Testing formal predictions of neuroscientific theories of ADHD with a cognitive model-based approach

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Abstract

Neuroscientific theories of attention-deficit/hyperactivity disorder (ADHD) alternately posit that cognitive aberrations in the disorder are due to acute attentional lapses, slowed neural processing, or reduced signal-to-noise ratios. However, they make similar predictions about behavioral summary statistics (response times [RTs] and accuracy), hindering the field's ability to produce strong and specific tests of these theories. The current study uses the linear ballistic accumulator (LBA; Brown & Heathcote, 2008), a mathematical model of choice RT tasks, to distinguish between competing theory predictions. Children with ADHD (n = 80) and age-matched controls (n = 32) completed a numerosity discrimination paradigm at 2 levels of difficulty, and RT data were fit to the LBA model to test theoretical predictions. Individuals with ADHD displayed slowed processing of evidence for correct responses (signal) relative to their peers but comparable processing of evidence for error responses (noise) and between-trial variability in processing (performance lapses). The findings are inconsistent with accounts that posit an increased incidence of attentional lapses in the disorder and provide partial support for those that posit slowed neural processing and lower signal-to-noise ratios. Results also highlight the utility of well-developed cognitive models for distinguishing between the predictions of etiological theories of psychopathology.