AN ANALYSIS OF SONORANT NASALITY IN BEIJING MANDARIN

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ABSTRACT

With the Nasometer, this paper studies the nasality contrast of liquid initials and the intrinsic nasality of seven cardinal vowels in Beijing Mandarin. The results show that the nasality contrast degree of initial consonants is high. The intrinsic nasality of vowels is closely related to the position of the tongue. The lower and more front the tongue is, the greater the degree of nasalization; the higher and more back the tongue is, the lower the degree of nasalization. The nasals and non-nasals have their own critical nasality values, where there is a gap between nasals from non-nasals, and the nasalized vowels distribute among the gap of the critical values.

Keywords: Beijing Mandarin, initials, nasality contrast, vowel, intrinsic nasality

1. INTRODUCTION

Nasality and nasalization are important linguistic phenomena that have attracted academic attention extensively.

The oral cavity and the nasal cavity are correlated. In practice, the nasal cavity works while articulating orals, and the oral cavity works while articulating nasals. By using the Nasometer, this paper carries out preliminary research on the degree of nasality in the sonorant part of the monosyllables in Beijing Mandarin (including both consonants and vowels).

2. THE EXPERIMENT

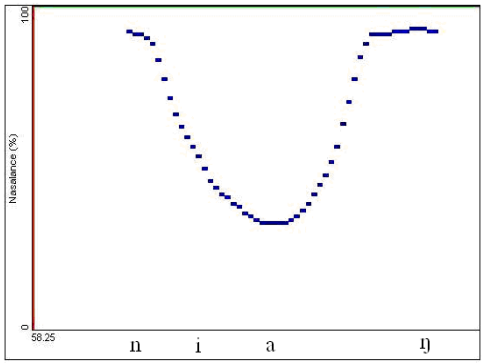
The testing materials in this study are monosyllabic words of Mandarin. The subjects were ten Beijing natives, five males (numbered from 1-5), and five females (numbered from 6-10); their average ages range from 20 to 22. Their parents are all native Beijing Mandarin speakers.The recording was carried out in a phonetics laboratory by using a Kay Nasometer II6400 to record and analyze.

Nasalance with Nasometer is the nasalization degree when pronunciation. It is the proportion the nasal energy occupies in the entire oral and nasal acoustic energy. The formula is as below:

(1) $N = 100 \times n / (n + o)$

The letter 'n' refers to the nasal acoustic energy, and 'o' the oral acoustic energy. N lies between 0-100%; the larger the value, the stronger the nasal acoustic energy and the higher the nasalance value. The nasalance contour is a graph of nasalance values as a function of time .The figure1 is the nasalance contour of the Beijing Mandarin utterance "niang2".

Figure 1: Nasalance contour for the Beijing Mandarin utterance "niang2".



In figure1, the starting point of the curve is high, it gradually drops down and then rises again. This reflects the changing nasalance from the high nasal acoustic energy in the initial /n/ to the lower nasal acoustic energy in the vowels /i/, /a/, and then to the high nasal acoustic energy of /ŋ/. Clearly, nasal acoustic energy is low in the vowels, and high in the nasal consonants.

3. NASALANCE IN APPROXIMANT INITIALS

3.1. The nasalance of the approximant initials

What the nasometer collects are the data of the sound energy under the stipulation that the vocal cords vibrate, so that nasalance shows mainly the degree of nasalization in voiced sounds. The nasometer cannot produce a meaningful nasalance measure for voiceless sounds, so there is no relevant data and nasalance contour. In this respect

the nasalance contour is similar to the tone contour—only the voiced parts show up while the voiceless parts are blank.

In Beijing Mandarin, the nasal onset consonants are /m/ and /n/; the oral onset sonorants are /l/ and /r/. They can be categorized as Approximant initials. Table 1 shows the average N value of approximant initials of the 10 speakers.

Table 1: The nasalance of approximant initials of Beiing Mandarin.

speakers	approximant initials			
	m	**n**	**l**	**ɾ**
Mean	**91(4.2)**	**93(3.4)**	**27(7.6)**	**25(7.0)**

From table 1 we can see the difference between the nasality degrees of /m, n/ on the one hand and /l, r/ on the other. We have make the analysis of variance (ANOVA) and the results show that the difference of the main effect is obvious, with nasal/oral as one factor and type (m versus n, and l versus r) as a second factor, both within subjects. The RM-ANOVA show that the nasal/oral difference is highly significant.

In the Beijing consonant system, the sound of /l, r/ does not have its series of phoneme aggregation, so the aggregation degree is the smallest and there are more phoneme varieties. Correspondingly, their nasalance data are scattered with bigger standard deviation.

3.2. The contrast nasalance

From table 1, we can get the whole contrast nasalance of the nasal initials and oral onset sonorants. In Beijing Mandarin, the average nasalance value of the two nasal initials /m/ and /n/ is 92. And the average nasalance value of the two oral onset sonorant /l/ and /r/ is 26. Then we can get the contrast nasalance of the nasal initials and oral onset sonorants, that is 92－26=66. The data show the difference of the average nasalance of nasal initials and oral onset sonorant in Beijing Mandarin and represents the whole contrast nasalance.

Next we can observe the contrast nasalance of specific sounds. The contrast nasalance of /n/ and /l/ is 93－27=66. And the contrast nasalance of /n/ and /r/ is 93－25=68. The contrast nasalance of /l/ is lower than that of /r/. The contrast nasalance of the individual sound is related to the whole contrast nasalance, but their functions are different. The individual contrast nasalance shows the specific initial consonants' features and reflects the individual difference of different initial consonants. The individual contrast nasalance is the major measuring symbol of different initial consonants.

