The Falsetto Tones of the Dialects in Hubei Province

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Abstract

Falsetto phonation was applied to produce 上声 *Shangsheng/Rising Tone* in the early stage of Chinese tonal development (ca. 400-700 AD) and this *phonation type* is still in use in the tonal systems of several major Chinese dialect-groups now. In Hubei 湖北 province, falsetto tones are found in three cities, Songzi 松滋, Jingmen 荆门 and Jianli 监利. In the tonal systems of these three dialects, the tone values show some noteworthy correspondences. In order to present the contemporary state of the falsetto tones and explore the tonal evolution through the synchronic field data, we conducted this research and chose Songzi as our starting point. Based on *Evolutionary Phonology* and the *Multi-Register and Four-Level Tonal Model*, three geographically connected and phonologically related dialects are found in Songzi: *Weishui Type 沩水式* in the south, *Nanhai Type 南海式* in the middle, and *Songzihe Type 松滋河式* in the north. They share almost identical onset and rime systems, and their tonal systems are different but related. Weishui maintains a 入声 *Rusheng/Entering Tone* in *falsetto* or *fortis voice* and there are five tones in its tonal system; Rusheng has disappeared in Nanhai and four tones remain which are the same as their counterparts in Weishui; there is no Rusheng in Songzihe either, and it shares 阳平 *Yangping/Low Level Tone* and *Shangsheng* with Weishui and Nanhai, but the tone values of its 阴平 *Yinping/High Level Tone* and 去声 *Qusheng/Departing Tone* are involved in a *tonal flip-flop* [10] with their counterparts of the other two dialects. These three synchronic tonal systems show a diachronic chain shift. At present, the Weishui's Rusheng which is in falsetto or fortis voice is moving down in two ways: an overall falling (the pitch falls while the contour maintains), and the lowering of the tone tail. These findings offer us the chance to detect the initial changes in the chain shift of these three tonal systems and evaluate their impact to the phonological systems.

Index Terms: falsetto, tone, phonation type, evolutionary phonology, the Multi-Register and Four-Level Tonal Model

1. Introduction and methodology

About a half century ago, falsetto was observed and its average range, 235-650 Hz, was defined by linguists [4]. Later on, the physiological mechanism of its production was described in detail and was defined as *falsetto phonation* among the six phonation types [5]. While its paralinguistic function was explored in the process by many linguists, its linguistic function, however, was not found until very recent times. In addition to its morphological function [16], falsetto phonation is applied to tone production in both early and contemporary Chinese [6][13].

In this research, falsetto tones are found in three places of Hubei Province 湖北省, i.e. Songzi 松滋, Jianli 监利 and Jingmen 荆门 (hereafter the place may refer to its dialect). As shown in Fig. 1, they were marked in the circles on a map of *Report on a Survey of the Dialects of Hupeh* [1] which was based on the fieldwork guided by Chao Yuen-Ren in 1930s.

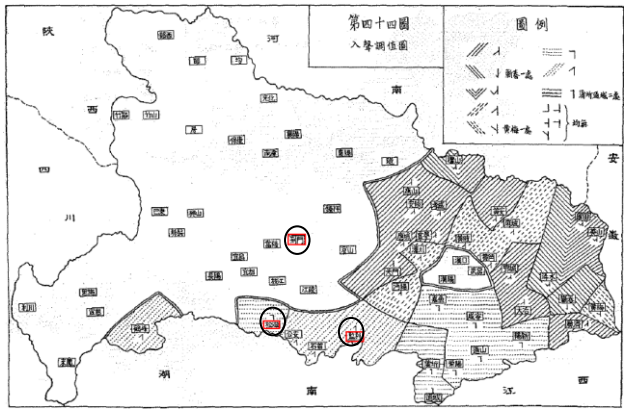

Figure 1: *Rusheng distribution in Hubei Province* [2]

Note: In the circle are the places of Hubei where falsetto tones are found. The southwestern one is Songzi, the southeastern one is Jianli and the northern one is Jingmen.

