

## An Acoustic Study on the Tones of Dong Language in Shuangjiang Town, Tongdao County, Hunan Province

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**Abstract:** This paper made use of F0 to analyze the pitch patterns of tones in monosyllabic and disyllabic words of Dong Language in Shuangjiang Town, Tongdao county of Hunan Province. The results revealed the acoustic characteristics of the tones of this dialect. Similarities and differences exist when compared to the results of previous recording.

### 1. Introduction

Dong language belongs to the Kam-Sui Branch, Kradai Group of the Sino-Tibetan Language Family, which is spoken in southern China and roughly divided into two dialects, south and north, along the Jinping county of Guizhou Province. The south dialect can also be divided into three groups and Don language in Shuangjiang town, Tongdao county represents the first group of the south dialect, which is also called "Yutou speech".

Dong language has developed tone system and its tone development has a close relationship with the consonants and vowels [1]. The number of tones in Dong language evolved from 4 to more than 10 in the history is due to the differentiation of the voiced vs. voiceless consonants and the long vs. short vowels [2]. As for Yutou speech, the previous research of Yang Tongyin in 1993 and 2009 pointed out that there are 13 tones: 8 long tones and 5 short tones which only appear in the syllables with stop codas as [-p], [-t] and [-k] [3,4]. The tone types and values are in Table 1 and the values of T1', T2, T3 and T4 are similar to T7, T7', T8, T9, T9'. The initials and tones are strictly combined, for the tones with symbol " ' " owed to the differentiation of aspirated vs. unaspirated consonants. Therefore, aspirated stop initials can only appear in the singular tones with symbol " ' " and the glottal stop initials cannot appear in those tones, while unaspirated stop initials and other non-stop initials can appear in all of the tones.

Table 1. Tones of Yutou speech in previous study

T1	T1'	T2	T3	T4	T5	T5'	T6	T7	T7'	T8	T9	T9'
55	35	11	323	31	53	453	33	55	35	31	323	24

However, the previous description of tones of Yutou speech is basically relying on the hearing and experience of the researchers, which is lack of objectivity and coherence. Therefore, this study investigates the recordings of Yutou speech by Yang [3] in 1993 with acoustic experiment and phonology analysis, to provide objective data and scientific foundation for the tone research of Dong language in Shuangjiang town, Tongdao county, Hunan Province.

### 2. Experiment

As we mentioned before, Yutou speech has 13 tones for monosyllabic words and they combined 169 disyllabic tone patterns (13\*13=169) theoretically. The original materials we use in this study is the recording of «Chinese minority language phonetic file—Dong language in Shuangjiang town, Tongdao county, Hunan Province» [3], which was pronounced by a male native speaker in 1993. Therefore, 6 words were chose for the study on each monosyllabic tone and 4 words were chose for the analysis on each disyllabic tone pattern. As the lack of words for some disyllabic tone pattern,

we finally obtained 78 monosyllabic words (6\*13=78) of 13 monosyllabic tones and 372 disyllabic words of 93 disyllabic tone patterns (4\*93=372).

The experiment was conducted by praat software (Boersma and Weenink 2009)[5]. We first normalize the duration of each word, then get 30 points from the F0 of each long tone word and 15 points from the F0 of each short tone word equidistantly. All of these data were average calculated to plot the F0 contour of each monosyllabic tone and disyllabic tone pattern.

### 3. Results

#### 3.1. Monosyllabic tones

The average F0 data of monosyllabic tones were transformed to five-scale notation by Formula (1) with 1 indicating the lowest pitch and 5 indicating the highest pitch, and then those data were used to plot Fig.1. In formula(1),

$$T = [(lgfx - lgfmin) / (lgfmax - lgfmin) \times 4] + 1 \quad (1)$$

(fmin indicates the lowest F0 in this language's tone system while fmax indicates the highest F0)

