

Distinguishing adults with ADHD from adults without ADHD symptoms with computerized cognitive tests

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The methodological question being addressed

In what way can computerized cognitive tests reliably distinguish adults with ADHD from adults without symptoms of ADHD?

Introduction

Attention Deficit Hyperactivity Disorder (ADHD) is a developmental disorder characterized by behavioural dysfunctions such as inappropriate inattention, impulsivity and overactivity. The world wide prevalence of this disorder is estimated at 3.4% in adults (Fayyad et al., 2007). ADHD manifestations cause problems in every day life, like difficulties in social skills, impairment of school performance, difficulties in driving and problems with occupational functioning (Biederman & Faraone, 2005). Diagnosis is based on observable behaviour criteria as stated in the Diagnostic and Statistical Manual of Mental Disorders, fifth edition (DSM-V). However, the cognitive impairments seen in child and adult ADHD can be measured by standardized tests. In diagnostic- and treatment research in adult ADHD, many different neuropsychological tests are used as indices of symptom severity. This leads to the question which tests are reliable in adult ADHD-studies.

Next to the reliability, the degree of symptom severity is a point of interest. Performance on tests may show differences between ADHD and no ADHD, but whether these differences resemble the strict cut-off point as handled using the DSM-V criteria, remains the question.

Taken together, **the aim of our present study** is to validate cognitive tests as diagnostic markers of adult ADHD-symptoms.

Methods

The experiment is still ongoing, but preliminary analysis is reported on a sample of 62 participants. Subjects were tested three times: the first session was for familiarization. The second and third sessions were identical and were used to determine test-retest reliability.

In addition to diagnosed and control adult populations, adults with ADHD-like complaints that weren't eligible for the diagnosis were taken into account, for studying the degrees of symptom severity and their resemblance to the cut-off point at which the diagnosis is given. Characteristics of each group are presented in table 1.

Table 1: group characteristics

	N (% female)	Mean age (SD)	Range
ADHD	15 (73.3)	22.13 (3.60)	18 - 31
Symptom	23 (69.6)	22.57 (3.27)	18 - 31
Control	24 (83.3)	21.29 (2.48)	18 - 29

Main outcome measures were:

- commission errors and reaction time of correct responses on the continuous performance test (CPT)
- percentage long term rewards on the choice-delay test (CDT) as a measure of impulsivity
- number of immediate correctly recalled words on the 30-word visual verbal learning task (VVL) as measure of working memory capacity.

Conclusion

Based on preliminary results, the dependent measures of the cognitive tasks show promising reliability outcomes, especially the reaction time on the CPT and number of correctly recalled words on the second and third trial. The CDT outcomes show mixed results and a lesser reliability than the CPT and VVL, which might indicate that the CDT is less useful as a cognitive measure of ADHD symptoms. Regarding the tests' diagnostic sensitivity, some signs are observed in terms of commission errors on the CPT and number of correctly recalled words during the third trial of the VVL, but ongoing data collection will hopefully substantiate these observations.

References

- Biederman, J., & Faraone, S. V. (2005). Attention-deficit hyperactivity disorder. *The Lancet*, 366(9481), 237-248.
Epstein, J.N., Erkanli, A., Conners, C.K., Klaric, J., Costello, J.E., & Angold, A. (2003). Relations between continuous performance test performance measures and ADHD behaviors. *Journal of abnormal child psychology*, 31(5), 543-554.
Fayyad, J., Graaf, R. D., Alonso, J., Angermeyer, M., Demyttenaere, K., Girolamo, G. D., et al. (2007). Cross-national prevalence and correlates of adult attention-deficit hyperactivity disorder. *British Journal of Psychiatry*(190), 402-409

Results

The main outcomes of the CPT are presented in figure 1 and figure 2. Reaction times of the control group resemble closely those reported by Epstein et al. (2003): 394 ms (SD=69). The ADHD group tends to show more commission errors as compared to the other groups. Test-retest analysis of the reaction time showed a correlation of $r = 0.89$, $p < .01$. and $r = 0.54$, $p < 0.01$ for commission errors.

