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UNIVERSITY OF SOUTHAMPTON

FACULTY OF SOCIAL AND HUMAN SCIENCES

School of Psychology

**Does emotion dysregulation mediate the relationship between
behavioural inhibition and psychopathological symptoms?**

by

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Thesis for the degree of Doctor of Educational Psychology

August 2011

UNIVERSITY OF SOUTHAMPTON

ABSTRACT

FACULTY OF SOCIAL AND HUMAN SCIENCES

School of Psychology

Doctorate in Educational Psychology

DOES EMOTION DYSREGULATION MEDIATE THE RELATIONSHIP BETWEEN
BEHAVIOURAL INHIBITION AND PSYCHOPATHOLOGICAL SYMPTOMS?

by Anne Christine Willie

Failure to address poor mental health during childhood and adolescence results in higher risk of suicide, substance misuse, self-harm, and lower achievement in education and employment (Richards *et al.*, 2009). Of the psychological factors underlying mental health, it has been argued that self-regulation is central (Posner & Rothbart, 2000). The Barkley (1997) model of self-regulation is reviewed, and evidence considered that suggests it has cross-diagnostic validity. The typical developmental courses of emotion regulation and effortful control, and how these are associated with mental health, are considered in order to inform applied psychology practice with children and young people. A refinement of the Barkley model is proposed to enable the synthesis of findings from different bodies of research, and to offer a framework by which psychopathological diagnoses might be etiologically, rather than behaviourally, defined.

The research study used neuropsychological and self-report measures to test whether emotion dysregulation mediated the relationship between behavioural inhibition and psychopathological symptoms in adolescents. 39 pupils, aged 10 to 16 years, completed sustained attention subtests from the Test of Everyday Attention, the Attentional Control Scale, Difficulties in Emotion Regulation Scale, the Aggression Scale and the Strengths and Difficulties Questionnaire. Adult-report versions of the Strengths and Difficulties Questionnaire were also completed by parents and teachers. Significant, positive correlations between difficulties in emotion regulation and psychopathological symptoms were observed. Significant negative correlations were observed between behavioural inhibition and psychopathological symptoms. The mediation model was supported: emotion dysregulation fully mediated the relationship between behavioural inhibition and psychopathological symptoms. The relationship of the study results to the Barkley (1997) model of self-regulation is discussed. The study findings suggest that intervention to treat or prevent the development of psychopathological symptoms in adolescents is better targeted at reducing habits of emotion dysregulation than at improving the capacity for behavioural inhibition.

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Author's declaration

I, Anne Willie declare that the thesis entitled "Does emotion dysregulation mediate the relationship between behavioural inhibition and psychopathological symptoms?" and the work presented in the thesis are both my own, and have been generated by me as the result of my own research. I confirm that:

- this work was done wholly or mainly while in candidature for a research degree at this university;
- where any part of this thesis has previously been submitted for a degree or any other qualification at this University or any other institution, this has been clearly attributed;
- where I have consulted the published work of others, this is always clearly attributed;
- where I have quoted from the work of others, the source is always given. With the exception of such quotations, this thesis is entirely my own work;
- I have acknowledged all main sources of help;
- where the thesis is based on work done by myself jointly with others, I have made clear exactly what was done by others and what I have contributed myself;
- none of this work has been published before submission.

Acknowledgements

A thesis is never the work of just one person, and I am in debt to many.

First of all, I would like to thank my supervisor, Dr Nick Maguire, for his crucial guidance, patience and support throughout the process.

I am very grateful to Dr Julie Hadwin, Dr Denis Drieghe and Dr Mark Kilfoyle for their advice and expertise, to Helen Watt, Virginia Rounding and Tony Ley for proof-reading for me, and Alice Gordon for being such an enthusiastic and thorough research assistant.

Thanks of course to my friends for their invaluable confidence and encouragement when I needed it most.

This thesis would not have been possible without the considerable time, support and welcome offered me by staff in schools, in particular Sharon B, Carol F, Marie S, Pat C and Andy G.

Lastly, and most importantly, my thanks are due to the pupils who patiently completed questionnaires and tests with me, and shared their reflections on the experience.

Thank you.

I could not have completed this without all of you.

Chapter 1: The Impact of Emotion and Attention Regulation on the Development of Psychopathological Symptoms in Children and Young People: an extension of the Barkley (1997) model of self-regulation

1.1. Introduction

Measured by both psychiatric diagnoses and self-reports of quality of life, the prevalence of mental health difficulties in young people in Western economies is increasing (Collishaw, Maughan, Goodman & Pickles, 2004). Estimates suggest that the mental distress of 10% of children and young people in the UK reaches the criteria for a diagnosable mental health condition (Green, McGinnity, Meltzer, Ford & Goodman, 2005). Many of these difficulties persist into adult life (Rutter, Kim-Cohen & Maughan, 2006), with half of all lifetime mental health problems starting by the age of 14 (National Mental Health Development Unit, 2007). Failure to address poor mental health and conduct disorder during childhood and adolescence results in higher risk of suicide, substance misuse, self-harm, and lower achievement in education and employment (Richards *et al.*, 2009).

A wide range of contextual and physical factors has been associated with mental health outcomes, including neighbourhood resources (Ratchford & Beaver, 2009), family cohesion or discord (Fergusson, Horwood & Lynskey, 1992), and birth weight (Hille *et al.*, 2001); typically, individual psychological factors contribute around 16% of the variance in mental health outcomes (Vasilev, Crowell, Beauchaine, Mead & Gatzke-Kopp, 2009). A clearer understanding of these psychological factors is needed to ensure that the efforts of psychology practitioners, working to facilitate change at the level of the individual, are applied where they can be most effective.

Of the psychological factors underlying mental health, it has been argued that self-regulation is central (Posner & Rothbart, 2000). Contemporary conceptualisations view mental health as a balance between unconscious impulses and conscious strategies (Posner & Rothbart, 2000).

Self-regulation is the process of overriding automatic responses by altering thoughts, feelings or behaviour in order to pursue middle or long term goals (Baumeister & Vohs, 2003; Calkins, 2010). An influential theoretical model in this field is the Barkley (1997) model of self-regulation, developed in the context of attention deficit hyperactivity disorder. The following review considers whether there is evidence to support application of the Barkley (1997) model to a broader range of mental health difficulties. In considering the elements of that model the review will consider the typical developmental courses of emotion regulation and of attentional control, and how these are associated with mental health. It will draw out implications from recent empirical research findings for applied psychology practice, and identify gaps in the existing literature. Finally, it will propose a refinement of the Barkley (1997) model as a framework for further research.

1.1.1. Psychopathological symptoms

At what point do behaviours, rather than being considered healthy, come to be viewed as symptomatic of mental health difficulties? Currently, the most influential documents in the categorisation of mental ill-health in the Western world are the Diagnostic and Statistical Manual of Mental Disorders (DSM-IV) published by the American Psychological Association (APA, 2000) and the International Statistical Classification of Diseases and Related Health Problems (ICD-10) published by the World Health Organisation (WHO, 2007). The ICD-10 describes mental disorder in relation to a concept of normality: 'some combination of abnormal thoughts, emotions, behaviour and relationships with others' (WHO, 2007). The DSM-IV defines mental disorder as 'a significant behaviour or pattern that is associated with distress, impairment in one or more areas of functioning, or loss of freedom, excluding behaviours that are merely an expectable and culturally sanctioned response to a particular event, for example the death of a loved one' (APA, 2000, p. xxxi). The ICD-10 definition demands a further clarification of normality in order to be workable, but the DSM-IV definition clearly considers behaviours symptomatic of mental health difficulties when they cause distress or loss of freedom to an individual or others around them. The term 'psychopathological symptoms' is used throughout much of the research literature to describe such behaviours, and therefore will be used in the rest of this review. This broad-ranging construct encompasses behaviours associated with aggression, hyperactivity, non compliance with authority, drug and alcohol use, anxiety, depression, self-harm, and eating disorders amongst others (Goodman, 1997; Achenbach, 1991; APA, 2000) –

behaviours which cause distress or loss of freedom to the individual or others around them, and which, when they become habitual, tend to compromise that individual's ability to work towards medium or long-term goals. Use of the term 'psychopathological symptoms' is not intended to imply a medical model of disease, within which symptoms might be expected to disappear completely once an illness was cured. The same behaviour may be considered an indicator of mental ill health in one context, and a healthy response in another, for example avoiding a certain situation might represent effective management of an alcohol addiction (Baumeister & Tierney, 2011) or ineffective management of social anxiety (Antony & Stein, 2008). It is therefore argued that whether or not a particular behaviour is categorised as a psychopathological symptom depends upon a consideration of the affective context of the behaviour, and the extent to which it is successful in meeting the individual's middle- or long-term goals. Since an external observer is unlikely to be able to make informed judgements about an individual's goals, it could be argued that self-reports constitute the most reliable operationalisation of psychopathological symptoms from adolescence onwards.

Most mental health problems are better represented as the outer edges of a continuum of emotional and behavioural functioning rather than as qualitatively different syndromes in their own right (Tillman, Eninger, Forssman & Bohlin, 2011; Hayes *et al.*, 1996). Scores on the three key questionnaires commonly used to assess the severity of psychopathological symptoms in young people typically demonstrate normal, rather than bimodal, distributions across clinical and community samples, suggesting that the behaviours measured by these questionnaires are normally distributed across the population (Achenbach, 1991; Goodman, 1997; Steer, Kumar, Beck & Beck, 2005), and which, at their most extreme or frequent, are typically categorised as mental illness.

1.1.2. Barkley model of self-regulation

An influential model in the diagnosis and treatment of psychopathological symptoms has been the conceptualisation of attention deficit hyperactivity disorder (ADHD) proposed by Barkley (1997, 2006). Barkley drew upon extensive clinical experience of working with individuals with a diagnosis of ADHD to suggest that the primary characteristic of the disorder was a deficit in the capacity to inhibit responses to incoming or internally-generated stimuli. Barkley hypothesised

that this 'behavioural inhibition' needed to be intact for other executive functions serving self-control and goal-directed behaviour to operate optimally. The construct of behavioural inhibition will be discussed further in section 1.2. The other executive functions serving self-control were labelled by Barkley as working memory, emotion regulation, internalisation of controls (the self-talk necessary for planning, problem-solving and self-reflection), and reconstitution (processes involved in automatisation and synthesis of responses, enabling fluency of speech and action). Barkley proposed that all five processes work together in order to enable creative and goal-directed behavioural responses (labelled 'Motor control/fluency/syntax' in Figure 1). Although developed in the context of ADHD, Barkley widens the context to include typical child development, describing his proposals as a 'developmental-neuropsychological model of human self-regulation' (Barkley, 2006, p.300). Researchers have used different definitions of self-regulation as the outcome variable when testing the model (e.g. Boykin, 2001; Sarkari, 2003; Stevens, Quittner, Zuckerman & Moore, 2002).

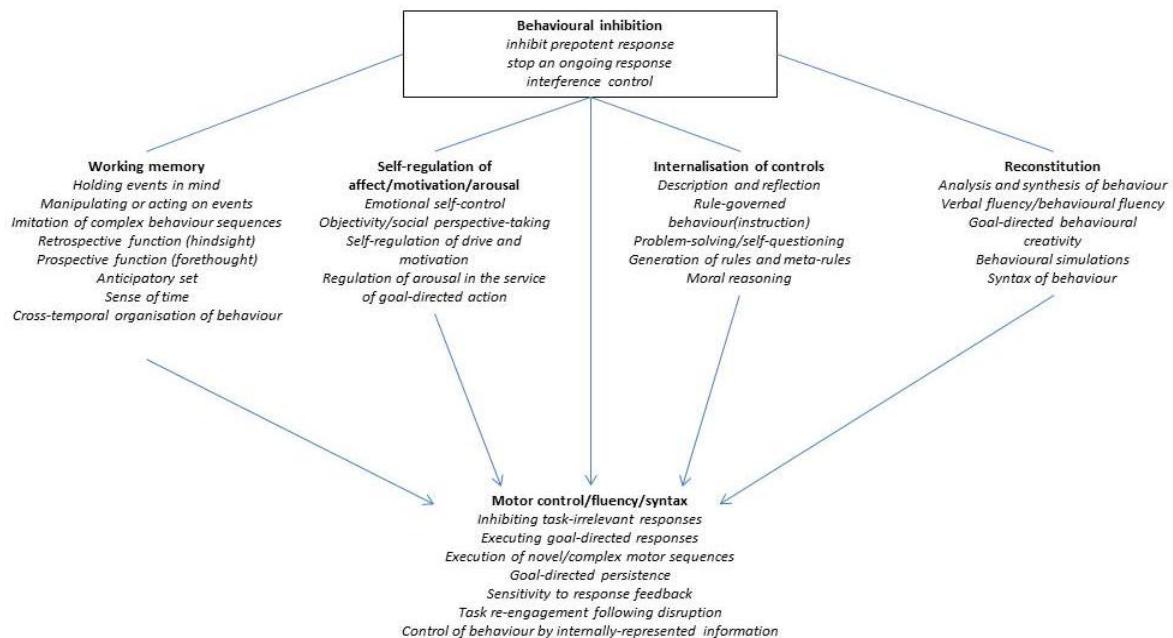


Figure 1: Barkley's model of executive functions, behavioural inhibition and motor control systems in ADHD. From Barkley (1997), p.73.

Besides the intrinsic value of a model which combines cognitive and emotional constructs (Sokol & Muller, 2007), there are strong arguments for the use of cross-diagnostic models in

research into psychological health and illness. Many individuals meet diagnostic criteria for more than one psychological disorder (Bjarehed & Lundh, 2008; Steer *et al.*, 2005; Stewart, Zvolensky & Eifert, 2002; Ybrandt, 2008). Researchers in the field of developmental psychopathology have argued that the challenges of equifinality and multifinality – that different etiologies may lead to apparently similar presenting difficulties and similar etiologies may result in different symptom presentation – have often presented barriers to effective research into psychopathological symptoms and intervention (e.g. Beauchaine, Klein, Crowell, Derbridge, & Gatzke-Kopp, 2009; Burke, Loeber & Birmaher, 2002; Tackett, Balsis, Oltmanns & Krueger, 2009; Cicchetti & Rogosch, 1996). Since the main psychiatric classification systems in use (American Psychiatric Association, 2000; World Health Organisation, 2007) are currently behaviourally-, rather than etiologically-defined, it has been argued that using individual psychiatric diagnoses as grouping variables for research may hinder the identification of common underlying factors (Nigg, Willcutt, Doyle, & Sonuga-Barke, 2005; Beauchaine, 2001; Cicchetti & Rogosch, 1996). There is therefore a need for theoretical models which take a cross-diagnostic approach to outcome definition in order to test whether risk factors identified in the context of individual diagnoses can be applied to a broader range of psychopathological symptoms.

In the field of ADHD, the Barkley model has had extensive influence on both clinical practice (e.g. Mash & Barkley, 2007; Frankel & Penn, 2007) and research design - the original 1997 model is cited over 1500 times in the current edition of a key database for psychological researchers. Despite this influence, little research has empirically tested the intermediate pathways predicted by the model. If, as the model suggests, inhibition moderates the effects of other executive functions on behaviour, the effectiveness of interventions targeted at those secondary executive functions will be dependent upon an individual's level of inhibitory control. Therefore research studies which fail to take behavioural inhibition into account may not demonstrate a generalisable effect of interventions which otherwise might be shown to be highly effective for sub-groups with a certain level of inhibitory control. For other individuals, intervention may be more usefully targeted at increasing their level of inhibitory control before further intervention is likely to be effective.

In order to validate the Barkley model, it would be necessary to demonstrate reliable, generalisable relationships between the 5 executive functions - behavioural inhibition,

reconstitution, working memory, internalisation of controls, and self-regulation of affect - and the outcome variable, motor control/fluency/syntax. In one of very few studies to test the model as a whole, Boykin (2001) attempted to use regression analysis to validate the model in a heterogeneous group of primary school children. Academic achievement and parent perception of child adaptability were used as outcome measures. Significant relationships were observed between the outcome measures and measures of self regulation of affect, internalisation of control, and reconstitution. No relationship was observed between the outcome measures and working memory or behavioural inhibition, leading the study's author to suggest that the effect of behavioural inhibition was subsumed within the other variables (i.e. that the other variables fully mediated the pathway between behavioural inhibition and the outcome variable). This study therefore appears to lend empirical support to the pathways predicted by the Barkley model, except for that involving working memory. However, it could be argued that the outcome measures of academic achievement and parent perception of child adaptability used in the Boykin (2001) study are too distant from Barkley's conceptualisation of the outcome variable ('goal-directed activity... the organization of behavior relative to time and the future', Barkley, 2006, p.317) to provide direct evidence for the model.

In section 1.1.1. it was argued that psychopathological symptoms were behaviours which were not effective in meeting an individual's middle or long-term goals. A reduction in goal-directed activity might be associated with an increase in psychopathological symptoms so that using psychopathological symptoms as the outcome variable in the model would be consistent with Barkley's conceptualisation. Testing the model using psychopathological symptoms as an outcome variable would also test the generalisability of the model beyond ADHD. Empirical evidence about the relationships between all these elements - behavioural inhibition, reconstitution, working memory, internalisation of controls, self-regulation of affect and psychopathological symptoms - will therefore be considered, with a view to what that evidence suggests about supporting the mental health of children and young people.

1.2. Association between behavioural inhibition and psychopathological symptoms

There are two related but distinct uses of the term behavioural inhibition in the literature: that defined by Barkley, and that associated with Gray's motivational theory of behavioural approach and behavioural inhibition systems (Gray, 1982). In Gray's model, behavioural inhibition is associated with shyness and a tendency to retreat from novel stimuli. In the Barkley model, behavioural inhibition is defined as the capacity to inhibit a dominant response, stop an ongoing response, or sustain an action in the face of distraction (Barkley, 2006, p301). An extensive body of research has associated psychopathological symptoms with deficits in behavioural inhibition as defined by Barkley (Davis, Bruce & Gunnar, 2002; Vitale *et al.*, 2005; Eisenberg *et al.*, 2001; Ellis, Rothbart & Posner, 2004; Rueda, Posner & Rothbart, 2004, 2010).

