

Neural bases of lexical tone and music processing

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Systematic use of pitch is not unique to language. In music, where musical tones are hierarchically organized to form a melody, relative pitch perception is also important. Previous studies have shown cross-domain transfer between musical perception and pitch perception. Non-tone language speakers with musical training perform better than those without musical training in pitch perception tasks. Moreover, among speakers of Mandarin Chinese, those with musical disorder show deficits in discrimination and identification of Mandarin lexical tones. What remains unclear is whether such cross-domain transfer is due to common neural circuitries recruited for lexical tone and music processing. In this fMRI study, we investigated the neural bases of lexical tone and musical tone processing in a group of twenty native Cantonese speakers without musical training and disorder. We examined neural responses to pairs of Cantonese level tones and piano tones with matched pitch, which were simply repeated (e.g., 277–233 Hz, 277–233 Hz), repeated with identical pitch interval in semitone but varied pitch height (e.g., 277–233 Hz, 294–247 Hz), or with varied pitch intervals (e.g., 294–233 Hz, 277–247 Hz). Brain regions involved in relative pitch perception are expected to show the strongest adaptation to the repetition condition, equal or slightly weaker adaptation to the identical pitch interval condition, and least adaptation to the varied pitch interval condition. For lexical tone perception, bilateral superior temporal gyri (STG) were significantly activated in the varied pitch interval condition versus the repeated condition, but not in the identical pitch interval condition versus the repeated condition. It indicates that bilateral STG adapt to level tone pairs with identical pitch interval but release from adaptation when the pitch interval was varied. No significant activation was found in musical tone perception. Our findings indicate that bilateral STG are likely selectively involved in relative pitch perception in language.

Key Words: Pitch, lexical tone, musical tone, cross-domain transfer, fMRI