

# An Experimental Study of Disyllabic Tones in Tianshui Dialect

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## ABSTRACT

In this paper, the experimental phonetics method is used to analyze the bi-syllable tone of Tianshui dialect. We find that there are seventeen types of disyllabic tone sandhi in Tianshui dialect. There are four types of tone sandhi in Ping, three types in Shang and four types in Qu.

## KEYWORDS

Tianshui dialect, disyllabic tones, experimental phonetics.

## INTRODUCTION

Tianshui, formerly known as Qinzhou, is located in the southeastern in Gansu Province. It is located in the junction of Gansu Province and Shanxi Province. The dialects in Gansu Province include Zhongyuan Mandarin, Lanyin Mandarin and Southwest Mandarin. Tianshui dialect belongs to the Zhongyuan Longzhong Mandarin. Up to now, there are many studies on the disyllabic tones in Tianshui dialect, such as *A study on the disyllabic tone sandhi of Tianshui dialect with three tones* from Zhang Wenxuan. In that article he points out that Ping was divide Yin and Yang in disyllable and if the tone of front word is YinPing, no matter which tone the back words are, the front word must change from 13 to 21. If the front word is Yangping, no matter which tone the back words are, the front word does not change. When the front word is Shang, sandhi occurs only in a part of combinations which the bank words are Shang and the front word changed from 53 to 21. Other studies on Tianshui dialects are available, such as *Three-tone dialect Tianshui dialect read two-tone tone* and *Phonological Features of Tianshui Dialect in Three Tune Dialects* from Zhang Wenxuan. In this thesis, we use experimental phonetics to study the tone of Tianshui dialect. In this way, we can use scientific methods to describe Tianshui dialect objectively and to provide a reference for further study of Tianshui dialect.

## EXPERIMENTAL DESCRIPTION

### Pronunciation table.

Through the study of the mono-syllable of Tianshui dialect, we know there are three tones in Tianshui dialect and they are Ping (24), Shang (51) and Qu (55). In this paper, we use T1, T2 and T3 refers to three mono-syllable respectively. "T1 + Tx"

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TABLE 1. VOCABULARY OF TIANSHUI DIALECT.

Back Front	T1 (24)	T2 (51)	T3 (55)
T1(24)	腊月 清明 黄瓜 洋葱	木耳 宽敞 牙齿 锣鼓	师傅 木匠 绰号 名字
T2(51)	牡丹 眼睛 左面 小心	老虎 老鼠 母狗 剪子	米饭 眼泪 扫地 考试
T3(55)	大门 算盘 放牛 上学	下雨 后悔 中暑 下午	豆腐 味道 算命 看病

means a combination of T1 and each tone, and so on. Three tones are grouped together with each other and the experimental word table is determined according to the principle of the double word design.

### Experimental equipment.

A computer, a microphone and Adobe Audition 3.0 recording software. Praat5.0 speech analysis software is used to segment and mark speech samples and extract experimental data.

### Experimental process.

Recording. Using Adobe Audition3.0 recording software recording, sampling frequency of 22050Hz, monophonic recording, sampling accuracy of 16. The informant living in Tianshui all the time. We recording at the phonetic laboratory. Data extraction and processing. First, for all bi-syllable words, use Praat and normalized script to extract the value of 30 base points for the first and back words respectively. Then, calculate the average of the fundamental frequency of each point. On this basis to make the basic frequency curves. In order to derive the fifth-order value of each word and make the respective T-values, we normalize the F0 data. The fundamental frequency is normalized by Shi Feng's proposed T-value fundamental frequency normalization formula.

### DATA ANALYSIS

There are two types in the change of bi-syllable tones: transposition and non-transposition. Transposition means tone letters changed, such as level tone changed to falling tone. Non-transposable means tone letters do not change but only the value changed.

According to the data, we obtained the T - value curves of bi-syllable words in Tianshui dialect (Figure 1-Figure 3) and analyze them in T1 + Tx mode. Some combinations differ in value, but there is no difference when listen them, so we combined them.