Specifically, falsetto differentiates the Rusheng of Songzi and Jianli as well as Jingmen's *Yangping* from the other tones in the three dialects. From the map, we can see that the three places are not geographically connected, but meaningfully they are all located near the dialectal border [1][8] which divides Hubei into half with the *Rusheng* (the striped area in Fig. 1) and the other half without it (the blank part). More impressive is the evidence that the tone values of the three dialects present clear correspondence [9]: besides the identity shown by their falsetto tones, Jingmen's Rusheng as well as the Yangping of Songzi and Jianli share similar tone values, and their Qusheng tones are the same. That is, a *flip-flop* [10] (a straight swap between the values of two tones) occurs in the tone values of Rusheng and Yangping between Jingmen and the other two dialects and the tone values of the other tones in all these three dialects are almost the same.

It is well-known that Rusheng's change/merger into Yangping is the most consistent phenomenon in Southwestern Mandarin, a Mandarin subgroup which covers the largest area and the most population among all Chinese dialectal groups and subgroups. How does this change occur? And what are the motivations for the change? Because of the word limit, in this paper we will focus on the falsetto tone and the tonal evolution of Songzi.

With respect to the terminology of Chinese tones, the historical background most relevant to this paper is that the phonological terms, *'平(Ping) 上(Shang) 去(Qu) 入(Ru)'*, were first advanced ca. 5th century and their subsequent equivalents, *'平声 Pingsheng, 上声 Shangsheng, 去声 Qusheng, and 入声 Rusheng'*, appeared in 601AD. After various changes of the tones, most present Chinese dialects are involved in the re-categorization and have become quite different from their Early Middle Chinese (EMC, ca. 6th–9th century AD) counterparts. Therefore the literal translations of these EMC terms which are still in use now will be misleading. We prefer their 拼音 *pinyin* (the Chinese alphabet) forms because they are abstract to the non-Chinese readers and facilitate the typological studies which cannot be done with some methods designed specifically to teach Chinese, e.g. to term Chinese tones as Tone 1, Tone 2, etc. In this paper tone values in the five-point scale (FPS) [2] are placed in square brackets like '[51]', and those in the Multi-Register Four-Level (RL) Tonal Model [12][14] are in curly braces like '{52}'.

Songzi is a county of Jingzhou City whose capital is Jingzhou 荆州. This county is composed of 16 towns which are marked with big dots in Fig. 7. In Jingzhou City, Songzi is 'famous' for its Rusheng. From the tone values [45/55] in terms of *the five point scale* (FPS) [1][9][11], this Rusheng is nothing special. But this tone is often teased by the other Jinzhou locals as being "an octave higher" and is generally judged to be "high and impressive" or "sharp" among the researchers [7][9][11]. How impressive is this tone? In this research, Songzi's Rusheng is perceived as far higher than the other [55] tones of the adjacent dialects and some Rusheng syllables are measured over 400Hz (male speakers).

1.1. Method and procedure

The whole investigation took about one year and proceeded in three steps. Firstly, in order to obtain a panorama of the dialects in Songzi and collect the data of the young speakers, we investigated some freshmen in Wuhan 武汉 (the capital city of Hubei Province) who came from the different towns of Songzi. Then based on this overall knowledge, we did the on-the-spot investigations from which the data of the old and the middle-aged speakers were collected. Finally, after the data analysis, we revisited some places again to clarify some interesting issues.

The sound data was recorded as follows: the researcher played the Powerpoint slides of stimuli at an interval of about two seconds (each slide containing one 字 Chinese *character/syllable*), the speakers read the stimuli accordingly, and their sounds were recorded with Praat. Four character lists which contain over 1,000 stimuli are designed to investigate the *onset* system, the *rime* system, the tonal system and Rusheng.

As a result, 43 samples from all the 16 towns of Songzi were collected. The speakers' information is as follows: 33 male and 10 female adults from three age groups, the young (about 20 years of age), the middle-aged (about 45) and the old (over 60). None were observed to have a speech or hearing disorder.

