Dynamics vs. Development in Numerosity Estimation: A Computational Model Accurately Predicts a Developmental Reversal

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Abstract

Perceptual judgments result from a dynamic process, but little is known about the dynamics of numerosity estimation. A recent study proposed a computational model (D-MLLM) that combined a model of trial-to-trial changes with a model for the internal scaling of discrete number. Here, we tested a surprising prediction of the model – a situation in which children's estimates of numerosity would be better than those of adults. Consistent with the model simulations, task contexts led to a clear developmental reversal: children made more adult-like, linear estimates when to-be-estimated numbers were descending over trials (backward), whereas adults became more like children with log estimates when numbers were ascending (forward). In addition, adults' estimates were subject to inter-trial differences regardless of stimulus order. In contrast, children were not able to use the trial-to-trial dynamics unless task contexts were salient (forward or backward order), indicating the limited memory capacity for dynamic updates. Together, the model adequately predicts both developmental and trial-to-trial changes in number-line tasks.