

Internal Differences of Tones in Shandong Dialect

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Abstract

The present study employs phonetic means and LZ-Score values to systematically investigate and tonal patterns and the internal differences of tones in Shandong (Hereinafter, SD) dialect. The dialect regions selected in the study is Jinan, Liaocheng, Tai'an and Zibo, all of which belong to Xiqi district. Results demonstrate that all of the four regions deserve four tones, specifically, tonal values are: tone1: 324, tone2: 52, tone3: 44 and tone4: 412 in Jinan dialect; tone1: 24, tone2: 51, tone3:44 and tone4: 23 in Liaocheng dialect; tone1: 24, tone2: 42, tone3: 44 and tone4: 323 in Tai'an dialect; tone1: 323, tone2: 43, tone3: 44, tone4: 41 in Zibo dialect. Based on this result, the study further proposes that tone2 & tone3 keep stable in SD dialect and tone1 & tone4 show great variations. Furthermore, it is different from other dialects, Liaocheng processes tones merging from four tones to three tones.

Index Terms: tonal pattern, Shandong dialect, tonal differences

1. Introduction

Shandong Province abbreviated as Lu, takes its name from the fact that it lies to the east of the Taihang range (East of the Mountains). It is situated on the eastern coast of China, in the lower Huanghe River valley. SD is China's second most populous province after the Henan province. The provincial capital is Jinan, and SD has a history of more than 5,000 years, is considered as one of the birthplaces of Chinese civilization. It is known that the official language of China is *Putonghua* or *Mandarin*, which is a standardized language based on Beijing dialect. Mandarin is spoken as a first language by over three-fourths of the population. It is in a large area extending east and west across north China from the coastal regions of Shandong to Sichuan in the interior, southward toward the Yangzi River and northward into Dongbei. SD dialect belongs to *Guan* or *Mandarin*. And, Guan is a group of Chinese varieties spoken in northern and southwestern China. This group includes Standard Mandarin or Standard Chinese, as well as regional varieties of Mandarin. As most varieties of Mandarin are found in northern China, they are also known as Northern language. There are differences between the varieties of Mandarin from northern and southern China, particularly in the tones, and mutually intelligibility between them is relatively low, however the differences are not as great as those between other varieties of Chinese.

SD dialect observes the major features of Guan, and it shows minor differences on the phonological inventory in different cities. However, different branches of SD dialect observe their unique features (Qian [1]). The branches of SD dialect are classified according to the phonological features. Specifically, Li [2] classifies SD dialect into three parts according to the representation of the entering tone (*Ru Sheng*),

i.e., Jilu Mandarin, Zhongyuan Mandarin and Jiaoliao Mandarin. However, Qian [1][3] divides SD dialect into two main parts and four sub-parts according to articulatory rules in SD dialect, i.e., East Part and West Part, both of which can be further divided into *Donglai*, *Dongwei*, *Xilu* and *Xiqi*.

In regard with the tones in SD dialect, they show distinct features. In the most parts of SD province, they deserve four tones and some of the areas have three tones. However, the overall tones perform merging tendency from four tones into three tones (Qian[1]). Previous studies on the tones of SD dialect mostly describe its tonal values through subjective perception, e.g., Gao [4] examines the tone and tone sandhi differences of Old and New Mingshui dialect based on perception. The descriptive examination was also conducted on Leling dialect (Cao [5]) and Linyi dialect (Cao [6]). In Qian [1], it systematically examines the phonological inventory within SD dialect, which includes tones, rhymes and initials. However, all these results are based on perception from one speaker and show no enough empirical data as the supporting evidences.

From the overview of previous studies, it can be obtained that previous study on the tones of SD dialect mainly adopt the subjective means, therefore, the empirical study on the SD dialect is of fundamental importance. The present study, in this regard, intends to examine the tonal patterns and tonal variations within SD dialect through which to explore the diversities and changing tendency of citation tones in SD dialect. The study also endeavors to answer the following questions: i) what is the differences of the tones in various dialectal regions in SD? ii) what constitutes the differences between the present empirical data and the former subjective results? iii) What is the emerging trend of the tones in SD dialect? In order to explore the above questions, the study selects four cities as the target language in the present study, they are: Jinan, Zibo, Liaocheng and Tai'an. The reason for the selection of the four cities lie in the following aspects: i) the four cities are considered to distribute in *Xiqi* district; ii) the four cities near to each other. From these two points, the internal differences of tones in SD dialect can be examined and explored in great extent.