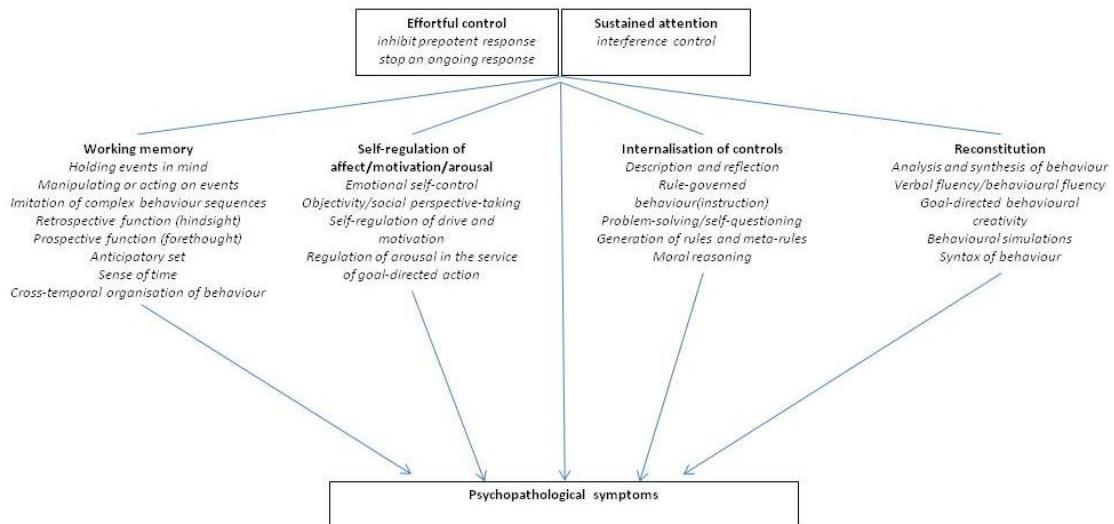


Figure 2: Proposed revision of the Barkley (1997) model showing changed specifications of behavioural inhibition and motor control/fluency/syntax.

Barkley's definition of behavioural inhibition clearly overlaps with the constructs of effortful control ('the ability to inhibit a dominant response to perform a subdominant response', Posner & Rothbart, 2000, p.434) and sustained attention ('the continuous inhibition of task irrelevances', Robertson and Gavarani, 2004, p.637). The current author argues that replacing the

single construct of behavioural inhibition with those of effortful control and sustained attention (as illustrated in figure 2) both provides a more precise specification of the Barkley model, and enables the synthesis of research findings from different schools of thought. Evidence about the developmental course and association with psychopathological symptoms of these two constructs will therefore be explored.

1.2.1. Effortful control: definition and developmental course

Effortful control is considered to be partly innate, emerging with the executive attention system during the second year of life (Murray & Kochanska, 2002), and increasing throughout childhood as a result of brain maturation and interaction with the environment (Posner & Rothbart, 2007).

Effortful control is typically assessed by parent- or teacher-report in young children, and self-report from middle childhood onwards (Derryberry & Reed, 2002; Eisenberg, Spinrad *et al.*, 2004; Salmon & Perreira, 2002). It has also been operationalized as delay of gratification tasks for young children, task persistence in older children, and Go-no-go or Stop-signal tasks, in which participants are asked to respond to stimuli except under certain conditions (e.g. press the left button as quickly as you can when you see an X and the right button as quickly as you can when you see an O unless you hear a beep over the headphones, in which case stop yourself from pressing any button) (Dalen, Sonuga-Barke, Hall & Remington, 2004; Eisenberg, Spinrad *et al.*, 2004; Kochanska, Murray & Harlan, 2000; Spinrad, Eisenberg & Gaertner, 2007).

Effortful control has trait-like characteristics, with studies observing longitudinal stability of 0.58-0.69 in early childhood (Murray & Kochanska, 2002; Kochanska *et al.*, 2000) and 0.39-0.79 in middle childhood (Eisenberg, Spinrad *et al.*, 2004; Valiente *et al.*, 2003). Long-term stability of the construct has also been demonstrated, with preschoolers' ability to delay gratification predictive of positive life outcomes, goal-setting, and self-regulatory abilities when participants reached their late twenties (Ayduk *et al.*, 2000).

It appears that there is a positive, curvilinear relationship between effortful control and age, with the curve flattening out between the ages of 9 and 13 (Kochanska *et al.*, 2000; Eisenberg, Spinrad *et al.*, 2004; Muris, der Pennen, Sigmond & Mayer, 2008; Muris, de Jong & Engelen, 2004). The

capacity for and tendency to demonstrate effortful control are suggested to depend on neural networks related to attentional control (Nigg, 2006).

1.2.2. Associations between effortful control and psychopathological symptoms

Effortful control has been repeatedly associated with vulnerability to or resilience against the proliferation of psychopathological symptoms in childhood and adolescence. For example, in a community sample of 173 adolescents aged 12 to 15 years, Muris (2006) observed significant, negative correlations of moderate strength between self-report measures of effortful control and self-reports of anxiety, depression, eating disorders, disruptive behaviour and substance abuse. Similarly, in younger samples of children aged 8 to 13 years, significant, negative correlations have been observed between self-report measures of attentional control and anxiety, depression, emotional problems, aggression, behavioural problems and hyperactivity (Muris *et al.*, 2004). Similar results have been replicated across different studies, generally observing stronger, negative correlations of attentional or effortful control with internalising problems than externalising problems (Meesters, Muris & van Rooijen, 2007; Muris, Mayer, van Lint & Hofman, 2008; Muris, Pennen *et al.*, 2008).

1.2.3. Attention: definition, developmental course and association with psychopathological symptoms

Whilst it has been suggested that effortful control represents the efficiency of operation of attention networks (Simonds, Kieras, Rueda & Rothbart, 2007; Rueda, Posner & Rothbart, 2004), attempts to triangulate questionnaire measures of effortful control with neuropsychological tests of attention have only observed significant relationships in samples of pre-adolescent children. In older children or mixed-age samples, research has failed to find significant relationships between the constructs (Muris *et al.*, 2008; Verstraeten, Vasey, Claes & Bijttebier, 2010). The current author suggests that measures of effortful control and neuropsychological measures of attention are better considered separately rather than combined.

Research studies have repeatedly associated attentional problems in childhood with psychopathological disorder in adulthood (e.g. Erlenmeyer-Kimling, Cornblatt, Rock, Roberts,

Bell, & West, 1993; Beauchaine, Brenner, Gatzke-Kopp & Neuhaus, 2008). Since there is a range of tools available for identifying attentional difficulties, and an increasing body of interventions that have been shown to be effective in improving aspects of attention in children and young people (Kerns, Eso & Thomson, 1999; Klingberg, Forssberg & Westerberg, 2002; Rueda, Rothbart *et al.*, 2005), attentional difficulties would appear to be an ideal target for intervention to reduce psychopathological symptoms.

The concept of attention, however, is very broad; separate neural anatomy has been shown to be associated with different aspects of attention (Posner & Petersen, 1990), and interventions have been shown to be effective only for the specific aspect of attention that has been targeted (Sturn, Willmes, Orgass & Hartje, 1997). In order to ensure that the need for intervention can be clearly assessed, and intervention strategies appropriately targeted, there is a need for clear hypotheses about the associations between different aspects of attention and psychopathological symptoms. The following section will consider evidence about the developmental course, and association with psychopathological symptoms, of different aspects of attention, with a view to generating hypotheses about intervention.

The dominant contemporary model of attention is that articulated by Posner & Petersen in 1990, and subsequently developed in the context of associations between self-regulation and attentional control (Rueda, Posner & Rothbart, 2004, 2010). This model conceptualises attention in terms of three key neural networks: orienting, alerting, and executive control. **Orienting** is the process relating to the selection of information from sensory input: engaging, moving and disengaging attention. Attentional orienting to a location is associated with faster responses to targets appearing in that location. **Alerting** represents the basic state of wakefulness (the equivalent of vigilance or some conceptualisations of arousal, most commonly operationalised as measures of sustained attention). Posner's construct of **executive control** largely overlaps with the concept of the central executive in the Baddeley (1986) model of working memory, and is associated with the management of conflict among mental processes. The executive control network will be discussed at length in section 1.4, within the context of working memory. Functional brain imaging studies have suggested that largely separable neuroanatomical networks underlie these three separate functions, as described in Figure 3.

Orienting	Executive	Alerting
Orienting to sensory events; Disengaging from one attentional focus; Inhibition of return to previously-attended location	Selection of signals for conscious processing	Maintaining a vigilant or alert state; preparation for processing of high priority target events.
Posterior attention system, involving posterior parietal lobe and pulvinar nucleus of the thalamus	Anterior attention system, involving anterior cingulate gyrus, dorsolateral prefrontal cortex	Rightprefrontal cortex, norepinephrine pathways arising in locus coeruleus to act upon the posterior attention system

Figure 3: Outline of the Posner network model of attention (Posner & Peterson, 1990).

1.2.3.a. Orienting network: developmental course and association with psychopathological symptoms

The different attentional networks mature at different rates, with the orienting network being the first to reach maturity. The orienting network is automatically (i.e. outside conscious awareness) activated to varying degrees by sensory input which has an abrupt onset or is associated with a currently-held goal (Pashler, Johnston & Ruthruff, 2001). Children's ability to shift their attention to a cue is observed very soon after birth (Rueda, Posner & Rothbart, 2004), tends to improve up to the age of 6, and then remains stable until adulthood. The speed at which individuals can disengage from a cued location continues to increase with age to adulthood (Rueda, Fan *et al.*, 2004; Akhtar & Enns, 1989).

There is some evidence associating the operation of the orienting network with selected psychopathological symptoms. Associations have been observed between the efficiency of the orienting network and autistic spectrum disorder: individuals with diagnoses of autistic spectrum disorder take longer to disengage from one visual stimulus to orient to another (Akshoomoff, Pierce & Courchesne, 2002). Whilst individuals with anxiety disorders have been shown to orient more quickly toward threatening than toward neutral stimuli, this is thought to be due to bias within the executive control, rather than the orienting network (Garner, Mogg & Bradley, 2006; Eysenck & Derackshan, 2007). The orienting responses of individuals with clinical diagnoses of depression or attention deficit hyperactivity disorder do not differ from those of matched, healthy individuals (Pardo, Pardo, Humes & Posner, 2006; Mullane, Corkum, Klein, McLaughlin & Lawrence, 2011), whereas the orienting responses of individuals with diagnoses of schizophrenia are significantly different to those of controls (Bernstein *et al.*, 1998). Evidence therefore suggests that the efficiency of the orienting network is associated with certain

psychopathological symptoms but not others. The operation of the orienting network is not proven to be generalisable as a risk or protective factor for or against psychopathological disorder.

1.2.3.b. Alerting network: developmental course, association with psychopathological symptoms and implications for intervention

The function of the alerting network is ‘to prepare and sustain alertness to process high priority signals’ (Posner & Petersen, 1990, p.35). It is indexed by changes of skin conductivity or heart rate in response to warning signals, or by measures of sustained attention such as continuous performance tasks which ask participants to respond to rare targets amongst a long series of distractors. Lin, Hsiao & Chen (1999) observed a positive, quadratic relationship between age and performance on a continuous performance task, such that the gradient of the convex curve flattened out considerably from age 12 onwards. It seems that accuracy on sustained attention tasks improves significantly between the ages of 6 and 10, plateaus between 10 and 14, before improving again (more slowly) from ages 14-15 onwards, with improvements in response speed following a slightly later developmental course (Betts, McKay, Maruff & Anderson, 2006; Manly *et al.*, 2001; Rebok *et al.*, 1997).

There are differences between the performance of children and adults on tests of sustained attention which may be linked to differences in the management of arousal levels (Robertson & Garavan, 2004). Typically, adults perform more poorly (i.e. respond more slowly, miss more targets, or show a faster decline in performance over time on task) when event rate is higher, i.e. when distractors and/or targets are presented more quickly (Parasuraman, 1979). Children, however, tend to perform better in such conditions (Rose, Bennett-Murphy, Schickedantz & Tucci, 2001). There is a close relationship between sustained attention and cortical arousal, such that the two concepts are often treated as one (but see Sarter, Givens & Bruno, 2001; Robertson & Garavan, 2004 for a more refined conceptualisation of arousal). Increasing the speed of presentation of sensory events typically increases cortical arousal levels (Robertson & Garavan, 2004). The relationship between cortical arousal and cognitive performance is an inverted U-shape, such that any task will have an optimal level of arousal above and below which performance will decline (Yerkes & Dodson, 1908). The current author hypothesises that the

improved performance of children on tasks with a high event rate is a result of an increase in cortical arousal towards more optimum levels for task performance, whereas the optimum arousal level in adults is lower, and therefore increased arousal causes a decline in cognitive performance.

Externally-induced levels of arousal can be used to improve sustained attention performance. Adults whose performance on a sustained attention task had been reduced by experimental manipulation of neurotransmitter levels performed significantly better when they were exposed to loud white noise whilst performing the task (Smith & Nutt, 1996). This finding suggests that the presence of the white noise increased participants' arousal from sub-optimal levels. There is also evidence that a small number of individuals perform better on attention tasks when asked to perform two tasks simultaneously than the same tasks one at a time (Robertson, Ward, Ridgeway & Nimmo-Smith, 1994; Willie, 2007). It is hypothesised that, when internal activation of cognitive arousal is sub-optimal, the second task provides bottom-up stimulation that enables a higher level of performance.

The capacity to sustain attention has been shown to be impaired in a wide range of psychopathological disorders, including schizophrenia, anti-social personality disorder, borderline personality disorder, attention deficit hyperactivity disorder, post-traumatic stress disorder, depression and the anxiety disorders (Gillig & Sanders, 2011; Muris, der Pennen *et al.*, 2008). Longitudinal studies have demonstrated that in groups of children and young people at risk of psychopathological disorder, a greater capacity to sustain attention acts as a protective factor against psychopathological outcomes including delinquency, personality disorder and drug use (Ayduk *et al.*, 2008; Loeber, Pardini, Stouthamer-Loeber, & Raine, 2007).

Some studies have suggested that, besides medication, targeted training can improve the capacity of individuals with attention difficulties to sustain their attention (Semrud-Clikeman *et al.*, 1999), but others have failed to observe improvements (Sturm & Willmes, 1991; Sohlberg *et al.*, 2000). Six months of twice-weekly practice, goal-setting and performance feedback improved the performance of children with diagnoses of ADHD aged 8 to 12 years on sustained attention tasks significantly more than the performance of their typically-developing peers improved over the same period without intervention. However, even in an intervention of this intensity, the

children's performance did not reach that of their peers, and no information is given as to whether the improvement generalised into classroom performance (Semrud-Clikeman *et al.*, 1999).

Significant difficulties in sustaining attention constitute a risk factor for later psychopathological disorder which should be taken into account when selecting children for intervention. Evidence has been presented that suggests nurturing the capacity to sustain attention may contribute to the reduction of psychopathological symptoms in children and young people. Further, the reported characteristics of sustained attention generate hypotheses for environmental manipulation and intervention for children and young people with atypical attentional profiles. Since the capacity to sustain attention has been shown to be affected by arousal levels, which in turn are affected by event presentation rate, it seems likely that the performance of children and young people who have difficulty sustaining attention may be improved by increasing background levels of stimulation or the speed of presentation of tasks. Whilst the efficacy of these interventions has been demonstrated in adults, no research available to the author has tested them with children with attention difficulties.

1.3. Association between reconstitution and psychopathological symptoms

Reconstitution is generally operationalised as fluency of speech or action. In support of his inclusion of this construct in the model, Barkley cites studies which suggest that verbal fluency is impaired in children with ADHD relative to controls, a difference that is more reliably observed when complex, task-focussed discourse rather than simple word generation is measured (Barkley, 1997, p.83). However, other studies have not observed a consistent relationship between verbal or behavioural fluency and ADHD symptoms. Boykin (2001) observed a relationship between reconstitution and parent perception of adaptability, but Sarkari (2003) observed that performance on neither design fluency nor verbal fluency tests discriminated between children with ADHD and a control group.

Fluency does, however, seem to be consistently impaired for other groups with clinical diagnoses. Both verbal and non-verbal fluency have been shown to be significantly impaired in adults with depression when compared with non-depressed controls (Henry & Crawford, 2005; Videbech *et al.*, 2003), and the degree of impairment has been associated with the degree of severity of symptoms (Gohier *et al.*, 2009). Adolescents with schizophrenia have poorer verbal fluency than typically developing controls (Landro & Ueland, 2008) and an impairment has been observed in the behavioural fluency of adults with schizophrenia relative to controls (Delevoye-Turrell, Giersch, Wing & Danion, 2007). Individuals' verbal fluency was significantly related to how much their anxiety increased under stress, although it was not associated with their state anxiety at baseline (Larsson, Michel, Backstrom & Johanson, 2007). This latter study provides some evidence of causal direction, suggesting that poorer fluency rates may predict increased vulnerability to emotional responses, rather than the converse. High trait anxiety has been associated with slower, more effortful responses in working memory tasks, which might reflect an association between anxiety and reconstitution (Eysenck & Derackshan, 2011; Hadwin, Brogan & Stevenson, 2005). Whilst existing evidence has therefore not supported the hypothesised relationship between reconstitution and the sub-group of psychopathological symptoms which relate to ADHD, there does seem to be a relationship between verbal and/or behavioural fluency and symptoms of anxiety, depression and schizophrenia. There is a need for further research to explore whether there is a reliable association between reconstitution and a range of psychopathological symptoms.

1.4. Association between working memory, internalisation of controls and psychopathological symptoms

Barkley argued that working memory capacity was related to goal-directed behaviour because the processes of re-seeing and re-hearing past experiences 'generate an internal stream of information that is then used to guide behavior across time toward a goal' (Barkley, 2006, p.307); he later explicitly labels this construct 'non verbal working memory'. The evidence that Barkley originally quoted to support his hypothesis was research demonstrating that children with ADHD performed more poorly than typically-developing peers on tasks involving recalling spoken number series (the digit span task) and remembering sequences of spatial locations

(Barkley, 1997). In the updated model (Barkley, 2006), Barkley subtitles the internalisation of controls construct 'Verbal working memory', linking it explicitly to the theories of Vygotsky (1978) and Skinner (1953) about the role of internal speech in the development of self-control. Barkley draws parallels between his construct and the phonological loop of the Baddeley (1986) model of working memory.

