The Neurobehavioral Basis of Parallel Individuation and Numerical Approximation

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Abstract

Research shows the existence of a small-number system (1-3) invoking parallel individuation, and a large-number system (4+) based on Weberian magnitude estimation. A 128-channel EEG system was used to investigate ERPs while participants detected numerical changes in dot arrays during an oddball task. During "No Change" trials, the N170 over the parietal-occipital-temporal areas showed distinct waveforms to the habituation of small (but not large) numbers, indicating that more items encoded in working memory leads to stronger N170 amplitudes. We also observed decreased accuracy for increasing vs. decreasing changes in magnitude. Converging over the mid-parietal area (Pz), lower P3b amplitudes were observed for harder, numerically-larger conditions, while Increasing-Large changes showed longer reaction times compared to Decreasing-Large. Our findings suggest a neurobehavioral differentiation in perceiving small vs. large numbers and increasing vs. decreasing change at early stages of processing, and a later stage that involves higher-order numerical processing linked to context-updating.

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