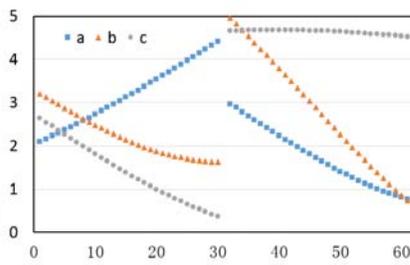
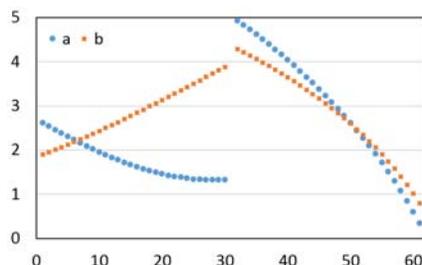
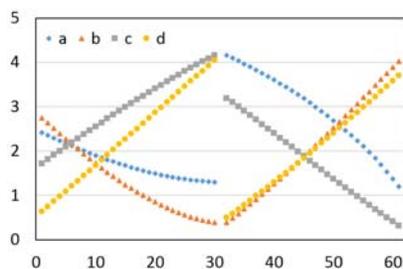


Fig. 1. Five-degree curve diagram of T1+T1.

Fig. 2. Five-degree curve diagram of T1+T2.

Fig. 3. Five-degree curve diagram of T1+T3.

**T1+T1** Figure 1 is the five-degree curve for T1+T1. In Tianshui dialect, its original value is 24+24, but there are four types of tone sandhi in this combination. a) 32+41. The front and back words are both changed to a falling tone. b) 31+14. The front word changed from a rising tune to a falling tune and the back word unchanged in tune letter but the value reduced. c) 24+31. The front word has nothing changed and the back word changed from a rising tone to a falling tone. d) 14+14. The pattern about front and back words are unchanged but domain value wider. In these four modes, 31+14 is the most important tone sandhi. No matter front or back word, secondary voiced and voiced initials are rising tone, the voiceless and aspirational voiceless are falling tones.

**T1+T2** Figure 2 is the five-degree curve for T1+T2. Its original value is 24+51 and there are two types of tone sandhi in this combination. a) 24+51. In this pattern, front and back words are not changed, and the front words are secondary voiced and voiced of Ping. b) 32+51. The front word changed from a rising tone to a falling tone and the back word do not changed. This change occurs when the front words are Ru and voiceless of Ping.

**T1+T3** Figure 3 is the five-degree curve for T1+T3. Its original value is 24+55 and there are three types of tone sandhi in this combination. a) 24+31. The front word not changed, and the back word changed from a level tone to a falling tone. b) 32+51. In this pattern, front word and back word both changed. The front word changed from a rising tone to a falling tone and the back word changed from level tone to a falling tone. c) 31+55. In this pattern, the front word changed to a falling tone and the back word do not changed.

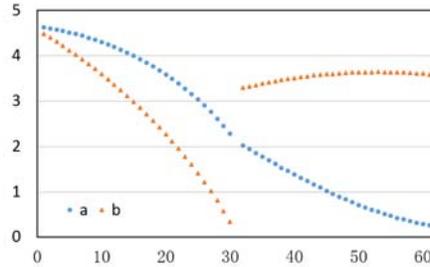
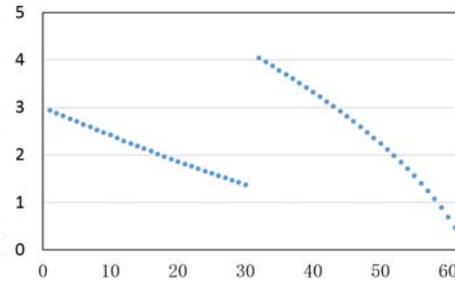
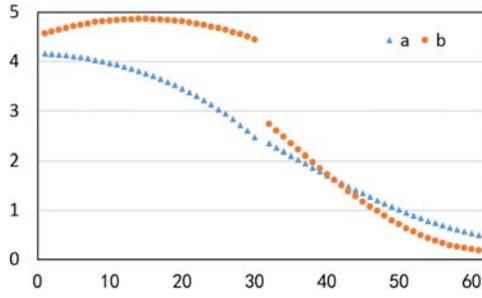


Fig. 4. Five-degree curve diagram of T2+T1.

Fig. 5. Five-degree curve diagram of T2+T2.

Fig. 6. Five-degree curve diagram of T2+T3.

**T2+T1** Figure 4 is the five-degree curve for T2+T1. Its original value is 51+24, there are two types of tone sandhi in this combination. a) 53+31. The front unchanged in the tone letter but the value at the end rose. The back word changed from a rising tone to a falling tone. b) 55+31. The front word changed from a falling tone to a high-level tone and the back word changed from a rising tone to a falling tone.

**T2+T2** Figure 5 is the five-degree curve for T2+T2. Its original value is 51+51 and there is only one type of tone sandhi in this combination. After the tone sandhi its value is 31+51. The front word unchanged in the tone letter but the value reduced and the back word has nothing changed.