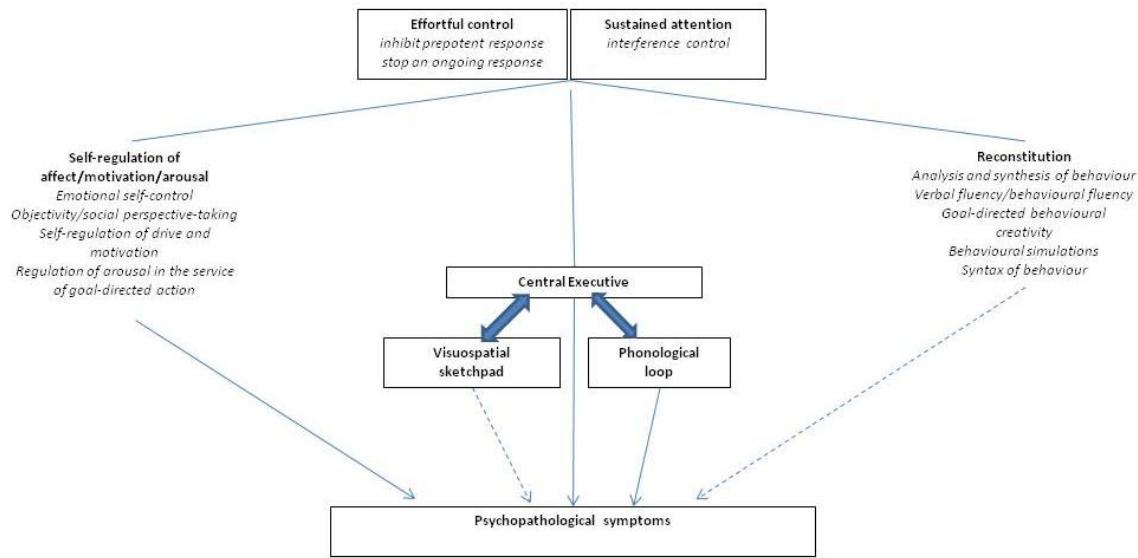


Figure 4: Proposed revision of the Barkley (1997) model showing replacement of Working Memory and Internalisation of Controls constructs with Baddeley (1986) model of working memory.

Some confusion between these two constructs arises from the fact that the digit span task, which Barkley associates with non-verbal memory, is generally considered a measure of the capacity of the phonological loop, otherwise known as verbal short term memory (Baddeley, 2001). Replacing Barkley's constructs of working memory and internalisation of controls with Baddeley's (1986) working memory model (as illustrated in Figure 4) might both enable a more precise and consistent specification of the constructs, and facilitate the synthesis of a range of existing research findings into the Barkley model.

The Baddeley (1986) model conceptualises working memory as having three components: the visuospatial sketchpad for the short term recall of visuospatial information, the phonological loop for the short term recall of verbal information, and the central executive, involved in the

manipulation of information held in mind. Evidence for the pathways predicted by Barkley will therefore be considered in terms of these three components.

1.4.1. Association between the phonological loop, visuospatial sketchpad, and psychopathological symptoms

There is evidence that groups of children with diagnoses of ADHD are impaired on measures of working memory compared to controls, that there is a continuous association between working memory levels and ADHD symptoms, and that the strength of the relationship increases with increasing age through childhood. Sarkari (2003) observed that measures of the phonological loop (measured using the digit span task) differentiated between children with diagnoses of ADHD and typically-developing controls. Whilst Tillman *et al.* (2011) observed significant negative correlations between measures of both verbal and visuospatial working memory and symptoms of inattention and hyperactivity, short-term visuospatial memory was associated only with symptoms of inattention, and not hyperactivity. Visuospatial working memory reflects the joint functioning of the visuospatial sketchpad and the central executive, and verbal working memory the functioning of the phonological loop together with the central executive. The Tillman *et al.* (2011) result therefore suggests that the phonological loop and the central executive, but not the visuospatial sketchpad, are associated with symptoms of hyperactivity.

There is evidence that age interacts with working memory in predicting symptoms of ADHD. Sonuga Barke, Daley, Daley & Remington (2002) found that measures of working memory were not associated with ADHD symptoms in a heterogeneous sample of pre-school children. However, Tillman *et al.* (2011) observed an interaction between age and working memory in predicting symptoms of ADHD, with the relationship being stronger in older children. So it could be that ADHD symptoms are only associated with working memory capacity in children of school age or above. The implication of this finding is that ADHD symptoms might constrain the development of working memory, rather than the converse. There is scope for further research to explore whether a direction of causality can be ascertained in this relationship.

There are mixed findings in the research about the extent to which measures of short term memory (visuospatial sketchpad and phonological loop) are associated with symptoms of anxiety and depression. An association was observed between trait anxiety and verbal, but not visuospatial, memory by Owens, Stevenson, Norgate & Hadwin (2008). In a contrasting finding, increases in state anxiety were associated with reductions in visuospatial, but not verbal, memory by Shackman *et al.* (2006). Christopher & MacDonald (2005) observed that groups of clinically depressed and anxious patients were significantly impaired on measures of phonological loop, visuospatial sketch pad, and central executive functioning compared to a non-clinical control group, whereas Gruber, Zilles, Kennel, Gruber & Falkai (2011) observed patients with a major depressive disorder to be significantly impaired on measures of verbal, but not visuospatial memory compared to non-clinical controls. It therefore appears that symptoms of anxiety and depression are reliably associated with reductions to the capacity of the phonological loop, but the relationship with the visuospatial sketchpad remains to be proven.

There is evidence for the association of working memory capacity with a range of other psychopathological symptoms. Measures of both verbal and visuospatial memory consistently differentiate between children and adolescents with diagnoses of schizophrenia and typically developing controls (Landro & Ueland, 2008; Quee, Eling, Heijden & Hildebrandt, 2011; White, Hongwanishkul & Marcus, 2011; White, Schmidt & Calhoun, 2011). Measures of phonological loop and the central executive were associated with symptoms of personality disorder in a non-clinical sample (Coolidge, Segal, Applequist, 2009). Performance on a spatial ordering task (a combined measure of the visuo-spatial sketchpad and the central executive), was associated with cigarette and alcohol use in a sample of adolescents (Grenard *et al.*, 2008): better performance on the working memory task was associated with lower consumption of cigarettes and alcohol.

There therefore appears to be reliable evidence associating a range of psychopathological symptoms separately with phonological loop and central executive functioning, but the association with the visuospatial sketchpad is less clear-cut. There is a need for further research to clarify the hypothesised relationship between the visuospatial sketchpad and psychopathological symptoms, and to explore whether the associations between the capacity of the phonological loop and individual clinical diagnoses can be reliably generalised across a range of psychopathological symptoms.

1.4.2. Executive attention

Measures used to assess the functioning of the central executive in the Baddeley (1986) model of working memory largely overlap with those typically used to assess the functioning of the executive attention network in the Posner & Petersen (1990) model. The definitions of both constructs involve the allocation of attentional resources, management of conflict, and the scheduling of and switching between tasks. It is therefore suggested that the terms represent overlapping constructs, and in the following discussion they will be used interchangeably.

1.4.2.a. *Developmental course of executive attention*

The ability to resolve cognitive conflict starts to develop during the first year of life, when around the age of 12 months children become able successfully to perform Piaget's A not B task (retrieving a hidden object from a new, rather than an old location). During the third year, children are able to match pictures successfully regardless of spatial compatibility (whereas younger children tend to continue repeating a single response). The ability to play versions of the 'Simon Says' game (e.g. follow the instructions given by one puppet, but not those given by another) generally emerges around the age of four (Rueda, Fan *et al.*, 2004).

There are different opinions about when the executive control of attention reaches maturity. From the results of their Attention Network Test, Rueda, Posner & Rothbart (2004) suggest that executive attention remains generally stable after the age of 7, whereas Simonds *et al.* (2007) observed an improvement with age in performance on a measure of executive attention in a cross-sectional sample of 7 to 10-year-old children. Luna and Sweeney (2004) report a rapid decrease in the number of errors with age on the Stroop task, with adult levels of performance not being reached until around mid-adolescence. Brain imaging studies suggest major differences between adolescents and adults in the brain activity involved in completing executive control tasks, with the adolescents showing weaker activation over wider areas (Luna & Sweeney, 2004).

Some of the neural structures underlying the executive attention network undergo significant changes during adolescence. There is extensive synaptic reorganisation in the pre-frontal cortex which underlies the development of executive attention. Because of neural reorganisation, there are significant, temporary alterations in the balance between cortical and limbic dopamine systems, which result in dopamine input to the pre-frontal cortex increasing to levels higher than

those seen before or after (Cicchetti & Rogosch, 2002; Spear, 2000). Since decision making abilities are strongly associated with the prefrontal cortex, the increased susceptibility to dopamine release is thought likely to give rise to heightened reactions to stress, impairing judgement and increasing impulsivity (Arnsten & Shansky, 2004). This is consistent with the observations of increased prevalence of risk-taking behaviours, depression and panic disorders at adolescence (Pine 2004; Spear, 2000).

1.4.2.b. Association of executive attention with psychopathological symptoms

Atypical functioning in tasks believed to tap the central executive has been associated with aggression, attention deficit hyperactivity disorder, conduct disorder, oppositional defiant disorder, anti-social behaviours, schizophrenia, symptoms of anxiety, depression and behaviour problems in clinical and non-clinical samples (Ellis, Rothbart & Posner, 2004; Goodwin & Sher, 1992; Harting, Milich, Lynam & Martin, 2002; Muris, Mayer *et al.*, 2008; Posner & Rothbart, 2000; Seguin, Boulerice, Harden, Tremblay & Pihl, 1999).

Longitudinal associations have suggested that the atypical development of executive attention tends to precede, rather than follow, the experience of psychopathological symptoms: in children aged six to nine years, scores on the Stroop task were shown to predict the change over two years in externalising and internalising problem behaviours, with poorer performance associated with increasing problems (Riggs, Blair & Greenberg, 2003). Deficits in executive attention therefore appear to be a risk factor for the development of psychopathological symptoms.

1.4.2.c. Association of executive attention with sustained attention

Consistent with the revised Barkley model, executive attention appears to depend upon levels of sustained attention. Sustained attention levels before an intervention were shown to moderate the effectiveness of the intervention at improving executive control (Sohlberg *et al.*, 2000). This is consistent with neuro-imaging data which has shown that the alerting network is activated earlier in time than the executive network in response to sensory events (Sarter, Givens & Bruno, 2001).

1.4.2.d. Intervention

There is evidence that targeted training and environmental interventions can lead to improvements in the functioning of the executive network (Kerns *et al.*, 1999; Klingberg *et al.*,

2002; Semrud-Clikeman *et al.*, 1999). Short periods of attention training have been shown to be effective in improving the performance of 4 to 7-year-olds on executive tasks involving the resolution of conflict (Posner & Rothbart, 2005, 2009), and a specifically-designed curriculum was similarly effective at improving the performance of pre-schoolers on conflict tasks (Diamond, Barnett, Thomas & Munro, 2007). Thirty minutes' practice per day on working memory and Go-no-go tasks over six weeks was successful in improving the performance of 7 to 15-year olds on the unpractised Stroop task (Klingberg *et al.*, 2002), though it might be argued that this intervention developed more elements of the Barkley model than just that of executive attention. It has been speculated that it might be more difficult to improve the functioning of the executive network once brain networks are established after puberty, although training programmes with adolescents and young adults have been successful in improving executive attention after brain injury (Blakemore & Choudhury, 2006).

1.5. Association between self-regulation of affect/motivation/arousal and psychopathological symptoms

The final pathway of the Barkley model to be discussed is that from behavioural inhibition through 'self regulation of affect/motivation/arousal' to psychopathological symptoms. Researchers in the field of developmental psychopathology have primarily focussed on this pathway, proposing that deficits of effortful control impact upon an individual's ability to regulate their emotions, and hence their vulnerability to psychopathological symptoms (Eisenberg *et al.* 2001; Muris, Mayer *et al.*, 2008). Since the term 'self-regulation' is more generally taken to include the establishment of goals and engagement in goal-directed action (Baumeister & Vohs, 2003), which appear as separately-labelled constructs in the Barkley model, it is argued that current conceptualisations of 'emotion regulation' are closer than those of 'self-regulation' to Barkley's definition (see Barkley, 1997, p.80). This is the term that will therefore be used in the following discussion.

Empirical research has yielded an expanding body of evidence about how different patterns of emotion regulation and dysregulation act as risk or protective factors for later mental health outcomes (e.g. Beauchaine, Gatzke-Kopp & Mead, 2007; Crowell, Beauchaine & Linehan, 2009), and how to formulate interventions which are effective in reducing mental health difficulties

(Gratz & Gunderson, 2006; McMain, Korman & Dimeff, 2001). Recent research findings in the field have a range of implications for prevention and intervention strategies with children and young people.

1.5.1. Definitions

At its most basic level, emotion regulation is a process of decreasing, maintaining, or increasing emotion (Werner & Gross, 2009). Most definitions of emotion regulation refer to the self-management of emotions with the purpose of enabling goal-directed or pro-social behaviour (for reviews see Gross, 1998; Southam-Gerow & Kendall, 2002; Thompson & Calkins, 1996). The process can be internal to the individual, or an interaction between individuals, as when a mother soothes a baby by rocking and talking (Gross & Thompson, 2007). An increasing body of evidence suggests that internal processes of emotion regulation are learned from early interactions with caregivers (Kopp, 1989; Sunderland, 2006).

In order to generate clinically useful research, operationalisations of emotion regulation have gone beyond this basic definition to incorporate hypotheses about what constitutes adaptive regulation. Early definitions assumed a common social context and understanding (e.g. “the ability to respond to the ongoing demands of experience with the range of emotions in a manner that is socially tolerable” (Cole, Michel & Teti, 1994, p. 76)). More recent definitions overcome these context-bound assumptions by suggesting that successful emotion regulation involves the ability to modify internal emotional responses to enable flexible, goal-directed action and engagement with the environment (Shields & Cicchetti, 1997; Gross, 1998; Gratz & Roemer, 2004).

The associated construct of emotion dysregulation represents habitual difficulty controlling behaviour and accomplishing tasks in the face of emotional distress, often associated with underlying beliefs that nothing can be done to regulate distressing emotions (Gratz & Roemer, 2004). Paradoxically, states of emotion dysregulation generally arise when strategies employed to regulate or avoid emotions are counter-productive, leading to an escalating cycle of increasing arousal and negative affect (Beauchaine *et al.*, 2007).

1.5.2. Dimensions of emotion regulation and dysregulation

The fact that, in some circumstances, attempts to control behaviour can result in increased emotion dysregulation highlights the difference between regulation and control. When individuals are asked to control behavioural displays of emotion, for example whilst watching amusing or distressing films, their physiological arousal levels are typically higher – implying increased emotion - than if not asked to control their behaviour (Gross & Levenson, 1997). In order to distinguish between regulation and control, one body of research has emphasised the understanding and acceptance of emotions within its definition of emotion regulation, and a questionnaire based on this approach has demonstrated high validity and reliability (Gratz & Roemer, 2004).

There are differences between the regulation of positive and negative emotion. In the above study, suppression of emotionally responsive behaviour resulted in participants reporting less enjoyment of an amusing film, but no less distress in response to a sad film (Gross & Levenson, 1997). This suggests that the suppressing of emotional display may affect the subjective experience of positive and negative emotions differently.

As well as differences between the regulation of negative and positive emotion, neuro-imaging findings have suggested that there are significant differences between the up- and down-regulation of emotion. Ochsner *et al.* (2004) employed brain imaging techniques whilst manipulating emotion regulation by asking adult participants to adopt different cognitive reappraisal strategies when observing neutral or aversive images. Whilst largely common brain areas were activated by the reappraisal process, increasing negative emotion was associated with broader, left-hemisphere activation of the cingulate cortex, and reducing negative emotion with specific, right-hemisphere activation of the orbito-frontal cortex. Experimental participants reported using greater mental effort when reducing negative emotion than when increasing it. Since the participants in this study were exclusively female, more research is needed to know whether these findings can be generalised to males. However, if generalisable, these findings suggest that using cognitive reappraisal to reduce negative emotion is perceived as a more effortful process than using the same technique to increase negative emotion, and that there are differences in the brain networks involved in the two processes.

1.5.3. Developmental course

In intervening to help infants and young children manage and talk about distress, caregivers support the early development of children's emotion regulation (Waters *et al.*, 2010). In less child-oriented environments, such as those of abuse, neglect or parental mental illness, children are more likely to develop dysregulated patterns of responding to emotion (Maughan & Cicchetti, 2002; Thompson & Calkins, 1996).

Over the first 5 years of life, the range and number of emotion regulation strategies that children attempt increases (Grodnick, Bridges & Connell, 1996; Mangelsdorf, Shapiro & Marzolf, 1995; Stansbury & Sigman, 2000). Evidence from self- and other-reports suggests there is little change in the effectiveness of emotion regulation strategies between the ages of 6 and 12 (Shields & Cicchetti, 1997), although from 6 onwards the awareness and appraisal of emotion appear to become more significant aspects of the emotion regulation process (Suveg, Payne, Thomassin & Jacob, 2010). Adolescents experience more frequent and intense emotions than younger or older individuals (Larson & Lampman-Petraitis, 1989), and there appears to be a drop in self-reported emotion regulation skills with the onset of puberty (MacDermott, Gullone, Allen, King, & Tonge, 2010).

Although outside the scope of this review, family and social factors, whilst most influential during the first 5 years of life, continue to impact upon patterns of emotion regulation/dysregulation throughout childhood, adolescence and beyond (Shipman, Edwards, Brown, Swisher, & Jennings, 2005; Adrian *et al.*, 2009).

1.5.4. Association of emotion regulation and dysregulation with psychopathological symptoms

Problems with emotion regulation characterise 75% of the clinical disorders listed in the primary psychiatric diagnostic manual (APA, 2000; see Werner & Gross, 2009). It has repeatedly been suggested that central to the management of psychopathology is an understanding of the emotion-regulatory function associated with problem behaviours (Abramowicz & Berenbaum, 2007; Calkins, 2010; Cappadocia, Desrocher, Pepler & Schroeder, 2009; Hayes *et al.*, 1996; Blackledge & Hayes, 2001). In a clinical sample of adolescents, the psychopathological diagnoses

of two-thirds of the sample could be accurately predicted based on emotion dysregulation variables alone (Adrian *et al.*, 2009).

The association of emotion dysregulation with symptoms of psychopathology has been demonstrated within both disordered and normative samples of adolescents and young adults. Difficulties with emotion regulation have been associated with depression and anxiety, likelihood and frequency of self-harm, suicidal ideation, eating disorders, alcohol and substance abuse, aggression, delinquency, conduct disorder and oppositional defiant disorder (Bjarehed & Lundh, 2008; Gratz, 2006; Gratz & Roemer, 2008; Klein, Torpey & Bufferd, 2008; Weems & Silverman, 2008; Weinberg & Klonsky, 2009; Vasilev *et al.*, 2009). The more difficulties adolescents report in regulating their negative emotions, the more aggressive and delinquent behaviours, depression, social and attention problems they report. Similar results are generally achieved when parental reports, rather than self-reports of psychopathological symptoms are used, but the correlations observed are slightly weaker (Adrian *et al.*, 2009).

