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Same Tone, Different Category: Linguistic-Tonetic Variation in the Areal Tone Acoustics of Chuqu Wu

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Abstract

Acoustic and auditory data are presented for the citation tones of single speakers from nine sites (eight hitherto undescribed in English) from the little-studied Chuqu 处衢 subgroup of Wu 吴 in East Central China: Lìshuǐ 丽水, Lóngquán 龙泉, Qìngyuán 庆元, Lóngyóu 龙游, Jǐnyún 缙云, Qīngtián 青田, Yúnhé 云和, Jǐngníng 景宁, and Táishùn 泰顺. The data demonstrate a high degree of complexity, having no less than 22 linguistic-tonetically different tones. The nature of the complexity of these forms is discussed, especially with respect to whether the variation is continuous or categorical, and inferences are drawn on their historical development.

Index terms: tone, linguistic-tonetics, Chinese, Wu, Chuqu, areal variation.

1. Introduction

How do tones vary phonetically across a dialectal area? Is the variation continuous, such that one finds a gradual change in tonal pitch shape as one goes from dialect to dialect? Or is it categorical, showing abrupt changes from site to site? This paper provides an answer to this question using acoustic data from the Chuqu dialects of the Wu language of China. Despite their more distant relationship with the northern Wu varieties, these southern Wu dialects have not been described acoustically before. Auditory descriptions are also rarely found in comparative or typological tonal studies, whether on Wu or generally.

Figure 1. *The Chuqu region, showing location of sites described. ─ = boundaries with non-Wu dialects; -- = other Wu sub-group boundaries; dot-dashed line = boundary between Chu & Qu sub-subgroups.*

The Chuqu subgroup of Wu lies in a mountainous area inland from the coastal Oujiang subgroup and south of the Wuzhou subgroup. Among a population of ca. 3.5 million, quite a small number by Chinese standards, and in an area of just 17,000km^2, the linguistic diversity is great. The location of the varieties described here (mostly from the eastern half of the Chuqu subgroup) is shown in Figure 1. Anecdotally, the eastern, Chu, varieties are mutually intelligible to varying degrees. The westernmost, Qu, varieties (Longyou, Qingyuan and Longquan) are not intelligible with the Chu sub-subgroup. None are intelligible with northern Wu varieties like Shanghai or Ningpo, or with Oujiang varieties like Wenzhou.

Although they are classified as Wu dialects e.g. in [3], most of the varieties described here do not exhibit all of the features typical of a Wu variety, particularly the well-known diagnostic tripartite division of syllable-initial stops into voiceless aspirated, voiceless unaspirated and voiced [1]. Thus all except one variety – Qingyuan – contrast only two series of stops: aspirated and unaspirated; and Qingyuan has three series, but has implosive [ɓ, ɗ] stops instead of voiceless unaspirated [p, t].

The varieties in this paper are described from recordings from three sources. The data for Jingning, Longyou, Lishui, Longquan and Taishun were recorded by Prof. William Ballard in the 1980s, as part of his own project in southern Wu lexical variation. The data for Jinyun, Yunhe and Qingyuan were recorded by Prof. Zhu Xiaonong in the late 1990s. Qingtian was recorded by the first author as a part of his fieldwork research in 2007. Recordings from one speaker from each site were used.

2. Procedure

All recordings were digitised at 16 kHz and then further processed with *Praat*. The recordings were first transcribed and the number of tones in each dialect determined by auditory-linguistic analysis. (The term *tone* is used here in the sense analogous to *phone*, that is, as a constellation of audibly different properties, with pitch predominating but also including length and phonation type, that constitutes observation data for further analysis.) For each token of each tone, F0 was sampled at a high enough rate to capture the details of the tonally relevant F0 time course – 10% intervals of the tonally relevant portion of the Rhyme – and at the 5% point to capture any segmental perturbatory effects in F0 from initial consonants. The Rhyme duration was also measured. Means were calculated for between five and ten tokens per tone per speaker to derive a mean duration and F0 contour for each tone. The resulting mean F0 contours were then plotted as a function of mean Rhyme duration: it is important when doing comparative work of this kind not to equalize duration, otherwise important linguistic-tonetic details may be lost [5].

