

Experimental Research on the Monosyllabic Tones of Wudu Dialect

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Abstract—This paper uses the method of experimental phonetics analysis the tones of Wudu dialect. Through recording, extracting and analysis data, we get a conclusion that there are three tones in Wudu dialect, they are Yinping (41), Yangping (13) and Shang (44). We found that Ru was all merged into Yangping. This article makes an objective description of the specific situation of the Wudu dialect and to provide some reference for the study of Wudu dialect in the future.

Keywords—Tianshui dialect; Monosyllabic tones; Experimental phonetics

I. INTRODUCTION

Wudu is located in the southeast of Gansu Province. It is located in the Qinba Mountain Area and at the junction of Gansu, Shaanxi and Sichuan provinces. It is the political, cultural and economic center of the Longnan City. The dialect in Gansu province can be divided into three parts: Zhongyuan Mandarin, Lanyin Mandarin and Southwest Mandarin. The largest number of people used in the Zhongyuan Mandarin. Its basic features are “voiceless, aspirational voiceless and secondary voiced of Ru was merged into Yinping now. The voiced of Ru was merged into Yangping”. Zhongyuan Mandarin can be divided into three parts: Longzhong film, Qinlong film and Guanzhong film. Wudu dialect belongs to Qinlong film. So far, linguists have done a small amount of research on Wudu dialect. In A study of the Southwest Mandarin in Gansu, Mochao studied on the sound system of Fengxiang in Wudu County. He point out that there are four tones in Fengxiang dialect and they are Yinping (334), Yangping (31), Shang (53) and Qu (24).¹ This article will study the tones of Wudu dialect from the perspective of experimental phonetics and quantitative analysis them. Finally it will provides a reference for the further study of Wudu dialect [1].

II. EXPERIMENTAL DESCRIPTION

Pronunciation table. The main task of this experiment is to have a comprehensive depiction and analysis to Wudu dialect using the method of experimental phonetics. In this paper, we according to Dialect Survey Questionnaire to determine the experimental pronunciation list (Table 1). The design of the word list follows the principles below: 1) In each words, the boundaries of consonants and vowels should be obvious. 2) About each words, the final of a syllable should be a pure

vowel, reduce tongue movement and avoid affecting the accuracy of data. 3) Consider the minimal pair in each tones.

TABLE I. PRONUNCIATION LIST

Ancient tone	Ancient sound	Cases of words
Ping	Voiceless	东、该、灯、风
	Asperational voiceless	通、开、天、春
	Secondary voiced	门、龙、牛、油
	Voiced	铜、皮、糖、红
Shang	Voiceless	懂、古、鬼、九
	Asperational voiceless	统、苦、讨、草
	Secondary voiced	买、老、五、有
	Voiced	动、罪、近、后
Qu	Voiceless	冻、怪、半、四
	Asperational voiceless	痛、快、寸、去
	Secondary voiced	卖、路、硬、乱
	Voiced	洞、地、饭、树
Ru	Voiceless	谷、百、搭、节、急
	Asperational voiceless	哭、拍、塔、切、刻
	Secondary voiced	六、麦、叶、月
	Voiced	毒、白、盒、罚

The speaker is Wudu natives, rarely go out and his dialects are not affected by Mandarin. In order to pronounce naturally, we ask the speaker to be familiar with the table and to practice it before recording [2].

Recording Adobe Audition 3.0, a computer, a microphone are used when recording. When recording, the sampling frequency is 22050Hz, mono recording and the sampling accuracy is 16 bits.

Speech analysis (1) Voice segmentation and labeling. Record with Audition 3.0 and save them as wav format. Segment and label qualified samples. (2) Extract the fundamental frequency data. Extract the base frequency of each eligible audio and place it in the table. (3) Processing all fundamental frequency data and all values are normalized. The fundamental frequency is normalized by Shi Feng's proposed T-value fundamental frequency normalization formula:

$$T = [(lgF0 - lgmin) / (lgmax - lgmin)] * 5$$

[1] Mo super, Yin Wen. Research on the Southwest Mandarin in Gansu, [J]. language science, 2013, 12 (06): 658-668.

F0 is the average fundamental frequency of the observation point, min and max are the minimum and maximum fundamental frequency value, T is the normal result. The value of the T calculated in this way is in the range of 0-5. According to the correspondence in Table 2 to determine the five degrees.

TABLE II. THE CORRESPONDING OF FIVE DEGREE VALUE AND T VALUE

T value	0-1	1-2	2-3	3-4	4-5
Five degrees	1	2	3	4	5

III. DATA ANALYSIS

After extracting the fundamental frequency data of all the samples and normalizing them, calculate the average of voiceless, asperational voiceless, secondary voiced and voiced of each tone. Figure 1, figure 2, figure 3 and figure 4 are fundamental frequency curves for Ping, Shang, Qu and Ru. Finally get their domain value [3].

