Evidence of motor-control difficulties in children with attention deficit hyperactivity disorder, explored through a hierarchical motor-systems perspective.

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Abstract
INTRODUCTION: Attention deficit hyperactivity disorder (ADHD) may reflect a disorder of neural systems that regulate motor control. The current study investigates motor dysfunction in children with ADHD using a hierarchical motor-systems perspective where frontal-striatal/"medial" brain systems are viewed as regulating parietal/"lateral" brain systems in a top down manner, to inhibit automatic environmentally driven responses in favor of goal-directed behavior. It was hypothesized that due to frontal-striatal hypoactivation, children with ADHD would have difficulty with higher order motor control tasks felt to be dependent on these systems, yet have preserved general motor function.

METHOD: A total of 63 children-ADHD and matched controls-completed experimental motor tasks that required maintenance of internal motor representations and the ability to inhibit visually driven responses. Children also completed a measure of motor inhibition, and a portion of the sample completed general motor function tasks.

RESULTS: On motor tasks that required them to maintain internal motor representations and to inhibit automatic motor responses, children with ADHD had significantly greater difficulty than controls, yet on measures of general motor dexterity, their performance was comparable. Children with ADHD displayed significantly greater intraindividual (subject) variability than controls. Intraindividual variability (IIV) contributed to variations in performance across the motor tasks, but did not account for all of the variance on all tasks.

CONCLUSIONS: These findings suggest that children with ADHD may be more controlled by external stimuli than by internally represented information, possibly due to dysfunction of the medial motor system. However, it is likely that children with ADHD also display general motor-execution problems (as evidenced by IIV findings), suggesting that atypicalities may extend to both medial and lateral motor systems. Findings are interpreted within the context of contemporary theories regarding motor dysfunction in ADHD, and implications for understanding externalizing behaviors in ADHD are discussed.