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The Nasality of Voiced Stops and Vowels in Taiwan Min Revisited*

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This study used an identification test technique to investigate whether native speakers of Taiwan Min treat nasal and oral consonants and vowels as distinct entities. Thirty subjects were asked to judge whether pairs of two-syllable words contained the same sound. In one part of the test, they were asked to judge if the first sounds (which were consonants) were the same, while in another part of the test, they were asked to judge if the second sounds (which were vowels) were the same. The results showed that the subjects treated the nasal-oral consonant pairs neither as containing the same sounds nor as different sounds. More specifically, the subjects rejected the [l/n] pair; but the subjects' answers were unsure for the [b/m] and [g/ŋ] pairs. This result, we surmise, may have been due to the fact that these pairs of sounds are 'phonetically' different, and such phonetic difference may have influenced the subjects' judgments. In testing vowels, on the other hand, the number of positive answers for the test items is significantly higher than that of the negative answers. This single fact suggests that the subjects regarded the nasalized vowels and their oral counterparts as belonging to the same categories. Thus the conclusion in Wang 2001 is further confirmed.

Key words: Taiwan Min, nasality, consonant, vowel, identification test

1. Introduction

Taiwan Min is a Chinese dialect spoken by a majority of people in Taiwan. The language is known to have nasal and oral vowel distinctions. Thus, [ti33] 'chopsticks' and [tĩ33] 'full' are distinctive from each other phonetically simply by the fact that the vowel in the latter

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word is nasalized while it is not in the former word.

In conjunction with this fact, the voiced stops [b, l, g][1] occur before oral vowels, as in [bi33] ‘smell’, [li24] ‘separate’, [gɔ33] ‘five’, whereas their nasal counterparts [m, n, ŋ] occur before nasal vowels, as in [mĩ33] ‘noodles’, [nĩ24] ‘year’, [ŋɔ̃33] ‘mistake’. This complementary distribution has led the traditional linguists to assign nasality in vowels as underlying, and that in consonants as derived by assimilation (Tung 1957). However, there have been claims recently that nasality in Taiwan Min is an autosegment (Li 1990, Wang 1995). Recent experiments (see section 1) have shown that the native speakers regard the nasal consonants and the nonnasal voiced stop consonants as basically the same, and the nasal vowels and the oral vowels as not distinguishable, which seem to point to the possibility of nasality as an autosegment. This present study aims at validating such evidence.

2. Previous Studies

2.1 Studies on voiced stop consonants

Pan (1996) explored the [b-m] alternation using the concept formation paradigm in which two syllable stimuli were presented to the subjects. The subjects were asked to identify the initial sound of the second syllable (e.g. the [b] in [tsia bi] ‘eat rice’). The subjects were divided into two groups. In Group I (her Experiment I), the subjects were asked to form the concept [b-m], with positive items containing either [b] or [m] in the target position. In Group II (her experiment II), the subjects were asked to form the concept [b], with syllables containing [m] among the negative items. The results showed that the [b] group (Group II) performed far more poorly than the [b-m] group (Group I): Group I subjects were able to form the concept a lot more quickly and responded a lot more accurately than Group II subjects. Thus Pan concluded that the [b] and [m] sounds were variants of the same phoneme.

Wang (1999) on the other hand, tested three groups of subjects, using a different format of the concept formation paradigm. Group I subjects in this experiment were trained to respond to [b] sound in the initial position of two-syllable words. In the learning session, they were asked to respond with ‘Yes’ to the positive stimuli and ‘No’ to others. In the test session, the subjects were observed how they reacted to items containing [m] in the target position. Group II subjects were trained to respond positively to items containing [l] in the target position, and were observed how they reacted to items containing [n] in that position. Group

[1] [l] is technically not a stop, but in terms of the phonological pattern of the language, the phoneme is commonly treated as a stop. In some people’s speech, the phoneme is pronounced as a stop.

