The influence of executive function on externalising and internalising behaviours in middle childhood

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The Influence of Executive Function on Externalising and Internalising Behaviours in Middle Childhood

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Consent and Declaration

I certify that the work presented in this thesis is, to the best of my knowledge and belief, original, except as acknowledged in the text, and that the material has not been submitted, either in whole or in part, for a degree at this or any other university.

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Short Abstract

This thesis investigated the development of social competence in children, as tied to specific cognitive processes involved in executive function (EF). Executive processes, most commonly defined as higher order cognitions which guide goal-directed behaviour, enable the development of appropriate social skills through their influence on planning, problem solving, self-monitoring and mental flexibility. However, deficits in executive functioning - such as poor self-regulation skills and maladaptive social information processing (SIP) biases, can interfere with the development of positive social, cognitive, and emotional behaviour.

The aim of the investigation was to determine whether the behavioural problems of children in middle childhood (8-12 years), as identified by teachers and parents, can be explained, in part, by deficits in aspects of executive functioning, specifically SIP and self-regulation. To this end behaviour was examined as either internalising or externalising as a means of classifying profiles of cognitive strengths and weaknesses in order to identify the connection between EF and behaviour. The assessment approach and interpretation of findings were considered in the context of a biopsychosocial model. The investigation also generated the first test-retest reliability findings for several of the measures used, and tested claims of reliability for others previously used with children.

Analyses revealed that there were a number of similarities between children reported as either high on internalising or externalising behaviour with both behavioural dimensions struggling with aspects of EF, including emotional control. There were also a number of differences between the behavioural dimensions; wherein children who engaged in internalising problem behaviours were more likely to be reported as having difficulties
with cognitive shifting, children who engaged in externalising problem behaviours were more likely to be reported as having difficulties with inhibition. Data from SIP highlighted that children classified as high in internalising behaviour were more likely to endorse prosocial decisions in social situations while children high in externalising behaviour were more likely to endorse aggressive goals in the same scenarios. These findings supported the thesis’ predictions concerning the influence of executive functions on the behaviour of children.

In conclusion, different cognitive profiles appeared across the internalising-externalising behavioural dimensions which were based on parent report and child test performance, as well as on mood questionnaires. This was in accordance with key thesis hypotheses, and suggests that if interventions are uniquely tailored by using SIP and EF models to understand possible impairments and relative strengths, the interventions may have greater benefit for the child in terms of improved social, cognitive, emotional, and academic outcomes. While beyond the scope of the current work this is an area that also requires further research.
Long Abstract

This thesis examines the development of social competence in children, which has been closely tied to the cognitive processes involved in executive function (EF). Executive functions enable the development of appropriate social skills through their influence on planning, problem solving, self-monitoring and mental flexibility. Children typically develop these EF skills by interacting with their environment. For example, through engagement with parents, peers and teachers a child will learn and practise skills such as attention, goal formation, inhibition and decision making which will either be supported or met with resistance in others, thus shaping future interactions and skill development. These skills help them regulate emotions and subsequently control behavioural responses. However, deficits in executive functioning - such as poor self-regulation skills and maladaptive social information processing (SIP) biases - can interfere with the development of appropriate social, cognitive, and emotional tendencies.

The examination of SIP has been instrumental in understanding the development of social competence in children. SIP involves the coordination of numerous mental processes that are involved in the generation of a behavioural response, including attention to social cues, attributions, goal clarification, and decision making. If one’s SIP is functioning normally the individual will exhibit social competence; however, if any stage of SIP is biased or deficient (e.g. incomplete attention to social cues or inaccurate attributions), behaviour can become less socially appropriate and result in problem behaviours such as social withdrawal or aggression.

The thesis also examines self-regulation as another vital ability available to children who exhibit socially competent behaviour. Self-regulation refers to the processes by which an individual exerts control over their inner processes and overt behaviours in a way that
reflects one’s desires and emotional awareness. In addition to positive feelings that may be derived from a sense of personal mastery, the ability to control one’s behaviour is also fundamental in the development of socially competent behaviour, including compliance with parental guidance, developing friendships, adjusting to varying social demands and academic success. Research suggests that as children develop, they move from more reactive behaviour to more regulated behaviour, but executive dysfunction can interfere with this normal progression and negatively affect a child’s ability to self-regulate.

Many studies investigate singular factors involved in the development of social maladjustment or social incompetence, despite the acknowledgment that such outcomes are influenced by multiple factors. A major aim of this thesis was to investigate whether the behavioural problems of children in middle childhood (8-12 years), as identified by teachers and parents, can be explained, in part, by deficits in aspects of executive functioning, specifically SIP and self-regulation. In this respect behaviour was examined on an internalising – externalising dimension as a strategy for classifying profiles of cognitive strengths and weakness for the purpose of identifying the connection between EF and behaviour. These behavioural dimensions were differentiated according to whether they involved the encoding of socially relevant information, situational attributions, or behavioural choices, all of which were considered components of a biopsychosocial model.

Participants completed a variety of questionnaires and assessment tools designed to measure EF and assess behaviour. Parents completed the Child Behaviour Checklist (CBCL), Behaviour Rating Inventory of Executive Functioning (BRIEF), and either the Temperament in Middle Childhood Questionnaire (TMCQ; for ages 7-9) or the Early Adolescent Temperament Questionnaire (EATQ; for ages 9-13), to estimate their child’s
behaviour, SIP skills, emotionality, and self-regulation. Children completed the Beck Youth Inventory (BYI) and the Skills Level Activity (SLA) measure, in addition to tests of complex attention and EF (subtests from the Concussion Resolution Index [CRI] of the HeadMinder program, the NEPSY-II Affect Recognition [NAR] Subtest, and the Delis-Kaplan Executive Function System [DKEFS] Tower Task). Multiple regression was used to explore relationships among the reported behavioural problems of the children and their executive functioning. In relation to these measures the thesis also generated the first test-retest reliability findings for several of the measures used, as well as tested claims of reliability for others previously used with children.

Based on parental reports, analyses revealed that there were a number of differences between the problem behaviours. Firstly, children who engaged more in internalising problem behaviours were reported at a higher rate by parents using the BRIEF as having difficulties with cognitive shifting while children who engaged more in externalising problem behaviours were reported at a higher rate as having difficulties with inhibition. Similarly, using the temperament scales (TMCQ or EATQ), parents indicated that children high in externalising behaviours were higher in Surgency (a willingness to approach the environment) and Affiliativeness (the desire for connection with others), yet low in Effortful Control (the regulation of emotion and behaviour).

The investigation also found a number of similarities between the behavioural dimensions. Firstly, children scoring higher in either internalising behaviours or externalising behaviours were equally likely to be reported by parents as having difficulties with Emotional Control. Further, those scoring higher in either internalising behaviours or externalising behaviours were equally likely to be reported as having issues
with the temperamental factor of Negative Affect (including emotions of sadness, frustration, anger, and depression).

Based on findings from the SLA, children scoring higher in internalising behaviour were more likely to endorse pro-social decisions in social situations while children scoring higher in externalising behaviour were more likely to endorse aggressive goals in the same scenarios. Turning to the child’s performance on the D-KEFS Tower Task, those scoring higher on either internalising behaviour or externalising behaviour struggled with consistent response styles and adopted a relatively slow approach to task moves. Children scoring higher in externalising behaviour but not internalising behaviour had difficulty with following task rules. When asked to report on their own behaviour children scoring higher on externalising behaviour were more likely to report higher levels of disruptive behaviour. However, children scoring higher on internalising behaviour did not report significant elevations of problem behaviour. There were no significant associations between behaviour and EF as assessed by the CRI subtests, between behaviour and SIP as assessed by the NEPSY II Affect Recognition subtest or between behaviour and mood as assessed by the BYI.

To assess the stability of the measures, a small subsample of children and their parents were assessed twice using the same battery. Consistent with previous findings, significant correlations were found between time 1 and time 2 on the CBCL behaviour subscales, BRIEF GEC, NEPSY II Affect Recognition, the temperament factors of Negative Affect and Effortful Control, the BYI of Anxiety, Anger and Depression, and the SLA subscales of Goal Formation and Decision Making, suggesting moderate to high test-retest reliability. However no significant test-retest relationship was found for the remaining measures.
In conclusion, different cognitive profiles appeared across the internalising-externalising dimensional construct posited by the thesis, based on both parent report and child test performance and mood questionnaires. This suggests that if interventions are uniquely tailored by using SIP and EF models to understand possible impairments and relative strengths they are expected to be more beneficial for the child in terms of improving social, cognitive, emotional, and academic difficulties. It also appeared clear that children scoring higher on both internalising and externalising behaviour on the CBCL expressed negative affect, including sadness and frustration. This finding is important because it does not support previously held beliefs about internalisers being at greater risk for mood disorders may not be supported.
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List of Abbreviations used in this Thesis

ADHD: Attention Deficits Hyperactivity Disorder

BAI-Y: Beck Anxiety Inventory for Youth

BANI-Y: Beck Anxiety Inventory for Youth

BDBI-Y: Beck Disruptive Behaviour Inventory for Youth

BDI-Y: Beck Depression Inventory for Youth

BSCI-Y: Beck Self-Concept Inventory for Youth

BRI: Behaviour Regulation Index

BRIEF: Behaviour Rating Inventory of Executive Function

BYI: Beck Youth Inventory

CBCL: Child Behaviour Checklist

CBT: Cognitive Behaviour Therapy

DKEFS TT: DKEFS Tower Task

EATQ: Early Adolescent Temperament Questionnaire

EF: Executive Function

Ext: Externalising

GEC: Global Executive Composite

Int: Internalising
**MI:** Meta-Cognitive Index

**MC:** Making Choices

**NEPSY II AR:** NEPSY II Affect Recognition

**SIP:** Social Information Processing

**SLA:** Skill Level Activity

**SR:** Self-Regulation

**TMCQ:** Temperament in Middle Childhood Questionnaire
CHAPTER 1: INTRODUCTION TO THE RESEARCH

The Influence of Executive Function on Externalising and Internalising Problem Behaviours in Middle Childhood

1.0 Introduction

This thesis examines relationships among deficits in executive function (EF) and the internalising and externalising problem behaviours of middle childhood (8-12 years; Simonds & Rothbart, 2004). Throughout the literature, these behaviours are often called behaviour problems, problem behaviours, and challenging behaviours. Due to such overlap, these terms will be used interchangeably in this thesis. EF is most commonly referred to throughout the literature as the collection of higher order cognitions which help to organise and drive goal directed behaviour, as well as regulate emotions (Morra, 2000; Pintrich, 2000). This thesis focuses on the specific executive functions of social information processing (SIP) and self-regulation (SR) and how these components influence behaviours occurring along the internalising and externalising continuum. Of import to the thesis is that the influence of EF on successful development and adaptive behaviour has been an area of key research in recent years (Best, Miller, & Jones, 2009; McDermott et al., 2013; Sadeh, Burns, & Sullivan, 2012).

An online search of EF (limiting the search to children) through the PsycINFO database reveals 1627 references up until the year 2009 (the year this research began) and an additional 1444 have been published throughout the author’s candidature (2009 - 2014). Due to the volume of research dedicated to this area, this thesis will not seek to provide detail on every aspect or theoretical approach to understanding the links between EF and
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behaviour. In relation to this thesis, the literature review will focus on uncovering whether there are predictable links between internalising and externalising problem behaviours and the executive functions of SIP and self-regulation. The underlying hypothesis of the thesis is that children who vary along the internalising-externalising behavioural continuum will have distinctive cognitive profiles reflective of their specific SIP patterns and self-regulatory strengths and relative weaknesses. The chief aim of the thesis is to demonstrate how to utilise such distinctive profiles to better support individual behaviour management in the Early Childhood area.

Social information processing (SIP) is an important aspect of EF in the literature (Anderson, 1998; Blair, Zelazo, & Greenberg, 2005; Powell & Voeller, 2004). However, while it is commonly hypothesized that children identified with problem behaviours, both internalising and externalising, will have deficits in SIP and self-regulation, it is less certain as to how these executive dysfunctions will present. The reason for this is that most prior research in the area has looked at just one of the two behavioural types or at children in clinical samples (ADHD, Autism Spectrum Disorder). In both cases however important distinctions are to be made concerning the specific executive dysfunctions that relate to SIP and self-regulation, and a distinctive contribution of the current thesis is that it addresses both internalising and externalising behaviours designed to identify the individual dysfunctions involved in both behavioural dimensions. In this respect the literature identifies children identified with externalising behaviour problems as being “under-regulated” (high on impulsivity while low on inhibition) while children identified with internalising behaviour problems are identified as being “over-regulated” (low on impulsivity while high on inhibition) (Eisenberg, et al., 2001; Eisenberg, Fabes, Guthrie, & Reiser, 2000b; Spinrad, et al., 2004). Thus, the terms under-regulated and over-regulated
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will be used to signify the particular executive dysfunctions connected to SIP and self-regulation for the thesis, with each term indicating a particular self-regulatory relationship that represents either an externalising pattern (under-regulated) or an internalising pattern (over-regulated).

Further research on SIP and behaviour has also helped to inform the hypothesis by identifying that both behavioural dimensions will have deficits in SIP with biases in cue encoding, attributions, goal formation, and decision making. From this perspective it is proposed that both behavioural dimensions will have similar biases in cue encoding; those scoring higher on either internalising behaviour or externalising behaviour will attend to fewer and more negative cues in their environment (Quiggle, Garber, Panak, & Dodge, 1992). However, it is also proposed that both behavioural dimensions will differ in their attributions, goal formation, and decision making with those scoring higher on externalising behaviour predicted to be more likely to select less pro-social responses, favouring instead more hostile or aggressive choices, and those children scoring higher on internalising behaviour more likely to favour the use of social withdrawal to minimise conflict (Burgess, Wokslawowicz, Rubin, Rose-Krasnor, & Booth-LaForce, 2006; Quiggle et al., 1992). These hypotheses, and the literature which has helped inform them, are discussed in more detail in the literature review provided in Chapter 2.

1.1 Executive Function and Social Competence

Deficits in SIP and self-regulation often lead to poor social behaviour, and this will now be briefly discussed and further examined in chapter 2. Problem behaviour in childhood can be thought of as a feature of social incompetence and can lead to
undesirable social outcomes such as peer rejection, poor academic performance, school absenteeism, and social isolation in earlier stages of development, and to unemployment and even adult criminal behaviour later in life. This occurs due to the many issues facing children with EF deficits, who often have problems with attention, inhibition, emotional regulation, thinking, and knowledge of behavioural options (Anderson, 2002; Best et al., 2009). These deficits often lead to poor communication and socially unacceptable interactions with peers, marked by hyperactivity, impulsivity, social withdrawal, anxiety, and aggressive behaviour. Thus EF deficits can underlie social interaction styles that are not well received by other children, who often ignore or reject the child or respond themselves with socially unacceptable behaviour, such as aggression (Moffitt and Lynam, 1994; Riggs, Greenberg, Kusche, & Pentz, 2006). Adult responses may include excessive application of punishment or restriction of social opportunities (Powell & Powell, 2008). These interactions often create a cycle of socially unacceptable behaviour for the child identified with behavioural problems, who may then be excluded from peer groups and consequently have little opportunity to learn more or practice appropriate ways of relating to others (Powell, Kytja, & Voeller, 2004). These deficits in thinking and behaviour are often defined as components of EF and a considerable amount of research shows a consistent relationship between EF and problem behaviour as well as problem behaviour and lower social competence (Anderson, 2002; Best et al., 2009; Moffitt and Lynam, 1994; Riggs, Greenberg, Kusche, & Pentz, 2006).

There are, therefore, a variety of factors that need to be considered in relation to the internalising-externalising model adopted for this thesis, and an important contribution of the thesis is that it extends on prior research by using a comprehensive assessment battery to look at the specific executive functions of SIP and self-regulation. Many studies have
investigated singular factors that relate to the development of social maladjustment or social incompetence, despite the acknowledgment that such outcomes are influenced by an array of factors. In contrast, this research focuses on the contributions of multiple factors, including temperament, mood, executive functioning as indexed by standardised cognitive tests and behavioural reports, SIP patterns, and self-regulation skills. Also, because of the need to intervene as early as possible when problems exist, focusing on the social and emotional wellbeing of children in primary schools is viewed as imperative. As Anderson (2002) states, there has been considerable research conducted looking at the influence of EF on the behaviour and adjustment of adolescents and adults, but relatively little to date looking at the links being EF and behaviour in younger children. Those studies that do look at the executive functioning of children are often inconsistent due to the limited language ability of children and the use of complex tests (Jurado & Rosselli, 2007).

Because of these factors, participants for the current investigation included students in middle childhood aged 7 – 13 years (Year-3 to Year-7 at school) who had not been diagnosed with a developmental delay, in order to avoid confounding the investigation. In terms of data collection, the children completed a number of age appropriate and engaging psychological tests and questionnaires that assessed EF, specifically focusing on SIP and self-regulation, along with a self-report measure of mood. Behaviour ratings were included from the parents of these children, and ratings from teachers were included as well when the parent and child consented. In line with prior work, both parent and teacher information were deemed useful in formulating each child’s cognitive profile of perceived strengths and relative weaknesses however this aspect of the project was found to be problematic (these measures are further explained in the detailed methodology of Chapter 3). It is with this more detailed and unique cognitive profile of the underlying strengths
and weaknesses of behavioural problems found in middle childhood that parents, teachers, and other professionals will hopefully be enabled to better understand and more effectively intervene to remediate the issues facing children who are identified with problem behaviours.

1.2 Definitions

Researchers vary considerably in their definitions of the key concepts central to this thesis, so these terms have been defined below to clarify the position of the current thesis. These concepts are further explained in the literature review in Chapter 2.

- **Challenging Behaviour/Problem Behaviour/Behaviour Problems** – for this thesis, these behaviours refer to the internalising and externalising behaviours of middle childhood as reported on the Child Behaviour Checklist (CBCL). Due to the use of different terms in the relevant literature that refer to essentially the same behaviours, these terms will be used interchangeably in the current thesis.

- **Externalising Behaviour** - are problematic behaviours directed toward people or objects which are outside the individual’s body. Examples of such behaviours include aggression toward people or property, hyperactivity, distractibility, and impulsivity.

- **Internalising Behaviour** - are problematic behaviours which are considered more internal to the child or directed towards the self. Examples of such behaviours include social withdrawal, anxiety, fearfulness, avoidance, shyness, behavioural inhibition, and difficulty concentrating due to preoccupying thoughts or rumination.
Executive Functions – are most commonly defined as higher order cognitions which guide goal-directed behaviour. They involve the manipulation of information required to control cognitions and behaviour and include, but are not limited to, the functions of inhibition, mental shifting, emotional regulation, planning and organisation and initiating behaviour. For the current study the key executive functions discussed are social information processing and self-regulation but as described below they may be reliant on more fundamental perceptual, cognitive and EF processes.

Self-Regulation - involves the processes by which an individual exerts control over their internal thoughts and feelings, as well as overt behaviours. It involves processes that allow for both emotion regulation and behaviour regulation. The executive functions of attention, shifting mental sets and inhibition are most commonly involved in the deficits described here.

Social Information Processing (SIP) – refers to a set of perceptual and cognitive abilities that subserve encoding and processing information about social relationships. It includes selective and accurate social cue encoding from environmental stimuli, attributions made about those cues, the formation of goals regarding social behaviour, and finally, decision making about which behaviours will or will not be acted upon in order to achieve a goal. A child can have deficits in one or several of these information processing steps and this can impair their ability to respond to social situations in a socially acceptable and adaptive way. Numerous executive functions are involved in SIP; including attention, shifting one’s focus appropriately, inhibition of attention to distracters and maladaptive impulses, planning, emotion regulation and decision making. In some cases, a
knowledge deficit may also account for poor social responses even when other aspects of the system are seemingly intact.

- **Temperament** – is most commonly defined as a biological predisposition to individual differences in emotional reactivity, attention, motivation, and self-regulation. Temperamental traits include negative affect (e.g. fear, sadness, anger), surgency (high level of positive emotions and engagement with the environment) and effortful control (emotional and behavioural regulation). These traits are mediated by pre-frontal cortex functioning, specifically, by the executive functions.

### 1.3 Rationale for the Current Study

Children’s social competence is increasingly being seen as a vital component in the prevention of a number of developmental psychopathologies including depression (Muris, Pennen, Sigmond, & Mayer, 2008), anxiety (Afffrunti & Woodruff-Borden, 2013; Ursache & Raver, 2014), and aggressive behaviour (Fraser et al., 2005). As noted by Spinrad et al (2009), due to the overwhelming importance of these disorders, in which even subclinical levels of dysfunction can create significant individual and social burdens, further understanding of the factors which influence the development of social competence is urgently required. In addition, because the social and emotional wellbeing of children in primary schools and preschools is imperative, and because strategies are most effective when intervention occurs as early as possible when problems do exist, focusing on measures that provide early assessment and intervention where needed is viewed as highly appropriate.
This area of investigation involves a complex set of issues, and, as a result, it is difficult to identify those factors which have a direct impact on behaviour and performance and demonstrate a precise causal effect. However, as will be demonstrated throughout the following literature review, recent research has identified a number of key factors, including SIP patterns and self-regulation abilities, which significantly impact upon a child’s social and emotional development and thus influence their social competence and future adjustment (see Figure 1 below for a brief overview of the proposed interaction between EF and behaviour; these interactions will be discussed in more detail in the following chapter). Of particular importance is that these areas of functioning have also been shown to be amenable to remediation using a range of interventions when applied effectively.
Figure 1. Model outlining the dynamic interactions between SIP, self-regulation, and behaviour in a child’s personal system (adapted with permission from Donnelly and Flemming).