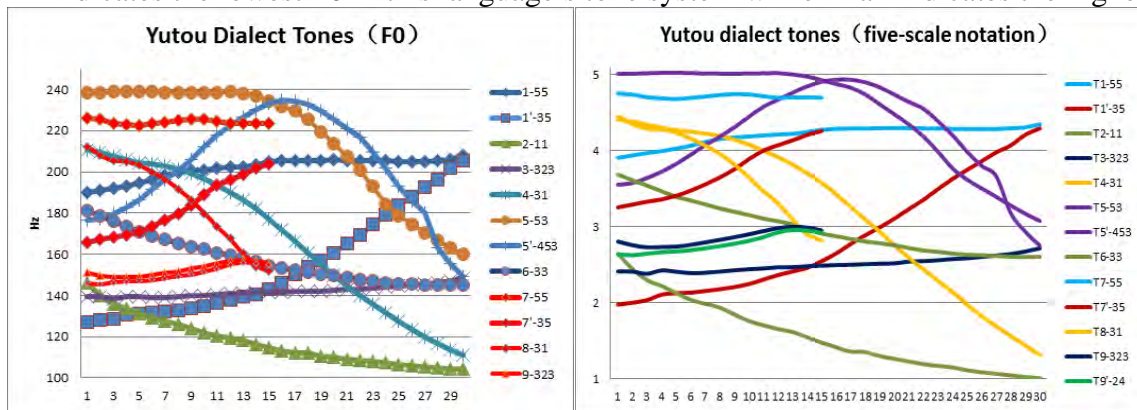


Fig. 1. Pitch contours of the 13 monosyllabic tones

According to Fig.1, we can find some acoustic features of the monosyllabic tones of Yutou speech. In previous study, researchers pointed out that the values of T1', T2, T3 and T4 are similar to T7, T7', T8, T9, T9'. However, our acoustic study turned out that the values of short tones like T7, T7', T8, T9 and T9' are always one degree higher than the long tones such as T1, T1', T2, T3 and T4. The separation of T9 and T9' was due to the differentiation of aspirated vs. unaspirated consonants in the history, but the value and duration of the two tones are almost the same by our acoustic analysis. Therefore, it is more reasonable to combine the two tones into one tone category. Furthermore, the rising-falling tones T3 and T9 are more like level tones as their values can be described as 33 and 22 respectively. In addition, the decreasing amplitude of T4 is steeper compared to the previous research, and the value of T8 is one degree higher whereas the values of T1' and T7' are one degree lower than the previous recording. In summary, the monosyllabic tone system of Yutou speech can be described as Table 2.

Table 2. Tones of Yutou speech by acoustic analysis

	Long tones								Short tones			
Tone types	T1	T1'	T2	T3	T4	T5	T5'	T6	T7	T7'	T8	T9
Tone values	44	24	31	22	51	53	453	42	55	34	53	33

#### 3.2. Tone sandhi in disyllables

Tone sandhi occurs to some extent in nearly all tonal languages. Therefore, we investigated the 93 disyllabic tone patterns in Yutou speech to obtain its tone sandhi rules. The pitch contours of disyllabic tone patterns were plot in Fig.2—Fig.13. As we can see from the Figs., when T7 is in the second syllable, it changes from a high level tone to a rising tone with value of 35. Furthermore, T3

and T9 changes into falling-rising tones when followed by or in front of other syllables. Last but not least, T5 changes from a falling tone to a rising-falling tone with its value similar to T5', which may indicates that the tones with symbol "" differentiated by aspirated initials in the history are now eventually replace its original tones.

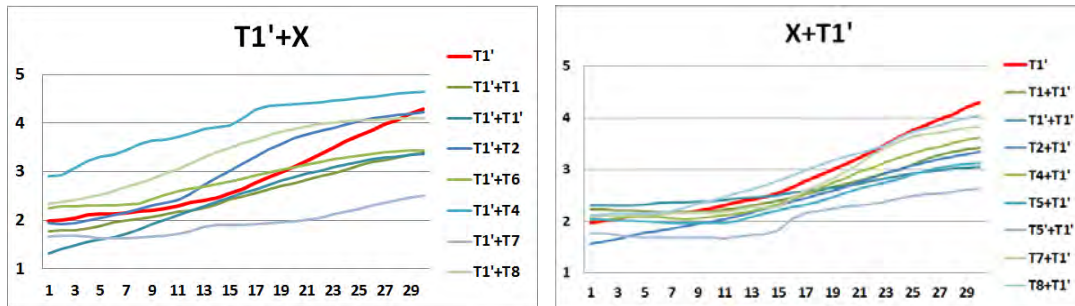


Fig. 2. Tone sandhi of T1'

