tokens (N = 400) is too low to venture grand generalizations, the data show a clear trend for the nasal closure in /ⁿt/ to be significantly longer when the prenasalization is the result of morphological processes (with a mean duration of 61.2% of the closure for morphological prenasalization in comparison to a mean of 54.15% of the closure when the prenasalization is a feature of the lexical item itself). No difference was found in the duration of voicing in the oral segment.

This trend signals at the possibility that morphological status directly effects phonetic realization: although these are the same phones, undistinguished by speakers, their phonetic realization seems to be significantly different depending on their morphology (or lack thereof), with simplex lexical items displaying shorter duration of the nasal closure than those items in which prenasalization is morphological.

This may be due to morphological prenasalization in Sà'án Sàvǐ ñà ñuù Xnúvíkó historically deriving from a prefix *nì-* that can still be found in the language, and signals perhaps at an ongoing process of segmental erosion. It could be the case that the significantly longer realization of the nasal closure for morphological prenasalization is due to its importance in marking a relevant morphological distinction. That is, the forms that have undergone morphological processes all contrast directly with simplex non-prenasalized items. Prenasalization as a morphological process in Sà'án Sàvǐ ñà ñuù Xnúvíkó leads to the existence of several minimal and near-minimal pairs whose only differing segment is the prenasalized one. This may explain the need to emphasize the nasal closure in order to maximize difference with the unmarked, non-prenasalized form. However, prenasalization is not the only distinctive feature of these forms, as tone is also affected by the same morphological processes, and tone can even be the sole indicator of aspect change (see Table 2). A possible future direction to expand this analysis would be to include the prenasalized velar stop /ⁿk/ and its labialized counterpart /ⁿkʷ/, as well as other contexts in which prenasalization is morphological (such as the prospective aspect).

However, durational differences between lexical and morphological prenasalization were not observed for /ⁿt͡ʃ/. This is probably due to the already complex articulation of the affricate /t͡ʃ/ and the already crowded window of time for the gestures necessary to produce this segment. When prenasalized, therefore, there would be much less room for lengthening of the nasal closure.

Finally, we want to emphasize this study's combination of experimental and field methods. Experimental paradigms of phonetic research have traditionally placed an almost non-negotiable importance on tightly controlled settings and procedures, as well as heavy reliance on written representations of language. These present an unrealistic ideal when working with speakers of endangered minoritized languages residing in areas where access to higher education and laboratories is nearly non-existent. These were hurdles that we had to overcome during this study, leading to the mixed methodology presented in this paper: a fieldwork elicitation session using experimental stimuli. We hope that this study adds to the currently expanding body of literature working with languages underrepresented in scholarly research.

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