Exploring the implementation of attention and goal management training interventions with a boy diagnosed with attentional difficulties in a single case design

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And to my son Leonardo, thank you for your unconditional love even though I have been a little absent this year.

Abstract

Attention Deficit Hyperactivity Disorder (ADHD) is said to be one of the most common childhood disorders. Pharmacological treatment has been shown to be the most popular form of treatment, but this addresses the symptoms associated with ADHD rather than the actual deficits. This exploratory study employs a non-pharmacological approach through the concurrent implementation of an attention-training and a goal management training programme with an 11-year-old boy diagnosed with poor attention and difficulties with impulsivity. I used a pre- and post- test, single case experimental design (SCED) to explore the effects of the interventions. Outcome measures included neuropsychological tests of attention, memory and executive functions as well as parent- and teacher-reported measures of internalizing and externalizing behaviours and executive functions. I used the Reliable Change Index (RCI) to assess the level of change between the pre- and post- test scores. The implementation of the SCED to explore these interventions allowed for a deeper understanding of the attentional and impulsivity problems of the participant. It also provided feedback about the relevance and feasibility of implementing the interventions in the participant's context, which in turn contributed quite significantly in terms of interpreting the results. RCI analyses show significant improvements in the domains of attention and executive function. More research is needed to explore non-pharmacological interventions in addressing the deficits due to ADHD, and attention problems and executive dysfunction more generally, among children. The results suggest that this sort of combined intervention could be useful in remediating attention and executive function deficits.

Keywords: attention; executive function; single-case experimental design (SCED); intervention; pharmacological; non-pharmacological

There is currently little research on non-pharmacological treatment of significant attentional difficulties, as is experienced with ADHD, in children. The approach to treatment is commonly pharmacological in nature. However, it has long been established that children still experience difficulties with attention, despite receiving such pharmacological methods of treatment. Hence, researchers investigate non-pharmacological interventions as alternatives to, or complementary forms of, treatment (Kerns, Eso, & Thomson, 1999, p.75).

Non-pharmacological cognitive interventions previously employed, have usually included programs directed at attention specifically. Although attention may be considered an independent function, higher order aspects of attention, such as attentional control, also form part of our executive functions (Anderson, 2002). Hence, targeting both attention and executive function domains might be ideal in non-pharmacological treatment of ADHD. Recent literature shows that the Single-Case Experimental Design (SCED) is well suited to examining the outcomes of psychological (including neuropsychological) intervention, and as such, could be a promising design in a study using attention-training and other executive function related interventions in the treatment of ADHD or attentional impairments more generally (Smith, 2012). The aim of this study was to use a SCED to explore the concurrent use of two neuropsychological interventions, namely Pay Attention! and pediatric Goal Management Training (pGMT), and assess their usefulness as an alternative to pharmacological treatment in a child with diagnosed attentional problems (Levin, 2004; Thomson, Kerns, Seidenstrang, Sohlberg, & Mateer, 2005).[1]

[1] In the case of the participant of this study, although ADHD is a probable diagnosis, it has not been formally diagnosed as yet. The results of a formal neuropsychological assessment of the child carried out in November 2014 showed significant attentional impairment and problems with impulsivity suggestive of an ADHD presentation. Given that not much literature exists on diagnosed significant attentional problems without the label of ADHD, I will discuss this project in the context of ADHD.

Attention Deficit Hyperactivity Disorder (ADHD)

ADHD is defined in the Diagnostic and Statistical Manual of Mental Disorders (5th ed.) as a neurodevelopment disorder, which has a strong genetic component (American Psychiatric Association, 2013). It is said to be one of the most common childhood disorders with a global prevalence rate of about 5% (American Psychiatric Association, 2013). The prevalence rate has large variability globally, but data on ADHD in South Africa shows prevalence rates to be similar to those mentioned in DSM-5 (Meyer, Eilertsen, Sundet, Tshifularo, & Sagvolden, 2004; Polanczyk, de Lima, Horta, Biederman, & Rohde, 2007). Aspects of a child's social, academic and personal life can be impaired, leading to increasing challenges later in life if not treated (Vogel, 2014).

ADHD presents in one of three ways: hyperactive/impulsive type, inattentive type, or a combined type, and can be at mild, moderate or severe levels (American Psychiatric Association, 2013). Currently treatment for ADHD is based on the severity and type of the disorder. The primary deficits in ADHD are considered to be that of attention and executive function (EF; e.g. inhibitory control, working memory and planning) (Kerns, Eso, & Thomson, 1999; Pennington & Ozonoff, 1996). Although inattention is one of the deficits in ADHD (American Psychiatric Association, 2013), a well-known theory by Barkley suggests that basic deficits in ADHD are related to behavioural inhibition and the incapacity to delay responding, rather than only attentional deficiencies (Penkman, 2004). Barkley (1996) suggests that it could be beneficial for future research on non-pharmacological interventions to address these dysfunctions; not necessarily as separate functions, but ones that are interlinked (Barkley, 1996).

Attention

Attention has been defined as a complex and multidimensional construct (Barkley, 1996). It is the gateway function that one relies on in order to respond to stimuli in the

environment (Tamm, Epstein, Peugh, Nakonezny, & Hughes, 2012). Sohlberg and Mateer's (1987) clinical model of attention posits that attention is hierarchical in nature, with higher levels of attention being dependent on lower levels thereof (Sohlberg & Mateer, 1987). This model includes five domains of attention, but I will focus on the four domains that are relevant to this study, as these correspond to the domains included in the chosen attention intervention. The domains from lower to higher order include: sustained attention, selective attention, alternating attention, and divided attention (Sohlberg et al., 2003).

Sustained Attention. Sustained attention refers to the ability to focus consistently on a particular task, which is continuous or repetitive. This type of attention includes vigilance (focus consistently) and aspects of mental control evident in tasks, which require manipulating, and holding information in mind (Sohlberg et al., 2003). It is this type of attention that one would use during reading, for example.

Selective Attention. Selective attention refers to the ability to attend to one stimuli or task, while making a choice to ignore others (Sohlberg et al., 2003). Children with attention difficulties often find it challenging to ignore external or internal distractors while attending to a task, such as trying to listen to a teacher's instructions in a noisy class.

Alternating Attention. Alternating attention is required when one has to switch one's attention rapidly from one task to another where tasks have varying cognitive requirements (Sohlberg & Mateer, 1987). This is evident in a situation where a student, for example, switches between taking notes and listening to a lecture.

Divided Attention. When multiple stimuli are presented simultaneously, divided attention is required to attend to those stimuli at the same time. An example of this would be when one is having a conversation while driving a car (Thomson et al., 2005).

Although attention is often considered an independent function, higher order aspects thereof are considered part of our executive function system. The interrelationship between

attention and executive functions is well noted in the literature (Barkley, DuPaul, & McMurray, 1990; Barkley, 1996).

Executive Function (EF)

Given the heterogeneous nature of executive function there is no unitary definition. There is, however, consensus that it includes abilities that enable goal-directed behaviour (Gioia, Isquith, Kenworthy, & Barton, 2002). Anderson's developmental model of executive function suggests that there are four functional domains: (a) attentional control, (b) information processing, (C) cognitive flexibility and (d) goal setting, with attentional control having the most influence on the functioning of the other domains (Anderson, 2002). Anderson's model suggests that even though these domains are independent, they function in an integrative manner and can therefore be considered "an overall control system" (see Fig.1) (Anderson, 2002).

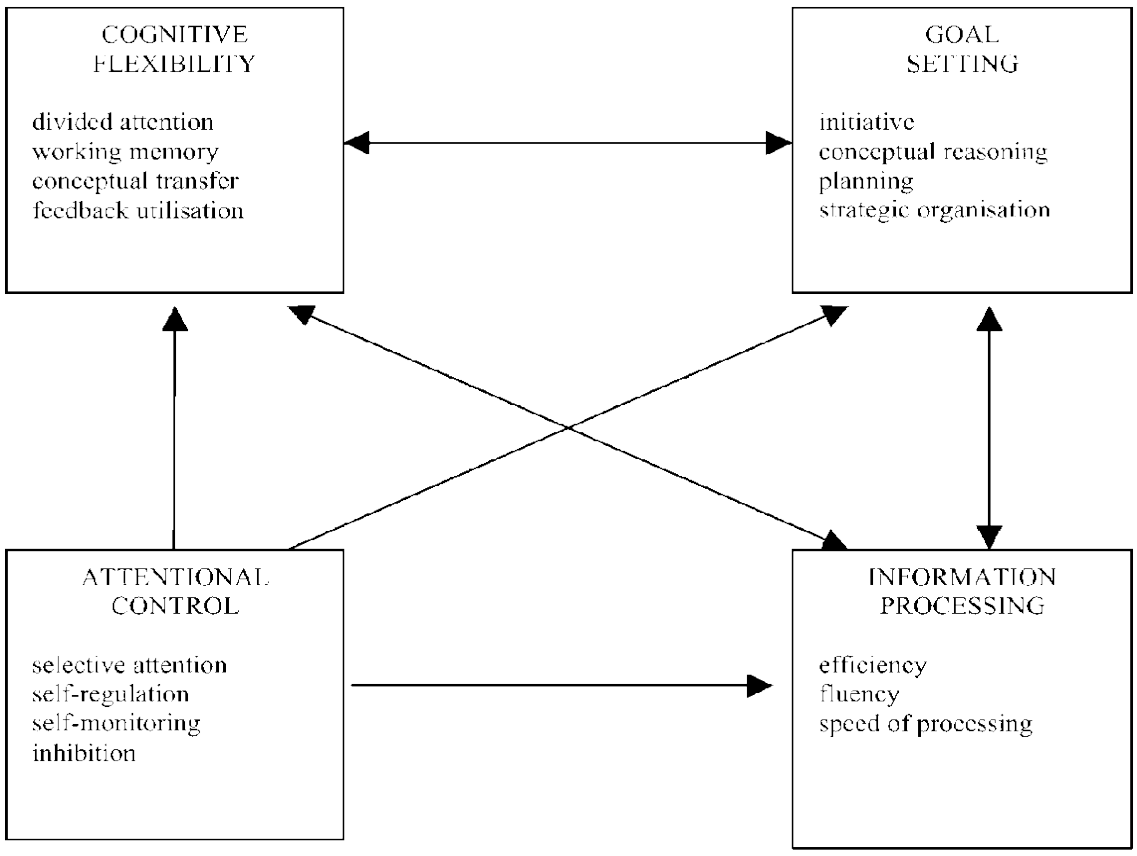

Figure 1. Anderson's proposed model of executive function.

With both attention and executive function being so intricately linked, and dysfunction arising in both those domains in attentional disorders such as ADHD, it could be advantageous to implement parallel interventions that target both domains.

Treatment approaches to ADHD/significant attentional problems

Pharmacological intervention. Pharmacological intervention is the primary and most successful mode of treatment for ADHD, but it has been suggested that even with medication, issues still persist (Kerns et al., 1999). Pharmacological treatments have been shown to be highly effective in the short-term treatment of symptoms of ADHD, but long-term studies are still needed to assess the safety and long-term effects thereof (Goldman et al., 1998).

Non-pharmacological intervention. Currently, alternative treatments to medication as suggested by The American Academy of Child and Adolescent Psychiatry's practice guideline focus on creating a better environment for the child and their family (such as behavioural therapy and parenting education), and to better manage the symptoms of ADHD (AAP, 2011). Interestingly, not many interventions address actual neuropsychological deficits associated with ADHD.

The evidence base for cognitive rehabilitation however suggests different approaches to remediation for different domains (Tajik-Parvinchi, Wright, & Schachar, 2014). For example, literature suggests more restorative (drill and practice) types of remediation for attention training with more compensatory types of remediation or environmental adaptation for targeting executive functions (Sohlberg et al., 2003; Tamm et al., 2009). Multimodal approaches (combination of pharmacological interventions and behavioural interventions) show greater results than singular approaches of either medication or behavioural interventions (MTA Cooperative Group, 2004). However, there is a concern that neither behavioural nor pharmacological approaches remediate the actual cognitive deficits

associated with ADHD (O'connell, Bellgrove, Dockree, & Robertson, 2006). It has been suggested that following pharmacological or behavioural interventions, residual impairments in EF could continue to have a negative effect on academic achievement; therefore cognitive rehabilitation could be considered beneficial in addressing the actual deficits associated with ADHD (O'connell et al., 2006).

Studies utilizing cognitive remediation in addressing the deficits in ADHD have shown promising results (O'Connell et al., 2006; Tamm et al., 2010; Tamm, Epstein, Peugh, Nakonezny, & Hughes, 2013). With the increasing use of multimodal treatment to treat ADHD, individual integrated programs (for example that focus on both attention training and executive function remediation) are generally not available. Therefore, one could consider a combination of different programs (e.g., Pay Attention! for attention training and Goal Management Training (GMT) for executive functions) administered in parallel, which target these individual domains.

Pay Attention! Modelled on Sohlberg and Mateer's (1987) Attention Process Training (APT) and adapted for a paediatric population, Thomson and Kerns'(1999) Pay Attention! is an intervention directed at children with attentional deficits (Kerns et al., 1999). Also known as direct or process-specific intervention, the premise of this tool is that structured tasks exercise certain parts of attention, thus leading to associated improvement in those domains (Kerns et al., 1999; Thomson et al., 2005). The intervention employs a restorative approach in terms of cognitive rehabilitation (Rizzo et al., 2000). Findings from several studies using Pay Attention! for attention remediation in children with ADHD show significant improvement in all aspects of attention (Kerns et al., 1999; Sohlberg & Mateer, 2001; Tamm et al., 2009; Tucha et al., 2011). In a recent study utilizing Pay Attention! to remediate attention, significant improvements were found not only in the domains of

attention (sustained, selective, divided and alternating), but also in executive functioning domains including inhibition, planning and shifting attention (Tamm et al., 2013).