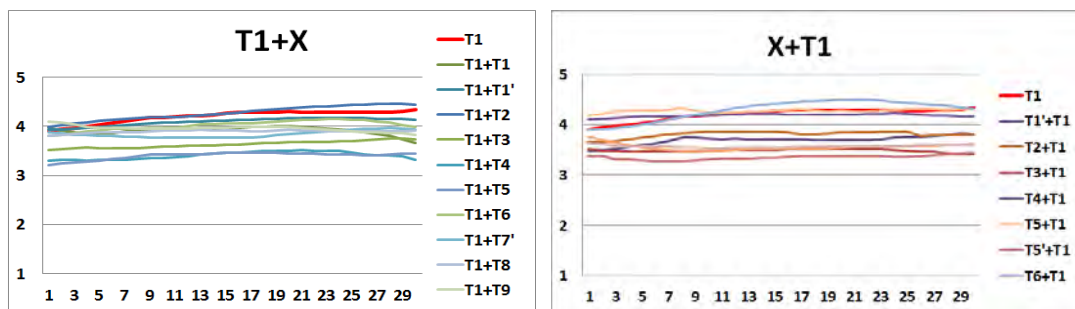


Fig.3. Tone sandhi of T1

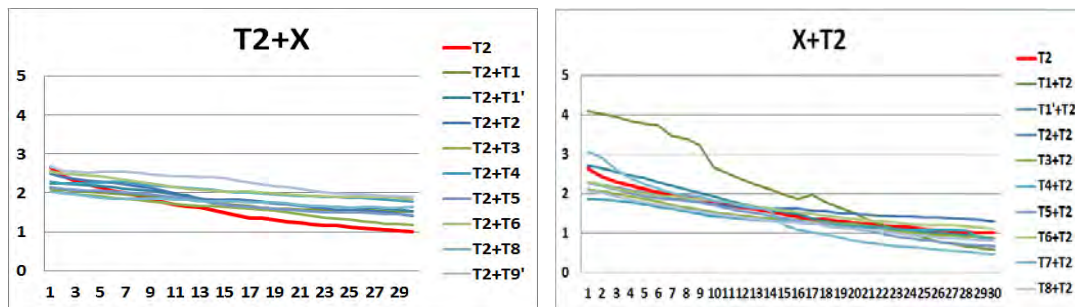


Fig. 4. Tone sandhi of T2

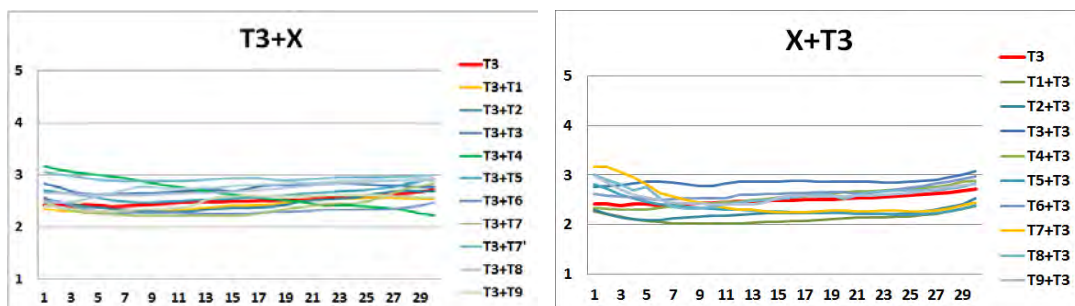


Fig.5. Tone sandhi of T3

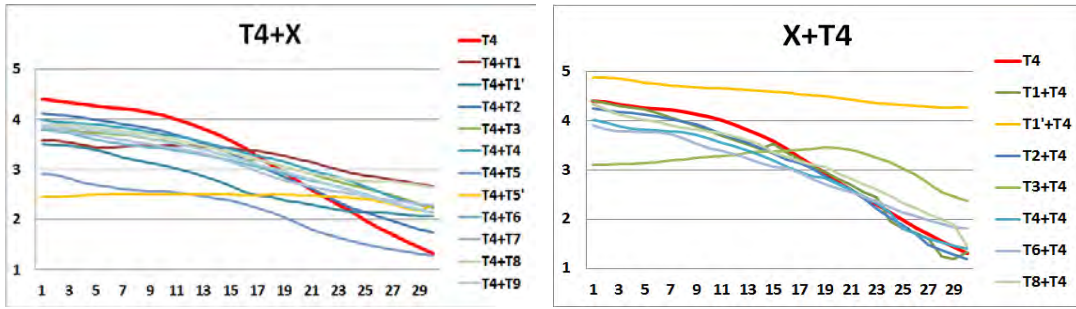


Fig. 6. Tone sandhi of T4