Category	Ping		Shang		Qu		Ru	
	Yin	**Yang**	**Yin**	**Yang**	**Yin**	**Yang**	**Yin**	**Yang**
Lishui 丽水	213 low rise	211 low fall-level	322 mid fall-level	= *yinshang*	51 high fall	342 depressed high fall	5ʔ stopped high	23ʔ stopped low rise
Longyou 龙游	33 mid level	31 low fall	35 high rise	214 low rise	52 high fall	342 depressed high fall	5ʔ stopped high	23ʔ stopped low rise
Jinyun 缙云	44 high level	131 low convex	51 high fall	331 mid fall	342 depressed high fall	411 high fall-level	311ʔ mid fall-level	213ʔ stopped low rise
Qingtian 青田	434 mid dipping	331 mid level-fall	231 depressed high fall	= *yinshang*	311 mid fall-level	11 low level	51 high fall	231 short depressed high fall
Yunhe 云和	213 low rise	211 low fall-level	31 low fall	= *yinshang*	44 high level	11 low level	5ʔ stopped high	2ʔ stopped low
Jingning 景宁	31~ low fall creaky	41 high fall	322 mid fall-level	= *yinshang*	324 low rise	11 low fall	5ʔ stopped high	23ʔ stopped low rise
Longquan 龙泉	31~3 creaky mid level	31 low fall	52 high fall	= *yinshang*	324 low rise	213 low rise	5ʔ stopped high	23ʔ stopped low rise
Qingyuan 庆元	24 mid rising	52 high falling	33 mid level	= *yangqu*	11 low level	31 mid fall	5ʔ stopped high	3ʔ stopped mid
Taishun 泰顺	212 low dipping	42 high fall	44 high level	= *yangqu*	324 mid rise	33 mid level	5ʔ stopped high	2ʔ stopped mid

Table 1. *Citation tone pitch of nine Chuqu sites compared by Middle Chinese category.*

