TONE VARIATION IN THE WUXI DIALECT

Jingwei Zhang, Hans Van de Velde & Ren éKager

Utrecht University, the Netherlands
J.Zhang1@uu.nl

ABSTRACT

This study presents an acoustic analysis of F0 contours of T2, T4 and T6 words by 40 Wu speakers of the Wuxi dialect (stratified for area, sex and age). The results show that T4 is merging with T2 and T6, and that T4 words which have the same corresponding tone of *Putonghua* with T6 are leading the change. Among young people, the previously merged T2 and T6 show a tendency to split. These ongoing changes are partly induced by contact with *Putonghua*, but are also internally constrained by the historical tonal categories.

Keywords: tone variation, Wuxi dialect, *Putonghua*, contact-induced, Chinese

1. INTRODUCTION

It is generally accepted that Middle Chinese (MC), the ancestor of most modern Chinese dialects, has four tonal categories: *Ping* ("Even"), *Shang* ("Ascending"), *Qu* ("Departing") and *Ru* ("Entering"). Each of these tonal categories can be divided into two registers according to the initial consonants: syllables with voiceless initials in MC are classified as *Yin* (Upper) and those with voiced initials are classified as *Yang* (Lower) [8]. Accordingly, this paper will adopt the tone labeling scheme in Table 1.

Table 1: MC tone system and labeling scheme.

Register	Tonal category			
	Ping	*Shang*	*Qu*	*Ru*
Yin	T1	T3	T5	T7
Yang	T2	T4	T6	T8

Among modern Chinese dialects, the tone system of Wu dialects has the closest resemblance to the MC tone system [5]. Chao [3] investigated 33 Wu dialects in the 1920s. He found that one third of them, including the Wuxi dialect, coincided with the 8 tonal categories of MC. 60 years later, Qian [9] restudied those 33 dialects and found that most of them showed an on-going merger of T4 into T6. However, in the 1980s, the Wuxi dialect deviated from most other Wu dialects by merging T2 and T6 before merging T4 into T6. A recent acoustic study of the Wuxi dialect showed that T2 and T6 have merged completely while T4 was in the process of merging with T2/T6 [12]. However, this was based on a small sample of speakers while the causes of the T4 shift are not discussed.

This paper aims at supplementing the previous studies by investigating tone variation of T2, T4 and T6 in the Wuxi dialect from a socio-phonetic perspective. The merger of T4 with T6 is a diachronic phonological process occurring in almost all Chinese dialects, but the motivation behind it has so far remained unclear [7, 11]. Chen [6] proposed that the merger of T2, T4 and T6 in Shanghai dialect is a contact-induced change. In this study, we want to establish whether ongoing changes in the Wuxi dialect are caused by internal factors or induced by contact with *PTH*.

2. METHODOLOGY

2.1. Materials

The word list consists of 136 monosyllabic CV words, which are distributed over the eight tones. We have 18 stimuli for T2, 18 for T4 and 16 for T6. All vowels are monophthongs in the Wuxi dialect. All the words are frequently used Chinese characters.

2.2. Participants

Wuxi is a prefecture-level city in Jiangsu Province with a population of around 6 million. It is located 130 km northwest of Shanghai in the Yangtze River Delta Area.

40 working class native speakers of the Wuxi dialect participated in our study. 20 participants are from the *urban* area, 20 from Huazhuang, a *suburban* town adjacent to Tai Lake and 13 km southwest of downtown Wuxi. The participants (5 per cell) were further stratified for sex (male-female) and age (17-22 and 60-75). All participants involved in this study and their parents were born and raised locally. The Wuxi dialect is their mother tongue and only home language. They are all literate and completed at least primary

education. Most of them claim to be able to speak *PTH*.

2.3. Recording

The participants were interviewed in their neighborhood and their speech was recorded in a quiet room. The randomized stimuli were presented one by one in simplified Chinese characters on a computer screen. The participants were asked to read the stimuli in their dialect and were able to control the speed of the stimulus presentation. The speech was recorded with a portable TASCAM DR-100 solid state recorder and an AKG C420 headset microphone. The recordings were sampled at 48kHz (24 bits).

2.4. F0 analyses

Praat [1] was used for all segmentations and measurements. Tonal domains were automatically labeled, and then manually checked and corrected. The F0 values of the tone contour of each word were measured at 20 equidistant points, resulting in a time-normalized F0 [13].

To avoid syllable edge effects, the first and last part of the tone contour is commonly neglected in tonal research [10, 14], but previous researchers differ in the size of the parts they neglect while giving no justification for the differences. In this study, the relevant part of the F0 contour was determined by comparing the standard deviations of the F0 values at the 20 points. It turned out that the first 10% and last 20% of the duration of the F0 contour in the Wuxi dialects have significant higher variation than the 10% to 80% range of the F0 contour. Therefore we use the F0 contours from the 10% to 80% points for our analyses, which are presented in Figures 1 to 8 as points 0 to 14.