1.2. Theoretical basis: Evolutionary Phonology and Multi-Register and Four-Level (RL) Tonal Model

In this research, *the five point scale* (FPS) is challenged in the tonal transcription of the three types of Songzi dialects. Weishui's Rusheng in falsetto or fortis voice is too distinct phonetically to be regarded phonologically the same as the highest tones in this frame. Besides this, with the discovery of *Nanhai Type/Nanhai 南海* in this study, the typological problem arises. The tones of *Weishui Type/Weishui 沧水* and Nanhai are identical in perception except that the former has an extra falsetto Rusheng. The highest tone (Qusheng) of Nanhai should be transcribed as [55] according to the criteria of the FPS, but if it is transcribed as [55], Weishui's Qusheng should be [55] too for it is identical perceptually with Nanhai's Qusheng, and then there is no space for Weishui's falsetto Rusheng in the FPS. In order to transcribe the tonal systems of Weishui and Nanhai, we have to differentiate their highest tones. The Multi-Register and Four-Level (RL) Tonal Model is able to present the differentiation.

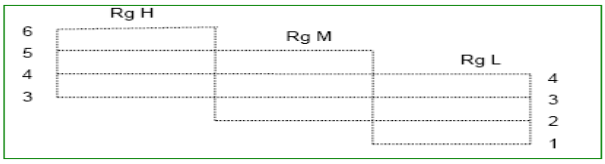

Figure 2: *Multi-Register Four-Level (RL) Tonal Model*

Phonation-defined registers exist in most groups of Chinese dialects as well as in many languages around China [3][12]. Different from the FPS, the RL Tonal Model is based on the concept of phonation differentiation. As shown in Fig. 2, there are three registers in this model, i.e. Register High, Mid and Low (Rg H, M and L) which are defined respectively by *falsetto*, *voicelessness* and *breathy voice*. These three registers share some overlapped levels, and each register includes four levels. In total, there are six levels in the RL Tonal Model.

In addition, we find the three subdivisions of Songzi present a diachronic evolution in the synchronic distribution, the sole diachronic or synchronic perspective is an impediment. Pan-chronic phonology [12] which studies speech sounds in a pan-chronic perspective overcomes the limitations and thus becomes the other theoretical basis for this research.

2. Three different but closely related tonal systems in Songzi

2.1. Three dialects only different in tonal systems: Weishui Type, Nanhai Type, and Songzihe Type

Both acoustic and perceptual data show that the onset and rime systems of Songzi dialects are generally the same, but according to their tonal systems, they can be classified into three types which are labeled as *Weishui Type/Weishui 沧水*, *Nanhai Type/Nanhai 南海* and *Songzihe Type/Songzihe 松滋河* in this study (refer to Fig. 7). These names are from the main rivers crossing the relevant region. The present re-categorization of the EMC tones in these three dialects is the same except that Weishui maintains an independent Rusheng category. By the LZ (logarithm z-score) normalization [16], the acoustic charts of their tonal systems are drawn as follows:

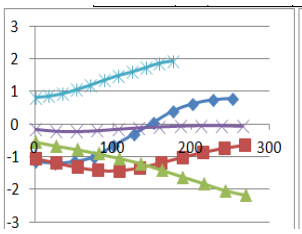

Figure 3: *Weishui tonal system*

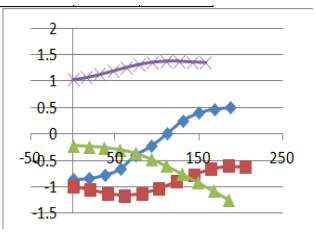

Figure 4: *Nanhai tonal system*

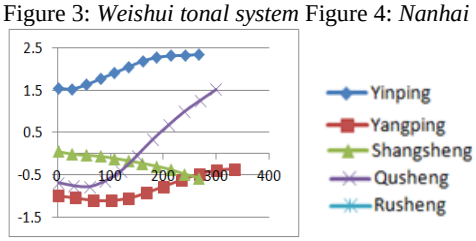

Figure 5: *Songzihe tonal system*

It is clear that Weishui possesses one more tone than the other two, a Rusheng category. This Rusheng is easy to identify for it is quite high acoustically and sharp perceptually. Take a male speaker (59 years of age) for example. The frequency ranges of his Yinping, Yangping, Shangsheng and Qusheng are

respectively about 131-212Hz, 122-149Hz, 156-105Hz, and 163-172Hz. His Rusheng, however, is about 220 --300Hz. Some of his Rusheng syllables are over 400Hz as shown in Fig. 6.