It has been suggested that viewing behaviours associated with psychopathological symptoms as attempts to manage painful and unwanted thoughts and feelings is likely to generate useful guidelines for treatment (Blackledge & Hayes, 2001; Gratz, 2006; Hayes *et al.*, 1996). That the self-management of emotion can be a motivating factor for drug use and aggressive behaviour has been empirically demonstrated. Adolescent cannabis users attending a treatment clinic, asked about their motivations for drug use, cited the achievement of a feeling of detachment, relaxation and reduction of anxiety, and euphoria as their three primary aims (Dorard, Berthoz, Phan, Corcos & Bungener, 2008), all of which clearly relate to the modification of emotional experience. In an experimental situation, young adults who believed that the expression of anger would make them feel better were significantly more aggressive toward an imaginary critical peer than participants who did not hold such beliefs, suggesting that their behaviour was to some degree motivated by a desire to regulate emotion (Bushman, Baumeister & Phillips, 2001).

In an attempt to find objective measures of emotion regulation, different physiological indices have been considered, including heart rate, breathing rate, skin conductance and the inter-beat variability of heart rate (respiratory sinus arrhythmia) (Beauchaine, Katkin, Strassberg & Snarr,

2001; Greaves-Lord *et al.*, 2010; Gross & Levenson, 1997). Of these, the latter has to date yielded the most reliable results (Beauchaine *et al.*, 2007).

Respiratory sinus arrhythmia (RSA) describes the subtle autonomic adjustment of the intervals between heart beats, coordinating the flow of blood into and out of the heart with the respiratory cycle such that blood moves more slowly through the lungs during the in-breath, and more quickly during the out-breath. RSA is controlled by the parasympathetic nervous system, and high RSA reflects the heart & respiratory cycles working together at optimum efficiency (Porges, Doussard-Roosevelt & Maiti, 1994; Porges, 2007). When under stress or pressure, the action of the sympathetic nervous system dominates over that of the parasympathetic system, and the intervals between heart beats become equal in what is described as vagal or RSA withdrawal.

Although some studies have reported direct relationships between psychopathological symptoms and baseline RSA, others have failed to replicate such associations (Vasilev *et al.*, 2009; Santucci *et al.*, 2008). It seems possible that associations between baseline RSA and psychopathological symptoms vary with age across childhood (Beauchaine *et al.*, 2007; Vasilev *et al.*, 2009). However, throughout childhood and adolescence, it appears that emotion dysregulation and psychopathological symptoms are reliably associated with *change* in RSA, such that (counterintuitively) larger changes in RSA in response to emotion-provoking stimuli, and a quicker return to baseline, are associated with more effective emotion regulation and fewer psychopathological symptoms. Children's emotion dysregulation was associated with a slower return of RSA to baseline after frustration in a sample of 4 to 7-year-olds (Santucci *et al.*, 2008). A larger change in RSA while watching a sad film was associated with fewer depressive symptoms in a normative sample of 5 to 13-year-olds (Gentzler, Santucci, Kovacs & Fox, 2009). Similarly, significant associations between RSA change, self-reports of emotion regulation, and parental reports of psychopathological symptoms (depression, anxiety, conduct problems) was observed in 8 to 12-year-olds by Vasilev *et al.*, (2009). RSA responsivity appears to index emotion regulation even for pre-school children: Hastings *et al.* (2008) found that the difference between 2 to 4-year-old childrens' RSA at rest at home and in a social situation with two other unknown children was positively correlated with maternal reports of their difficulties in self-regulation, internalising and externalising problems.

There is evidence to suggest that RSA reactivity may be a useful indicator of later psychopathological outcomes: in separate longitudinal studies of (a) 2-year-olds and (b) 10 to 15-year-olds, lower RSA reactivity significantly predicted (a) behaviour problems and (b) anxiety levels 2 years later (Greaves-Lord *et al.*, 2010; Calkins & Keane, 2009). Further, an intervention which used a biofeedback programme for adult participants with substance use disorder found that the programme was both successful in increasing RSA reactivity, and in bringing about clinically-significant reductions in symptoms of depression, post-traumatic stress disorder and insomnia (Zucker, Samuelson, Muench, Greenberg & Gevirtz, 2005).

The rate and extent of RSA change between rest and emotionally-charged situations appears to be a risk factor for the development of psychopathological symptoms. Therefore measurements of RSA change could contribute to the assessment of children at risk of later psychopathological disorder, in order to highlight those most likely to benefit from targeted intervention. The evidence reported above also suggests that direct intervention to increase RSA reactivity may reduce the severity of psychopathological symptoms (Zucker *et al.*, 2005), although to the author's knowledge the effectiveness of this intervention with young people has not yet been established.

Emotion dysregulation has been consistently associated with psychopathological symptoms in both clinical and normative samples (Gentzler *et al.*, 2009; Adrian *et al.*, 2009; MacDermott *et al.*, 2010; Newhill, Mulvey & Pilkonis, 2004), and has been shown to act as a mediating variable between early life experiences and later outcomes, e.g. in the relationship between early maltreatment and anxiety and depression (Maughan & Cicchetti, 2002). Maughan & Cicchetti (2002) classified 4 to 6-year-old children who demonstrated strong and prolonged emotional display in a threatening situation as emotionally dysregulated, and those displaying less negative affect and more problem-solving strategies as emotionally regulated. These observations were compared to maternal reports of symptoms of anxiety, depression, aggression and delinquent behaviour: the more dysregulation children displayed, the more psychopathological symptoms they displayed according to maternal report.

However, whilst questionnaire measures appear to confirm the hypothesis that emotion dysregulation is a risk factor for the development of psychopathological symptoms, they yield

more ambiguous results about whether effective emotion regulation strategies offer protection against the development of psychopathological symptoms. Emotion regulation is observed to have a significant, negative association with psychopathological symptoms in some studies (e.g. MacDermott *et al.*, 2010; Newhill *et al.*, 2004), but not others (e.g. Gentzler *et al.*, 2009; Silk *et al.*, 2003). Negative thinking and rumination have been shown to increase negative affect, and therefore (depending on the context) might be viewed as ineffective emotion regulation strategies, whilst distraction and positive thinking have been shown to decrease negative affect (Gross, 1998; Nolen-Hoeksema, McBride & Larson, 1997; Silk, Steinberg & Morris, 2007). Whilst significant positive correlations were observed between the frequency of self-harm and tendency to rumination in a community sample of 14 year-olds, no significant correlation was observed between self-harm and distraction or positive thinking (Bjarehed & Lundh, 2008). By contrast, in a study of young adults, a negative correlation was observed between the use of cognitive reappraisal as an emotion regulation strategy and depressive symptoms: the more participants reported using cognitive reappraisal, the fewer depressive symptoms they reported (Gross & John, 2003). It may be that cognitive reappraisal is more protective than distraction or positive thinking against psychopathological symptoms because it demands both effortful control (i.e. the control of attention and inhibition of impulsive responding) and clarity about goals. Or it could be that the age difference between the samples is relevant to the study outcomes: that the uses of distraction, positive thinking and cognitive reappraisal as emotion regulation strategies are more effective for young adults than adolescents. Alternatively, it could be that some studies fail to find a protective effect of emotion regulation strategies because effect sizes are small and so there is insufficient power to detect the relationship. A meta-analysis of studies which evaluated the relationship between different styles of emotion regulation and psychopathological disorders observed medium to large effect sizes for the maladaptive strategies of suppression, rumination and avoidance, and small to medium effect sizes for the adaptive strategies of reappraisal, problem-solving, distraction and acceptance (Aldao, Nolen-Hoeksema & Schweizer, 2010).

1.5.5. Intervention

Interventions to support the development of effective emotion regulation strategies amongst adults have reported some success, although the process has been long, slow and treatment-

intensive (Gratz & Gunderson, 2006; McMain, Korman & Dimeff, 2001). Cognitive-behavioural interventions which incorporate the cultivation of awareness and acceptance of emotions have reported success in the reduction of problem behaviours and depressive symptoms in children with special educational needs, in the treatment of adolescent anxiety, and, to a lesser degree, anger (Greenberg, Kusche, Cook & Quammer, 1995; Podell & Kendall, 2011; Humphrey & Brooks, 2006). However, other group- or class-based interventions focussing on the development of emotion regulation skills in adolescents have reported high attrition rates and/or unsuccessful outcomes (Humphrey, Curran, Morris, Farrell, & Woods, 2007; Schuppert *et al.*, 2009) and it is clear that there is a considerable 'caught' rather than 'taught' element to the development of emotion regulation (Weare & Gray, 2003). Since emotion regulation skills are generally developed in the context of secure attachment relationships (Humphrey *et al.*, 2007), improving the mental health of children and young people on a broad scale is likely to involve both improving their ability to form secure relationships with the adults around them, and supporting those adults in modelling effective emotion regulation skills (Bennathan, 1997).

Since emotion dysregulation is reliably found to be a risk factor for the development of psychopathological symptoms, but effective emotion regulation and/or coping strategies may not reliably provide a protective influence (Aldao *et al.*, 2010), strategies aiming to decrease psychopathological symptoms might be better targeted at individuals at risk of emotion dysregulation than at attempting to increase the emotion regulation skills of a general population. In order to identify children and young people most likely to benefit from intervention, the current author suggests that priority for support be given to those with high scores on measures of unhelpful strategies, i.e. suppression, rumination and avoidance, rather than low scores on measures of helpful strategies, i.e. reappraisal, problem-solving, distraction and acceptance.

1.6. Proposed revision of Barkley model

This review has suggested that refinements to the Barkley model of self-regulation, as illustrated in figure 5, might facilitate more consistent operationalisation of its constructs and clearer integration of the model with other bodies of research. It has argued that altering Barkley's outcome variable from 'Motor control/fluency/syntax' to 'Psychopathological symptoms' is both consistent with Barkley's definition of his model as a conceptualisation of self-regulation, and likely to facilitate cross-diagnostic research into mental health and illness. It has suggested

that Barkley's construct of 'Behavioural inhibition' might be more precisely specified as incorporating both 'Effortful control' and 'Sustained attention', (the latter reflecting the operation of the alerting network of the Posner & Petersen (1990) model of attention).

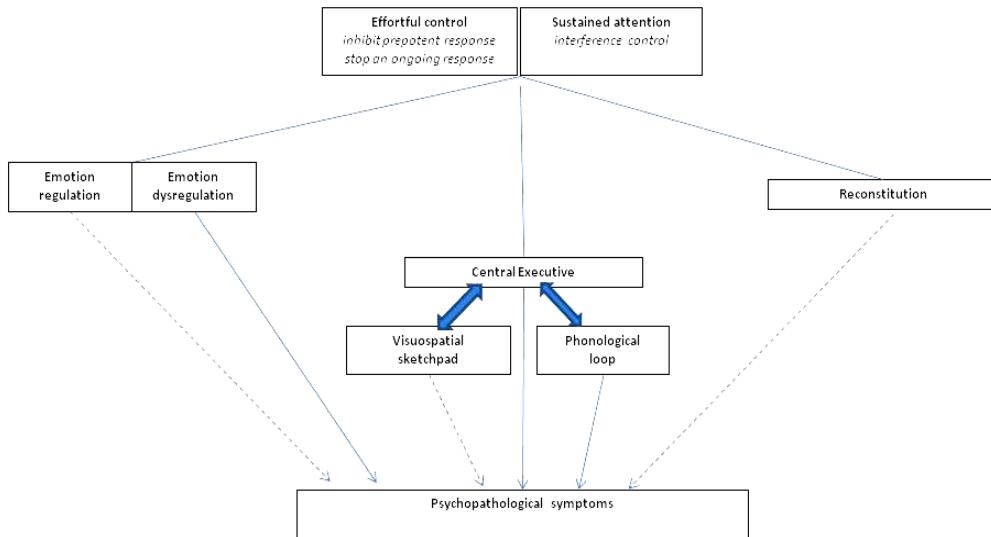


Figure 5: Model of self-regulation, derived from Barkley (1997).

The empirical evidence reviewed supported the hypothesised relationship between effortful control, sustained attention and psychopathological symptoms, but did not unambiguously support a relationship between reconstitution and psychopathological symptoms.

The current review argued that Barkley's constructs of Working memory and Internalisation of controls might be more usefully replaced by the Baddeley model of working memory, replacing Barkley's 'Working memory' with Baddeley's 'Visuospatial sketchpad', Barkley's 'Internalisation of controls' with Baddeley's 'Phonological loop', and introducing Baddeley's concept of a 'Central executive' (the latter reflecting the operation of the executive control network of the Posner and Petersen (1990) model of attention). The evidence reviewed supported a relationship between the central executive, the phonological loop and psychopathological symptoms, but not between the visuospatial sketchpad and psychopathological symptoms.

Finally, the review has suggested that Barkley's 'Self-regulation of affect/motivation/arousal' might usefully be replaced by the constructs of emotion regulation and dysregulation. The

evidence reviewed supported a positive relationship between emotion dysregulation and psychopathological symptoms, but the hypothesised negative relationship between emotion regulation and psychopathological symptoms was not clearly supported.

1.7. Conclusion and implications for practice

Following Barkley's (1997) model of Attention deficit hyperactivity disorder, empirical evidence has been reviewed that suggests that levels of sustained attention, effortful control, emotion dysregulation and short-term verbal memory affect the likelihood of children and young people experiencing mental health difficulties.

It has been shown that, whilst emotion dysregulation is a risk factor for the development of psychopathological symptoms, effective emotion regulation is not necessarily a protective influence. Evidence has been reviewed which shows that children and young people at greatest risk of developing psychopathological symptoms are those who often use unhelpful strategies of emotion regulation such as suppression, rumination and avoidance, rather than those who rarely use helpful strategies such as reappraisal, problem-solving, distraction and acceptance. Therefore it has been argued that strategies to improve mental health would be more productively targeted at individuals at risk of emotion dysregulation than at increasing the emotion regulation skills of a general population.

The existing evidence suggests that a strategic, psychological approach to reduce the prevalence of mental health difficulties in children and young people might involve general curricula in schools which cultivate pupils' attentional skills (as per Diamond *et al.*, 2007), and nurturing interventions specifically targeted at children and young people identified as at risk of, or demonstrating, emotion dysregulation (Bennathan, 1997). There is a need for further research to unpick the direction and degree of interaction between the regulation of emotion and attention, in order to clarify when intervention for an individual is best targeted at processes of attentional regulation, emotion regulation, or both.

Evidence has been reviewed which shows that measurements of change of respiratory sinus arrhythmia (RSA) between rest and emotionally-charged situations could contribute reliably to the assessment of children at risk of later psychopathological disorder: those with least RSA

change are likely to benefit most from targeted intervention to reduce dysregulatory strategies for managing emotion. The current review has suggested that, since emotion regulation strategies are generally 'caught' rather than 'taught', improving the emotion regulation of children and young people is likely to involve increasing the availability of adults with whom children can form secure attachment relationships within which effective emotion regulation strategies can be modelled. There is a need for further empirical research to explore this hypothesis.

The current review hypothesised that the performance of children and young people who have difficulty sustaining attention may be improved by increasing background levels of stimulation (e.g. with background music) and assisting them to maintain task goals (e.g. by subvocal rehearsal or visual prompts), and that this in turn may lead to better mental health outcomes. There is a need for further research to explore this hypothesis.

Cross-diagnostic models are needed to clarify the relationships between risk and protective factors in mental health and illness, and thus to identify effective approaches to intervention. Applied psychology practitioners working with clients with multiple diagnoses need theoretical models which are both academically rigorous and clinically relevant. For such models to be developed, greater consistency will be needed in the definition and operationalisation of psychological constructs between researchers in the field to facilitate the synthesis of multiple conflicting and overlapping research findings. The current review has proposed such a model by extending the Barkley model of self-regulation to incorporate constructs from different psychological disciplines. There is now a need for research to test and refine the predictions made by this extended model.

Chapter 2: Does emotion dysregulation mediate the relationship between effortful control and psychopathological symptoms?

2.1. Introduction

2.1.1. Context of study

2.1.1.a. Adolescent psychopathology: prevalence and impact

The proportion of 15 to 16-year-olds with emotional or behavioural difficulties approximately doubled between 1974 and 2006 (Layard & Dunn, 2009). According to recent estimates, 13% of girls and 10% of boys aged 11 to 15 years in the UK suffer from mental health problems (Children's Society, 2009). For a significant proportion of young people, mental disorder in adolescence has more negative associations than physical illness with quality of life indicators including physical health, social relationships and quality of accommodation 17 years later (Chan, Lai & Robertson, 2006). In addition to the impact on individuals, mental health difficulties present a huge cost to society: in 2005, for example, doctors in England wrote 29 million prescriptions for anti-depressant drugs, costing over £400 million to the National Health Service (Layard & Dunn, 2009). In order to reverse this increasing trend, there is a need to increase our understanding of the underlying causes and developmental course of mental health problems.

2.1.1.b. Risk factors for psychopathology

A range of environmental factors has been associated with increased risk of mental health difficulties in children and young people, including marital conflict (Gharehbaghy, 2010), neighbourhood disadvantage (Ratchford & Beaver, 2009), early traumatic life experiences (Pine *et al.*, 2005), invalidating relationships with parents (Rubin, Burgess, Dwyer & Hastings, 2003), and urban environments (Jané *et al.*, 2006). The fact that not all children exposed to many of these risk factors go on to develop mental health problems raises the question which psychological factors increase risk of or resilience against mental health difficulties. Psychological factors which have been associated with increased psychopathological symptoms in adolescents include low self-esteem (Bos *et al.*, 2010), learning disabilities (Garaigordobil & Bernarás, 2009; Garaigordobil & Perez, 2007), low self-efficacy beliefs (Alinia, Borjali, Johmehri & Sohrabi,

2008), speech and language difficulties (Cohen, 2001; Cohen & Horodezky, 1998), and neuroticism (Muris & Ollendick, 2005).

Amongst psychological factors, low levels of effortful control and high levels of emotion dysregulation have been particularly associated with long term mental health difficulties. Children and young people who are low in effortful control are at greater risk of developing a range of psychopathological symptoms including behaviours associated with aggression, depression, anxiety and attention deficit hyperactivity disorder (Derryberry & Reed, 2002; Muris, Mayer *et al.*, 2008; Muris, Meesters & Rompelberg, 2006; Muris & Ollendick, 2005; Nigg, 2006; Verstraeten, Vasey, Claes & Bijttebier, 2010). Similarly, emotion dysregulation is a predominant factor in mental health difficulties, to the extent that difficulties with emotion regulation characterise most forms of psychopathology (Bradley, 2000; Calkins, 2010; Werner & Gross, 2009). Whilst the associations of effortful control and emotion dysregulation with psychopathological symptoms have been widely explored, far less is understood about the way these factors interact.