The normalization technique we used is logarithmic z-score (LZ) [10, 14]. 15 data points of each word pronounced by the 5 speakers from the same age group, sex and region are transformed into 15 LZ-scores with Formula (1) respectively.

$$(1)\quad z_i = \frac{\log_{10} x_i - \frac{1}{n}\sum_{i=1}^{n}\log_{10} x_i}{\sqrt{\frac{1}{n-1}\sum_{i=1}^{n}(\log_{10} x_i - \frac{1}{n}\sum_{i=1}^{n}\log_{10} x_i)^2}}$$

3. RESULTS

3.1. Citation tone inventory of Wuxi dialect

The Wuxi dialect is a typical northern Wu dialect. Speakers of the older generation generally have seven to eight lexical tones. The tone inventory in Table 2 is based on the data of the old informants in our data. The Wuxi urban and suburban areas basically have the same tone inventory with the exception of T4 and T5; see Table 2. This paper will only focus on the merger or split among T2, T4 and T6 and not discuss T5. The 5-scale tonetic representation introduced by Chao [4] is adopted. Checked tones are underlined.

Table 2: Citation tone inventory of Wuxi urban and suburban area, based on old speakers.

	Urban	Suburban	Corresponding tone in *PTH*
T1	/51/	/51/	PT1(/55/)
T2	/213/	/213/	PT2(/35/)
T3	/313/	/313/	PT3(/214/)
T4A	/13/	/131/	PT4(/51/)
T4B	/13/	/22/	PT3
T5	/34/	/412/	PT4
T6	/213/	/213/	PT4
T7	/53/	/53/	PT1/PT2/PT3/PT4
T8	/13/	/13/	PT1/PT2/PT3/PT4

Compared to the *PTH* tone system, T2 words in the Wuxi dialect are realized as a high rising tone, /35/ (as PT2). Wuxi T4B words with nasal and approximant initials are realized as a low dipping tone, /214/ (corresponding with PT3). T4A words and T6 words all have a high falling tone, /51/ (as PT4). If the merger of T4 with T2/T6 is induced by *PTH* contact, Wuxi T4 words with different *PTH* tone counterparts are expected to split in the young age group. So, T4B words (with nasal and approximant initials) are analyzed separately from the other T4 words (T4A). The mean normalized F0 contours of T2, T4A, T4B and T6, split up by area, age and sex, are plotted in Figures 1 to 8.

3.2. T4 merger with T2/T6

Wuxi T4 had a convex contour (/232/) in the urban area in the 1920s [3]. In the 1980s, this convex contour was reported as /131/ [2], but according to Qian [9] it was leveled to /33/. Recently, a rising T4 (/13/) has been observed [12]. In Table 2 – based on old speakers – a rising tone is observed in the urban area; in the suburban area T4A and T4B are still maintained as convex contours. We will now have a look at the social stratification by area.

3.2.1. T4A

The convex pattern of T4A [2, 3] has almost disappeared in the urban area (Fig. 1-4) and is gradually disappearing in the suburb (Fig. 5-8). The age comparison shows that T4A is merging

toward T2/T6, more evidently so in the suburb. Suburban old males (Fig. 6) display the most conservative T4A F0 contour, which is quite distinct from the concave T2/T6 contour. For the suburban old females (Fig. 5), T4A basically overlaps with T6 during the first part of the tone. For the young (Fig. 7-8), the overlap extends to the final part, while the middle part of T4A still maintains the distinction with T2/T6.

In the urban area (Fig. 1-4), both in the young and old age groups, T4A is nearly merged with T2/T6, hence the difference between young and old speakers is much smaller than in the suburban area. But it should be noticed that the urban older speakers have a rising T4A (at the end), whereas the young ones have a fully concave T4A.

In T4A change, the following 4 steps can be distinguished: (1) convex contour tone (Fig. 6); (2) semi-convex contour tone (Fig. 5, 7, 8); (3) rising tone (Fig. 1-2); (4) concave contour tone (Fig. 3-4). Each step results in more convergence with T2/T6.

Figure 1: Mean F0 contours of T2, T4A, T4B and T6 of old females in Wuxi urban area.

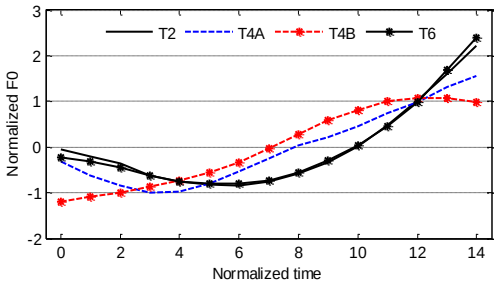


Figure 2: Mean F0 contours of T2, T4A, T4B and T6 of old males in Wuxi urban area.

