Reexamine the Sandhi Rules and the Merging Tones in Hakka Language

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Abstract

This paper tried to probe the merging tones and the application of sandhi rule for unchecked tones (/24/[33] and /33/[33]) in Hailu variety of Hakka language. Generally speaking, the sandhi rule was applied in both the younger (under 30) and the older (above 50) groups. Tone merging phenomenon (/24/[24] merging toward /33/[33]) was not found in the older group. Yet, the merging phenomenon was found in the younger group. The sandhi rule for /24/ and /33/ was not observed in most of the young speakers. It is proposed that the /24/ and /33/ tones were undergoing sound change by the younger generation.

Index Terms: Hakka, sandhi rule, merging tones, sound change

1. Introduction

There are seven lexical tones in Hailu variety Hakka language. These seven lexical tones are /55/, /33/, /11/, /24/, /5/, and /3/ [1, 2, and 3]. The modern researchers might use different tone values, expressed by the Chao-number, to portray these 7 tones. The disagreements are mainly on the rising tone /24/, which is transcribed as /13/ in some literatures [4, 5, and 6].

Although there is a difference between the descriptions of lexical tone values, the difference is subtle. The lexical tones values used in current studies are shown in Table 1. Following Chao-number, the higher the number the higher the f0 values. The tone values are mainly based on [1, 2, and 3], and presented in Chao-number.

Table 1. *Tone types, tone codes, and the tone values.*

Tone Type	Tone Code	Tone Value
High level (HL)	T1	55
Mid level (ML)	T5	33
Low level (LL)	T3	11
Falling (F)	T4	53
Rising (R)	T2	24
High checked (HC)	T6	5
Mid checked (MC)	T7	3

Aside from the lexical tones, there are two sandhi rules in Hailu variety of Hakka language (the sandhi rule for the duplicated phrase is excluded in this paper), and the sandhi rules were listed below:

The first sandhi rule shows a high checked tone /5/ will be changed into a mid checked tone /3/ when it was followed by any other tones.

$$\text{HC tone /5/} + \text{X tone} = \text{MC tone [3]} + \text{X tone} \quad (1)$$

We will focus on the second sandhi rule which shows that a rising tone /24/ will be changed into a mid level tone /33/ when it was followed by any other tones.

$$\text{R tone /24/} + \text{X tone} = \text{ML tone [33]} + \text{X tone} \quad (2)$$

The high numbers of lexical tones which include f0 height contrast between three level tones in Hailu variety of Hakka, make it interesting to probe how native speakers produce a distinction among the seven lexical tones .

Recently, a research of Cantonese indicated that the young-aged (20-25 years old) and mid-aged (35-45 years old) native Cantonese speakers in Hong Kong cannot produce a distinction between the high rising tone /35/ and low rising tone /23/. The same situation was also found on the mid level tone /33/ and low level tone /22/. Though the old-aged native speakers (50-58 years old) had no such mutual confusion in these tones, they had unidirectional tone merging phenomenon. For the old-aged people, the low rising tone /23/ was merged to the high rising tone /35/; the low level tone /22/ was merged to the mid level tone /33/; the low level tone /22/ and mid level tone /33/ were merged to the low rising tone /23/. This research proposed that the unidirectional tone merging in the old-aged speakers in the earlier stage for the mutual tone confusion on the young-aged speakers, and predicted that the high rising tone /35/ & low rising tone /23/ and the mid level tone /22/ & low level tone /33/ would merge as two tones [7]. The merging between /35/ and /23/ tones led to the emergence of a new rising tone of which the tone height resembled the canonical high rising tone, whereas the slope resembled the canonical low rising tone n the production of the young Hong Kong Cantonese speakers (21-24 years old) [8].

Similarly, some researches of Hakka language observed that the tone /22/ (/33/ in the current paper) and tone /31/ (/11/ in the current paper) was merging, and attrition was suggested as the main factor [9]. Besides, it was suggested that the T5 tone (/22/ in the paper) was largely pronounced as T3 tone (/31/ in the paper) across group of different use frequency. Moreover, the T5 tone had been gradually lost and replaced by the T3 tone [10].

Since Hailu Hakka language and Hong Kong Cantonese both belong to Yue language family similar in the complex lexical tone system, we are curious in the current tone system of Hailu Hakka. Are there more possible potential merging tones? If so, in what circumstances will they merge, and they would merge in what direction? Does native speakers' age play a role in the tone merging phenomenon?

