



Time Perception and Related Cognitive Abilities in Adults with Attention Deficit/Hyperactivity Disorder (ADHD) Traits



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Background

- The ADHD population may experience impaired time perception (e.g. Toplak et al., 2003); however, many related studies focused on ADHD children but neglect the research of adults.
- Difficulties on attention, working memory (WM) or inhibition in the ADHD population may be responsible for their dysfunctional time perception, as aforementioned abilities may be severed as crucial components during time perception (Barkley, 1997; Grondin, 2010).
- The complexity of visual stimuli in time tasks may also influence participants' time perception, evidenced by several time studies suggested that when visual stimuli (animations) yielded more variations, shorter duration estimations were made (e.g. Liverence & Scholl, 2012).

Aims of the current study:

- To explore whether adults with attention deficits (AD) would have more imprecise performance in time task.
 - To investigate whether more complex visual stimuli in the time task would lead participants to underestimate durations, and whether this tendency would be more pronounced on adults with AD
 - To explore whether adults with AD would have poorer performance on WM and inhibition tasks, and whether those abilities would correlate with their time perception performance.
- ※ Participants' IQ levels were also monitored in this study.

Method (1/2)

Participants:

	Low-AC (N=8)	High-AC (N=6)
Age (years)	21.63(2.13)	23.17(3.76)
Gender (male: female)	0:8	2:4
Linguistics (English: Chinese)	7:1	4:2

- Low-AC = attention deficits group; High-AC = high attention capacity group.
- The Conners' Adult ADHD Rating Scales (CAARS) was adopted to screen participants' attention.

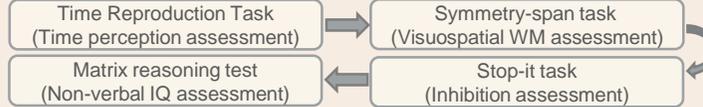
Reference

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- Grondin, S. (2010). Timing and time perception: a review of recent behavioral and neuroscience findings and theoretical directions. *Attention, Perception, & Psychophysics*, 72(3), 561-582.
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Method (2/2)

Procedure

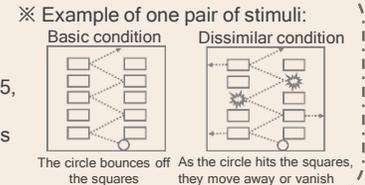
- Participants were required to complete the following tasks:



- ※ The time reproduction task mainly requires participants to separately reproduce stimuli's durations by pressing buttons after watching each stimulus.

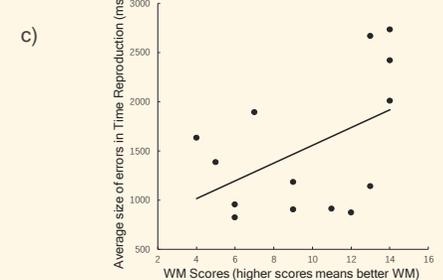
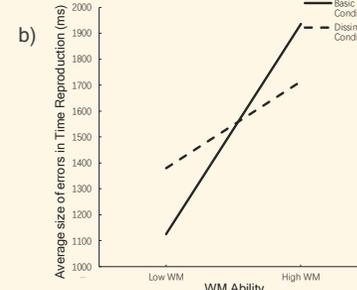
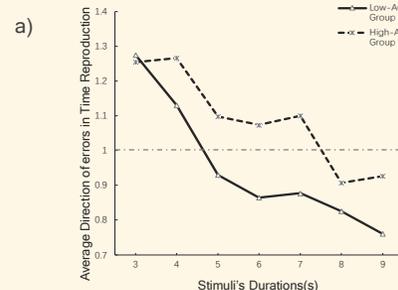
Stimuli in the time reproduction task

- Containing 28 pairs of visual stimuli.
- Each pair:
 - had identical clock durations (3, 4, 5, 6, 7, 8, 9s)
 - differed in the complexity conditions (basic or dissimilar conditions)



Result

- Data from time task were mainly analyzed by the three-way MANOVA (2 groups × 7 durations × 2 complexity conditions); independent t-test and correlation were mainly adopted to analyze data from WM, inhibition and IQ tests.



- Interaction of group × duration (non-significant, $F_{3,35} = 40.21 = 1.95, p = .131$) on the direction of errors in the time reproduction suggested that the Low-AC group tended to more underestimate durations.
- Direction of errors = reproduced duration / actual duration; >1 means overestimation, <1 means underestimation.
- By entering WM scores into MANOVA as a covariate, a significant interaction of complexity × WM ($F_{1,10} = 8.06, p = .018$) on participants' size of errors in the time reproduction was detected.
- Size of errors = |reproduced duration - actual duration|; larger value means large error size.
- For correlation analysis, only one marginally significant correlation between WM and participants' size of errors in the time reproduction was detected ($r = .48, p = .084$).
- ※ Non-significant main effects for group, complexity and interaction of group × complexity in time reproduction, as well as non-significant between group differences in WM, Stop-it and IQ tests were found.

Discussion

- This study detected that the low-AC group tended to slightly more underestimate durations; however, non-significant differences between two groups and two complexity conditions in the time reproduction were found. These may be because the relatively short stimuli's durations (compared with other time studies on ADHD adults) and the difference between two conditions in this study may be insufficient to significantly influence participants' reproduction of time.
- Among other cognitive assessments, this study detected that, in general, participants with better WM tended to make larger errors in the time reproduction. This may be because subjects with better WM could capture more details of stimuli, and correspondingly they may have been inclined to reproduce longer durations and thus made larger errors. However, based on the current data, it is difficult to form a comprehensive explanation for WM's effects.
- Several limitations were existed in this study, such as the small sample size and the solo use of the self-report CAARS. Future studies are recommended to verify this study's results by improving above limitations. The effects of WM on time perception are also worthy of further investigation.

Acknowledgements

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