ADHD REACTION TIME TO A STIMULUS OVERTIME

Nicole Rothner

George Mason University

Background

Attention Deficit Hyperactivity Disorder

Attention Deficit Hyperactivity Disorder (ADHD) is a chronic condition which includes symptoms such as:

- Attention difficulty
- Hyperactivity
- Impulsiveness

Symptoms will appear in childhood and typically persist throughout the individual's life.

Research has shown that ADHD has a strong correlation with reaction time (RT) variability, referring to inconsistency in speed of RT or intermittent and long RT (Tamm, et. al., 2012).

- One common hypothesis attributes this to lapses in attention experienced by affected individuals. (Wood, et al., 2010).
- These lapses in attention represent brief periods of inattention where RT is either slow or absent and may reflect the frontal cortex function (Saville, et al, 2015; Johnson, et. al., 2007).

Hypothesis

There is an expectation of a main effect that the ADHD group will perform worse overall and an interaction effect where RT will increase for the ADHD group as the study goes on.

- We can expect the ADHD group will have a higher RT than the control group.
- We hypothesize there will also be an interaction effect showing an increase in RT of the ADHD group over blocks of time.

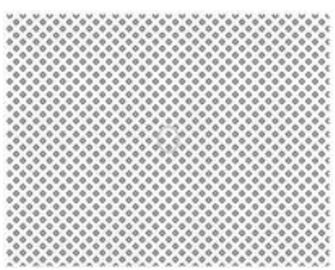

Figure 1. Image of Critical Signal

Methodology

- 27 undergraduates (14 female, 13 male)
- 2 (condition) x 6 (number of blocks) mixed design with repeated measures on the blocks factor.
- Task: Respond to a critical signal (the letter "O") as soon as detected (shown in Figure 1).
  - The letters "O", "D", and "backwards D" all appeared on screen.
  - Participants were instructed to press the spacebar when critical signal was detected as quickly as possible.
  - They were told not to react to non-critical signals.

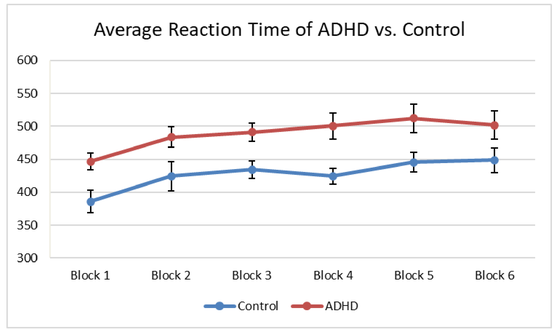

Figure 2. ADHD Reaction Time compared to control group with standard error bars

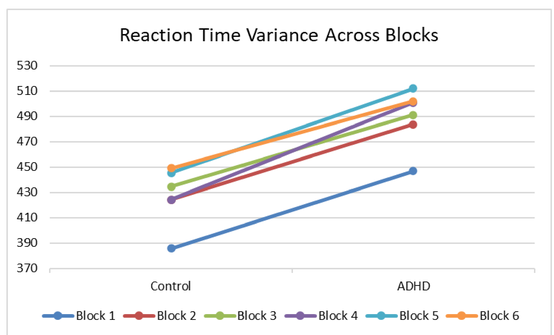

Figure 3. Reaction Time across Blocks

Results

The 2X6 ANOVA revealed:

- Main effect of group condition (ADHD, Control) was found significant ($p<.05$).
- Assumption of Sphericity was violated and followed up with a Greenhouse-Geisser correction ($p<.05$)
- Significance found in Pairwise comparisons of within-subjects factor of blocks. Interaction effects found in block 1 with every subsequent block as reaction time trended upwards.
  - Blocks 1 x 2, blocks 1 x 3, blocks 1 x 4, blocks 1 x 5, blocks 1 x 6
  - No other pairwise comparisons from the data were found significant.
- The a priori Power Analysis revealed that given $F=.58$, alpha .05, power .80, in a design of 2 subject groups with 6 repeated measures having an average correlation of $r=.601$ with a sphericity correction, $n=8$.

Conclusion/Discussion

- The results for RT variability over time did not prove to be exclusive to the ADHD group based on the hypothesis that the ADHD group will increase in RT the longer they were asked to sustain attention.
  - Both groups increased in RT as the study went on however there was only significant increase in RT from block 1 to block 2 and block 1 with each block thereafter (3-6) in both the Control and ADHD groups.
- A main effect was also found with RT between groups (Control & ADHD)
- There are limitations since the data was not initially gathered for the purpose of studying RT variability, some improvements could be made to the experiment to focus on studying RT variability specifically.
  - One suggestion would be to conduct the study over a longer period.

References

Saville, C.W.N., Feige, B., Kluckert, C., Bender, S., Biscaldi, M., Berger, A., Fleischhaker, C., Henighausen, K. and Klein, C. (2015), Increased reaction time variability in attention-deficit hyperactivity disorder as a response-related phenomenon: evidence from single-trial event-related potentials. J Child Psychol Psychiatr, 56: 801-813.

Shaw, T.H., Curby, T.W., Satterfield, K., Monfort S. S., Ramirez, R. (2019) Transcranial Doppler sonography reveals sustained attention deficits in young adults diagnosed with ADHD. Exp Brain Res 237, 511–520.

Tamm, L., Narad, M. E., Antonini, T. N., O'brien, K.,M., Hawk,Larry W.,,Jr, & Epstein, J. N. (2012). Reaction time variability in ADHD: A review. Neurotherapeutics, 9(3), 500-8.

Wood, A. C., Asherson, P., van der Meere, ,J.J., & Kuntsi, J. (2010). Separation of genetic influences on attention deficit hyperactivity disorder symptoms and reaction time performance from those on IQ. Psychological Medicine, 40(6), 1027-37.