Goal Management Training (GMT). Executive Functions (EF) are higher-order cognitive processes, including, for example, decision-making and goal-directed behaviour. Executive dysfunction has a detrimental effect on the practical issues of daily life; this is evident in the inability to withhold or delay responding, poor planning and execution of tasks (Barkley, 1996; Levine et al., 2000b). Goal Management Training (GMT), created by Robertson (1996) has been developed as a way of rehabilitating EF by tackling goal-directed behaviour (Robertson, 1996). Based on Duncan's (1986) theory of goal neglect, it has recently been adapted for a paediatric population and shows promising outcomes (Duncan, 1986; Krasny-Pacini, Chevignard, & Evans, 2013). This intervention has recently been adapted to a South African pediatric population, described in an unpublished study on pediatric traumatic brain injury (Mahomed, 2015). Results suggest that the intervention might best be used alongside other interventions and that it could be beneficial in addressing executive function issues associated with ADHD.

GMT has not previously been utilized in the treatment of ADHD. However, with executive dysfunction (such as impairment in working memory and response inhibition) considered a deficit in ADHD, and with GMT having been created to address these deficits, this intervention could be considered as a non-pharmacological treatment option (Barkley, 1997; Levine et al., 2000b). The paediatric version of GMT (adapted for use with children) will be referred to as pGMT from this point onwards.

A review of literature revealed no studies for this sort of combined intervention in the context of children with ADHD. There is however literature on individual interventions aimed at remediating EF in children with ADHD. One study employed computer gaming elements and results showed significant improvement on EF and reduction in ADHD

symptoms as rated by their parents (Oord, Ponsioen, Geurtz, Brink & Prins, 2014). A qualitative study employed coaching as a means of addressing EF issues in students with ADHD; the students felt that the coaching helped them with planning and goal management thus reducing anxiety in their academic environment (Parker & Boutelle, 2009).

Hence, different designs and approaches have been employed to evaluate non-pharmacological treatments among children with ADHD. Single-case experimental designs are among designs suggested as ideal for such exploratory intervention studies.

Single-case Experimental Design (SCED)

As the name suggests, a single-case experimental design (SCED) refers to a type of research design where there is only one participant. Unlike group measures where groups can be compared to establish a control, in a SCED, the participant is their own control (Tate, Perdices, McDonald, Togher, & Rosenkoetter, 2014). It has been argued that SCEDs are ideal designs to use in intervention studies, as the central goal of these designs is to establish whether a causal relationship exists between an independent variable and changes within the dependent variable (Smith, 2012). There is a large amount of literature on the use of SCEDs. Perdices and Tate (2009) state that the SCED is a solid research tool, but even though it has many advantages it seems to be 'undervalued' in research (Perdices & Tate, 2009). The credibility of single subject designs is always measured against randomized controlled trials, which are regarded as the gold standard approach in intervention studies and suggested as having more stringent methodology. Some of the main criticisms of SCEDs are based on the associated methodology. These include, for example, queries related to external validity (i.e. how generalizable the results are to a bigger population) and also the use of visual rather than statistical analysis of data (Tate et al., 2008). However, the results from surveys show that SCEDs are not only used often, but that statistical analysis is conducted in the majority of the research (Perdices & Tate, 2009; Smith, 2012). The increased use of the SCED over time led

to the creation of the SCED Scale (Tate & Douglas, 2011; Tate et al., 2008). The scale allows researchers to rate the methodological soundness of SCEDs (Tate et al., 2008).

Aims and Objectives

The aim of this study was to explore whether the concurrent implementation of two interventions, namely Pay Attention! and Paediatric Goal Management Training (pGMT) would ameliorate symptoms of inattention and executive dysfunction in a child with diagnosed attentional problems and impulsivity problems. There were no specific hypotheses, given the exploratory nature of the study. The study objectives were, however, to investigate whether: (a) there would be significant improvements in attentional and executive functions following the implementation of Pay Attention! and pGMT interventions, and, (b) whether such improvements could extend beyond outcomes on neuropsychological tests to behavioural and adaptive functioning, as well as real world outcomes.

Methods

Research Design

I used a SCED (also known as n of 1 or n=1 trial) in this study. The SCED scale and description of items for that scale are presented as Appendices E and F. Neuropsychological tests and parent- and teacher behavioural report forms were administered pre- and post-intervention at the Department of Psychology, UCT. The intervention consisted of 20 sessions, which ran over a period of 10 weeks. The intervention took place at the participant's home with the permission of his parents. This had the effect of not only being convenient for the participant and the family, but it was also hypothesized that being in a familiar environment was less anxiety provoking and created fewer distractions for the child.

Participant

The participant for this study was an 11-year-old boy, AN, from a high socio-economic status background, who had previously been assessed by Dr. Susan Malcolm-Smith

and Dr. Leigh Schrieff-Elson of the Department of Psychology at UCT (November, 2014), after his mother self-referred him following difficulties at school and at home (Schrieff-Elson, personal communication, 23 April 2015). He was found to have significant problems with attention and there were some difficulties with impulsivity too. At the time of that assessment, AN's parents expressed an interest in the possibility of him being involved in a study using a non-pharmacological approach. Given his performance on the neuropsychological testing, he was an ideal candidate for this type of exploratory study.

Measures

Demographic Questionnaire. A demographic questionnaire and asset index incorporates methods put forward by Myer, Stein, Grimsrud, Seedat, and Williams (2008), captures information about the participant's parents in order to gain a greater understanding of the context within which they live (Myer, Stein, Grimsrud, Seedat, & Williams, 2008). It records demographic information such as parental education, occupation and income, and captures asset information such as the financial resources accessed and the material resources present in the household (Myer, Ehrlich, & Susser, 2004).

Neuropsychological Measures.

General Intellectual Functioning. At the initial assessment with Dr. Susan Malcolm-Smith and Dr. Leigh Schrieff-Elson in November 2014 (Schrieff-Elson, personal communication, 23 April 2015), the Wechsler Abbreviated Scale of Intelligence (WASI, Wechsler, 1999) was used. The WASI was not repeated at the pre-intervention testing which took place 7 months after the initial assessment, as it is believed that IQ is stable over time and therefore no changes were expected.

Cognitive Measures. Various subtests of Test of Everyday Attention for Children (TEA-Ch) (Manly et al., 2001), Children's Memory Scale (CMS) (Cohen, 2011), Rey Complex Figure Test (RCFT), NEPSY II, and Delis-Kaplin Executive Function System

(DKEFS) were used in order to assess attention, working memory, inhibition and executive function. These tests were implemented at both pre-intervention and post-intervention.

Test of Everyday Attention for Children (TEA-Ch). This test was developed, normed and standardized in Australia for children from the age of 6 years to 16 years. Used as a measure of attention, this battery consists of nine subtests (Manly et al., 2001). It measures selective, sustained and divided attention, as well as attentional control in children. For the purpose of this study I utilized the brief screening version, which includes four of the subtests, namely: Sky Search, Score!, Creature Counting and Sky Search Dual Task (DT). The adult version of the TEA-Ch has been used in one published study in South Africa (Powell, 2000), and a pediatric version has also been used in a published study in South Africa (Schrieff-Elson, 2015).

Children's Memory Scale (CMS). Designed for children from the age of 5 years to 16 years, the CMS measures learning and memory in a variety of dimensions (Cohen, 2011). The *Dot Locations* subtest assesses visual memory and the *Word List* subtest assesses verbal/auditory learning and memory. The *Numbers* subtest measures attention (*Numbers Forward*) and working memory (*Numbers Backwards*). This measure has been used in South African research (Ferrett, Carey, Thomas, Tapert, & Fein, 2010), although currently there is no literature on using this measure on an ADHD population in South Africa.

Rey Complex Figure Test (RCFT). Developed by Rey (1941), and standardized and normed in Canada by Osterrieth (1944) this test is suitable for individuals aged from 6 to 89 years. This neuropsychological test assesses visual memory by asking a child to reproduce, as accurately as possible, a two-dimensional figure with a pencil and paper and to recall it 3 minutes later, and again after 30 minutes (Osterrieth, 1944). Normative data show that it has been used in many countries, including published research in South Africa (Ferrett et al., 2010; Hoare et al., 2012; Meyers & Meyers, 1995; Mitrushina, 2005). Literature shows that

the RCFT has also been used to measure executive function (Shin, Park, Park, Seol, & Kwon, 2006).

NEPSY II. Developed by Korkman, Kirk, & Kemp (2007), this instrument has been standardized for American populations but it has been used in studies in South Africa; and it is suitable for use on children and adolescents aged 5 to 16 years of age (Corbett & Thomas, 2009; Hoare et al., 2012; Korkman, Kirk, & Kemp, 2007). For the purpose of this study, I have used the *Inhibition* subtest, which addresses the domain of attention and executive function. The tasks assess the participant's ability to switch between two response types and inhibit automatic responses (Korman, et al., 2007).

Delis-Kaplin Executive Function System (DKEFS). I used subtests from this battery to assess specific domains within executive function. It is suitable for individuals aged 8 to 89 years and although it has been standardized to an American population, it has been used on adolescents in studies in South Africa (Delis, Kaplan, & Kramer, 2001; Rice, Correia, Schutte, 2014)). For this study I have utilized the *Tower, Verbal Fluency* and *Trail making* subtests.

The *Tower* subtest measures spatial planning and reasoning, and impulsivity; this task is based on how many towers were correctly completed in a set amount of time and how many moves were made; the *Trail Making* subtest assesses flexibility of thinking on a visual-motor task; and the *Verbal Fluency* subtest measures letter fluency, category fluency and category switching in the verbal domain (Delis et al., 2001).

Behavioural Questionnaires. I used the following measures to assess the participant's behavior and daily functioning as reported by his parents and teachers, and the participant himself (in the case of the CBCL). These measures were administered both pre- and post-intervention.

Behaviour Rating Inventory of Executive Function (BRIEF). I used the parent and teacher report forms to assess the participant's executive functioning in his home and school environments (Gioia et al., 2002). This questionnaire consists of 86 questions that produce three indexes: The Behavioural Regulation Index, the Metacognition Index and the Global Executive Composite, which incorporates both former measures. It is suitable to a population of 5-18 years (Gioia, Isquith, Guy, & Kenworthy, 2000). This measure has been used in a South African study on traumatic brain injuries in a paediatric population (Schrieff-Elson, 2015).

Child Behaviour Checklist (CBCL). I used the parent and teacher report forms, and youth self-report form to assess emotional and behavioural problems in the participant. This measure includes questions about internalizing (e.g. 'Feels worthless or inferior') and externalizing (e.g. 'Breaks rules at home, school, or elsewhere') behaviours in children and adolescence aged 6 to 18 years . It has previously been used in South African research (Shields, Nadasen, & Pierce, 2008). In the current study, the participant, his mother and a teacher from his school completed the CBCL.

Pre GMT questionnaires. This questionnaire is supplied by the test developer and assesses a participants' experience of executive dysfunction in everyday life (Robertson, 1996). The participant and his mother completed the same questionnaire in order to acquire collateral information. I employed the questionnaire to establish areas of difficulties and to determine real life goals of the participant, which was used during the pGMT part of the intervention.

Materials

Pay Attention! Based on Sohlberg and Mateer's (1989) Attention Processing Training (APT), Pay Attention! has been designed for a pediatric population aged 4 – 10 years of age. The materials are colourful and interesting, thereby more engaging to young

children (Kerns et al., 1999; Sohlberg & Mateer, 1987; Thomson et al., 2005). The structured and focused tasks are hypothesized to improve attentional functioning in children (Thomson et al., 2005). The intervention consists of three different tasks (Card Sort, House Search and Card Flip), which aims to train visual attention, and a fourth task (an Attention CD) aimed to train auditory attention. The domains of attention that are addressed in this intervention are *Sustained attention, Selective attention, Alternating attention* and *Divided attention*. As the intervention progressed, visual and audio distractors would be deployed in combination to increase the level of difficulty of the tasks. In order for progression of tasks to take place, there has to be improvement over three consecutive sessions on the amount of errors made and the time taken to complete the tasks.

Pediatric Goal Management Training (pGMT). Adjusted for a pediatric population and based on Robertson, Levine and Manly's (2005) Goal Management Training (GMT), the aim of this intervention is to assist in the remediation of executive dysfunction (Krasny-Pacini et al., 2013; Levine et al., 2000a; Robertson, 1996). The adapted intervention (Mahomed, 2015) consists of 9 modules. Modules 1 – 4 introduce key concepts and are theoretical in nature. Modules 5 – 9 are combined and repeat the first 4 modules within each of those modules, however it also adds practical elements through the use of a Picture Exchange Communicating System (PECS), and incorporating practical tasks. The pGMT intervention took place once (sometimes twice) a week for 9 weeks (for a breakdown of the sessions, see Appendix G). The sessions ran between 35-60 minutes depending on the module. Initially pGMT was done after the Pay Attention! intervention on alternate sessions, however due to the length of the combined modules it was decided that module 3 and 4 would be split over two sessions each week. Modules 5 – 9, like modules 1 and 2 were done after Pay Attention! once a week on alternate sessions

Procedure

Once ethical approval for the study was granted, the following steps were taken. A meeting with all relevant parties was organized in order to introduce and explain the study. Consent from the participant's parents was obtained, along with assent from the participant. Pre- and post- testing took place at the Department of Psychology, UCT.

The main interventions were implemented concurrently over a 10-week period. It was believed that these two interventions could be run concurrently as they follow different cognitive rehabilitation approaches - one is based on a restorative approach and the other a compensatory approach – and as such could be considered complementary. The sessions took place twice a week at the participant's home and lasted on average around 60-80 minutes. The first part of the session was dedicated to the attention intervention and the second part of the session was dedicated to the executive function intervention. In order to minimize bias, research assistants with relevant experience implemented the pre- and post- testing, and I implemented the interventions.

Data Analysis

My supervisor and I informally rated this study using the SCED scale (see Appendices E and F). In presenting the results, I first present information about the participant's background. I then present information and results for each of the interventions, followed by analyses of changes from pre- to post-intervention testing using the Reliable Change Index.