2. Methodology

2.1. Subjects

According to the isoglosses defined [11], Hailu Hakka natives speakers were mainly distributed in Hsinchu County. Therefore, all of our subjects were recruited from Hsinchu County. All of them were able to speak Mandarin and Hakka,

but none of them had learned Taiwan Min and cannot speak fluent Taiwan Min before their 20s. In order to check that the subjects were not influenced by the major or predominant variety of Hakka (Sixian), twenty words were utilized as the pretest. The twenty words were pronounced differently in these two varieties either in the nucleus or the whole syllable structures [2, 5]. To eliminate the influence of attrition, we asked subjects the frequency of being exposed in Hakka and of speaking Hakka. All subjects self-reported that they spoke Hakka and were exposed to Hakka every day. Moreover, they had to pass a pretest of reading out a 296 words article from a newspaper in Hakka language before they participated in the experiment. Finally, six subjects participated in the production experiment. They were subdivided into two categories according to their age as shown in Table 2.

Table 2. *Subject background. M: male, F: female.*

Age	Gender
Above 50 (mean = 51.5)	1M,1F
Under 30 (mean = 24)	2M, 2F

2.2. Corpus

To eliminate the potential influence of lexical frequency, we invited five native speakers to rate the lexical frequency by their own intuition and life experience. (Since there was no a well-formed database for the lexical frequency of Taiwan Hakka language, it would be difficult to determine the corpus in accordance with a statistical lexical frequency method.) After their judgment, only the highest frequent disyllabic words were used in the corpus of production experiment.

2.2.1. Target tone and its syllable structure

In the production experiment, we focused on the three level tones and the level tone related sandhi tone (tone /24/), thus there were only four target tones. Two checked tones /5/ and /3/ were the filler tones. The falling tone /53/ was excluded in this experiment since it was neither a level tone nor sandhi related tone. In addition, all the syllable structure of target tones were an onset consonant followed by a mid vowel (either /e/ or /o/). Only checked tones had an unreleased coda /p/, /t/, or /k/.

Finally, there were 252 items in a reading list (6 tone X * 7 combinations * 2 syllable positions * 3 repetitions = 168 items). The 252 items were randomly ordered in the list.

2.3. Instruments

A korg Mr1000 1-bit professional mobile recorder and AKG HSD 200 microphone were utilized to pick up acoustic data in a sound-treated room. The acoustic signals were tagged in Praat to mark the target boundaries of vowels [12]. All the acoustic data then were analyzed with VoiceSauce [13]. The statistics results were done with R [14].

2.4. Procedure

During the recording, speakers read the tokens on the reading list in order. They first read the number of every token, and then had a short pause between the number and the target token. The microphone was placed within 15 cm in front of speakers' mouth to maintain a good quality of recording. Speakers would take a short break for drinking water after they read every 100 tokens. The recording lasted for approximately 35 minutes.

2.5. Data Analysis

The f0 values were measured every 10 % in time of the vowel.

A one-way ANOVA was utilized to analyze the vowel time points for each speaker. The lexical tones (rising tone /24/ and mid level tone /33/) served as the independent variable, and the f0 values were the dependent variable.

3. Results

3.1. Above 50 group

As shown in Figure 1 and Table 3, at the first syllable, the sandhi rule (2) was realized in both speaker 1 (LSH) and speaker 2 (LPS). The f0 contour of the rising tone /24/[33] was changed into a flat shape, and the contour shape was similar to the mid level tone /33/[33]. Also, the changed tone /24/ [33] was located in the similar register with the mid level tone /33/[33]. The other tones were not merged and separated clearly.

As for the second syllable, the three level tones /55/, /33/ and /11/ were not merged. The contour of the rising tone /24/[24] was maintained well, which was not changed into the mid level tone /33/[33] as at the first syllable. Moreover, after 60% of the vowel time point, the f0 value of /24/[24] was significantly higher than /33/[33] in both speaker 1 (LSH) and speaker 2 (LPS).