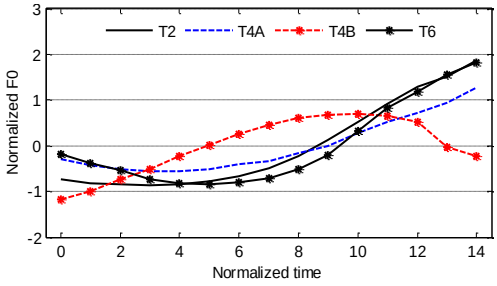


Figure 3: Mean F0 contours of T T2, T4A, T4B and T6 of young females in Wuxi urban area.

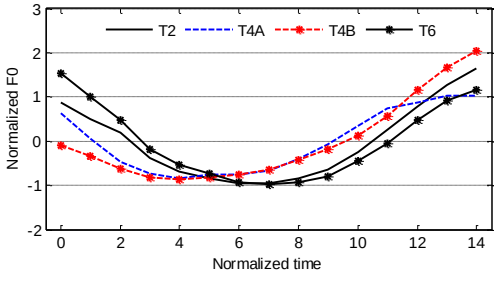


Figure 4: Mean F0 contours of T2, T4A, T4B and T6 of young males in Wuxi urban area.

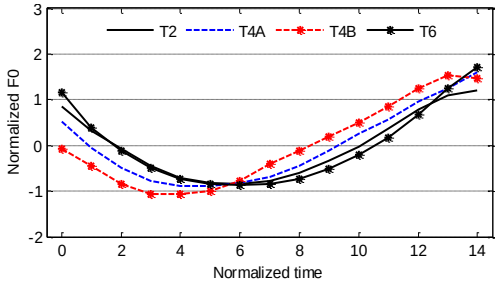


Figure 5: Mean F0 contours of T2, T4A, T4B and T6 of old females in Wuxi suburban area.

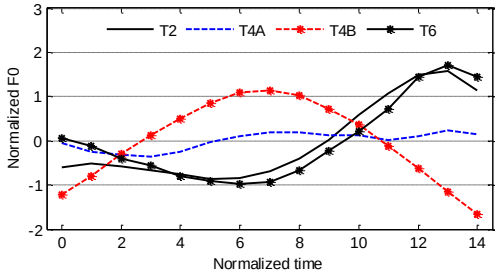


Figure 6: Mean F0 contours of T2, T4A, T4B and T6 of old males in Wuxi suburban area.

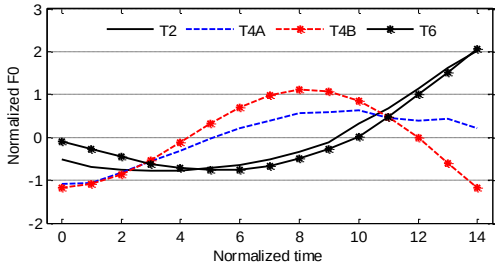


Figure 7: Mean F0 contours of T2, T4A, T4B and T6 of young females in Wuxi suburban area.

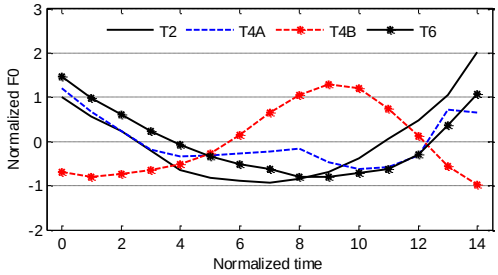
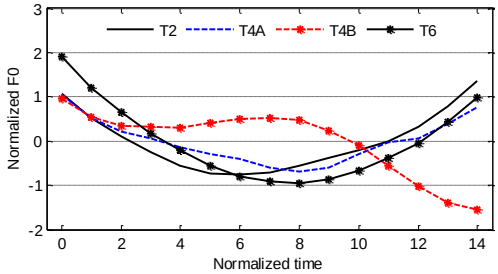


Figure 8: Mean F0 contours of T2, T4A, T4B and T6 of young males in Wuxi suburban area.



3.2.2. T4B

Compared with T4A, the convex pattern of T4B is preserved clearly among all suburban speakers. In the suburb, T4B is merging toward T2/T6 in two aspects (compare Fig. 5 with 8): (1) the old females have an ascending first part of T4B, the young males have a descending one (old female: $slope_{point0-1}$=0.475; young male: $slope_{point0-1}$=−0.485); (2) the convex vertex declined from 1.124 (old females) to 0.488 (young males).