Caption: Firstly, a child attends to environmental stimuli; which are neutral until meaning gets attached. The meaning attached to environmental stimuli is influenced by prior knowledge (e.g. encoding a facial expression as angry rather than neutral due to a previous negative encounter with the same person; selectively attending to only negative cues; failing to integrate cues). How a child encodes and interprets environmental cues then influences the goals and decisions they make in how to respond (e.g. selecting to act aggressively as opposed to deciding on a more socially acceptable response). The child’s self-regulation skills are also of importance in this process in
order to control the information being attended to (e.g. shifting attention away from negative stimuli) as well as inhibiting or activating an appropriate behavioural response (e.g. refraining from hitting a peer and rather, deciding to ask a teacher for assistance). All of these influences can be driven by the child’s emotional state (e.g. anger). There is also a presumption that there may be a biological predisposition that makes children vulnerable to a SIP style; temperamental variables that give rise to tendencies for emotional reactivity or behaviour (for further detail see Donnelly & Kocek (2011).

Interventions which aim to increase a child’s repertoire of social-emotional skills, in particular SIP and self-regulation, will inevitably promote the development of positive social development and reduce the developmental pathways leading to problem behaviours (Fraser et al., 2005). Such interventions would ensure that treatment is provided to lessen the negative effects of such deficits and ultimately improve the child’s quality of life, in both academic and social areas.

As noted prior, many studies investigate singular factors for the development of social maladjustment or social incompetence despite the acknowledgment that such outcomes are influenced by an array of factors. Because of this the current author and others acknowledge that research needs to focus on the contributions of multiple factors, such as executive functions, SIP patterns and self-regulation skills (Adrian, Zeman & Veits, 2011). By comprehensively assessing executive functioning in children, any deficits in such skills can be more easily identified. Consequently, more effective behavioural interventions, based on cognitive profiles, can be put into place to manage challenging behaviours and improve social competence (Biederman et al., 2001; Feifer & Rattan, 2007; Haskett &
Willoughby, 2006). It is the position of the thesis that not only the children themselves, but also their parents and teachers, will benefit from this approach.

1.4 Organisation of the Thesis

This research thesis is organised into 12 chapters. This first chapter has given a concise introduction to the research thesis; important constructs and definitions, identified gaps in the literature which the current research attempts to help overcome and now, a brief outline of the thesis organisation. This chapter also gave an overview of the key ideas which form the basis of the current thesis position while anticipating the need for further research in the area of executive dysfunction in childhood.

The second chapter will further support these ideas through a detailed review of the relevant literature and conclude with a reiteration of the rationale for the research study. Chapter three presents the research methodology, including aims, hypotheses and the processes undertaken to recruit and assess participants. Chapter four discusses the process variables encountered throughout the project and their impact on data collection and interpretation. Chapters five through eleven report the study’s results and summarise the research findings, organised into multiple chapters due to the complex nature of the data. Each results chapter examines a specific relationship between EF and behaviour, and it is felt that this division of results has improved the accessibility of information for the reader. The final chapter concludes the thesis by providing recommendations for future research and discussing the limitations of the study.
CHAPTER 2: LITERATURE REVIEW

2.1 Early Life Experiences

The following literature review addresses the fundamental constructs examined in this thesis. It begins with an examination of how early childhood experiences may affect development, including a rudimentary discussion of how experiences may affect brain neurophysiology. Next the chapter discusses the constructs variously linked to the term executive function (EF), and how the relations amongst those constructs might predispose a child to behavioural problems in social contexts. Social competence is then discussed in relation to SIP, and the relationship between self-regulation and the externalising/internalising continuum established. Finally, a review of the relevant screening processes and existing intervention strategies will be presented.

A number of early life experiences have been identified as having a significant impact on the development of social, emotional, and behavioural disorders in children. The experience of unstable parent-child relationships, dysfunctional family environments, abuse, and neglect have all been implicated in the negative shaping of a number of crucial brain functions, including neurochemical makeup, alterations in brain structures, cortical modulation, and EF. Although difficult to isolate causal links, these developmental changes have been identified as increasing the likelihood that a child will experience some form of challenging behaviour at a later stage of development, including substance abuse, aggression, sexual promiscuity, depression, anxiety, and even suicide (Blythe, 2014; Flier, Underhill, & McEwen, 1998; McEwen, 2003).

The wellbeing of children is heavily dependent upon the quality of family life, with the parent-child relationship being of particular importance to the development of physical,
psychological, social, and emotional competence in children (Sanders, Dadds, & Turner, 2003; Valiente, Lemery, & Reiser, 2003). Reports in the literature indicate that dysfunctional family environments early in a child’s life, such as a chaotic home, the breakdown of relationships and inconsistent discipline, are linked to the development of neurochemical imbalances in the brain which alter how the individual interprets environmental cues and the behavioural responses which result. A key neurotransmitter believed to be subject to such imbalance is serotonin which is thought to influence mood, social behaviour, learning, and memory with higher levels promoting more socially competent behaviour by decreasing impulsivity and aggressive responding (Young & Leyton, 2001). Studies by Flier et al. (1998) and McEwan (2003) have shown that children reared in dysfunctional family environments have reduced brain serotonin associated with an increased tendency for aggressive behaviour, impulsivity, substance abuse, and depression, especially when experiencing stressful or novel environments.

Specific brain structures are implicated in the manifestation of effective behavioural regulation and may be negatively altered by overexposure to stressful environments during the formative years, such as in the case of child abuse. Brain structures important to social competence include the amygdala, which is involved in the activation of both behavioural, emotional, and physiological stress responses, and the hippocampus, a structure associated with memory consolidation and inhibiting the stress response (Denkla, 1996; O’Brien, Dowell, Mostofsky, Denckla, & Mahone, 2010; Ryan, Denckla, Mostofsky, & Mahone, 2010). Both the amygdala and hippocampus are important to the general encoding of information and the control of specific behavioural responses and the amygdala is of particular importance for processing basic emotional information. The hippocampus also provides a context for emotional cues by linking current events to those stored in memory.
as the individual interprets social information and makes attributions about the behaviour of others.

Social attributions are important determinants of behaviour and in this respect both of these structures are intimately linked to processes mediated by the frontal lobes, which allow humans to reflect on current environmental input, reason about links among the past, present and future, and choose adaptively from a range of behavioural options (Fuster, 1995). The relationship between brain structure and social attributions are important to the thesis because it helps to provide an introductory understanding of the neural basis for possible individual differences in behaviour.

In terms of functional development, it is adaptive for the brain to respond to novel or threatening stimuli, both in terms of life preservation as well as in learning new behavioural strategies for coping. However, neurological research has shown that consistent exposure to stress and fear can ultimately lead to cognitive impairment and problematic behaviour. Negative outcomes associated with these changes include overactivity of the amygdala resulting in increased anxiety, aggression, and enhanced fear conditioning, the development of anxiety disorders and depression in children, and permanent loss of nerve cells in the hippocampus as the result of excess cortisol during experiences of chronic psychosocial stress (McEwen, 2003; Pritchard & Alloway, 1999). Thus, at the neurological level, consistent exposure to stress and fear seems to interfere with the sub-cortical and cortical integration of information about emotions in decision making and behaviour, resulting in potentially problematic behaviours such as anxiety, aggression, and impulsivity (Score, 2001).

Other, less severe family characteristics, including a lack of parental warmth, or the under regulation or over regulation of a child’s behaviour have also been identified as
factors which are related to behavioural problems and mental health disorders in childhood (McEwen, 2003; Perry, 2004). Some children are born with neural, endocrine, and psychophysiological dispositions in addition to being raised in socio-cultural environments which predispose them to exhibit problematic behaviours. For example, when a child is born with a difficult temperament such as avoidant, anxious, dependent or fearful dispositions, and parents are not able to overcome these temperamental vulnerabilities, or they perhaps aggravate these vulnerabilities through harsh, critical or unsupportive parenting, or conversely through being overindulgent and overprotective, then the child’s temperamental vulnerability is more likely to continue and the child may manifest more severe behavioural and emotional problems. These problems are often responded to by peers and other adults in a negative manner, which then continues to intensify their innate temperamental vulnerabilities, causing these vulnerabilities to become progressively more difficult to alter over time (Centre for Community Child Health, 2007). On the other hand, if parents are able to be compassionate regarding their child’s difficult temperament yet are also able to set appropriate boundaries on their behaviour, the child may never fully develop severe emotional or behavioural disturbances (Nolen-Houseman, 2007).

Children experience a number of diverse sensory, emotional, cognitive, and social experiences during their formative years which allow them to acquire the skills necessary to be socially competent and well adjusted. Indeed, according to Anderson (1998) and Perry (2004), the potential to develop a positive capacity for tolerating frustration, containing impulses, and regulating aggression and anxiety develops from precisely these early experiences.

In terms of brain development, when a child is provided with a variety of optimal emotional, behavioural, cognitive and social experiences at significant times in their
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development, a healthy cortical modulation ratio (i.e., balanced cortical, limbic/midbrain and brainstem growth) develops (Morrison, Points, & McClelland, 2010). The development of higher order structures (including the pre-frontal cortex) are necessary to ensure that the more reactive, primitive processes of the lower order structures (including the limbic system) are modulated, in order to support healthy cortical development. According to Perry (2004) and McEwen (2003) an interruption to the development of healthy cortical modulation - either overdevelopment of the midbrain and brainstem or under development of the limbic and cortical areas - will result in an imbalance in the cortical modulation ratio and may subsequently predispose the child to aggression, anxiety or other behavioural disorders.

The literature also suggests that vulnerability to negative experiential influences appears most prominent during early childhood, when the brain is most receptive to the effects of environmental stimuli (Bryck & Fisher, 2012; McDermott et al., 2013; Perry, 2004). Of interest to the thesis, it has also been proposed that specific types of negative experiences can determine the neuroanatomical and neurophysiological modulation profile that develops in the child’s brain. For example, when key experiences are minimal or entirely absent, as in the case of neglect, the development of a healthy cortical modulation ratio is dramatically impaired (Morrison, et al., 2010; Perry, 2004). The profile resulting from developmental neglect is that while the primitive brain structures are normally developed, the limbic and cortical regions (closely aligned with the amygdala and hippocampus) remain underdeveloped due to lack of input. The limbic and cortical regions have been consistently linked to a wide range of cognitive and emotional functions (referred to by some as executive functions) that also allow for social functioning in animals and humans (Fuster, 1995), so this particular type of “underdeveloped” brain
function may contribute to immature emotional and behavioural functioning, and subsequent impulsivity and aggression in social interactions (McEwen, 2003; Perry, 2004). This accords with the thesis notion of an externalising “under-regulated” SIP type, and thus supports the thesis’ contention that particular executive dysfunctions can be identified in terms of their distinctive SIP characteristics.

Alternatively, when a child is exposed to persisting trauma, as in the case of domestic violence and physical abuse, he or she purportedly develops an excessively active and reactive stress response leading to overdevelopment of the midbrain and brainstem (the locus of the stress response system). The overdevelopment of these other, more reactive regions, can result in a predisposition to a generally highly reactive behavioural repertoire that may present as irritability or even aggression, impulsivity leading to social withdrawal, and chronic anxiety (Blythe, 2014; Perry, 2004; Schore, 2001).

Thus, a variety of disruptions to the development of healthy sub-cortical and cortical brain function can lead to problem behaviours. It is the author’s position that these problem behaviours are highly influenced by an interaction between certain aspects of SIP and self-regulation and can appear as either internalising or externalising behavioural profiles. It is proposed, therefore, that a particular type of holistic and interactive developmental dynamic determines the neurocognitive basis for social competence, wherein environmental inputs shape the processing and interpretive structures in the brain, which in turn facilitate a repertoire of cognitive abilities that foster further influential environmental interactions. This dynamic repertoire of processing abilities, which has been the increasing focus of investigators trying to understand social competence and childhood difficulties, will be referred to here as executive functions. A more detailed discussion of these functions now follows.
2.2 Executive Function

Research on the development of EF and its influence on social, emotional, and cognitive development is fairly recent, despite the potential for such an understanding to lessen the negative impact of various disorders and behavioural problems on a child’s emotional, social, and educational performance (Anderson, 2002). The increasing focus on the development of EF and its links to various domains of functioning later in life is timely as the importance of early intervention with children has been demonstrated from both economic (Valentine & Katz, 2007) and mental health perspectives (NSW Ministry of Health, 2014).

It is important to note, however, that definitions of EF vary considerably throughout the literature. The term Executive Function (EF) has been used to refer to various complex or higher-order mental processing functions, such as goal-directed behaviours (Morra, 2000; Pintrich, 2000), planning and organising activities (Antonietti, Ignazi, & Perego, 2000), evaluation and discriminatory functions (Neill, Valdes, & Terry, 1995), task-switching strategies (Mitchell, Johnson, Raye, & Greene, 2004), problem-solving activities (Fincham, Carter, vanVeen, Stenger, & Anderson, 2002), and self-reflective awareness or the awareness of one’s own thinking or emotional states (Zimmerman, 2000). In terms of operationalising EF, common denominators have been that it is essential to goal orientated behaviour, including the initiation, maintenance and planning of behaviour, learning and following rules, sustaining attention and concentration, solving problems and responding effectively to feedback as tasks progress. These functions have all been identified as skills included in EF, and are viewed as crucial to the development of appropriate social, cognitive, and emotional behaviour (Seguin, Boulerice, Harden, Tremblay & Pihl, 1999). As a child ages, executive functions progressively include the ability to anticipate future
events and adapt to changing situations, to regulate behaviour, to reason based on prior knowledge about similar situations or problems, to process and use social feedback cues about emotion in others, and the ability to inhibit behaviours (Seguin, Pihl, Harden, Tremblay, & Boulerice, 1995). For the purposes of this thesis, EF is also defined as a functional control centre that coordinates, suppresses, and integrates information from different areas of the brain. Understanding EF from these perspectives is important to the thesis because it clearly outlines not only the higher order cognitive skills which are mediated by executive functioning, but it also suggests the types of behaviours which may provide evidence for executive dysfunction.

Executive functions enable the development of appropriate social skills through their influence on SIP, self-regulation, effective communication, and the ability to anticipate outcomes and adapt to changing situations (Jurado & Rosselli, 2007). Anderson (1998, p.321) has noted that operational definitions of EF include “planning, problem solving, abstract thinking, concept formation, self-monitoring and mental flexibility”. Important to the thesis, executive dysfunction can therefore be revealed in test performances demonstrating deficient planning and organisation skills, difficulties generating and implementing problem solving strategies, perseveration, and inflexible thought processes. Furthermore, the behavioural correlates of executive dysfunction can be observed through an individual’s poor self-control, impulsivity, and behavioural dis-inhibition, all problematic behaviours connected with SIP that can interfere with the development of social competence and school success, as often indicated by parent or teacher report (Anderson, 1998; Barkley, 1997). Of note, “theory of mind” (the capacity to imagine the mental or emotional state of someone else [Baron-Cohen, 1994; Ozonoff & McEvoy, 1994; Pellicano, 2007]) is also considered an EF and is certainly implicated in some
clinical disorders in children such as those on the Autism Spectrum. It is possible that performance on the included SIP tasks was dependent on an intact theory of mind but this was not tested directly and was beyond the scope of the current project.

A large body of research exists concerning the development of EF in children. Of relevance to the thesis is that the development of executive functions seems to parallel the physical development of the frontal lobes, specifically, the prefrontal cortex which is often considered to be responsible for the brain’s self-control processes (Anderson, 1998; Fuster, 1995; Lezak, 2004; Riggs et al., 2006). The frontal lobes seem to be most activated in novel situations when new learning is occurring and in circumstances when a child has to shift from one mental or behavioural activity to another, resist shifting despite distraction, or when an “if in the past, then in the future” process is involved. Children with clinical syndromes that show differences in frontal brain activity (e.g., Attention Deficit Hyperactivity Disorder [ADHD], Autism Spectrum Disorders, frontal brain injuries, and mood disorders) also show difficulty with these associated executive functions (Corbett, Constantine, Hendren, Rocke, Ozonoff, 2009). As mentioned above, children with an Autism Spectrum Disorder also have significant difficulty understanding the perspective of others, referred to as theory of mind, which is reportedly based in the complex connections between frontal lobes and other brain regions (Baron-Cohen, 1994). The frontal lobes are also intimately connected to emotion generation systems, and differences in activation across the two hemispheres of the frontal cortex have been linked to child temperament and risk for depression (Tomarken & Davidson, 1994; McManis, Kagan, Snidman, & Woodward, 2001; Wheeler, Davidson, & Tomarken, 1993).

Individual differences in frontal brain asymmetry (i.e., one frontal hemisphere being more activated electrically than the other) are detectable at birth and are related to how a
child responds to positive and negative stimuli (Baving, Laucht, & Schmidt, 2000). More specifically, research has consistently found that activation in the left frontal brain region is linked with the expression of positive emotions and a willingness to engage in social environments while activation in the right frontal brain is linked with the expression of negative emotions such as disgust and sadness, and withdrawal reactions (Baving et al., 2000; McManis et al., 2002; Tomarken & Davidson, 1994). One exception to the hemispheric links between affective valence and approach-withdrawal tendencies has been found in studies of anger which show left frontal activation for a negative emotion that may foster approach-related behaviour as the person moves to address the offending behaviour from others (Harmon-Jones, 2007; Harmon-Jones & Sigelman, 2001). In general, however, this provides a basis upon which to link the thesis concept of SIP profile to the neuro-correlates of cognitive architecture. For example, when children demonstrate stable differences in their expressions of emotion early in life, electroencephalogram (EGG) patterns may be able to help identify whether specific temperamental dispositions and maladaptive behaviour are correlated with particular activation patterns. In support of this, research has found that children with either internalising or externalising behaviour profiles on the Child Behaviour Checklist (CBCL; Achenbach, 2001) and activation in the right frontal brain are likely to exhibit withdrawal or shy behaviours and aggression or impulsivity respectively (Baving, Laucht, & Schmidt, 2003; McManis et al., 2002). Moreover, Baving et al. (2000) highlighted that while there is an association between relative right frontal brain asymmetry and challenging behaviours, it is the child’s temperamental disposition that influences the type of challenging behaviour they are likely to exhibit. Thus, a shy child is more likely to experience internalising problems such as withdrawal while a highly sociable child is more likely to experience externalising
behavioural problems such as aggression even though they both show similar right frontal brain asymmetry.

In some cases where the differences are extreme and stable over time, a child may be at increased risk for depression, have difficulty maintaining motivation in the classroom and may demonstrate a bias in retrieving negative emotional memories about their past experience (Davidson, 1998a, 1998b; Kagan, MacLeod, & Pote, 2004). Children with significantly more brain activation in their right prefrontal cortex relative to their left may have excellent access to memories of their perceived failure or negative emotional experiences and have difficulty recalling positive experiences. The theory is that excessive right frontal brain activation may increase access to brain regions where negative emotional experiences are stored so thoughts about how things might go for them in the future are also negatively biased. This mind set may contribute to a child’s reluctance to explore their world or try new things if they believe things will generally go poorly or offer only rare positive results. If the child is also selectively attending to evidence in their environment that things are not going well it further confirms what may be a very distorted, disabling view of them self and their school experience (Kagan et al., 2004), and contribute to the sorts of social attributions associated with dysfunctional SIP. Despite these brain profiles it is re-assuring to note that some children who appear at risk based on brain activation and their behaviour in anxiety producing situations at 30 months old behave in a healthy, less anxious way at 10 years old even when their frontal brain asymmetry profile does not change (Rickman, 1997). Of importance to the thesis’ focus on early intervention, the key variable that was found to predict behavioural improvement was a positive approach to parenting at home, coupled to quality teaching and social guidance at school and in early childhood settings.
As children progress through physical growth spurts they also exhibit growth of brain connections, refinement of “brain maps” and better connections between brain regions and hemispheres, all of which allow for coordination of sensory and motor functions (Anderson, 1998; Bell & Fox, 1992). Research suggests that the first EF to arise is the ability to resist distraction or inhibit an over-learned response (Diamond, 2002). Rather than just responding reflexively to a stimulus, the child through the involvement of frontal brain systems can begin to pause and reflect between the processing of incoming information and the selection of a behavioural response (Brocki & Bohlin, 2004). However, environmental conditions may make children appear to regress or act younger than their age as the emotional nature or novelty of the situation may cause them to react without thinking even though they seem to be more thoughtful in their behaviour in other more familiar circumstances (Diamond, 2002).

When the development of executive functioning begins and ends depends on who and what is assessed. While children as young as three have demonstrated behavioural evidence of basic planning skills (e.g., doing things that suggest that they are getting ready for an upcoming event) (Jurado & Rosselli, 2007), studies have more consistently found that not until children are around the age of six do they become capable of performing tasks requiring true independent strategic reasoning that subserves planning for future events (Best et al., 2009; Passler, Isaac, & Hynd, 1985). Mastery of some EF skills are not achieved until around the age of 12 years while others are not evident until 16-19 years old (Anderson, 1998).

The link between EF deficits and social success is important to this thesis because it allows a means of determining the relative development of the cognitive foundations of social competence for individual children at various ages.
**2.2.1 Executive Dysfunction and Behavioural Problems.**

Executive dysfunction can appear as impairments in selective attention, behavioural inhibition, emotion regulation, thinking, and behaviour, all of which have serious consequences for normal social development. Such dysfunction can occur due to a number of factors including head injuries or other medical or developmental syndromes, environmental factors such as parenting, as well as genetics (Powell et al., 2004).

