POST-ORALIZED NASAL CONSONATS IN CHINESE DIALECTS —AERODYNAMIC AND ACOUSTIC DATA

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ABSTRACT

Denasalization is a widely detected but not well documented and thus poorly understood phonetic or phonological process in Chinese dialects. The plain nasal consonants in Middle Chinese may remain as plain nasals such as in Wu dialects, have conditionally changed into plain fricatives or approximants such as in Mandarin dialects, or become post-oralized. This paper discusses acoustic and aerodynamic data of the post-oralized nasal consonants from four major Chinese dialect groups—Shanxi Jin dialects, Cantonese dialects around the Zhongshan area, southern Min dialects (Xiamen and Chao-Shan areas), and the Qingxin Hakka. The presented phonetic data reveal details of the denasalization process in Chinese dialects in particular and shed light on the understanding of historical sound change in general.

Keywords: denasalization, nasality, post-oralized nasals, prenasalized consonants.

1. INTRODUCTION

Post-oralized nasal consonants have been observed in a number of Chinese dialects with a widespread geographical distribution ([1]). For instance, [2] reported there were prenasalized stops in Shanxi dialects. [3] and [4] found that the nasal consonants in Zhongshan and Taishan Cantonese were characterized by an oral release, respectively, and were thus referred to as poststopped nasals [m^b n^d $ŋ^g$]. It is controversial whether there are complex nasal consonants in Southern Min. The consonants [b l g] in Southern Min were described as transcribed by some researchers ([2], [5], [6], [7]), but as having a characteristic of being prenasalized by the others ([8], [9], [10]). However, past studies are mostly descriptive dialectological works and only a few phonetic studies have been carried out ([1], [11], [12]).

Post-oralized nasal consonants usually do not contrast with plain nasal consonants in most cases. For instance, the oralized nasals occur before oral vowels while the plain nasal consonants before nasalized vowels in Xiamen; poststopping of the nasals is a phonetic variation in Cantonese dialects. But in some dialects, there are phonological contrasts. For instance, [^{m}bak] 'wood' vs. [mak] 'eyes' in Shantou; [n^zɑŋ] 'to speak to oneself' vs. [n^dɑŋ] 'south' in Wenshui and Pingyao.

Historically, the oralized nasal consonants in Chinese dialects result from the denasalization triggered by the orality on the following vowel. Dialects differ regarding the denasalization process. In Wu dialects, no denasalization is detected and the plain nasal consonants remain as plain nasals. In Mandarin dialects, the historical alveolo-palatal nasal consonant has changed into a fricative or an approximant while the other nasals remain intact, i.e., the denasalization process has been applied conditionally. In the dialects discussed in this paper, the plain nasal consonants have become post-oralized. Based on the aerodynamic and acoustic data from four major Chinese dialect groups, it is proposed that the plain nasal consonants may undergo the process of denasalization with several different steps. At the first stage, the orality on the following vowel only affects the release part of the nasal, so that the nasal has an oral release and the nasal murmur remains intact. At the second stage, as the assimilation of orality proceeds, both the release and part of the nasal closure acquire orality.

2. METHODOLOGY

Four major Chinese dialect groups were investigated. For Shanxi Jin, 51 native speakers from 39 counties were recorded. In this paper, the discussion is focused on the six speakers from four locations: one male speaker from Pingyao (PYM), one female speaker from Wenshui (WSF), one male and two female speakers from Fenyang (FYM, FYF1 and FYF2), and one male speaker from Linfen (LFM). For all the six speakers, both aerodynamic recordings and separate audio recordings were made. For Cantonese, six speakers from four locations were recorded aerodynamically:

three male speakers from Kaiping (KPM1, KPM2 and KPM3), one male speaker from Taishan (TSM), one male speaker from Enping (EPM), and one female speaker from Xinhui (XHF). For southern Min, six male speakers from the Chao-Shan area were recorded aerodynamically: two from Chaozhou (CZM1 and CZM2), two from Shantou (STM1 and STM2), one from Chenghai (CHM), and one from Chaoyang (CYM). As for Hakka, one male speaker from Qingxin (HKM) was recorded aerodynamically. Scicon's PCquirer S16 or X16 system was used in acquiring the aerodynamic data. Both oral flow and nasal flow were recorded for all the speakers. And for suitable speakers, the intraoral pressure was also recorded for the test words with a labial initial. In addition to the fieldwork data collection, published audio data ([7], [13]) were also used in the present study.

