Monkeys and Lions: Improving the ecological validity of working memory tests to assess contextual impact on daily functioning in children with developmental disorders

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The objective is to examine how working memory functioning in children with ADHD and/or ASD as measured with the Lion game and the Monkey is influenced by context and to assess the diagnostic utility and ecological validity of the Lion and Monkey…

Ethical review	Approved WMO
Status	Recruitment stopped
Health condition type	Developmental disorders NEC
Study type	Observational non invasive

Summary

ID

NL-OMON49582

Source
ToetsingOnline

Brief title
Distractors in the classroom

Condition

- Developmental disorders NEC

Synonym
ADHD, autism

Research involving
Human

Sponsors and support

Primary sponsor: Universiteit Utrecht
Source(s) of monetary or material Support: Ministerie van OC&W

Intervention

Keyword: Children, Daily functioning, Developmental disorders, Working memory

Outcome measures

Primary outcome

Percentage of correct answers on the working memory tests, specifically on the:

- Lion game in the diagnostic setting

- Monkey game in the diagnostic setting

- Lion game in the classroom

- Monkey game in the classroom

Secondary outcome

Attention and inhibition, i.e., performance on the ANT battery

- Focused attention 4 Letter task

- Flanker task

School performance, i.e., performance on the

- Cito Mathematics Test

- Cito Reading comprehension Test

Childrens* everyday behaviour and cognitive functioning:

- Child behaviour (parent and teacher report)

- Child executive functioning (parent and teacher report)

Participant characteristics:

- Clinical diagnosis

- Classroom size and classroom management

- Age

- Gender

- IQ

- Reaction speed (ANT baseline speed)

Only when available: neurocognitive parameters, i.e, performance on the ANT

battery:

- GoNoGO task

- Memory Search Letters

- Response Organization Objects

- Sustained attention Dots

- Shifting Attentional Set * Visual

Study description

Background summary

Working memory is an important predictor of both behavioral and academic functioning in typically developing children (Alloway, Gathercole, Kirkwood, & Ellit, 2009; Peng, Barnes, Wang, Wang, Li, et al., 2018; Peng, Namkung, Barnes, & Sun, 2016). Moreover, and perhaps more important, problems in working memory ability have been identified in children with developmental disorders (Kasper, Alderson, & Hudec, 2012; Kercood, Grskovic, Banda, & Begske, 2014). Working memory problems are exhibited by children with various developmental disorders, such as autism spectrum disorder (ASD) and attention deficit hyperactivity disorder (ADHD)(Kasper et al., 2012; Kercood et al., 2014), although there are some inconsistencies in findings with regard to how profound these problems are

and in which aspects of working memory (verbal or visual-spatial) these mostly occur. Likewise, although working memory assessment is considered a crucial part of the clinical diagnostic process when children are suspected to have such developmental difficulties (Holmes, Gathercole, Place, Alloway, Elliot & Hilton, 2010), neuropsychologists are often perplexed by the inconsistency between clients performance on tests of EF and their everyday EF abilities (Chaytor, Schmitter-Edgecombe & Burr, 2006). These inconsistencies in research and clinical assessments have sparked continuous discussion on the ecological validity of neuropsychological tests and it is questioned whether current available tests provide an accurate prediction of a person*s functioning in real-world settings (Barkley, 1991; Burgess, Alderman, Forbes, Costello, Coates, et al., 2006).