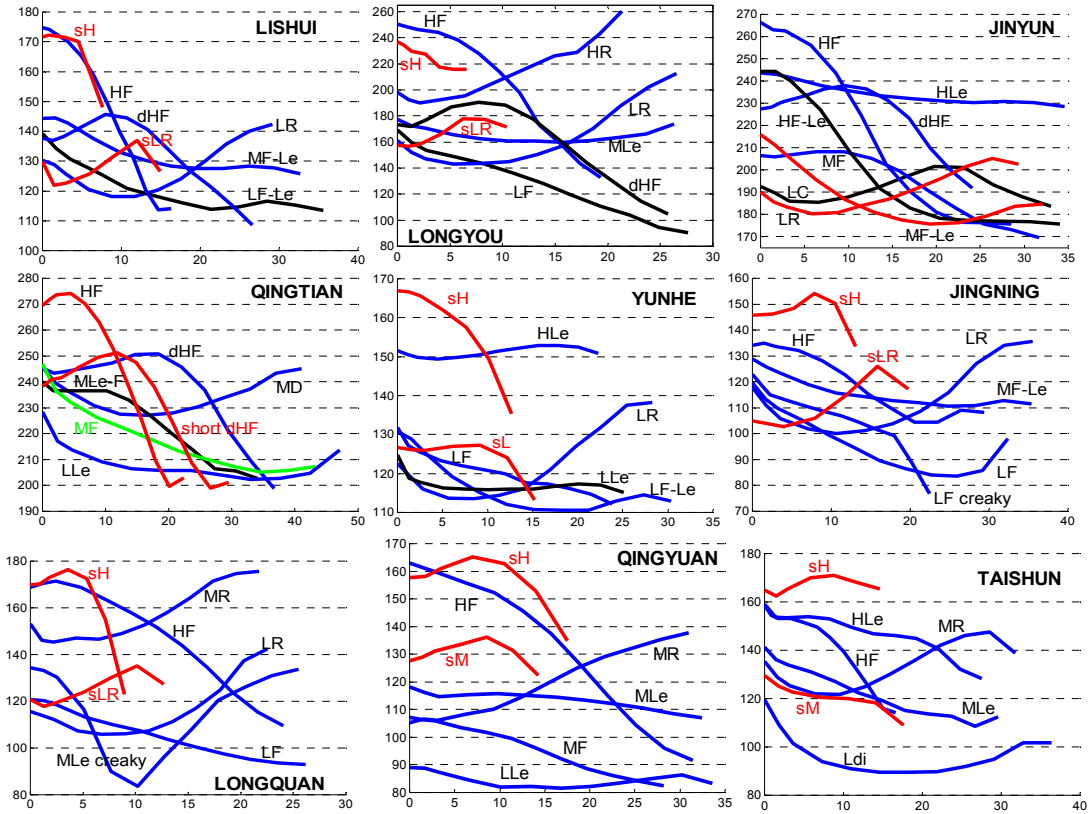

Figure 2. *Mean citation tonal acoustics (F0, duration) for speakers from nine Chuqu sites. Vertical axis = F0 (Hz), horizontal axis = duration (csec). H, M, L = high, mid low; F, R, Le, Di,C = fall, rise, level, dipping, convex; s = stopped, d = depressed.*

3. Results

Table 1 gives the results of the auditory-linguistic analysis of the tones of the nine sites. Tones are described by their Chao tone letters [2] and also by a simple pitch descriptor. *Stopped* means the tone occurs on syllables with a glottal-stop coda. Such tones sound much shorter than the unstopped tones (this is transcribed by the underline). *Depressed* is term referring to the lowering of a tone's pitch onset (such that a convex pitch is interpreted as a depressed high falling tone). To facilitate subsequent comparison, the tones are set out according to the eight historical tonal categories which developed from Middle Chinese (*Yinping, Yangping*; *Yinshang, Yangshang; Yinqu, Yangqu; Yinru, Yangru*). This guarantees identification of cognate tones across dialects. For example, table 1 shows that the low rising [213] tone in Lishui is cognate with (i.e comes from the same historical *Yinping* tone as) the mid level [33] tone in Longyou, and the high level [44] tone in Jinyun. Table 1 shows that the dialects have either seven or eight tones, which is typical for Wu. The seven-tone varieties show the Middle Chinese category of *Yangshang* merging either with *Yinshang* or *Yangqu*. In all, about 22 linguistic-tonetically different pitch shapes may be identified. The different categories and their pitch shapes are listed in table 2. It can be seen that there are two sites (Longquan and Jingning) where one of the tones is also characterized by extrinsic creaky phonation. Another unusual category – but fairly common for Wu – is tones with falling-level pitches. There is also one contrast between complex contoured depressed high falling tones, in Qingtian, that depends on duration. The stopped tones show similar contours across seven of the nine sites. It is the unstopped tones that are more likely to vary, but perhaps that is simply because there are more of them (each dialect can have only two stopped tones).

Linguistic-tonetic category	Examples		
Level (3)	44	22	11
Creaky Mid Level (1)	31~3		
High Fall (2?)	52, 51	42	
Depressed High Fall (1)	342, 231		
Short Depressed High Fall (1)	231		
Mid/low Fall (1)	31		
Mid/low fall creaky (1)	31~		
Falling-Level (2)	411, 322	311, 211	
Level-Falling (1)	331		
High Rise (1)	35		
Low Rise (1)	213, 324, 24		
Convex (1)	131		
Dipping (2)	434	212	
Stopped (5)	5ʔ	3ʔ, 2ʔ	311ʔ
		23ʔ	213ʔ

