

# An Experimental Study of Tone and Tone Sandhi in Baoding Dialect

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**Abstract:** This paper analyzes the tone and tone sandhi of Baoding dialect by means of experimental phonetics. So far, only Li Zihé has conducted typological research on the tone sandhi of Baoding dialect in 2008. By using statistical methods, his paper summarizes the common characteristics of tone types and tone sandhi in northern dialects, and then investigates the two-character tone sandhi in Baoding dialect from the perspective of typology. This paper uses Praat to analyze the tone and tone sandhi of Baoding dialect and tries to give an objective description. In this paper, we obtain the data from the pronunciation of the native speakers of Baoding dialect. The data were collected from the native speakers of Baoding dialect by recording their pronunciation of the citation syllables and disyllabic sequence. The collected data were given a careful and detailed acoustic analysis by Praat. This study is the first attempt to analyze the tone and tone sandhi in Baoding dialect using the Praat. Comparing the present study with the previous study of Mandarin in terms of citation tones, it is found that T2 (43) is different in both pitch values and tonal shape; T1 and T4 are different in pitch values but not tonal shapes; T3 is the same in both pitch values and tonal shape. In terms of tone sandhi, the third tone T3 changed significantly in disyllabic sequence.

**Keywords:** Citation tone; Tone sandhi; Baoding dialect; Experimental phonetics

## 1. Introduction

This paper is an acoustic experimental study of the tone and tone sandhi in Baoding dialect. The tone sandhi in Baoding dialect have only been studied by Li (2008) in the perspective of typology with statistic methods. This paper is the first attempt using Praat to give an acoustic analysis of the tone and tone sandhi in Baoding dialect in order to obtain a more objective description of the tonal features in Baoding dialect<sup>[1]</sup>.

## 2. Introduction to Baoding dialect

Baoding, located in the center of Hebei Province and at the eastern foot of Taihang Mountain, is the central city of Beijing-Tianjin-Hebei region. Baoding is located in the west of Jizhong Plain, between 38°10' -40°00' N and 113°40' -116°20' E. Baoding has jurisdiction over 5 districts, 15 counties, 4 county-level cities and 2 development zones.

Baoding dialect is the local dialect of Baoding city, which belongs to Ji-lu mandarin of Sino-Tibetan languages, with four tones, no checked tone and with partial rhotic accent. Baoding city jurisdiction area is large, so the internal language situation of each district is not consistent. The northernmost Zhuozhou dialect belongs to Beijing Mandarin because of its proximity to Beijing. Other dialects, according to Liu Shuxue (2006), belong to the Jilu mandarin.

According to Li (2008), Baoding dialect contains 24 initials (including the zero initial). Baoding dialect has a total of 36 finals, including 10 single finals and 26 complex finals.

## 3. The Definition of Tone and Tone Sandhi

Tone refers to the use of pitch in language to distinguish lexical or grammatical meaning. For example, in Standard Mandarin Chinese, there are four lexical contrastive tones: yinping (55), yangping (35), shangsheng (214), and qusheng (51). For example, the syllable “ba” can have four meanings depending on the use of the tone. Ba (55) means 八 “eight”; Ba (35) means 拔 “pull out”; Ba (214) means 靶 “target”; Ba (51) means 坝 “dam”.

The tone sandhi is a phonological change occurring in tonal languages, in which the tones are assigned to individual words or morphemes change based on the pronunciation and adjacent words or morphemes. The phenomenon is very common and well documented in Chinese. The trigger of the tone sandhi can be adjacent tones, as exemplified by the well-known Mandarin third-tone sandhi, whereby a third tone (falling) becomes a second tone (rising) in the context followed by a third tone, for example, 买马 (214, 214), which means “buying horse”, will change into (35, 214).

## 4. Experimental Design

This paper aims to design an acoustic experiment to investigate the tonal system in Baoding dialect so as to offer some valid data on the study of tones in Baoding dialect.

About the selection of participants, the traditional choice is to take those who are elderly and have less education and travel experience to ensure the true dialect. However this kind of recording is hard to get because of the rare participants. So we chose

two Baoding people who were born and grown up in Baoding to take the experiment. During the experiment, each participant was recorded in a quiet room. In the experiment, participants were not allowed to think about pronunciation for a long time, but were asked to pronounce according to their usual pronunciation habits, so as to avoid interference from the pronunciation habits of Mandarin.

As for the recording materials used in the study, 32 monosyllabic words in citation form (8 for each tonal category), and 80 disyllabic phrases were recorded (5 for each tonal category). This reading materials are frequently used in daily life. In the recording process, the Chinese characters used as reading materials were printed out and presented in random order.