III subjects were trained to respond positively to items containing [g] in the target position, and were observed how they reacted to items containing [ŋ]. The results showed that the subjects overwhelmingly treated [b] and [m] as the same phoneme. The tendency to treat [g] and [ŋ] is slightly less, but there is still no mistake that the subjects regarded these two sounds as the same phoneme. On the other hand, the [l] and [n] sounds are pointing to the other way: the subjects tended to regard them as two separate phonemes. The conclusion drawn from the study is that voiced stops and nasals are basically the same phonemes, with the exception of the [l-n] pair, which may have been influenced by the Mandarin phonological system.

2.2 Study on nasal vowels

Wang (2001) is a sequel to Wang (1999). Since voiced stops and nasals are basically the same phoneme, then according to the segmental theory, the nasality must reside in the vowels. Wang (2001) thus attempted to test if the subjects treated the nasal vowels as different phonemes from their oral counterparts. The same concept formation paradigm was used. Four groups of subjects were recruited, each working on the [i-ĩ], [e-ẽ], [ɔ-ɔ̃] or [a-ã] pair. The results showed that the subjects overwhelmingly treated the nasal vowels as not distinguishable from their oral counterparts.

The results from these latter two studies seem to suggest that nasality is not a segmental phenomenon, but rather a syllable phenomenon. However, a question remained of the experimental artifact. Since the subjects in both studies were asked to identify if the initial part of the two-syllable word contains a certain consonant or vowel, it is possible that the subjects treated nasal consonants and vowels as 'containing' the oral targets.[2] Thus the following experiment is designed to resolve this possibility.

3. The Experiment

In this experiment, we asked the subjects to identify whether two sounds in a pair of two syllable words are 'the same'. For example, is the first sound in [ma55 co51] '(a goddess)' the same as the first sound in [bo33 cing24] 'pitiless'? In this way the question of 'containing' can be avoided.

[2] We appreciate Ching-ching Lu for pointing out this possibility.

3.1 Subjects

Thirty students from Tsing Hua, Chiao Tung and Feng Chia universities were recruited as subjects, all of whom were native speakers of Taiwan Min. They took part in the experiment voluntarily and received a small payment. Each subject was tested individually.

3.2 Procedure

There were two parts in the experiment, each containing 34 items. The first part tested the consonants, and the second part tested the vowels. Each item contained two two-syllable words. In the first 18 items of both parts, there were 9 positive control items which contained identical consonants or vowels in the first syllables, whereas there were 9 negative control items, separately randomized for each part. The latter 16 items differed somewhat between the two parts. In Part I there were 5 positive and 5 negative control items as in the first 18 items. The remaining 6 items were the test items in which one of the first syllables contained a voiced stop while the other contained a nasal counterpart. Among these 6 items, there were two each for the [b-m], [l-n] and [g-ŋ] pairs. In Part II there were 4 positive and 4 negative control items as in the first 18 items. The remaining 8 items were the test items in which one of the first syllables contained an oral vowel while the other contained a nasal counterpart. Among these 8 items, there were two each for the [i-ĩ], [e-ẽ], [ɔ-ɔ̃] and [a-ã] pair. In order to make sure that the subjects were responding to the target, all control items in Part I shared only the consonants in the first syllables and differed in the vowels and tones, and all control items in Part II shared only the vowels in the first syllables and differed in the consonants and the tones. In this way when the subjects answered ‘Yes’ to the item, it could only be the target sound that they identify as ‘the same’. Similarly, the test items in Part I differed in vowels and tones in the first syllables, and those in Part II differed in consonants and tones in the first syllables. The presentations of the test items were arranged such that half of the items contained the nasal elements in the first word and half in the second word. Thus, while one item contained the [b-m] pair in that order, the other item used the [m-b] order. These items were also separately randomized for each part. For a list of the stimuli used in the experiment, see Appendix.

The subjects sat in a quiet room and listened to the stimuli played from the tape. They indicated their answer to each item by circling ‘○’ when they think the sounds are the same, and by crossing ‘╳’ when they think they are different.