Executive function is associated with the prefrontal cortex (Denckla, 1996) and damage to this brain region is likely to result in a disruption to EF-mediated behaviours (Pritchard & Alloway, 1999). Shimamura (2000) has also suggested that the prefrontal cortex acts to filter attentional salience, and Knight and Grabowecky (1995) have shown that individuals with damage or disruption to the prefrontal cortex exhibit significant impairment in their ability to inhibit irrelevant (non-salient) information. There is also growing evidence that children who sustain frontal lobe brain injury exhibit deficits in EF skills, including problems with planning, problem solving, and the performance of socially competent behaviours due to poor self-regulation and biases in SIP skills (Anderson, 1998; Jurado & Rosselli, 2007). Despite obvious brain damage, many of these individuals do not demonstrate abnormal levels of intelligence as measured by traditional intelligence tests (Friedman et al., 2006). This supports the thesis position that children, who exhibit dysfunctions in social, emotional and behavioural skills as evidenced by poor academic performance and inappropriate social behaviour, may have deficits in executive functioning rather than knowledge, basic memory or reasoning abilities, as measured by tests of IQ.

Problems in executive function are usually first identified in primary school as children face more structured settings and new rules in the classroom and increasing
academic demands (Meltzer, 2010; Powell & Powell, 2008). In the school situation, children who are more impulsive, emotionally dysregulated, noncompliant or antagonistic toward other children frequently get identified as problem students by teachers, as their behaviour can be disruptive (Little, 2005). This behavioural profile is typically referred to as *externalising* when characterised by adults using questionnaires to rank children (Achenbach, 2001). However, it is important to note that executive dysfunction can also result in a profile that is characterised by social withdrawal, poor selective attention, and cognitive disorganisation (Feifer & Rattan, 2007). This profile is generally referred to as *internalising* and, while often missed by teachers due to the lack of disruptive behaviour, can also interfere with classroom learning and social success (Achenbach, 2001; Biddulph, 2000). Age-appropriate shyness or a child taking more time to separate from parents or adjust to the new school setting may also lead teachers to accept these behaviours as normal and the child may be moved down the priority list for additional support, especially when resources are limited (Feifer & Rattan, 2007). Again however, it is important to note that parent or teacher questionnaires are being used to classify the child rather than direct measures of what cognitive dysfunction may be giving rise to the behaviour. Neuropsychological measures on the other hand are specifically designed to capture the aspects of cognitive dysfunction which may be underlying the behavioural problems children are exhibiting.

The general domain of *social competence* or *social information processing* has been the focus of psychological and educational research for many years, as it appears to be an issue for children with either externalising or internalising behaviour patterns. How externalising and internalising versions of executive dysfunction affect social behaviour will therefore be the focus of the next section.
2.2.2 Social Competence.

Social competence is generally defined as, “the ability to achieve personal goals in social interaction while simultaneously maintaining positive relationships with significant others” (Camodeca & Goossens, 2005, p. 193). Children differ in their experience of and ability to regulate emotion and these differences are also associated with social competence (Eisenberg et al., 2000a). Social competence can therefore be operationalised as the social-cognitive and emotion-regulation skills necessary to select and engage in appropriate behaviours in social situations, thus linking it clearly to the externalising/internalising profiles indicative of problems in EF. This clearly ties the development of social competence in children to the cognitive processes involved in EF, and it is important to note that deficits in executive functioning - including temperamental extremes in emotionality that can be present at birth, poor self-regulation skills, and SIP biases (e.g., encoding a neutral facial expression as angry) - have been linked to poor development of appropriate social, cognitive, and emotional behaviours (Blair et al., 2005; Eisenberg et al., 2000a; Dadds, El Masry, Wimalaweera, & Guastella, 2008; Powell & Powell, 2008).

A lack of early social skill development interferes with the child’s ability to learn and benefit from their school environment, ultimately impeding further the development of many social competencies including interpersonal relationships, emotional support, school adjustment, and social approval (Anderson, 1998; Powell & Powell, 2008; Riggs et al., 2006). Furthermore, as children begin to realise that they are being neglected or excluded in social situations by their peers, they may start to experience poor self-evaluations leading to low self-esteem and reduced confidence in social interactions (Powell & Powell, 2008). Although not yet directly assessed, one can imagine that even more complex brain
maps need to form in middle childhood in response to social experience. As outlined visually in Figure 2 below, the lack of social opportunities, either because a child’s aggression or impulsiveness has led to rejection by peers or because anxiety has led to social withdrawal, could conceivably leave a child’s brain ill prepared for adolescence, where peer interactions are essential to the development of adult social behaviours and psychological individuation.

**Figure 2.** Representation of how deficits in EF may influence peer behaviour, which in turn can negatively affect or delay the child’s ability to become socially competent.
The literature on social competence indicates that children who struggle socially in the early years due to extremes in temperament and executive dysfunction are at greater risk for social failure and mental health concerns as adults (Brocki & Bohlin, 2004; Coie & Dodge, 1998; Farrell & Barrett, 2007). For example, executive dysfunction has been implicated as a diagnostic feature or in the development of clinical disorders such as Autism Spectrum Disorder, ADHD, Schizophrenia, Obsessive-Compulsive Disorder (OCD), and Conduct Disorder with clinical research demonstrating that deficits in EF, specifically behavioural dis-inhibition and emotion dysregulation, play an influential role in the development of these disorders (Brocki & Bohlin, 2004). Consequently, the identification of executive dysfunction early in a child’s life may be imperative for proper early intervention and the possible prevention of severe cognitive and behavioural problems later on.

Deficits in executive functions have been consistently shown to have a significant influence on social behaviour problems (Feifer & Rattan, 2007). For instance, Dodge and Frame (1982) found that limitations in executive functioning contribute to aggressive behaviour in children as a consequence of their inability to regulate their emotions. Moffitt & Lynam (1994) found that emotionally disordered children have difficulty self-regulating in social situations by using reflection and self-talk. Their results, which now seem obvious, demonstrated that children who experience intense sadness or frequent anger were more likely to exhibit problem behaviours as a means of possibly eliciting external control in situations that were overwhelming. In addition, they argued that emotionally disordered children may not be able to learn from environmental consequences as easily as their non-disordered peers as they may not understand the impact of their behaviour on
others. Research has since indicated that this may be the result of deficits in the executive functions of SIP and self-regulation (Crick & Dodge, 1996).

The problem behaviours of aggression, impulsivity, social withdrawal, and antisocial behaviour have received particular attention in recent years, as have their developmental trajectories. Importantly, research indicates that excessive behavioural inhibition predisposes children to social anxiety in later life. For example, a significant positive correlation has been found between behavioural inhibition and overanxious, avoidant and phobic disorders (Biederman et al., 2001). On the other hand children who are very low in behavioural inhibition are more likely to exhibit disruptive behaviours, including aggression and impulsivity, than their more inhibited peers (Biederman et al., 2001; Young et al., 2009). Thus problems with behavioural inhibition can manifest as either excessive inhibition or insufficient inhibition, which lead to internalising or externalising profiles respectively. It is a key thesis position that these internalising and externalising problem behaviours can be predicted to correlate significantly with deficits in the executive functions of SIP and self-regulation (Dadds, Fraser, Frost & Hawes, 2005). For example, Young et al. (2009) demonstrated that the EF most closely related to externalising behaviours was behavioural disinhibition ($r = -.39$), or the lack of behavioural control, as opposed to when externalising behaviour was compared to the executive functions of working memory ($r = -.18$) or task-set shifting ($r = -.17$). Figure 3 below depicts this set of relationships as an internalising/externalising continuum. This continuum represents a fundamental construct of the thesis, and can be conceived as a dimension of behavioural inhibition.
SIP was defined by Crick and Dodge (1994) as a set of perceptual and cognitive abilities that include cue encoding, attributions about those cues, goal formation, decision making and self-regulation (the capacity of an individual to exert control over their inner processes and overt behaviours). These SIP abilities have been identified as key influences in the development of social competence in children. For example, Debaryshe and Fryxell (1998) suggest that children who have efficient SIP skills and who are able to regulate both their internal emotions and overt behaviours demonstrate competent social behaviour, whereas those who have biases in SIP and poor self-regulation are more inclined to exhibit behaviours such as aggression and withdrawal when interactions are socially challenging.

Although research is rapidly progressing on the distinct contributions emotion-regulation and SIP have on social competence, a problem yet exists in this area of
knowledge in that there is limited attention being given to the integration of both SIP and emotion-regulation (Lemerise & Arsenio, 2000). In light of this problem, Lemerise and Arsenio (2000) argue for further research into the integration between the executive functions of SIP and self-regulation in order to forge a more complete understanding of children’s social, emotional, and cognitive development, and the influence these have on social competence. This particular integration is important to the thesis because it underscores the relationship between social competence and the executive functions of SIP and self-regulation.

2.3 Social Information Processing

SIP refers to the interaction of numerous mental processes which are involved in the generation of a behavioural response as a consequence of one’s own social interactions (Dodge & Rabiner, 2004). According to Dodge and Rabiner (2004) the cognitive dimensions involved in SIP include attention to social cues (facial expressions, body posture), accurate attributions about the meaning of those cues (this person is safe or dangerous or fun), personal goal clarification (this person might help me achieve my goal of having friends), effective decision making and behavioural responding. As noted previously, how children selectively encode and interpret the cues from their external environment influences how they will subsequently respond to that situation (Lansford, Malone, Dodge, Crozier, Pettit & Bates, 2006). If one’s SIP is intact, that is, when information processing gives rise to adaptive behaviour, the individual will exhibit social competence; however, if any stage of information processing is biased or deficient, that is, when information processing gives rise to maladaptive behaviour, the individual becomes
less socially competent and often engages in problem behaviours such as social withdrawal and/or aggression (Camodeca & Goosens, 2005).

2.3.1 Social Information Processing and the Externalising and Internalising Continuum.

SIP models have been used to understand the development and maintenance of a number of problem behaviours in children, including aggression and social withdrawal. These models outline children’s social behaviour as a series of interacting processing steps. Figure 3, below, depicts the steps involved in SIP, albeit from a maladaptive processing perspective. Children are believed to first encode social cues, subsequently interpret these cues, clarify goals, decide on a response, and behave accordingly. If the child is able to successfully proceed through these processing steps, with accuracy in encoding and adaptive goals and decisions, appropriate and effective behaviour is the normal result (Horsley, Orobio de Castro, & Van der Schoot, 2010). Indeed, children whose SIP is intact, as well as children who are taught better SIP strategies, have both been found to show more negotiated, less confrontational solutions to peer conflict situations (Haskett & Willoughby, 2005).

A problem arises, however, if a child is deficient in any one or more of these steps. In such cases problematic behaviours such as aggression, social withdrawal, or inhibited social behaviour are likely to occur (Crick & Dodge, 1996). For example, aggressive and withdrawn children have been identified as having deficits in SIP surrounding how environmental cues are interpreted and the ability to select socially appropriate behavioural responses (Crick & Dodge, 1996; Haskett & Willoughby, 2005). Importantly, the more
problems that a child has with SIP, the more likely they are to show severe behavioural problems (Lansford et al., 2006). Thus, whereas a child who has deficits in the early steps of SIP (encoding and interpreting social information) or in just the later steps of processing (decisions about behaviour) will tend to produce minimal problem behaviours, a child who has deficits at both stages of SIP will tend to produce more intense problem behaviours such as aggression or social withdrawal (Lansford et al., 2006). Another assumption of this thesis is, therefore, that understanding the type of SIP deficits that may be at work in a child’s early development is fundamental to the design of appropriate early intervention strategies to support the child. These differences are represented in Figure 4, which depicts the relationship between SIP stage and type of challenging behaviour.
Figure 4. A diagram outlining the steps involved in SIP which may influence the expression of challenging behaviours such as aggression or withdrawal (adapted with permission from Crick & Dodge, 1994).

The ways in which children interpret the intent of others as well as their generation of solutions to social problems have been identified as key predictors of the development of children’s social competence (Burgess, et al., 2006). Research shows that aggressive children make attributions about another’s intent based on fewer social cues than their nonaggressive peers and have difficulty shifting their attention away from aggressive cues once focused (Dodge & Schwartz, 1997; Quiggle, et al., 1992). Aggressive children consistently show a bias toward hostile attributions of others’ behaviour, generate significantly more aggressive responses and value aggressive behavioural responses more
so than their nonaggressive peers (Crick & Ladd, 1990; Quiggle et al., 1992). Similar to aggressive children, children who withdraw from social situations more often attend to negative cues in their environment and have difficulty shifting their attention away from such cues once focused. However, while aggressive children believe that aggression will result in positive outcomes, depressed/sad children report a favourable use of withdrawal. Finally, aggressive children are more likely to use aggressive behaviour in negative situations and place blame on others while depressed/sad children are more likely to report that the use of withdrawal or appeasement would lead to positive outcomes in negative situations; strategies that would effectively reduce their feelings of stress and anxiety (Burgess, et al., 2006; Nolen-Hoeksema, 2014).

Both externalising and internalising children become more emotionally aroused in negative situations than their socially competent peers and these more intense emotional responses are often associated with poor social skills (Burgess, et al., 2006; Quiggle et al., 1992; Powell & Powell, 2008). Some children externalise these negative emotions, in overt aggression for example, while other children internalise these emotions and may develop physical symptoms and withdraw from or avoid social contact (Quiggle et al., 1992).

Lemerise and Arsenio (2000) have applied Crick and Dodge’s SIP model but integrated it with emotional experiences. They found that aggressive children often experience frustration and anger in social situations while socially withdrawn children are more likely to experience anxiety and stress. They argue that these negative emotional responses may, in part, shape SIP and lead to the maladaptive thinking styles and coping strategies often seen in these children. This disparity in response, even after the same attribution is made, highlights the additional role of techniques for self-regulation in the
occurrence or nature of problem behaviours. Self-regulation and its influence on the internalising/externalising dichotomy will now be discussed.

2.4 Self-Regulation

Self-regulation, including emotional and behavioural regulation, has become a topic of increasing interest in recent years due to the realisation of its significant influence on a child’s social and emotional development (Eisenberg et al., 2003). Individual differences in temperament and self-regulation will affect a child’s social competence at school (Rothbart & Jones, 1998) and both seem more malleable than initially thought.

It was originally believed that temperament, observed early in life, continued to remain stable over time, but it is now understood that this initial reactivity to situations and expression of emotions (i.e. how easily and intensely children become emotionally aroused - fearful, positively excited, or frustrated), observed from an early age, can be altered via changes in self-regulatory capabilities that influence whether the initial disposition persists. Throughout their early schooling years, the child’s experiences affect the further expression of native temperament. Children differ significantly in their emotional reactions and self-regulatory abilities; some children are impulsive and have less attentional control while others are easily overwhelmed and withdraw from social situations. Central to this thesis is that the child’s ability to regulate emotions and behaviour depends on whether executive functions develop that support self-regulatory capacities, thereby determining risk for the development of maladaptive behaviours and poor social skills across a number of environments (Powell & Powell, 2008; Rothbart & Jones, 1998). Parents and family can
create opportunities for some EF development through processes often referred to as *emotional socialisation*.

Emotional socialisation refers to the ways in which parents and caregivers directly influence the child’s emotional development, including parental expression and regulation of their own emotion and their responses to children’s emotion (Baker, Fenning & Crnic, 2011). Early emotional socialisation has a significant effect on the ability of children to self-regulate later in life (Debaryshe & Fryxell, 1998; Morrison, et al., 2010). More specifically, family members can foster the physiological regulation of emotion and skills children have in selecting appropriate strategies to regulate their emotions as they are frequently the sole source of human contact and possible early attachment. Family members are crucial in this early emotional socialisation. In this respect, a secure attachment has been associated with the use of pro-social skills, increased social relationships and a general increase in social competence (Blythe, 2014). Similarly, parents who assist their children in regulating negative emotions provide the supportive environment and guidance required for the child to develop efficient regulation. However, if parents discourage their children’s emotional expression or are too permissive of such emotions, the normal development of self-regulation does not occur or is delayed. Furthermore, the manner in which families demonstrate problem solving, especially in situations that evoke emotions, has a significant effect on a child’s emotion regulation and social competence in other settings (Debaryshe & Fryxell, 1998; Morrison, et al., 2010). If parents have poor emotion-regulation skills, then it is likely that their children will exhibit emotional dysregulation later in life (Miller, Ferguson, & Moore 2004).

The development of self-regulation may also be influenced by experiences at school. When children enter the education system, a number of expectations exist, including that
they sustain and shift attention, and inhibit their emotions and behaviour (e.g. tolerating frustration of their needs, sitting still in class, not interrupting). These practises, if the child is again supported well by school staff, are likely to influence the development of effortful control in children (Zhou et al., 2007). These early emotional socialisation processes not only affect the ability of a child to effectively self-regulate, but also play a vital role in shaping a child’s SIP skills, which in turn, have a significant influence on social competence.

Important to the thesis’ emphasis on links between the development of EF and behaviour, research has found distinct connections between social competence and self-regulation. Self-regulation of inner processes and overt behaviour is generally understood to function as a “key mediator between genetic predisposition, early experience, and adult functioning” (Fonagy & Target, 2002, p. 307). Thus the ability to control one’s behaviour is a vital component in the development of social competence due to its influence on the dimensions of emotionality, compliance, social adjustment, and academic performance. However, executive dysfunction can interrupt the normal development of self-regulation and negatively affect a child’s social competence (Rueda, Posner & Rothbart, 2004; 2005).

Research suggests that as children develop, they move from more reactive and involuntary behaviour to more self-controlled or regulated behaviour. That is, they are more able to overcome their reactive tendencies and regulate their own behaviour rather than relying on external sources to regulate their behaviour (CCCH, 2007). Consequently, older children should be better regulated, through an improvement in self-control, than younger children (Eisenberg et al., 2003; Rothbart & Jones, 1998). Rather than reacting impulsively, they should become increasingly more able to use attentional and cognitive strategies (distraction and cognitive restructuring, respectively) to refrain from focusing on
negative stimuli and emotions and better focus on positive information in their environment which subsequently leads to positive emotions (Eisenberg et al., 2003; Rothbart & Jones, 1998). Older children should also demonstrate a capacity to consider a larger repertoire of cognitive and behavioural options before responding as their frontal brain systems become more organised and they learn new strategies. Hopefully, they have also been exposed to positive adult models of pro-social behaviour that expand their behavioural repertoire. However, executive dysfunction can interrupt the progression of this normal development and negatively affect the subsequent development of a child’s social competence (Rueda et al., 2005).

2.4.1 Emotion and Behavioural Regulation.

Self-regulation encompasses two distinct processes that play a role in child behaviour; emotional regulation and behavioural regulation. Emotion regulation is often defined as the process of “initiating, maintaining, modulating, or changing the occurrence, intensity, or duration of internal feeling states and emotion-related physiological processes” (Eisenberg et al., 2000a, p. 1367). Behavioural regulation is the process of “initiating, maintaining, inhibiting, modulating, or changing the occurrence, form, and duration of behavioural commitments of emotion, including observable facial or gestural responses and other behaviours that stem from, or are associated with, internal emotion-related psychological or physiological internal states and goals” (Eisenberg et al., 2000a, p. 1367). As shown in Figure 5, emotion regulation involves the regulation of internal reactions and relies on skills such as attention to emotional cues and cognitions that may evoke emotion, and behavioural regulation involves the control of overt behaviour driven by these internal reactions, and relies on the child’s ability to control their impulses (inhibition and
Looking more closely at these self-regulatory forms, emotion regulation is made up of two additional components, “effortful control” (a self-regulatory component), and “reactive control” (encompassing the less voluntary processes of “over control and “under control”). Effortful control is voluntary or internally generated, and thus encompasses the voluntary shifting of attention to deal with task demands or to shift attention away from emotion-provoking stimuli, in order to focus and maintain one’s attention. Effortful control also involves the use of inhibitory control (to suppress inappropriate responses) and activation control (to execute responses that one would prefer to avoid), both of which are required in situations where adaptive functioning is needed. Consequently, the processes involved in effortful control regulate both emotion and emotion-driven behaviour, and are

*Figure 5. Self-regulation processes: Emotion vs. behavioural regulation*
therefore critical to socialisation and academic success (Eisenberg et al., 1995; Eisenberg et al., 2000a).

In contrast to effortful control, reactive control refers to how able an individual is to contain impulses and emotions. Reactive control is comprised of two relatively involuntary processes: “over control” and “under control”. These processes are less voluntary than effortful control, and respectively result in potentially chronic behavioural inhibition (rigid and inflexible behaviour) and impulsivity (a lack of behavioural inhibition) (Eisenberg et al., 2005; Spinrad et al., 2006). These distinctions are important to the current thesis position because they highlight the specific self-regulatory difficulties hypothesized to underlie the differences between internalisers and externalisers. Thus, having a clear understanding of these distinctions can be expected to assist in the development of individualised - and therefore more effective - interventions for children exhibiting these styles.

2.4.2 Poor Self-Regulation and the Internalising and Externalising Continuum.

Overall, research shows that children who are effective at managing their emotions and emotion related behaviours are more socially competent across a variety of settings (Eisenberg et al., 2001; Eisenberg, Fabes, Guthrie, & Reiser, 2000b; Eisenberg et al., 1997; Spinrad et al., 2004). Conversely, some children tend to avoid social situations and experience more feelings of fear and anxiety. Children who exhibit these types of what are labelled internalising problem behaviours are believed to be “over-controlled” (that is, they exhibit high reactive control). These children are reportedly not deficient in inhibitory control, but rather lack the ability to activate and pursue desired behaviours (i.e., activation
control) (Eisenberg et al., 1995). They are also overly efficient in delaying gratification, inhibiting actions and affect, ignoring environmental distractions and controlling impulses and are therefore perceived as less impulsive. Often these children are too constrained or inflexible in their behaviour, leading them to become prone to internalising behaviour problems such as becoming overly shy and socially withdrawn and exhibiting poor social skills as adults (Eisenberg et al., 2001; Eisenberg et al., 2000b; Eisenberg et al., 2003).

Alternatively, children who are under-controlled (lacking inhibitory control) are more likely to exhibit externalising problematic behaviours, such as impulsivity, hyperactivity, inattention, and aggression in social situations that exceed developmental normative levels (Eisenberg et al., 2000). This is because such children have difficulty regulating their own emotions, controlling impulses and inhibiting behavioural responses, delaying gratification, suppressing motivations and affects, and ignoring environmental or internal distracters. Under-controlled children are also generally low in attention and behaviour regulation.

