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A Study on the Tone Perception of Mandarin by Native Speakers of Shaoxing Dialect

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Abstract: This article studies how native speakers of Shaoxing dialect perceive Mandarin tones, and whether there is a perceptual correspondence between the tone system of Shaoxing dialect and Mandarin tone system. Ten participants from the Shaoxing dialect area were selected to create six pairs of Mandarin tone opposition groups, with a total of 60 Mandarin perception samples. The perception experiment was conducted using E-Prime software. The subjects determine which tone in the dialect is similar to the Mandarin tone they hear, and then input the similar tone category. Finally, statistical analysis is conducted to calculate the similarity of tone classes between two tone systems and establish a tone perception model. The corresponding relationship between the perceived Mandarin tones by 10 native speakers of Shaoxing dialect and their own dialect tone system indicates that the Gaoping 55 tone in Mandarin is perceived as the Shaoxing dialect 33 tone, and the Mandarin tortuous 214 tone is perceived as the Shaoxing dialect 35 tone. There is a similar correspondence between the perception of tones in different tone systems, which has reference value for phonetic teaching.

Keywords: Tone Perception; Tone Similarity; Psychological Mechanism of Tone Perception; Chinese Dialects; Speech Perception

1. Introduction

Our brain perceives the changes in the fundamental frequency produced as tones, decodes the pitch information transmitted after production, and obtains information to achieve the purpose of language communication. Therefore, studying the perception of Chinese tones among people with different language backgrounds is an excellent perspective for studying the neural mechanisms of the brain. Studying the tone perception mechanism of people in different Chinese dialect regions is helpful for language teaching and researching the language learning and processing mechanism of the brain, and gaining a deeper understanding of the language function of the brain.

There are significant differences in tone systems between Chinese dialects in different regions, and also between Chinese dialects and Mandarin. How do people in Chinese dialect areas perceive Mandarin tones? Is there a certain pattern between perceiving dialect tones and Mandarin tones? In response to these issues, this article selects 10 native speakers of Shaoxing dialect to conduct a similarity perception matching experiment on the four tones of Mandarin.

The research on speech perception began in Haskins Laboratory. Alvin Liberman, a member of the laboratory, and other researchers carried out the research on consonant perception in 1957, which created the first research on speech category perception. In recent years, the research on language perception has focused on second language acquisition. Many studies have confirmed that the perception of second language sounds is influenced and restricted by the native language sounds. Abrmason found that adult listeners of different native language backgrounds divide the VOT continuum into two or three categories [1]. Abramson was the first to study the category perception of Thai tone, and he believed that fundamental frequency was the main acoustic cue of Thai tone perception, rather than duration and amplitude [2]. Abramson conducted a perception experiment on the three flat tones of high, middle and low, and identified that the experiment showed category perception characteristics, while the

differentiation experiment found that the perception of the three flat tones of Thai had continuous perception characteristics, so the perception of the three flat tones of Thai was classified as continuous perception. [3]

The research on the tone perception of Mandarin Chinese is mainly carried out through the perceptual category behavior experiment. The recognition curve and the distinction curve are obtained from the recognition and distinction experiment, and the tone belongs to the category perception or continuous perception. At present, there is some debate about whether the perception of the combination of Chinese tone parts belongs to category perception or continuous perception. Wang was the first to carry out experimental research on Chinese tone perception. [4] He found that Chinese native speakers' perception of Yin flat and Yang flat belongs to category perception, that is, continuous pitch changes are perceived as two discrete categories, and there is a clear recognition boundary between the two tones. More studies later showed that the tonal perception between Yin Ping and Yang ping, Yin ping and de-vocalization, Yin ping and up-vocalization, and Yang ping and de-vocalization in Mandarin by native speakers is category perception [5-9]. There is relatively little research on perceptual similarity matching of different tone systems.

This article analyzes the perceptual similarity of native speakers of Shaoxing dialect towards the four tones of Mandarin, and examines the perceptual correspondence between the four tones of Mandarin and the six Shu tones of Shaoxing dialect. Shaoxing dialect has six Shusheng tones, Yin Ping, Yang Ping, Yin Shang, Yang Shang, Yin In, and Yang In. Two levels, 22 and 33; An increase of 35; Three downgrades, 51, 31 and 42, and 31 and 42 are parallel, with a difference of one degree.

2. Corpus and Analysis Methods

Record a Mandarin announcer's tone sample in the recording room and create 6 sets of tone perception samples, with 10 samples per set, for a total of 60 samples. Ten native speakers of Shaoxing dialect were selected as participants in the tone perception similarity experiment.

The recording acquisition uses equipment such as microphone, mixer, external sound card and laptop computer to collect single channel voice signal, sampling frequency is 22050Hz, sampling accuracy is 16 bits.

The tonal perception experiment was conducted by using E-Prime2.0 software and two laptops. The perception experiment was carried out simultaneously by two students wearing headphones.