3.3 Results

We set 70% items correct on the control items in the latter 16 items as the criterion, that is, more than 7 correct items in Part I and more than 6 correct items in Part II. We did so to ensure that the subjects really understood what was required of them to make the answers. We found that 29 subjects reached this criterion in Part I and 28 subjects did so in Part II. Table 1 shows the results from Part I.

Table 1: Number of subjects who answered 'Yes' to each item in Part I. (N=29)

	Mean	Range
The first 18 items		
Positive control items	23.78	11–29
Negative control items	2.89	0–7
The latter 16 items		
Positive control items	25.40	14–27
Negative control items	1.20	0–5
Test items	12.00	4–18

The number of positive responses to each item is listed in the Appendix. In the training session of Part I, the positive items all received more than 25 correct responses except two items. Among these two, one of them compared between [si] and [su] (No. 18), which received only 11 positive answers. This is probably because of the fact that the [s] in [si] is palatalized, and was treated differently from the [s] of [su], which is labialized. The other item involved [ki] and [ku] (No. 7), and was responded positively only 15 times. This may also be because of the fact that the [k] in [ki] is palatalized and the [k] in [ku] is labialized. On the other hand, the negative items all received 7 positive answers or less.

In the test session, of the five positive control items, three received 27 positive answers or more. Of the other two, one item which compared [gi] and [ge] (No. 23) received 20 positive responses. The positive answers are still significant. The remaining item (No. 32), which compared [tsa] and [tsi] received 14 positive answers. Again, this may be attributed to the palatalization of [ts] in [tsi]. In contrast, the five negative control items all received no more than 5 positive responses; in fact, three of the items received **no** positive responses at all.

Thus it seems that the subjects were performing as expected. On the basis of this understanding, we examine the subjects' performances on the test items. The two items which contrasted [b/m] (Nos. 28 and 31) received 16 and 18 positive answers respectively ('Yes' > 'No', Cochran's Q=.500, $p > .1$). The two items which contrasted [l/n] (Nos. 25 and 34)

received 15 and 4 positive answers respectively ('No' > 'Yes', Cochran's Q=9.308, p < .01). The two items which contrasted [g/ŋ] (Nos. 22 and 26) received 10 and 9 positive answers respectively ('No' > 'Yes', Cochran's Q=.077, p > .1). Considered as a whole, the average scores of positive answers of the test items differed significantly from those of the positive items (Friedman χ^2=24.143, p < .001); however, they also differed significantly from those of the negative items (Friedman χ^2=19.593, p < .001).

These numbers show that with the exception of [b/m], the subjects seemed not to have considered the nasal consonants to be the same as their nonnasal counterparts.[3] This result is at odds with Wang (1999), where we found that the subjects considered [b/m] and [g/ŋ] to belong to the same phoneme, while [l] and [n] are considered to be separate phonemes. This difference may have been due to the fact that the subjects were required to performed two different tasks. In Wang (1999) the subjects were asked to identify if a certain sound existed in the syllable, whereas in the present experiment the subjects were asked to tell if the two sounds were the same. When the subjects were asked to tell if the sounds were the same, phonetic (nonphonemic) details might have affected the subjects judgments, as in the case of [si] and [ki] suggested above. On the other hand, when the sounds are phonetically different, as in the case of [b/m], but they were nonetheless judged as the same, we can be sure that the subjects based the judgment on phonemic grounds.

The results from Part II are summarized in Table 2.