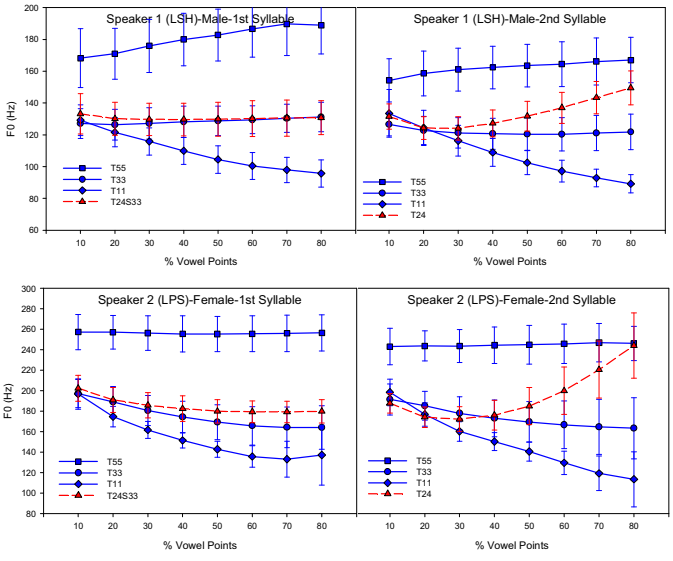

Figure 1: *F0 contours in above 50 group. S: sandhi tone. If it was a sandhi tone, the underlying tone would be listed before "S", and the changed tone will be listed immediately after the "S".*

Table 3. *Differences between rising tone /24/ and mid level tone /33/ at different syllables for the above 50 group. "***" means p<0.001 and "%" means vowel point times*

	Speaker / %	1 (LSH)	2 (LPS)
First syllable	50	n.s.	n.s.
	60	n.s.	n.s
	70	n.s.	n.s.
	80	n.s	n.s.
Second syllable	50	***	n.s.
	60	***	***
	70	***	***
	80	***	***

As shown in Table 3, the older speakers (above 50) significantly differentiated the rising tone /24/[33] and mid level tone /33/[33] at the second syllable from 60% to 80% vowel points. Speaker 1 (LSH) even significantly produced a distinction between the rising tone /24/[24] and the mid level tone /33/[33] at 50% vowel time point at the second syllable. (**Speaker 1 (LSH):** 50% $F(1,40)=13.95$, $p<0.001$; 60% $F(1,40)=28.4$, $p<0.001$; 70% $F(1,40)=45.65$, $p<0.001$; 80% $F(1,40)=67.15$, $p<0.001$ **Speaker 2 (LPS):** 60% $F(1,40)=21.49$, $p<0.001$; 70% $F(1,40)=44.12$, $p<0.001$; 80% $F(1,40)=71.81$; $p<0.001$)

In sum, for speakers above 50 years old, there was no difference in f0 contours between /24/[33] and /33/[33] at the first syllable, where the two tones were related to each other with tone sandhi rules, However, there is a difference between the two tones, /24/[24] and /33/[33], at the second syllable, where there is not a sandhi relationship between the two tones.

3.2. Under 30 group

The results of the under 30 group was shown in Figure 2 and Table 4. Cross-individual comparison showed that the sandhi rule (2) was realized at the first syllable. In this group, the difference among individuals seemed to be larger. Some speakers were more conservative and others were more innovative. At the first syllable, the mid level tone /33/ and low level tone /11/ was merged in speaker 6 (LST).

At the second syllable, it was also noticed that the contour shape of the rising tone /24/[24] was compressed to be a flat one, which was similar to the mid level tone /33/ [33] either in the contour shape or the tone register. In addition, though the more conservative speakers (speaker 3 (ZMS)) could differentiate the rising tone from the mid level tone, the rising tone /24/[24] was higher than the mid level tone /33/[33] only at 80% vowel points, which was much later than the above 50 group which could differentiate from 60 % vowel time point. For the more innovative speakers, the rising tone /24/[24] and mid level tone /33/[33] were even merged together.