2. Geographical distribution of cities in Shandong province

The selected dialects within SD in the present study are Jinan, Zibo, Liaocheng and Tai'an. Their geographical distributions in SD province are described in the following Figure 1. The red and round circles are employed to mark the locations of four cities.



Figure 1: Geographical distribution of cities in SD

Jinan, the capital of Shandong Province on China's east coast, is located in the mid west of SD. It is the province's political, economic and cultural center. Lying on the lower reaches of the Yellow River, *Liaocheng* is seated in the western part of SD Province. It neighbors the provincial capital Jinan to the southeast. *Tai'an* is located in the middle part of SD Province, bordering upon Jinan, Qufu and Zibo. Because of its important geographical position and convenient traffic conditions, Tai'an becomes the indispensable part of the Eastern Coastal Economy Belt and the Economic Zone around the Bohai Sea. *Zibo*, lying at the intersection of the Luzhong mountainous region and the Lubei plain, is seated in central SD Province. The city is adjacent to Weifang to the east, Linyi to the south, Laiwu and Tai'an to the southwest, the provincial capital Jinan to the west. From the classification of the dialect in SD, they all belong to Xiqi district. Previous study has demonstrated that Jinan, Liaocheng and Tai'an were classified into four tones system while Zibo was set into the three tones system. The present study, therefore, adopts empirical means and phonetic data to further investigate the tonal system, the tonal values and tonal differences of the above mentioned four cities.

3. Methodology

3.1. Materials

From the phonological inventory of SD dialect (Qian[1]), it can be obtained that the dialect which show most initials is *Zhucheng* dialect, and the number is 28. The four cities selected in the study belong to the district which shows the initial numbers as 22~26, e.g., Tai'an: 26. In regard with the rhymes, Rongcheng dialect deserves the most complex rhyme system in SD dialect. And, the selected dialect regions deserve about 40 rhymes. Therefore, during the examination of the tones in SD dialect, the material selection needs to take the combinations of the initials and rhymes into consideration and cover all the acceptable combinations from initials and rhymes.

Totally, 120 samples for each tone were selected as the samples which cover all the acceptable combinations of initials and rhymes. It has been reported that most dialect regions have four tones. Therefore, each city in the present study is designed to observe four tones and each city has 480 samples for statistical analysis. Following table shows some examples, all the acceptable combinations are tried to keep balance in all the four tones.

Table 1: Material samples

Samples	Initial	Rhyme	Tone
书/ (book)	B	TM	Tone1
熟/ (familiar)	B	TM	Tone2
数/ (count)	B	TM	Tone3
树/ (tree)	B	TM	Tone4

3.2. Recording

All the above samples were randomized and appeared one time in the recording schema. Recording was conducted in the quiet room in Shandong University of Science and Technology through recording software which was co-developed by Chinese University of Hong Kong and Chinese Academy of Social Science. During recording, the subject seated comfortably in front of the cell-computer and was asked to read the schema in normal speed. The microphone selected in the experiment is Sennheiser PC166. Figure 2 illustrates the recording platform and microphone. Through the software, each sample was kept as a 'wav' file for further segmentation and analysis.

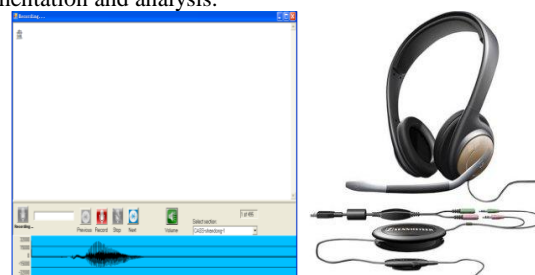


Figure2: Recording platform and microphone

3.3. Annotation and statistical analysis

The 'wav' files were segmented phonemic boundaries through automatic segmentation software to generate textgrid files. Then, the pitch tier files were generated by Praat script. In order to ensure the accuracy of data, both the textgrid and pitch tier files were modified by hand. The pitch of tones was extracted by praat script with one syllable being selected ten points to normalize the duration. As for the statistical analysis, the four tones are selected as the independent variable to get the means of the pitch. For each tone in different, they are calculated through the LZ-Score formula (Zhu [7]):