In the urban area, the convex pattern is present in the old males (Fig. 2). The old females have a rising T4B; the young groups raise the onset of the rising contour and make it closer to the concaved T2/T6. In spite of losing the convex pattern, among urban old females and urban young people, T4A is still more similar to T2/T6 than T4B.

In summary, the T4B change follows the same steps as T4A, but the difference between the 4 steps is more obvious in T4B than in T4A.

3.3. T2 and T6

In Figures 1 to 8, T2 and T6 consistently have a concave contour, but there is a new change in progress. T2 and T6 were completely merged in the old, but a new split emerges in the young, especially in the suburban area (Fig. 7-8). The split of T2 and T6 is visible in both onsets and offsets.

In *PTH* T6 has a very high onset in contrast to T2's intermediate onset. Among the young, the onset of T6 (1.524) is higher than T2 (0.955), and both onsets are much higher than those of the old participants (T2:-0.476, T6:-0.109).

Similar to the onset, the corresponding offset of T2 in *PTH* is higher than T6. The young have a higher offset of T2 (1.554) than T6 (1.253), which is not the case among the old (T2:1.813, T6:1.927).

T2 and T6 are showing *PTH* tone tractions in the onset and offset, consistently splitting toward their corresponding tone in *PTH*. We can conclude that this split is induced by contact with *PTH*.

4. DISCUSSION AND CONCLUSION

Acoustic evidence shows that the tones T2, T4 and T6 in the Wuxi dialect are undergoing changes. By examining the F0 contours of words, classified by area, age and sex, the results validate previous claims about (i) the merger of T2 and T6 and (ii) the on-going merger of T4 with T2/T6, but also adds new insights: (iii) T4A words are leading the merger with T2/T6 as T4A words have the same corresponding tone in *Putonghua* with T6 and (iv) the previously merged T2 and T6 show a tendency to split among young Wuxi speakers.

On the one hand, the changes are induced by contact between Wuxi dialect and *PTH*. For the T4 merger, T4A words have initiated and been leading the merger because T4A and T6 are the same tone in *PTH* (PT4). In the split of T2 and T6, T2 and T6 are moving towards their *PTH* corresponding tones PT2 and PT4 respectively. On the other hand, the tonal variations primarily occur in the class of words defined by the historical tone categories of the local variety. The T4B variation is mainly internally constrained to follow the steps of T4A.

In sum, the present-day Wuxi dialect is heavily influenced by *PTH*, but the changes are not simply reducible to a convergence with *PTH*. The tone variation in the Wuxi dialect reflects both an internal and external development.

5. ACKNOWLEDGEMENTS

We would like to thank Prof. Xu Daming and anonymous reviewers for their valuable comments, and all the speakers for their participation.

6. REFERENCES

[1] Boersma, P., Weenink, D. 2010. Praat: Doing phonetics by computer [Computer Programme] Version 5.1.43. *http://www.praat.org.*

[2] Chan, M., Ren, H. 1989. Wuxi tone sandhi. *Acta Linguistica Hafniensia* 21(2), 35-64.

[3] Chao, Y. 1928. *Studies in the Modern Wu Dialects*. Peking: Tsinghua University.

[4] Chao, Y. 1930. A system of tone letters. *Le Maître Phonétique* 45, 24-27.

[5] Chen, M.Y. 2000. *Tone Sandhi: Patterns across Chinese Dialects*. Cambridge: CUP.

[6] Chen, Z. 2007. On the cause of the merger of Yangping, Yangshang and Yangqu tones in the Shanghai dialect, *Fangyan* 4, 305-310.

[7] Ho, D. 1988. The development of the rising tone with MC voiced obstruent initials into the departing tone among modern Chinese dialects. *Bulletin of the Institute of History and Philology* 59, 115-140.

[8] Norman, J. 1988. *Chinese*. Cambridge: CUP.

[9] Qian, N. 1992. *Studies in the Contemporary Wu Dialects*. Shanghai: Shanghai Education Press.

[10] Stanford, J. 2008 A sociotonetic analysis of Sui dialect contact. *Language Variation and Change* 20, 409-450.

[11] Xie, F., Hong, W. 1998. The change of the rising tone with MC nasal and approximant initials in modern Hakka. *Proc. 8th International Symposium on Taiwanese Languages and Teaching*, 83-100.

[12] Xu, J. 2005. *An Acoustic Experimental Study of Tones in Wuxi Dialect*. MA thesis, Nanjing Normal University.

[13] Xu, Y., Prom-on, S. 2010-2011. PENTAtrainer.praat. *http://www.phon.ucl.ac.uk/home/yi/PENTAtrainer.*

[14] Zhu, X. 1999. *Shanghai Tonetics*. München; Newcastle: Lincom Europa.