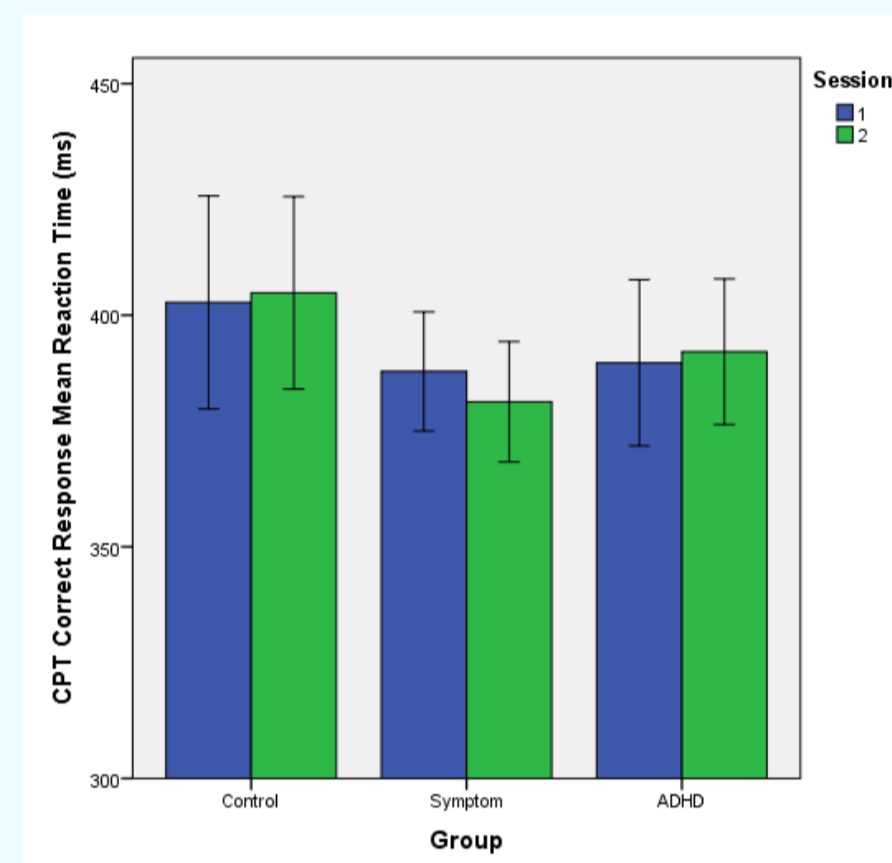


Figure 1: CPT correct response reaction times per group per session in milliseconds