Meaningful monosyllabic words were used as test material. For each dialect group, test material consists of all the nasal consonants, both post-oralized and plain, and the corresponding stops, affricates or fricatives. The test material was balanced concerning the vowel category and syllable structure. In total, 51 test words were used for Shanxi dialects, 62 test words for southern Min, and 66 test words for Cantonese and Hakka. For each test word, three repetitions of the citation form were recorded and analyzed.

3. RESULTS

3.1. Shanxi dialects, Cantonese and Hakka

Table 1: Post-oralized nasal consonants in Shanxi.

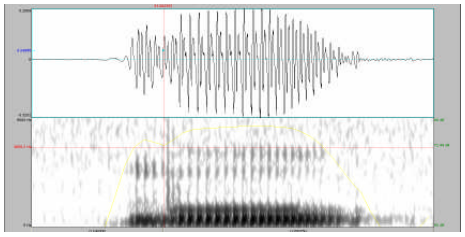
	PY	WS & D. FY	LF	R. FY
labial	m^b	m^b	m^b	m^b
alveolar	n^d	n^d n^z/n^{dz}	n^d	n^d
retroflex[1]	$ɳ^d/ɳ^{dʐ}$	-	-	-
alveolo-palatal	$ȵ^d/ȵ^{dʑ}$	$ȵ^d/ȵ^{dʑ}$	$ȵ^d/ȵ^{dʑ}$	$ȵ^d/ȵ^{dʑ}$
palatal	-	-	-	$ɲ^j$
velar	$ŋ^g$	$ŋ^g$	$ŋ^g$	$ŋ^g$

Shanxi has the richest inventory of post-oralized nasal consonants among the investigated four dialect groups. Pingyao (PY) has poststopped nasals in five places of articulation; Wenshui (WS) has poststopped nasals in four places of articulation, and a post-fricated/affricated alveolar nasal; Linfen has poststopped nasals in four places of articulation. The two speakers (FYM & FYF1) from downtown Fenyang (D. FY) have an inventory of post-oralized nasal consonants identical to that of the Wenshui speaker, but another speaker from a rural area (R. FY) has a different inventory. See Table 1 for details.

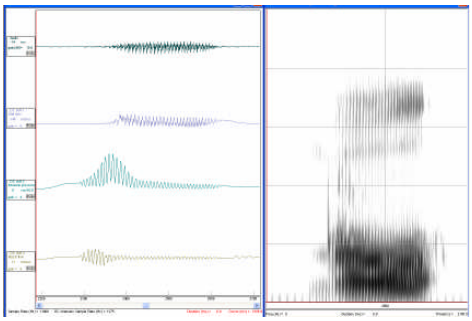
Acoustically, the production of Shanxi poststopped nasals is characterized by a strong burst and an abrupt energy drop during consonant release, indicating an oral release of the stop. Aerodynamically, there is a certain amount of nasal flow during the closure portion of the consonants, indicating the presence of the nasal. Typically, nasal flow diminishes when the oral release begins[2].

Figure 1 is a typical case for the production of Shanxi poststopped nasals. In the figure, the upper panel (a) shows the acoustic data: the audio and corresponding wideband spectrogram with the intensity envelope superimposed; the lower panel (b) shows the aerodynamic data: the audio, oral flow, intraoral pressure and nasal flow (left), and the corresponding wideband spectrogram. As can be seen from the figure, there is intraoral pressure build-up for the postsopped nasal and the pressure reaches its peak immediately before oral release.

Figure 1a: The audio and wideband spectrogram for [m^bu] from PYM.



1b: The audio, oral flow, intraoral pressure, nasal flow (left), and wideband spectrogram (right) for [m^bu] from PYM.



And interesting stop/affricate alternation is detected in the production of the retroflex and alveolopalatal nasals in Shanxi. Figure 2 shows an example for the alternation of poststopped/post-affricated retroflex nasal in Pingyao: [$ɳ^d$ɑŋ] (left)

and [ɳ^{dz}ɑŋ] (right). [ɳ^{dz}ɑŋ] differs from [ɳ^{d}ɑŋ] mainly in that [ɳ^{dz}ɑŋ] has a certain period of frication after oral release. The fact that [ɳ^{dz}ɑŋ] has an apparently greater amplitude drop than [ɳ^{d}ɑŋ] suggests that oral release is stronger for the post-affricated nasal than for the poststopped nasal.