Table 2. *Linguistic-tonetic categories of the Chuqu tones.*

Although Chinese is noted for its preference for contour tones over level tones [10], there is still a startling number of complex tones (i.e. tones with more than two targets), including a contrast between falling-level tones and level-falling tones, especially in Jinyun. Of the 65 different tones in the nine sites, nearly half are complex. The eight tones of Jinyun, six of which are complex, are worth exemplifying: high level [44 - k^{h}ej 开 *open*, p^{h}je 片 *slice*, $tɕ^{h}$iw 秋 *autumn*]; low convex: [131 - zɔŋ 床 *bed*, mʌw 麻 *hemp*, zʐ̩ 时 *time*]; high falling: [51 - nɑwŋ̍m 懂 *know*, tiw 岛 *island*, faŋ 粉 powder]; mid falling: [331 - mʌw 马 *horse*, tɕaŋ 近 *near*, tsʐ̩ 是 *be*]; depressed high fall: [342 - tsʐ̩ 醉 *drunk*, ej 爱 *love*, najŋ 登 *climb*]; high falling-level: [411 - tʌ 大 *big*, va 饭 *rice*, jɔŋ 用 *use*] mid falling-level and stopped: [311ʔ - pɔʔ 八 *eight*, t^{h}jaʔ 铁 *iron*, tɕɔʔ 脚 *foot*]; low rising and stopped: [213ʔ - zɛʔ 杂 *mixed*, tawʔ 读 *read*, paʔ 白 *white*].

The diversity of tone realisations in the Chuqu region is thus clear in these data. This diversity contrasts with the segmental phonology, which is more uniform.

The mean tonal F0 for all nine sites is plotted as a function of absolute duration in figure 2. The complexity of the resulting configurations gives an idea of the variety in tonal acoustics in this area: there are considerable pairwise differences between all sites. It is necessary now to try to make some sense of this variation in terms of the questions we posed at the beginning of the paper, namely can we demonstrate any continuity or categoricality in the tonal acoustic shapes?

In order to be able to compare tonal acoustics across varieties it is of course necessary to abstract away the speaker-dependant features. Therefore we first did a conventional z-score normalization of the tonal F0 [4], using normalization parameters of mean and standard deviation F0 from all sampled F0 values in non-stopped tones. This option was taken as the large amount of variation between sites meant there is no *a priori* subset of all tones from which to extract normalization parameters that are comparable across all varieties. The duration of each tone was also normalized as proportion of mean unstopped duration [7]. So for example the mean duration of unstopped tones in Longquan was 24.0 csec. This was taken as unity and the individual Longquan tones' duration normalized with respect to that.

4. Analysis

4.1. Continuous and categorical variation

A precondition of identifying continuous variation is controlling for historical category. Once this is done, some continuous variation can be seen in the data. For example, for tones in the historical *Yinping* category, some phonetic relatedness is present. The normalized F0 for the group of *Yinping* reflexes is shown in figure 3. If one takes the mid level tone in Longyou as a starting point, it is possible to see a gradual lowering the further south one goes. The start of this lowering may be seen in the mid-dipping pitch of the Qingtian reflex. It is possible that the pitch has gradually lowered in Yunhe and Lishui, the end point of which is seen in Taishun. Lowering has resulted in the development of extrinsic creaky phonation types in Longquan and Jingning, with perhaps the latter failing to restore modal voice at the end and thus ending in creak. On the periphery of this lowering area, in Jinyun to the NE and Qingyuan to the SW, are seen higher reflexes which may be more conservative.

Variation within a category is not always as neat as this, however. A nice example can be seen in the tones of the historical *Yangqu* category. These are realised as a mid falling-level [311] tone in Qingtian, a high falling-level [411] tone in Jinyun, a low level [11] tone in Yunhe and Jingning, a mid falling [31] tone in Qingyuan, a mid level [33] tone in

Taishun, a low rise [213] tone in Longquan, and a depressed high falling [342] tone in Lishui and Longyou. It is more difficult to relate these tones in the quasi-Wittgenstinian manner of the *Yinping* tones in figure 3, and they appear to instantiate categorical variation, at least to a certain extent.