Table 2: The number of subjects who answered 'Yes' to each item in Part II (N=28)

	Mean	Range
The first 18 items		
Positive control items	25.90	22–28
Negative control items	2.00	0–5
The latter 16 items		
Positive control items	25.50	24–28
Negative control items	1.75	1–3
Test items	20.75	14–26

As can be seen, the control items all performed as expected. In the first 18 items, all positive control items received 22 positive answers or more, and all negative items received 5

[3] We should also observe that although these test items were not answered like positive control items, they were not like negative control items either, as the negative control items received less than 2 positive answers in average in the latter 16 items, while the test items received 12 positive answers. In fact, the Friedman Test also showed significant difference between test items and negative control items (χ^2=19.593, p < .001).

positive answers or less. In the latter 16 items, all positive control items received 24 positive answers or more, and all negative control items received 3 positive answers or less. Compared with these results, the test items received about 21 positive answers in average, with at least 14 (half) positive answers to each test item. This response pattern is less ideal than the positive control items, but is obviously a lot different than negative control items. The Friedman Tests also showed this fact: test items vs. positive control items $\chi^2=7.2$, $p < .01$; test items vs. negative control items $\chi^2=28.0$, $p < .001$. Although the χ^2 were all significant, it is easy to see that the χ^2 value between test items and positive control items was a lot smaller than that between test items and negative control items. This means that the test items were more like positive control items than negative control items. If we consider the fact that the subjects' judgments may have been influenced by phonetic details, and adjust the α level to .005, then we will obtain a nonsignificant difference between test items and positive control items, while that between test items and negative control items remains significant. A Cochran test also showed that the number of 'Yes' answers was significantly higher than the number of 'No' answers (Q=24.927, $p = .001$)

4. Conclusion

In this study, we used a different experimental paradigm than concept formation to test if the subjects considered the voiced consonants to be the same as the nasal consonants, and if the subjects considered the oral vowels to be the same as the nasal vowels. The results showed that the subjects did not consider the voiced consonants to be the same as the nasal consonants, but they did not consider them to be different either. Their judgments were equivocal, leaning toward the negative side. This result contradicts Wang (1999), but since we found that the subjects' judgments may have been influenced by phonetic detail differences, we decide that the result is not conclusive.

On the other hand, the subjects did not consider the oral vowels to be the same as the nasal vowels, but they did not consider them to be different either. However, observing the numbers of positive answers and the χ^2 scores, we judge that the subjects tended to accept the oral vowels to be the same as nasal vowels. If so, the results coincides with Wang (2001), and the traditional view that nasality resides in vowels should be rejected.

Based on these findings, it seems reasonable to argue that nasality does not reside in the segment, either the consonant or the vowel. The nasality property can be more properly regarded as an autosegment, and realized as nasal segments.

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Appendix: List of Items Used in the Experiment

Part I: Consonant Identification

Instruction: (In Chinese)

In this experiment we want to find out how Taiwan Min speakers treat speech sounds. The experiment contains two parts. The first part has 34 items, each with two two-syllable words. We ask you to identify if the first sound of the first syllables are the same. For example:

[ke33 k'i21] 'machine' [kɔ̃55 i21] 'good-willed'

Are the first sounds of the first syllables in these two words the same? And for example:

[pan33 gi24] 'cheap' [gan55 kong55] 'vision'

Are the first sounds of the first syllables in these words the same?

Please use circle '○' or cross '╳' to indicate your answers. If you have any questions, stop the tape recorder.

(The number in square brackets in front of each item is the number of people who chose 'Yes' for that item. The last column is the expected answer. N=29)

A. Training Session

[1]	1.	bɔ̃55 kiã51	'wife and child'	t'ĩ21 sã55	'sew clothes'	NO
[7]	2	pe21 bu51	'parents'	p'e33 tsua51	'letter paper'	NO
[28]	3	t'e55 lat33	'body strength'	t'ao33 ke55	'boss'	YES
[0]	4	k'e51 k'i21	'polite'	hap3 tsɔ̃k31	'cooperate'	NO
[25]	5	te21 kiu24	'earth'	tĩ33 kue51	'sweet cake'	YES
[3]	6	si33 kue55	'watermelon'	t'i51 tiŋ̃55	'nail'	NO
[15]	7	ku21 ts'u21	'old house'	ki33 t'a55	'others'	YES
[26]	8	pẽ21 laŋ̃24	'patient'	pa33 kiet31	'flatter'	YES
[2]	9	lɔ̃21 tiŋ̃55	'road lamp'	tu55 ho51	'just right'	NO
[4]	10	tsu33 pi55	'benevolence'	sao51 ts'iu51	'broom'	NO
[25]	11	bak21 tsui51	'ink'	bu55 su33	'fighter'	YES
[29]	12	mɔ̃33 pẽ33	'defects'	mã55 siɔŋ̃33	'right away'	YES