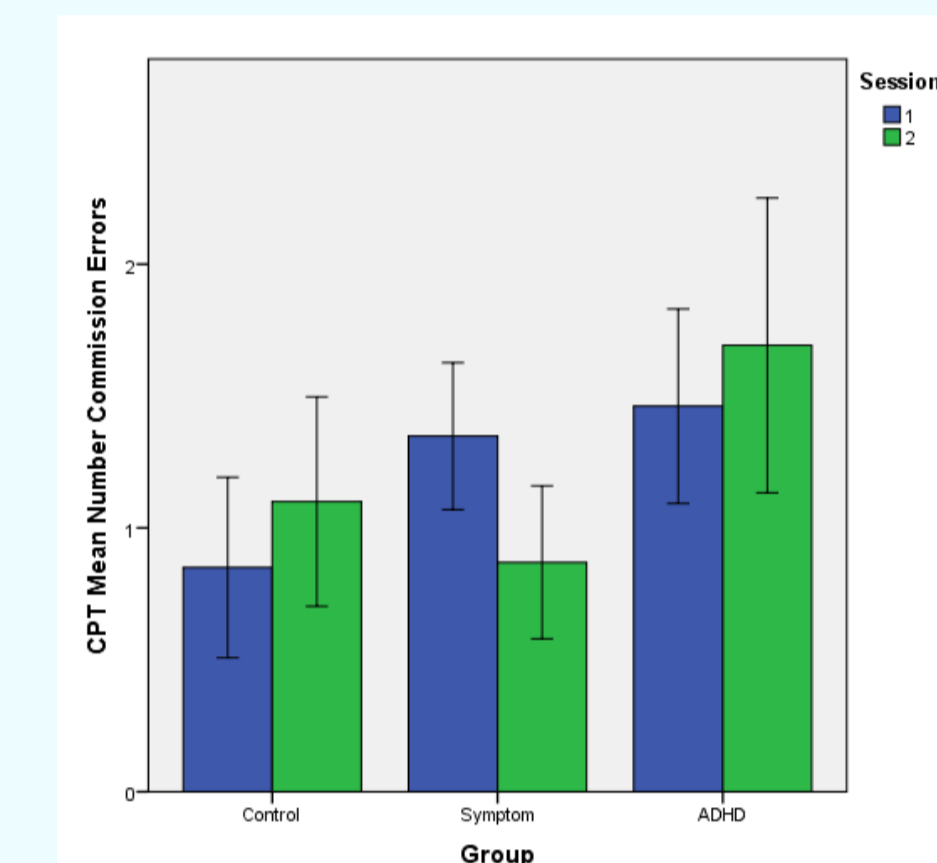


Figure 2: CPT mean number of commission errors per group per session in milliseconds

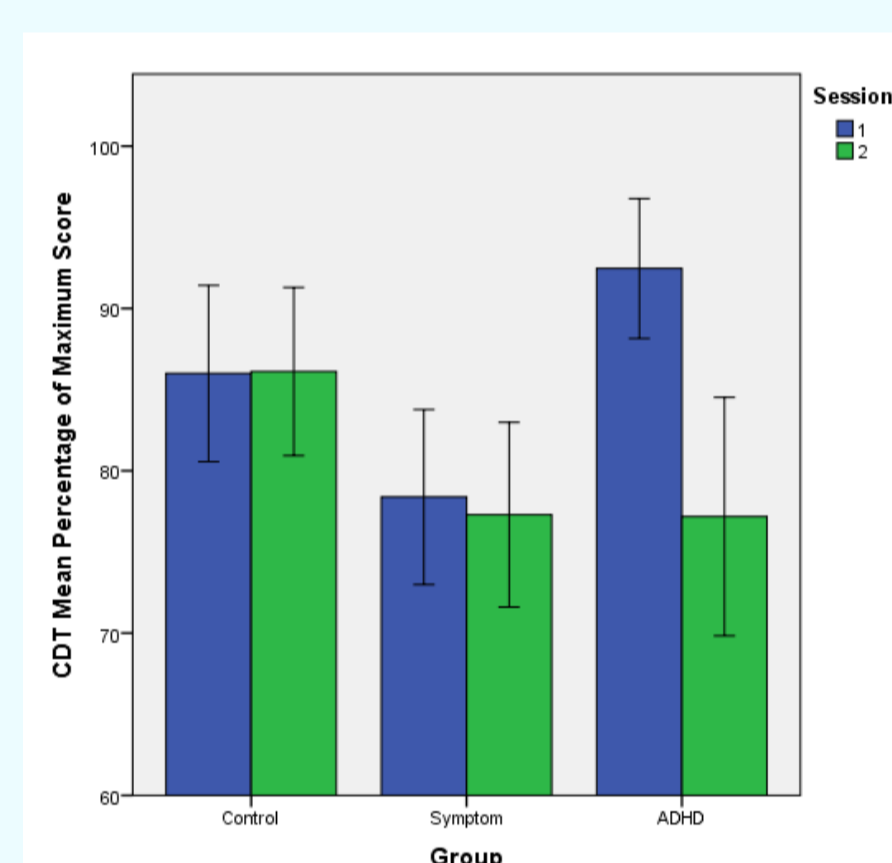


Figure 3: mean percentages of maximum obtainable score on the CDT

The mean percentages of long-term reward of the CDT are presented in figure 3. The control group tends to reach a higher percentage of maximum obtainable score as compared to the symptom group. The ADHD-group tends to score inconsistently during the separate sessions. Despite the inconsistency, overall test-retest analysis showed a correlation of $r = 0.60$, $p < 0.01$.

The number of correctly recalled words of the VVL is presented in figures 4, 5 and 6. The symptom group tends to score more inconsistently between sessions as compared to the other groups. The control group tends to recall more words during the third trial as compared to the other groups. Test-retest analysis showed a correlation of $r = .44$, $p < .05$ for the first trial, $r = .70$, $p < .01$ for the second trial and $.76$, $p < .01$ for the third trial.