These divergent styles may represent internalised and externalised approaches to behavioural self-regulation, as represented in Figure 6 below. Important to this thesis is that both styles involve some form of EF processing deficit and lead to potential social impairments that may foster further development delays. The figure depicts various pathways to behavioural profiles and subsequent maladaptive social interactions that may feedback to exacerbate EF development problems.
Figure 6. Diagram of the interrelated executive functioning concepts in externalising and internalising problem behaviours in children.

Caption: SIP and self-regulation are two key components of executive functioning. If deficits arise in these functions, children may begin to display challenging behaviours, either those of an externalising nature, such as aggression or impulsivity or those of an internalising nature, such as social withdrawal and anxiety.
When a child is either too over-controlled or too under-controlled they are unable to adapt in changing environments. Insufficient effortful control and the dominating drive by reactive processes can lower a child’s resiliency, resulting in little adaptive flexibility in changing situations and poor organisation in novel environments, an outcome which can potentially further increase stress levels (Eisenberg et al. 2003; Spinrad et al., 2006). These findings are important to the thesis because they suggest that efficient effortful regulation is of key importance for the development of high resiliency and social competence in children and should, therefore, be a key component of any effective early intervention program (Eisenberg et al, 2003). In terms of identification, it is suggested that a combination of neuropsychological and SIP measures will allow examiners and researchers to better understand where the child’s strengths and weaknesses may lie. This more complete understanding of the links between child cognition, emotion, and behaviour can, in turn, better inform the development of remedial programs and early intervention approaches.

Most problem behaviours are seemingly characterised by negative emotionality and poor self-regulation. Internalising and externalising problem behaviours are differentiated through the types of emotions and regulation abilities which characterise the children who exhibit such behaviour. In sum, children with internalising problem behaviours lack sufficient ability to respond with confidence, with flexibility and spontaneity, and often withdraw from social situations, thus limiting their social adjustment. Conversely, children with externalising problem behaviours, such as angry responses, impulsivity, and overactivity, have deficiencies in the ability to regulate negative emotions, leading them to respond poorly in social situations, with aggressive behaviours for example, and this ultimately limits their social adjustment (Eisenberg et al., 2001).
2.5 Interventions

Behavioural problems are a source of significant stress for parents, teachers and the referred child her or himself, and because of this internalising and externalising behaviours are regularly the focus of psychological referrals (Forehand, Jones & Parent, 2013). The literature suggests that these problems are often correlated with poor academic achievement, peer rejection, and social maladjustment. Indeed, research has now demonstrated that social and emotional competence is essential for academic achievement, social adjustment, and appropriate behaviour (Jurado & Rosselli, 2007). In addition to encouraging cognitive development in primary school children, recent research highlights the need for educational settings to also promote the development of social and emotional competencies in children to reduce the risk for behavioural problems and enable the child to function in a more appropriate way (Commonwealth, 2007; Powell & Powell, 2008; Riggs et al., 2006).

Behaviours such as inattention, aggression, hyperactivity and disinhibition all impede effective learning (Ciairano, Visu-Petra, & Settanni, 2007). As a result, educators are now being encouraged to identify those children who are displaying such behavioural problems and implement early interventions to ensure the development of positive behaviours and subsequently ensure adequate education attainment (Miller, Williams, & McCoy, 2004). While externalising behaviour problems are often easier to identify due to their negative impact on the classroom environment, it is just as important that children with internalising behaviour problems be identified. Biddulph (2000) reports that after accurate identification, both externalising and internalising behaviours can be effectively managed through the implementation of individualised remediation strategies which not only
improve EF but can also heighten self-esteem and social competence, especially for those children with internalising behaviours.

One challenge is to provide an appropriate screening battery that assesses all EF domains that may subserve the behavioural problems. In addition, maladaptive behaviours are often resistant to change once they develop and often progress into more severe behavioural problems as the child ages. Consequently, prevention and early intervention strategies are more effective and cost efficient than treatment approaches targeted at crystallised styles of attention, thinking and behaving (CCCH, 2007).

A common strategy used by parents and teachers to manage the behavioural problems of children is in the form of rewards for ‘good’ or appropriate behaviour (pro-social behaviours for example) and punishment for ‘bad’ or inappropriate behaviour (for aggression, hyperactivity etc.). However, if the behavioural problem is driven by deficits in EF (for example, an inability to concentrate in a distracting positive environment, poor self-regulation, or deficits in SIP) then motivation related to reinforcers or negative feelings after punishment may be ineffective at improving the child’s competence. If however, it is acknowledged that EF difficulties are at the root of a child’s behavioural problems or are at least a major contributing factor, then more effective remediation strategies can be put in place to help manage such maladaptive behaviours (Powell & Powell, 2008). In terms of preventative measures, the current author suggests that attending to and addressing more subtle signs of executive dysfunction would prevent many problem behaviours from ever developing. By helping parents and teachers learn to understand and deal with a child’s problem behaviours early and in terms of executive functioning a number of long term benefits may evolve, including improved social
competence and emotional wellbeing for the child and reduced stress and concern in others (cf. Smart & Sanson, 2001).

Indeed, at the heart of many emotional and behavioural problems may lie the child’s weaknesses in EF. While further research is still needed to ascertain the effectiveness of remediation strategies targeting underlying EF deficits, strengths in executive functioning have been consistently found throughout the literature to significantly contribute to the development and maintenance of socially appropriate interactions in social settings, including school environments. Specific skills required for this effective interaction include the ability for children to regulate emotional impulses and inhibit inappropriate behaviours.

The differences in self-regulation observed between internalising children and externalising children indicates that unique interventions, tailored to each type of behavioural repertoire, may be required in order for strategies to be effective. More specifically, reactive over-control has been identified as a key characteristic of an internaliser; and as such the promotion of effortful regulation may be less efficacious. On the other hand, externalising children are often characterised by low self-regulation and high impulsivity and thus they may benefit more from interventions aimed at increasing effortful control, at both an emotional and a behavioural level (Eisenberg et al., 2004). This understanding aligns with the thesis, and indicates that the current investigation is positioned to contribute to more effective early interventions, through the implementation of a more comprehensive assessment approach that is better able to identify those children at risk for behavioural problems, based on profiles of EF deficits indicating either an internalised or an externalised behavioural repertoire or subclinical levels of EF problems.
2.5.1 Overview of Programs Available for Targeting Social, Emotional, and Behavioural Problems in Children.

As previously mentioned, family issues have been found to play a significant role in the development of many social, emotional and behavioural disorders in children. Due to the influence of family systems on the behavioural outcomes of children, it is imperative that interventions also acknowledge and target these relationships where appropriate to ensure that the family as a whole is receiving effective treatment including the targeting of substance abuse, poor parenting practices and relationship conflicts (Miller, et al., 2004). Research has shown however, that despite facing a disadvantaged upbringing, including low income, broken families, and poor housing, many children and young people can avoid legal troubles and become productive members of society as adolescents and adults. The factor which seemed to alter the usual trajectory of delinquent behaviour and poor social and emotional outcomes later in life from these disadvantaged early experiences was the involvement of a positive adult role model, from outside the family, who was supportive, secure and involved in the young person’s life (Grossman & Garry, 1997; Hurd, Zimmerman, & Xue, 2009).

The Triple P – Positive Parenting Program is one family support strategy with the main aim of enhancing parent’s knowledge, skills, and confidence and in turn, helps to prevent social, emotional, and behavioural problems in children (Sanders et al., 2003). Triple P practitioners understand that there are differing levels of dysfunction in the family environment as well as differences in the severity of behavioural problems in children. Consequently, the program offers a diversity of support services to meet the needs and preferences of parents concerning the type, mode of delivery, and intensity of the intervention. This approach is reportedly cost effective, time efficient and reaches a much
greater population (Sanders et al., 2003). Triple P aims to not only reduce family risk factors but to also enhance family protective factors, including “enhancing knowledge and skills, confidence and resourcefulness of parents, promote nurturing, safe, and engaging low conflict environments for children and promote children’s social, emotional, and behavioural competencies through the implementation of positive parenting practises” (Sanders et al., 2003, p. 58). It has not yet been determined however whether efficacy of the Triple P program would be further enhanced by applying the research on individual differences in EF and the distinctions between internalising and externalising behaviour problems. This is important to the thesis as it highlights that some parenting programs may be improved through the use of a comprehensive assessment of EF with intervention strategies tailored to suit the individual needs of the child. This, in combination with follow-up studies which assess the efficacy of these programmes to manage behaviour, would help determine the role of EF in problem behaviour.

Investigators have begun to recognize that the effectiveness of family based interventions can be improved when the child’s distinct behaviour problems are considered. Strategies can then be adopted that specifically target the challenges unique to the individual child. Children with externalising behaviours have been found to benefit significantly more from parent involvement than children with internalising behaviours who seem to benefit just as well with a child-focused treatment approach (Forehand, Jones, and Parent, 2013). Despite consistent findings on this distinction in the effectiveness of parent supported interventions, some research has found that while the addition of parental involvement in treatment for children with internalising behaviours may not show evidence of incremental improvement in immediate outcomes, parent involvement may lead to a better long term outcome as parents begin to work through their own issues of
Executive Function & Problem Behaviour

anxiety and depression (Cobham, Dadds, & Spence, 1998). When parents are involved, internalisers improve with interventions that focus on increasing positive attention for appropriate behaviour and being less controlling (e.g. through granting more autonomy) (McLeod, Wood, & Weisz, 2007) while externalisers improve with interventions that focus on decreasing negative or coercive parental behaviour, using time out for inappropriate behaviour and exerting more control (e.g. through implementing boundaries) (Forgatch & Patterson, 2010). Based on this understanding, it is important that when families are involved in the treatment of problem behaviours in children, parental involvement is tailored uniquely to the behavioural profile of the child, and according to the thesis also to EF profiles, to ensure positive outcomes. An example of such an approach is the Modular Approach to Therapy for Children with Anxiety, Depression Trauma or Conduct Problems (MATCH-ADTC; Chorpita & Weisz, 2009) which has been found to be consistently effective in the treatment of multiple childhood disorders and involves parents as necessary in the treatment process. Additional research which looks at the efficacy of this therapy when EF profiles are targeted is still needed however in order to better understand the role that EF plays in childhood disorders.

While it is important to include parents in the treatment approaches of a child’s behavioural problems, it is also vital that any weaknesses in EF which are causing difficulties for the child be identified and specifically targeted in treatment. Practical strategies aimed at teaching and improving executive functioning, including planning, organising, shifting attention, and self-regulation, may be critical to ensure children are able to perform to their potential, both academically and socially. There are numerous methods available to help lessen the impact that executive dysfunction has on children. For example, the simple use of organisers, visual schedules, and checklists has a positive
influence on helping many children organise and plan their social and academic lives is typically covered in teacher education programs but may need to be altered based on the assessment of an individual child’s behavioural profile (Meltzer, 2007; 2010). If the system the teacher is using for an entire class does not seem to be effective for a few children, the assumption is often that the problem is related to poor attitude or cooperation, yet this may be totally unwarranted. Non-compliance or negative behaviour can often be explained by the child’s difficulty with the mode or speed of information delivery or the complexity or novelty of the situation, and thus inappropriate behaviours might be better explained in terms of maladaptive coping strategies on the part of the child. Ensuring parents and teachers understand the underlying difficulties facing the child, through the implementation of parenting programs and information sessions that explain executive dysfunction and behaviour, may make it more likely that they will be able to implement the above behavioural management strategies insightfully (Miller et al., 2004).

As has been shown throughout this review, EF, specifically SIP patterns and self-regulation are key components in the understanding of children’s social adjustment and competence. Disruptive behaviours, such as aggression, impulsivity, and withdrawal cause significant difficulties for all individuals involved, including the child, parents, teachers, schools, and eventually the community. They increase the child’s risk of “poor academic achievement, substance use, mental illness, and adult anti-social behaviour” (CCCH, 2007; www.responseability.org). A number of programs however, that focus on strengthening social and emotional skill development have shown the possible improvement of social competence in children (e.g. The Aussie Optimism Program (Roberts, 2006), The Friends for Life Program (Farrell & Barrett, 2007) and the PATHS Curriculum (Riggs et al., 2006)).
The central component of many of these intervention programs is the promotion of social competence through the focus on developmentally appropriate EF skills such as the inhibition of impulsive behaviour, the identification and regulation of negative emotions, as well as the more effective and pro-social processing of social information in perspective taking, problem solving, and decision making. It is believed that following the remediation of these social competencies, children will be able to modify emotions and behaviours in social environments and subsequently respond with increased social and emotional competence (Riggs et al., 2006).

The Friends for Life Program is an evidence-based approach to teaching children cognitive-behavioural skills to effectively manage or regulate feelings of stress, anxiety, and depression. The program also aims to foster positive coping skills including problem solving, using support networks, and exposure to positive role models and by promoting the development of self-esteem, psychological resilience, and self-expression by creating positive relationships with adults and peers. The Friends for Life Program consists of developmentally appropriate family and peer group cognitive behavioural therapy (CBT) sessions. These sessions are delivered once per week for 10 weeks, with the addition of 2 booster sessions when required. ‘Friends’ is an acronym, representing the skills taught during the program, including Feelings, Relax and feel good, I can do it! I can try my best! Explore solutions and coping step plans, Now reward yourself! You’ve done your best! Don’t forget to practise, and smile! Stay calm for life. The program also includes 2 - 4 parent sessions which focus on strategies to improve coping skills, reinforcement strategies, and behaviour management for children as well as training in problem solving and communication (Farrell & Barrett, 2007).
Research has consistently demonstrated the effectiveness of the Friends for Life Program with studies showing a significant reduction in up to 80% of participant’s anxiety, stress, and depression symptoms as well as promoting better coping strategies at follow up assessment, an effect which has been found to continue 6 years post intervention (Farrell & Barrett, 2007). This program therefore demonstrates that the implementation of practical strategies aimed at improving a child’s ability to manage negative emotions and provide effective coping strategies that the child can utilise in stressful environments is effective. From the thesis’ perspective, it could be inferred that these effects were due to increases in executive functions such as SIP and self-regulation, which subsequently reduced challenging behaviours and dysphoric mood and improved social competence.

The Aussie Optimism Program (Roberts, 2006) is an intervention for children in middle and upper primary years (years [grades] 4 to 6) as well as lower secondary school years (years [grades] 7 to 8) aimed at preventing anxiety and depression and providing the skills necessary for them to meet the challenges and stresses of life. The program consists of 4 components which include 3 school based components; Aussie Optimism: Social Life Skills; Optimistic Thinking Skills and the Positive Thinking Program and a family based component called Aussie Optimism: A Program for Parents and Families. Each component focuses on specific skill development. The Social Life Skills element focuses on skills such as decision making, negotiation, assertiveness and coping skills. Optimistic Thinking Skills help to develop awareness and identification of feelings as well as generating alternative solutions and challenging unhelpful thoughts. The Positive Thinking Program includes modules on the thought - feeling connection, looking for evidence and thinking positively and best, worst and most likely outcomes. Finally, the Program for Parents and Families aims to get parents more involved in their children’s education and social lives. In
summary, the Aussie Optimism Program provides children with the skills necessary to learn the link between feelings and thoughts, to develop a positive view of life, to become more assertive and better negotiators, to improve coping strategies and social problem solving and to better deal with family conflict (Roberts, 2006). These results demonstrate that early interventions can significantly improve a child’s self-regulation and SIP skills which ultimately lead to a reduction in challenging behaviours and an improvement in social competence.

Making Choices: Social Problem Solving Skills for Children (MC) is an intervention based on the belief that aggression in children results from negative biases in SIP and social-emotional deficits. MC is aimed at improving children’s social, emotional, and cognitive skills associated with the development of social competence and adjustment. The program focuses on teaching children how to encode and interpret social information, how to recognise and regulate their emotions, as well as how to make appropriate responses in a variety of social interactions. In strengthening these skills over a 12 month period, the program aims to decrease peer rejection, increase positive social contact with peers, and disrupt the developmental trajectories to problem behaviours and later maladjustment (Fraser et al., 2005).

Fraser et al. (2005) found that children who were placed in the MC group, that is, who received additional instruction in EF including effective SIP skills and emotional control, demonstrated significantly improved social competence compared to their peers who did not receive such intervention. Furthermore, they displayed significantly less aggression and improved concentration. Findings also suggest that the children who received the MC intervention showed significantly more SIP skills in encoding social cues and developing more pro-social behaviours (Fraser et al., 2005). This suggests that the development of SIP
skills, in addition to the improved ability for children to self-regulate influences the development of appropriate social behaviour and therefore enhances social competence and adjustment. It also demonstrates again that while early life experiences play a crucial role in the shaping of children’s SIP patterns and self-regulation skills, the implementation of interventions, aimed at strengthening children’s social understanding and decision making abilities can significantly improve social behaviour and therefore influence later adjustment.

Finally, the PATHS Curriculum is a school based intervention program aimed at reducing challenging behaviours such as aggression and social anxiety and promoting the development of social-emotional competence in middle childhood. The PATHS curriculum is heavily tied to neurocognitive models of development, specifically *vertical control*, and *horizontal communication*. Vertical control refers to the control exerted by the higher order processing of the prefrontal cortex over the lower order limbic system. In adults this process is usually intact. Emotions are perceived by the limbic system and sent via neurons to the frontal cortex where further emotion processing and interpretation occurs. This information is then sent back to the limbic system where emotional responses are attenuated or amplified if necessary. However, in young children, or children with deficits in the EF of self-regulation, the neural connections between the prefrontal cortex and the limbic system are underdeveloped which may result in biased SIP and poor self-regulation. Limited experience or knowledge may also lead to inappropriate interpretation at the cortical level. The PATHS curriculum is used to help remediate the underdevelopment of this vertical processing in children by providing children with opportunities to practise self-control strategies including self-talk (verbal mediation) and inhibitory control (Riggs et al., 2006).
Horizontal communication refers to the communication between the two brain hemispheres via the corpus callosum and other interhemispheric pathways. As discussed earlier, the two hemispheres specialise in the processing of different information with the left hemisphere believed to be responsible for the processing of positive affect and the right hemisphere responsible for the processing of negative affect. Those applying the PATHS curriculum attempt to improve the integration of information between the two hemispheres by teaching children to better identify and discuss emotions and emotional experiences. These strategies are believed to improve a child’s SIP by providing them with a wider repertoire of emotions and behavioural responses to select from when confronted with possibly ambiguous social tasks (Riggs et al., 2006).

The PATHS Curriculum has been consistently found to significantly improve inhibitory control and therefore reduce challenging behaviours, both internalising and externalising, in children at post-test and at one year follow up. That is, PATHS has been shown to be effective in altering the developmental trajectories of neurocognition and behaviour among children in middle childhood. This study therefore highlights the role of neurocognitive functions in the social and emotional development of children and implies that such functioning needs to be considered in all future intervention programs designed to improve social competence (Riggs et al., 2006). However, the specific neurocognitive effects, possibly reflected in changes in performance on tests of SIP and other aspects of EF have not been conducted, indicating another area of contribution to existing knowledge by the current thesis.

Considerable evidence exists in support of the value of promoting social and emotional development and wellbeing in children at an early age. Promoting this development, together with cognitive development, has the potential to considerably
improve outcomes for children and young people both at school and later on in life (CCCH, 2007). Providing teachers with a better understanding of how a child’s temperament, or self-regulatory skills, can influence their behaviour might lead to reduced conflict in the classroom and provide teachers with the skills of implementing more appropriate intervention strategies which are uniquely tailored, and therefore more effective, for the individual child (Rothbart & Jones, 1998). It seems intuitively logical therefore, that research aimed at developing more comprehensive assessment procedures that, following research on efficacy, could potentially lead to additional and more effective intervention strategies for younger children will make a valuable contribution. The current investigation appears highly relevant to informing the design of programs from a cognitive-developmental perspective, including attention to executive functioning.
CHAPTER 3: METHODOLOGY

3.1 Aims and Hypotheses

The aim of the present study was to assess the relationship between EF and behavioural problems in middle childhood, both internalising and externalising. Based on previous research looking at the relationship between these problem behaviours and deficits in EF, a key prediction of this thesis was that children who were identified by parents and teachers as exhibiting higher levels of internalising or externalising behavioural problems would have more deficits in EF, specifically in SIP and self-regulation. It was further predicted that children with negatively biased SIP would be less socially competent and would therefore be more pre-disposed to engage in behavioural problems. However, whether the child externalised or internalised their negative emotions would depend upon their techniques for self-regulation.

An additional aim was to understand emotions and self-concept from the child’s perspective using the BYI due to the belief that emotional state may account for individual differences in the hypothesised links between behaviour and EF discussed above. Further, differences across age cohorts were also looked at to examine whether age was a factor influencing differences in the predicted relationship between behaviour and EF.

Based on these premises, the following hypotheses were proposed for the investigation:

H₁: There will be a significant association between behavioural problems and EF deficits (overall scores on the Behaviour Rating Inventory of Executive Function [BRIEF], and performance on the D-KEFS Tower Task and subtests from the Concussion Resolution Index [CRI] of the HeadMinder Program).
H₁A: In particular, those children who are identified as over-controlled (scoring higher on measures of behavioural inhibition on the BRIEF) will also show internalising patterns of behaviour such as social withdrawal and anxiety (as measured by the Child Behaviour Checklist (CBCL)).

H₁B: Those children who are identified as under-controlled (scoring higher on measures of behavioural dis-inhibition or impulsivity on the BRIEF) will also show externalising patterns of behaviour such as aggression or overactivity (as measured by the CBCL).