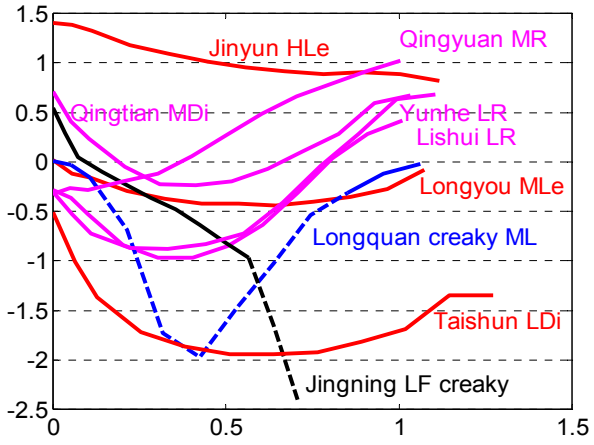

Figure 3. *Continuous variation in tonal F0: Chuqu reflexes of the historical Yinping category. Vertical axis is normalised F0 (sdF0), horizontal axis is normalised duration.*

4.2. Intercategorical Similarities

The variation in realisations within the same historical category exemplified above can be juxtaposed to the similar realisations of tones from different categories. A good example is furnished by the low rising tone found in six sites (Longyou, Lishui, Yunhe, Jingning, Longquan, Jinyun). Figure 4 shows the z-score normalized F0 for these tones plotted as a function of normalised duration. It can be seen that there is exceptionally good agreement in F0 contour, with the amount of variation well within that expected for normalised tonal F0 from different speakers of the same dialect [8]. These clearly are examples of the same linguistic-tonetic category, *a fortiori* so because the tones are actually reflexes of five different historical categories (*Yangshang* in Longyou, *Yinping* in Lishui & Yunhe, *Yinqu* in Jingning, *Yangqu* in Longquan, and *Yangru* in Jinyun. The same degree of similarity can be demonstrated for the mid/low falling tones which appear in seven sites, from five historical categories. These data show that the Chuqu speakers are using the same tone, but from different historical categories. The main significance of this lies in the demonstration that such objects as *the same tone* do exist cross-linguistically.

5. Summary

We have presented data in this paper to illustrate both categorical and continuous variation in the tones of the Chuqu region. From this it is reasonable to infer that the synchronic variation in tones in this area has historically arisen both by a gradual shifting of the pitch contour, sometimes with concomitant changes to phonation type, but also by an abrupt change of contour from one type to another.

The diversity of the tone variation has also been illustrated, showing the presence of 22 linguistic-tonetically different tones from the nine sites described.

6. Acknowledgements

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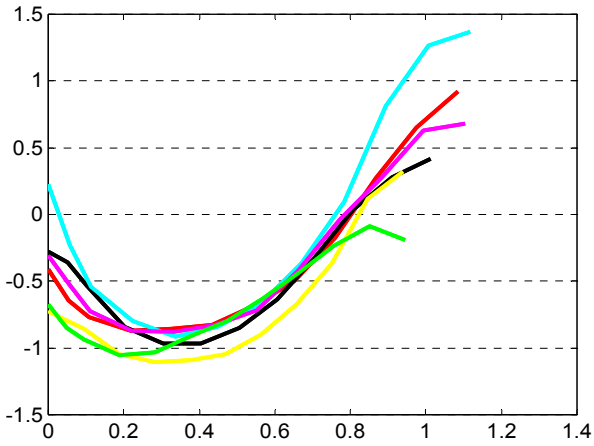

Figure 4. *Normalised mean F0 contours of low rising tones from six Chuqu dialects. Vertical axis is normalised F0 (sdF0), horizontal axis is normalised duration.*

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