A Comparative Study On Cantonese Rising Tones: Native Cantonese Speakers And Canadian Raised Cantonese Speakers

Connie Kwok Lai So
Department of Linguistics, Simon Fraser University, Burnaby, BC V5A 1S6

1. INTRODUCTION

The two Cantonese rising tones, the High Rising (Tone 2) and the Mid-Low Rising (Tone 5), are traditionally described as Tone 35 and Tone 23. Recent studies, however, show that the High Rising tone has changed from Tone 35 to Tone 25 (Bauer, 1997). It starts at a pitch level similar to that of the Mid-Low Rising tone. The High Rising tone is also described to have a long and sharp rise from the midway of its fundamental frequency (Fo) contour pattern (Bauer 1997: 133). There is also a temporal difference among all the lexical tones in Cantonese. The High rising has the longest duration (Kong, 1987: 396). Cantonese rising tones produced by Canadian Born/ Raised Cantonese speakers seem to be under-investigated (So 1997, 1998). The present study aims to assess the above phenomena in these speakers.

2. THE EXPERIMENT

This study recruited 12 adult speakers in two groups, (3 females and 3 males in each group). The first group consisted of those who were either Canadian Born Cantonese speakers, or who had immigrated to Canada before age of seven (hereafter, I called them as CRC, since all of them were raised in Canada). The second group is a comparison group formed with Native Hong Kong Cantonese speakers (NC), who had moved to Vancouver within two years. Productions of their rising tones in citation forms were acoustically analyzed and compared in the aspects of temporal and fundamental frequency (Fo) contour patterns.

Four target words with the High and the Mid-Low rising tones on two root-words /si/ and /fu/ were used. These words were /si 2/ "history" , /si 5/ "city'', /fu 2/ "tiger'' and /fu 5/ "woman". Totally, 480 tokens of these four target words produced by the speaker groups (i.e., 10 tokens of each target from individual speaker) were examined.

3. RESULTS AND DISCUSSION

3.1. TEMPORAL PATTERNS

The temporal patterns between the two rising tones and between the speaker groups were compared. Durations were measured in three different domains of the words - whole syllable (S), prevocalic consonant (C), and vowel (V). Table 1 shows the mean durations and standard deviations of Tone 2 and Tone 5 on /si/ and /fu/ in the NC and the CRC. The data were submitted to three separated ANOVAs for the three domains to see if speaker groups, rising tones, and root-word types had any effect on the duration in the three respective domains (S, C, and V). For all these three domains, no main effects of any factors and no interactions of the factors were found (*ps* > 0.05). The results suggest that durational differences at syllable, prevocalic consonant, and vowel do not play an important role in differentiation between the two tones and between the speaker groups, at least in citation forms. However, there was a non-significant tendency that the durations of Tone 2 were slightly longer than those of Tone 5, except the pairs in /fu/ at S and C in the CRC, and the pair in /fu/ at V in the NC (see Table 1).

3.2. Fo CONTOUR PATTERNS

The method to compare Fo contour patterns between the two rising tones and between the speaker groups has been used in earlier studies (So, 1997, 1998). Fo contours of individual tokens were first obtained through pitch extraction. Then, their durations were normalized using five temporal reference points (at 0%, 25%, 50%, 75% and 100%). Since the mean Fo contour patterns of Tone 2 and Tone 5 on /si/ and /fu/ in each group were very close to each other, the data were collapsed and were averaged to form two mean contours for Tone 2 and Tone 5 in each group. The contour patterns of the two rising tones of groups are shown in Figure 1. The onsets of Tone 2 and Tone 5 in both the NC and the CRC started at a similar level of Fo height, and had a falling pattern from 0% to 25%. In the NC group, the mean contour of Tone 2 began to rise from 25%, and had a sharp rise from 50 to 100%. The mean contour of Tone 5 only rose gently from 25% toward 100%. As a result, the Fo differences between Tone 2 and Tone 5 gradually increased toward the end. Similar to the contour patterns of the NC, the contour of Tone 2 in the CRC was also located on top of the one of Tone 5. However, the Fo height of Tone 2 was close to that of NC's Tone 5, and the slope of Tone 2 in the CRC was less steeper than that of the NC's. It was also noted that the range of Fo height for the two tones in the NC was observed to be much larger than that of the CRC.

		NC		CRC	
Domains	**Tones**	**/si/**	**/fu/**	**/si/**	**/fu/**
S	T 2	511.51 (61.49)	499.97 (48.60)	506.28 (90.79)	476.29 (81.92)
	T 5	503.97 (62.09)	494.97 (57.67)	496.06 (93.85)	476.88 (85.10)
C	T 2	206.80 (43.65)	175.22 (29.69)	205.44 (47.09)	176.95 (52.85)
	T 5	201.26 (40.97)	174.94 (45.34)	205.21 (47.29)	181.93 (57.99)
V	T 2	304.71 (39.73)	317.73 (38.12)	300.83 (61.78)	299.34 (63.15)
	T 5	302.71 (38.69)	320.04 (40.63)	290.85 (66.17)	294.95 (61.30)

Table 1. Speaker groups' mean durations and standard deviations (in parentheses) of Tone 2 and Tone 5 on /si/ and /fu/.