Reliable Change Index (RCI)

I used the Reliable Change Index (RCI) to assess whether changes in pre- and post-test scores were clinically significant. The RCI is based on the Jacob & Truax (1991) model used to assess significant change. Clinically significant changes are differentiated according

at three confidence levels of 86.2%, 95% and 99%; a change in score above 1.96 on this index is considered a significant difference (Jacobson & Truax, 1991).

The formula used to compute the RCI is:

$$SEd = \sqrt{2}p(Se)2, \text{ where } Se = s(\sqrt{1} - rxx),$$

where *s* is the standard deviation and *rxx* is the test-retest reliability coefficient (Jacobson & Truax, 1991).

Ethics

Consent and Assent

As the participant is a minor, consent was obtained from his parents. The parents and child were reminded that the study is voluntary and as such they could withdraw from it at any stage without any consequences. Assent was also obtained from the participant. The Consent form is attached as Appendix A and Assent form is attached as Appendix B. Ethical approval for this study was granted by the Research Ethics Committee of the Department of Psychology at the University of Cape Town.

Confidentiality and Anonymity

All information obtained from the study is confidential and is only to be used for the purpose of research. All data and documents are being kept in a safe place and can be accessed only by my supervisor and myself. Should the study be written up for publication, all identifying information regarding the child and his family will be removed.

Risks

There were no anticipated risks to the participant in the study. It was explained to the participant that he might experience fatigue during the testing sessions, but regular breaks were given as stated in the consent forms.

Benefits

The participant and his parents and/or school could experience beneficial changes within his home and school environment if the intervention proved efficacious. In addition, the participant's parents received feedback regarding their son's performance on the neuropsychological testing sessions, as well as on the intervention.

Results

I begin with describing the participants background, followed by a description of each of the interventions, AN's engagement with it, and his performance during the administration of these interventions. I end with the results of the RCI analyses. An informal analysis of this study was done by my supervisor and I, using the SCED scale as proposed by Tate el al. (2008); we found that this study met 9 out of the 11 proposed criteria on the SCED scale (see Appendix E & F).

Participant Background

AN is an 11-year-old boy. His parents describe him as a 'kind, considerate and very intelligent' boy who is 'thoughtful and very knowledgeable to talk to'. His issues with concentration and its interference with his academic life is what led his parents to seek the initial neuropsychological assessment. An assessment done by Dr. Susan Malcolm-Smith and Dr. Leigh Schrieff-Elson in November 2014 at UCT established that AN has a full scale IQ score in the very superior range of intelligence, but also established that there were difficulties with attention and impulsivity present, which were negatively impacting AN academically (Schrieff-Elson, personal communication, 2015).

Family structure and demographic information. AN is the eldest of two boys and resides with his mother, father and brother in a suburb of Cape Town. His mother is a medical doctor who works full time and travels often for work. His father is an engineer who at the time of this study was continuing his studies and spent more time working from home.

As per the asset index (Appendix C) the family comes from a high socioeconomic status (SES). Their home languages are English and isiXhosa, but at AN's school English is the medium of instruction.

Academic information. AN attends a private school within 5 minutes of his home. At the time of the study he was in grade 6. He is a high achiever academically and mostly enjoys the challenge of maintaining high grades. Feedback from his parents and teachers suggested that his difficulties with attention were affecting his performance at school and therefore he was not performing as well as he could. He has a very active academic life with extra mural activities on some afternoons.

Social Structure. AN has a few friends with whom he has shared interests. He does not have many friends at school, as he does not like their behaviour. He loves robotics, reading and playing computer games, and he has a close relationship with his younger brother.

Pay Attention! Intervention

This intervention consisted of 20 sessions over a period of 10 weeks. The lengths of the sessions were between 30 – 45 minutes.

Sessions 1 – 5. All Pay Attention! Tasks completed during these sessions fall within the sustained attention domain. A reminder that the tasks consisted of Card Sort, House Search, Card Flip and the Audio CD. AN was able to easily understand most of the instructions. He personalized the intervention by naming the characters on the cards and creating stories around the intervention material. His questioning mind was always alert and during one of the CD activities that required him to use the clicker whenever he hears "red" and "yellow", he wanted to know if he could also click on "orange" as that was the combination of the two colors. He was able to easily move through the visual activities, but was more challenged by the audio activities, a presentation often accompanying difficulties with attention (Kerns et al., 1999). AN was confident across the sessions, with the challenge

of beating his previous scores. However that confidence waned when he realized the challenge of progression. The audio tasks became increasingly laborious to him. The slower audio tracks which required AN to focus his attention for longer became increasingly challenging and the discomfort was evident in his body language. He would squirm in his chair; at one session he turned to face away from me; at another session he got up and danced through the task. He would also become very quiet and concentrate intensely with his eyes closed, and at times showed resistance and avoidance of the audio tasks. The sessions generally happened around the same time and day, but due to extended extramural activity at school the 5th session started late. He was mentally tired during the session and his overall performance was slow.

Figures 2, 3, 6,12 and 14 (Appendix D) graphically displays AN's performance across the tasks. Regarding *Card Sort* timing component, the *Families* task started slowly as he was unfamiliar with the tasks, but he improved as the sessions progressed. The *Card Sort* Error component reflects errors made in session 3 which AN attributed to uncertainty as to the gender of the person on the card.

Sessions 6 – 10. The Pay Attention! tasks completed in these sessions fall within the sustained attention (Card Sort, House Search, Audio CD) and selective attention (House Search, Card Flip). At this stage of the intervention, AN had habituated to the role of the sessions in his schedule. He approached it with the same acceptance and dedication as in previous sessions. He became familiar with the content to the point of memorizing the instructions of the audio tracks. Two issues however arose during those weeks. First, at session 6, I requested that AN move from a revolving chair onto a stable chair, as the revolving chair became a distractor. Second, the audio tasks require a clicker, which AN showed little ability to resist playing with during the task; this was a distraction which counted towards the errors he was making during the tasks. At session 8 AN was penalized

for the errors he made due to not properly using the clicker. AN felt that it was unfair that him not using the clicker properly would contribute to errors made. Although this problem was addressed, it still surfaced at times during the intervention. In session 9, AN exhibited some anxiety as to our separation at the end of the intervention, but this did not extend beyond this session. As AN moved into the selective attention tasks, overlays for the visual tasks and audio distractors were introduced. These distractors increased the difficulty of the tasks and AN found them to be 'annoying' and challenging. Figures 2, 3, 6, 7, 12 and 14 (Appendix D) displays AN's progression in the sustained attention domain. There is improvement on most tasks where timing and errors are concerned, however figure 14 highlights the challenges that AN experienced with the Auditory tasks. Figures 8, 9 and 13 (Appendix D) represents the tasks that introduced the distractors in the selective attention domain AN did not find it problematic moving onto new tasks and at times found the challenge stimulating.

Session 11 – 15. During these sessions the majority of the tasks fall within the domain of selective attention (now including *Card Sort*), with a few residual tasks falling within the domain of sustained attention (Card Sort, Card Flip) At this stage of the intervention there was a change in AN's behaviour (as reported by his parents) which was evident in both his home and school environments. His parents noticed that he easily lost his temper and easily became tearful, and thought it could possibly be the hormonal mood swing of a pre-teenager. At school AN was receiving demerits, academic penalties that could lead to detention, which was not only out of character for AN, but also created tension at home. AN expressed frustration at home as he felt his parents did not trust him, and he also expressed frustration with regards to school and how he felt that the teachers (one in particular) did not have his best interest at heart. This seemed to be an emotionally challenging time that weighed heavily on him. His affect, energy levels and motivation were all negatively affected

and these effects flowed into our sessions too. AN showed frustration at times at having to repeat tasks. Success was a very important factor for him. Progression of tasks was much slower, and the lack of progression signified failure to him as it meant he was not beating his own scores. There was a delay of 1 week between session 12 and 13 due to health concerns. At session 13 we had to work in a different part of AN's home; the change was not as disruptive as I had anticipated, with only errors in the House Search: Selective Attention (figure 9, Appendix D) showing an unusual increase. Figures 5, 8 (Appendix D) shows a large peak in errors on the Card Sort: Selective Attention and slow timing on the House Search: Selective Attention tasks at session 15. During this session, AN was tired and distracted. He was preparing for an upcoming event, which was time and energy consuming and therefore it is possible that this had a negative impact on our session.

Sessions 16 – 20. At this stage of the intervention, all Sustained Attention (except residuals of the auditory CD) tasks had been completed. Tasks in these sessions consisted of Card Sort (selective attention), Card Sort Switch (alternating attention), House Search (selective attention) House Search (alternating attention), Card Flip (selective attention) and Auditory CD (selective attention).

The intervention was drawing to a close and AN approached the sessions with more enthusiasm. He became a little more competitive and he tried harder to beat his previous timed scores, but this led to an increase in errors. Session 18 was a difficult one as AN had received more D-merits and subsequently detention. This caused great upset not only in AN, but also to his parents who expressed doubt at the efficacy of the intervention due to the decline in AN's behaviour. AN voiced his frustration at the school system and again felt that certain teachers were unjust and therefore contributed to his current situation. He also voiced frustration at not being able to communicate how he felt to his parents. The last two sessions were brief as it only consisted of the Pay Attention! components (for a breakdown of the

structure and length of sessions of the combined intervention, please see Appendix H) AN expressed his relief when the intervention ended as he would have one less item on his busy schedule.

Paediatric Goal Management Training (pGMT)

Module 1. This module introduced the concepts of 'goals' and 'oops mistakes'. AN enjoyed the fun hands-on exercises in this module. However, his attention was not engaged by the introduction of the two theoretical concepts. We established some real life goals for the purposes of discussion. These goals were academic (such as homework that he often forgets to do) and personal (such as chores he needs to do around his home). He failed the prospective memory task (he had to ask me the time at a specific point of the module), but was able to easily understand the instructions and even found them too simplified.

Module 2. Here the 'mental notepad' and 'looking at our mental notepad' was introduced. AN was able to remember the prospective memory tasks of this module and we established some real life activities he struggles to remember or plan. These were usually instructions given to him by his parents or teachers that involved him doing something he was not interested in, but were nonetheless important (homework or chores). I also gave him laminated cards of Mr Stop & Think. The motivation for this was that he could place the cards strategically in places that he might need them most (eg. on the bedroom door to remind him to tidy his room) and uses these as cues to remind him that he needs to check his mental notepad.

Module 3. In this module I introduced 'planning to achieve a goal', the 'paper notepad' and 'writing down the steps'. When recapping what was learnt previously, AN remembered the stories and the characters therein, and did not recap the concepts. He was not able to engage in depth with the material and was very distracted, which could be the result of being very tired as that day's session started later than our usual session time. I also gave him

a paper notepad which he could use in-between sessions to practically apply the concepts. At the end of the module, it seemed that he clearly understood the concepts and was able to discuss the steps and relate it to real life situations.

Module 4. I introduced the concepts of 'writing down the steps' and 'checking the steps'. AN understood the concepts and was able to apply it abstractly to the activities in this module. He was also able to incorporate the steps cognitively to real life situations. One of the real life tasks that we chose for applying the pGMT steps was his chore of having to light the fire in the evening. He was able to describe the processes involved by using the steps. However, he showed great resistance to physically using his notebook and using the steps between sessions. He had lost the notebook that I had given to him in the previous session. He felt that because he was able to do it mentally there was no need to do it physically.

Modules 5 – 9. These modules are based on and reinforce the theoretical concepts of the first 4 modules, in addition to the use of a PECS board and laminated cards to reinforce the concepts. AN showed a resistance to using the PECS board, as he felt he understood the concepts clearly enough. Throughout these sessions he also displayed boredom and it seemed that the material was not engaging enough for him. He did, however, enjoy the practical tasks, such as the timed exercise, planning a party, and planning and making a sandwich. The use of the laminated cards proved helpful in adding a practical aspect to the planning, but the content and images seemed more suited to a younger audience and therefore did not engage his attention. At session 18 of the intervention (module 9 of pGMT), AN's parents raised concern that there were increasing problems in AN's academic and home life and questioned whether the intervention was working. It seems that even though AN understood the concepts and was able to discuss it and apply it to tasks and smaller real life goals within the intervention sessions, he was not utilizing the skills he had learnt in the pGMT to his life outside of the intervention. It came to my attention towards the end of the intervention that

there were changes that took place within the family during the year with regards to AN's parents giving him more freedom and the opportunity to be take more responsibility for his academic work. In the second half of the intervention there was a decline in his academic performance and behavioural, which could be attributed to AN's contextual factors rather than the intervention itself.

Changes in Neuropsychological Performance: RCI Analyses

On the cognitive measures (see Table 1), the greatest improvement between pre- and post-test scores is in the domain of Attention, with both CC accuracy and CC timing score creating a positive change of at least 2.58 standard deviations (SD). These tasks are related to attentional control and attentional switching. In the Score! Subtest, which focuses on sustained attention/concentration, AN's pre-test scores placed him at below average, and despite the intervention he maintained his below average score.

In the Memory & Learning domain, the RCFT showed a marked improvement between pre and post-test scores, however no RCI analyses could be done to interpret the significance of this improvement.

All other positive changes from pre- to post-intervention occurred at the 68% confidence interval.