The nature of the interaction between effortful control and emotion dysregulation has direct implications for the way in which applied psychologists target interventions to reduce mental health difficulties. For example, reducing levels of emotion dysregulation might only reduce psychopathological symptoms for individuals with high levels of effortful control. If that were the case, then intervention to reduce psychopathological symptoms in individuals with low levels of effortful control might be most effectively targeted at increasing their effortful control, whereas for individuals with higher levels of effortful control, intervention would be more effectively targeted at reducing habits of emotion dysregulation. If the constructs are independent (which seems unlikely, Humphrey *et al.*, 2007) both might need to be targeted separately for intervention. Despite the need to understand the nature of the interaction between emotion dysregulation and effortful control, few theoretical models incorporate both constructs. One model which does so, and which has been influential in clinical practice (Berger *et al.*, 2007), is the model of self-regulation proposed by Barkley (1997).

2.1.2. Barkley model of self-regulation

In trying to explain the self-regulation difficulties of individuals with ADHD, Barkley proposed that the primary deficit in ADHD is in what he labelled 'behavioural inhibition': the capacity to withhold an automatic response, interrupt an ongoing response, and avoid distraction. He proposed that intact behavioural inhibition was necessary for four other executive functions – working memory, self-regulation of affect/motivation/arousal, internalisation of controls, and reconstitution – to operate. He argued that the joint operation of these four functions is necessary to enable an individual consciously to direct their behaviour over time and to respond creatively according to internally-held goals, rather than reacting automatically to the environment (Barkley, 1997). The complete model is shown as Figure 6. If empirical research could demonstrate that the Barkley model has cross-diagnostic validity, then the model could provide a theoretical framework from which a range of interventions could be derived and tested.

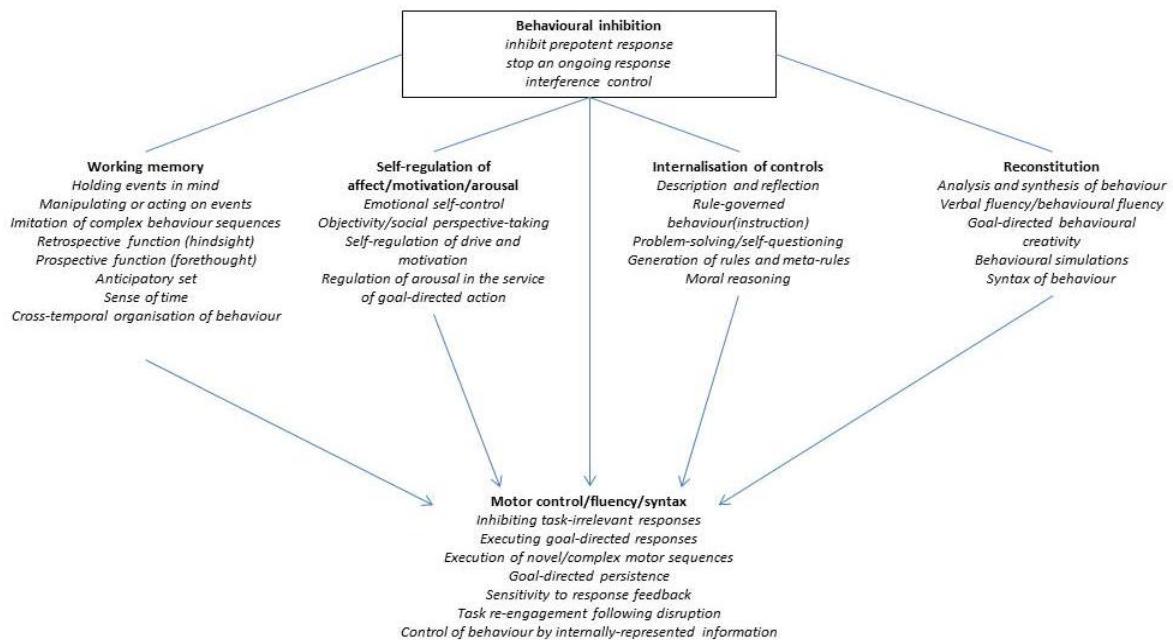


Figure 6: Barkley's model of executive functions, behavioural inhibition and motor control systems in ADHD. From Barkley (1997), p.73.

Empirical evidence for the direct pathways shown in the model has been reviewed elsewhere, as has the argument for the operationalisation of the motor control/fluency/syntax construct as psychopathological symptoms (Chapter 1). The weight of current evidence suggests that the pathway with the strongest influence on psychopathological symptoms is that from behavioural inhibition through self-regulation of affect/motivation/arousal to motor control/fluency/syntax. These constructs have been operationalised in different ways by different researchers.

Although behavioural inhibition is typically operationalised as Go-no-go, Stop signal, or Stroop tasks (Oosterlaan *et al.*, 1998; Schwartz & Verhaegen, 2008; Sonuga-Barke *et al.*, 2002), recent reviews have suggested that these tests provide generalised measures of cognitive & attentional processing, rather than specific measures of behavioural inhibition (Alderson, Rapport & Kofler, 2007; Schwartz & Verhaegen, 2008; van Mourik *et al.*, 2009). An alternative conceptualisation of the construct views it as a combination of effortful control and sustained attention (Barkley, 1997, pp. 67-68; Muris & Ollendick, 2005).

As described in section 2.1.1.b., effortful control has been repeatedly associated with vulnerability to or resilience against the proliferation of psychopathological symptoms in childhood and adolescence (Eisenberg *et al.*, 2010; Meesters *et al.*, 2007; Muris, 2006; Muris, Mayer *et al.*, 2008, Verstraeten *et al.*, 2010). Sustained attention has been less reliably associated with psychopathological symptoms. Muris, Mayer *et al.* (2008) failed to observe significant correlations between self-reports of psychopathological symptoms and scores on the Test of Everyday Attention for Children (TEA-Ch) in a community sample of 9 to 13 year-old children. The TEA-Ch is a standardised, neuropsychological test battery designed to measure children's ability to sustain, switch and divide their attention, so it could be that the researchers failed to find a significant relationship because an overall attention measure was used, rather than a specific measure of sustained attention. Verstraeten *et al.* (2010) similarly found no significant relationship between overall TEA-Ch scores and psychopathological symptoms in a community sample of 8 to 17-year-olds. When the Verstraeten *et al.* (2010) sample was divided into two age groups (mean ages 9.2 and 12.6 years), however, those subtests of the TEA-Ch designed to measure sustained attention correlated significantly with parental reports of psychopathological symptoms for the younger, but not for the older, age group. It could be that there is no relationship between sustained attention and psychopathological symptoms in the 11-16 age

group, but since a ceiling effect was observed in the TEA-Ch scores of the older group, there is a need for further research to test this hypothesis using appropriate measures of sustained attention.

As has been reviewed in Chapter 1, research has not consistently observed direct associations between emotion regulation and psychopathological symptoms. The related construct of emotion dysregulation has, however, been reliably associated with a range of psychopathological symptoms including aggression, delinquent behaviour and the avoidant and self-destructive behaviours associated with self-harm, eating disorders, depression and anxiety (Gentzler *et al.*, 2009; Adrian *et al.*, 2009; MacDermott *et al.*, 2010; Newhill *et al.*, 2004). This suggests a need for research to test the model with Barkley's 'Self-regulation of affect/motivation/arousal' construct operationalised as a measure of emotion dysregulation.

Figure 6 could predict a moderated relationship between behavioural inhibition, emotion dysregulation and psychopathological symptoms. It could also predict a mediated relationship, or a mixture of the two (Kraemer, Stice, Kazdin, Offord & Kupfer, 2001). If degrees of emotion dysregulation were only related to levels of psychopathological symptoms at certain levels of behavioural inhibition, behavioural inhibition would be said to moderate the relationship between emotion dysregulation and psychopathological symptoms. If, however, behavioural inhibition only affected psychopathological symptoms to the extent that it impacted upon emotion dysregulation, then emotion dysregulation would be said to mediate the relationship between behavioural inhibition and psychopathological symptoms (Baron & Kenny, 1986). What empirical evidence exists about the nature and direction of an interaction between these three constructs?

2.1.3. Evidence supporting the Barkley pathway

Longitudinal studies have contributed evidence supporting the direction of the relationship between behavioural inhibition, emotion regulation and psychopathological symptoms hypothesised by the Barkley model. Eisenberg and colleagues (Eisenberg *et al.*, 2004; Spinrad *et al.*, 2006) conducted a series of analyses using structural equation modelling on longitudinal data drawn from parent questionnaires completed two years apart, about children who were aged 4 to

8 at the start of the study. Their models found that effortful control significantly predicted both externalising and internalising problems two years later, but that the reverse relationship was non-significant. This result supports the assumption that problematic levels of effortful control confer vulnerability to psychopathological symptoms, rather than the converse. Similarly, in very young children, Kochanska *et al.*, (2000) observed that behavioural measures of effortful control at the age of 22 months significantly predicted approximately a third of the variance in observations of emotion regulation at the age of 33 months, suggesting that the development of effortful control precedes and is associated with that of emotion regulation. There is a need for further research to test whether similar longitudinal relationships can be observed in late childhood and adolescence.

Barkley hypothesises that a certain level of effortful control is necessary for effective emotion regulation to take place. This would imply a moderated relationship, although he uses only anecdotal evidence to support his hypothesis (Barkley, 1997). High levels of effortful control have been shown to reduce the impact of anxiety upon performance in young adults (Derryberry & Reed, 2002), which would support the moderation hypothesis.

Studies with children and young people, however, suggest a mediated relationship. In a longitudinal study with 6 to 8 year-olds, Eisenberg *et al.* (1995) found that both effortful control and emotion dysregulation significantly correlated with children's later behaviour. When all the study variables were entered into a regression equation, emotion dysregulation was the strongest predictor, suggesting that, for this sample, emotion dysregulation contributed more than effortful control to later behavioural outcomes. Muris, Mayer *et al.*, (2008) conducted a study with 50 children aged 9 to 13 years to assess whether young people's beliefs about their ability to manage their emotions mediated the relationship between effortful control and psychopathological symptoms. Emotional self-efficacy beliefs were found partly to mediate the relationships between effortful control and psychopathological symptoms (Muris, Mayer *et al.*, 2008).

2.1.4. Aims and objectives of the current study

The current study aims to test whether predictions of the Barkley (1997) model of self-regulation, using psychopathological symptoms as the outcome variable, have cross-diagnostic validity in adolescents.

It is assumed that psychopathological symptoms are normally distributed in the population, and at their most extreme or frequent are classified as mental health difficulties (Goodman, 1997; Achenbach, 1991). The study assumes that individuals with diagnoses of psychological disorder differ only from those without such diagnoses by the number of psychopathological symptoms they report; the generalisability of the model will therefore be tested by using a mixed clinical/non clinical sample.

Behavioural inhibition will be operationalised both as self-report measures of effortful control and as neuropsychological measures of sustained attention. Sustained attention, measured using subtests of the TEA-Ch, correlated with psychopathological symptoms for children aged 8 to 10 (Verstraeten *et al.*, 2010), but since the main areas of the brain controlling attention undergo significant developmental changes from the age of 10 onwards (Betts *et al.*, 2006), this relationship may not hold for an older age group. Since a ceiling effect was observed in the sustained attention measures for the older (11 to 16-year-old) participants in the Verstraeten *et al.* (2010) study, the current study will aim to extend the findings of the Verstraeten *et al.* (2010) study by using different measures to investigate whether sustained attention is associated with psychopathological symptoms for young people in the 11 to 16 age group.

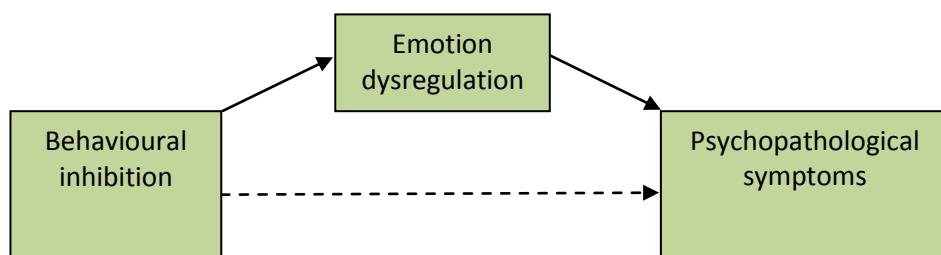


Figure 7: Proposed mediation of the relationship between behavioural inhibition and psychopathological symptoms by emotion dysregulation.

Muris, Mayer *et al.* (2008) demonstrated that emotional self-efficacy beliefs partially mediated the relationship between effortful control and psychopathological symptoms in the 9-13 age group. Emotion dysregulation has been shown to have a stronger relationship with psychopathological symptoms than other measures of emotion regulation skills and beliefs (Aldao *et al.*, 2010). So the current study will attempt to extend the Muris Mayer *et al.* (2008) finding, by testing whether emotion dysregulation mediates the relationship between behavioural inhibition and psychopathological symptoms in the 11-16 age group, as illustrated in Figure 7.

Baron and Kenny (1986) suggest that, in order to establish a mediation model, the following three conditions must be met: (a) that the predictor variable (i.e. behavioural inhibition, operationalised as effortful control and sustained attention) accounts for variation in the presumed mediator (emotion dysregulation); (b) that the mediator accounts for variation in the dependent variable (i.e. psychopathological symptoms); and (c) that the relationship between the predictor and the dependent variable significantly decreases when controlling for the mediator. The specific study hypotheses are therefore:

H1: There will be a negative relationship between behavioural inhibition and psychopathological symptoms.

H2: There will be a positive relationship between emotion dysregulation and psychopathological symptoms.

H3: Emotion dysregulation will mediate the relationship between behavioural inhibition and psychopathological symptoms.

2.2. Method

2.2.1. Design

A cross-sectional, quasi-experimental design was used, with psychopathological symptoms as dependent, and sustained attention, effortful control and emotion dysregulation as independent variables.

2.2.2. Participants

39 pupils (17 female, 22 male) with a mean age of 13 years 7 months (standard deviation 1 year 5 months, range 10 years 5 months to 16 years 4 months) took part. Pupils were drawn from five institutions: two mainstream schools, two pupil referral units (PRUs) for pupils excluded from school, and one specialist school for pupils with emotional and behavioural difficulties (SEBD). Nine pupils reported current clinical diagnoses, which included attention deficit hyperactivity disorder, schizophrenia, depression and autistic spectrum disorder. All pupils between the ages of 11 and 16 for whom the relevant consents were received were eligible for inclusion in the study; since the aim of the study was to demonstrate generalisability of the Barkley model, there were no exclusion criteria other than age.

All local-authority maintained PRUs and specialist SEBD schools in two adjacent local authority regions were invited by telephone to take part in the study; one SEBD school and two PRUs agreed to participate. Two mainstream schools were recruited from one of the same two local authority regions via existing contact with the researcher. In one mainstream school, the special educational needs coordinator of the school sent out letters inviting pupils supported by her department to take part: two pupils were recruited by this method. For the remainder of the sample, the researcher (or researcher's assistant following a script), introduced the study to all eligible class groups in consenting institutions and asked for volunteers to take part. For those pupils who volunteered, parent/carer consent was sought by letter, and followed up by telephone where letters were not returned.

Table 1: Crosstabulation of gender by school type

School type	Gender		Total
	female	male	
SEBD	0	10	10
PRU	3	9	12
Mainstream	14	3	17
Total	17	22	39

Table 1 shows the distribution of gender by school type. The study had aimed to recruit equal numbers of male and female pupils from each type of school, but time restrictions and difficulties with school recruitment meant this was not possible. Table 2 shows the distribution of adult questionnaires collected; at least one adult-report questionnaire was collected for every pupil participating.

Table 2: Cross tabulation of adult questionnaires returned by school type

School type	Adult questionnaires returned		Total
	teacher	parent	
SEBD	10	2	12
PRU	12	5	17
Mainstream	14	17	31
Total	36	24	60

2.2.3. Procedure

Participants completed the booklet of questionnaires and the Test of Everyday Attention individually with the researcher or researcher's assistant in a quiet room at school during the school day, in a single session lasting between 40 minutes and an hour. Participants were able to choose whether or not to have the questions and response choices read aloud to them: approximately one third of the sample chose to do so. Questionnaires within the booklets were counterbalanced for order to control for possible fatigue effects.

The researcher's assistant was a sixth form pupil studying psychology at one of the mainstream schools, who collected data for three of the pupils at that school. The assistant was trained and given feedback on practice sessions by the researcher before collecting data; a written protocol was followed to ensure consistency of delivery (attached as Appendix VI). In order to protect the confidentiality of personal information, participants sealed their questionnaires in an envelope before handing them to the assistant for delivery to the researcher.

Upon completion of the questionnaires and attention test, participants were thanked with a £5 voucher for their participation.

2.2.4. Measures

Psychopathological symptoms were measured using the total difficulties score of the Strengths and Difficulties Questionnaire (Goodman, 1999) and the Aggressive behaviour subscale of the Aggression Scale (Orpinas, 2001).

The **Strengths and Difficulties Questionnaire** (SDQ) is a 25-item questionnaire designed for the 4 to 16-year-old age range, with parallel youth, teacher and parent report versions, all three of which were employed. Respondents are asked to consider whether statements are not true, somewhat true, or certainly true about behaviour over the preceding six months (e.g. “I fight a lot, I can make other people do what I want”/ “Often fights with other children or bullies them”). A high score indicates a high level of problem behaviour. The SDQ has been used extensively in clinical practice in the UK since 1997, and has been shown to differentiate between community and clinical populations (Goodman, Meltzer & Bailey, 1998), so has good ecological validity. The parallel pupil, teacher and parent versions have been shown to correlate significantly with each other ($r=0.38$ to 0.43 in a community sample; Goodman *et al.*, 1998). It has equivalent specificity and sensitivity to clinically significant psychopathology as the much longer Child Behaviour Checklist (Achenbach, 1991) and the widely used Children’s Behaviour questionnaires (Rutter, 1967; Goodman, 1997; Goodman & Scott, 1999). It has good test-retest (0.85; Goodman, 1999) and internal reliabilities (0.82; Goodman *et al.*, 1998). The internal reliability of the total difficulties scores in the current study was good (pupil $\alpha=0.68$, parent $\alpha=0.92$, teacher $\alpha=0.88$). Total scores on the questionnaire can range from 0 to 40.

The **Aggression Scale** is an 11-item self-report measure, asking respondents to indicate on a 7-point scale how many times over the last week they have engaged in certain behaviours, e.g. “During the last 7 days, I teased other students to make them angry... 0 / 1 / 2 / 3 / 4 / 5 / 6 or more times”. The scale was designed for use with the 12 to 15-year-old age group, and validated against teachers’ ratings of pupils’ aggressive behaviour and the US Center for Disease Control and Prevention’s Youth Risk Behaviour Survey (Orpinas & Frankowski, 2001). In the current study it was used for a slightly wider age range than originally devised, but it was

considered that the questions remained relevant to the sample under study, and no participants reported difficulty understanding or completing items. It has been shown to have good internal and test-retest reliability ($\alpha=0.87, 0.85$ respectively; Orpinas & Frankowski, 2001). The internal reliability of this scale in the current study was good ($\alpha=0.90$). Total scores on the scale can range from 0 to 66.

