Pitch Relationship and Phonation Cues in Native and Non-native listeners' Mandarin Tone Perception

The primary goal of the present study is to understand the roles of pitch and non-pitch external cues in native and non-native Mandarin tone perception. Of particular interest is the examination of how the pitch relationship between syllables and phonation, neither inherent to the target tone, interact in native and non-native listeners' perception of Mandarin Tone 1 and Tone 3, with specific focus on the effects of L1 background (tone vs. non-tone) and Mandarin L2 proficiency (low vs. high). This study employed a tone identification experiment with 140 participants from five groups: native Mandarin listeners, and Cantonese and Korean listeners with low and high Mandarin proficiency. Cantonese and Korean groups were selected to compare the effects of L1 background and L2 development factors. Cantonese has more lexical tones, with creaky voice associated with Tone 4 (a low falling tone), whereas Korean lacks both lexical tones and phonation features associated with lexical tone. Participants identified the first tone in disyllabic conditions where the first syllable could be judged as Tone 1 or Tone 3. Stimuli were created from naturally produced words by synthesizing pitch height differences along a ten-step continuum and by manipulating phonation types (modal vs. creaky) using open quotient, irregular F0, period doubling, and speed quotient. A total of 360 stimuli were used.

Results show that the pitch relationship between syllables was the primary cue, while creaky voice elicited more Tone 3 responses across all listener groups. L1 backgrounds had considerable effects, whereby native Mandarin listeners were the most sensitive to the pitch relationship cue, with Korean listeners being the least sensitive. Cantonese and Korean listeners revealed an interesting divergence from native listeners in opposite directions; the former produced more Tone 3 responses, whereas the latter produced more Tone 1 responses. L2 proficiency also influenced perception, with higher sensitivity to the pitch relationship cue observed in listeners with high proficiency levels in both Cantonese and Korean groups. However, Cantonese listeners produced more Tone 3 responses in both phonation conditions, while the shift from Tone 1 to Tone 3 responses in creaky phonation was most notable among Korean listeners, particularly those with high proficiency level. This study suggests that non-native listeners from a tone language utilizing a lower pitch range for low tones may require enhanced pitch cues for high tones in L2 Mandarin, whereas those from a non-tone language background may develop a strategy to use phonation properties to compensate for their relatively unstable pitch acquisition.