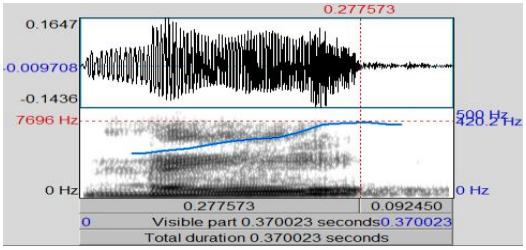

Figure 6: *The falsetto Rusheng syllable 鹿* ***nu*** *(male, 59)*

In Nanhai (Fig. 4), Rusheng has disappeared and has mainly changed into Yangping. From the comparison between Fig. 3 and 4, we can find that the tone shapes and the relative height of the non-Rusheng tones in Weishui (Fig. 3) are roughly the same as their counterparts in Nanhai except that Nanhai's Qusheng rises conspicuously after the disappearance of its Rusheng. The pitch curve of Nanhai's Qusheng is far more 'detached' than the one of the Weishui's Qusheng. It does not run across any other tones in the figure (Fig. 4), while in Weishui its Qusheng crosses the Yinping and the four non-entering tones closely overlap. However, all the four tones of Nanhai are perceived as the same as their counterparts in Weishui by the Songzi locals, and the Qusheng of the two is not exceptional. As a researcher, I sense the pitch heights of the two tones are slightly different, but as a local of Jingzhou city I also feel the two Qusheng tones are the same phonologically. In order to ascertain whether Weishui and Nanhai share the same Qusheng, we designed a perception experiment which covers the locals from Weishui, Nanhai and Songzihe. The result agreed with the perception above.

In Songzihe (Fig. 5), its Yangping and Shangsheng are identical to their counterparts in the other two dialects but the tone values of its Yinping and Qusheng show a *tonal flip-flop* with their counterparts. These findings are in accordance with the perception. With the RL Tonal Model, the three tonal systems of Songzi dialects are transcribed as follows:

Table 1 *Songzi tonal systems under the RL Tonal Model*

	Yinping	Yangping	Shangsheng	Qusheng	Rusheng
Weishui	{35}	{324}	{42}	{55}	{66}
Nanhai	{35}	{324}	{42}	{55}	-
Songzihe	{55}	{324}	{42}	{35}	-

2.2. Three consecutive tonal systems geographically connected

The phonological data indicates a close relationship among the three subdivisions of Songzi dialects: they share the onset and rime systems and their tonal systems also show salient correlation. In addition, these three dialects are geographically connected (Fig. 7): Weishui is in the south, Nanhai the middle, and Songzihe is in the north.

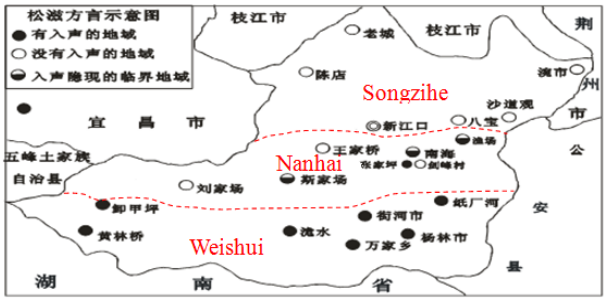

Figure 7: *Three consecutive dialects geographically connected: Weishui, Nanhai and Songzihe*

Note: ● Rusheng Maintains in these places.

◒ In these places, Rusheng may maintain in one and disappear in another adjacent place. Or in the same place, some people maintain Rusheng while the others do not.