Emotion dysregulation was measured using the **Difficulties in Emotion Regulation Scale** (DERS, Gratz & Roemer, 2004). Although initially developed with undergraduates, this self-report scale has been validated for use with adolescents from both clinical and community populations (Vasilev *et al.*, 2009; Weinberg & Klonsky, 2009). It is a 36-item scale; respondents indicate on a five-point scale (almost never/sometimes/about half the time/most of the time/almost always) how often they consider a series of statements apply to them (e.g. “I experience my emotions as overwhelming and out of control”; “When I’m upset, I believe that my feelings are valid and important.”(reverse-scored item)); higher scores are associated with greater difficulties with emotion regulation. The DERS has been shown to correlate significantly with another measure of emotion regulation, the Generalized Expectancy for Negative Mood Regulation scale (Catanzaro & Mearns, 1990), and with parental reports of psychopathological symptoms in adolescents (Weinberg & Klonsky, 2009), demonstrating construct and predictive validity. The DERS has been shown to have high internal consistency in adolescents ($\alpha=0.93$, Weinberg & Klonsky, 2009) and test-retest reliability in young adults ($\alpha=0.88$, Gratz & Roemer, 2004). The internal consistency demonstrated by the DERS in the current study was good ($\alpha=0.89$). Scores on the DERS can range from 36 to 180.

Behavioural inhibition was measured using self-report measures of effortful control (Attentional Control Scale) and neuropsychological measures of sustained attention (Test of Everyday Attention for Children).

The **Attentional Control Scale** (ACS, Derryberry & Reed, 2002) is a 20 item self-report questionnaire measuring the ability to focus and shift attention at will (e.g. “After being interrupted or distracted, I can easily shift my attention back to what I was doing before.”) Respondents rate statements on a scale with four points: almost never, sometimes, often, always. Higher scores reflect higher levels of attentional control. Although initially devised with an

undergraduate sample, it has now been extensively used with younger participants and has demonstrated good internal consistency ($\alpha=0.81$), and a significant, strong correlation ($r=0.72$) with parental reports of attentional control in 9 to 13-year-olds (Muris, Meesters & Rompelberg, 2006). Good internal consistency was demonstrated by the ACS in the current study ($\alpha=0.74$). Possible scores range from 20 to 80.

The **Test of Everyday Attention** (TEA, Robertson, Ward, Ridgeway & Nimmo-Smith, 1994) is a neuropsychological battery of eight subtests designed to measure sustained, selective and divided attention in visual and auditory modalities. The subtests are designed to mimic everyday activities so as to maximise ecological validity. In the current study, in order to minimise time demands on participants, only the three subtests loading on a sustained attention factor (Robertson *et al.*, 1994) were used: Elevator Counting, Telephone Search while counting, and Lottery; plus an associated test, Telephone Search. These subtests were selected because previous research had suggested that sustained attention, rather than selective attention or attentional switching, was more reliably associated with measures of psychopathology (Verstraeten *et al.*, 2010). There are sound clinical precedents for administering only part of the TEA (e.g. Chan, Robertson & Crawford, 2003; Chan *et al.*, 2006, Crawford & Sommerville, 1997).

The Elevator Counting subtest is based on a long-established measure of sustained attention (Wilkins *et al.*, 1987). Participants are asked to count seven series of tones played from an audio tape on a cassette player. In the Telephone Search task, participants circle key symbols while searching through pages in a simulated telephone directory. In the Telephone Search while Counting task, participants again circle key symbols in a telephone directory whilst simultaneously counting strings of tones presented on audio tape. In the Lottery task, subjects have to listen to a ten-minute series of numbers of the form 'BC143', 'LD967' etc. presented on an audio tape. Their task is to write down the two letters preceding all numbers ending in 55, of which there are 10.

The TEA was designed and standardised on healthy adult participants aged 18 to 80, in whom it has been demonstrated to have adequate test-retest reliability ($r=0.61$ to 0.90 for the subtests used in the current study) using parallel versions. Healthy adults have been shown to differ

significantly in their performance on the test from participants who have suffered brain injury or stroke (Robertson *et al.*, 1994). The test has been adapted for use with a younger age group, the Test of Everyday Attention for Children (TEA-Ch, Manly *et al.*, 2001), and significant relationships have been observed between TEA-Ch scores, school performance and diagnoses of attention deficit hyperactivity disorder (Manly *et al.*, 2001) in children aged 6 to 16. However, since previous research had observed a ceiling effect when using the TEA-Ch with adolescents, the adult version of the test was used for the current study in an attempt to overcome this problem (Verstraeten *et al.*, 2010). Since the current sample was outside the age range on which the test had been standardised, raw scores of the individual subtests, rather than composite scores, were used for the study analyses.

Finally, participants' tendency to give socially desirable responses was assessed using the **Lie scale** from the Revised Children's Manifest Anxiety Scale (RCMAS, Reynolds & Richmond, 2008). The Lie scale asks for yes/no responses to nine items to which a socially-desirable response is assumed to be different to an honest response, for example "I like everyone I know". A high score indicates a high tendency to socially desirable responding. In the questionnaire for which this scale was designed, items were interleaved with items related to other measures. This was not possible in the current study since the answer format of this scale differed to those of the other scales, so these nine items were presented as a block.

2.2.5. Ethical considerations

The study procedure was approved by the University of Southampton Ethics and Research Governance committees. All participants and their parents received an information sheet and the chance to ask questions about the study; it was made clear that participation in the study was voluntary and that participants had the right to withdraw, and request their data be destroyed, at any time. Signed consent to participate in the study was obtained from all participants, and signed or verbal telephone consent from all parents. The researcher had enhanced Criminal Records Bureau approval for working with children. The researcher's assistant was trained and supervised by the researcher, and coached by the Child Protection Officer in the school about appropriate working practices.

2.3. Results

Data were entered anonymously onto SPSS 16.0 for analysis. Missing values were inspected and, since the distribution of missing values appeared to be random, were substituted with the scale mean for that participant as recommended by Field (2005). A total of twelve substitutions were made in this way, representing 0.2% of the total data. Before testing the main study hypotheses, a range of checks were carried out which will now be reported.

2.3.1. Data characteristics

The whole sample mean for the social desirability (Lie) scale was 1.79, with a standard deviation of 1.79 (range 0 – 4 of a possible 0 – 9). Since no participant scored more than two standard deviations above the mean (Jacobson & Truax, 1991), it was assumed that no participant's responses were significantly affected by a tendency to socially desirable responding, and all data were admitted for further analysis.

The descriptive statistics of the sample were then inspected, and are reported in Table 3. The mean score on the Attentional Control Scale in the current sample is equivalent to that observed in a study of undergraduates (52.5), and higher than that observed in a sample of primary school children (34.0) (Derryberry & Reed, 2002; Muris *et al.*, 2004). This is consistent with the observation that effortful control increases with age up to adult levels during adolescence (Betts *et al.*, 2006; Posner & Rothbart, 2007).

The mean score on the Difficulties in Emotion Regulation Scale (90.01) was slightly higher than that reported in other studies (77.99/80.66 in the validation sample of undergraduates, 78.90 in a community sample of adolescents; Gratz & Roemer, 2004; Weinberg & Klonsky, 2009). The mean score of 13.72 on the Strengths and Difficulties Questionnaire lay in between mean scores observed by Goodman & Scott (1999) of 8.6 for a group selected as being at low risk of psychopathology, and 19.5 for a group at high risk. The DERS and SDQ scores in the current study are therefore consistent with the expectation of this as a sample at medium risk of psychopathological symptoms.

Before conducting the main study analyses, the distribution of scores for each variable was inspected for significant skew or kurtosis, subjected to Kolmogorov-Smirnov tests to check for significant departures from normality, and box plots were used to identify extreme values. Questionnaire data were normally distributed for the ACS, DERS and SDQ: the distribution of scores on the TEA tests and Aggression scale departed significantly from normality. Non-parametric tests were therefore used to test hypotheses involving these variables.

Table 3: Means, standard deviations and ranges of scores for study variables

Questionnaire measure	Mean score (standard deviation)	Range (possible range)
ACS	51.17 (7.42)	28 - 66 (20 – 80)
DERS	90.01 (19.55)	55 – 139 (36 – 180)
SDQ-C total difficulties	13.72 (5.87)	3 – 16 (0 – 40)
SDQ-P total difficulties	11.00 (7.27)	4 – 28 (0 – 40)
SDQ-T total difficulties	13.09 (7.74)	1 – 27 (0 – 40)
Aggression scale	11.56 (12.42)	0 - 55 (0 – 66)
TEA – elevator counting	6.49 (0.82)	4 – 7 (0 – 7)
TEA – telephone directory	3.89 (1.21)	2.11 – 8.35 (ω)
TEA – dual task	3.44 (15.56)	- 2.38 - +97.55 (ω)
TEA – lottery	7.63 (2.07)	2 – 10 (0 – 10)

Note: SDQ-C, P, T refer to child-, parent- and teacher-completed versions, respectively, of the Strengths and Difficulties Questionnaire.

The following potential confounds were then tested: the correlations of dependent variables with age were inspected; ANOVAs or non-parametric tests of difference were run to check for significant differences in study variables between genders and school type.

None of the dependent variables correlated significantly with age. There were significant differences between genders for teacher- ($F(1,33)=13.84, p<.01$) and parent- ($F(1, 21)=15.78, p<.01$) reports of total difficulties on the SDQ, and for self-reports of aggression on the Aggression scale ($Z=2.7, p=.01$). Parents and teachers reported more difficulties in boys than in girls; boys reported more aggressive behaviours than girls. However, there were no significant differences between genders for self-reports of total difficulties on the SDQ ($F(1, 36)=1.42, p>.05$).

The only significant difference observed between pupils from different types of school was on the selective attention (telephone directory) subtest of the Test of Everyday Attention, $F(2,36)=3.64, p=.04$. Participants from the specialist school for pupils with emotional and behavioural difficulties were significantly slower at finding the target symbols than those from pupil referral units or mainstream schools. Since this measure was not used to test the final study hypotheses, data were therefore considered to be from a homogeneous population and were combined across school types for all subsequent analyses. The absence of significant differences between school types in self-reports of psychopathological symptoms was unexpected, and will be commented upon further in the discussion.

Table 4: Correlations (Kendall's tau) between self-, parent and teacher reports on the subscales of the Strengths and Difficulties Questionnaire

Subscale	Child-parent	Child-teacher	Parent-teacher
Total difficulties	0.34	0.28	0.50
Conduct problems	0.57	0.34	0.45
Emotional problems	0.47	0.25	n.s.
Hyperactivity	0.35	0.34	0.40
Peer problems	0.63	n.s.	0.53

Note: n.s. means the correlation did not reach one-tailed significance at $p\le.05$

Correlations between adolescent self-reports, parent and teacher reports on the main measure of psychopathological symptoms (the Strengths and Difficulties Questionnaire) were then inspected, and are given in Table 4. Since the distribution of scores on some subscales departed significantly from normality, Kendall's tau correlation coefficient was used as it is considered the most reliable non-parametric measure of correlation in small samples (Field, 2005).

The strongest correlations were generally those between pupil and parent; there was lower agreement between pupil and adult reports on measures of internalising (emotional) problems than on the other scales (as also observed by Seiffge-Krenke & Kollmar, 1998). Since, as typically found in other studies (e.g. Koskelainen, 2000), inter-rater correlations were generally moderate, ranging from 0.25 to 0.63, subsequent analyses were carried out separately by informant.

2.3.2. Correlations between study variables

As recommended by Baron and Kenny (1986), in preparation for testing the study hypotheses, primary correlations between the study variables were then inspected, and are reported in Table 5. Significant correlations are highlighted in bold font.

There were significant correlations between the total difficulties pupils reported on the SDQ and their self-reports of effortful control and emotion dysregulation ($r=0.38$ to 0.71 , $p<.05$). The less pupils reported being able to control their attention, the more emotion dysregulation and psychopathological symptoms they reported. The more difficulties pupils reported with their emotion regulation, the more psychopathological symptoms they reported.

Although parent- and teacher-reports of pupil psychopathological symptoms correlated strongly and significantly with each other ($r=0.66$, $p<.001$), they did not correlate significantly with pupil reports of emotion dysregulation or effortful control. Therefore, following the recommendations of Baron & Kenny (1986), only pupil reports, and not parent- or teacher-reports, of total difficulties were used as the dependent variable to test the mediation model proposed by the study hypotheses.

Table 5: Correlations (Pearson's r) between Strengths and Difficulties questionnaire, Attentional Control scale and Difficulties in Emotion Regulation Scale

		SDQ pupil-reported difficulties	SDQ teacher-reported difficulties	SDQ parent-reported difficulties	Difficulties in emotion regulation
SDQ teacher-reported difficulties	Pearson Correlation	.377			
	Sig. (2-tailed)	.028			
SDQ parent-reported difficulties	Pearson Correlation	.516	.660		
	Sig. (2-tailed)	.014	.002		
Difficulties in Emotion Regulation	Pearson Correlation	.706	.225	.386	
	Sig. (2-tailed)	.000	.194	.069	
Attentional control scale	Pearson Correlation	-.613	-.100	-.293	-.588
	Sig. (2-tailed)	.000	.568	.175	.000

Since scores on the Aggression scale were not normally distributed, the non parametric Kendall's tau was used as a measure of correlation (Field, 2005). Pupils' scores on the Aggression Scale correlated positively and significantly with their scores on the Strengths and Difficulties Questionnaire; the more aggressive behaviours they reported engaging in during the previous week, the more difficulties they reported overall ($\tau=0.28$, $p<.05$). However, there were no significant correlations between the aggressive behaviours pupils reported on the Aggression Scale and the effortful control or emotion dysregulation they reported ($\tau=-0.08$, 0.15 respectively, both $p>.05$). Therefore this measure was not included as a dependent variable in the mediation model (Baron & Kenny, 1986).

Next, correlations between pupils' scores on the four attention tests and the self-report measures were inspected, and are reported in Table 6. Since the attention test data were not normally distributed the non-parametric Kendall's tau was again taken as the most robust measure of correlation. Pupils' scores on the Lottery task correlated significantly with their performance on the Telephone Search ($\tau=-.30$, $p=.01$) and the Telephone Search with Counting ($\tau=-0.37$, $p<.01$) tasks. The longer pupils took to find visual targets amongst distractors, the more lottery letters they missed. The more pupils' performance at finding visual targets was adversely affected by performing an auditory task at the same time (dual task decrement), the more lottery letters they missed. None of these three tasks correlated significantly with pupil reports of emotion

dysregulation, effortful control or psychopathological symptoms. Therefore these three measures were not used to test the mediation model proposed by the study hypotheses.

Table 6: Correlations (Kendall's tau) between self-report scales of emotion dysregulation, aggression, total difficulties and Test of Everyday Attention subtest scores

Measure		SDQ						
		pupil-reported difficulties	Aggression scale	Difficulties in emotion regulation	Attentional control scale	TEA/ Elevator counting	TEA/ Telephone search	TEA/ Dual task decrement
Aggression scale	τ	.276						
	Sig. (2-tail)	.019						
Difficulties in emotion regulation	τ	.540	.154					
	Sig. (2-tail)	.000	.178					
Attentional control scale	τ	-.374	-.085	-.509				
	Sig. (2-tail)	.001	.458	.000				
TEA/ Elevator counting	τ	-.420	-.159	-.397	.342			
	Sig. (2-tail)	.002	.228	.002	.009			
TEA/ Telephone search	τ	.062	.059	.045	-.100	-.030		
	Sig. (2-tail)	.588	.602	.689	.376	.819		
TEA/ Dual task decrement	τ	.087	.219	.105	-.166	-.248	.091	
	Sig. (2-tail)	.449	.054	.351	.142	.055	.418	
TEA/ Lottery task	τ	.005	-.172	.043	-.011	-.120	-.298	-.372
	Sig. (2-tail)	.968	.161	.719	.928	.390	.013	.002

Pupils' scores on the Elevator Counting task did not correlate significantly with any of the other attention test measures, although a correlation with the dual task decrement approached significance ($\tau=-0.25$, $p=.06$). The more accurately pupils counted the tape-presented beeps, the less their performance on the Telephone Search task was affected by simultaneously counting beeps. Pupil scores on the Elevator Counting task did, however, correlate significantly with self-report measures of emotion dysregulation ($\tau=-0.40$, $p<.01$), effortful control ($\tau=0.34$, $p<.01$), and psychopathological symptoms ($\tau=-0.42$, $p<.01$). As predicted, the better pupils performed on the Elevator Counting task, the less emotion dysregulation, the more effortful control, and the fewer psychopathological symptoms they reported. As will be discussed later, there are precedents for using the scores of this subtest as a stand alone measure (Wilkins, Shallice &

McCarthy, 1987). As recommended by Baron & Kenny (1986), pupil scores on this subtest alone were therefore used to test the mediation model.

2.3.3. Testing the mediation model

The hypothesis that emotion dysregulation would mediate the relationship between behavioural inhibition and psychopathological symptoms (Figure 8) was examined using hierarchical regression analysis following the procedure recommended by Baron and Kenny (1986). The distribution of the model residuals was inspected at each step to check for normality and constant variance around a mean of zero (Sim & Wright, 2000). The two measures of behavioural inhibition – effortful control questionnaire (ACS) and sustained attention test data (Test of Everyday Attention, Elevator Counting task) were tested in separate models. Since the range of possible values on the Elevator Counting task was too limited for this to be effectively treated as scale data within the regression, this variable was dichotomised (Kraemer *et al.*, 2001) using the value suggested as a clinical cut-off point within the test manual (Robertson *et al.*, 1994). Since initial analyses had indicated no significant associations or differences in the outcome variable by age, school type or gender, it was not considered necessary to enter these as covariates into the model (Sim & Wright, 2000).

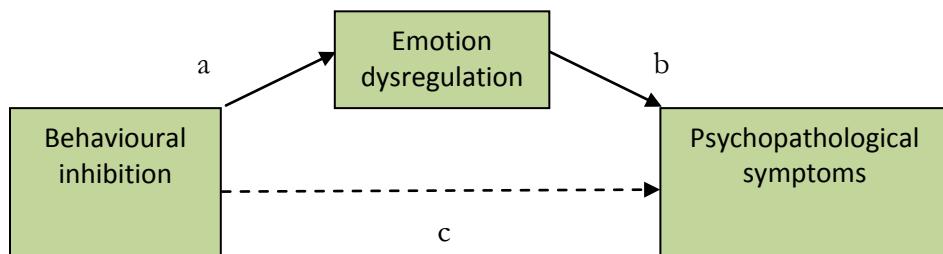


Figure 8: Mediation model, showing emotion dysregulation acting as a mediator between behavioural inhibition and psychopathological symptoms

In the first stage, effortful control was entered as a predictor in the regression equation and the SDQ total difficulties score (pupil report) as the outcome variable. The model predicted a significant amount of variance ($F (1, 36) = 21.68, p < .001$), indicating that the questionnaire measure of effortful control made a significant contribution to the prediction of psychopathological symptoms. Using the dichotomised Elevator Counting subtest result as a

measure of sustained attention, the model similarly predicted a significant amount of variance ($F(1, 36) = 8.96, p < .005$), indicating that sustained attention made a significant contribution to the variance of psychopathological symptoms.