H₁C: Those children with negatively biased SIP will perform with less social competence (scoring lower on measures of pro-social behaviour on the Skill Level Activity Measure) and will therefore be more pre-disposed to engage in problem behaviours (internalising or externalising behaviours).

In general, this research aimed to provide a more comprehensive assessment of children, both for those at risk for academic and social problems and those not deemed at risk. This comprehensive assessment will allow for the identification of children at potential risk for behavioural problems based on profiles of EF deficits indicating either an internalised or an externalised behavioural repertoire. Having a clear understanding of the risk factors surrounding the development of childhood psychopathologies, including divergent profiles of EF, will inevitably allow clinicians and researchers to identify those at-risk children who would benefit from preventative interventions (Biederman et al., 2001), and thereby allow for the development and implementation of more individualised and effective early intervention strategies (Haskett & Willoughby, 2006).

3.2 Method
3.2.1 Participants.

Following ethics approval (see Appendices C: SCU Human Research Ethics Committee Approval and D: SCU Human Research Ethics Committee Approval Renewal and E: SERAP Approval), participants \((n = 64; 66.7\%)\) were initially recruited through emails sent to all staff and students of Southern Cross University (SCU) offering participation in a study designed to understand how children think and respond in social situations (see Appendix A: Information Sheet and Consent Form). Following this initial recruitment phase, advertisements describing the study were placed in newsletters sent to parents of children in local independent primary schools on the Mid North Coast of NSW, Australia. Further to this recruitment through the school system, children \((n = 25; 26\%)\) who had been identified by their teachers, and subsequently referred to the school support services or school counsellor as having school or social concerns (such as aggressive tendencies, impulse control issues, or withdrawal/depressive behaviours) were also invited to participate after their parents were told by school staff about the study and agreed to participate. A letter describing the opportunity to participate in the study was also included with standard contact information sent between support services and parents. A final recruitment phase placed a detailed advertisement in the local area newspaper aimed at parents who may have concerns about their child’s social and emotional behaviour at home or at school \((n = 7; 7.3\%)\).

In all recruitment phases mailing address, email, and phone contacts for the investigators were included so interested parents could contact SCU for additional information and to schedule an appointment. Due to the need to intervene as early as possible when problems exist, focusing on the social and emotional wellbeing of children in primary schools was the chief aim of the investigation. In line with this focus,
participants for the investigation were primary school students aged 8 – 13 years (Year 3 [3rd Grade] to Year 7 [7th Grade] at school). Overall, a total of 96 children \( (n = 43 \text{ males, } n = 53 \text{ females}) \), with a mean age of 10.02 years, \( (SD = 1.75) \) participated in this study.

The criteria for inclusion required that children had been identified by parents as exhibiting social, emotional, or behavioural problems or had been referred by teachers for learning or behavioural support. Age matched, non-referred children who had not been identified as exhibiting social, emotional, or behavioural problems were included as a comparison group. Children who had been clinically diagnosed with a developmental disorder or delay (e.g. Autism Spectrum Disorder [ASD], intellectual disabilities) or Attention Deficit Hyperactivity Disorder [ADHD] were excluded from the study, as these children would have confounded the current investigation and have been reported on previously (see review of EF profiles in children with ASD in Gilotty, Kenworthy, Sirian, Black & Wagner, 2002 and Ozonoff & Jensen, 1999; see review of EF profiles in children with intellectual disabilities in Alloway, 2010; see review of EF profiles in children with ADHD in Metin et al., 2013 and Nyberg, Bohlin, Berlin & Janols, 2003). Thus, given the challenges associated with assessment and the lack of associated clinical support, children who had been previously diagnosed with a psychiatric disorder were not included. Similarly, children with a neurological disorder affecting attention or cognition (e.g. epilepsy) were not included.

### 3.2.2 Procedure.

Depending on their preference, parents who accepted the invitation to participate were contacted via email, phone, or mail and arrangements for an appointment were made. Any
questions or comments regarding the research specifics were discussed thoroughly with the parent via phone, email or an organised face to face meeting prior to the assessment session. Parents were given a screening questionnaire (see Appendix B: Demographics Screening Questionnaire) to ensure that children who did not meet the inclusion criteria were not scheduled for an appointment. Children who were either previously clinically diagnosed or were outside the age range were advised that the child could not be included in the current project and were referred to other appropriate services.

Individual assessment took place in a single session that was approximately 90 minutes in duration and was conducted in a well-lit room free from external distractions. At the assessment session, parents were asked to read an information sheet and sign a consent form for their child (one per child if siblings were tested). Any questions the parents or the child had regarding the assessment session were discussed at this stage and only after both parent and child were comfortable to progress were the assessments administered. At this point, parents and children were also reminded that they could withdraw their consent at any time without negative consequences.

Parents were then provided with questionnaires including demographic items and questions about their child’s history and current emotional and behavioural functioning. If approved by the parent, the child’s teacher was also asked to complete teacher versions of the Child Behaviour Check List (CBCL) and Behaviour Rating Inventory of Executive Function (BRIEF).

Cognitive assessment tools were used to assess each child’s EF psychometrically. Tests of complex nonverbal visual attention and EF were administered on a laptop or presented in an engaging puzzle format. Tests of SIP were included in the form of vignettes and pictures depicting children interacting. Lastly, a self-report measure was
provided to each child to assess mood, self-esteem, and behavioural concerns using the Beck Youth Inventory (BYI). Children were assessed outside of school hours, at the most convenient time for individual parents and children. Individual assessment took approximately 90 minutes to complete, and children were allowed brief breaks during the assessment if required (e.g. to go to the toilet or to have a drink of water). Prior to beginning the assessment session, children were asked that if they needed to have a break, that they did so between activities to avoid disruption to individual tasks. A debriefing session was provided at the conclusion of the assessment with any questions or concerns raised by the parent or child being immediately addressed. A summary of the child’s assessment results approved by a consulting clinical neuropsychologist were sent to parents/guardians following participation.

3.2.3 Measures.

As described throughout the literature review, research has identified a number of key factors, including SIP patterns and self-regulation abilities, which significantly affect a child’s social and emotional development, and thus influence their social competence and future adjustment. The following measures were selected for the assessment of children identified as being at risk for social difficulties because they address these key factors.

Participants completed a variety of questionnaires and assessment tools designed to measure EF and behaviour. Parents completed a number of questionnaires (the Child Behaviour Checklist (CBCL), the Behaviour Rating Inventory of Executive Function (BRIEF), the Temperament in Middle Childhood Questionnaire (TMCQ: 7 to 9 years) or the Early Adolescent Temperament Questionnaire (EATQ: 10 to 13 years) on each child’s
behaviour, SIP skills, emotionality, and self-regulation. Children completed questionnaires (the Beck Youth Inventory [BYI] and the Skill Level Activity Measure [SLA]) in addition to tests of complex attention and EF (HeadMinder subtests, NEPSY-II Affect Recognition [NAR], and the D-KEFS Tower Task).

Test-retest reliability was assessed by performing the above assessments on 22 of the research sample approximately 12 months (mean lag = 14.09 months; $SD = 3.10$) after the original assessment process. Task order was varied across participants to control for order effects. Half the participants completed the HeadMinder tasks first while the remaining participants completed them fourth. All children completed the BYI as their final task to eliminate the emotional effect that this measure may have had on other tasks. The details of the assessment tools are as follows.

**Executive functioning.**

*The Behaviour Rating Inventory of Executive Function (BRIEF)* (Gioia, Isquith, Guy & Kenworthy, 2000) assesses a child’s executive functioning based on parent or teacher report. Respondents circle the response on a 3-point scale which best describes the child’s difficulty with a range of behaviours ($N =$ Never a problem; $S =$ Sometimes a problem or $O =$ Often a problem). The BRIEF contains 86 items. Item scores are summed to create a total score of EF called the Global Executive Function Composite (GEC). The GEC is made up of items loading on two subscales: Behaviour Regulation (BRI) and Meta-cognition (MI) indices. The Behavioural Regulation subscale includes items relating to the ability to inhibit impulsive responses (e.g. “Acts wilder or sillier than others in groups [birthday parties, recess]”), adjust to changes in routine or task demands (e.g. “Resists or
has trouble accepting a different way to solve a problem with school work, friends, chores etc.”), and modulate emotion (e.g. “Overreacts to small problems”).

The Meta-cognition subscale includes items designed to estimate working memory capacity (e.g. “When given three things to do, only remembers the first or last”), the ability to plan/organise problem solving approaches (e.g. “Has good ideas, but cannot get them onto paper”), the ability to organise one’s environment and materials (e.g. “Keeps room messy”), monitor one’s own behaviour (e.g. “Has poor understanding of own strengths and weaknesses”) and initiate problem solving or appropriate activity (e.g. “Does not realise that certain actions bother others”). High age-based scaled scores suggest deficits in EF while low scaled scores suggest relative strength in EF.

Using Cronbach’s Alpha, Gioia et al., (2000) reported high internal consistency for all BRIEF subscales across both normative and clinical samples ($\alpha = .80 - .98$). Test-retest reliability within the normative sample across an average of four weeks has been reported at .84 for the Behaviour Regulation Index (BRI), .88 for the Meta-cognition Index (MI) and .86 for the Global Executive Composite (GEC). Test-retest reliability within the clinical sample has been reported at .80 for the BRI, .83 for the MI and .81 for the GEC (Gioia et al., 2000).

The D-KEFS – Tower Task (Delis, Kaplan & Kramer, 2001) is designed to measure spatial planning, rule learning, and inhibition of impulsive and perseverative responding. The child is asked to move disks across three pegs, using the fewest number of moves possible to match a pictured sample arrangement while following two rules: only move one piece at a time, and a big piece cannot be placed on top of a little piece. The D-KEFS Tower Task assesses multiple executive functions including planning, adherence to rules, behavioural inhibition, and establishing and maintaining cognitive set. Performance on the
Taylor Task is assessed using a number of scores: a Total Achievement Score (TAS), Mean First-Move Time, Time Per Move ratio, Move Accuracy Ratio, Number of Rule Violations, and Rule Violations per Item Ratio. The meaning and clinical interpretation of scores on these subscales are presented in Table 1 below.

Table 1

*The Meaning and Clinical Interpretation of Scores on the D-KEFS Tower Task.*


<table>
<thead>
<tr>
<th></th>
<th>Mean Scaled Score</th>
<th>High Scaled Score</th>
<th>Low Scaled Score</th>
</tr>
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<tbody>
<tr>
<td>TAS</td>
<td>Reflects cognitive strengths in multiple fundamental skills and executive functions</td>
<td>Reflects cognitive strengths in multiple fundamental skills and executive functions</td>
<td>Impairments in fundamental component skills (visual perception) to deficits in higher level executive functions (spatial planning)</td>
</tr>
<tr>
<td>Mean First Move Time</td>
<td>Usually quick or slow first moves may reflect executive dysfunction</td>
<td>Quick response time (<em>impulsive</em>)</td>
<td>Slow response time (<em>activation problems;</em> long response times/obsessive tendencies)</td>
</tr>
<tr>
<td>Time Per Move Ratio</td>
<td>Average response time (<em>consistent</em>)</td>
<td>Quick response time average (<em>impulsive</em>)</td>
<td>Slow response time average (<em>activation problems; sacrificed speed for accuracy</em>)</td>
</tr>
<tr>
<td>Move Accuracy Ratio</td>
<td>Careful planning (a raw score close to 1)</td>
<td>Minimal responding (<em>activation problems – a raw score close to 0</em>)</td>
<td>Excessive, haphazard moves (<em>impulsivity</em>)</td>
</tr>
<tr>
<td>Total Rule Violation</td>
<td>Younger children and older adults tended to commit an average of 2-3 rule violations. No</td>
<td><em>High number of rule violations:</em> Impairment in rule following</td>
<td><em>Low number of rule violations:</em> Ability to establish and maintain cognitive set</td>
</tr>
</tbody>
</table>

rule violations was the norm for 12-59 year olds.

Delis et al. (2001) reported internal consistency scores to be within the moderate to high range for most age groups on the TAS ($r = .43 - .84$) and test-retest reliability data across an average of 25 days to be in the moderate range across age groups for the TAS ($r = 0.44$).

HeadMinder CRI (2007) is an internet based test battery which assesses mental processing speed, selective visual attention, response inhibition, memory, and executive functioning using reaction time tasks. Two subtests quantify each child’s keyboard proficiency so that individual differences in keyboard use could be controlled for when interpreting other subtests using similar keystrokes. On screen instructions precede each of 8 separate tasks (see Table 2 below), and the child is asked to paraphrase these instructions prior to commencing each task in order to ensure comprehension. Split half reliability data for children 13 to 18 years is reported at .83 for the Simple Reaction Time index, .96 for the Complex Reaction Time index. Test-retest reliability data across an average of two weeks for children 13 to 18 years is reported at .72 for the Simple Reaction Time index, at .65 for the Complex Reaction Time index, and at .79 for the Processing Speed index. There is no reliability data for children 12 years and under as this is the first study to assess this age group with the exception of Donnelly, Nugent-Cleary-Fox, Gardner, & Maund (2005).

Although the entire HeadMinder battery was administered only the scores for Reaction Time (ms), Cued Reaction Time (ms), Symbol Scanning (average response time (ms) and number correct) and Animal Decoding average response time (ms) and number
correct subtests were included in the current analyses as they were most related to EF as defined for this thesis. A Cue Benefit score (RT-CRT/RT+CRT*100) was computed to assess the per cent decrease in reaction time in milliseconds due to having a cue about when an upcoming target stimulus would appear. Cues would typically decrease a subsequent target reaction time so higher Cue Benefit scores reflected better EF. The balance of the CRI subtest descriptions is included so that the reader understands the complete experience of the child participants.

Table 2


<table>
<thead>
<tr>
<th>Subtest</th>
<th>Measures</th>
</tr>
</thead>
<tbody>
<tr>
<td>Keyboard Proficiency 1 (KP1)</td>
<td>Children are asked to hit the spacebar, as quickly as possible, with one finger on her or his dominant hand, until the light turns from green to red.</td>
</tr>
<tr>
<td>Keyboard Proficiency 2 (KP2)</td>
<td>Children are asked to hit the number key, as quickly as possible, to correspond with single digits that appear on the screen.</td>
</tr>
<tr>
<td>Simple Reaction Time (RT)</td>
<td>A series of Geometric shapes appears on the screen. Children are asked to press the spacebar whenever they see a white circle.</td>
</tr>
<tr>
<td>Cued Reaction Time (CRT)</td>
<td>A series of geometric shapes appears on the screen. Children are asked to press the spacebar whenever they see a white circle that immediately follows a black square.</td>
</tr>
<tr>
<td>Animal Decoding (AD)</td>
<td>A key pairing animals with numbers is provided throughout the test. Animals subsequently appear with empty boxes underneath. Children must use the</td>
</tr>
</tbody>
</table>
number keys as quickly as possible to enter the number paired with that animal into the empty box.

**Visual Recognition Trial 1 (VR1)**

A series of pictures appears on the screen. Children are asked to press the spacebar whenever a picture appears for a second time.

**Symbol Scanning (SS)**

A pair of shapes appears on the left side of the screen. Eight shapes appear on the right. Children must detect as quickly as possible whether one or both shapes on the left appear on the right and enter their answer by pressing the number 1 or number 2 key.

**Visual Recognition Trial 2 (VR2)**

Following an intervening task, a series of pictures appears on the screen with some of the same items from Visual Recognition 1. Children are asked to press the spacebar when they recognized a picture from the earlier test.

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**Behaviour.**

*The Child Behaviour Checklist (CBCL)* (Achenbach, 2001) is an assessment tool used by parents and teachers to identify a child’s behavioural or emotional difficulties as well as their social competencies. The CBCL consists of 140 items across two sections. Section 1 consists of 20 competence items (e.g. “Compared to others of his/her age, how well does your child get along with other kids?”) and section 2 consists of 120 items examining behavioural and emotional problems (e.g. “Impulsive, acts without thinking”) by having parents or teachers rank their frequency for the child (0 = Not True; 1 = Somewhat or Sometimes True; 2 = Very True or Often true). The CBCL summarises behavioural and emotional problems using eight syndrome scales of which five reportedly differentiate between externalising and internalising behaviour patterns. Internalising behaviour combines the syndrome scales of Social Withdrawal (e.g. “Refuses to talk”), Somatic
Complaints (e.g. “Aches or pains”), and Anxiety/Depression (e.g. “Feels or complains that no one loves him/her”) while externalising behaviour combines the syndrome scales of Delinquent or Rule Breaking Behaviour (e.g. “Lying or cheating”) and Aggressive Behaviour (e.g. “Destroys things belonging to his or her family or others”). Behavioural and emotional problems can also be examined via the additional syndrome scales of Social Problems (e.g. “Clings to adults or too dependent”), Thought Problems (e.g. “Can’t get his/her mind of certain thoughts; obsessions”), and Attention Problems (e.g. “Can’t concentrate, can’t pay attention for long”).

For the competence scale, the normal range is defined as a score above 40, a borderline range is defined as a score of 37-40 and a clinical range is defined as a score of <37. For the internalising and externalising behavioural profiles, a score <60 is defined as within the normal range, a score of 60-63 is defined as within the borderline range and a score of >63 is defined as within the clinical range. Achenbach (2001) reported internal consistency data using Cronbach’s alpha to range from .78 to 97 for the Problem Behaviour scales and from .63 to .79 for the Social Competence scales. Test-retest reliability data across an average of seven days for both the Problem Behaviour scales and the Social Competence scales was reported at .90 (Achenbach, 2001).

The Temperament in Middle Childhood Questionnaire (TMCQ) (Simonds, & Rothbart, 2004) and the Early Adolescent Temperament Questionnaire (Ellis & Rothbart, 2001) have been designed to measure aspects of temperament related to emotion regulation in middle childhood to adolescence including measures of Effortful Control, Affiliativeness, Surgency and Negative Affect.

The TMCQ consists of 157 items reported on a 5-point Likert scale (1: Almost always untrue; 2: Usually untrue; 3: Sometimes true, sometimes untrue; 4: Usually true; and 5:
Almost always true). This questionnaire is completed by parents of children age 7 to 9 years. It measures 17 elements of child temperament including Anger (e.g. “Gets mad when provoked by other children”), Sadness (e.g. “Tends to become sad if plans don’t work out”), shyness (e.g. “I feel shy around new people”), Attention Focusing (e.g. “Needs to be told by teacher to pay attention” – reverse), Impulsivity (e.g. “Usually rushes into an activity without thinking about it”), Activation Control (e.g. “Can make him/herself do homework, even when wanting to play”), Soothability (e.g. “Cheers up quickly”), Perceptual Sensitivity (e.g. “Notices the colour of people’s eyes”), Low Intensity Pleasure (e.g. “Likes to play quiet games”), High Intensity Pleasure (e.g. “Likes rough and rowdy games”), Fear (e.g. “Gets nervous about going to the dentist”), Fantasy/Openness (e.g. “Likes to think of new ideas”), discomfort (e.g. “Becomes quite uncomfortable when wet or cold”), Assertiveness/Dominance (e.g. “When with other children, is the one to choose games or activities”), Affiliation (e.g. “Would like to be friends with lots of people), Activity Level (e.g. “Prefers to play outdoors than indoors when weather permits”) and Inhibitory Control (e.g. “Has an easy time waiting to open a present’"). These 17 subscales load onto four factor scores of temperament; Effortful Control (the regulation of emotion and behaviour), Negative Affect (internalized emotions of sadness, frustration, anger and depression), Surgency (a willingness to approach the environment) and Affiliativeness (the desire for warmth and closeness with others). For both the factor scores and the subscales, a low score represents a low level of that attribute while a high score represents a high level of that attribute. Simonds & Rothbart (2004) reported Cronbach’s alpha coefficients to range from .69 to .90 for the subscales.

The EATQ (Ellis & Rothbart, 2001) consists of 62 items also reported on a 5-point Likert scale (1: Almost always untrue; 2: Usually untrue; 3; Sometimes true, sometimes
untrue; 4: Usually true; and 5: Almost always true). This questionnaire is completed by parents of children age 10 to 13 years. It measures eight elements of temperament, including Fear (“I worry about getting into trouble”), Activation Control (“I have a hard time finishing things on time”), Frustration (“I am a patient person”), Affiliation (e.g. “Wants to have close relationships with other people”), Attention (e.g. “Pays close attention when someone tells him/her how to do something”), High Intensity Pleasure (e.g. “Would like driving a racing car”), Inhibitory Control (e.g. “Is able to stop him/herself laughing at inappropriate times), and Shyness (e.g. “Feels shy about meeting new people”) as well as two elements of behaviour including Depressive Mood (“My friends seem to enjoy themselves more than I do”), and Aggression (“When I am angry, I throw or break things”). These 10 subscales load onto four factor scores of temperament; Effortful Control, Negative Affect, Surgency and Affiliativeness. Again, a low score represents a low level of that attribute while a high score represents a high level of that attribute. Ellis & Rothbart (2001) reported Cronbach’s alpha coefficients to range from .65 to .86 for the subscales. Test-retest reliability has not been reported for either temperament scale.

The Beck Youth Inventory (BYI) (Beck, Beck & Steer, 2005) is a 100 item self-report measurement tool that assesses a child’s experiences of their own positive self-concept and mental health and behaviour problems. The BYI was also used to check for any influence of mood on children’s performance on measures of EF. Items are scaled on a 4 point Likert-type scale (0: Never; 1: Sometimes; 2: Often and 3: Always). The BYI is completed by children aged 7 to 18 years and consists of five different 20-item scales assessing symptoms associated with Depression (e.g. “I think bad things happen because of me”), Anxiety (e.g. “I worry people might tease me”), Anger (e.g. “When I get mad, I have trouble getting over it”), Disruptive Behaviour (e.g. “I like it when people are scared of
me”), and Self-Concept (e.g. “I am just as good as the other kids”). Each scale asks the child about their thoughts, feelings, and behaviour. For the Self-Concept scale, a score of >55 is defined as within the above average range, a score of 45-55 is defined as within the normal range, a score of 40-44 is defined as within the lower than average range and a score of <40 is defined as within the much lower than average range. For the remaining scales, a score of <55 is defined as within the average range, a score of 55-59 is defined as within the mildly elevated range, a score of 60-69 is defined as within the moderately elevated range and a score of >70 is defined as within the extremely elevated range. High internal consistency has been reported for all scales across ages 7 to 18 years (α = .86 -.96). Beck et al. (2005) reported test-retest reliability to range from .74 to .93 across all age groups across approximately one week.