○ There is no Rusheng in these places.

Two findings are achieved here. (1) The tonal systems in Weishui and Songzihe area are relatively stable. While Rusheng is retained in the former, it disappears in the latter. (2) But in the Nanhai area, two tonal systems co-occur, i.e. the tonal systems of Nanhai Type and Weishui Type are interwoven. Referring to the evolutionary trend of Rusheng in Chinese languages, i.e. a tendency to disappear (it has disappeared in most Mandarin varieties), we can deduce from the comparison of Weishui and Nanhai as well as Finding (2) that Weishui Type will evolve toward Nanhai Type. As for Nanhai and Songzihe, they also show a strong evolutionary correspondence. Firstly, they share two tones and their other two tones are in a tonal flip-flop. Secondly, from the map, we can see Songzihe area is contiguous to Jingzhou 荆州, the capital town of Jingzhou City. Jingzhou dialect is prestigious in the area where Songzi is located. Actually the dialect of Songzihe is almost identical to the Jingzhou dialect. Here, the influence of the prestigious language cannot be neglected and it is the probable impulse for the flip-flop occurring in Nanhai and Songzihe.

As a result, a consecutive change is found among these three synchronic dialects: Weishui is the starting point of the evolution, Songzihe is the contemporarily predictable ending point, and Nanhai is the intermediary, a transitional stage between Weishui's phonological system with an independent Rusheng and Songzihe, a system further developed after the disappearance of Rusheng. The process of evolution is shown as follows:

Weishui → Nanhai → Songzihe

Figure 8: *The tonal evolution of Songzi dialects*

3. The evolution of Rusheng in Weishui

When more and more complexities are found in the fieldwork of East and Southeast Asia (ESA) languages [3][12][17], the convention that regards tone as a pitch-only phenomenon cannot work anymore. Tone consists of three components: *register* (determined by phonation types), *length*, and *pitch* [12].

After systematic analyses (omitted for the word limit), we find the length of the Rusheng in Weishui is indistinguishable from other tones, i.e. they are no longer short. Therefore, it is the register and pitch that determine the Weishui's Rusheng to be an independent category. At present, these two features of Weishui's Rusheng show a downward movement from Rg H to Rg M, which is in accordance with the evolution from Weishui to Nanhai discussed above.

3.1. The evolution of the pitch of Weishui's Rusheng

Being "super-high" is the striking feature of Weishui's Rusheng. However, auditory analysis shows that some Rusheng syllables are considerably lower than the others. Acoustic analysis proves that some Rusheng syllables undergo *an overall falling* (Fig. 9).

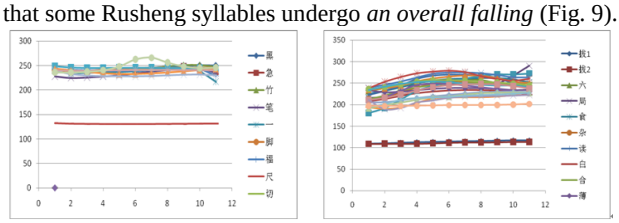

Figure 9: *Overall falling of Weishui's Rusheng*
[Left]尺 **ʦʼɹ** 'ruler' [Right] 拔 **pɑ** 'to pull'

An overall falling refers to the phenomenon that the pitch of the tone falls while its contour maintains. As in Fig. 9, the pitches of three Rusheng syllables are lowered by about 100Hz.

The statistical data of Weishui's Rusheng involved in the overall falling is shown in Table 2.

Table 2: *The overall falling of the falsetto Rusheng*

Informant	Yinru	Lowering Degree	Yangru	Lowering Degree
26	Without			
29	1/15	45.41%	Without	
32	1/17	54.95%	2/17	47.73%
36	Without		3/14	48.48%
37	3/23	17.1%	Without	
12	2/25	29.25%;17.21%	2/24	52.51%

The table indicates that the overall falling is a general phenomenon. Among the six speakers, only one speaker (No. 26) does not show this falling. Besides this, we can also find from the table, most syllables involved in this overall falling move down considerably. Their pitch height is only about half of the other Rusheng syllables.