Contributing to the limited ecological validity of neuropsychological tests is the fact that the diagnostic testing situation is highly structured and standardized, offering an environment stripped of the external stimuli that put a burden on children with developmental disorders in everyday life. In other words, a working memory deficit may cause no problems if the environment places little demand on this skill. A recent non-clinical study on the ecological validity of two existing working memory tests, the Lion game and the Monkey game, compared performance in a typically developing sample of primary school children on the tests in two settings: an individual (diagnostic-like) setting and a classroom setting (Friso van den Bos & Van de Weijer-Bergsma, 2019). Because instructions are embedded in the computerized tasks and given through audio-recordings using headphone, children were able to perform the tests self-reliantly and independently. The results from this study showed that performance in a classroom setting was hampered when compared to the individual setting. Most importantly, data from the same study showed that children differ greatly in how much their performance was hampered, with some children performing 5 standard deviations lower in their classroom assessment compared to their individual assessment. Also, classroom assessment of verbal working memory (but not visual-spatial working memory) proved a better predictor of mathematics and reading attainment than verbal WM as tested in the controlled testing situation, supporting the conclusion that adding (natural) distractors may provide a more ecologically valid assessment of working memory functioning (Friso van den Bos & Van de Weijer-Bergsma, 2019). Consequently, while children who have difficulties with attention are more vulnerable to distractions than typically developing children (Cassuto, Ben-Simon, & Berger, 2013; Geffner, Lucker, & Koch, 1996), it is very likely that these children will show even more profound differences between settings than typically developing children. Indeed, several studies have shown that, in (virtual reality) classrooms, attentional functioning in children with ADHD or ASD is hampered more by distracters than in typically developing children (Adams, Finn, Moes, Flannery, & Rizzo, 2009; Hanley, Khairat, Taylor, Wilson, Cole-Fletcher, & Riby, 2017; Negut, Jurma & David, 2017). A such, the assessment of individual differences in working memory functioning in different settings has potential clinical utility through adding a valuable source of information that is typically not acquired in the diagnostic process. A comparison between working memory

performance in settings that vary on a continuum from *ideal circumstances* to *everyday circumstances* may give more insight into working memory difficulties and under which circumstances they occur. As children are likely to differ in the extent to which they are affected by environmental distracters, information about such setting-specific performance and differences between settings may provide crucial information for the diagnostic process as well as for promising areas of intervention and support.

Study objective

The objective is to examine how working memory functioning in children with ADHD and/or ASD as measured with the Lion game and the Monkey is influenced by context and to assess the diagnostic utility and ecological validity of the Lion and Monkey games.

The following research questions will be examined:
* Do children with developmental disorders score lower on the Monkey and Lion games compared typically developing children and is this moderated by the type of setting?
* Which setting, diagnostic or classroom, yields the best working memory predictors for everyday working memory functioning (ecological validity) and for academic performance (predictive validity) in children with a developmental disorder?
* What is the diagnostic utility (i.e., specificity and sensitivity) of the working memory tests in both settings?
* Which child-level factors (e.g. EF, symptoms and severity) affect how strongly children with ADHD and/or ASD are affected by the setting (classroom versus diagnostic setting) in which the working memory tests are conducted?

Study design

This prospective observational study investigates working memory in two different settings, the diagnostic setting and the classroom setting, in children with and without developmental disorders.

The aim of the study is to assess the performance on the Lion game (Van de Weijer-Bergsma, Kroesbergen, Prast, & van Luit, 2015) and Monkey game (Van de Weijer-Bergsma, Kroesbergen, Jolani, & Van Luit, 2016) in a group of children with developmental disorders (N = 75) and a control group of children without a developmental disorder (N = 30) in two different settings (i.e., diagnostic setting versus classroom setting).
All participants will be assessed with the Lion game and Monkey game in two settings: a) in the diagnostic setting and b) a classroom setting. The order of these conditions (diagnostic first versus classroom first) will be varied between subjects to preclude condition order effects. Time between assessment in the two settings will be 1 (minimum) to 2 (maximum) weeks.

In the classroom setting, the teacher will ask the participant to finish the Monkey and Lion games on the class computer during a moment where classmates are working independently. The total duration of this assessment is 20 minutes.
In the diagnostic setting, participants will finish the Monkey game and the Lion game on a computer in the presence of a test-leader. Also, two additional neuropsychological behavioral tasks will be administered, assessing inhibitory control and focused attention, to examine which individual child-level factors affect the influence of the setting. To do so, children are asked to perform the Baseline Speed task (duration: 2 minutes), the Flanker task (duration: max. 15 minutes) and the Focused attention 4 Letters task (duration: 10 minutes) from the Amsterdamse Neuropsychologische Taken (ANT, De Sonneville, 2014). The total maximum duration of this assessment is 45 minutes.
In case children with a developmental disorder use psychostimulants (e.g., ritalinmethylphenidate, e.g. Ritalin, Concerta, Medikinet or Equasym), they will be asked to withhold medication on the morning of both assessments. This is standard procedure during the diagnostic process, to ensure a reliable picture of a child*s everyday functioning and to be able to reliably assess the ecological validity and diagnostic utility of the working memory tasks for the diagnostic process. Any other form of psychoactive medication is not allowed during the study, and therefore a exclusion criterion.