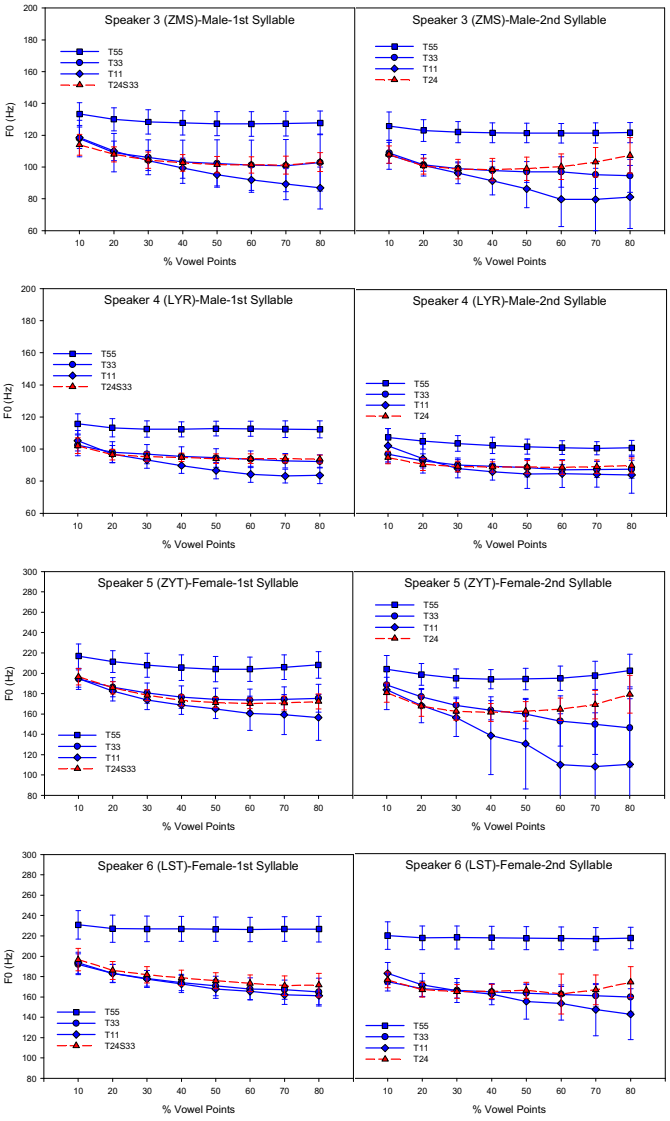

Figure 2: *F0 contours in the under 30 group. S: sandhi tone. If it was a sandhi tone, the underlying tone would be listed before "S", and the changed tone will be listed immediately after the "S".*

Table 4. *Differences between rising tone /24/ and mid level tone /33/ at different syllable for the under 30 group. "***" means p<0.001 and "%" means vowel point times*

	Speaker / %	3 (ZMS)	4 (LYR)	5 (ZYT)	6 (LST)
First syllable	50	n.s	n.s	n.s	n.s
	60	n.s	n.s	n.s	n.s
	70	n.s	n.s	n.s	n.s
	80	n.s	n.s	n.s	n.s

Second syllable	50	n.s	n.s	n.s	n.s
	60	n.s	n.s	n.s	n.s
	70	n.s	n.s	n.s	n.s
	80	***	n.s	n.s	n.s

As shown in Table 4, only speaker 3 (ZMS) could differentiate tone /24/[24] and tone /33/[33] at 80% vowel time point in the second syllable. (**Speaker 3 (ZMS):** 80% $F(1,40)=14.76$; $p<0.001$)

In sum, for most speakers (3 out of 4) under 30 years old, there is no difference in f0 contours between /24/[33] and /33/[33] at the first syllable, where the two tones were related to each other with tone sandhi rules, Additionally, there is no difference between the two tones, /24/[24] and /33/[33] at the second syllable, where there is not a sandhi relationship between the two tones.

4. Discussion

At the first syllable, the sandhi rule for the rising tone /24/ and mid level tone /33/ was realized in both above 50 years old group and under 30 year old group. There was no difference between /24/[33] and /33/[33].

However, at the second syllable, the rising tone /24/ [24] and mid level tone /33/[33] were separated clearly, after 60 % vowel time point in the older group, whereas, the younger group lagged the older group in differentiation tone /24/[24] and tone /33/[33] at the second syllable. The more conservative younger speaker (speaker 3 (ZMS)) could differentiate these two tones at 80% vowel time point. The more innovative speaker could not differentiate tone /24/[24] and tone /33/[33] at no matter 60%, 70%, or 80% vowel time point.

According to the merging tones /24/ and /33/ in the younger group in the second syllable, it was proposed that the sandhi rule for the uncheck tone might not actually be realized of the more innovative speakers. The merged /24/[33] and /33/[33] in the first syllable might not result from the realization of sandhi rule but result from the confusion of the rising tone /24/[24] and the mid level tone /33/[33]. This observation also suggested that the rising tone /24/[24] was undergoing sound change in today's Hailu variety of Hakka language.

Last, this was a preliminary and on-going project, so more statistical analysis and subjects were needed. We might also attempt to probe whether there is any correlation between this phonetic change and other factors like the education level of the speakers in the near future.

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