Acoustic data also show that Weishui's Rusheng falls in the other way: the lowering of the *tone tail* (Fig. 10).

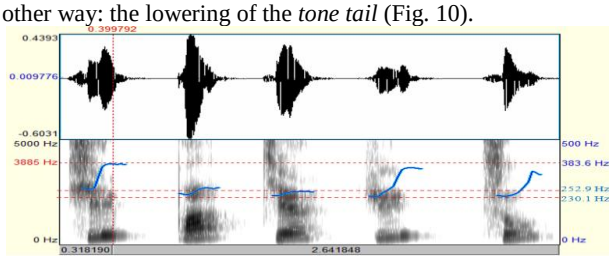

Figure 10: *The lowering of the tone tail in falsetto Rusheng*

Note: The Rusheng syllables 七**ɕi**, 八 **pɑ**, 结 **tɕje**, 菊 **tɕy**, and 叔 **su** from the left to the right.

In this figure we can see that compared to the other three Rusheng syllables the tone tail of the syllables **pɑ** and **tɕje** is lowered, which turns their tone contour from a sharp rising tone to a level.

In sum, Weishui's Rusheng is moving down in two ways, an overall falling and the lowering of the tone tail, which present the initial downward movement of Weishui's falsetto Rusheng from Register High to Register Mid.

4. Summary and discussion

Under the Evolutionary Phonology and the RL Tonal Model, three tonal systems of Songzi dialects are found. They are geographically connected and present a diachronic evolution in synchronic distribution: Weishui is the starting point of the evolution, Nanhai is the transitional stage and Songzihe is the end. Acoustic data proves that Weishui's falsetto Rusheng in Register High is moving down toward Register Mid in two ways. This change offers us the chance to bridge the tonal systems of Weishui and Nanhai. When all the Rusheng syllables of Weishui move into the Register Mid and merge with the other tones, Nanhai type is formed. This downward movement of Weishui's Rusheng starts the chain tonal shift among Weishui, Nanhai and Songzihe.

This study reveals the importance of an effective theory and sufficient fieldwork in the definition of tones.

Before this study, the consecutive changes among the three dialects of Songzi were never reported. Some difficulties in this study actually highlighted how it was impossible for the previous researchers to find this evolution in the synchronic distribution when there are no theories to distinguish tonal registers. Two phonetic properties of Weishui's Rusheng greatly challenge the conventional tonal representation which does not distinguish different registers and holds pitch contour as the only parameter in tonal definition: (1) Weishui's Rusheng in falsetto or fortis voice is phonetically incompatible to other [55] tones in *clear voice*; (2) Two contours (a rising one and a level one) are found in Weishui's Rusheng. Furthermore, with the discovery of Nanhai's tonal system, the typological challenge arises. The tonal systems of Weishui and Nanhai are almost identical except that the former possesses one more Rusheng category. Independently, Nanhai's Qusheng should be transcribed as [55] under the five-point scale, but in Weishui's tonal system Qusheng can only be marked with [44] for the highest position [55] should be left to the falsetto Rusheng. As a result, before the RL tonal model, Weishui's Rusheng in Register High could only be compressed with other tones in clear voice, which failed to transcribe the tonal systems of Songzi dialects objectively and then made the valid typological studies impossible. Then even if the three tonal systems were successfully defined in the past, researchers might not be able to find their consecutive relation because of the lack of the pan-chronic perspective. Besides effective theories, sufficient fieldwork is another necessity in the definition of tones. In this study, the discovery of Nanhai Type, the link connecting this chain shift, is a critical step. Sufficient fieldwork on tones will facilitate us to observe more phonological properties of tones and thus offer us more opportunities to design an appropriate theory to accommodate tones in different types.

Following this study, we will turn to the investigation of the other two Hubei dialects, Jingmen and Jianli where Falsetto tones were found. The co-existence of the two phonation types and the strong correspondence among the three dialects indicate the significance of the subsequent research.

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