Table 1
Pre- and post-test outcome scores and RCI outcomes: Cognitive Domains

		Outcomes		
Domain	Subtest	RCI	Pre	Post
Attention	Sky Search Time-per-target	-	10	11
	Sky Search Attention Score	-	11	12
	Sky Search DT	Δ	6	9
	CC accuracy	ΔΔΔ	5	13
	CC timing score	ΔΔΔ	1	11
	Numbers Forward		11	13
	Numbers Total	Δ	15	13
	Score!	No RCI	5	6
Executive Function	Numbers Backward	Δ	10	12
	VF – Cond.1: Letter Fluency	-	9	11
	VF – Cond. 2: Category Fluency	-	13	9
	VF – Cond. 3: CS Total Correct	Δ	8	12
	VF – Cond. 3: CS Total Switching Accuracy	Δ	10	13
	Tower – Total Achievement Score	Δ	7	10
	TM – Cond. 1: Visual scanning	-	12	11
	TM – Cond. 2: Number sequencing	-	13	15
	TM – Cond. 3: Letter sequencing	-	14	10
	TM – Cond. 4: Number-letter switching	-	11	13
	TM – Cond. 5: Motor speed	-	10	10
	TM – combined measure CT	Δ	15	13
	Inhibition – Inhibition Combined SS	Δ	8	10
	Inhibition – Inhibition Total CT	-	13	15
	Inhibition – Switching Combined SS (Cognitive flexibility)	Δ	9	11
	Inhibition – Switching Total CT	-	12	12
	Inhibition – Naming Combined SS (Sustained attention)	-	8	7
	Inhibition – Naming Total CT	Δ	13	15
	Inhibition – Total Errors	-	8	9
Memory and learning	WL Learning	-	14	10
	WL Delayed	-	15	14
	WL Delayed Recognition	-	11	13
	Dot location Learning	-	15	15
	Dot Location Short Delay	-	13	13
	Dot Location Long Delay	-	13	13
	Dot Location Total Score	-	15	15
	RCFT - immediate	No RCI	27	34
	RCFT - delayed	No RCI	29	42

Note. Δ = a positive change of at least 1 standard deviation with a confidence interval of 68.26%; ΔΔ = a positive change of at least 1.96 standard deviations with a confidence interval of 95%; ΔΔΔ = a positive change of at least 2.58 standard deviation with a confidence interval of 99%. CC= creature counting; Cond. = Condition; CS = Category Switching; CT = Completion Time; DR=Delayed Recognition; EF = Executive Function; RCFT = Rey Complex Figure Test; SS = Scaled Score; TM = Trail Making; VF = Verbal Fluency; WL = Word List.

Changes in behavioural outcomes- RCI Analyses

On the behavioural measures (see Table. 2), AN's parents report significant behavioural improvements between pre- and post- intervention on the scales that represent AN's ability to initiate tasks, his working memory and his ability to monitor his performance. There was also significant change on the overall Metacognition Index, as reported by his parents. Positive changes on the BRIEF Teacher Report from pre- to post-intervention are negligible. On the problem scales of the CBCL, even though the outcomes reported for AN falls in the normal range for a boy his age, he made significant improvements on the *Internalizing* and *Total problems* between pre- and post-testing according to his parents' repot. These changes were mainly as a result of changes in the Anxious/depressed subscale. No significant positive changes were reported by AN or his teacher regarding his internalizing and externalizing behaviours.

Table 2
Pre- and post-test outcome scores and RCI outcomes: Behavioural Domains

Domain	Subtest	Outcomes		
		RCI	Pre	Post
BRIEF Parent Report	Inhibition	-	40	43
	Shift	-	52	52
	Emotional Control	-	56	51
	BRI	-	49	48
	Initiate	ΔΔΔ	65	47
	Working Memory	ΔΔ	69	56
	Plan/Organize	-	56	51
	Org. of Materials	Δ	57	46
	Monitor	ΔΔ	54	39
	MI	ΔΔΔ	62	48
	GEC	Δ	58	48
BRIEF Teacher Report	Inhibition	Δ	51	57
	Shift	-	63	63
	Emotional Control	-	57	60
	BRI	-	57	61
	Initiate	Δ	51	60
	Working Memory	-	48	50
	Plan/Organize	-	60	64
	Org. of Materials	Δ	54	60
	Monitor	-	57	60
	MI	Δ	55	60
	GEC	Δ	56	61
CBCL Parent Report				
	Internalizing	ΔΔ	58	48
	Externalizing	-	40	44
	Total Problems	ΔΔ	53	45
CBCL Teacher Report				
	Internalizing	-	45	45
	Externalizing	-	48	51
	Total Problems	-	44	41
CBCL Youth Self Report				
	Internalizing	-	60	58
	Externalizing	-	51	55
	Total Problems	-	58	61

Note. Δ = a positive change of at least 1 standard deviation with a confidence interval of 68.26%; ΔΔ = a positive change of at least 1.96 standard deviations with a confidence interval of 95%; ΔΔΔ = a positive change of at least 2.58 standard deviation with a confidence interval of 99%. BRIEF = Behaviour Rating Inventory of Executive Function, BRI = Behaviour Recognition Index, Org. = Organizational, MI = Metacognition Index, GEC = Global Executive Composite. CBCL = Child Behaviour Checklist

Discussion

Due to difficulties in his home and academic environments, AN's parents sought the initial neuropsychological assessment for him in November 2014. The results of that neuropsychological assessment showed that AN had significant difficulties with attention, which included not being able to focus and sustain his attention, and being highly distractible and impulsive at times. He could remember both visuospatial and audio-verbal material and had above average working memory and general intellectual functioning (Schrieff-Elson, personal communication, 23 April 2015). At the time, ANs parents expressed interest in possibly pursuing non-pharmacological interventions for AN. Hence the family was contacted for participation in the current study.

A review of literature on the non-pharmacological treatment of ADHD, have shown cognitive interventions to be efficacious in treating the cognitive deficits associated with ADHD O'Connell et al., 2006; Tamm et al., 2010). Given AN's difficulties in both attention and executive function domains, I implemented two interventions that ran concurrently: an attention-training intervention (Pay Attention!) and a goal-management training intervention (pGMT). These interventions were targeted at those respective domains of difficulty.

The study took the form of a SCED and meets most criteria for a methodologically sound study on the SCED scale (Tate et al., 2008). I discuss the results for each of the interventions in conjunction with the pre- and post-test comparisons for the cognitive and behavioural measures.

Interventions

Pay Attention! This intervention utilizes structured tasks in order to train different domains of attention, such as sustained attention, selective attention, alternating attention and divided attention (Thomas et al., 2005). AN found Pay Attention! stimulating and the

challenge of improving his time motivated him. The sessions took place late in the afternoons, after he had already had a busy day at school therefore he was generally tired. Pay Attention! is ideally for children aged 5 – 10 years of age, and considering that AN was 11 years old at the time of the intervention and that he had a higher than average IQ and a very knowledgeable mind, there were certain tasks that although challenging he considered rather immature. Researchers do however note that the programme can be used with children turning 11 years during the course of the intervention (Kerns et al., 1999).

In terms of AN's performance, he progressed somewhat steadily through most of the different tasks and domains, but lingered on others. His level of motivation fluctuated and impacted on his performance. This relationship between attention and motivation is well described (Raymond, 2009).

AN's sustained attention scores did not change from pre-to post-intervention testing. Compared to his 2014 assessment, he again performed discrepantly on the Numbers Forward and Score! tasks, both of which assess sustained attention and concentration. While his performance on the Numbers Forward task was in the average to high-average range, his performance of the Score! Task was poorer (low average to borderline). The presentation of the tasks are different in the sense that in the Numbers Forward task, AN was required to repeat strings of numbers presented by the examiner, in increasing lengths. For Score!, AN was required to count varying numbers of sounds, played on a CD. Hence, in the latter task, AN was required to direct his own sustained attention, whereas in the former, it may be cued by the examiner on each round of numbers. This performance may be suggestive of a higher level of attentional control impacting his performance on these more basic tests of attention. This idea would be consistent with the significant results found on the RCI analyses on other attentional measures.

Although AN's sustained attention scores remained unchanged, from pre- to post-testing, he seemed to show significant change on more higher order aspects of attention: divided attention and attentional control and switching. Interestingly, both of these areas of functioning, in which AN showed the most improvement, rely both on attention and executive function domains.

Although not overtly apparent, a number of the Pay Attention! tasks rely on attentional and inhibitory control. For example, both the Card Flip and Audio CD tasks required that AN respond to certain stimuli (through visual or auditory presentation modes, respectively), while inhibiting responses to non-targets, even on sustained attention tasks. Hence training these executive areas of functioning may occur discreetly, while attempting to train other attentional domains. In addition, I also implemented an intervention focused on aspects of executive function. However, the contribution of Pay Attention! to these significant outcomes is still apparent, as the pGMT intervention was focused on goal setting and planning, rather than attentional control.

pGMT. The aim of this intervention is to assist in the rehabilitation of executive function, (specifically in the area of goal-directed behaviour) by introducing concepts and tasks which allows the participant to explore their current functioning, and utilize the practical tools which the intervention provides to assist in goal planning (Robertson, 1996; Levine et al., 2000a). The biggest challenge with implementing the pGMT is that AN did not engage much with the modules. Despite showing that he clearly understood the concepts and steps, there was a resistance from him to engage in the tasks as it is currently set. He preferred to use abstract thinking when addressing the tasks, and showed great resistance to using the PECS board to show his understanding of the steps. His engagement with the intervention highlights the importance of adjusting the intervention to best suit the population it aims to address.

In the theoretical modules (1-4) AN understood and was able to theoretically apply the concepts to real life examples. He showed insight into his life and could see areas where he could apply these concepts. In modules 4-9, the concepts were reinforced through exercises and tasks. AN's feedback on the intervention is that he enjoyed the practical exercises, especially planning and making a sandwich. It was challenging to gauge whether his resistance to the other aspects of the intervention was due to his attentional difficulties, or due to the time of the day in which the intervention took place, with the latter of course being confounded by the former.

The neuropsychological test that is probably most related to the functions trained in the pGMT is the Tower test. Here, AN's overall achievement score (based on how many towers were correctly completed in the allotted time and how many moves were required to complete them) did in fact increase from low average to average, although the RCI analyses only reflected change at with a confidence interval of 68.26%. Given the compensatory nature of the intervention and the real-world nature of a tasks included there, one might expect relevant changes to perhaps be more reflected in the behavioural outcomes than the cognitive ones.

Behavioural and real world outcomes

Because the ultimate aim of cognitive rehabilitation is to improve the individual's daily functioning , true efficacy of an intervention lies in the generalizability of outcomes to real world tasks or situations. Besides identifying areas of improvement that AN could focus on, using the pre-GMT questionnaires, I also used parent, teacher, and self-report behavioural questionnaires.

We identified real-world tasks from the pre-GMT questionnaire. These were regarding homework that he forgets to do at school, and chores he has to do at home such as tidying his room, making the fire, and keeping the bathroom clean. His parents reported some

improvement in the chores, but not much improvement seems to have been made at school. A follow up visit would is advisable to establish whether there have been effects from the intervention that extended to his home and academic life.

The BRIEF Parent Reports shows significant improvements in the scales that fall under the Metacognition Index which corresponds to AN's working memory and his problem solving abilities. No improvements were seen in the scales representing the self-regulation of behaviour. The BRIEF Teacher Report also saw improvements in this Metacognition Index, but not in as many scales. Interestingly, the scale of 'Inhibition' saw an improvement which is in agreement with the results from the Inhibition subtest in the cognitive outcomes.

Of the CBCL reports, the Parent Report saw the only significant improvement and this is evident in Internalizing behaviour especially that of Anxious/Depressed behaviour. It is important to note that at both pre and post testing, AN fell within the normal range for boys of his age.

Limitations and recommendation for future study

Overall, it appeared as though the interventions were not stimulating enough for AN. This outcome may be related to AN's age and level of IQ and highlights the frequently cited need for individualized treatment strategies (ref). One needs to keep in mind the participants the interventions are aimed at and adjust the interventions accordingly

Combining the two interventions meant that the sessions were not consistent in how long it ran for. Some sessions were very long and therefore AN was tired and did not engage well with the material. It is essential that combined interventions structure the sessions in a uniformed way. Finally, the AN's home was selected as an ideal location in order to provide a location that was less distracting and anxiety provoking. However, there were many distractions, which suggest that a neutral environment might be better suited to this sort of intervention.

Conclusion

ADHD is said to be one of the most prevalent childhood disorders, and the majority of treatment options utilize multimodal approaches of pharmacology and behavioural therapy. The concern with these treatment approaches is that they do not address the actual cognitive deficits that are present in ADHD. Research shows that cognitive rehabilitation such as attention training and executive function remediation show promise as alternatives to pharmacological approach to treatment. The interventions employed in this study brought about significant improvements in the areas of attention and executive function in the participant, which supports the literature on cognitive rehabilitation. However due to the nature of the SCED, more research is warranted in order to determine if the efficacy of such combined interventions and improvements in functioning can be replicated to a larger population.

References

AAP. (2011). ADHD: Clinical practice guideline for the diagnosis, evaluation, and treatment of attention-deficit/hyperactivity disorder in children and adolescents. *Pediatrics, 128*(5), 1007-1022. doi:10.1542/peds.2011-2654

American Psychiatric Association. (2013). *Diagnostic and statistical manual of mental disorders* (5th ed.) American Psychiatric Association.

Anderson, P. (2002). Assessment and development of executive function (EF) during childhood. *Child Neuropsychology, 8*(2), 71-82.

Barkley, R. A. (1997). *ADHD and the nature of self-control*. New York, NY: Guilford Press.

Barkley, R. A. (1996). In Lyon G., Krasnegor N. (Eds.), *Linkages between attention and executive functions.* Balitmore,MD: Paul H. Brookes Publishing Co.

Barkley, R. A., DuPaul, G. J., & McMurray, M. B. (1990). Comprehensive evaluation of attention deficit disorder with and without hyperactivity as defined by research criteria. *Journal of Consulting and Clinical Psychology, 58*(6), 775-789. doi:10.1037/0022-006X.58.6.775

Cohen, M. J. (2011). Children's Memory Scale. Encyclopedia of Clinical Neuropsychology, 556–559. doi:10.1007/978-0-387-79948-3_1532

Corbett, C., & Thomas, K. G. (2009). Rehabilitation of executive functioning following paediatric traumatic brain injury: A goal management training intervention. *South Africa: University of Cape Town.*

Delis, D. C., Kaplan, E., & Kramer, J. H. (2001). *Delis-kaplan executive function system (D-KEFS)* Psychological Corporation.

Devilly, G.J (2004). The Reliable Change Generator for Windows version 2.0 [computer programme]. The Centre for Neuropsychology, Swinburne University, Australia.