$$Z_i^t = \frac{y_i - m_y}{s_y} \quad (1)$$

Within the formula, $y = \log_m X_i$, and m_y and s_y are the means and Standard deviation y_i ($i=1,2, \dots, n$), respectively. Therefore, the data for Jinan, Liaocheng, Tai'an and Zibo were selected, labeled, and calculated in the same way, through which the results can be further compared to obtain both similarities and differences among these dialectal regions.

4. General results

In this part, the study systematically examines the tonal patterns of Jinan, Liaocheng, Tai'an and Zibo, and the empirical data is provided to further explore the intrinsic differences within these places in SD dialect. Previous study has demonstrated that Zibo dialect belongs to the three tones systems and the other three belong to the four tones system. In this part, One-Way ANOVA will be adopted to investigate the discrimination of the tones in each dialect region.

4.1. Tonal pattern of Jinan dialect

In Qian [1], it demonstrates that Jinan dialect deserves four tones, and their tonal values are: *Yinping* (Tone1:213), *Yangping* (Tone2: 42), *Shangsheng* (Tone3: 55) and *Qusheng* (Tone4: 21). From this observation, it can be seen that previous results show that there are two falling tones, i.e., tone2 and tone4, one devious tone, i.e., tone1, and one low level tone, which is tone3. The following figure shows the empirical data observed in the present study.

Figure3 illustrates the pitch of four tones in Jinan dialect. Within the figure, the right part shows the content of the contours, and the left part illustrates the values of formula (1), which is separated into five parts. Therefore, in the present study five-scale values are marked as following: -2.5 and 2.5 marks 0~5, -1.5 and 0.5 stands for 1~4, further, -0.5 and 0.5 mark 2~3.

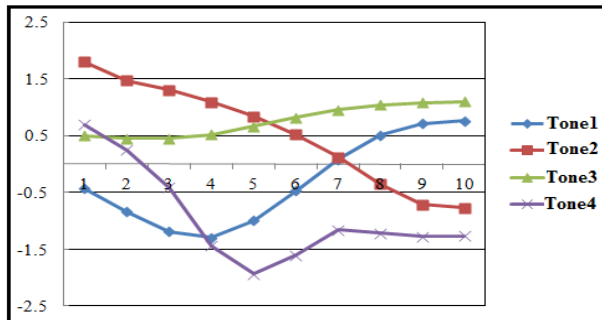


Figure3: Four tones of Jinan dialect

From the above figure, it can be seen that Tone1 and Tone4 are devious tones, specifically, their values are: 324 and 412. As for Tone2, it can be obtained that it is a falling tone and its value is 52. As for the Tone3, it is a relative level tone 44. In comparison with the previous results, the great differences lie in tone4 which is written as a low level tone with the value of 21 in Qian [1] and a devious tone with the value of 412 in the present study. Besides this difference, the other ones are all minor differences in the tonal values, which is not the overall tonal pattern. It is known that the result of Qian [1] was based on one writer, therefore, the data in the present study is more reliable and objective. The study further conducts One-Way ANOVA to test the significance of tonal contour of the four tones. For each tone, all the ten points are selected to test the difference. The result demonstrates that they are significantly different from each other with $P < 0.005$.

4.2. Tonal pattern of Liaocheng dialect

This sub-part is employed to investigate the tonal pattern of Liaocheng dialect. In the previous analysis, it has been regarded as four tone system and the tonal values for each tone are as: *Yinping* (Tone1:213), *Yangping* (Tone2: 42), *Shangsheng* (Tone3: 55) and *Qusheng* (Tone4: 313) (Qian[1]).

Figure 4 beneath shows the tonal pattern of Liaocheng dialect. The symbols in the figure keep identical with previous figure 3.