**Social Information Processing.**

*The Skill Level Activity Measure (SLA)* (Fraser, 2008) is designed to assess a child’s SIP and self-regulation skills, based on how the child interprets and describes how they would respond to social situations. The SLA consists of 6 very short, hypothetical, stories about social scenarios with related pictures. Children are asked to explain how they interpret the events in stories and pictures and how they would respond to these scenarios in a real world situation. For example: “One day on the playground you are wearing a new pair of running shoes that you have wanted to get for weeks. All of a sudden, a kid runs into you, making you step right into a big mud puddle. The kid looks at you and smiles in a strange way. Standard questions include: A) Why did the kid run into you? (e.g. To be friendly, To be mean, Mistake or accident, Can’t tell); B) Look at the picture and circle all the clues that tell you what is happening; C) What would you want to happen? (e.g. Fight
the kid, Check out your shoes); D) What would you do? (e.g. Push him back, Tell everyone that kid is a bully, Clean your shoes)”. The first question assesses the child’s Attribution style; why they believed the character engaged in the behaviour. The child could select from the following reasons for behaviour; to be friendly, to be mean, a mistake or accident or can’t tell. The second question assesses Cue Encoding; what environmental cues the child attends to in their discussion of the social story. Cues are coded as either prescribed (as identified by the SLA authors) or relevant versus irrelevant as calculated by the current author. The third question looks at Goal Formation; what the child would like to do in response to the scenario. The child has two options to select from; one which is a pro-social response (e.g. “Just forget about it and find an empty seat”) and the other which is an aggressive or less pro-social response (e.g. “Make your friend sorry he didn’t save you a seat”). The final question looks at Decision Making; what the child believes they would do in response to the scenario. The child has three options to select from; one which is a pro-social response (e.g. “Say, I’ll go look for a seat and talk to you later”) and the other two which are aggressive or less pro-social responses (e.g. “Hit Lee on the head”; “Tell someone else that Lee is a liar”). There is no total SIP score calculated for the SLA. Rather, items load onto individual scales looking at Attribution style, Cue Encoding, Goal Formation, and Decision Making. A low score on the attribution scale suggests a low number of hostile attributions were selected to explain behaviour while a high score suggests a high number of hostile attributions were selected. A high score on the cue encoding scale suggests attention to multiple cues in the environment to help inform behaviour while a low score suggests poor use of environmental information. A high score on the goal formation and decision making scale suggests the use of more pro-social responding while a low score suggests minimal pro-social responding. Fraser (2008) reported internal consistency scores for all items at the moderate level ($\alpha = .71$) and inter-
rater reliability at 98%, based on 414 reports. No test-retest data was available at the time of writing.

*The NEPSY II Affect Recognition* subtest (Korkman, Kirk, Kemp, 2007) is a facial emotion processing task used to identify a child’s strengths and weaknesses in social perception surrounding facial emotion recognition. The task is designed for children aged 3 to 16 years who are asked to compare and match pictures of various children’s faces based on emotional expression. The emotions conveyed in the stimuli are Happy, Sad, Fear, Angry, Neutral and Disgust. The total score provided represents how well the child was able to correctly match emotional expressions. A score of 13-19 represents performance above the expected levels for a child of a particular age; a score of 8-12 represents performance at the expected level; a score of 6-7 represents performance at the borderline level; a score of 4-5 represents performance below the expected level and a score of 1-3 represents performance well below the expected level. Korkman et al. (2007) reported Cronbach’s alpha for the Social Perception Affect Recognition subtest to range from .64 to .89 across all age groups. However for the ages specific to the current study (7 to 13 years), internal consistency is reported to range from .84 to .86. Test-retest reliability for the Social Perception Affect Recognition subtest has been reported to range from .50 to .61 across all age groups, but again for the ages specific to the current study (7 to 13 years), test-retest reliability is reported to range from .50 to .58 (Korkman et al., 2007).

All participants were contacted regarding the request to return for reassessment at least 6 months after the first assessment. Similar scheduling, information delivery, and consent processes were repeated for parents and children who responded to the round of advertising for the test-retest component of the project. The results for these assessments
will be presented in separate chapters in order to improve the clarity and accessibility of information for the reader.
CHAPTER 4: PROCESS VARIABLES

In addition to the important data regarding test scores generated during this project, the process variables involved in recruiting children and parents were notable and potentially informative for future research. A primary focus of this project was the relationship between parent reports on the CBCL internalising and externalising subscales and EF. This evolving focus was partly because only a few parents \((n = 5; 4.8\%)\) were willing to allow teacher reports on their child’s behaviour. It was thought, therefore, that a report on the more troublesome aspects of community engagement and recruitment in the relevant regional area of NSW, as well as some other potential barriers to comprehensive research of this type, would be helpful at this point in the thesis.

In general, the recruitment of children for participation proved quite difficult for the research. This occurred for two essential reasons: because it was difficult to gain access to the school systems to get referrals from teachers and parents for the referral group, and because it was also difficult to get parents from the community sample to volunteer for participation. Of import to future research is that these recruiting issues were related primarily to systemic factors that posed significant barriers for the research. They will therefore now be discussed as important variables that affected the assessment process required for the research.

One significant barrier was the new disability scheme, *Every Student Every Child: Learning and Support* (NSW DET, 2012), implemented by the state government during the course of the research project and which altered school policies at the time of data collection. The number of students in NSW public schools who have been identified as having a disability or additional need is 90,000 (12% of the total student population). This number is increasing every year, especially for children with autism and mental health
problems. Of those children with identified disabilities 55,000 (7.3%) have additional needs relating to learning difficulties or behavioural disorders. The *Every Student, Every School: Learning and Support* initiative is an attempt to better address the additional learning and support needs of these students through the implementation of a number of interrelated activities as briefly discussed below.

While students were previously categorised by disability type, the new initiative means that students are now to be assessed on their additional, individual educational needs (NSW DET, 2012). This is a positive change in assessment of disability as it acknowledges the importance of understanding the specific educational needs of students on an individual level, which is vital in the planning and implementation of support services. Another component to the new initiative involves the training of teachers to better identify the strengths and relative weaknesses of students with disabilities (NSW, DET, 2012). Again, this is a positive move forward as teachers will presumably be in a good position to note issues over periods of extended contact in the classroom and other settings and possibly better inform the assessment and accommodation of each child’s specific learning and behaviour management requirements. Another key aspect of the new initiative involves the improvement of accessibility to expert information and support for students with disability, including academic partnerships (NSW, DET, 2012). This too is an essential step forward to ensure effective, evidence based programs are being implemented to support children with all types of disability and additional learning and support needs and the hope was that the current project would fit nicely into the new scheme as an example of an academic partnership.

However, while the *Every Student, Every School: Learning and Support* initiative is theoretically sound, the management system changes meant additional demands were
placed on all levels of the school system and consequently meant teachers, support staff, and regional officers reportedly had minimal resources available to provide support for the project. This eventuated even after several months of what seemed to be very fruitful discussions with the same managers, school principals and school counselling management, and the requirements for the school being carefully negotiated to impose minimally on existing routines and staff time. While the regional management were very supportive of the current project when it was first introduced, including support for the project in the successful application to the NSW DET for research approval, following the implementation of the new initiative, resources were reportedly so stretched that local support for the project was withdrawn.

Despite the lack of public school support for the current project, it is hoped that the *Every Student, Every School: Learning and Support* initiative helps in better understanding the underlying causes of a child’s behaviour and, in line with the activities mentioned above, that expert information is continually sought from professionals working towards a more individualised intervention program to reduce problem behaviours and improve social competence. One of the major obstructions to effective strategies being implemented for children with problem behaviours has long been insufficient resources and competing priorities within the school system (Greene, 2010). It is difficult to propose a single solution to such a complex issue. Nevertheless, due to the importance of social competence and its influence in all aspects of a child’s development and later success, the provision of school resources and balancing priorities is urgently required.

An underlying assumption of the thesis is that the incorporation of a comprehensive assessment battery of EF for children who were already identified by teachers as at risk for problem behaviour would provide one way of reducing demands on teachers and support
staff and reducing problem behaviour in the long term. As was proposed for the current study, these assessments could be offered as part of a school-university collaboration. By being able to better identify the strengths and weakness underlying challenging behaviour and subsequently implementing remediation strategies that are more specifically targeted to a child’s unique cognitive profile, children could be expected to develop more socially competent behaviour. Those previously displaying challenging behaviours as they coped with EF difficulties might ultimately be far less disruptive in the classroom, reducing the stress and demands on teachers and support staff, and making learning more achievable for all students. The Every School Every Child: Learning and Support initiative is providing additional training to teachers to conduct functional assessments to profile each child’s specific learning and support requirements, however, a more specific, follow-up assessment battery, developed and implemented by qualified personnel, could be seen as more effective in the long term as well as reducing the workload on teachers and school counselling staff in the short term.

Another finding was that while the regional NSW DET officers were unable to commit to supporting the project due to the above demands, there was an apparent disconnect between these local managers and support staff and teachers in individual schools. Individual school staff were very supportive of having the project implemented in their schools while the timing of the project, i.e., co-occurring with change-management issues associated with the Every Student, Every School: Learning and Support implementation was touted as a barrier to this by management at the time of recruitment for this study. This discrepancy demonstrated that if there is to be true collaboration between the academic and school sectors, then a genuine need exists for a system that allows individual school staff to access the additional support and alternative means of
assessment and intervention offered by university-based programs for children already deemed “at risk” for social and emotional problems by teachers.

The obstacles encountered during the recruitment stage of the project ultimately meant that a large enough sample to assess the role of various potential covariates was unattainable. It is suggested that future research look into barriers to collaboration and determine the most efficient and effective way to have schools involved in the hope of minimising demands on all involved but still offering specialist assessments for children at risk. Unfortunately this was beyond the scope of the current research.

Because of these sector-specific issues, alternative advertising strategies were used to attract participants. Advertisements in local newspapers and posted announcements in areas frequented by parents and their children were utilised, but these did not lead to a significant number of contacts from parents. Personal presentations by project staff at private schools to address any concerns raised by staff were also used and reported by the individual school Principals as helpful yet again resultant referral rates were very low, even when staff mentioned that they were aware of several children at each grade level that would benefit from the project. Easy to use flyers about the project were also provided to counselling staff so all that was required was that they give the flyer to parents who were already attending support services. This may suggest that parents did not choose to respond, either due to already busy schedules or because of some perceptions about the project and its possible benefits that were not adequately addressed. It is to be noted that these outcomes contrast with the very positive responses from parents and children who did choose to participate, some for repeat assessments.

Another area that was found to be difficult was the parent’s approval concerning the involvement of teachers in the assessment process. While some parents \((n = 5; 4.8\%)\) were
happy to have their child’s teacher complete questionnaires on the child’s behaviour many were not and asked if that component of the project could be avoided. The reasons for why this occurred was anecdotally reported to include differences in beliefs about the child’s behaviour (while parents thought that the child may benefit from additional resources, some teachers did not), as well as parents not wanting to impose further on teachers who they viewed as already quite burdened. While these were a couple of the reasons for the lack of teacher inclusion, many parents simply stated that they did not want to include that component of the study. This was respected. In relation to this particular difficulty, however, it is recommended that future research assess why there is a lack of desire for Australian parents, at least based on this regional sample, to include their child’s teacher in the assessment process, and perhaps seek to ascertain whether a method for overcoming any barriers to such inclusion can be found as this would benefit the teacher, the parent, and most importantly the child.

Another possibility for a lack of access to children at risk for problem behaviour surrounds diverse perspectives on how problem behaviour is defined. Perhaps a child doesn’t appear to have “social or emotional” problems in certain cultures/subcultures/environments and hence the parent or teacher believes that no referral is necessary. So if parents are advised by a teacher that their child may be having difficulty socialising, but such behaviours (e.g. aggression) are the norm for a cultural group or environment (e.g. low SES; cf. Dodge, Pettit & Bates, 2008) then the parents would naturally disagree with the teacher’s report and perhaps blame the teacher as being incompetent or even bullying. In addition, a comparison by parents of one child to its siblings may mean that children who are struggling socially or emotionally according to a teacher yet who do not differ from their siblings or peers are not picked up as exhibiting
problem behaviours. In certain contexts and environments a child’s behaviour may be viewed as functional, with occasional aggressive behaviours even seen as adaptive; however, if placed into a different context that same child may be viewed (by a parent or teacher) as socially, emotionally or behaviourally competent or incompetent. It is difficult to determine whether a child is at risk for problem behaviour when the view of what constitutes problem behaviour is subjective and often dependent on environmental factors. For a teacher who is faced with a classroom containing several disruptive children those who display seemingly minor EF problems may not even reach the teacher’s attentional threshold. Unfortunately, those children and parents who would benefit most from an intervention are often those who are not included in some early intervention programs, possibly for reasons stated above (Kazdin, 2003a).

As children are likely to benefit from comprehensive assessments which inform individualised, and more effective, intervention strategies, it is important that future research focuses on removing the barriers to accessing those children most at risk for problem behaviours. If obstacles to child participation in research projects such as this one can be overcome, both those found in the NSW school system and through community involvement, the progression of social, emotional, and behavioural problems in children may be minimised. The following chapter will now present the study’s findings and highlight the importance of a comprehensive assessment in uncovering the influences on a child’s behaviour.
CHAPTER 5: RESULTS

5.1 Overview

Statistical analyses were performed using SPSS (IBM, 2013; Version 22.0). Multiple Regression was employed to explore the relationship between the behavioural problems of children and their executive functioning. This approach was deemed appropriate in that it is able to test how well a set of variables is able to predict the score on a continuous dependent variable. In addition, multiple regression can identify which behavioural profile (those high in internalising or externalising) correlates with deficits in executive functioning specifically associated with SIP biases and poor self-regulation.

5.2 Sample Description

As shown below in Tables 2 and 3, the sample consisted of 96 children, aged between 7 and 13 years ($M = 10.0, SD = 1.8$), predominantly coming from grade 2 through to grade 7 (96%) with females slightly outnumbering males (Females = 55%).

As discussed in Chapter 4, the initial aim of the study was to find out whether EF differed between children who were referred by parents or teachers because of engaging in problem behaviours relative to children who were classified as engaging in more socially acceptable behaviours (non-referred). However, as shown below in Table 3, only 25 children with referrals participated. Due to unequal sample sizes, it was decided that the best way to uncover any association between problem behaviour and EF was to look at all parent reports on the CBCL internalizing and externalizing subscales as continuous variables (see Table 4) and to explore their relations with EF testing and questionnaire profiles.
Table 3

*Frequency Statistics for all Demographic Variables*

<table>
<thead>
<tr>
<th>IV</th>
<th>Level</th>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Sex</strong></td>
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</tr>
<tr>
<td>Male</td>
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<tr>
<td>Female</td>
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<tr>
<td>Non-Referred</td>
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<td><strong>Year Level</strong></td>
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<td>(Grade)</td>
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<td>18.8</td>
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*Note.* K = Kindergarten.
Table 4

*Descriptive Statistics for Age and CBCL Problem Behaviour Subscales*

<table>
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<tr>
<th></th>
<th>N</th>
<th>Mean</th>
<th>Standard Deviation</th>
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<tr>
<td>Age</td>
<td>96</td>
<td>10.0</td>
<td>1.8</td>
</tr>
<tr>
<td>CBCL – Internalising</td>
<td>96</td>
<td>54.2</td>
<td>10.5</td>
</tr>
<tr>
<td>CBCL – Externalising</td>
<td>96</td>
<td>50.5</td>
<td>11.4</td>
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</table>

*Note.* CBCL = Child Behaviour Checklist.

Before analysis, the dataset was checked for accuracy and completeness. Due to the complexity of the full data set, a random selection of 10% of cases was checked and very few errors were found. Frequency and descriptive data were then used to locate any out of range values. For any out of range values that were the result of incorrect data entry into SPSS correct values from the original dataset were used.

A screen for missing values for the entire dataset revealed that the only case that had missing data was #83 and it was limited to a reaction time and accuracy score on the HeadMinder Animal Decoding subtest. It was decided that age based mean imputation was the least biased option for dealing with the missing data given the age effects on HeadMinder (Donnelly, Nugent-Cleary-Fox, Gardner, & Maund, 2005; Tabachnick & Fidell, 2007). Participant #83 was given the age based mean score (for a 10yo) for both Animal Decoding Response Time ($M = 3.78$ sec) and Animal Decoding Correct Responses ($M = 26.1$).
Preliminary assumption testing was conducted to check for normality, linearity, univariate and multivariate outliers, homogeneity of variance and covariance, and multicollinearity for the series of analyses covered in subsequent chapters. Any cases that were > 2 standard deviations (SDs) above or below the sample mean were investigated. Recoding these cases to 2 SDs, by creating trimmed means, did not significantly affect means scores. Consequently, due to the lack of great difference to the remaining distributions, outlying cases of < 2 SDs were retained in the data file for analysis (Pallant, 2011). Cases that were 3 SDs above or below the mean were considered to be outliers. Any specific transformations made to these extreme cases will be discussed in more detail in their respective chapters.

While the sample size met the guidelines for significance tests of Multiple R (50 + 8m where m = number of predictor variables) significance tests were slightly underpowered for individual predictors (104 + m) as recommended by Tabachnick & Fidell (2007).

Despite multiple transformations, a number of variables still violated the assumption of normality for regression analyses (see discussion on normality in the data cleaning section of each chapter for specific detail on transformations). However, a matrix of scatter plots between each pair of variables did not show any obvious signs of non-linearity, and therefore, the assumption of linearity was met consistently for all analyses discussed in the following chapters.

The following chapters describe the findings for a range of analyses designed to test the various hypotheses about links between EF and behaviour. Each chapter relates one aspect of the battery to either another measure of the same construct or an EF testing profile to problem behaviours.
CHAPTER 6: EXECUTIVE FUNCTION AND BEHAVIOUR

The measures of executive functioning used for this study included the Behaviour Rating Inventory of Executive Functioning - Global Executive Composite (BRIEF – GEC) (Gioia et al., 2000), the D-KEFS Tower Task (Delis, Kaplan, Kramer, 2001) and the HeadMinder subtests Animal Decoding Response Time, Animal Decoding Correct Responses and Cue Benefit, a derived score based on HeadMinder Cued Reaction Time (CRT) after accounting for Simple Reaction Time (RT-CRT/RT+CRT*100) (Donnelly et al., 2005; HeadMinder Inc., 2007).

As described above, the parent version of the BRIEF – GEC is made up of two indexes: the Behaviour Regulation Index (BRI) and the Metacognitive Index (MI). The BRI consists of the subscales called Inhibit, Shift, and Emotional Control while the MI consists of the subscales called Working Memory, Planning/Organization, Organization of Materials, Initiate, and Monitor (Gioia et al., 2000).

The D-KEFS Tower Task is a neuropsychological test which assesses high level cognitive functions including planning, nonverbal problem solving, and impulse control but also relies on basic visuo-motor processing. The Tower Task includes a Total Achievement Score (TAS) and five optional process scores; Mean First Move Time, Time per Move ratio, Move Accuracy Ratio, Total Rule Violations and Rule-Violation per Item Ratio (Delis, Kaplan, & Kramer, 2001).

The Concussion Resolution Index (CRI) of the HeadMinder program is a computerized assessment of visuomotor processing speed and accuracy under various conditions. The Reaction Time (RT) and Cued Reaction Time (CRT) subtests were used to assess a number of executive functions including rule learning and following and response
inhibition. The derived score of Cue Benefit was included to determine if participants were benefitting from the cue provided and therefore using executive functioning. The Animal Decoding subtest was also used to assess participant’s reaction time but with the additional component of a transcription component which assessed the EF ability of rapid coding and shifting mental sets (HeadMinder Inc., 2007).

Self-regulation is most often defined as the “ways in which an individual manages themselves in order to attain their goals” (Barkley, 2012, p.1). This definition closely mirrors that commonly used to define EF especially when cognitive and emotional control is considered along with the behavioural outcomes of these processes. Barkley (2012) suggests that each EF; for example, working memory, emotional control, inhibition, shifting etc. represents a type of self-regulation (self-control of emotion, self-directed problem solving, self-speech, self-restraint etc.). Relative to the model depicted in Figure 1, as described in the Introduction, these self-regulatory aspects of EF would be part of a central regulatory mechanism similar to that proposed by Hoffman, Schmeichel & Baddeley (2012) and by Dodge (1986, 1989). This mechanism purportedly mediates a child’s behavioural response based on cognitive processes such as attributions about intent, emotional experience, and a child’s knowledge about behavioural options and consequences.

6.1 Data Cleaning of EF and Behaviour Variables

Descriptive statistics for the EF measures are presented in Table 5.
Table 5

Descriptive Statistics for EF Measures

<table>
<thead>
<tr>
<th></th>
<th>N</th>
<th>Mean</th>
<th>Standard Deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>BRIEF – GEC</td>
<td>96</td>
<td>54.3</td>
<td>11.3</td>
</tr>
<tr>
<td>D-KEFS Tower Task</td>
<td>96</td>
<td>11.0</td>
<td>2.0</td>
</tr>
<tr>
<td>HeadMinder AD RT</td>
<td>96</td>
<td>4.12</td>
<td>2.09</td>
</tr>
<tr>
<td>HeadMinder AD CR</td>
<td>96</td>
<td>25.8</td>
<td>9.8</td>
</tr>
<tr>
<td>HeadMinder Cue Benefit</td>
<td>96</td>
<td>-13.85</td>
<td>27.50</td>
</tr>
</tbody>
</table>

Note. BRIEF - GEC = Behaviour Rating Inventory of Executive Function Global Executive Composite; AD RT = Animal Decoding Response Time; AD CR = Animal Decoding Correct Response; Cue Benefit = (RT-CRT/RT+CRT*100).