Recording were made by a laptop with a line-in microphone. Then, the technique Praat was used to further segment and analyze the data. The Praat is one of the most widely used computer programs for speech analysis and synthesis, which was developed by Paul Boersma and David Weenink (1995). Through running the Praat script, the pitch contours of each syllable were divided into nine equi-intervals. Then ten sample F0 values were chosen. Since this thesis focuses on the tone and tone sandhi in Baoding dialect rather than the individual's description of pronunciation, the F0 values of each one's tone and tone sandhi were not analyzed. Instead, the averages of each F0 value were calculated by the software Excel Viewer 2010<sup>[2]</sup>.

Fundamental frequency (F0) is very important for the analysis of the tone. However, according to Shi (1990), the F0 value is not in direct proportion with the subjective perception of the pitch. They are changed into common logarithm because of the fact that the psychological perception of the pitch is correlated with the logarithm of F0. Therefore, the pitch value of any point of a tone contour can be obtained in the following equation (Shi, 1990):

$$T = [(lgx - lgb) / (lga - lgb)] \times 5 \text{ (Shi, 2006)}$$

## 5. Result and Discussion

### 5.1 Tones of Citation Syllables

The group data of F0 contours and pitch value contours will be presented. Hereafter, T1, T2, T3 and T4 are used to represent Yinping, Yangping, Shangsheng, and Qusheng respectively. Each tonal category contained 10 samples. The numbers 1 to 10 represent F01 to F010. The unit of F0 was Hz. For accuracy, two decimal fractions of each F0 value remained.

Based on the data, the pitch values for citation tones in Baoding Dialect can be generalized as in Table 1. (Because of the participants' speaking habits, we ignore the falling tone at the end of the figure.)

Table 1. Pitch values of citation tones in Baoding dialect

T1	T2	T3	T4
45	43	214	53

### 5.2 Discussion

From the above table, it can be seen that except for T3, the other tones T1, T2, T4 are slightly different from the Mandarin, especially T2. Unlike Mandarin the pitch contour which is rising, T2 tend to have a falling tone in the end. Baoding dialect is more flat and not soft enough, but Baoding dialect as a whole is still close to Mandarin.

### 5.3 Tones of Disyllabic Sequence

This part we will presents the results of the F0 contours and pitch value contours of the tone sandhi in disyllabic sequences.

The 16 (4×4) kinds of tonal combinations in disyllabic sequences in Baoding dialect are divided into four groups: T1+Tx, T2+Tx, T3+Tx, T4+Tx (here, Tx stands for any tone). The tone sandhi patterns in disyllabic sequences in Baoding dialect are generalized in Table 2 below.

Table 2. Tone Sandhi of Disyllabic Sequence in Baoding Dialect

First Tone	Second Tone			
	T1(45)	T2(43)	T3(214)	T4(53)
T1(45)	45+54	55+54	55+121	45+53
T2(43)	44+43	45+43	45+12	55+53
T3(214)	212+44	44+43	35+32	33+53
T4(53)	53+43	54+43	54+232	54+53

### 5.4 Discussion

From the above table, we can see all four tones became more flat in disyllabic sequence. The T3+Tx and Tx+T3 group showed the biggest difference. Based on the above analysis, all changes can be generalized as follows.

$$T3 \rightarrow 212 / \_ T1; T3 \rightarrow 121 / T1 \_ \quad T3 \rightarrow 44 / \_ T2; T3 \rightarrow 12 / T2 \_ \quad T3 \rightarrow 35 / \_ T3; T3 \rightarrow 32 / T3 \_ \quad T3 \rightarrow 33 / \_ T4; T3 \rightarrow 232 / T4 \_$$

## 6. Conclusion

This study is the first attempt to analyze the tone and tone sandhi in Baoding dialect using the Praat. Comparing the present study with the previous study of Mandarin in terms of citation tones, it is found that T2 (43) is different in both pitch values and tonal shape; T1 and T4 are different in pitch values but not tonal shapes; T3 is the same in both pitch values and tonal shape. In terms of tone sandhi, the third tone T3 changed significantly in disyllabic sequence. Although the study of this experiment is desirable, it inevitably has limitations due to the limited time. In the future study, more participants should be included in order to get more data to conform the present finding.

## References:

[1] Ladefoged, Peter & Johnson, Keith. 2011. *A Course in Phonetics* (6th ed.) [M]. Canada: Nelson Education.

[2] Li Zihe. 2008. *The Typological Study of Tone Sandhi in Baoding Dialect* [D]. Nankai University.