Figure 2: The audio and wideband spectrogram for [ɳ^{d}ɑŋ] (left) and [ɳ^{dz}ɑŋ] (right) from PYM.

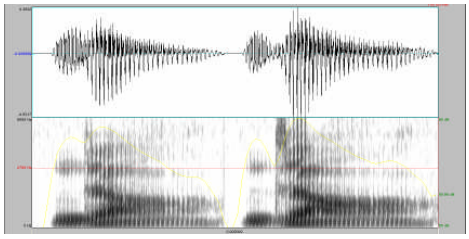


Figure 3: The audio and wideband spectrogram for [n^{z}ɿ] (left) and [n^{dz}ɿ] (right) from FYM.

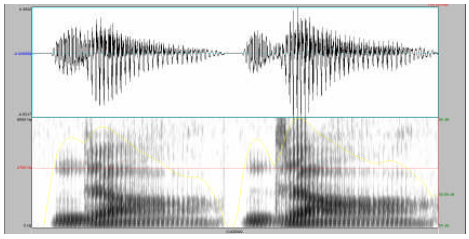


Figure 4: The audio, oral flow, intraoral pressure, nasal flow (left), and wideband spectrogram (right) for [m^{b}u] from TSM.

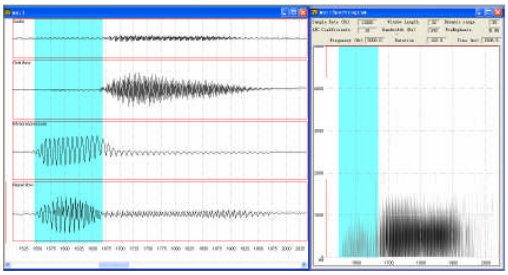
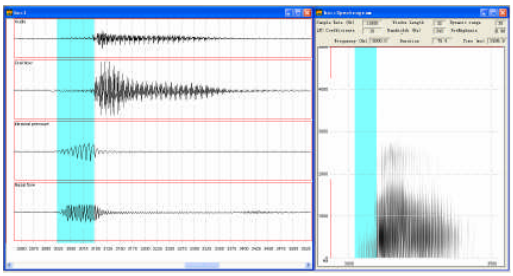


Figure 5: The audio, oral flow, intraoral pressure, nasal flow (left), and wideband spectrogram (right) for [m^{b}o] from HKM.



The Shanxi post-fricated nasal alternates with post-affricated nasal, too. Figure 3 shows an example from FYM. A post-fricated nasal differs from a post-affricated nasal in that the former has a weak oral release while the latter has a strong oral release. As shown by the superimposed energy envelopes, there is little drop in amplitude for [n^{z}ɿ], but an apparent drop in amplitude for [n^{dz}ɿ].

The examined Cantonese and Hakka dialects have three poststopped nasal consonants [m^{b} n^{d} ŋ^{g}].

Figure 4 and Figure 5 show examples for the poststopped labial nasal from Taishan Cantonese and Hakka, respectively. As can be seen from the figures, the Cantonese and Hakka data display a pattern similar to the Shanxi data. That is, for the production of poststopped nasals, the nasal flow continues until oral release begins, suggesting that only the release of the sound has acquired orality.

3.2. Southern Min

Xiamen has three pre-nasalized stops [^{m}b ^{n}d ^{ŋ}g]. And the southern Min dialects around the Chao-Shan area have an additional pre-nasalized alveolar fricative/affricate [^{n}z]/[^{n}dz].

Figure 6: The audio, oral and nasal flow (left), and wideband spectrogram (right) for [^{m}bi] from STM2.

