

The Perception and Integration of Lexical Tone and Vowel in Mandarin-speaking Children with Autism: An Event-Related Potential Study

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Abstract : Enhanced discrimination of pure tones but diminished discrimination of speech pitch (i.e., lexical tone) were found in children with autism who speak a tonal language (Mandarin), suggesting a speech-specific impairment of pitch perception in these children. However, in tonal languages, both lexical tone and vowel are phonemic cues and integrally dependent on each other. Therefore, it is unclear whether the presence of phonemic vowel dimension contributes to the observed lexical tone deficits in Mandarin-speaking children with autism. The current study employed a multi-feature oddball paradigm to examine how vowel and tone dimensions contribute to the neural responses for syllable change detection and involuntary attentional orienting in school-age Mandarin-speaking children with autism. In the oddball sequence, syllable /da1/ served as the standard stimulus. There were three deviant stimulus conditions, representing tone-only change (TO, /da4/), vowel-only change (VO, /du1/), and change of tone and vowel simultaneously (TV, /du4/). EEG data were collected from 25 children with autism and 20 age-matched normal controls during passive listening to the stimulation. For each deviant condition, difference waveform measuring mismatch negativity (MMN) was derived from subtracting the ERP waveform to the standard sound from that to the deviant sound for each participant. Additionally, the linear summation of TO and VO difference waveforms was compared to the TV difference waveform, to examine whether neural sensitivity for TV change detection reflects simple summation or nonlinear integration of the two individual dimensions. The MMN results showed that the autism group had smaller amplitude compared with the control group in the TO and VO conditions, suggesting impaired discriminative sensitivity for both dimensions. In the control group, amplitude of the TV difference waveform approximated the linear summation of the TO and VO waveforms only in the early time window but not in the late window, suggesting a time course from dimensional summation to nonlinear integration. In the autism group, however, the nonlinear TV integration was already present in the early window. These findings suggest that speech perception atypicality in children with autism rests not only in the processing of single phonemic dimensions, but also in the dimensional integration process.

Keywords : autism, event-related potentials, mismatch negativity, speech perception

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