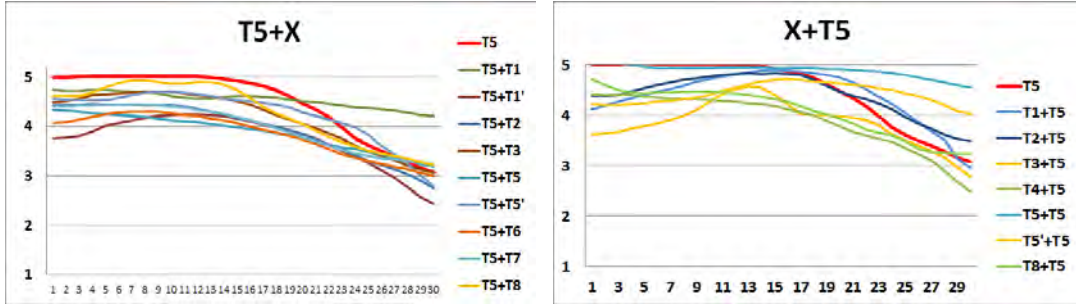


Fig. 7. Tone sandhi of T5

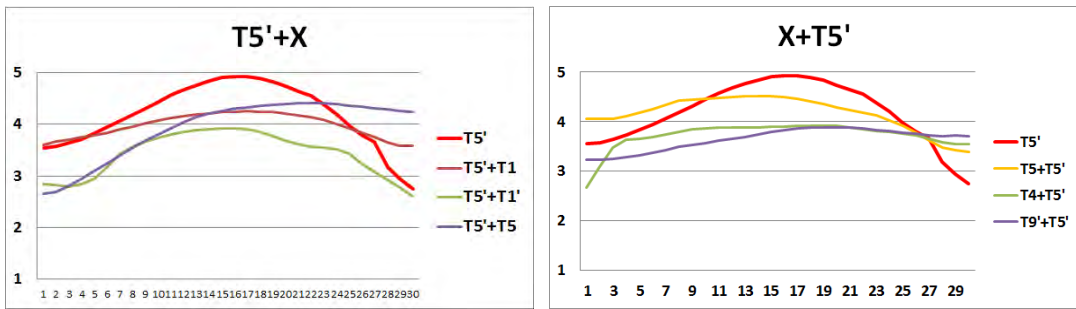


Fig. 8. Tone sandhi of T5'

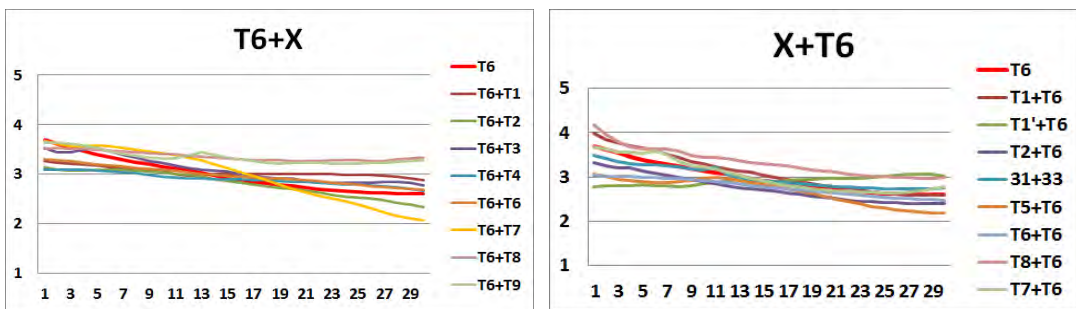


Fig. 9. Tone sandhi of T6

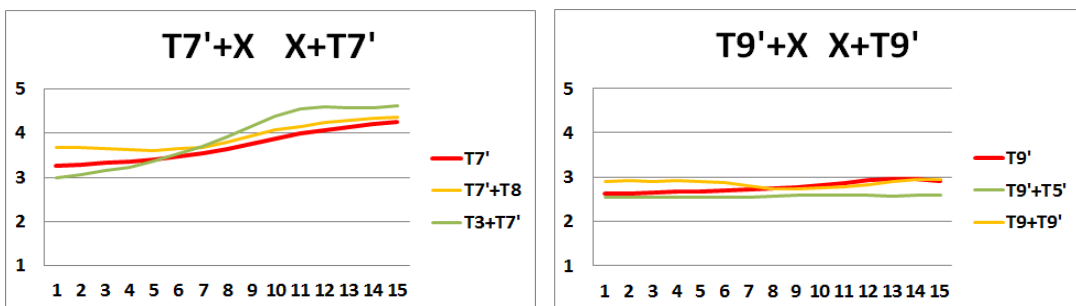


Fig. 10. Tone sandhi of T7' and T9'