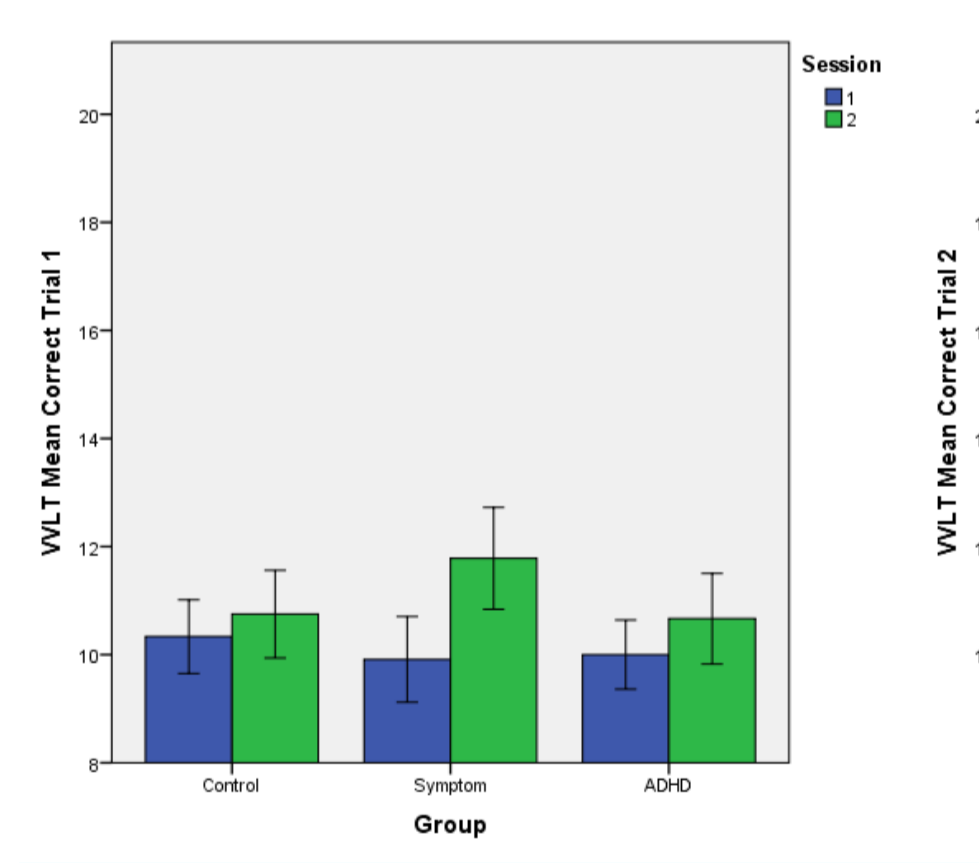


Figure 4: VVL Immediate Recall Correct Responses of trial 1 per session

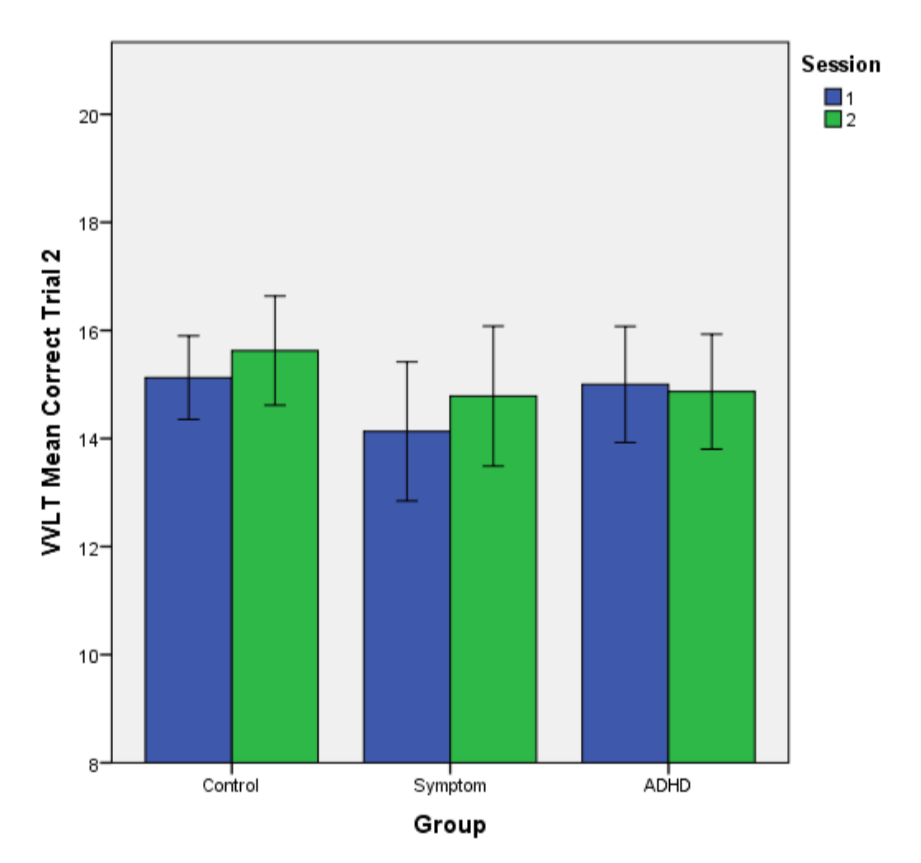


