

# A twin study of motor control and attention: Left hand accuracy as endophenotype for attention problems

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## Introduction

Motor control of children with ADHD and their unaffected siblings is less accurate and less stable compared to healthy children. This study investigated the phenotypic and genetic association between attention problems (AP) and left hand motor control in a population based twin sample. The use of motor control of the left hand was based on previous findings, showing that motor control deficits in children with ADHD are most pronounced in the left hand (Rommelse et al., 2007). From the results of the present study, we evaluate the usefulness of motor control as endophenotype for AP.



## Methods

Subjects were 97 MZ and 80 DZ twin pairs, age 12, from the Netherlands Twin Register (NTR). Accuracy of left hand motor control was measured with the pursuit task (fig. 1), which requires subjects to follow a randomly moving target on a computer screen. AP were assessed with the Strengths and Weaknesses of ADHD and Normal behavior scale (SWAN), which consists of 18 items rated on a continuous scale, and discriminates between attention deficits (AD) and hyperactivity/impulsivity (HI). Bivariate modeling in Mx was used to estimate genetic (A) and environmental contributions (C, E) to (co) variance of motor control and AD and of motor control and HI. Sex, birth weight and hand preference were included in the analyses as covariates.

Figure 1: Pursuit task

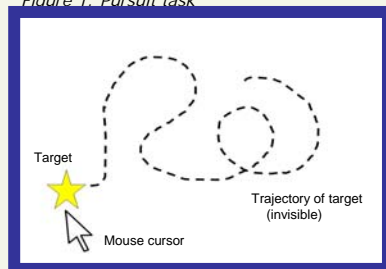
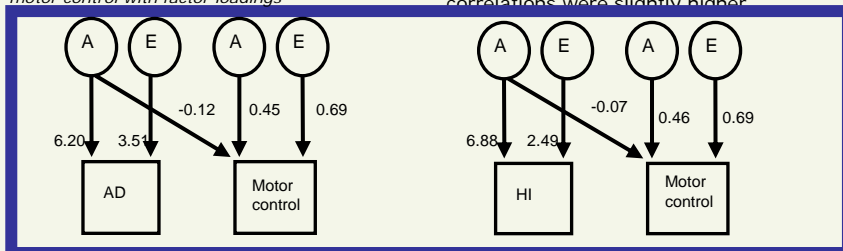


Table 1: Descriptives

	Right	Left
Hand preference	86.7%	13.3%
	Mean	SD
Motor control	4	1.3
AD	39.1	7.3
HI	39.1	7.5

Figure 2: Best fitting bivariate models for AP and motor control with factor loadings



## Results

Means and standard deviations of AD and HI scores, and of the motor control measure left hand accuracy are presented in table 1. Phenotypic correlations showed that lower accuracy of left hand motor control was associated with more AP ( $r^P$  HI = -0.09,  $r^P$  AD = -0.13). Twin correlations suggested genetic influences on left hand accuracy ( $rMZ$  = 0.30,  $rDZ$  = 0.25) and cross trait-cross twin correlations indicated a genetic correlation with HI and AD. The most parsimonious genetic model was an AE model that included genetic covariance (see fig. 2). Genes explained 31% of variation in left hand motor control, 88% of variation in HI and 77% of variation in AD, and around 50% of the covariance of motor control and AP could be explained by genetic variance. Genetic correlations ( $r^g$ ) of motor control with AD and HI were -0.21 and -0.16, respectively. If the analyses were limited to data of right-handed subjects only, model fitting results and heritabilities did not change, however, genetic correlations were slightly higher.

## Conclusion

The observed association of left hand motor control with attention deficit and hyperactivity/impulsivity corresponds to the previous observation that motor deficits in ADHD children are most pronounced in the left hand (Rommelse et al., 2007). In addition, it supports a relation between ADHD and right hemispheric dysfunction (Stefanatos et al., 2001). Our finding that the association of motor control with AD and HI may relate to a shared genetic influence, suggests that motor control of the left hand might be a proper endophenotype for attention problems.

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## Referenc

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