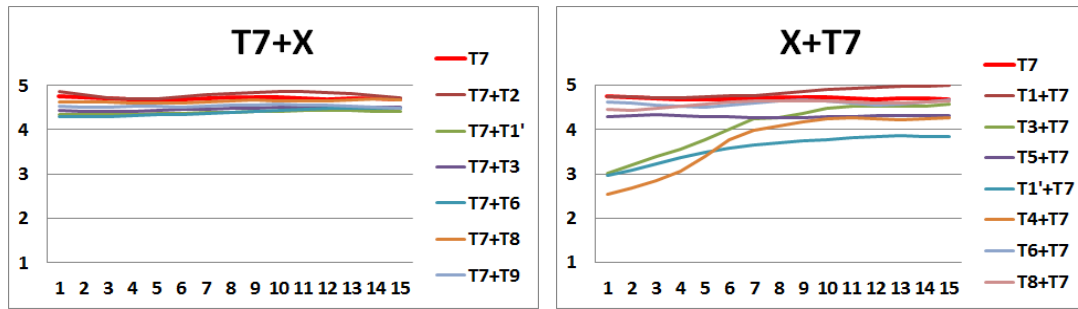


Fig. 11. Tone sandhi of T7

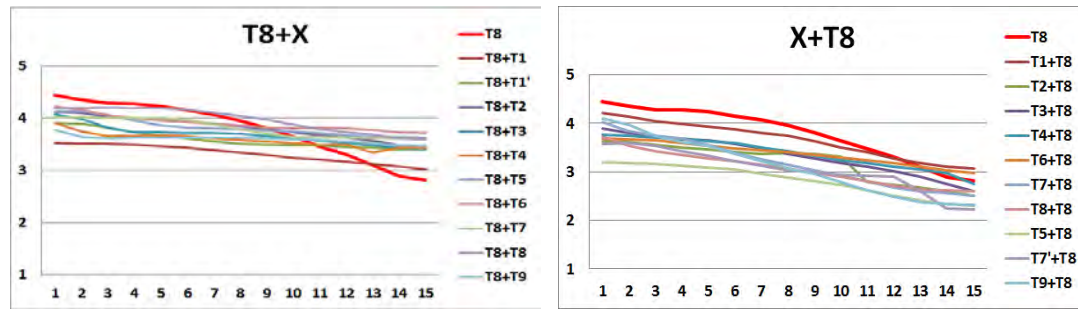


Fig. 12. Tone sandhi of T8

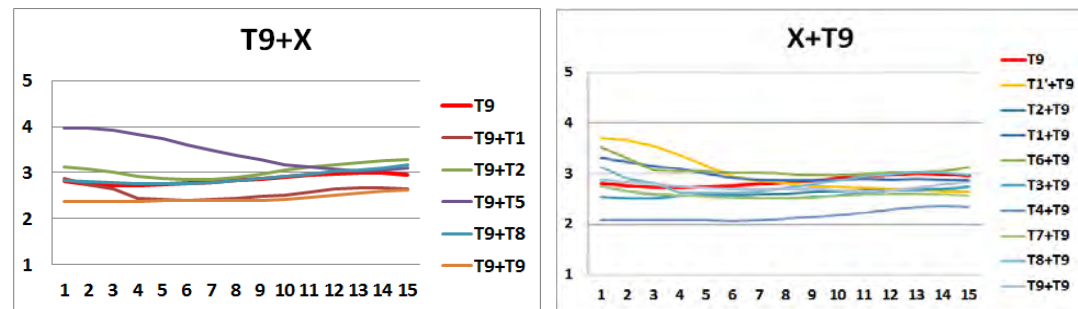


Fig. 13. Tone sandhi of T9

#### 4. Conclusion

The tones of monosyllables and disyllables in the Yutou speech are analyzed by acoustic experiment. The results revealed that Yutou speech has 12 monosyllabic tones: four level tones, two rising tones, four falling tones and one rising-falling tone. Furthermore, the study on disyllables showed the Yutou speech has three tone sandhi rules.

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