A Cross-Language Perceptual Study on Mandarin Tones by Ethnic Speakers in China

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This dissertation carried out a perceptual study on Mandarin tones by five groups of listeners with ethnic language background in China, and one matched group of native Mandarin listeners. The mother tongues for four groups of ethnic language listeners are Lhasa Tibetan, Dehong Dai, Zaiwa, and Shimenkan Hmong, which belong to Sino-Tibetan language family. The mother tongue for another group is Yanbian Korean, a Korean dialect characterized by word-level pitch accent.

The identification and discrimination tests were conducted for the six groups of listeners. The stimuli were resynthesized from the Mandarin syllables /ta/ with four tones uttered by a female Mandarin speaker (T1: /ta55/, “take”; T2: /ta35/, “reach”; T3: /ta214/, “hit”; T4: /ta51/, “big”). Altogether, six tone contrasts from the four Mandarin tones can be established. They are T1-T2, T1-T3, T1-T4, T2-T3, T2-T4, and T3-T4. The PSOLA method (pitch-synchronous overlap and add) in Praat was utilized to resynthesize the speech stimuli. We constructed 12 pairs of tone continua by manipulating F0 contour from one syllable to another in each pair, and then in reverse direction. In this way, 12 pairs of tone continua with 11 stimuli in each were resynthesized, and a total of 132 speech samples were obtained. Two parameters were calculated: the category boundary position and width, and the corresponding discrimination peak. The identification and discrimination functions were computed and drawn for data observation. A one-way ANOVA analysis and Turkey’s honestly significant difference (HSD) post-hoc test were applied to find the position of the discrimination peak by comparing the discrimination score for each discrimination pair in each tone continuum. The categorical perception degree of the tone contrast was analyzed by the “width of identification” and “peakedness of discrimination”.

Based on the statistical results, the paper discussed the judgment and comparison criteria of the categorical perception, and found that the perception mode of Mandarin tones by the five groups of ethinic listeners is conditioned by their language backgrounds. The main results are as follows:

First of all, previous researchers typically divided speech perception modes into categorical perception and continuous perception (e.g., consonants vs. vowels). However, these two perception modes were only discussed in the behavior level and cannot be directly used to differentiate phonemic categories. A phoneme is a linguistic unit that contrasts lexical meanings. Tones in Mandarin can contrast lexical meanings, thus they have phonemic functions. Our data provide evidence that the boundary width is less than 3 for the native Mandarin listeners. If the boundary width for the ethnic groups are not significantly different from that for the native Mandarin counterparts, it can be considered that the steep identification curve is well-founded to indicate the differentiation of the tone categories. Besides, a typical categorical perception needs a steep boundary of an identification curve as well as a corresponding discrimination peak at the behavior level. According to the observation of discrimination curve and the statistical results, if the discrimination scores are not significantly different between each discrimination pair in each tone continuum, and no

ups and downs can be observed in the curve or the peak of the curve departures from the the identification boundary, it indicates that the peak of discrimination does not exist. However, if ups and downs can be observed and the discrimination scores are significantly different between each discrimination pair in each tone continuum, it indicates a typical categorical perception at behavioral level together with the sharp identification boundary, although the shape of the discrimination curve can be classified into three types: “peak type”, “plateau type” and “placid type”. Moreover, “width of identification” and “peakedness of discrimination” can be applied to analyze the perceptual patterns for listeners with different linguistic backgrounds, but it is not suitable for within-group comparison.

Secondly, according to the statistical results and criteria before, we discussed the patterns for perceiving Mandarin tones by listeners with ethinic language backgrounds. Furthermore, according to the clustering analysist, the degree of categorization for the five groups with ethinic language backgrounds is lower than that for the native Mandarin listeners. The perceptual performance for the Korean listeners was closely resembled that for the native Mandarin listeners. Similar perceptual patterns were found respectively between the Lhasa Tibetan and Hmong listeners, and between Dai and Zaiwa listeners. The difference in tone perception between Zaiwa and the native Mandarin listeners was proved to be largest.

Last but not the least, the perception parameters differ significantly across the six groups of listeners in every continuum, which indicate that native language experience has a significant impact on the perception of tones in second language.

In conclusion, this dissertation revealed how the native language experience impact on the perception of tones in second language according to empirical study. The results are of great importance to explore the mental mechanism of tone perception, and provide new evidence of speech perception theory and language evolution research. In addition, this dissertation is also helpful to the Mandarin tone teaching in ethnic areas.