In the second stage, emotion dysregulation was entered as the outcome variable, and behavioural inhibition as the predictor (path a in Figure 8). Using either the ACS ($F(1, 37) = 19.57, p < .001$), or the Elevator Counting subtest ($F(1, 37) = 9.60, p = .004$), the model predicted a significant amount of variance, indicating that behavioural inhibition made a significant contribution to the prediction of emotion dysregulation.

In the third stage, both emotion dysregulation and behavioural inhibition were entered as predictors, and SDQ total difficulties score as the outcome variable. The regression coefficient for emotion dysregulation in both models was non-zero and significant, (using ACS: standardised $\beta = 0.53, p = .001$; using Elevator Counting task: standardised $\beta = 0.63, p < .001$) indicating that emotion dysregulation made a contribution to the prediction of variance in psychopathological symptoms beyond that predicted by behavioural inhibition. The mediation model provided a significantly better fit to the data than that in which behavioural inhibition alone was a predictor (using ACS: F change $(1, 35) = 14.44, p = .001$; using Elevator Counting task: F change $(1, 35) = 22.92, p < .001$).

In the fourth and final stage, the regression coefficients for behavioural inhibition in stages 1 and 3 were compared. The usual procedure suggests that, if complete mediation were present, the regression coefficient for behavioural inhibition would be reduced to zero upon the introduction of emotion dysregulation into the model. If the regression coefficient were significantly reduced, but not to zero, by the presence of emotion dysregulation in the model, partial mediation is thought to have occurred (Kenny, 2009). At this stage, different results were obtained according to whether the ACS or the Elevator Counting subtest was used as the measure of behavioural inhibition. Results using the Elevator Counting data will be reported first.

From the results given in Table 7, using the Elevator Counting data, it will be seen that the regression coefficient for behavioural inhibition was greatly attenuated to a level at which it was not significantly different from zero, by the introduction of emotion dysregulation to the model,

suggesting that emotion regulation completely mediated the relationship between sustained attention and psychopathological symptoms.

Table 7: Prediction of SDQ total difficulties score from sustained attention measures of behavioural inhibition (TEA Elevator counting) and emotion dysregulation (DERS).

Model	Unstandardized Coefficients		Standardized Coefficients
	B	Beta	Sig.
1 (Constant)	22.464		.000
Sustained attention	-5.357	-.446	.005
2 (Constant)	-.239		.964
Sustained attention	-1.819	-.152	.261
Difficulties in emotion regulation	.188	.635	.000

Table 8: Prediction of SDQ total difficulties score from self-report effortful control measures of behavioural inhibition (ACS) and emotion dysregulation (DERS).

Model	Unstandardized Coefficients		Standardized Coefficients
	B	Beta	Sig.
1 (Constant)	38.216		.000
Effortful control	-.478	-.613	.000
2 (Constant)	11.760		.166
Effortful control	-.236	-.303	.036
Difficulties in emotion regulation	.156	.528	.001

From the results given in Table 8, using the questionnaire measure, it will be seen that the regression coefficient for behavioural inhibition roughly halved, and remained significantly different to zero, once emotion dysregulation was introduced to the model, suggesting that a partial mediation relationship was present in the data.

Finally, the significance of the mediation was tested using Preacher & Hayes (2008) bootstrapping methodology using 2000 bootstrap resamples to estimate 95% confidence intervals for the regression coefficients. Bootstrapping sampling distributions are generated by

taking samples (with replacement) from the data set and calculating the regression coefficients in the resamples. Bootstrapping techniques are now generally thought to give more reliable estimates of the significance of indirect effects in samples smaller than 50 than the commonly-used Sobel test (Bollen & Stine, 1990; Mackinnon, Fairchild & Fritz, 2007; Shrout & Bolger, 2002), because they make no assumptions about distribution, whereas the estimated standard error in the tables above (which is the statistic used for the Sobel test) is calculated assuming the mediated effect is normally distributed. The bootstrap analyses are reported in Tables 9 and 10.

Since the bootstrapping resamples suggested a biased distribution, the bootstrap procedure was rerun using a bias-corrected, accelerated technique. The model findings remained unchanged.

Table 9: Prediction of psychopathological symptoms (SDQ total difficulties score) from attentional control (ACS) and emotion dysregulation (DERS) showing bootstrapped estimates of regression coefficients

		Regression coefficient	Bias	Std. Error	Sig. (2-tailed)	95% Confidence Interval
1	(Constant)	38.216	.049	4.532	.000	28.91 to 47.34
	ACSTOT	-.478	-.001	.086	.000	-0.65 to -0.31
2	(Constant)	11.760	-1.268	8.726	.164	-9.10 to 25.35
	ACSTOT	-.236	.019	.122	.047	-0.41 to 0.06
	DERSTOT	.156	.003	.037	.000	0.08 to 0.23

Table 10: Prediction of psychopathological symptoms (SDQ total difficulties score) from sustained attention (TEA Elevator counting) and emotion dysregulation (DERS) showing bootstrapped estimates of regression coefficients

		Coefficient	Bias	Std. Error	Sig. (2-tailed)	95% Confidence Interval
1	(Constant)	22.464	-.034	2.899	.000	16.55 to 27.99
	TEAEC	-5.357	-.002	1.706	.003	-8.55 to -1.83
2	(Constant)	-.239	.054	5.183	.962	-10.67 to 10.08
	TEAEC	-1.819	-.049	1.609	.264	-4.96 to 1.47
	DERSTOT	.188	.000	.038	.000	0.11 to 0.26

When emotion dysregulation was included in the model, for either measure of effortful control, the 95% confidence interval of the regression coefficient generated by bootstrapping techniques included zero, but with a significant negative skew. Thus the data for both models is consistent with the relationship between behavioural inhibition and psychopathological symptoms being completely mediated by emotion dysregulation (Shrout & Bolger, 2002; Hayes, 2009).

Since significant differences had been observed in the outcome variable when data were grouped by gender or school, the above analyses were rerun entering gender and school as covariates to check for possible confounding of the study results. The model findings remained unchanged.

2.4. Discussion

2.4.1. Primary findings.

As expected, significant relationships were observed between behavioural inhibition, emotion dysregulation, and psychopathological symptoms. The more difficulties participants reported with emotion regulation, the more psychopathological symptoms they reported. The greater their capacity to sustain their attention and inhibit their behaviour, the fewer psychopathological symptoms and the fewer difficulties in emotion regulation they reported. These findings therefore replicate those of Muris (2006), Muris, Mayer *et al.*, (2008), Muris, Pennen *et al.* (2008) and Meesters *et al.* (2007). The study successfully extended the work of Verstraeten *et al.*, (2010), by showing that sustained attention is associated with psychopathological symptoms in the 12 to 16 age group when an appropriate measure of sustained attention is used (e.g. Elevator Counting task of the TEA).

Whilst primary correlations between constructs in the Barkley model have been demonstrated elsewhere, to the knowledge of the author the current study was the first to test the nature of one of the indirect pathways. It was observed that, as expected, emotion dysregulation mediated the relationship between behavioural inhibition and psychopathological symptoms. When difficulties in emotion regulation were taken into account, the relationship between behavioural inhibition and psychopathological symptoms disappeared. This is consistent with the hypothesis of Boykin (2001) and extends the findings of Muris, Mayer *et al.* (2008), who observed that emotional self-efficacy beliefs partly mediated the relationship between attentional control and

psychopathological symptoms. The practical implications of this finding will be discussed in section 2.4.4.

2.4.2. Implications for future theory and research

2.4.2.a. *Cross diagnostic validity of the Barkley model*

The findings of the current study validated one pathway of the Barkley (1997) model of self-regulation in a mixed clinical and community sample, and so support the suggestion of Boykin (2001) that the Barkley model may have cross-diagnostic validity as a model of self-regulation. This has important implications for the field of mental health research, since the model offers a theoretical framework within which interventions can be derived and tested. Since, as suggested by Barkley (1997), different patterns of deficit amongst the constructs of the model might give rise to different phenotypes, the model is potentially a framework by which psychiatric diagnoses could be etiologically, rather than behaviourally, defined. Historically, the move to behaviourally-defined diagnoses was made to enable more consistency of diagnostic practice across mental health practitioners (Cichetti & Rogosch, 1996) but it has been argued elsewhere that this approach has impeded effective research into the substrates of mental disorder (e.g. Beauchaine *et al.*, 2008). A robust, empirically-supported model, with clearly-defined constructs, would facilitate both consistency of diagnosis and the design of effective research and intervention strategies.

2.4.2.b. *Implications of the mediation model*

The fact that emotion dysregulation fully mediated the relationship between behavioural inhibition and psychopathological symptoms in the current study calls into question Barkley's proposition that a certain level of behavioural inhibition is necessary for other executive functions, including emotion regulation, to function in controlling behaviour. Barkley's hypothesis implies a moderated, not a mediated relationship. Since the mediation model was supported, there is a role for further research to test the model with alternative operationalizations of variables e.g. by using behavioural or time-sampling self-report measures of emotion regulation and effortful control (Weems & Pina, 2010). Should the current study findings be successfully replicated, this would imply a refinement of Barkley's moderation hypothesis.

2.4.2.c. Operationalisation of behavioural inhibition

The current study makes a potentially significant contribution to discussions about how behavioural inhibition is most usefully construed (Alderson *et al.*, 2007; Barkley, 1997; Gillig & Sanders, 2011; Huang-Pollock *et al.*, 2006; Sarter *et al.*, 2001). The finding that only the Elevator Counting subtest of the Test of Everyday Attention, and not the other three subtests used, was associated with emotion dysregulation and psychopathological symptoms is consistent with other research findings that an individual's capacity to attend to a task is significantly affected by the frequency of presentation of stimuli (Robertson & Garavan, 2004; Wilkins *et al.*, 1987). The current study finding suggests that appropriate measures of sustained attention may yield more reliable insights into an individual's capacity for goal-directed behaviour than more complex attention tasks.

2.4.3. Study limitations

2.4.3.a. Analytical procedure

The validity of the analyses might be challenged because of the use of self-report data in a regression model, since regression techniques assume that any measurement errors are randomly distributed. When more than one variable is measured using self-report data, some degree of the variance in the data will be accounted for by the commonality of method (Sim & Wright, 2000). However, in the current study, the residuals of the simple models were inspected and found to be normally distributed. It is therefore argued that there is no evidence to suggest that common method variance confounded the results. However, there would be value in further research testing the model using variables operationalised differently e.g. by using behavioural or time-sampling measures of emotion regulation and attentional control (Weems & Pina, 2010).

2.4.3.b. School type

It was surprising that there was no significant difference between types of school in the reports of psychopathological symptoms. It was expected that participants attending schools specialising in the provision of education for pupils with social, emotional and behavioural difficulties would display more psychopathological symptoms than pupils attending mainstream schools, and demographic data collected as part of the study suggested that these pupils were indeed more likely to have a clinically diagnosed disorder. It seems likely that the absence of a significant difference between school types was a result of the sampling procedure: the fact that participants

at one of the mainstream schools were recruited exclusively from those supported by the special educational needs department of the school may have artificially skewed the comparisons.

2.4.3.c. Informant

Despite collecting both parent and teacher reports of pupil behaviour, only self-report measures correlated sufficiently strongly with psychopathological symptoms to be used for the main study analyses. Whilst there is research evidence to suggest that adolescent self-reports of behaviour may be more accurate than adult reports (Brody & Forehand, 1986; Christensen, Phillips, Glacow & Johnson, 1983; Koskelainen *et al.*, 2000), the lack of triangulation of measures of psychopathological symptoms could be considered a weakness of the current study.

2.4.3.d. Sampling procedure

The sample used for the study was not sufficiently randomised for statistical generalisation of the study results to a population. To obtain generalisable results, the sample for the study would need to be randomly selected, and relevant consents obtained from all those selected by the randomisation procedure. Taking into account the potential scale and impact of the study, it was considered that drawing the sample from those schools and pupils who expressed an interest in taking part was a more ethically justifiable procedure.

Consistent with the proposal that developmental psychopathology research should keep both normal and abnormal psychopathology within its focus (Cichetti & Rogosch, 2002), the current sample included both participants with clinical diagnoses of psychopathological disorders (including attention deficit hyperactivity disorder, schizophrenia, depression, and autistic spectrum disorder) and participants with no such diagnoses. Since all but the Aggression scale and TEA variables were normally distributed across the sample, the data were consistent with the proposal that the clinical diagnoses represented cut-off points on a continuum rather than qualitatively different conditions. Nevertheless, since a proportion of the sample (9/39) reported various clinical diagnoses, caution would be appropriate in generalising the findings of this study to exclusively clinical, or exclusively non-clinical, populations.

All the pupils from the SEBD school in the study were male; included in the sample were more males than females from the PRU, and more females than males from mainstream schools.

Consistent with other studies, gender differences were observed in the way that emotion

dysregulation was expressed (Dorard *et al.*, 2008; Gratz & Roemer, 2004; Stringaris & Goodman, 2008; Bjarehed & Lundh, 2008). Although, consistent with other research (Muris, Mayer *et al.*, 2008), controlling for gender did not change the main study findings, there is a role for future research to confirm with a larger, more evenly distributed, sample that the model has validity for both genders. Ideally, participants would have been matched for age and gender across school types, or sampled from a single school type, which would have enabled the results of the study to be more reliably generalised to equivalent populations. Further research would be needed to confirm whether the findings of this study could be replicated in exclusively clinical, or exclusively non-clinical, populations and equally across genders.

2.4.3.e. Study design

A primary limitation of the current study is that it has only taken account of within-person variables. The variance in psychopathological symptoms due to intra- rather than inter-individual factors has typically been estimated at around 16% (Ratchford & Beaver, 2009). There is a need for future research to expand the model to incorporate environmental influences, and also to measure or control for more aspects of the Figure 2 model than have been accounted for in the current study.

2.4.4. Educational and clinical implications

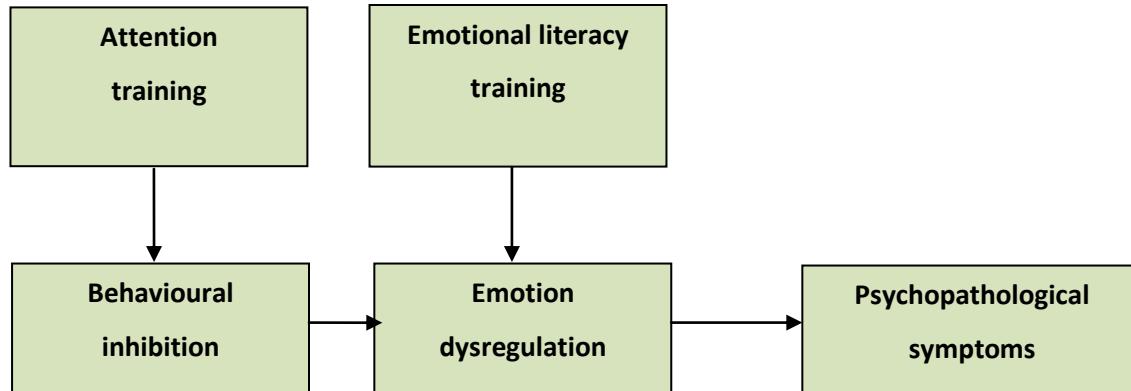


Figure 9: Implications of the mediation model for targeting of intervention

The observation of interactions between emotion dysregulation, behavioural inhibition and psychopathological symptoms has implications for the evaluation of the effectiveness of

interventions. When chains of risk factors affect an outcome, addressing only one link in the chain can result in minor treatment effects with no apparent clinical or policy significance, whereas interventions which address each link in the chain in turn may succeed (Kraemer, 2001). As illustrated in Figure 9 above, the nature of the relationship between behavioural inhibition, emotion dysregulation and psychopathological symptoms would determine whether there was a need to address both behavioural inhibition and habits of emotion dysregulation in order to impact meaningfully upon an individual's psychopathological symptoms. (Effective self-regulation is also likely to depend upon an individual's ability to articulate goals and hold them in mind, but this was not tested in the current study.)

Various interventions have been shown to improve attention performance in children and adults, at all levels of attentional difficulties from mild work completion problems to severe impairment associated with brain injury or clinical disorders (Kerns, Eso & Thomson, 1999; Sohlberg, McLaughlin, Pavese, Heidrich & Posner, 2000; Semrud-Clikeman *et al.*, 1999). A small scale study suggested that a five-day attention training computer programme with 4-year olds was successful in altering activity in underlying brain networks (Posner & Rothbart, 2005). Since attention training programmes are effective only for the specific aspect of attention which they target (e.g. sustained attention, selective attention, attentional switching; Sturm *et al.*, 1997), there are substantial implications of the study finding of a specific relationship between sustained attention and psychopathological symptoms. One current approach to intervention for difficulties with sustained attention (such as observed in ADHD) is to provide medication which increases the concentration of neurotransmitters in the alerting network. Since it has been shown that sustained attention can also be modulated by bottom-up stimulation (i.e. stimulation from the sensory environment) (Sarter, Givens & Bruno, 2001), this suggests an alternative, medication-free approach to intervention. (It is hypothesised that this is one pathway by which computer and video games enable young people with low effortful control to achieve an optimum level of arousal for task engagement, but this would need to be confirmed by further research.) It has been demonstrated that background white noise can achieve a similar effect to medication in facilitating focus on a task (Smith & Nutt, 1996), and that there is a small sub-group of children who are able to comprehend and remember more of a message when it is presented against a background of talk than when it is presented in quiet (Willie, 2007). There is therefore scope for considerable experimentation with the range of background environmental

stimuli which might help facilitate task engagement for young people who struggle to sustain their attention on classroom tasks.

However, the key implication of the study findings is that the primary within-person variable upon which to focus and develop intervention strategies to improve an adolescent's mental health is emotion dysregulation, since in this study emotion dysregulation was shown to account fully for the relationship between behavioural inhibition and psychopathological symptoms.