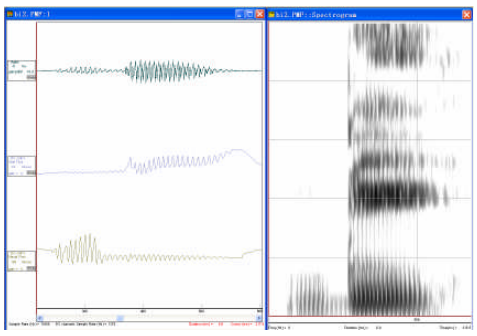


Figure 7: The audio, oral and nasal flow (left), and wideband spectrogram (right) for [^{n}dzi] from CYM.

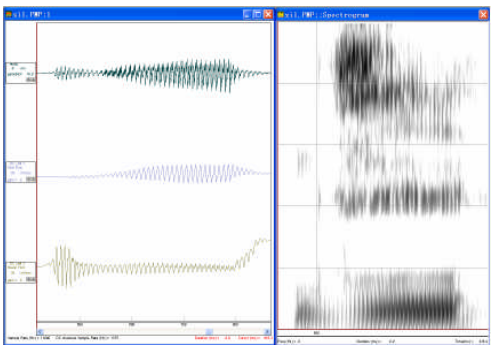


Figure 6 is a typical case for the production of southern Min pre-nasalized stops. It can be seen from the figure that (1) there is a short period of nasal flow before stop release; (2) the amplitude of

nasal flow is smaller than that in Shanxi, Cantonese or Hakka, suggesting low nasality (see 3.3 for the quantitive data); (3) there is an interval between the diminution of nasal flow and stop release, indicating a transition from a nasal to an oral stop. That is, not only the release but also part of the original nasal has acquired orality.

As in Shanxi dialects, [^{n}z] and [^{n}dz] are free variants in Shao-shan southern Min. But it should be noted that the affricate occurs more frequently than the fricative in Chao-Shan southern Min. Figure 7 shows an example for [^{n}dzi] in Chaoyang.

3.3. Inter-dialectal comparison and discussion

It has been shown thus far that for the post-oralized nasals in southern Min, both the release and part of the nasal closure have acquired orality, with the nasality being present at the beginning part of the sound. In other words, the sound is composed of an oral stop or fricative/affricate with a preceding nasal, i.e., a prenasalized consonant. But in the other dialect groups, only the release of the sound acquires orality, 'so that air flow is shunted almost instantaneously from a nasal escape to an oral one, without the overlapping of nasal and oral closures that occurs in a prenasalized [consonant]' ([14]: 281). Following [14], the post-oralized nasals in Shanxi, Cantonese and Hakka might be termed as "orally released nasals". As indicated by the presented aerodynamic data, there is a transition from a nasal to an oral stop in a prenasalized consonant but not in an orally released nasal.

To explore further differences between orally released nasals and prenasalized consonants, the duration and nasality of the nasal portion in the post-oralized nasals were measured. The average nasal flow velocity was used as an indicator of nasality in this study. The measurements are averaged across all the repetitions and all the speakers for each category of post-oralized nasal consonants for each dialect group. The results show that the mean duration for the nasal portion in the post-oralized nasals ranges from 73 to 94 ms in Shanxi, from 89 to 99 ms in Cantonese, from 66 to 81 ms in southern Min, and from 74 to 80 in Qingxin Hakka. That is, the duration in Shanxi and Cantonese is relatively greater than that in southern Min and the Qingxin Hakka. As for the nasality, all the prenasalized consonants in southern Min have a mean average nasal velocity (ranging from 52 to 86 ml/sec) pronouncedly smaller than that in any other dialect groups (ranging from 166 to 483 ml/sec in Shanxi, from 160 to 227 in Cantonese, and from 352 to 512 in Hakka). In short, the nasal portion on a prenasalized consonant has lower nasality than that on an orally released nasal.

4. CONCLUSION

In summary, the post-oralized nasal consonants in Shanxi, Cantonese and Hakka merely acquired orality at release, whereas the orality has spread from the release to the closure portion of the post-oralized nasal consonants in southern Min, suggesting that southern Min is at a late stage of denasalization while the other dialect groups are at an early stage from a diachronic point of view.

5. REFERENCES

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[1] The retroflex is, in fact, an apico-postalveolar sound.

[2] Sometimes nasal flow continues to some extent after oral release in some Shanxi, Cantonese and Hakka speakers, indicating the presence of nasality spreading from the nasal to the following vowel. This implies that there is merely momentary closure of the velo-pharyngeal port at oral release.