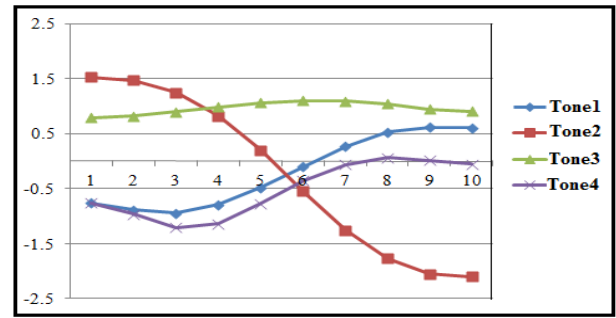


Figure4: Four tones of Liaocheng dialect

The above figure demonstrates that Liaocheng dialect deserves two rising tones, one level tone and one falling tone. Specifically, their tonal values are: Tone1: 24, Tone2: 51, Tone3: 44 and Tone4: 23. This result also shows differences with previous results in the way that previous study proposed that Liaocheng dialect deserved two devious tones, i.e., tone1 and tone4. And, in the above figure, they perform similar tendency as rising tones. We know that the result of present study states that tone1 and tone4 are quite similar with each other on the tonal performance and tonal values. We further conduct One-Way ANOVA to examine the difference between these two tones. For each tone, the study selects ten points for statistical analysis. Results demonstrate that the two tones are not always significant different from each other. Concretely, there are six points which covers the 2/3 of the tonal distribution, they are not significant different from each other starting from the left point. The other four points selected in the experiment are significant different from each other. We further use minimal pair of tone1 and tone4 to text if they can be discriminated. Specifically, the minimal pairs are: *fei1*(飞/fly): *fei4*(废/waste); *yang1*(央/central):*yang4*(样/sample); *si1*(私/selfish):*si4*(似/similar); *jia1*(家/home): *jia4*(架/shelf). We invited one subject from Liaocheng dialect to participate the discrimination test, and he can discriminate them accurately. Therefore, we can propose that tone1 and tone4 can be separated. Similar tonal performances and tonal values also demonstrate that the tones of Liaocheng dialect perform merging tendency, which merge four tones into three tones.

4.3. Tonal pattern of Tai'an dialect

In this sub-part, the study examines the tonal patterns of Tai'an dialect. Previous study on the description of Tai'an dialect has demonstrated that the tonal value of Tai'an is as: *yinping* (tone1) 213, *Yangping* (tone2) 42, *shangsheng* (tone3) 55, *qusheng* (tone4) 31(Qian[3]).

Figure 5 illustrates the four tones of Tai'an dialect and the symbols in the figure stand for the same content with previous figure4.

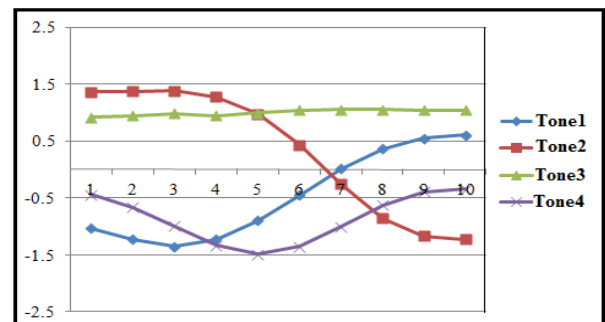


Figure5: Four tones of Tai'an dialect

The LZ-Score value in the figure demonstrates that there are one rising tone, one level tone, one falling tone and one devious tone in Tai'an dialect. Specifically, tone1: 24, tone2: 42, tone3: 44, and tone4: 323. From this observation, it can be obtained that the great difference between the former study and the present one also lies in the description of tone1 and tone4 which are presented as a devious tone and falling in the previous study. In Jia [8], it adopts formula: $T = [(lgx - lgb) / (lga - lgb)] \times 5$ as the normalization means. And, that result shows that tone1 and tone4 are rising tone and devious tone, respectively. Thus, it shows similar tendency with present result. However, the specific values of the present study and Jia [8] which are influenced by the normalized means.

4.4. Tonal pattern of Zibo dialect

This sub-part is adopted to examine the tonal patterns of Zibo dialect through which to explore the variations of tones in different cities in SD province. It has been proposed by Qian[1] that there are three tones in Zibo dialect in which tone2 and tone3 has been reported to merge into one tone, and it presents as a level tone. As for the tonal realization and specific values of Qian[1], tone1 is a devious tone with the tonal value of '214', tone2 and tone3 perform as a level tone with the value of '55', further, tone4 is reported as a falling tone with the value of '31'.