Figure 5: VVL Immediate Recall Correct Responses of trial 2 per session

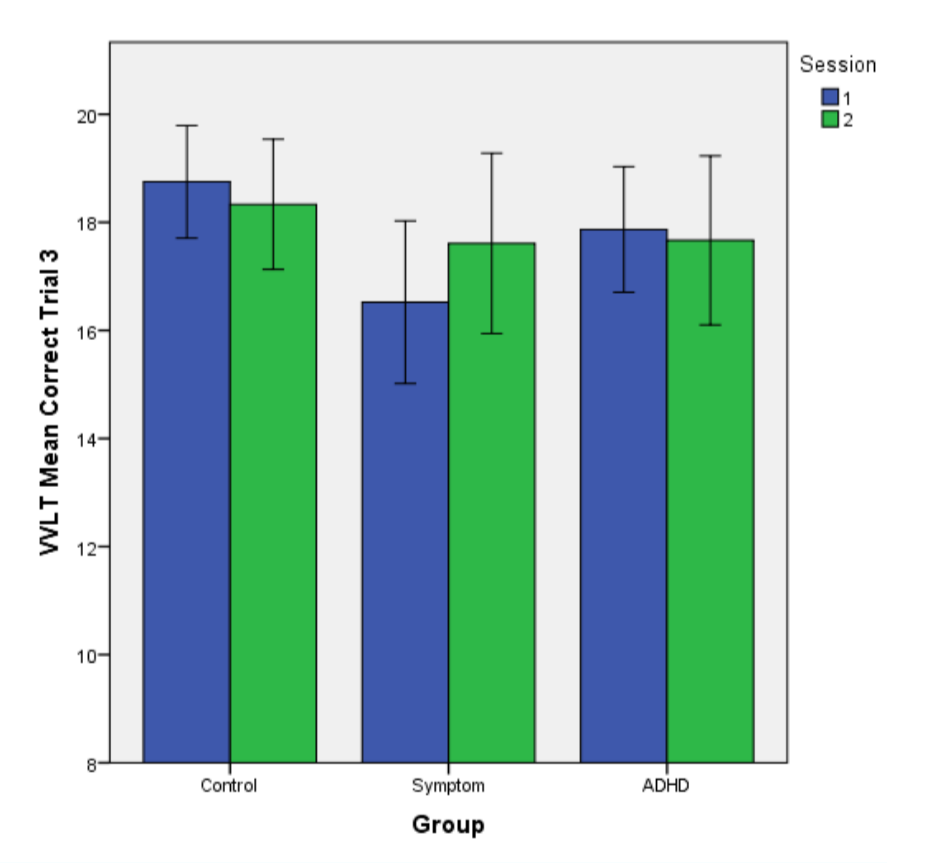


Figure 6: VVL Immediate Recall Correct Responses of trial 3 per session