[2]	13	lOO33 tsai24	‘lackey’	p'OO55 t'ONN55	‘ordinary’	NO
[3]	14	ka33 tiNN24	‘family’	pa55 bin24	‘good sleep’	NO
[26]	15	lim33 si24	‘temporary’	le55 but33	‘gift’	YES
[4]	16	k'OO55 lian24	‘pitiable’	ki51 tsia51	‘news reporter’	NO
[29]	17	k'ao55 tsai24	‘eloquence’	k'e51 k'i21	‘polite’	YES
[11]	18	si33 kan55	‘time’	su21 sian55	‘before hand’	YES

B. Test Session

[5]	19	tsOO55 sian55	‘ancestor’	ts'am33 ka55	‘participate’	NO
[29]	20	ts'ao55 te33	‘lawn’	ts'OO33 iONN51	‘sturdy’	YES
[0]	21	nẽ33 sã55	‘air-dry clothes’	kun33 tsu51	‘gentleman’	NO
[10]	22	gak21 tui33	‘band’	Nãũ33 ti55	‘tickle’	TEST
[20]	23	ge21 sut33	‘art’	gi33 lan24	‘I-lan’	YES
[1]	24	sim33 tsiNN24	‘mood’	gOO21 hue33	‘misunderstanding’	NO
[15]	25	nã33 kiu24	‘basketball’	lONN21 hui21	‘wasteful’	TEST
[9]	26	Nẽ51 ts'ai21	‘pick food’	gu33 ba?21	‘beef’	TEST
[27]	27	hOO51 tao51	‘thick-chinned’	hu33 ts'e5	‘husband and wife’	YES
[16]	28	mã55 tsOO51	‘a goddess’	bo33 tsiNN24	‘merciless’	TEST
[0]	29	t'OO55 te33	‘land’	pOO51 ts'an24	‘sow in the field’	NO
[0]	30	ho55 laNN24	‘good man’	su33 siONN51	‘thought’	NO
[18]	31	ba51 tsaNN21	‘rice dumpling’	mẽ21 laNN24	‘revile’	TEST
[14]	32	tsa55 k'i51	‘morning’	tsi33 ts'i24	‘support’	YES
[27]	33	p'i33 k'i21	‘temper’	p'a51 kiu24	‘play ball’	YES
[4]	34	la51 sap31	‘garbage’	nĩ33 kOO55	‘nun’	TEST

Part II: Vowel identification

Instruction

The second part also contains 34 items. We would like you to identify if the second sound of the first syllables are the same. For example,

[k'i55 ko55] ‘tooth paste’ [ti21 liau24] ‘treatment’

What are the second sounds of the first syllables? Are they the same? Also,

[to21 gi33] ‘moral justice’ [bi55 kok31] ‘the United States’

Are the second sounds in the first syllables the same?

Please use circle '○' or cross '╳' to indicate your answers. If you have any questions, stop the tape recorder.

