

The development of lexical tone normalization lags behind: Evidence from Hong Kong Cantonese-speaking children

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Previous studies suggest that lexical tone normalization is a “late bloomer” relative to consonant normalization. However, little is known about when the ability to utilize contextual cues to normalize level tones, which differ only in pitch height, attains maturity. To address this research gap, the current study recruited children speaking Hong Kong (HK) Cantonese that has high-, middle, and low-level tones, providing a window to look into the development of level tone normalization. In addition, the current study aimed to uncover the extent to which language ability and musical pitch sensitivity impact the development of the speech normalization process.

Twenty-six children aged 6 to 10 years (14 females) from HK have been recruited. In addition, 40 HK young adults (20 females) participated in the current study as controls. They all were native speakers of HK Cantonese. Participants’ level tone normalization was assessed by a task modelled after Tao et al. (2021). In this task, participants were required to identify Cantonese level tones after hearing a target (/ji33/, middle-level tone) preceded by contextual materials in two conditions: speech and nonspeech. In each condition, the F0 trajectories of the contextual materials were lowered or raised three semitones, or remained unchanged. In addition, subtests of the Montreal Battery of Evaluation of Musical Abilities and the Hong Kong Cantonese Oral Language Assessment Scale were administered to assess child participants’ musical pitch sensitivity and language ability, respectively.

For the speech context, we found the normalization of level tones reached the adult-like level at the age of eight, as was demonstrated by the findings that the identification rate of expected responses of children below eight was significantly lower relative to those aged eight and above who behaved like adults. In addition, nonspeech context failed to trigger the level tone normalization process in neither children nor adults. Finally, the results showed that the performance of level tone normalization in speech condition positively correlated with chronological age and language ability. However, the influence of musical pitch sensitivity on the level tone normalization was weak.

HK Cantonese-speaking Children's ability to utilize contextual cues to normalize level tones improved with chronological age and language ability. It was not until 8 years old that these children could efficiently use the speech context to overcome the speech variability and achieve perceptual constancy in level tone normalization. This finding corroborates previous findings that the development of lexical tone normalization lags behind consonant normalization (Chen et al., 2023), which might be due to the multiple functions of pitch movements. In addition, the development of level tone normalization in Cantonese-speaking children seemed later as compared to Mandarin-speaking children, which might be attributed to the complex tone system of Cantonese (Peng, 2006). Another possible reason is that level tones are not categorically perceived (Francis et al., 2003).