Tracking anticipatory oscillatory dynamics during audio-visual integration in autism

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Abstract

Atypical multisensory processing is a candidate building block of social communication difficulties in autism spectrum disorder (ASD). Although behavioral evidence converges to reveal an altered multisensory profile in ASD, little is known about the underlying neurophysiological bases. Recent data on the adult population supports the idea that oscillatory brain activity in different frequency bands subserves the integration of stimuli from multiple sensory modalities into a unified percept. For audiovisual (AV) integration, the literature hypothesizes a central role for: i) endogenous alpha rhythms (8-12 Hz), which would determine the hard-wired precision of cross-modal perception; ii) pre-stimulus theta oscillations, which would reflect the prediction of AV co-occurrence; iii) post-stimulus phase reset, which would be responsible for the temporal alignment of the different unisensory signals. In this study, to investigate the neural correlates of AV integration in children with ASD, as compared to typically developing (TD) peers, we employed electroencephalography (EEG) both during a resting state and a task probing audiovisual integration (i.e. AV bounce-inducing effect). In line with previous evidence in neurotypical adults, our results show that in TD children AV integration dynamics could be predicted by the individual alpha frequency peak measured at rest and by a modulation of anticipatory theta oscillations at the single-trial level. Conversely, in ASD participants the only discriminant marker between AV integration and segregation was the post-stimulus phase reset induced by the auditory event on visual cortical oscillations, while they did not show a relationship between AV integration and endogenous alpha rhythms, nor signatures of prediction of AV co-occurrence as measured by anticipatory theta activity. Overall, these findings suggest that atypical AV integration in ASD might be due, at least to some extent, to a higher and potentially interfering cross-modal influence of auditory stimuli in visual regions and to a weaker prediction of upcoming multisensory interactions.