**T2+T3** Figure 6 is the five-degree curve for T2+T3. Its original value is 51+55 and there are two types of tone sandhi in this combination. a) 51+44. The front word not changed, and the back word changed from a falling to a level tone. b) 53+31. In this pattern, front word and back word both changed. The front word changed in its value but the tone letter unchanged. The back word changed from a falling tone to a level tone.

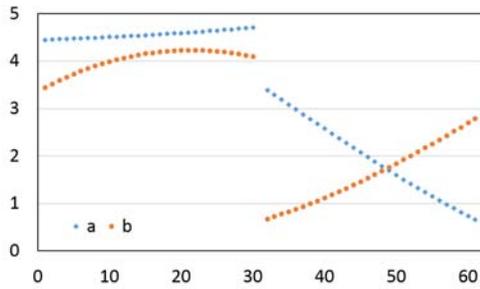


Fig. 7. Five-degree curve diagram of T3+T1.

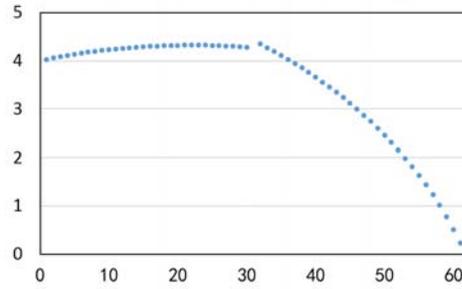


Fig. 8. Five-degree curve diagram of T3+T2.

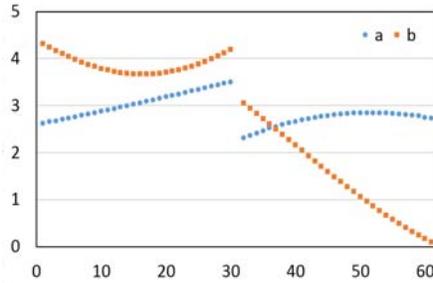


Fig. 9. Five-degree curve diagram of T3+T3.

**T3+T1** Figure 7 is the five-degree curve for T3+T1. In Tianshui dialect, its original value is 55+24 and there are two types of tone sandhi in this combination. a) 55+41. The front has nothing changed and the back word changed from a level tone to a falling tone. b) 44+14. The front word unchanged in its tone letter but the value reduced. The back word changed from a level tone to a rising tone.

**T3+T2** Figure 8 is the five-degree curve for T3+T2. Its original value is 55+51 and there is only one type of tone sandhi in this combination. After tone sandhi, the value is 44+51. In this pattern, the front word only changed in its value but the tone letter unchanged. About the back word, it changed from a level tone to a falling tone.

**T3+T3** Figure 9 is the five-degree curve for T3+T3. Its original value is 55+55 and there are two types of tone sandhi in this combination. a) 33+33. The front and back words both unchanged in their tone letter but the value reduced, and they changed in the same way. b) 44+31. In this pattern, the front word just changed in its value and the tune letter unchanged. The back word not only changed in its value but in the tune letter. It changed from a level tone to a falling tone.

## SUMMARY

TABLE 2. TIANSHUI DIALECT DOUBLE TONE MODE.

Back Front	T1 (24)	T2 (51)	T3 (55)
T1 (24)	32+41/14+14/31+14/24+31	24+51/32+51	24+31/32+51/31+44
T2 (51)	53+31/55+31	31+51	51+44/53+31
T3 (55)	44+14/55+41	44+51	33+33/44+31

In this paper, we are combining the method of field investigation and acoustic experiment to studies the bi-syllable tone sandhi mode and the tone type of disyllabic words in Tianshui dialect. Through the acoustic analysis of Tianshui dialect tones and the statistics and calculation of experimental data, this paper

draws the following conclusions: (1) When Ping is used as the front word, there are three types of sandhi: 32, 14 and 31. In sometimes, its tone unchanged and still is 24. When Ping is used as the back word, there also are three types of sandhi: 14, 41 and 31. So, no matter used as front or back word, Ping has four types of sandhi. (2) When Shang is used as the front word, there are three types of sandhi: 53, 55 and 31. When it is used as the back word the tone unchanged. (3) When Qu is used as the front word, there are two types of sandhi: 33 and 44, sometimes the tone unchanged and still is 55. When it is used as the back word, it has four types of sandhi: 33, 44, 31 and 51. Finally we find that there are seventeen types of disyllabic tone sandhi in Tianshui dialect.

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