Temporal dynamics of numerosity and symmetry processing in the human brain

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Abstract

The number of items in a visual image is underestimated when these are symmetrically arranged compared to when they are randomly scattered in space. The neural mechanisms underlying this perceptual illusion remain unclear. In this study, adult participants viewed arrays of dots varying in numerosity and spatial arrangement while undergoing EEG recording. Visual evoked potentials (VEPs) associated with numerosity were distinguishable over occipito-parietal electrodes in two distinct time windows: an early response 80 ms post-stimulus and a later response from 150 ms. Sensitivity to spatial arrangement (symmetrical vs random) emerged at approximately the timing of the second numerosity-related window. Representational similarity analysis confirmed that numerosity was processed independently of low-level visual features (dot size and convex hull). These findings suggest that the underestimation of numerosity in symmetrical displays may stem from later-stage perceptual grouping processes, whereby the visual system derives numerosity from segmented objects.

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