Duncan, J. (1986). Disorganisation of behaviour after frontal lobe damage. *Cognitive Neuropsychology, 3*(3), 271-290. doi:10.1080/02643298608253360

Ferrett, H. L., Carey, P. D., Thomas, K. G., Tapert, S. F., & Fein, G. (2010). Neuropsychological performance of south african treatment-naive adolescents with alcohol dependence. *Drug and Alcohol Dependence, 110*(1), 8-14. doi:10.1016/j.drugalcdep.2010.01.019

Gioia, G. A., Isquith, P. K., Guy, S. C., & Kenworthy, L. (2000). TEST REVIEW Behavior Rating Inventory of Executive Function. Child Neuropsychology (Neuropsychology, Development and Cognition: Section C), 6(3), 235–238. doi:10.1076/chin.6.3.235.3152

Gioia, G. A., Isquith, P. K., Kenworthy, L., & Barton, R. M. (2002). Profiles of everyday executive function in acquired and developmental disorders. *Child Neuropsychology, 8*(2), 121-137. doi:10.1076/chin.8.2.121.8727

Goldman, L. S. (1998). Diagnosis and Treatment of Attention-Deficit/Hyperactivity Disorder in Children and Adolescents. JAMA, 279(14), 1100. doi:10.1001/jama.279.14.1100

Hoare, J., Fouche, J., Spottiswoode, B., Donald, K., Philipps, N., Bezuidenhout, H., . . . Schrieff, L. (2012). A diffusion tensor imaging and neurocognitive study of HIV-positive children who are HAART-naïve “slow progressors”. *Journal of Neurovirology, 18*(3), 205-212. doi:10.1007/s13365-012-0099-9

Jacobson, N. S., & Truax, P. (1991). Clinical significance: A statistical approach to defining meaningful change in psychotherapy research. *Journal of Consulting and Clinical Psychology, 59*(1), 12-19. doi:10.1037/0022-006X.59.1.12

Kerns, K. A., Eso, K., & Thomson, J. (1999). Investigation of a direct intervention for improving attention in young children with ADHD. *Developmental Neuropsychology, 16*(2), 273. doi:10.1207/s15326942dn1602_9

Korkman, M., Kirk, U., & Kemp, S. (2007). NEPSY–Second edition (NEPSY II). *San Antonio: The Psychological Corporation,*

Krasny-Pacini, A., Chevignard, M., & Evans, J. (2013). Goal management training for rehabilitation of executive functions: A systematic review of effectivness in patients with acquired brain injury. *Disability & Rehabilitation, 36*(2), 105-116. doi:10.3109/09638288.2013.777807

Levin, K. (2004). Paediatric traumatic brain injury in south africa: Some thoughts and considerations. *Disability & Rehabilitation, 26*(5), 306-314. doi:10.1080/0963828032000174089

Levine, B., Robertson, I. H., Clare, L., Carter, G., Hong, J., Wilson, B. A., . . . Stuss, D. T. (2000a). Rehabilitation of executive functioning: An experimental–clinical validation of goal management training. *Journal of the International Neuropsychological Society, 6*(03), 299-312. doi:10.1017/s1355617700633052

Levine, B., Robertson, I. H., Clare, L., Carter, G., Hong, J., Wilson, B. A., . . . Stuss, D. T. (2000b). Rehabilitation of executive functioning: An experimental–clinical validation of

goal management training. *Journal of the International Neuropsychological Society, 6*(3), 299-312. doi:10.1017/S1355617700633052

Manly, T., Anderson, V., Nimmo-Smith, I., Turner, A., Watson, P., & Robertson, I. H. (2001). The differential assessment of children's attention: The test of everyday attention for children (TEA-ch), normative sample and ADHD performance. *Journal of Child Psychology and Psychiatry, 42*(08), 1065-1081. doi.org/10.1111/1469-7610.00806

Meyer, A., Eilertsen, D., Sundet, J. M., Tshifularo, J., & Sagvolden, T. (2004). Cross-cultural similarities in ADHD-like behaviour amongst south african primary school children. *South African Journal of Psychology, 34*(1), p.122-138. doi:10.1177/008124630403400108

Meyers, J. E., & Meyers, K. R. (1995). Rey complex figure test under four different administration procedures. *The Clinical Neuropsychologist, 9*(1), 63-67. doi:10.1080/13854049508402059

Mitrushina, M. (2005). *Handbook of normative data for neuropsychological assessment* Oxford University Press.

Mahomed, A. (2015). *Rehabilitation of executive functioning following pediatric traumatic brain injury: Evaluating a goal management training intervention.* (Unpublished University of Cape Town,

MTA Cooperative Group. (2004). National institute of mental health multimodal treatment study of ADHD follow-up: 24-month outcomes of treatment strategies for attention-deficit/hyperactivity disorder. *Pediatrics, 113*(4), 754-761.

Myer, L., Stein, D. J., Grimsrud, A., Seedat, S., & Williams, D. R. (2008). Social determinants of psychological distress in a nationally-representative sample of south african adults. *Social Science & Medicine, 66*(8), 1828-1840.

Myer, L., Ehrlich, R. I., & Susser, E. S. (2004). Social epidemiology in south africa. *Epidemiologic Reviews, 26*, 112-123. doi:10.1093/epirev/mxh004 [doi]

O'connell, R. G., Bellgrove, M. A., Dockree, P. M., & Robertson, I. H. (2006). Cognitive remediation in ADHD: Effects of periodic non-contingent alerts on sustained attention to response. *Neuropsychological Rehabilitation, 16*(6), 653-665. doi:10.1080/09602010500200250

Osterrieth, P. (1944). The test of copying a complex figure: A contribution to the study of perception and memory. *Arch Psychol, 30*, 206-356.

Parker, D. R., & Boutelle, K. (2009). Executive Function Coaching for College Students with Learning Disabilities and ADHD: A New Approach for Fostering Self-Determination. *Learning Disabilities Research & Practice*, 24(4), 204–215. doi:10.1111/j.1540-5826.2009.00294.

Penkman, L. (2004). Remediation of attention deficits in children: A focus on childhood cancer, traumatic brain injury and attention deficit disorder. *Pediatric Rehabilitation, 7*(2), 111-123.

Pennington, B. F., & Ozonoff, S. (1996). Executive functions and developmental psychopathology. *Journal of child psychology and psychiatry, 37*(1), 51-87.

Perdices, M., & Tate, R. L. (2009). Single-subject designs as a tool for evidence-based clinical practice: Are they unrecognised and undervalued? *Neuropsychological Rehabilitation, 19*(6), 904-927. doi:10.1080/09602010903040691

Polanczyk, G., de Lima, M. S., Horta, B. L., Biederman, J., & Rohde, L. A. (2007). The worldwide prevalence of ADHD: A systematic review and metaregression analysis. *AJP, 164*(6), 942-948. doi:10.1176/ajp.2007.164.6.942

Powell, T. J. (2000). Chronic neurobehavioural effects of mercury poisoning on a group of zulu chemical workers. *Brain Injury, 14*(9), 797-814.

Raymond, J. (2009). Interactions of attention, emotion and motivation. Attention, 293–308. doi:10.1016/s0079-6123(09)17617-3

Rice, J., Correia, A. F., & Schutte, E. (2014). Attention and concentration functions in HIV-positive adolescents who are on anti-retroviral treatment. *South African Journal of Psychology*, *44*(4), 467-482.

Rizzo, A. A., Buckwalter, J. G., Bowerly, T., Van Der Zaag, C., Humphrey, L., Neumann, U., . . . Sisemore, D. (2000). The virtual classroom: A virtual reality environment for the assessment and rehabilitation of attention deficits. *CyberPsychology & Behavior, 3*(3), 483-499.

Robertson, I. (1996). Goal management training: A clinical manual. *Cambridge: PsyConsult,*

Schrieff-Elson, L. E., Thomas, K. G. F., Rohlwink, U. K., & Figaji, A. A. (2015). Low brain oxygenation and differences in neuropsychological outcomes following severe pediatric TBI. Child's Nervous System. doi:10.1007/s00381-015-2892-2

Schrieff-Elson, L. (2015). *Personal communication*

Sergeant, J. A., Geurts, H., Huijbregts, S., Scheres, A., & Oosterlaan, J. (2003). The top and the bottom of ADHD: A neuropsychological perspective. *Neuroscience & Biobehavioral Reviews, 27*(7), 583-592. doi:http://dx.doi.org/10.1016/j.neubiorev.2003.08.004

Shields, N., Nadasen, K., & Pierce, L. (2008). The effects of community violence on children in cape town, south africa. *Child Abuse & Neglect, 32*(5), 589-601.

Shin, M., Park, S., Park, S., Seol, S., & Kwon, J. S. (2006). Clinical and empirical applications of the Rey–Osterrieth complex figure test. *Nature Protocols, 1*(2), 892-899.

Smith, J. D. (2012). Single-case experimental designs: A systematic review of published research and current standards. *Psychological Methods, 17*(4), 510-550. doi:10.1037/a0029312

Sohlberg, M. M., Avery, J., Kennedy, M., Ylvisaker, M., Coelho, C., Turkstra, L., & Yorkston, K. (2003). Practice guidelines for direct attention training. *Journal of Medical Speech Language Pathology, 11*(3), xix-xix.

Sohlberg, M. M., & Mateer, C. A. (2001). Improving attention and managing attentional problems. *Annals of the New York Academy of Sciences, 931*(1), 359-375. doi:10.1111/j.1749-6632.2001.tb05790.x

Sohlberg, M. M., & Mateer, C. A. (1987). Effectiveness of an attention-training program. *Journal of Clinical and Experimental Neuropsychology, 9*(2), 117-130. doi:10.1080/01688638708405352

Swanson, J., Posner, M. I., Cantwell, D., Wigal, S., Crinella, F., Filipek, P., . . . Nalcioglu, O. (1998). Attention-deficit/hyperactivity disorder: Symptom domains, cognitive processes, and neural networks.

Tajik-Parvinchi, D., Wright, L., & Schachar, R. (2014). Cognitive rehabilitation for attention deficit/hyperactivity disorder (ADHD): Promises and problems. *Journal of the Canadian Academy of Child and Adolescent Psychiatry, 23*(3), 207-217. Retrieved from http://www.ncbi.nlm.nih.gov/pmc/articles/PMC4197521/

Tamm, L., Hughes, C., Ames, L., Pickering, J., Silver, C. H., Stavinoha, P., . . . Emslie, G. (2010). Attention training for school-aged children with ADHD: Results of an open trial. *Journal of Attention Disorders, 14*(1), 86-94. doi:10.1177/1087054709347446 [doi]

Tamm, L., Epstein, J. N., Peugh, J. L., Nakonezny, P. A., & Hughes, C. W. (2012). Preliminary data suggesting the efficacy of attention training for school-aged children with ADHD. *Developmental Cognitive Neuroscience, 4*, 16-28. doi:10.1016/j.dcn.2012.11.004

Tamm, L., Epstein, J. N., Peugh, J. L., Nakonezny, P. A., & Hughes, C. W. (2013). Preliminary data suggesting the efficacy of attention training for school-aged children with ADHD. *Developmental Cognitive Neuroscience, 4*, 16-28. doi:http://dx.doi.org.ezproxy.uct.ac.za/10.1016/j.dcn.2012.11.004

Tamm, L., Hughes, C., Ames, L., Pickering, J., Silver, C. H., Stavinoha, P., . . . Emslie, G. (2009). Attention training for school-aged children with ADHD: Results of an open trial. *Journal of Attention Disorders*, doi:10.1177/1087054709347446

Tate, R. L., Mcdonald, S., Perdices, M., Togher, L., Schultz, R., & Savage, S. (2008). Rating the methodological quality of single-subject designs and n-of-1 trials: Introducing the single-case experimental design (SCED) scale. *Neuropsychological Rehabilitation, 18*(4), 385-401. doi:10.1080/09602010802009201

Tate, R. L., Perdices, M., McDonald, S., Togher, L., & Rosenkoetter, U. (2014). The design, conduct and report of single-case research: Resources to improve the quality of the neurorehabilitation literature. *Neuropsychological Rehabilitation, 24*(3), 315-331. doi:10.1080/09602011.2013.875043

Thomson, J., Kerns, K. A., Seidenstrang, L., Sohlberg, M., & Mateer, C. (2005). *Pay attention! A children's attention process training program* (2nd. ed.). North Carolina: Lash & Associates Publishing/Training Inc.

Tucha, O., Tucha, L., Kaumann, G., König, S., Lange, K. M., Stasik, D., . . . Lange, K. W. (2011). Training of attention functions in children with attention deficit hyperactivity disorder. *ADHD Attention Deficit and Hyperactivity Disorders, 3*(3), 271-283.

Van der Oord, S., Ponsioen, A. J. G. B., Geurts, H. M., Brink, E. L. T., & Prins, P. J. M. (2012). A Pilot Study of the Efficacy of a Computerized Executive Functioning Remediation Training With Game Elements for Children With ADHD in an Outpatient Setting: Outcome on Parent- and Teacher-Rated Executive Functioning and ADHD Behavior. *Journal of Attention Disorders*, 18(8), 699–712. doi:10.1177/1087054712453167

Vogel, W. (2014). An update on attention deficit hyperactivity disorder (ADHD) : CME article. *South African Medical Journal, 104*(1), 72-74.

Willcutt, E. G., Doyle, A. E., Nigg, J. T., Faraone, S. V., & Pennington, B. F. (2005). Validity of the Executive Function Theory of Attention-Deficit/Hyperactivity Disorder: A Meta-Analytic Review. *Biological Psychiatry*, 57(11), 1336–1346. doi:10.1016/j.biopsych.2005.02.006

Appendix A

Parental Consent Form

Informed Consent for you and your child to participate in research and authorization for collection, use, and disclosure of neuropsychological rehabilitation and cognitive performance, and other personal data

You are being asked to allow your child to take part in a research study. This form provides you with information about the study and seeks your permission for the collection, use and disclosure of your child's neuropsychological rehabilitation and cognitive performance data, as well as other information necessary for the study. The Principal Investigator (the person in charge of this research) or a representative of the Principal Investigator will also describe this study to you and answer all of your questions. Your child's participation is entirely voluntary. Before you decide whether or not to allow your child to take part, read the information below and ask questions about anything you do not understand. By allowing your child to participate in this study you will not be penalized or lose any benefits to which you would otherwise be entitled.

