Evidence for abnormal motor planning in ADHD

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It has been shown that individuals who are diagnosed with ADHD have atypical motor development and behaviour. They have been shown to have slower performance on timed motor tasks (Piek et al., 1999), greater variability in speed (Castellanos & Tanock, 2002; Gilden, 2007), poor locomotor skills (e.g., running, hopping, leaping, sliding) and control of objects (kicking, catching, throwing) (Harvey et al., 2007) and poor fine motor ability (Pitcher, Piek, & Hay, 2003). Although a variety of clinical tests have shown that a motor dysfunction is present in ADHD, they do not indicate which specific processes are involved, as motor planning and/or motor adjustment (Sergeant et al., 2006).

Few studies have looked at the aspect of preparation for movement. Wood et al. (1999) contrasted task performance with a brief (100-150ms) versus a longer (350-800ms) interval between warning cue and target. They found that the longer interval increased differences between ADHD and control groups with respect to susceptibility to invalid warning cues. This suggests that individuals with ADHD do not benefit to the same extent from, or were adversely affected by, increased time to prepare a response. Deficient response preparation in ADHD was reported by Klimkeit et al. (2005), who showed that children with ADHD were slower than typical controls with no ADHD symptoms, in reacting to a response cue by releasing a button, but did not differ in the time taken up by the actual execution of motor responses. They suggested that ADHD is characterised by slow motor preparation but not by actual slow motor execution. Eliason et al. investigated the ability of children with ADHD to program and execute goal-directed movements. Start and End positions were always visible while the cursor was either visible (visual feedback) or hidden (without visual feedback). They found that movement control was impaired for children with ADHD, especially during the without-feedback condition, indicating poorer motor programming in ADHD.

Dahan Rydar and Reiner (2016), suggested looking at the aspect of motor deficiencies in the prism of four partly overlapping components: movement planning, execution, attention to task and motion monitoring. Hence we seek for a methodology that would allow measurements of the entire movement process, from attending a target, planning and then execution of the movement.

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