There were no outlying cases for the behaviour variables of internalizing or externalizing problem behaviours. While there were a few univariate outliers across the EF scales, these were scores only two standard deviations above the sample mean and were retained in the data file for analysis (Pallant, 2011). However, Animal Decoding Response Time had a number of outliers (participants #65, #31, #86, and #78) at three standard deviations above the mean. Square root transformation of the Animal Decoding Response Time variable (see below) resulted in a reduction of 50% of these univariate outliers with only case #65 and #31 remaining as extreme outliers. To reduce the impact of these univariate outliers, the original scores were transformed using imputation of a score that was one unit above the next highest score (Tabachnick & Fidell, 2007).
The maximum Mahalanobis distance was higher (20.05) than the critical value of 18.5 (with four variables) suggesting the presence of multivariate outliers. Inspection of the Mahalanobis distance values revealed cases #83 (20.05) and #86 (19.95) as multivariate outliers. Regression analyses were then run twice; once with multivariate outliers excluded and then with multivariate outliers included. Results from the multiple regression analyses were fairly consistent regardless of whether multivariate outliers were included or excluded from analysis. Due to the lack of great difference to the results between these separate analyses, multivariate outliers were retained in the data file for analysis (Tabachnick & Fidell, 2007).

Due to a positively skewed distribution, square root transformations were computed for Externalizing Behaviour, the BRIEF – GEC, the D-KEFS Tower Task and Animal Decoding Response Time scores. Other than for the BRIEF – GEC, transforming the variables made only minimal difference to normality. Furthermore, logarithmic transformation did not correct the positive skew for Externalising Behaviour, Animal Decoding Response Time or for the Tower Task scores. This may be because the sample is made up of children with a range of abilities in EF yet none with identified learning or developmental difficulties, so there being a few in either the very high or very low end of the distribution, depending on the scale, was expected on the basis of individual differences. Most children in the sample performed well on the Animal Decoding subtest (more fast response times and few very slow response times) leading to a positively skewed distribution.

The distribution of scores on the D-KEFS Tower Task was reasonably normal, but somewhat platykurtic, due to the performance of two participants; one who performed quite poorly and one who performed extremely well. The distribution of scores on
Externalising Behaviour was also reasonably normal, with true normality being skewed due to a number of participants being classified as very low in externalizing behaviour; this was expected due to the study’s criteria excluding clinical populations. It is believed that the issues with normality on these measures is not the result of issues with the scales themselves but rather accurately reflects the constructs being investigated in this sample of children (Pallant, 2011).

While the violations of normality for the D-KEFS Tower Task and the Animal Decoding Response Time were not overcome following the square root transformation, all extreme outliers on the Animal Decoding Response Time Task were reduced to two standard deviations. In turn however, the transformation of the D-KEFS Tower Task actually created more univariate outliers. Furthermore, regression analyses were run twice; once with the D-KEFS Tower Task, Animal Decoding Response Time, and the BRIEF – GEC untransformed, and then once with these same variables transformed (Tabachnick & Fidell, 2007). Results from the multiple regression analyses were fairly consistent regardless of whether variables were transformed or not. Due to the lack of great difference to the results between these separate analyses, it was decided that the most efficacious principle for analyses was to include variables whose transformations improved normality and removed multivariate outliers. This included both the BRIEF – GEC and the Animal Decoding Response Time. The D-KEFS Tower Task visually looks symmetrical and will be untransformed for all analyses. Further discussion of these variables will be referred to as D-KEFS Tower Task, BRIEF – GEC(t) and Animal Decoding Response Time(t).

6.2 Correlations among EF and Behaviour Variables
The relationships among internalizing and externalizing problem behaviour (as measured by the CBCL) and EF (as measured by the BRIEF-GEC(t), the D-KEFS Tower Task, and the HeadMinder subtests) were first investigated using Pearson product-moment correlation analyses.

The correlations between age and internalizing and externalizing behaviour scores were not significant, possibly due to CBCL scores already being age standardized. Furthermore, the BRIEF GEC(t) and the D-KEFS Tower Task were not significantly correlated with age as, again they were both age-based standardized scores. As expected, there was a strong, negative correlation between age and response speed on the HeadMinder Animal Decoding(t) subtest, $r = -.64, n = 96, p < .001$. However, the Cue Benefit composite score was also unexpectedly negatively correlated with age, $r = -.42, n = 96, p < .001$ indicating that as age increased the capacity to use a cue to enhance RT decreased. A strong positive correlation was found between age and the number correct on the HeadMinder Animal Decoding Correct variable, $r = .64, n = 96, p < .001$.

As presented in Figure 7 below, significant correlations were found between Internalizing Behaviour as reported by parents on the CBCL and EF as measured by the BRIEF GEC(t), the D-KEFS Tower Task and the HeadMinder subtests of Animal Decoding Response Time(t) and Animal Decoding Correct. In addition, significant correlations were found between Externalizing Behaviour as reported by parents on the CBCL and EF as measured by the BRIEF GEC(t), the D-KEFS Tower Task and the HeadMinder subtests of Animal Decoding Response Time(t) and Animal Decoding Correct. Higher parent reported levels of internalizing or externalizing behaviours were significantly associated with poorer EF performance as measured by the D-KEFS Tower Task and HeadMinder, and with higher parent reported deficits in EF as measured by the
BRIEF-GEC(t). In contrast to expectations, the relationship between behaviour problems and Cue Benefit was not significant.

Figure 7. Zero order correlations between internalising (Int) and externalising (Ext) scores on the parent reported CBCL and EF test performance.

Note. GEC(t) = Behaviour Regulation of Executive Function - Global Executive Composite (transformed); TT = Tower Task; ADRT(t) = Animal Decoding Response Time (transformed); Cue Benefit = (RT-CRT/RT+CRT*100); ADcorr = Animal Decoding Correct Responses.

\* = p < .05. ** = p < .001.

To further explore the relationship among these variables, multiple regression analysis was performed to assess the ability of EF to predict problem behaviour.

6.3 Multiple Regression of EF variables on Estimates of Behaviour
Before conducting the multiple regression analysis, a correlation matrix was generated to check for multicollinearity and also to assess the concurrent validity of the EF measures (see Table 6 below). As expected, all measures of EF were at least moderately correlated. However, except for the variables mentioned below, EF variables were not excessively co-varying, suggesting that each might account for unique variance in overall behavioural functioning.

Table 6

Correlations among the EF Measures

<table>
<thead>
<tr>
<th></th>
<th>BRIEF-GEC(t)</th>
<th>D-KEFS TT TAS</th>
<th>HM AD RT(t)</th>
<th>HM AD CR</th>
<th>HM Cue Benefit</th>
</tr>
</thead>
<tbody>
<tr>
<td>BRIEF-GEC(t)</td>
<td>-.19</td>
<td>.31**</td>
<td>-.31**</td>
<td>.00</td>
<td></td>
</tr>
<tr>
<td>D-KEFS TT TAS</td>
<td>-.13</td>
<td>.03</td>
<td>.10</td>
<td></td>
<td></td>
</tr>
<tr>
<td>HM AD RT(t)</td>
<td></td>
<td>-.92**</td>
<td>.36**</td>
<td></td>
<td></td>
</tr>
<tr>
<td>HM AD CR</td>
<td></td>
<td></td>
<td></td>
<td>-.43**</td>
<td></td>
</tr>
</tbody>
</table>

Note. BRIEF – GEC(t) = Behaviour Regulation Index of Executive Function - Global Executive Composite (transformed); D-KEFS TT TAS = D-KEFS Tower Task Total Achievement Score; HM AD RT(t) = HeadMinder Animal Decoding Response Time (transformed); HM AD CR = HeadMinder Animal Decoding Correct Responses; HM Cue Benefit = HeadMinder Cue Benefit (RT-CRT/RT+CRT*100)

Due to the trend ($r = .19$, $p = .058$) towards a relationship between the BRIEF-GEC(t) and the D-KEFS TAS, a second correlation matrix was generated to investigate whether
any clinical subscales on the BRIEF were associated with the process scores on the D-KEFS Tower Task. As shown below in Table 7, significant correlations were found between a number of the BRIEF subscales and process scores on the D-KEFS Tower Task.

Table 7

Correlations between BRIEF Clinical Subscales and D-KEFS Tower Task Process Scores

<table>
<thead>
<tr>
<th></th>
<th>TAS</th>
<th>Mean First Move</th>
<th>Move Accuracy</th>
<th>Time per Move</th>
<th>Rule Violations</th>
</tr>
</thead>
<tbody>
<tr>
<td>BRIEF-GEC(t)</td>
<td>-.19</td>
<td>-.16</td>
<td>.07</td>
<td>-.20</td>
<td>-.07</td>
</tr>
<tr>
<td>Inhibit</td>
<td>-.18</td>
<td>-.03</td>
<td>.08</td>
<td>-.17</td>
<td>-.22*</td>
</tr>
<tr>
<td>Shift</td>
<td>-.05</td>
<td>-.14</td>
<td>.04</td>
<td>-.11</td>
<td>.11</td>
</tr>
<tr>
<td>Emotional Control</td>
<td>-.21*</td>
<td>-.20</td>
<td>-.01</td>
<td>-.22*</td>
<td>-.16</td>
</tr>
<tr>
<td>Initiate</td>
<td>-.14</td>
<td>-.14</td>
<td>.08</td>
<td>-.21*</td>
<td>-.06</td>
</tr>
<tr>
<td>Working Memory</td>
<td>-.17</td>
<td>-.10</td>
<td>.04</td>
<td>-.17</td>
<td>-.16</td>
</tr>
<tr>
<td>Plan/Organise</td>
<td>-.14</td>
<td>-.15</td>
<td>.03</td>
<td>-.15</td>
<td>-.02</td>
</tr>
<tr>
<td>Organisation of Materials</td>
<td>-.09</td>
<td>-.10</td>
<td>.20</td>
<td>-.17</td>
<td>.08</td>
</tr>
<tr>
<td>Monitor</td>
<td>-.18</td>
<td>-.07</td>
<td>-.02</td>
<td>-.10</td>
<td>-.03</td>
</tr>
</tbody>
</table>

Animal Decoding Response Time and Animal Decoding Correct Responses were highly negatively correlated at -.92. Animal Decoding Correct Responses was subsequently removed from the regression analyses, as combining the variables in a meaningful way did not seem possible. Following the removal of Animal Decoding
Correct Response there was no evidence of multicollinearity among EF variables used to predict either Internalizing Behaviour (tolerance values for all predictors were above .10 and VIF values were all <10) and sequential dependence (Durbin-Watson = 1.80), or Externalizing Behaviour (tolerance values for all predictors were above .10 and VIF values were all <10) and sequential dependence (Durbin-Watson = 2.01).

At this point in the analyses, hierarchical multiple regression was performed to assess the ability of EF variables to predict levels of internalising and externalising behaviour, after controlling for the influence of age. Four independent variables were used: The BRIEF-GEC(t), the D-KEFS Tower Task, and the HeadMinder subtests of Animal Decoding Response Time and Cue Benefit. Age was included as a fifth predictor to control for any age related effects on performance on the HeadMinder subtests and any age effects not accounted for by using standardized scores for the other measures. The dependent variables were Internalising Behaviour and Externalising Behaviour scores and these were entered separately into independent multiple regression analyses.

6.3.1 Internalising Criterion.

Age was entered at Step 1 explaining 2.9% of the variance in age-corrected Internalizing Behaviour scores. After the entry of the EF measures at Step 2 the total variance explained by the model as a whole was increased to 33.3%, $F (5, 90) = 8.99, p = <.001$. The EF measures explained an additional 30.5% of the variance in Internalizing Behaviour, $R^2$ change = .31, $F$ change (4, 90) = 10.27, $p < .001$. As shown in Table 8 below, examination of the beta coefficients revealed that the BRIEF – GEC(t) and the D-KEFS Tower Task explained significant amounts of unique variance in Internalizing
Behaviour. While Animal Decoding Response Time was positively correlated with Internalizing Behaviour, after accounting for the other variables in the regression equation it did not account for a significant amount of unique variance.

Parents who reported high levels of internalizing behaviour in their children were also likely to endorse high levels of EF difficulties in behaviour regulation and meta-cognition as assessed by the BRIEF. Children who were reported as having higher levels of internalizing behaviour were also likely to perform worse on the D-KEFS Tower Task. In general, a higher level of reported internalizing behaviour was related to higher levels of executive dysfunction.

Table 8

Predicting Internalizing Behaviour from Age and Four Measures of Executive Function

<table>
<thead>
<tr>
<th>Predictor</th>
<th>B</th>
<th>95% CI for B</th>
<th>β</th>
<th>r</th>
<th>sr²</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>LB</td>
<td>UB</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Step 1</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Age</td>
<td>-1.02</td>
<td>-2.24</td>
<td>.20</td>
<td>-.17</td>
<td>-.17*</td>
</tr>
<tr>
<td><strong>Step 2</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Age</td>
<td>-.62</td>
<td>-2.09</td>
<td>.86</td>
<td>-.10</td>
<td>-.17*</td>
</tr>
<tr>
<td>BRIEF-GEC(t)</td>
<td>6.04**</td>
<td>3.48</td>
<td>8.60</td>
<td>.43</td>
<td>.51**</td>
</tr>
<tr>
<td>Tower Task</td>
<td>-1.14*</td>
<td>-2.12</td>
<td>-.16</td>
<td>-.22</td>
<td>-.29**</td>
</tr>
<tr>
<td>AD RT(t)</td>
<td>2.10</td>
<td>-3.72</td>
<td>7.92</td>
<td>.09</td>
<td>.33**</td>
</tr>
<tr>
<td>Cue Benefit</td>
<td>.01</td>
<td>-.07</td>
<td>.08</td>
<td>.21</td>
<td>.08</td>
</tr>
</tbody>
</table>

Model 1: \( p = .100 \), \( R = .17, R^2 = .03, Adj R^2 = .02. \)

Model 2: \( p < .01, R = .58, R^2 = .33, Adj R^2 = .30. \)

** Correlation is significant at the 0.01 level (one tailed).
6.3.2 Externalising Criterion.

Age was entered at Step 1 explaining 2.8% of the variance in age corrected Externalizing Behaviour scores. After the entry of the EF measures at Step 2 the total variance explained by the model as a whole was increased to 52%, \( F(5, 90) = 19.50, p = <.001 \). The EF measures explain an additional 49.2% of the variance in Externalizing Behaviour, \( R^2 \) change = .49, \( F \) change (4, 90) = 23.07, \( p < .001 \). As shown by Table 9 below, examination of the beta coefficients revealed that the BRIEF – GEC(t) and the D-KEFS Tower Task again explained significant amounts of unique variance in Externalizing Behaviour. While Animal Decoding Response Time was positively correlated with Externalizing Behaviour, after accounting for the other variables in the regression equation it did not account for a significant amount of unique variance.

Parents who reported high levels of externalizing behaviour in their children were also likely to endorse high levels of EF difficulties in behaviour regulation and meta-cognition as assessed by the BRIEF. Children who were reported as having high levels of externalizing behaviour were also likely to perform worse on the D-KEFS Tower Task. In general, as was found for those who were exhibiting high levels of internalizing behaviour, a higher level of reported externalizing behaviour was also related to higher levels of executive dysfunction.
### Table 9

*Predicting Externalizing Behaviour from Age and Four Measures of Executive Function*

<table>
<thead>
<tr>
<th>Predictor</th>
<th>B</th>
<th>95% CI for B</th>
<th>β</th>
<th>r</th>
<th>sr²</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>LB</td>
<td>UB</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Step 1</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Age</td>
<td>-1.09</td>
<td>-2.40</td>
<td>.22</td>
<td>-.17</td>
<td>.03</td>
</tr>
<tr>
<td><strong>Step 2</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Age</td>
<td>-.27</td>
<td>-1.62</td>
<td>1.08</td>
<td>-.04</td>
<td>.01</td>
</tr>
<tr>
<td>BRIEF-GEC(t)</td>
<td>9.15**</td>
<td>6.80</td>
<td>11.49</td>
<td>.61</td>
<td>.32</td>
</tr>
<tr>
<td>Tower Task</td>
<td>-.91*</td>
<td>-1.81</td>
<td>-.01</td>
<td>-.16</td>
<td>-.28**</td>
</tr>
<tr>
<td>AD RT(t)</td>
<td>3.30</td>
<td>-2.03</td>
<td>8.63</td>
<td>.13</td>
<td>.38**</td>
</tr>
<tr>
<td>Cue Benefit</td>
<td>.01</td>
<td>-.05</td>
<td>.08</td>
<td>.03</td>
<td>.08</td>
</tr>
</tbody>
</table>

Model 1: $p = .100$, $R = .17$, $R^2 = .03$, $Adj \ R^2 = .02$.
Model 2: $p < .01$, $R = .72$, $R^2 = .52$, $Adj \ R^2 = .49$.

** Correlation is significant at the 0.01 level (one tailed).
* Correlation is significant at the 0.05 level (one tailed).

Note. BRIEF GEC(t) = Behaviour Regulation of Executive Function - Global Executive Composite (transformed); AD RT(t) = Animal Decoding Reaction time (transformed); Cue Benefit = (RT-CRT)/RT+CRT*100).

Based on the multiple regression models for the influence of EF on internalizing and externalizing behaviour scores, and after considering the variance accounted for by each measure of EF, it is clear that the BRIEF-GEC(t) and the D-KEFS Tower Task account for a significant amount of the variance in both internalizing and externalizing scores (see Figure 8 below).
Figure 8. Partial correlations from the multiple regression analyses showing the unique variance in internalising and externalising scores on the parent reported CBCL accounted for by EF performance.

Note. GEC(t) = Behaviour Regulation Index of Executive Function - Global Executive Composite (transformed); TT = Tower Task; ADRT(t) = Animal Decoding Response Time (transformed); Cue Benefit = (RT-CRT/RT+CRT*100).

* = p < .05. ** = p < .01.

Also of note is that the BRIEF-GEC(t) is correlated with externalizing behaviour significantly more than internalizing behaviour as reported by parents on the CBCL. As shown in Figure 9 below, greater executive dysfunction on the BRIEF-GEC(t) is associated with higher internalising behaviour, $r = .443$, $p < .001$, and externalising behaviour $r = .633$, $p < .001$. These correlations with the BRIEF-GEC(t) are significantly different, $t = 2.535$, $p < .05$. The correlations between internalising and externalising behaviour scores and remaining EF tasks were not significantly different.
Figure 9. Partial correlations from the multiple regression analyses showing the unique variance in internalising and externalising scores on the parent reported CBCL accounted for by EF performance on the BRIEF and the D-KEFS Tower Task.

Note. BRIEF-GEC(t) = Behaviour Regulation Index of Executive Function - Global Executive Composite (transformed).

* = p < .05. ** = p < .01.

6.4 BRIEF Subscale Follow Up Analyses

As mentioned previously, the BRIEF is a parent report which is made up of two indices; the Behaviour Regulation Index (BRI) and the Metacognitive Index (MI). These two indices are in-turn made up of eight clinical scales. The BRI consists of Inhibit, Shift, and Emotional Control while the MI consists of Working Memory, Planning/Organization, Organization of Materials, Initiate, and Monitor (Gioia et al., 2000). Due to the significant unique contribution of the BRIEF-GEC(t) to both the Internalizing and Externalizing
Behaviour scores, the author decided to investigate further which specific clinical scales were predicting internalizing and externalizing problem behaviours.

### 6.4.1 Data Cleaning of BRIEF Clinical Subscales and Behaviour Variables.

Descriptive statistics for the BRIEF clinical subscales are presented in Table 10.

<table>
<thead>
<tr>
<th></th>
<th>N</th>
<th>Mean</th>
<th>Standard Deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inhibit</td>
<td>96</td>
<td>51.9</td>
<td>10.5</td>
</tr>
<tr>
<td>Shift</td>
<td>96</td>
<td>51.7</td>
<td>12.0</td>
</tr>
<tr>
<td>Emotional Control</td>
<td>96</td>
<td>52.0</td>
<td>11.5</td>
</tr>
<tr>
<td>Initiate</td>
<td>96</td>
<td>52.5</td>
<td>10.8</td>
</tr>
<tr>
<td>Working Memory</td>
<td>96</td>
<td>55.0</td>
<td>11.3</td>
</tr>
<tr>
<td>Plan/Organise</td>
<td>96</td>
<td>55.5</td>
<td>12.4</td>
</tr>
<tr>
<td>Organisation of Materials</td>
<td>96</td>
<td>55.3</td>
<td>10.4</td>
</tr>
<tr>
<td>Monitor</td>
<td>96</td>
<td>52.1</td>
<td>12.2</td>
</tr>
</tbody>
</table>

There were no univariate outliers > 2 SDs across the BRIEF clinical scales. However, the maximum Mahalanobis distance was higher (28.24) than the critical value of 26.13 (with eight variables), suggesting the presence of multivariate outliers, and inspection of
the Mahalanobis distance values revealed case #58 as a multivariate outlier. Regression analyses were then run twice; once with the multivariate outlier excluded and then with the multivariate outlier included. Results from the multiple regression analyses were fairly consistent regardless of whether the multivariate outlier was included or excluded from analysis and therefore the multivariate outlier was retained in the data file for analysis (Tabachnick & Fidell, 2007).

