Categorical Speech Perception in Chinese Children with Autism Spectrum Disorder

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Categorical speech perception has been robustly demonstrated in typically developing (TD) adults (Liberman et al. 1957, 1967), where speech sounds that vary continuously along a physical dimension are perceived as distinct categories. Categorical speech perception emerges in prelinguistic infants (e.g., Eimas et al 1971, Werker & Tees 1984) and develops and matures with children's acquisition of their first language (e.g., Chen 2017). Few studies have examined whether children with ASD perceive speech sounds in a categorical fashion like their TD peers. Individuals with ASD exhibit perceptual processing patterns different from TD peers. They demonstrate enhanced perceptual performance in low levels that deal directly with the physical properties of the stimuli, e.g., pitch processing (e.g., Bonnel et al. 2003; Stewart et al. 2015), but they show deficits in higher levels of processing relating to mental representations such as interpretation of intonational phrases (e.g., Ashwin et al. 2007). Little research has investigated the perception of speech sounds in Chinese children with ASD.

This study investigated whether Chinese children with ASD discriminate acoustic

differences in speech sounds categorically. Three sound identification experiments were conducted to examine the perception of consonants, vowels, and tones with 16 children with ASD (mean age 5;1, sd=0.66) and a control group of 17 age- and verbal-IQ-matched typically developing (TD) children (mean age 4;9, sd=0.55). Each experiment included six stimulus sounds: six consonants on the /ba/-/da/ continuum (i.e., da1-da6), six vowels on the /a/-/ ϵ / continuum (ϵ 1- ϵ 6), and six tones on the continuum of the first (high-level) tone to the second (mid-low-rise) tone in a carrier syllable ba (ba1-ba6). Each target sound occurred 6 times and resulted in a total of 36 trials presented in a random order in each experiment.

The results showed that both groups similarly perceived the target consonants categorically: da1, da2, and da3 were perceived as /da/ (100%) and da5 and da6 as /ba/ (100%). But on da4 the ASD group was significantly more likely to perceive it as /da/ than the TD group (53% vs. 32%) (F (5, 31)=4.76, p <.05). Both groups also showed categorical perception of the vowels: $\varepsilon 1$ and $\varepsilon 2$ were perceived as / ε / (100%) and $\varepsilon 5$ and $\varepsilon 6$ as /a/ (80-100%), but on $\varepsilon 3$ and $\varepsilon 4$ the ASD group was significantly more likely to treat them as / ε / than the TD group ($\varepsilon 3$: p<.05; $\varepsilon 4$: p<.001). On tone identification, the two groups also exhibited a clear categorical perception: they both perceived ba1 and ba2 as Tone 1 (100%), ba3 as Tone 1 (80%), and ba4, ba5, and ba6 as Tone 2 (90-100%). The results, taken together, indicate that preschool Chinese children with ASD are similar to their TD peers in showing categorical speech perception. They perceive the target stimuli on the two ends of the continua, i.e., the first and the last two or three stimulus tokens of consonants, vowels, and tones, categorically. But they differ significantly from the TD peers in the intermediate consonant and vowel tokens, suggesting some deficits in the accuracy in categorical perception.