The (final) DSM diagnosis will be requested from the recruiting organization, as well as information on Intelligence (IQ) scores (when available).
When additional data is available at the recruiting organization from the following ANT tasks (GoNoGO task; Memory Search Letters; Response Organization Objects; Sustained attention Dots; Shifting Attentional Set * Visual) these data will also be requested.

Parents and teachers will be requested to fill out two questionnaires regarding the child*s behavior and executive functioning (i.e., the Behavior Rating Inventory of Executive Function (BRIEF; Goia, Isquith, Guy, & Kenworthy, 2000), Child Behavior Checklist (CBCL; Achenbach & Rescorla, 2001) and Teacher Report Form (TRF; Achenbach & Rescorla, 2001). Additionally, the latest Cito achievement scores for mathematics achievement and reading comprehension (Feenstra, Kamphuis, Kleintjes, & Krom, 2010; Janssen, Scheltens, & Kraemer, 2005) will be requested rom teachers (duration: 10 minutes).

Study burden and risks

The risks associated with participation in this study are minimal/ negligible. The burden to child participants will be reduced to a minimum as much as possible and can be considered *light*. The physical or psychological integrity of the participants will not be impinged. Children are assessed using computerized behavioral tasks tapping into working memory ability twice: once in their classroom during school time (max. duration: 20 minutes), and once in a diagnostic setting (max. duration: 45 minutes). The working memory tasks are game-like and resemble the tasks children do in school. In the diagnostic

setting two additional computerized behavioral tasks tapping into inhibitory and attentional skills are selected to match the tasks that will be administered in the standard diagnostic process.
The burden for teachers and parents is light, with a maximum of 30 minutes for filling out questionnaires. If questionnaire data is available through the diagnostic process, permission will be asked to use this data, further reducing the burden for parents and teachers.
To be able to draw conclusions about the ecological validity and diagnostic utility of the working memory tasks for children with developmental disorders, it is crucial to examine these aspects in the goal population itself. A typically developing control group is added to generate reliable reference data.
Participants do not directly benefit from participating in this study.
However, for children with ADHD and/or ASD, this study brings a detailed characterization of cognitive functioning in different settings for each of the participants, which can facilitate better guidance for parents, clinicians and teachers.

Contacts

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Trial sites

Listed location countries

Netherlands

Eligibility criteria

Age
Adolescents (12-15 years)
Adolescents (16-17 years)
Children (2-11 years)

Inclusion criteria

Children with (suspected) developmental disorders:
* Age: 7 to 12 years
* A (suspected) primary diagnosis of ADHD and/or ASD (DSM IV or V, judged by an experienced clinician. Note: children who are eventually not classified with the suspected diagnosis are still included)

Typically developing children:
* Age: 7 to 12 years
* Attends regular education

Exclusion criteria

Children with developmental disorders:
* Presence of major genetic/neurological disorders (e.g., epilepsy, 22q11 syndrome)
* Use of psychoactive medication other than psychostimulants (methylphenidate)
* Suspected mental retardation or fullscale IQ < 70
* Major visual or auditory impairment

Typically developing children:
* A (history of) psychiatric diagnosis (DSM IV or V, judged by an experienced clinician, or current CBCL-scores in the clinical range)
* Use of any form of psychoactive medication
* A diagnosed learning disability (i.e., dyslexia, dyscalculia)
* Attends special education
* Major visual or auditory impairment

Study design

Design

Study type:	Observational non invasive

Intervention model:	Other
Allocation:	Non-randomized controlled trial
Masking:	Open (masking not used)
Control:	Active
Primary purpose:	Basic science

Recruitment

NL

Recruitment status:	Recruitment stopped
Start date (anticipated):	15-03-2021
Enrollment:	105
Type:	Actual

Ethics review

Approved WMO Date:	26-02-2020
Application type:	First submission
Review commission:	METC NedMec
Approved WMO Date:	31-03-2020
Application type:	Amendment
Review commission:	METC NedMec

Study registrations

Followed up by the following (possibly more current) registration

No registrations found.

Other (possibly less up-to-date) registrations in this register

No registrations found.

In other registers

Register	ID
CCMO	NL72090.041.19