The experiment involved 10 participants listening to 6 pairs of Mandarin four tones, with a total of 60 samples, to determine which tone in the speaker's dialect is similar to the syllable tone heard, and input the corresponding tone number. The four tones of Mandarin are composed of 6 pairs, T1-T2, T1-T3, T2-T3, T2-T4, T2-T4, T3-T4, Da-da, Da-da, Da-da, Da-da, Da-da, Da-da, Da-da, Da-da, each combination fundamental frequency isometric synthesis of 10 samples, a total of 60 monosyllabic tone samples. Each sample is played twice, and the stimulus sample is presented using E-Prime. Figure 1 shows 10 samples composed of T1-T3 opposites. The subjects are asked to listen and identify which tone is similar to the dialect of the subjects. Finally, based on the input data of the subjects, the frequency of each sample perceived as corresponding dialect tone is counted to determine the correspondence and similarity between the four tones of Mandarin and each tone of Shaoxing dialect.

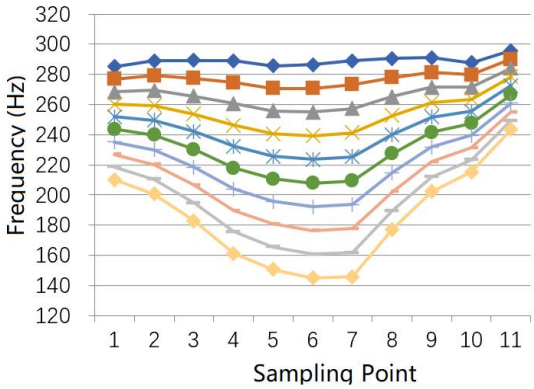

Figure 1. Fundamental Frequency Curves of 10 Synthetic Samples of T1-T3 Opposites

3. Experimental Results and Analysis

Among the 6 soothing tones in Shaoxing dialect, there are two flat tones, 22 and 33; A sharp 35; Three flats, 51, 31 and 42. Figure 2 shows 10 samples of the opposite group of Putonghua T1-T2. Samples 1 and 2

on the left side are the Gao Ping 55 tone of Putonghua, which is 100% perceived as the 33 tone of Shaoxing dialect, and gradually becomes the rising tone at sample 4, which is perceived as the 35 sharp tone corresponding to Shaoxing dialect. The basic perceptual law presented is that the flat tone and rising tone in Mandarin are perceived as the corresponding flat tone and rising tone in Shaoxing.

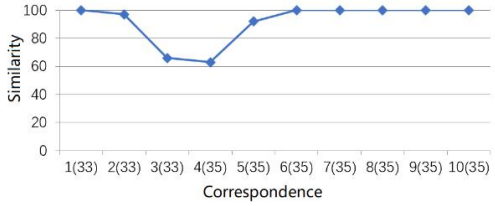

Figure 2. Similarity of Tone Modulation Values Corresponding to T1-T2 of Mandarin in Shaoxing Dialect

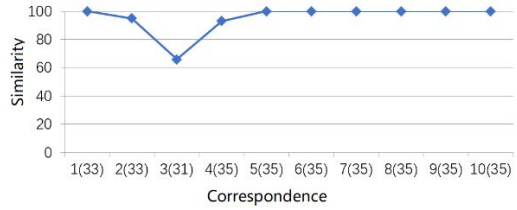

Figure 3. Similarity of Tone Modulation Values Corresponding to T1-T3 of Mandarin in Shaoxing Dialect

Figure 3 shows the 10 samples of the T1-T3 opposite pairs of Putonghua. Samples 1 and 2 are the Gao Ping 55 key of Putonghua, which is perceived by 100% as the 33 key of Shaoxing dialect, and the probability of sample 3 being perceived as the 31 low flat key is 63%. Shaoxing does not have the zigzag tone found in Mandarin, so the common T3 is perceived as the 35 sharp tone of Shaoxing. The basic perceptual law presented is that the zigzagging tone in Mandarin is perceived as the corresponding Shaoxing 35-sharp tone.

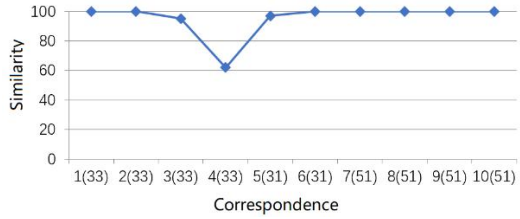

Figure 4. Similarity of Tone Modulation Values Corresponding to T1-T4 of Mandarin in Shaoxing Dialect

Figure 4 shows 10 samples of the opposite pairs of T1-T4 in Mandarin. Samples 1-2 are the Gao Ping 55 tone of Mandarin, which is 100% perceived as the 33 tone of Shaoxing. Samples 5 to 6 had a small drop and were perceived as the low drop 31 of Shaoxing dialect. With the increase of the drop, samples 7 were perceived as the high drop 51 of Shaoxing dialect.