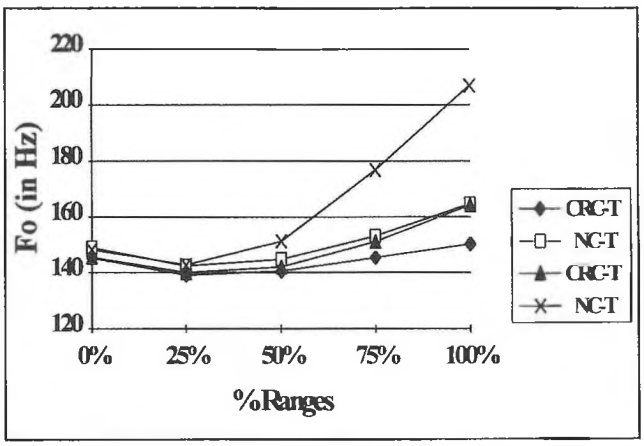

Figure 1. Fo contours for Tone 2 and Tone 5 in the CRC and the NC groups.

In order to compare the relative slopes of the contours between the speaker groups, the differences in changed Fo (ΔFo) among the five reference points, [i.e., four ranges; hereafter R1(0-25%), R2 (25-50%), R3 (50-75%), and R4 (75%-100%)], were investigated. Since durations of individual contours had been normalized, the slopes of these ranges could be interpreted as a function of ΔFos in the four durational ranges. Thus, comparison of ΔFos in the ranges might be fruitful.

The ΔFos data of the rising tones for the NC and the CRC were submitted to a mixed-design ANOVA with speaker groups (G) as between-subjects factor, and durational ranges (R) and tones (T) as within-subjects factors. The result revealed significant main effects of G [F (1, 22) = 18.007, p <0.01], R [F (3, 66) = 49.157, p < 0.01], and T [F (1, 22) = 74.800, p < 0.01]. The results also indicated significant G x R [F (3, 66) = 20.472, p < 0.01], G x T [F (1, 22) = 18.892, p < 0.01], and R x T [F (3, 66) = 47.820, p < 0.01] interactions. Moreover, significant G x R x T interaction was found [F (3, 66) = 8.872, p < 0.01].

Two separated 1-way ANOVAs with durational ranges (R) and tones (T) as within-subjects factors for the CRC and the NC were also conducted to explore the effects of R and T on the ΔFos in each group. The analyses revealed significant main effects of R [Fs (3, 33) = 6.032 and 56.436, ps < 0.01], and T [Fs (1, 11) = 20.091 and 54.852, ps < 0.01], as well as significant R x T [Fs (3, 33) =15.736 and 33.236, ps <0.01] interactions in the NC and the CRC respectively. Individual t-tests for the CRC and the NC further indicated that the differences in ΔFos at R1 and R2 (i.e., the first 50%) between Tone 2 and Tone 5 in CRC were non-significant (ps > 0.05), but significant at R3 and R4 (ps < 0.01). On the other hand, the differences in ΔFos between the two rising tones in the four ranges in the NC group were all significant (ps < 0.01), except at the R1 (p > 0.05) (i.e., the first 25%). (See Figure 2 and 3). All these statistical results suggest that Tone 2 and Tone 5 can be differentiated within each group on the basis of ΔFos in the four durational ranges. Nevertheless, the timing for the NC to differentiate the two tones is earlier than that of the CRC (i.e., R2 vs. R3).

4. CONCLUSIONS

In this exploratory experiment, it is found that Tone 2 did not have durational patterns significantly longer than Tone 5 at the three domains (i.e., syllable, prevocalic consonant and vowel) in both the NC and the CRC. With respect to the onsets of the two rising tones, the contour patterns in Figure 1 clearly demonstrate that the onsets of the two tones are very close to each other in both speaker groups. However, the overall range of Fo height for Tone 2 and Tone 5 in the NC is wider than that of the CRC. It is surprising that the differences of the changed Fo height in the four durational ranges between the two rising tones for the CRC was found to be different from those of the NC in this study. Lastly, since the timing associated with ΔFos in differentiating the two tones is found to be different in productions between the two speaker groups, it is not unreasonable to suggest that Canadian Raised Cantonese speakers may also exhibit deviation from Native Cantonese speakers in perception of the two rising tones. However, this issue awaits further research.

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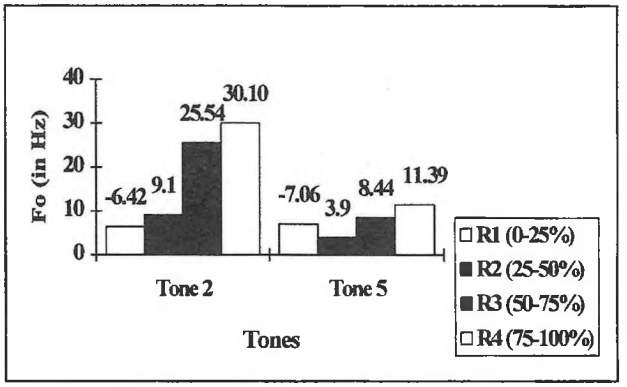

Figure 2. Average Changed Fos of Tone 2 and Tone 5 in the NC.

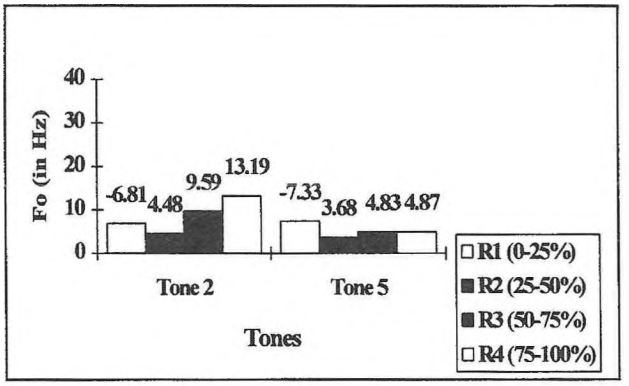

Figure 3. Average Changed Fos of Tone 2 and Tone 5 in the CRC.