1. Name of Participant ("Study Subject" – the child)

---

2. Title of Research Study

Exploring the implementation of attention and goal management training interventions with a boy diagnosed with attentional difficulties in a single case design

3. Principal Investigator(s) and Telephone Number(s)

Candice Nicoló, Psychology Honours Student

Psychology Department

University of Cape Town

082 592 3455

4. Source of Funding or Other Material Support

None

5. What is the purpose of this research study?

The main purpose of this study is to investigate the effectiveness of two cognitive interventions in a boy with attentional problems.

6. What will be done if you take part in this research study?

Firstly, a number of neuropsychological tests will be carried out with your child to assess his cognitive and behavioural functioning. Then we we will implement two interventions to help with his attentional problems and help with practical tasks such as planning and setting goals. At the end of the interventions the neuropsychological tests will be carried out again.

7. If you choose to participate in this study, how long will you be expected to participate in the research?

You will also need to be available before and after the intervention for two testing days at the Department of Psychology, UCT and testing could take around 3 hours. You and your

son will be asked to be available for about 90 minutes twice a week for a period of 12 weeks for the actual intervention. This will be arranged at a time and location that is convenient for you.

8. How many people are expected to participate in the research?

Your son will be the only participant in this study.

9. What are the possible discomforts and risks for you or your child?

There are no known risks associated with taking part in this study.

Your son might feel fatigued or irritable during testing, as the tasks require concentration. However, he will be given breaks where necessary as well as refreshments. Where necessary, testing can be split over 2 days.

If you wish to discuss the information above or any discomforts you may experience, you may ask questions now or call the Principal Investigators listed on the front page of this form.

10. What are the possible benefits to you and your child

By you and your child partaking in the neuropsychological assessment, this will provide you with a deeper understanding of the neuropsychological functioning of your child. We will also give you feedback on the results from the neuropsychological tests. As part of this aim is to investigate how effective these intervention might be, it is not guaranteed that the attention-training program and goal-management intervention will result in improved functioning or performance for your child. It is important to bear this in mind at the outset of the study.

11. What are the possible benefits to others?

Should this training program prove to be effective, this will be an important contribution to future neuropsychological rehabilitation services offered to other children with attentional problems. In other words, this research can then be applied to other children, or families of children, who have attentional problems.

12. If you choose to take part in this research study, will it cost you anything?

Participating in this study will not cost you anything.

13. Can you and your child withdraw from this research study?

You may withdraw your consent and stop participating in this research study at any time, without any penalty to you or your child. In addition, refusal to consent to participation in the study will not affect future self-referrals.

14. If you withdraw, can information about you and your child still be used and/or collected?

Information that has already been collected may be used.

15. Once personal and performance information is collected, how will it be kept secret (confidential) in order to protect your privacy?

Information collected will be stored in locked filing cabinets or on computers with security passwords. Only the researcher and supervisors will have access to this information. Your research records will not be released without your permission unless required by law or a court order.

16. What information about you or your child may be collected, used and shared with others?

This information gathered from you will be demographic information, records of your responses, or your child's performance on the neuropsychological tests, records of your child's progress in the intervention, and images of their brain. If you agree to be in this research study, it is possible that some of the information collected might be copied into a "limited data set" (a computer file) to be used for other research purposes. If so, the limited data set may only include information that does not directly identify you or your child. For example, the limited data set cannot include you or your child's name, address, telephone number, ID number, or any other photographs, numbers, codes, or so forth that link you to the information in the limited data set.

17. How will the researcher benefit from your being in the study?

This study is being conducted as a part of an Honours degree at the UCT. In addition, the researcher may choose to present this research at a conference or in a scientific journal.

Signatures

As a representative of this study, I have explained to the participant's (child's) parent the purpose, the procedures, the possible benefits, and the risks of this research study; and how the participant's performance and other data will be collected, used, and shared with others:

_____

Signature of Person Obtaining Consent and Authorization Date

You have been informed about this study's purpose, procedures, possible benefits, and risks; and how your responses and your child's performance and other data will be collected, used and shared with others. You have received a copy of this form. You have been given the opportunity to ask questions before you sign, and you have been told that you can ask other questions at any time.

You voluntarily agree for you and your child to participate in this study. You hereby authorize the collection, use and sharing of your performance and other data. By signing this form, you are not waiving any of your legal rights.

_____

Signature of Person Consenting and Authorizing Date

Authorization for _____ to participate in the study.

Relationship to child participating in the study: parent / legal guardian

_____

Please indicate below if you would like to be notified of future research projects conducted by our research group:

_____ (initial & surname) Yes, I would like to be added to your research participation pool and be notified of research projects in which I might participate in the future.

Method of contact:

Phone number: _____

E-mail address: _____

Mailing address: _____

_____

_____

Appendix B

ASSENT FORM

ASSENT TO PARTICIPATE IN RESEARCH

We are inviting you to be in our research study because we would like to learn more about children with attentional issues and ways to help them.

If you agree to be in this study we will visit you at your home a few times a month to do some activities with us.

For example, we may ask you to try to remember things, to draw or read things. We will also ask your family to do the activities with you at home, and your teacher to do them with you at school.

These exercises and activities will not hurt you, but some of them may be long and you may feel tired at times. If you do, you can stop and rest at any time.

Signing this paper means that you want to be in the study. If you don't want to be in the study, don't sign the paper. No one will be cross if you don't sign this paper, and no one will be cross if you change your mind later and want to stop.

You can ask any questions that you have about the study. If you have a question later that you didn't think of now, you can call me on 082 592 3455 or ask me next time.

Signature of Participant _____ Date _____

Signature of Investigator _____ Date _____

Appendix C

Demographic Questionnaire and Asset Index

PARENT QUESTIONNAIRE AND ASSET INDEX

GENERAL INFORMATION

Full name (Parent):	
Telephone:	Work: ( ) Home: ( ) Cell:
How would you describe your ethnicity / race?	1. Black 2. Coloured 3. White 4. Asian 5. Other(specify):
Home Language:	
Full name (Child):	
Gender:	M F
Date of Birth:	
Grade:	

HOUSEHOLD INCOME: (Please circle appropriate number)

Household income per	1. R0

year:	2. R1 – R5 000 3. R5001 – R25 000 4. R25 000 – R100 000 5. R100 001+

PARENTAL EDUCATION: (Please circle appropriate number)

	Biological mother	Biological father	Guardian
Highest level of education reached? Mark one response for each person as follows:			
1. 0 years (No Grades / Standards) = No formal education (never went to school)	1.	1.	1.
2. 1-6 years (Grades 1-6 / Sub A-Std 4) = Less than primary education (didn't complete primary school)	2.	2.	2.
3. 7 years (Grade 7 / Std 5) = Primary education (completed primary school)	3.	3.	3.
4. 8-11 years (Grades 8-11 / Stds 6-9) = Some secondary education (didn't complete high school)	4.	4.	4.
5. 12 years (Grade 12 / Std 10) = Secondary education (completed senior school)	5.	5.	5.
6. 13+ years = Tertiary education (completed university / technikon / college)	6.	6.	6.
7. Don't know	7.	7.	7.

PARENTAL EMPLOYMENT: (Please circle appropriate number)

Hollingstead categories:	Biological mother	Biological father	Guardian
1. Higher executives, major professionals, owners of large businesses)	1.	1.	1.
2. Business managers of medium sized businesses, lesser professions (e.g. nurses, opticians, pharmacists, social workers, teachers)	2.	2.	2.
3. Administrative personnel, managers, minor professionals, owners / proprietors of small businesses (e.g. bakery, car dealership, engraving business, plumbing business, florist, decorator, actor, reporter, travel agent)	3.	3.	3.
4. Clerical and sales, technicians, small businesses (e.g. bank teller, bookkeeper, clerk, draftsperson, timekeeper, secretary)	4.	4.	4.
5. Skilled manual – usually having had training (e.g. baker, barber, chef, electrician, fireman, machinist, mechanic, painter, welder, police, plumber, electrician)	5.	5.	5.
6. Semi-skilled (e.g. hospital aide, painter, bartender, bus driver, cook, garage guard, checker, waiter, machine operator)	6.	6.	6.
7. Unskilled (e.g. attendant, janitor, construction	7.	7.	7.

helper, unspedified labour, porter, unemployed) 8. Homemaker 9. Student, disabled, no occupation	8. 9.	8. 9.	8. 9.

MATERIAL AND FINANCIAL RESOURCES (ASSET INDEX): (Please circle appropriate number)

Which of the following items, in working order, does your household have?

Items	Yes	No
1. A refrigerator or freezer	1.	1.
2. A vacuum cleaner or polisher	2.	2.
3. A television	3.	3.
4. A hi-fi or music center (radio excluded)	4.	4.
5. A microwave oven	5.	5.
6. A washing machine	6.	6.
7. A video cassette recorder or dvd player	7.	7.

Which of the following do you have in your home?

Items	Yes	No
1. Running water	1.	1.
2. A domestic servant	2.	2.
3. At least one car	3.	3.
4. A flush toilet	4.	4.
5. A built-in kitchen sink	5.	5.
6. An electric stove or hotplate	6.	6.
7. A working telephone	7.	7.

Do you personally do any of the following?

Items	Yes	No
1. Shop at supermarkets	1.	1.
2. Use any financial services such as a bank account, ATM card or credit card	2.	2.
3. Have an account or credit card at a retail store	3.	3.