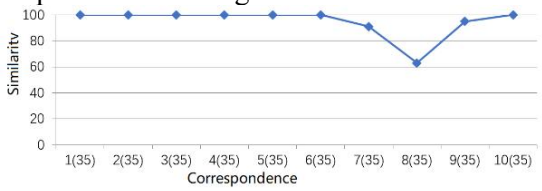

Figure 5. Similarity of Tone Modulation Values Corresponding to T2-T3 of Mandarin in Shaoxing Dialect

Figure 5 shows 10 samples from the opposite group of Mandarin T2-T3. Samples 1-7 are close to the T2-rising tone 35 of Mandarin, which is 100% perceived as the tone 35 of Shaoxing. Since the T3 inflected key 214 of Mandarin is not present in Shaoxing, samples 9-10 are perceived as the 35 sharp key of Shaoxing.

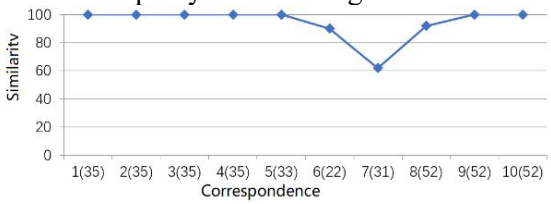

Figure 6. Similarity of Tone Modulation Values Corresponding to T2-T4 of Mandarin in Shaoxing Dialect

Figure 6 shows 10 samples of the T2-T4 opposite pairs of Putonghua. Samples 1-4 are close to the T2-rising tone 35 of Putonghua, which is 100% perceived as the tone 35 of Shaoxing. The trend of samples 5 to 6 is flat, the flat tone 33 and 22 perceived as Shaoxing dialect, sample 7 has a smaller drop, and the low tone 31 perceived as Shaoxing dialect, sample 8 to 9 is perceived as Shaoxing dialect, high tone 52. The basic perceptual rule is that the native speakers of Shaoxing dialect have more accurate perceptual changes of falling tone and can accurately judge whether it is low falling tone or high falling tone.

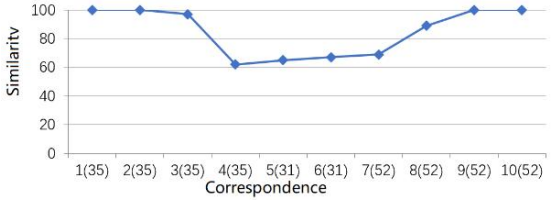

Figure 7. Similarity of T3-T4 Corresponding to Shaoxing Dialect Tones

Figure 7 shows 10 samples of T3-T4 antithesis pairs of Mandarin. Samples 1-3 are close to the T2 high-rise tone 35 of Mandarin, which is perceived as the tone 35 of Shaoxing. Samples 5-6 changed to a falling tone, which was perceived as the low falling tone 31 of Shaoxing dialect, and samples 7-10 were perceived as the high falling tone 52 of Shaoxing dialect with the increase of sample decline. In the combination pairs, the native speakers of Shaoxing dialect are more accurate in the perceptual changes of falling tone, and can be prepared to distinguish between high falling tone and low falling tone.

By calculating the above data, taking the similarity ratio of the first and last two samples for each pair and combining 6 samples, the perceptual correspondence between the four tones of Mandarin and the tone of Shaoxing dialect can be obtained. As shown in Table 1, native speakers of Shaoxing have a clear perception of the four tones of Putonghua. Putonghua T1 (55) is perceived as Shaoxing 33, Putonghua T2 (35) corresponds to Shaoxing 35, meandering T3 (214) is perceived as Shaoxing 35, and Putonghua toning T4 (51) is perceived as Shaoxing 51. Since there is no zigzag tone in Shaoxing dialect, the subjects pay more attention to the rising part in the latter half of the zigzag tone, so it is perceived as the 35 sharp tone in Shaoxing dialect.

Table 1. The Perceptual Correspondence Between Mandarin Four Tones and Shaoxing Tones

Mandarin four tones	The perception corresponds to Shaoxing tone	similarity
T1(55)	33	97%
T2(35)	35	100%
T3(214)	35	94%
T4(51)	51	100%

4. Conclusion

The corresponding relationship between the perceived Mandarin tones by 10 native speakers of Shaoxing dialect and their own dialect tone system indicates that the Gaoping 55 tone in Mandarin is perceived as the Shaoxing dialect 33 tone, and the Mandarin tortuous 214 tone is perceived as the Shaoxing dialect 35 tone.

The research in this article indicates that the brain has a certain pattern in perceiving tones, and there is a similar correspondence between the perception of tones in different tone systems. The perception of tones of the same type corresponds to rising tones matching rising tones, falling tones matching falling tones, and flat tones matching flat tones. Match the tones of the same shape with the closest frequency.

Chinese is a tonal language, and the tonal systems of Chinese dialects vary greatly. Studying the similarity between tone systems in different dialect regions and establishing a tone perception model can provide a deeper understanding of the brain's processing mechanism for tones. Helps with language teaching and research on the language learning mechanism of the brain, providing a deeper understanding of the language function of the brain. It has important reference value for speech teaching and speech rehabilitation, and can deeply analyze and explain the reasons for tone errors.

Acknowledgements

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