

# Attenuated Graphomotor Procedural Learning in Children and Adolescents with ADHD



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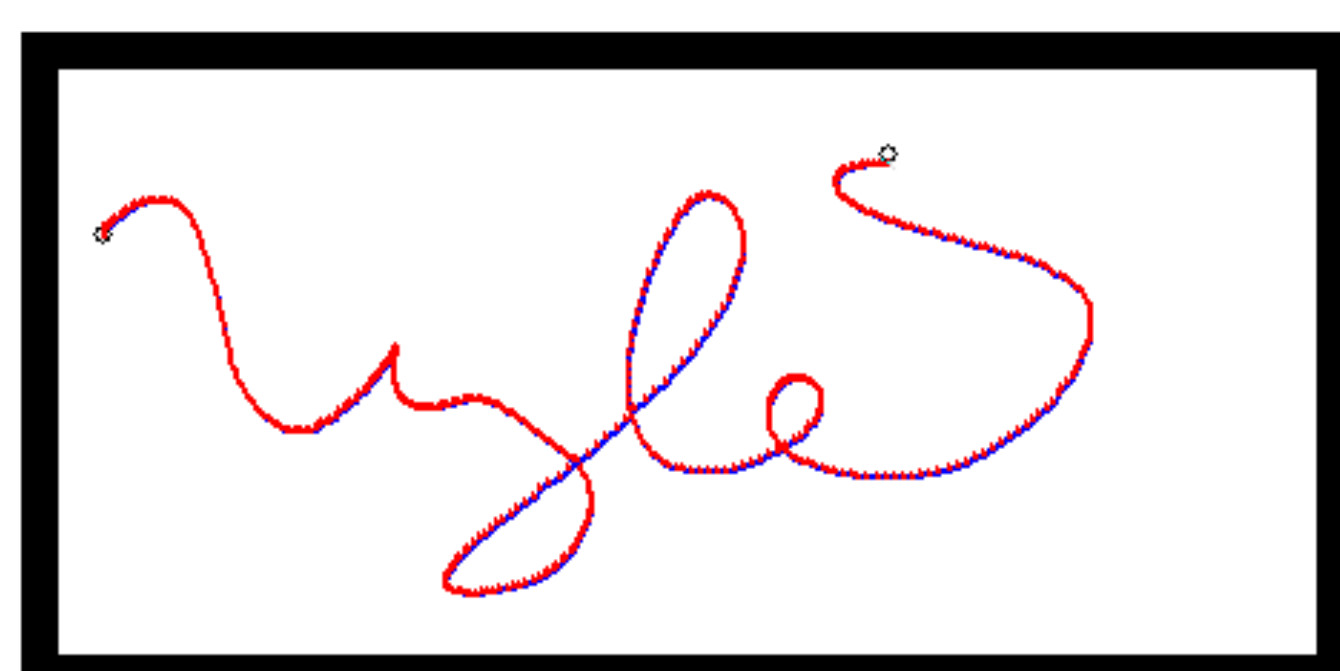
## Introduction

- Research indicates children, adolescents, and young adults with ADHD frequently present with motor difficulties, including handwriting problems and reduced automatization and procedural learning of motor skills (Adi-Japha et al., 2011; Brossard-Racine et al., 2015; Duda et al., 2014; Koziol et al., 2013).
- There are no published studies that have investigated the development of graphomotor procedural learning in children with ADHD.
- The present study sought to determine if children and adolescents with ADHD would demonstrate reduced procedural learning of a novel grapheme relative to typically developing peers as indicated by an objective measure of graphomotor automatization and fluency.

## Participants & Methods

- Thirty-two children and adolescents with ( $n = 16$ ) and without ( $n = 16$ ) ADHD who did not differ significantly in age, IQ, and SES participated in the study.
- Participants with ADHD discontinued stimulant medication 24 hours prior to taking part in the study ( $n = 2$ ) or were medication naïve ( $n = 14$ ).
- Participants practiced a novel grapheme on a digitizing tablet 30 times.
- Normalized Jerk (NJ) was operationalized as degree of graphomotor automaticity. Higher NJ values indicated a less automatized graphomotor program, and lower NJ values indicated a more automatized graphomotor program.

Novel grapheme



## Results

- Control participants demonstrated a statistically significant improvement in graphomotor fluency from the beginning to the end of practice,  $t = 2$ ,  $z = -2.53$ ,  $p = .009$ ,  $r = -0.448$ , whereas participants with ADHD did not,  $t = 4$ ,  $z = -1.81$ ,  $p = .074$ ,  $r = -0.32$ .

## Discussion & Conclusions

- Consistent with findings in adults with ADHD, results provide evidence that graphomotor procedural learning in children and adolescents with ADHD may be attenuated relative to typically developing peers.
- Attenuation of learning versus no learning is emphasized noting near-significant improvement in the ADHD group and a medium effect size.
- Findings have implications for future research that may inform remediation of handwriting difficulties, academic accommodations, and using digitizing technology as a neuropsychological assessment instrument.

Nonparametric Test Results	Mann-Whitney U		Wilcoxon Signed-Rank					
	N	M NJ	SD NJ	M Rank	Sum of Ranks	Neg. Ranks	Pos. Ranks	Ties
<b>Beginning</b>								
Controls	16	535	323	15	240			
ADHD	16	835	841	18	288			
<b>Ending</b>								
Controls	16	406	400	15	236			
ADHD	16	591	594	18	292			
<b>Beg.-End.</b>								
Main Effect						26	6	0
Controls						14	2	0
ADHD						12	4	0

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