2.5. Conclusion

This study tested whether predictions of the Barkley (1997) model of self-regulation had validity for a mixed population of adolescents with and without clinical diagnoses. It extended previous research by demonstrating that, as predicted by the Barkley model, emotion dysregulation mediated the relationship between behavioural inhibition and psychopathological symptoms in a mixed clinical and non-clinical sample. A key implication of this finding is that intervention strategies to improve the mental health of adolescents would be more effectively targeted at reducing their habits of emotion dysregulation than at increasing their effortful control and/or ability to sustain their attention. The study highlights the potential of the Barkley (1997) model to provide an empirically-supported, theoretical framework for psychological diagnosis and intervention.

APPENDIX I: Ethics and research governance approval

Your Ethics Form approval

Psychology.Ethics.Forms@ps2.psy.soton.ac.uk [Psychology.Ethics.Forms@ps2.psy.soton.ac.uk]

Sent: 22 June 2010 14:40

To: [Willie A.C.](#)

This email is to confirm that your ethics form submission for "Does emotion dysregulation mediate the relationship between attentional control and conduct problems in adolescence?" has been approved by the ethics committee

Project Title: Does emotion dysregulation mediate the relationship between attentional control and conduct problems in adolescence?
Study ID : 1196

Approved Date : 2010-06-22 14:40:49

[Click here to view Psychobook](#)

If you haven't already submitted the Research Governance form for indemnity insurance and research sponsorship along with your ethics application please be aware that you are now required to fill in this form which can be found online at the link below.
Research Governance Form: http://www.psychology.soton.ac.uk/psyweb/psychobook/admin/ethics/research_governance.doc
This will need to be returned to the address provided on the form.

Please note that you cannot begin your research before you have had positive approval from the University of Southampton Research Governance Office (RGO). You should receive this by email in a maximum of two working weeks. If you experience any delay beyond this period please contact Barbara Seiter. More information about Research Governance can be found at the link below. (You will be prompted to log into sussed.)

Research Governance Feedback for your study ID1196

Psychobook@ps2.psy.soton.ac.uk [Psychobook@ps2.psy.soton.ac.uk]

Sent: 24 June 2010 10:32

To: [Willie A.C.](#)

This email is to let you know that the Research Governance Office has Approved your study

Study : Does emotion dysregulation mediate the relationship between attentional control and conduct problems in adolescence?

Comments : none.

#####

DO NOT REPLY TO THIS EMAIL!

#####

APPENDIX II: Parental letter and consent form

Dear parent/carer

I am writing to you because your son/daughter has expressed an interest in taking part in a study which I am carrying out. I'm a trainee educational psychologist, attached to the University of Southampton and Hampshire County Council, and as part of my studies I am carrying out research into how the way teenagers concentrate affects how they deal with what they feel.

If your son/daughter takes part, they will be asked to:

- answer a questionnaire in school time, which is expected to take them between 15 and 30 minutes
- do an attention test with me in a room at school, which involves counting sounds and listening to numbers, and will take about 30 minutes to complete.

The questionnaire will ask them how much they agree with statements like: "I have one good friend or more." ; "When I'm upset, I believe that I'll remain that way for a long time." ; "When I'm reading and studying, I am easily distracted if there are people talking in the same room.", and to complete statements like: "During the last 7 days, I pushed or shoved other students (0/1/2/3/4/5/6) times". They will also be asked to get a parent/carer and a teacher to complete a questionnaire about them, which should take about 5 minutes to answer. I enclose a copy of that questionnaire.

They don't have to take part in this study; they are free to change their mind about doing so at any time, and can ask me to destroy their answers. No one (including you!) will see their answers except for me and possibly my research supervisor, and they won't be able to see the answers given by their parents/teachers. After I have received them, all the questionnaires will be anonymised. When I write my report about the results I have found, I won't report anyone's name or school. When I have finished the study, I have to keep all the questionnaires safely for 5 years before I can shred them.

When I have received a complete set of questionnaires and test results for your son/daughter, I will be giving them a £5 book/record voucher for their time, unless you request otherwise. If you have any questions, then please feel free to contact me on acw2g08@soton.ac.uk, or via 023 8059 5575. Please keep this letter in case you wish to contact me after the study is completed.

If you have any questions about your son/daughter's rights as a participant in this research, or if you feel they have been placed at risk, you may contact the Chair of the Ethics Committee, Department of Psychology, University of Southampton, Southampton SO17 1BJ, telephone: 023 8059 5578 quoting study number 1196.

If you're happy for your son/daughter to take part, please read and sign the following sheet and return it to me together with the completed questionnaire. Thank you very much for your help.

Best wishes

Anne Willie

Trainee Educational Psychologist

University of Southampton

Attention, emotions and action

Anne Willie, Trainee Educational Psychologist,
School of Psychology, University of Southampton
Study ID number: 1196

If you are willing to allow your son/daughter to take part in my study, then please tick these boxes, sign the bottom, and return this sheet to me, together with the enclosed questionnaire, as soon as possible and in any case before xx **2010**.

Pupil's name: _____

Pupil's date of birth: _____

- I have read the letter and I understand the information I have been given about the study.
- I give consent for my son/daughter to take part, and for their answers to be used for the purpose of the study.
- My son/daughter would like to take part.
- I understand that I can withdraw this consent, and ask for my and my child's answers to be destroyed, at any time, by contacting the researcher.
- I enclose a completed Strengths and Difficulties Questionnaire about my son/daughter.

Parent's name (please print):_____

Parent's signature: _____

Date: _____

Please return to: Educational Psychology (AW 08), 34 Bassett Crescent East, FREEPOST SO286, University of Southampton, Southampton SO16 7PB (no stamp required).

Thank you very much!

APPENDIX III: Student information sheet and consent form

Attention, emotions and action

Anne Willie, Trainee Educational Psychologist, University of Southampton

Thank you for your interest in my study. I'm exploring whether or not people's ability to concentrate affects how they deal with what they feel. If you take part, you'll be asked to:

- answer all the questions on the following pages;
- ask a parent or carer to answer a short questionnaire about you;
- ask a teacher to answer a short questionnaire about you;
- complete an attention test with me, which involves counting sounds and listening to numbers.

The questionnaires your parent/carer and teacher will be asked to complete will take them less than 5 minutes to answer. The questionnaires attached here will probably take you between 15 and 30 minutes to answer. The attention test, which you'll do individually with me in a room at school, will take about 30 minutes to complete.

No one will see your answers except for me and maybe my research supervisor. Your parents/teachers won't be able to see your answers, and you shouldn't be able to see theirs. When I enter your answers onto the computer so I can analyse them, they won't have your name on. When I write my report about the results I have found, I won't report anyone's name or school. When I have finished the study, I have to keep the questionnaires safely for 5 years before I can shred them.

Your form tutor and the student services in your school will know that you have taken part in this study for me. If you find any of the questions upsetting to answer, then I hope you will talk to me, student services or your parents/carers about it. When I have received all the questionnaires for you, I'll be able to give you a £5 book/music voucher for your time.

You can contact me by email at acw2g08@soton.ac.uk. If you have any questions about your rights as a participant in this research, or if you feel you have been placed at risk, you may contact the Chair of the Ethics Committee, Department of Psychology, University of Southampton, Southampton SO17 1BJ, telephone: 023 8059 5578, quoting study number 1196.

Before you answer any questions, please tick the boxes on the next page to show you have read and understood what this sheet says. If there's anything else you want to know, then please ask me.

Thanks! *Anne*

Attention, emotions and action

Anne Willie, Trainee Educational Psychologist, University of Southampton

Study ID number: 1196

Your name (in capitals): _____

Your date of birth: _____ Male or female? (please circle): M F

Please tick each box to show you have read that sentence. Thanks.

- I understand the information about the study, and I've been given the chance to ask questions about it.
- I understand that I don't have to take part in this study.
- I understand that I can change my mind about taking part in the study at any time, and I can ask for any answers I have already given to be destroyed, without any consequences for me.
- I agree to take part in the study.

Signed: _____

Date: _____

You don't have to answer this, but it would help me to know if you have been diagnosed with any of the following in the last 6 months (please tick any that apply):

- depression
- anxiety
- any phobia
- attention deficit hyperactivity disorder
- conduct disorder
- oppositional defiant disorder
- none of these

APPENDIX IV: Student questionnaires

This set of questions tells me about how you like to control your attention.

(Deleted from here for electronic version: Attentional control scale (Derryberry & Reed, 2002)

These questions are about how you manage your feelings.

*Deleted from here for electronic version: Difficulties in Emotion Regulation Scale
(Gratz & Roemer, 2004)*

These questions are about things that you might have done over the last week.

**Please answer these questions thinking of what you actually did during the last week.
For each question, mark with a circle how many times you did that during the last 7 days.**

<i>During the last 7 days</i>	<i>0 times</i>	<i>1 time</i>	<i>2 times</i>	<i>3 times</i>	<i>4 times</i>	<i>5 times</i>	<i>6 or more times</i>
1. I teased other students to make them angry.	0	1	2	3	4	5	6+
2. I got angry very easily with someone.	0	1	2	3	4	5	6+
3. I fought back when someone hit me first.	0	1	2	3	4	5	6+
4. I said things about other kids to make other students laugh.	0	1	2	3	4	5	6+
5. I encouraged other students to fight.	0	1	2	3	4	5	6+
6. I pushed or shoved other students.	0	1	2	3	4	5	6+
7. I was angry most of the day.	0	1	2	3	4	5	6+
8. I got into a physical fight because I was angry.	0	1	2	3	4	5	6+
9. I slapped or kicked someone.	0	1	2	3	4	5	6+
10. I called other students bad names.	0	1	2	3	4	5	6+
11. I threatened to hurt or to hit someone.	0	1	2	3	4	5	6+

These sentences describe how some people feel about themselves. There are no right or wrong answers. Only you can say how you think and feel about yourself. After you read each sentence, ask yourself, "Is it true about me?". If it is, circle Yes. If it is not, circle No.

(Deleted from here for electronic version: Lie Scale from the Revised Children's Manifest Anxiety Scale, Reynolds & Richmond, 2008)

Strengths and Difficulties Questionnaire

For each item, please mark the box for Not True, Somewhat True or Certainly True. It would help us if you answered all items as best you can even if you are not absolutely certain or the item seems daft! Please give your answers on the basis of how things have been for you over the last six months.

Your Name

Male/Female

Date of Birth.....

	Not True	Somewhat True	Certainly True
I try to be nice to other people. I care about their feelings	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
I am restless, I cannot stay still for long	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
I get a lot of headaches, stomach-aches or sickness	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
I usually share with others (food, games, pens etc.)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
I get very angry and often lose my temper	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
I am usually on my own. I generally play alone or keep to myself	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
I usually do as I am told	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
I worry a lot	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
I am helpful if someone is hurt, upset or feeling ill	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
I am constantly fidgeting or squirming	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
I have one good friend or more	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
I fight a lot. I can make other people do what I want	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
I am often unhappy, down-hearted or tearful	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Other people my age generally like me	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
I am easily distracted, I find it difficult to concentrate	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
I am nervous in new situations. I easily lose confidence	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
I am kind to younger children	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
I am often accused of lying or cheating	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Other children or young people pick on me or bully me	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
I often volunteer to help others (parents, teachers, children)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
I think before I do things	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
I take things that are not mine from home, school or elsewhere	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
I get on better with adults than with people my own age	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
I have many fears, I am easily scared	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
I finish the work I'm doing. My attention is good	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Your signature

Today's date

Thank you very much for your help

© Robert Goodman, 2005

APPENDIX V: Strengths and Difficulties Questionnaire adult version

Strengths and Difficulties Questionnaire

For each item, please mark the box for Not True, Somewhat True or Certainly True. It would help us if you answered all items as best you can even if you are not absolutely certain or the item seems daft! Please give your answers on the basis of the child's behaviour over the last six months or this school year.

Child's Name

Male/Female

Date of Birth.....

	Not True	Somewhat True	Certainly True
Considerate of other people's feelings	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Restless, overactive, cannot stay still for long	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Often complains of headaches, stomach-aches or sickness	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Shares readily with other children (treats, toys, pencils etc.)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Often has temper tantrums or hot tempers	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Rather solitary, tends to play alone	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Generally obedient, usually does what adults request	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Many worries, often seems worried	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Helpful if someone is hurt, upset or feeling ill	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Constantly fidgeting or squirming	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Has at least one good friend	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Often fights with other children or bullies them	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Often unhappy, down-hearted or tearful	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Generally liked by other children	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Easily distracted, concentration wanders	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Nervous or clingy in new situations, easily loses confidence	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Kind to younger children	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Often lies or cheats	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Picked on or bullied by other children	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Often volunteers to help others (parents, teachers, other children)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Thinks things out before acting	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Steals from home, school or elsewhere	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Gets on better with adults than with other children	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Many fears, easily scared	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Sees tasks through to the end, good attention span	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Signature

Date

Parent/Teacher/Other (please specify:)

Thank you very much for your help

© Robert Goodman, 2005

APPENDIX VI

Test of Everyday Attention Administration instructions

Instructions in bold are the sections you read out to the test taker.

Check before you start that you have:

2 pens,
1 blank piece of lined paper,
results sheet,
stopwatch,
test cassette
cassette player (check it's plugged in and working),
pictures 1 & 2
2 A3 sheets: plumbers, restaurants

After introducing yourself, say:

Thank you for coming to complete this test. You are free to change your mind about doing the test, and you can choose to leave at any time. No one in school is going to see your results, and when they are analysed and reported for the research, your name will not be attached to them at all. Is that clear? There are four tasks altogether, the last one takes the longest. The whole test will take about half an hour. OK?

Task 1

The first thing I am going to ask you to do is listen to some beeps on a tape and count how many you hear. When the tape asks you to, I'd like you to tell me how many you have counted. Is that clear? There are a couple of practice tests we will do together first, so let's listen to those.

Play tape "Elevator task", counting along with the test taker. When tape asks 'how many?', pause the tape and wait for the test taker's response. If their response is incorrect, rewind the tape and play it again, continuing to do so until you are sure they understand the test and can do the first example.

If their response is correct, say **Let's have another practice** and continue playing the tape for the next example. If their response to the second example is incorrect, then return to the beginning and count with them, continuing until they get the right answer on their own. When it is correct, say:

You will notice that the time between the beeps varies, sometimes it's longer and sometimes shorter.

Now I would like you to do the same thing with the next sets of beeps and I will write down your answers. There are seven sets altogether.

Task 2

Put picture 1, and the 'plumbers' sheet in front of the test taker.

Now, I would like you to imagine that you are away on holiday, staying in a house. The sink starts to leak and you need to find a plumber. What you have here is a section of the telephone book which lists all the plumbers. You have been told that the best plumbers have the same two symbols in front of their number. So you are going to look through the telephone book for any two symbols (two squares, two stars, two circle or two crosses) and circle them when they are the same. Work as quickly but also as accurately as you can to find all the double symbols quickly. Let me know the moment you have finished working through the four columns. When you reach the bottom, put a cross in the box, here, and put your pen down. I don't want you to go back and check after you have reached the bottom right-hand corner. OK?

When the test taker understands and is ready, say 'begin' and start your stopwatch. When the test takers indicates that they have found all the targets, write down the time they took. If you see that they have reached the bottom of the fourth column and they have not put a cross in the box, then say: **When you have reached the bottom, put a cross in the box.**

Task 3

Leave picture 1 in front of the test taker, and put the 'restaurant' sheet in front of them.

Now you are going to look through different pages in the telephone book for the same double symbols as in the last test. But this time, I want you to do a second and equally important task at the same time – counting a number of a series of beeps on the tape recorder. These are simple strings of beeps which are very easy to count on their own, but which are more difficult to count when searching in the telephone directory at the same time. Now, let's play a sample of what you will hear on the tape.

Start the tape and count the practice series with the test taker. Wait until the voice says 'OK, let's start' before you press the pause button on the tape. Say:

So you will be looking for the same double symbols as before and marking them as quickly and as accurately as possible. As soon as you have finished marking them, cross this box in the lower right hand corner as you did before.

At the same time as you are circling the double symbols, listen for the beeps and when you hear the voice on the tape say 'How many?', say out loud the answer straight away.

Remember to tell me as soon as you have finished marking the symbols and put a cross in the box even if you are in the middle of counting. Remember to give equal importance to the telephone and counting tasks. OK?

Start the tape and the stopwatch together. Write down the numbers the test taker says in response to the 'How many?' questions. If they fail to give a number for a string of beeps, say "Hear those?", or repeat "How many?" and write down their answer. After one or two prompts of this type, consider missed numbers as an error and write M for missed on the results sheet. As soon as they cross the box at the end stop both the stopwatch and the tape, even if they are in the middle of counting a string of beeps. Write down the time taken.

Task 4

This task takes 10 minutes to do, and a couple of minutes to explain, so do not start it unless you are confident you will have enough time to complete it in the session without being disturbed.

Fast-forward the tape to the beginning of the test.

Remove picture 1 and put picture 2 in front of the test taker.

So for this last task, I'd like you to imagine that you are on holiday in another country and you have bought a ticket in their lottery. What you are going to be doing is listening to a long list of lottery numbers on the radio. Their lottery numbers aren't quite like ours, their numbers would be like WD389 or ZX638, so that is two letters followed by three numbers. All your tickets end in 55, so you must listen out for all the tickets that end in 55. When you hear a ticket ending in this number, write down the first two letters of the ticket. So if you hear SD355, you will write SD. To remind you, the number you are listening for is here. Here is a piece of paper for you to write the letters on, OK?

The radio programme goes on for quite a long time. Your number is not going to be mentioned very often. Try your best to listen for your number over the fairly long radio broadcast. Let's listen to the beginning of the radio programme to make certain you are clear about what you have to do.

Play the tape to the point when the first lottery number ending in 55 is mentioned then press pause. Check that the test taker has heard the series and written down the right letters; if so, release the pause button and carry on to the end of the test. If they fail to write the letters, remind them that they will hear two letters and three numbers and when the last two numbers are 55 they are to write down the letters. Rewind and restart the test until they successfully respond to the first number ending in 55.

Be sure to sit still yourself during this test, so as not to distract their attention. Write a note on the results sheet if there are any loud or sudden noises outside, or interruptions, while the test is going on. When observing the test taker, mark an 'M' in the appropriate box on the results sheet for any 55 tickets they fail to notice or write down. Ask the test taker to write their name on their answer sheet at the end.

TEST OF EVERYDAY ATTENTION
RESULTS SHEET

Date and time: _____

Name of test taker: _____

Date of birth: _____

Name of test administrator: _____

Task 1 responses:

--	--	--	--	--	--	--	--

Task 2:

Time taken: _____ min _____ secs

Task 3 responses:

Time taken: _____ min _____ secs

Task 4:

HH	EA	LV	DR	CF	QO	TS	FN	FA	XT

Please write the pupil's name on the 'plumbers' and 'restaurant' sheets and staple them to this page.

Thank you!

References

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