From the above analysis, we can make the conclusion that the bigger the contrast nasalance is, the much clearer the distinction between the nasal and non-nasal sounds is, vice verse. And to a certain extent, the combination of phonemes occurs.

4. THE INTRINSIC NASALITY OF VOWELS

4.1. The intrinsic nasality of vowels

There are seven basic vowels in Beijing Mandarin (also called 'simple vowels'), viz. /a, i, u, y, ɤ, ɿ, ʅ/ (see [8]). The average N value of each basic vowel of ten speakers can be seen in Table 2.

Table 2: Nasalance Beijing Mandarin vowels.

speakers	nasalance of vowels						
	a	**i**	**y**	**ɤ**	**u**	**ɿ**	**ʅ**
Mean	**29(6.7)**	**25(10.3)**	**19(8.3)**	**7(2.0)**	**9(4.3)**	**11(4.9)**	**11(6.1)**

From table 2 we can find rules: The nasalance of the back high vowel /u/ and back half-high vowel /ɤ/ and the apical vowels /ɿ/ and /ʅ/ is low and stable; that of the front high vowels /i/ and /y/, and the low vowel /a/ is higher and more variable.

Because the nasalization of different vowels cannot be caused by external factors but has to be due to an internal phenomenon. We define the nasalance of the vowel itself as its intrinsic nasality, just like different vowels have their own intrinsic pitches; this is also a natural property of sounds.

The intrinsic nasality of different vowels has its physiological causes. [2, 5, 6] have done experiments and pointed out that "while producing mid and low vowels, it is more possible for the soft palate to fall" (see [4] p. 59-60). From our experiment, we conclude that this is only one kind of state. While articulating, the opening and closing of the mouth and palatoglossus be more flexible, especially with high front vowels and mid-low vowels.

4.2. The critical value between nasals and orals

According to the average N values of the 10 speakers, among the non-nasal sounds, the nasalance of the vowel /a/ is the highest with a value of 29; the nasalance of the liquid /l/ is the highest with a value of 27, that of /r/ is little lower

with a value of 25. Therefore, the N value 40 can be considered as the critical value of non-nasals. Below 40, a sound is categorized as non-nasal; for the nasals, the nasalance of /m/ and /n/ is 91 and 93 respectively, so the N value 80 can be considered as the critical value of nasals. Over 80, a sound is categorized as nasal. It is probable that the distinction between the nasals and non-nasals are the distributive scope of nasalized vowels and other nasalized sounds. Note that this is still an absolute threshold. It is not relative.

5. THE DISTRIBUTION OF VOWELS WITH NASALIZED CODA

5.1. Nasalance of vowels with nasalized coda

In Beijing Mandarin, the vowels with a nasal in the coda will be influenced and nasalize to some degree. We chose the vowels with nasal codas in order to measure the nasalance of five vowels /aŋ/, /ɤŋ/, /iŋ/, /uŋ/, and /yŋ/. The result can be found in Table 3.

Table 3: Nasalance of vowels preceding nasal codas.

speakers	initial vowel				
	a(ŋ)	**ɤ (ŋ)**	**i(ŋ)**	**y(ŋ)**	**u(ŋ)**
Mean	**47(7.8)**	**49(3.5)**	**55(11.9)**	**51(9.7)**	**47(6.9)**

From table 3 we can see that compared with the simple vowels, the nasalance of the vowels with nasalized coda is increased; most exceed the critical value 40 and become a nasalized vowel. Compared with the nasalance of the basic vowels in Beijing Mandarin in table 2, the position of the nasalance of the vowel /ɤ̃/ increases because when uttering nasalized vowels, the tongue position is lower and gets closer to the center, compared with its tongue position in producing simple vowels. (see [8]).

5.2. Continuity between nasalized and non-nasalized sounds

In this section, the N-values of nasalized vowels are between 40 and 80, which conform to the two critical values postulated. The finding implies that there are other sounds, such as nasalized vowels, which lie in the gap between nasalized and non-nasalized sounds. There is continuity between the nasal and non-nasal sounds.

5.3. Related research on the different nasalized vowels

Wang [9] pointed out: "General Phonetics has shown that high vowels are not easily nasalized" (p. 24), which claim is supported by the results of the present paper. Fung [3] studied the nasalance of simple nasalized vowels in Beijing Mandarin and Hong Kong Cantonese by studying the airflow of oral and nasal sounds. He concludes that "Low vowels are the easiest to be nasalized". In Beijing Mandarin, different speakers show different representations and the experimental results are different, too.

Studies of the attrition of the nasalized coda in Chinese dialects show the nasalized coda after low vowels is more prone to disappear ([1, 7]). Our results on nasalance values of the various vowels show that the diachronic evolution and synchronic representation correspond.

6. CONCLUSION

With the Nasometer, we studied the nasalance of basic vowels and Approximant initialsin Beijing Mandarin. The bigger the nasalization contrast is, the more obvious the difference between the nasals and the non-nasals is. Approximant initials in Beijing Mandarin have a high degree of nasalization contrast according to the experiment. Evolution of nasals is an important issue in the historical study of Chinese sounds. The confusion of nasals and laterals in some dialects is because of the increasing nasalance of the laterals.

Different vowels have their own intrinsic nasality values, which are related to the tongue position of vowels. The lower and more front the tongue position, the higher the nasality is; the higher and more back the position of the tongue, the lower the nasality is. The intrinsic nasality of vowels is an innate feature of sounds.

The nasality of nasal sounds is relative to the critical N value, 80; while the critical N value for non-nasal sounds is 40. There is a gap between two critical values and the values of nasalized vowels lie in the gap.

7. REFERENCES

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