Appendix D

Pay Attention! Progression graphs

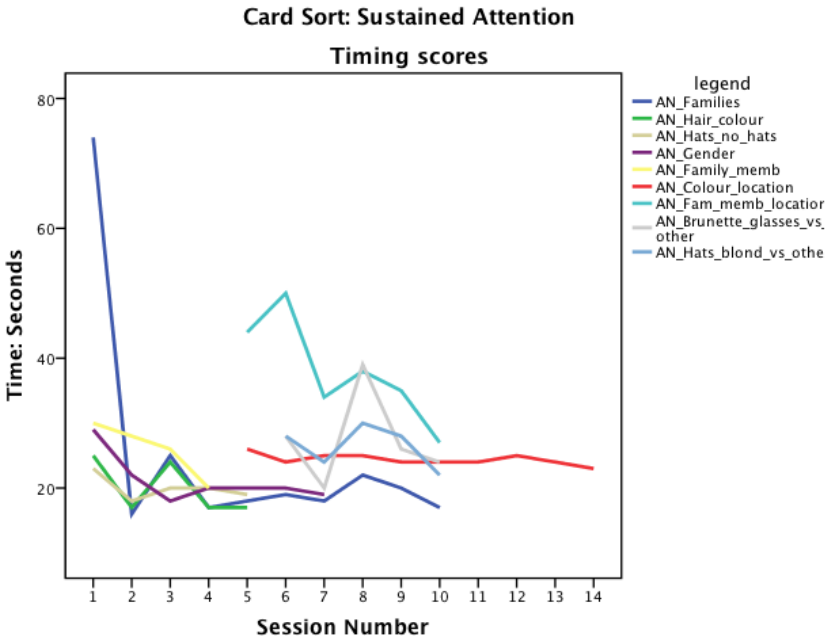

Figure 2

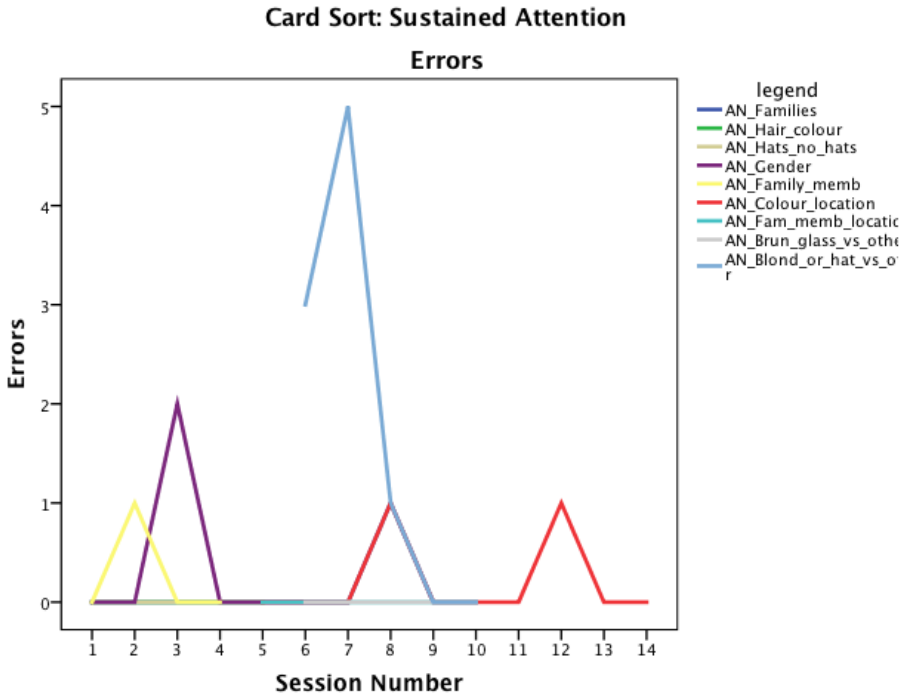

Figure 3

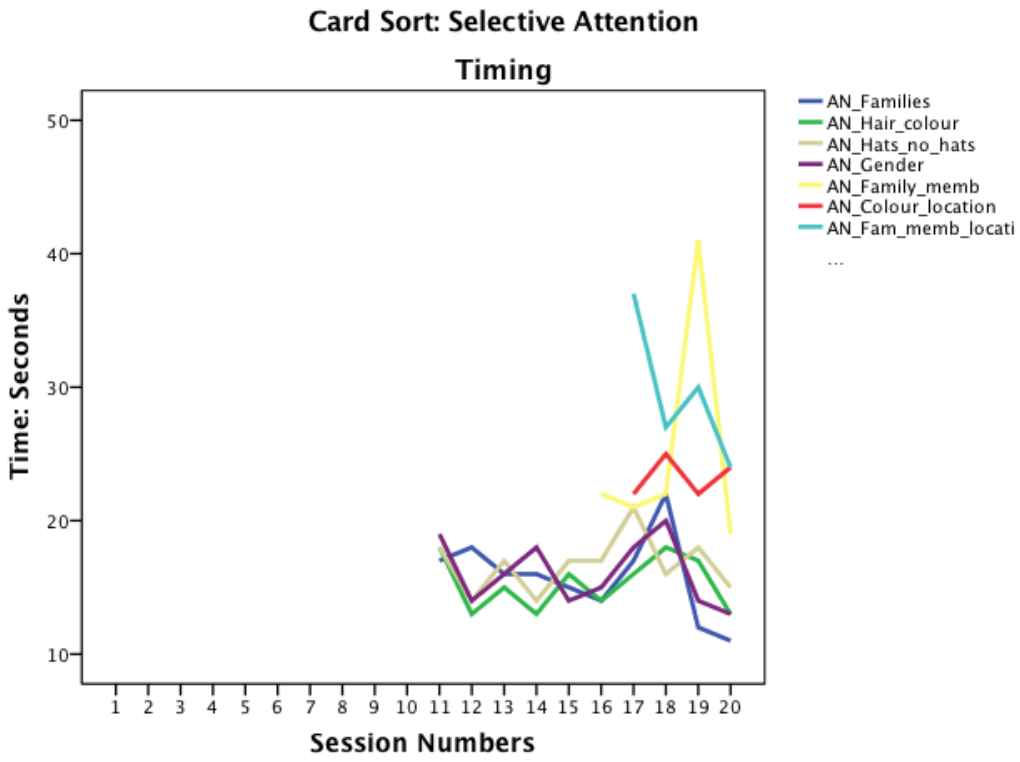

Figure 4

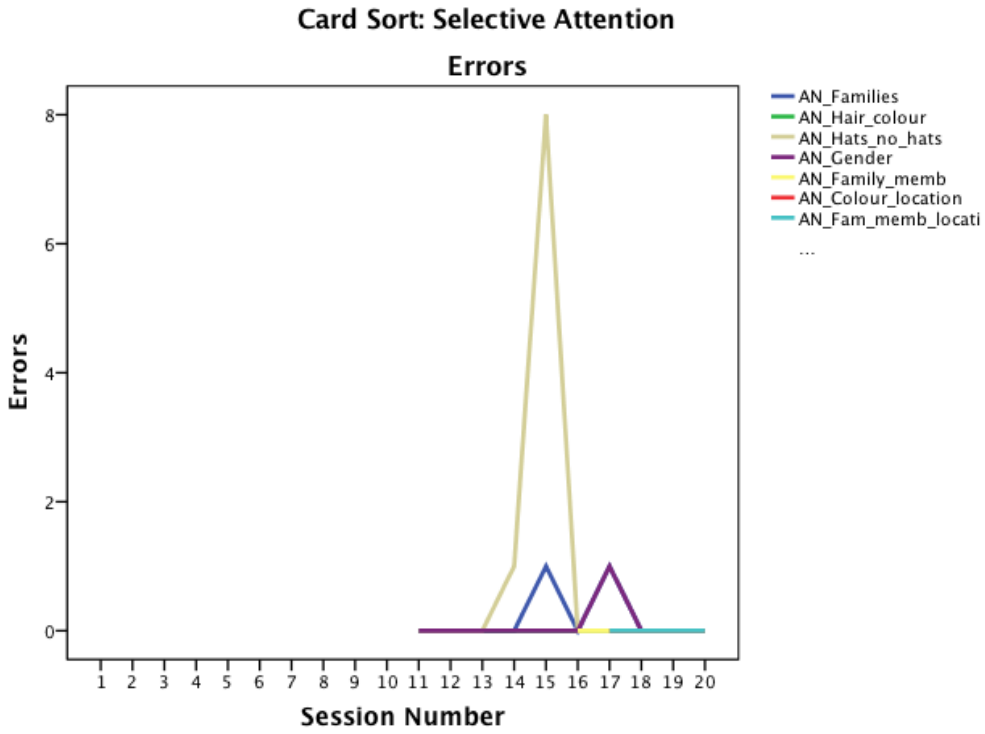

Figure 5

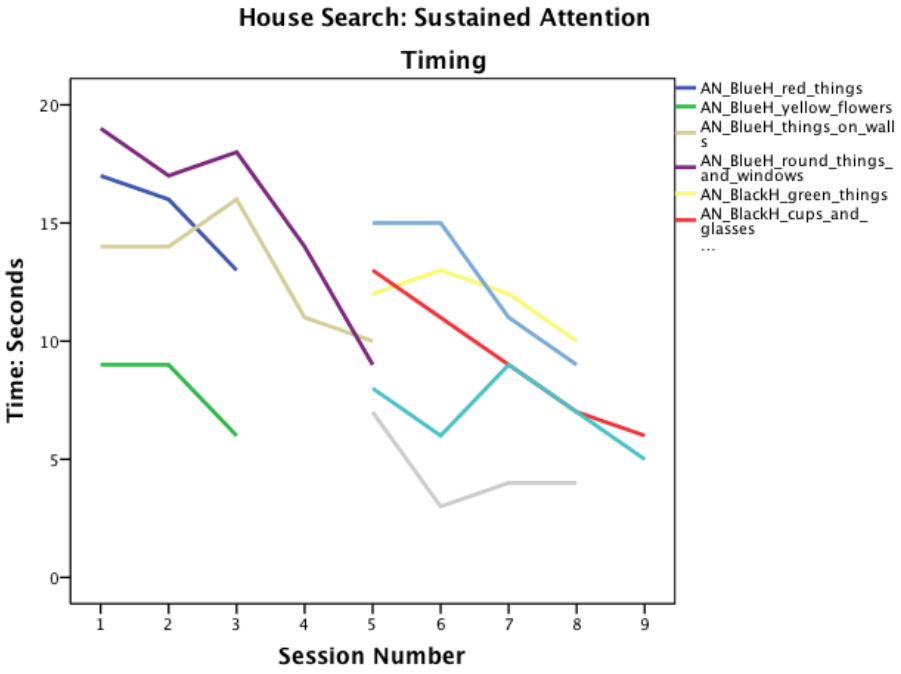

Figure 6

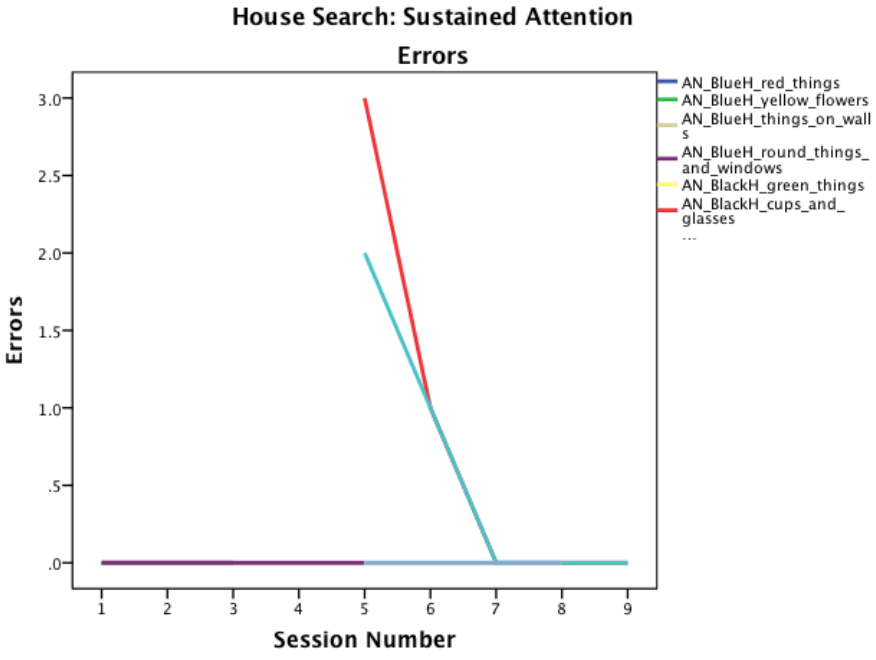

Figure 7

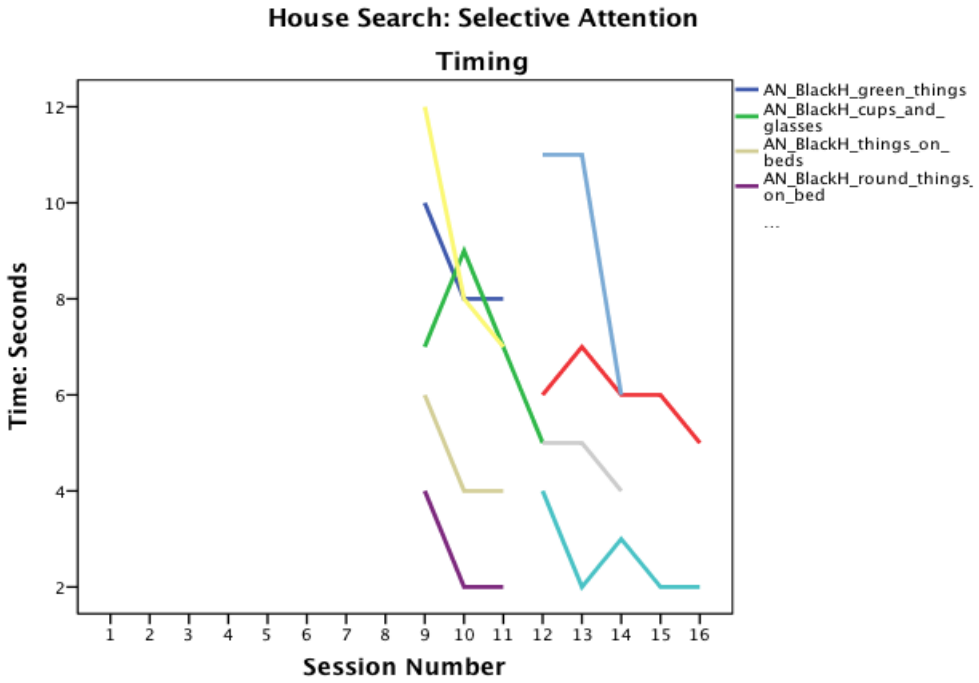

Figure 8

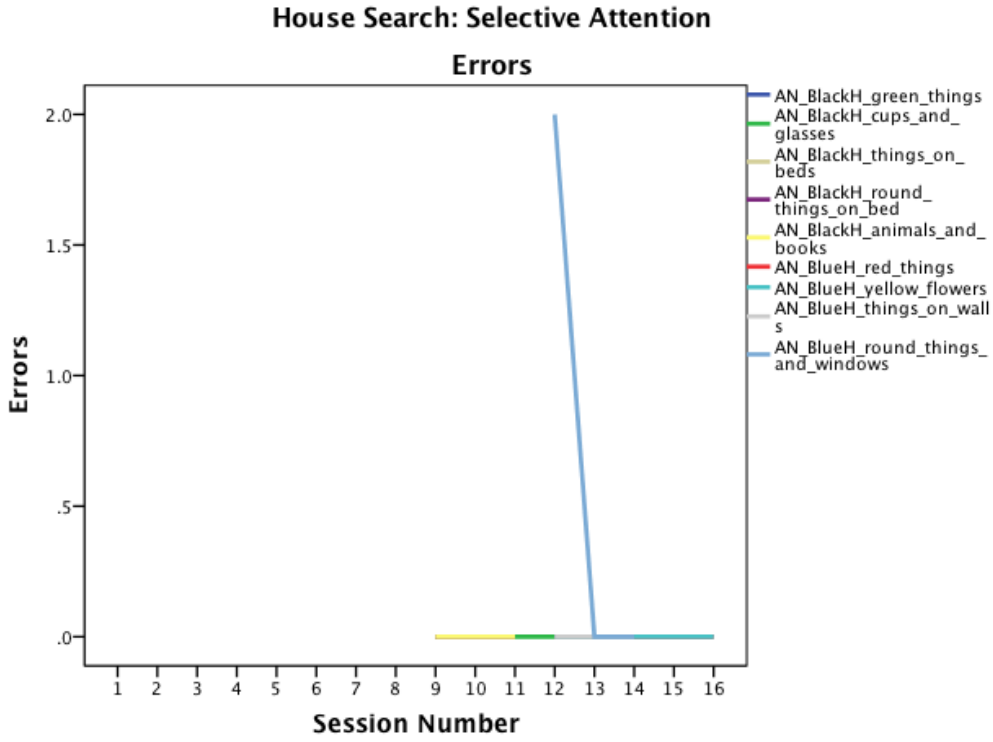

Figure 9

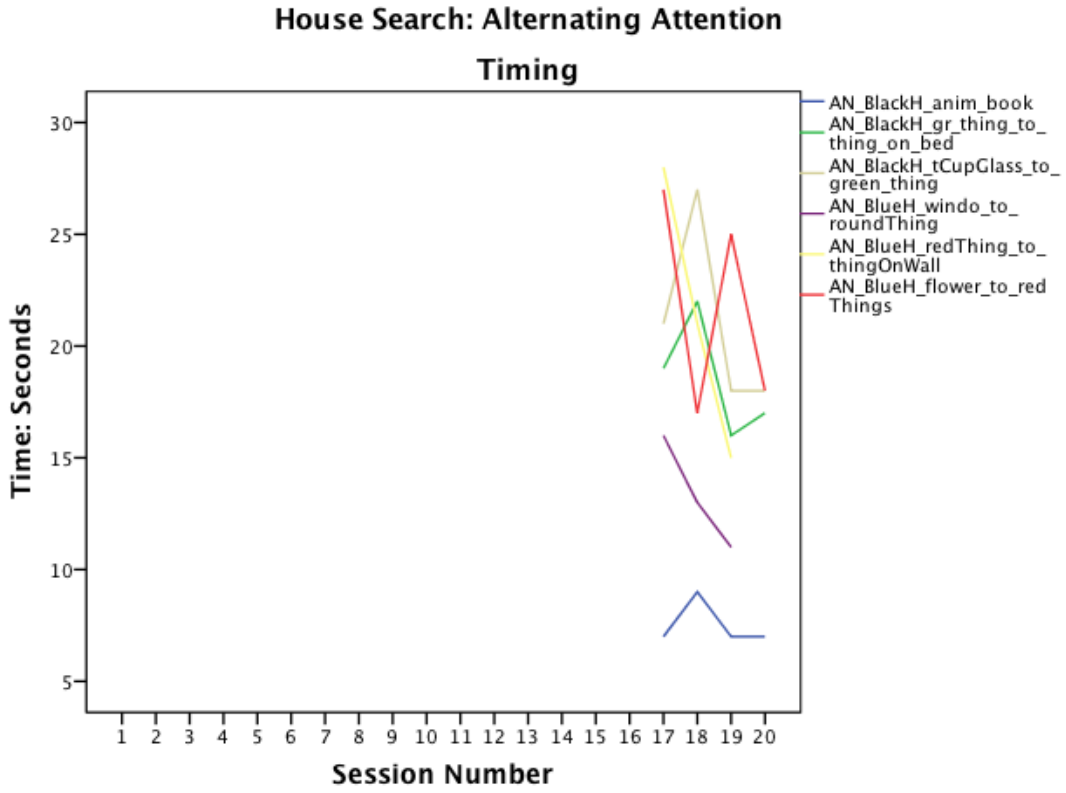

Figure 10

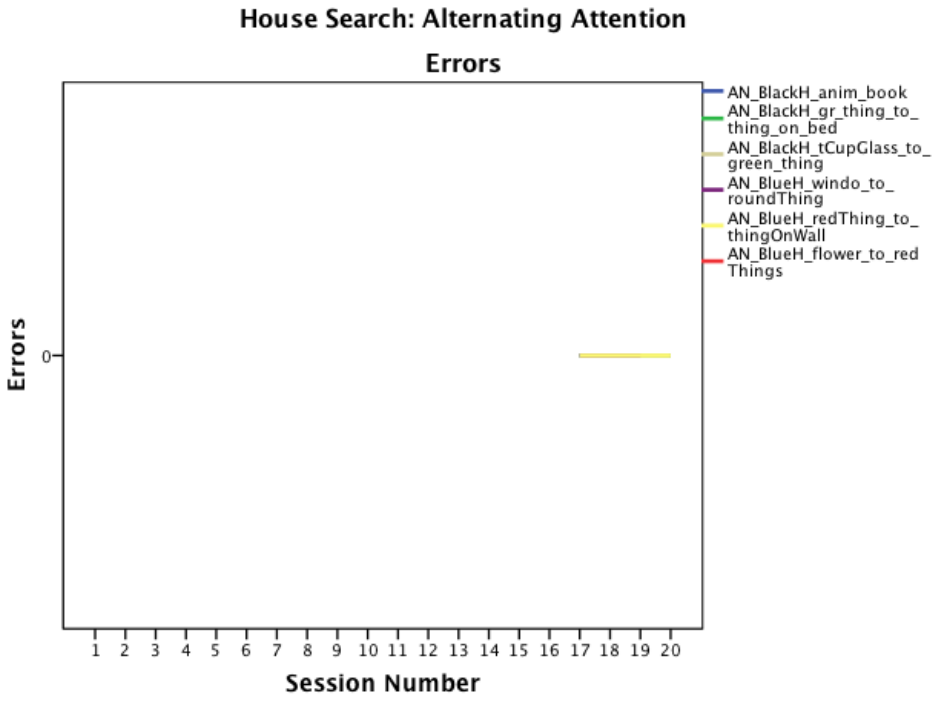

Figure 11

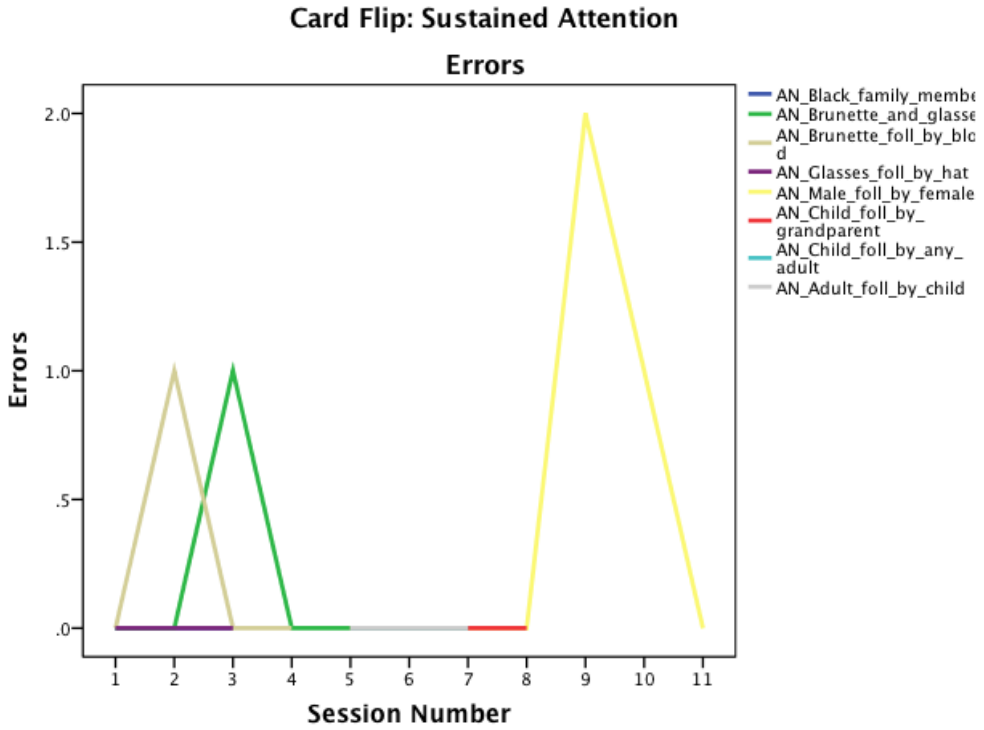

Figure 12

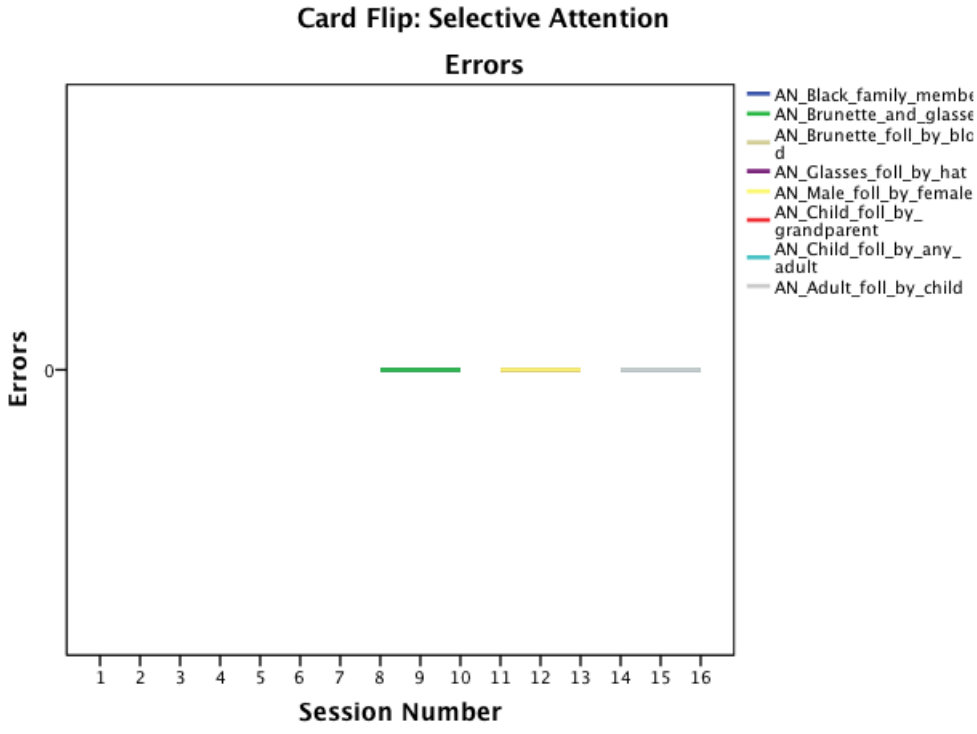

Figure 13

Appendix E

SCED Scale

PsycBITE

Rating Scale for Single Participant Designs

For each item, please justify scoring (for both "yes" and "no" responses), by at least mentioning page and paragraph numbers in the field underneath the tick boxes.

	Rater 1:		Rater 2:		Consensus	
	yes	no	yes	no	yes	no
1. Clinical history was specified. *Must include Age, Sex, Aetiology and Severity.*	☐	☐	☐	☐	☐	☐
	specify page & paragraph		specify page & paragraph		specify page & paragraph	
2. Target behaviours. Precise and repeatable measures that are operationally defined. *Specify measure of target behaviour.*	☐	☐	☐	☐	☐	☐
3. Design 1: 3 phases. Study must be either A-B-A or multiple baseline	☐	☐	☐	☐	☐	☐
4. Design 2: Baseline (pre-treatment phase). Sufficient sampling was conducted	☐	☐	☐	☐	☐	☐
5. Design 3: Treatment phase. Sufficient sampling was conducted	☐	☐	☐	☐	☐	☐
6. Design 4: Data record. Raw data points were reported	☐	☐	☐	☐	☐	☐
7. Observer bias: Inter-rater reliability was established for at least one measure of target behaviour	☐	☐	☐	☐	☐	☐
8. Independence of assessors	☐	☐	☐	☐	☐	☐
9. Statistical analysis	☐	☐	☐	☐	☐	☐
10. Replication: *either* across subjects, therapists or settings	☐	☐	☐	☐	☐	☐
11. Evidence for generalisation	☐	☐	☐	☐	☐	☐

Appendix F

DESCRIPTIONS OF ITEMS IN THE SINGLE CASE EXPERIMENTAL DESIGN (SCED) SCALE

Item	*Aim and brief definition**	*Examples meeting the criterion*
1. Clinical history	The study provides critical information regarding demographic and injury characteristics of the research subject that allows the reader to determine the applicability of the treatment to another individual.	"S1 was a 38-year old woman with a TBI of moderate severity (GCS = 9)."
2. Target behaviours	The paper identifies a precise, repeatable and operationally defined target behaviour that can be used to measure treatment success.	"The participant exhibited a specific problem behaviour defined as walking repeatedly around the rest home unit in which she resided with no apparent aim. The identified problem behaviour was operationally defined as the number of minutes during 1-hour observation periods that the participant walked around the unit."
3. Design	The study design allows the for the examination of cause and effect relationships to demonstrate treatment efficacy.	"A multiple baseline design across communication behaviours was employed to examine the effects of memory books on communication aspects of individuals with dementia."
4. Baseline	To establish that sufficient sampling of behaviour had occurred during the pre-treatment period to provide an adequate baseline measure.	"The subject was observed twice a day during the study. He underwent the control condition for 3 consecutive days, and then the treatment condition for 10 consecutive days, producing 3 control data points and 10 treatment data points."