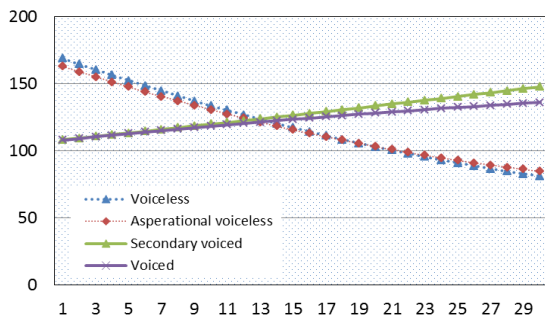


Fig. 1. Fundamental frequency curve of Ping

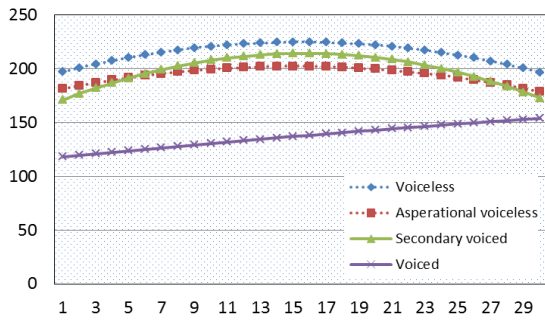


Fig. 2. Fundamental frequency curve of Shang

Ping In ancient phonology, Ping was divided into Yinping and Yangping in most dialects. Figure1 is the fundamental frequency curve for Ping. In Wudu dialect, Ping was divided into Yinping and Yangping. Voiceless and asperational voiceless are falling tones, the maximum and minimum fundamental frequency are 185.2Hz and 77.2Hz and the domain value is 108Hz. The secondary voiced and voiced are rising tones. The maximum and minimum fundamental frequency are 154.7Hz and 93.7Hz, its domain value is 61Hz.

Shang Figure 2 is the fundamental frequency curve for Shang. In Wudu dialect, Shang was divided into two tones.

Voiceless, asperational voiceless and secondary voiced are level tones, and the maximum fundamental frequency is 220.3Hz and the minimum is 186.8Hz, its domain value is 44Hz. The voiced of Shang is a rising tone, its maximum and minimum fundamental frequency are 170Hz and 105.9Hz, the domain value is 64.1Hz.

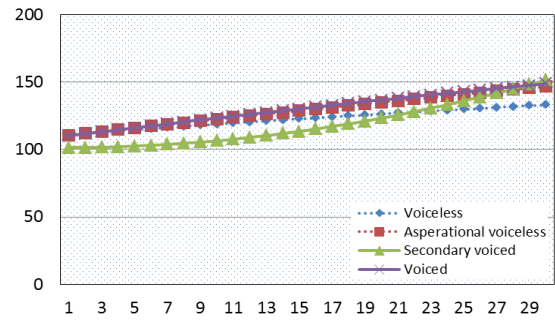


Fig. 3. Fundamental frequency curve of Qu

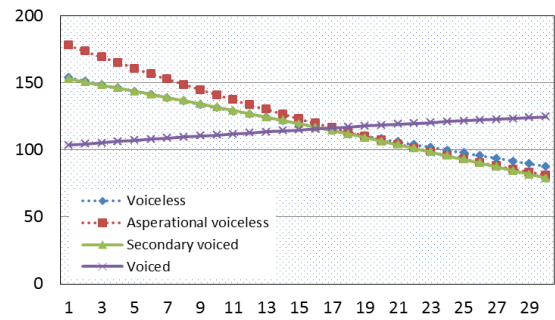


Fig. 4. Fundamental frequency curve of Ru

Qu Figure 3 is the basic frequency curve for Qu and in Wudu dialect it is a rising tone. The maximum and minimum fundamental frequency are 151.7Hz and 101.4Hz and the domain value is 50.3Hz. So, its domain value is close to Yangping.

Ru Figure 4 is the basic frequency curve for Ru. In Wudu dialect, Ru was divided into two tones.

Voiceless, asperational voiceless and secondary voiced are falling tones. The maximum and minimum fundamental frequency are 178Hz and 78.9Hz, the domain value is 99.1Hz. It is close to Yinping. The voiced of Ru is a rising tone. The maximum and minimum fundamental frequency are 136.8Hz and 89.4Hz, the domain value is 47.4Hz [4].

IV. FIVE DEGREES CALCULATION

Through the analysis of Wudu dialect fundamental frequency, we found that in ancient there are four tones in Wudu dialect, but now there are a lot of changes. Ping was divided into Yinping and Yangping [5], Yinping is a falling tone and Yangping is a rising tone. Voiceless, asperational voiceless and secondary voiced of Shang are changed into a level tone, the voiced of Shang is changed into a rising tone. There was no differentiation of Qu and it is a rising tone. Ru was divided into two tones. Voiceless, asperational voiceless

and secondary voiced of Ru are falling tone and the voiced of Ru is a rising tone [6].

According to Mr. Shi Feng's T value method, the fundamental values of 30 points of each word extracted from this experiment are substituted into F0 respectively. Then put

the calculated data into the Excel and draw the T value curves for three tones in Wudu dialect. We concludes that there are three tones in Wudu dialect, they are Yinping (41), Yangping (13) and Shang (44). The voiced of Shang, Qu and the voiced of Ru all merged into Yangping. Voiceless, asperational voiceless and secondary voiced of Ru merged into Yinping.

TABLE III. THE MONOSYLLABIC TONES OF WUDU DIALECT

Ancient tones	Ancient sound	Tones	Five degrees
Ping	Voiceless	Yinping	41
	Asperational voiceless		
	Secondary voiced	Yangping	13
	Voiced		
Shang	Voiceless	Shang	44
	Asperational voiceless		
	Secondary voiced		
	Voiced		
Qu	Voiceless	Yangping	13
	Asperational voiceless		
	Secondary voiced		
	Voiced		
Ru	Voiceless	Yinping	41
	Asperational voiceless		
	Secondary voiced	Yangping	13
	Voiced		

V. SUMMARY

Through the acoustic analysis of Wudu dialect tones and the statistics and calculation of experimental data, this paper draws the following conclusions: (1) In Wudu dialect, there are three tones. (2) Yinping is a falling tone and the value is 41. (3) Yangping is a rising tone and the value is 13. (4) Shang is a level tone and the value is 44.

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