(The number in square brackets in front of each item is the number of people who chose 'Yes' for that item. The last column is the expected answer. N=28)

A. Training Session

[4]	1	lOO21 tsui51	'dewdrops'	gu33 ts'ia55	'ox cart'	NO
[1]	2	pi55 kau21	'compare'	k'o33 hak33	'science'	NO
[26]	3	hi33 baNN33	'hope'	ts'i51 kik31	'stimulate'	YES
[1]	4	k'io51 ts'a24	'collect firewood'	ge33 k'i51	'teeth'	NO
[22]	5	lo51 k'a55	'tall person'	to21 tik31	'morality'	YES
[22]	6	ts'ẽ33 sik31	'green color'	mẽ21 laNN24	'revile'	YES
[0]	7	ti33 ba?31	'pork'	gan55 kONN55	'vision'	NO
[5]	8	ts'i21 tĩũ24	'market'	le55 mãũ33	'politeness'	NO
[27]	9	ts'OO33 taNN33	'heavy'	lOO55 ba?21	'stewed meat'	YES
[27]	10	ge21 sut33	'art'	k'e33 tsui51	'creek water'	YES
[5]	11	tsi55 to33	'guidance'	t'e51 ũã33	'replace'	NO
[27]	12	tĩ33 kue51	'sweet cake'	mĩ21 sũã21	'noodles'	YES
[0]	13	ts'a33 piat33	'difference'	gi21 bu33	'obligation'	NO
[28]	14	ha21 pan55	'off work'	ka51 ts'e21	'teach'	YES
[25]	15	kã55 si51	'dare-devil'	nã33 kiu24	'basketball'	YES
[28]	16	ke55 siau51	'pretend to be crazy'	pe21 bu51	'parents'	NO
[0]	17	tsa55 k'i51	'morning'	tOO21 tsai24	'belly button'	NO
[27]	18	hu51 kui21	'wealth'	tsu21 tONN33	'automatic'	YES

B. Test Session

[18]	19	pOO51 ts'an24	'sow in the field'	NOO55 hiaNN55	'five spices'	TEST
[24]	20	se51 kai21	'world'	t'e55 lat33	'body strength'	YES
[23]	21	sã33 nĩ24	'three years'	k'a51 iu24	'scrounge'	TEST
[1]	22	ts'a33 to55	'wood cutter'	to21 tik31	'morality'	NO
[18]	23	te21 tsu51	'landlord'	ts'ẽ33 sik31	'green color'	TEST
[28]	24	ku21 ts'u21	'old house'	su33 siONN51	'thought'	YES
[20]	25	gi21 bu33	'obligation'	t'ĩ33 kONN55	'God'	TEST

[3]	26	nN̂21 e24	‘two’	nĩ55 sik31	‘dye with color’	NO
[24]	27	gŎ21 hue33	‘misunderstanding’	kŎ33 tĩũ33	‘uncle’	YES
[23]	28	mĩ21 sũã21	‘noodles’	li55 iu24	‘reason’	TEST
[2]	29	hi33 baN̂33	‘hope’	se51 han21	‘small child’	NO
[26]	30	ko33 biN̂24	‘brilliant’	so55 si24	‘key’	YES
[14]	31	tsẽ55 tsui51	‘water from well’	he21 t'ŎN51	‘system’	TEST
[24]	32	mŎ33 pẽ33	‘problem’	pŎ55 tsŎ33	‘subsidize’	TEST
[1]	33	po55 pi21	‘bless’	p'i21 k'aN̂55	‘nostril’	NO
[26]	34	ha21 pan55	‘off work’	mã33 huan24	‘trouble’	TEST

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再論台閩語濁子音與母音的鼻化問題

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本研究利用語音判別的方式探討台閩語子音與母音的鼻音性問題。在實驗中，受試者要判定每一題中兩個雙字詞的語音是否相同。在實驗的第一部份，要判定兩個詞的第一音節聲母是否相同，再第二部分，要判定兩個詞的第一音節韻母是否相同。實驗結果顯示，受試者認為[l]與[n]的聲母是不同的，但在另兩組[b]與[m]以及[g]與[ŋ]結果就不確定。受試者既不認為這兩組音相同，又不認為他們不同。在韻母方面，則傾向於認為鼻母音與非鼻母音是屬於同一個音。

關鍵詞：台閩語、鼻化、子音、母音、判別實驗