5. Sampling behaviour during treatment	To establish that sufficient sampling of behaviour during the treatment phase has occurred to differentiate a treatment response from fluctuations in behaviour that may have occurred at baseline.	"Testing was undertaken daily throughout all study phases. A minimum of 10 data points per phase were collected for all three tests of neglect. Intervention always took place during the morning, for a minimum of 10 sessions."
6. Raw data record	To provide an accurate representation of the variability of the target behaviour.	Provides the individual data from pre-treatment, treatment, and post-treatment phases, either in graphed or tabular form.

7. Inter-rater reliability	To determine if the target behaviour measure is reliable and collected in a consistent manner.	"Inter-rater reliability for the spelling accuracy and identification of facts was calculated by having both authors analyse all data. Inter-rater agreement was 93% for spelling accuracy and 90% for reporting accuracy."
8. Independence of assessors	To reduce assessment bias by employing a person who is otherwise uninvolved in the study, to provide an evaluation of the patients.	"To reduce the possibility of observer bias, all testing sessions for subjects were videotaped and later independently analysed. Testing and training were carried out by two different individuals, and the assessor was masked to which phase of the single-subject design was in effect in each test session."
9. Statistical analysis	To demonstrate the effectiveness of the treatment of interest by statistically comparing the results over the study phases.	"Interrupted time-series analysis was used to examine the effect of treatment", if the *t* statistic and associated *p* value were provided
10. Replication	To demonstrate that the application and results of the therapy are not limited to a specific individual or situation (i.e., that the results are reproduced in other circumstances – replicated across subjects, therapists or settings).	"Five patients underwent the treatment protocol."
11. Generalisation	To demonstrate the functional utility of the treatment in extending beyond the target behaviours or therapy environment into other areas of the individual's life.	"The extent to which patients gained in task relearning was quantified by comparing the performance of the trained tasks at baseline with the performance at the end of the training session. Upon completion of the programme the additional five untrained tasks assessed at baseline were readministered to the patients."

(Tate, et al., 2008)

Appendix G

Table 3

Intervention Schedule

Session	Intervention	Session Duration (minutes)
1	Pay Attention!	50
2	Pay Attention! /pGMT module 1	90
3	Pay Attention!	60
4	Pay Attention! /pGMT module 2	75
5	Pay Attention! /pGMT module 3.1	90
6	Pay Attention! /pGMT module 3.2	75
7	Pay Attention! /pGMT module 4.1	85
8	Pay Attention! /pGMT module 4.2	75
9	Pay Attention!	50
10	Pay Attention! /pGMT module 5	80
11	Pay Attention!	45
12	Pay Attention! /pGMT module 6	75
13	Pay Attention!	55
14	Pay Attention! /pGMT module 7	80
15	Pay Attention!	50
16	Pay Attention! /pGMT module 8	75
17	Pay Attention!	45
18	Pay Attention! /pGMT module 9	90
19	Pay Attention!	45
20	Pay Attention!	30