Figure6 lists the F_0 patterns of the tones in Zibo dialect and the symbols in the figure show identical meaning with the previous figures.

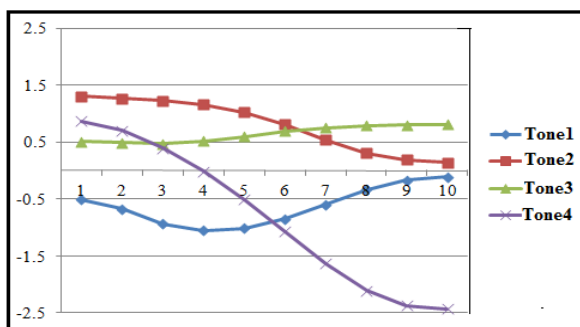


Figure6: Four tones of Zibo dialect

Results of the above figure show that the four tones in Zibo dialect are different from each other. Concretely, tone1 realizes as a low rising tone, tone2 presents as a falling tone, tone3 is a level tone and tone4 is a falling tone. Regarding with the specific tonal values, tone1: 323, tone2: 43, tone3: 44 and tone4: 41. Therefore, the present result shows differences with previous study in the way that the tonal inventory and the tonal values show distinctions. Specifically, the great difference lies in the number of tones. We further adopt minimal pair of tone2 and tone3 to further test their differences, specifically, the samples are as: (节/festival), (姐/sister); (白/white), (摆/move); (椅/chair), (移/move); (竹/bamboo), (主/host). One subject from Zibo was asked to discriminate the tones, and they are accurately distinct. In order to further test the observation in the present study, we further conduct One-Way ANOVA to examine the discrimination of all tones. And, results show that all the points selected to represent tones in Zibo dialect are significantly different from each other. The other differences are due to the specific values which may affect by different data in the two studies.

5. Conclusions and discussion

The study adopts phonetic means to systematically examine the tonal patterns of dialect regions in Xiqi district of SD dialect through which to further explore the specific variations within SD. The target dialect region in the present study is selected as Jinan, Liaocheng, Tai'an and Zibo, all of which belong to the Xiqi district. Previous study of tones in SD dialect show that Jinan, Liaocheng and Tai'an are classified into four tones system and the Zibo dialect is considered to be set into the three tones system. In the present study, although all of these four cities have four tones, they show different patterns in each dialect region. The overall results are listed in the following tables:

Table 2: Tonal types and values

Dialect region	Tone1	Tone2	Tone3	Tone4
Jinan	Devious tone/ 324	Falling tone/ 52	Level tone/ 44	Devious tone/ 412
Liaocheng	Rising tone/ 24	Falling tone/ 51	Level tone/ 44	Rising Tone/ 23
Tai'an	Rising tone/ 24	Falling tone/ 42	Level tone/ 44	Devious tone/ 323
Zibo	Devious tone/ 323	Falling tone/ 43	Level tone/ 44	Falling tone/ 41

From the above observations, it can be obtained that the dialect regions selected in the present study present similar pattern in Tone2 and Tone3 in the way that tone2 realizes as a falling tone while tone3 performs as a level tone. In regard with the specific tonal values, tone3 always keeps the same tonal value and tone2 shows minor differences among Jinan, Liaocheng, Tai'an and Zibo. However, great differences of tonal performances among the four dialect regions are tone1 and tone4. Specifically, tone1 is a devious tone in Jinan and Zibo, it realizes as a rising tone in Liaocheng and Tai'an. As for tone4, devious tone appears in Jiann and Tai'an, rising tone in Liaocheng and falling tone in Zibo. Also, from the above overview of the study from Qian[1], the disagreement exists in the description of tone1 and tone4 in the four regions.

In summary, the study employs empirical means and LZ-Score value to investigate and describe the internal differences of the tonal patterns in SD dialect. The study points out the differences from previous evaluation and it also proposes that the tones of SD dialect process the merging tendency from four tones into three tones. More data needs to be presented from other cities or dialect regions examine the typology of tones in SD dialect.

6. Acknowledgements

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7. References

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