The Auditory Discrimination of Mandarin Retroflex Contrasts and Spectral Moment Analysis

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There are three pairs of retroflex contrasts in Mandarin fricative and affricates, and perceptually, they are very similar and not easy to be distinguished, especially for non-skilled listeners. The purpose of this study is to investigate the auditory perception of retroflexation of Mandarin in adults and investigate the relationship between the spectral moments of frication noise and the auditory discrimination of the fricatives and affricates with retroflexed contrasts. There were thirty adults of native Mandarin speakers participating in the retroflex recognition tasks. There were two tasks of retroflexation judgment in the experiment. In the first one task, the monosyllabic words were used as stimuli and the listeners were asked to judge the retroflexation of Mandarin monosyllabic words. In the second task, the disyllabic words were used, and the retroflexation of the first syllables of words was required to be judged.

In the first task, the monosyllable stimuli had three degrees of retroflexation variations which was consciously made by the speakers, including nonretroflexation, slightly retroflexation, and more retroflexation. The results show that if the slightly retroflexed stimuli were excluded, the correctness percentage of responds was 78% for all listeners. The highly retroflexed consonants had the significantly shortest reaction time (RT), while the RTs between the nonretroflexed and the slightly retroflexed had no significant difference. According to the retroflexness categorical responses of the listeners, the spectral moment analysis of the stimuli showed that the retroflexed consonants had significantly lower M1, higher M2, higher M3, and lower M4, compared to the nonretroflxed consonants. The results are compatible with the data of the previous study of retroflex production (Jeng, 2005). Among the four spectral moments, M1 was the most robust parameter for discriminating the retroflex contrasts The correlation coefficient between the retroflex response percentages and M1 of the stimuli was -0.61 ($p < .0001$). In the second task, the listeners were asked to judge the retroflexation of the first syllables of the disyllabic words based on their acoustical retroflexation, instead of their lexical retroflexation. However the results show that the retroflexation judgment of the listeners was inevitably influenced by the lexical information of the second syllables of the words. Among the four spectral moments, M1 still the most robust parameter for discriminating the retroflex contrasts. The interaction of the lexical information and acoustical information during the retroflexation judgment of the disyllabic words was discussed.

Keywords: auditory recognition, Mandarin fricatives, moments, spectral retroflex