Due to a violation of normality, square root transformations were computed for the clinical scales of Inhibit, Shift, Emotional Control, Initiate, Working Memory, and Plan/Organize to correct for positive skew. Other than for the clinical scales of Initiate and Working Memory, transforming the variables didn’t make much difference to normality. Furthermore, logarithmic transformation did not correct violations of normality in the subscales. Again, this may be because the sample was made up of children who did not meet criteria for any clinical syndrome so highly elevated scores were expected to be rare, therefore leading to positively skewed distributions. As noted earlier, the skewed distribution may reflect the underlying nature of the construct in this sample, as opposed to problems with the scale itself (Pallant, 2011).

To help in deciding whether to transform the subscales or leave them untransformed, regression analyses were again run twice; once with the subscales untransformed and then with these subscales transformed. Results from the multiple regression analyses were fairly consistent regardless of whether variables were transformed or not. Due to the lack of great difference to the results between these separate analyses, it was decided that the transformed versions of scores were to be used in the analyses only when they improved normality. When this did not occur, the untransformed variables were retained. The transformed versions included the BRIEF MI subscales of Initiate and Working Memory.
which further discussion of these variables will refer to Initiate(t) and Working Memory(t). The subscales of Inhibit, Shift, Emotional Control, and Plan/Organise will remain untransformed for all analyses.

6.4.2 Correlations among BRIEF Clinical Subscales and Behaviour Variables.

The relationships among Internalizing and Externalizing problem behaviour (as reported by parents on the CBCL) and EF (as reported by parents on the clinical subscales of the BRIEF) were first investigated using Pearson product-moment correlation analyses.

The only significant relationship between age and the already age-corrected, BRIEF clinical subscales was for Organization of Materials $r = -0.26, n = 96, p = .010$. As presented in Figure 10 below, significant correlations were found between Internalizing Behaviour as reported by parents on the CBCL and the BRIEF subscales of Initiate(t), Working Memory(t), Inhibit, Shift, Emotional Control, Plan/Organize and Monitor. In addition, significant correlations were found between Externalizing Behaviour as reported by parents on the CBCL and the BRIEF subscales of Initiate(t), Working Memory(t), Inhibit, Shift, Emotional Control, Plan/Organize, Organization of Materials, and Monitor. Parent reported problem behaviour characterised as internalizing and externalizing was associated with deficits in EF as measured by several BRIEF subscales. The only subscale exception was that Internalizing Behaviour was not correlated significantly with the Organisation of Materials subscale on the BRIEF.
Figure 10. Zero order correlations between internalising and externalising scores on the parent reported CBCL and EF scores as parents reported on the clinical subscales of the BRIEF.

Note. Ini = Initiate (transformed); WM = Working Memory (transformed); EC = Emotional Control; Plan/Org = Planning/Organisation; Org Mat = Organisation of Materials; Mon = Monitor. * = \( p < .05 \) ** = \( p < .01 \).

To further explore the relationship among these variables, a multiple regression analysis was performed to assess the ability of the BRIEF clinical subscales to predict problem behaviour.

6.4.3 Multiple Regression of BRIEF Clinical Subscales on Behaviour Variables.

Before conducting the multiple regression analysis, a correlation analysis was performed to check for multicollinearity which revealed a couple of highly correlated predictor variables (range of correlation coefficients: .24 - .82). However, an examination
of the collinearity diagnostics table suggested that there was no evidence of
multicollinearity among the BRIEF clinical scales used to predict Internalizing Behaviour
(tolerance values for all predictors were above .10 and VIF values were all <10) or
Externalizing Behaviour (tolerance values for all predictors were above .10 and VIF values
were all <10). There was also no evidence of sequential dependence for either internalizing
behaviour (Durbin-Watson = 1.83) or externalizing behaviour (Durbin-Watson = 1.92).

A hierarchical multiple regression was performed to assess the ability of the clinical
scales of the BRIEF to predict levels of Internalising and Externalising Behaviour after
controlling for the influence of age. The eight BRIEF clinical scales were used as
independent variables. Age was included as a ninth predictor to control for any age related
effects on parental reports on the CBCL or the BRIEF. The dependent variables were
Internalising Behaviour and Externalising Behaviour and these were entered separately
into independent multiple regression analyses.

Internalising Criterion.

Age was entered at Step 1 explaining 2.9% of the variance in Internalizing Behaviour.
After the entry of the BRIEF clinical subscales at Step 2 the total variance explained by the
model as a whole was increased to 46.7%, $F (9, 86) = 8.39, p = .001$. The BRIEF
subscales explain an additional 43.9% of the variance in Internalizing Behaviour, $R$
squared change = .44, $F$ change (8, 86) = 8.86, $p < .001$. As shown by Table 11 below,
examination of the beta coefficients revealed that the clinical subscales of Emotional
Control and Shifting explained significant amounts of variance in Internalizing Behaviour.
Parents who reported high levels of internalizing behaviour in their children were also likely to endorse high levels of EF difficulties in the specific areas of Emotional Control and Shifting behaviour and thinking.

Table 11

*Predicting Internalizing Behaviour from Age and the BRIEF Clinical Subscales*

<table>
<thead>
<tr>
<th>Predictor</th>
<th>B</th>
<th>95% CI for B</th>
<th>β</th>
<th>r</th>
<th>sr²</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Step 1</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Age</td>
<td>-1.02</td>
<td>-2.24</td>
<td>.20</td>
<td>-.17</td>
<td>-.17*</td>
</tr>
<tr>
<td><strong>Step 2</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Age</td>
<td>-.38</td>
<td>-1.40</td>
<td>.65</td>
<td>-.06</td>
<td>-.17*</td>
</tr>
<tr>
<td>Inhibit</td>
<td>-.14</td>
<td>-.42</td>
<td>.14</td>
<td>-.14</td>
<td>.34**</td>
</tr>
<tr>
<td>Shift</td>
<td>.20</td>
<td>.01</td>
<td>.40</td>
<td>.23</td>
<td>.54**</td>
</tr>
<tr>
<td>Emotional Control</td>
<td>.41**</td>
<td>.19</td>
<td>.63</td>
<td>.45</td>
<td>.61**</td>
</tr>
<tr>
<td>Initiate(t)</td>
<td>2.05</td>
<td>-2.46</td>
<td>6.57</td>
<td>.14</td>
<td>.50**</td>
</tr>
<tr>
<td>Working Memory(t)</td>
<td>1.17</td>
<td>-2.68</td>
<td>5.02</td>
<td>.08</td>
<td>.44**</td>
</tr>
<tr>
<td>Plan/Organise</td>
<td>.13</td>
<td>.20</td>
<td>.45</td>
<td>.15</td>
<td>.46**</td>
</tr>
<tr>
<td>Organisation of Materials</td>
<td>-.18</td>
<td>-.38</td>
<td>.02</td>
<td>-.18</td>
<td>.17*</td>
</tr>
<tr>
<td>Monitor</td>
<td>-.10</td>
<td>-.40</td>
<td>.19</td>
<td>-.12</td>
<td>.37**</td>
</tr>
</tbody>
</table>

Model 1: $p = .100$, $R = .17$, $R^2 = .03$, $Adj \ R^2 = .02$.

Model 2: $p < .01$, $R = .68$, $R^2 = .47$, $Adj \ R^2 = .41$.

** Correlation is significant at the 0.01 level (one tailed).

* Correlation is significant at the 0.05 level (one tailed).
**Externalising Criterion.**

Age was entered at Step 1 explaining 2.8% of the variance in Externalizing Behaviour. After the entry of the BRIEF clinical subscales at Step 2 the total variance explained by the model as a whole was increased to 64.3%, $F(9, 86) = 17.20$, $p = .001$. The BRIEF subscales explain an additional 61.5% of the variance in Externalizing Behaviour, $R^2$ squared change = .62, $F$ change (8, 86) = 18.51, $p < .001$. As shown in Table 12 below, examination of the beta coefficients revealed that the clinical subscales of Emotional Control and Inhibit explained significant amounts of variance in Externalizing Behaviour.

Parents who reported high levels of externalizing behaviour in their children were also likely to endorse high levels of EF difficulties in the specific areas of Emotional Control and Inhibiting behaviour.

### Table 12

**Predicting Externalizing Behaviour from Age and the BRIEF Clinical Subscales**

<table>
<thead>
<tr>
<th>Predictor</th>
<th>B</th>
<th>95% CI for B</th>
<th>$\beta$</th>
<th>$r$</th>
<th>$sr^2$</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Step 1</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Age</td>
<td>-1.10</td>
<td>-2.40</td>
<td>.22</td>
<td>-.17</td>
<td>-.17*</td>
</tr>
<tr>
<td><strong>Step 2</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Age</td>
<td>-.79</td>
<td>-1.70</td>
<td>.11</td>
<td>-.12</td>
<td>-.17</td>
</tr>
<tr>
<td>Inhibit</td>
<td>.44**</td>
<td>.19</td>
<td>.69</td>
<td>.41</td>
<td>.69**</td>
</tr>
<tr>
<td>Shift</td>
<td>-.15</td>
<td>-.32</td>
<td>.02</td>
<td>-.16</td>
<td>.45**</td>
</tr>
<tr>
<td>Emotional Control</td>
<td>.48**</td>
<td>.29</td>
<td>.67</td>
<td>.48</td>
<td>.72**</td>
</tr>
<tr>
<td>Initiate(t)</td>
<td>1.82</td>
<td>-2.20</td>
<td>5.81</td>
<td>.12</td>
<td>.54**</td>
</tr>
<tr>
<td>Working Memory(t)</td>
<td>-1.42</td>
<td>-4.82</td>
<td>2.00</td>
<td>-.09</td>
<td>.51**</td>
</tr>
<tr>
<td></td>
<td>Plan/Organise</td>
<td>Organisation of Materials</td>
<td>Monitor</td>
<td></td>
<td></td>
</tr>
<tr>
<td>---------------------</td>
<td>---------------</td>
<td>---------------------------</td>
<td>---------</td>
<td></td>
<td></td>
</tr>
<tr>
<td>** Correlation is significant at the 0.01 level (one tailed).**</td>
<td>** Correlation is significant at the 0.05 level (one tailed).**</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Model 1: $p = .100, R = .17, R^2 = .03, Adj R^2 = .02.$

Model 2: $p < .01, R = .80, R^2 = .64, Adj R^2 = .61.$

Children who engaged in either internalising or externalising behaviours also had problems endorsed by their parents on the BRIEF subscale of Emotional Control.

However, and in accordance with the thesis, while internalisers have difficulty with the EF of shifting behaviour and cognition in response to environmental demands, externalisers have difficulty with the EF of inhibiting behaviour.

Based on the multiple regression models for the relations between the clinical scales of the BRIEF and Internalizing and Externalizing Behaviour scores, and after considering the variance accounted for by each subscale, it is clear that the subscales of Inhibition and Emotional Control account for a significant amount of the variance in Externalizing scores while Shifting and Emotional Control account for a significant amount of the variance in reported Internalizing Behaviour (see Figure 11 below).
Partial correlations from the multiple regression analyses showing the unique variance in internalising and externalising scores on the parent reported CBCL accounted for by EF scores as parent reported on the clinical subscales of the BRIEF.

*Note.* Ini = Initiate (transformed); WM = Working Memory (transformed); EC = Emotional Control; Plan/Org = Planning/Organisation; Org Mat = Organisation of Materials; Mon = Monitor. 

\* = \( p < .05 \). ** = \( p < .01 \).

Also of note is that the subscale of Inhibition is correlated with Externalizing Behaviour significantly more than Internalizing Behaviour as reported by parents on the CBCL. Furthermore, the subscale of Shifting is correlated with Internalizing Behaviour significantly more than Externalizing Behaviour as reported by parents on the CBCL. As shown in Figure 12 below, greater reported executive dysfunction on the Inhibition subscale was associated with slightly lower Internalising behaviour, \( r = -.104, p = .335 \), and significantly higher Externalising behaviour \( r = .358, p < .001 \) and these correlations with Inhibition are significantly different, \( t = 5.336, p < .01 \). In contrast, greater reported executive dysfunction on the Shifting subscale was associated with slightly lower
Externalising Behaviour, $r = -0.184, p = .086$, and significantly higher Internalising Behaviour $r = 0.222, p = .038$ and these correlations with Shifting are significantly different, $t = -4.316, p < .01$. The correlations between Internalising and Externalising Behaviour scores and the remaining BRIEF subscales were not significant.

*Figure 12.* Partial correlations from the multiple regression analyses showing the unique variance in internalising and externalising scores on the parent reported CBCL accounted for by EF scores as parents reported on the BRIEF subscales of Inhibition, Shifting, and Emotional Control.

*Note.* EC = Emotional Control

$* = p < .05$. $** = p < .01$.

### 6.5 D-KEFS Tower Task Subscale Follow Up Analyses

Due to the significant unique contribution of the D-KEFS Tower Task achievement score to the variance in both internalizing and externalizing behaviours, the author decided
to investigate further which specific supplementary Tower Task scores may be predicting behavioural problems. As outlined earlier, the D-KEFS Tower Task includes five optional process scores; Mean First Move Time, Time per Move Ratio, Move Accuracy Ratio, Total Rule Violations, and Rule-Violation per Item Ratio. Mean First Move Time reflects the average response speed of the examinee’s first moves; Time per Move Ratio reflects the average time taken to make each move; Move Accuracy Ratio reflects the efficiency of the examinee’s approach to constructing the towers; Total Rule Violations reflects the total number of times the examinee violated one of two task rules (moving more than one disc at a time or placing a larger disc on a smaller one); and Rule Violations per Item Ratio reflects the average number of rule violations across the number of items administered (Delis, Kaplan & Kramer, 2001).

6.5.1 Data Cleaning of Tower Task Process Variables and Behaviour Variables.

The descriptive statistics for the D-KEFS Tower Task process variables are presented below in Table 13.

<table>
<thead>
<tr>
<th></th>
<th>N</th>
<th>Mean</th>
<th>Standard Deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Move Accuracy Ratio</td>
<td>96</td>
<td>7.1</td>
<td>2.8</td>
</tr>
<tr>
<td>Mean First Move Time (sec)</td>
<td>96</td>
<td>11.3</td>
<td>1.2</td>
</tr>
<tr>
<td>Time Per Move Ratio (sec)</td>
<td>96</td>
<td>11.4</td>
<td>1.9</td>
</tr>
</tbody>
</table>
There were a few univariate outliers across the D-KEFS Tower Task process scores which were > 2 SDs above the mean. Mean First Move Time had a number of extreme outliers, with participants #7, #31, and #86 above three standard deviations above the mean. However, the trimmed mean and mean values were very similar for these outlying cases ($M = 11.27, tM = 11.37$). Time per Move Ratio also had an extreme outlier, with participant #86 more than three standard deviations above the mean. However, the trimmed mean and mean values were very similar for this outlying case ($M = 11.4, tM = 11.6$). Number of Rule Violations also had an extreme outlier, with participant #56 above three standard deviations above the mean. However, the trimmed mean and mean values were very similar for this outlying case ($M = 1.7, tM = 1.4$). Rule Violations per Item Ratio also had an extreme outlier, with participant #56 above three standard deviations above the mean. However, the trimmed mean and mean values are very similar for this outlying case ($M = 10.4, tM = 10.5$). Due to the lack of great difference to the remaining distribution, these outlying cases were retained in the data file for analysis (Pallant, 2011; Tabachnick & Fidell, 2007).

The maximum Mahalanobis distance value was higher than the critical value of 20.5 (with five variables) suggesting the presence of multivariate outliers. A look at the Mahalanobis distance variable revealed cases #7 (27.07), #56 (31.00) and #86 (50.22) as multivariate outliers. Regression analyses were then run twice; once with multivariate outliers excluded and then with multivariate outliers included. Results from the multiple
regression analyses were fairly consistent regardless of whether multivariate outliers were included or excluded from analysis and therefore these multivariate outliers were retained in the data file for analysis (Tabachnick & Fidell, 2007).

Due to a violation of normality, square root transformations were computed for all of the process scores for the D-KEFS Tower Task. However, transforming these process variables didn’t make any difference to normality. Furthermore, logarithmic transformation did not correct violations of normality in any of the process variables. Again, this may be because the sample is made up of children who did not meet criteria for any clinical disorder so highly elevated scores were expected to be rare, resulting in positively skewed distributions. As noted earlier, the distribution may have reflected the underlying nature of the construct in this sample as opposed to problems with the scale itself (Pallant, 2011).

### 6.5.2 Correlations among Tower Task Process Variables and Behaviour Variables.

The relationships among internalizing and externalising problem behaviour (as reported by parents on the CBCL) and EF (measured by the D-KEFS Tower Task process scores) were first investigated using Pearson product-moment correlation analyses.

The only significant relationship between age and the D-KEFS Tower Task process scores was for Number of Rule Violations, $r = -0.43$, $n = 96$, $p < .001$ with higher age associated with fewer rule violations. As presented in Figure 13 below, the only significant correlation found between Internalizing Behaviour as reported by parents on the CBCL and the Tower Task process scores was for Time per Move Ratio. Higher parent reported
Internalizing Behaviour was associated with a slower, on average, response time. In addition, significant correlations were found between Externalizing Behaviour as reported by parents on the CBCL and the Tower Task process scores of Time per Move Ratio, Number of Rule Violations, and Rule Violations per Item Ratio. Higher parent reported Externalizing Behaviour was associated with a slower, on average, response time, as well as a higher number of rule violations even after controlling for the number of items completed by the child. Move Accuracy was not related to reports of either type of behaviour problems. However, given that higher levels of reported Internalising and Externalising Behaviour problems were associated with slower response times, it is possible that participants sacrificed speed for accuracy.

*Figure 13.* Zero order correlations between internalising and externalising scores on the parent reported CBCL and EF performance as measured by the D-KEFS Tower Task process variables.
To further explore the relationship among these variables, a multiple regression analysis was performed to assess the ability of the D-KEFS Tower Task process scores to predict problem behaviour.

### 6.5.3 Multiple Regression of Tower Task Process Variables on Behaviour

Before conducting the multiple regression analysis, a correlation was performed to check for multicollinearity which revealed a couple of highly correlated predictor variables. An examination of the collinearity diagnostics table further suggested that there was evidence of multicollinearity; tolerance values for all predictors were above .10, however two VIF values were >10. The correlation matrix revealed that the process scores of Number of Rule Violations and Rule Violations per Item Ratio were highly correlated at .87. Consequently Number of Rule Violations was excluded from regression analyses. There was no evidence of sequential dependence for either Internalizing Behaviour (Durbin-Watson = 1.77) or Externalizing Behaviour (Durbin-Watson = 1.96).

A hierarchical multiple regression was performed to assess the ability of the D-KEFS Tower Task process scores to predict levels of Internalising and Externalising Behaviour after controlling for the influence of age. The Tower Task process scores were used as
independent variables. Age was included as an additional predictor to control for any age related effects on performance on the Tower Task. The dependent variables were Internalising Behaviour and Externalising Behaviour and these were entered separately into independent multiple regression analyses.

*Internalising Criterion.*

Age was entered at Step 1 explaining 2.9% of the variance in Internalizing Behaviour. After the entry of the Tower Task process scores at Step 2 the total variance explained by the model as a whole was increased to 14.8%, $F(5,90) = 3.12$, $p = .012$. The Tower Task process scores explained an additional 11.9% of the variance in Internalizing Behaviour, $R^2$ squared change = .12, $F$ change (4, 90) = 3.15, $p = .018$. As shown by Table 14 below, examination of the beta coefficients revealed that the process score of Time per Move Ratio explained a significant amount of variance in Internalizing Behaviour. Children who were reported by parents as having higher levels of Internalizing Behaviour were likely to show EF difficulties in the specific area of Time per Move Ratio Scale, suggesting a slower response time per move on the task.

Table 14

*Predicting Internalizing Behaviour from Age and the D-KEFS Tower Task Process Scores*

<table>
<thead>
<tr>
<th>Predictor</th>
<th>B</th>
<th>95% CI for B</th>
<th>β</th>
<th>$r$</th>
<th>$r^2$</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>LB</td>
<td>UB</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Step 1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Age</td>
<td>-1.02</td>
<td>-2.24</td>
<td>.20</td>
<td>-.17</td>
<td>-.17*</td>
</tr>
</tbody>
</table>
Step 2

<p>| | | | | | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Age</td>
<td>Move Accuracy Ratio</td>
<td>Mean First Move Time</td>
<td>Time Per Move Ratio</td>
<td>Rule Violations per Item</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- .98</td>
<td>-.81</td>
<td>-.85</td>
<td>-1.54*</td>
<td>-.76</td>
<td></td>
</tr>
<tr>
<td></td>
<td>-2.16</td>
<td>-1.68</td>
<td>-2.94</td>
<td>-2.99</td>
<td>-2.58</td>
<td></td>
</tr>
<tr>
<td></td>
<td>.20</td>
<td>.07</td>
<td>1.23</td>
<td>-.10</td>
<td>1.06</td>
<td></td>
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<tr>
<td></td>
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<td>-.21</td>
<td>-.10</td>
<td>-.28</td>
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<td></td>
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<tr>
<td></td>
<td>-.17*</td>
<td>-.08</td>
<td>-.20*</td>
<td>-.25*</td>
<td>-.18*</td>
<td></td>
</tr>
<tr>
<td></td>
<td>.03</td>
<td>.03</td>
<td>.00</td>
<td>.04</td>
<td>.00</td>
<td></td>
</tr>
</tbody>
</table>

Model 1: $p = .100, R = .17, R^2 = .03, Adj R^2 = .02.$

Model 2: $p = .020, R = .38, R^2 = .15, Adj R^2 = .10.$

* Correlation is significant at the 0.05 level (one tailed).

**Externalising Criterion.**

Age was entered at Step 1 explaining 2.8% of the variance in Externalizing Behaviour. After the entry of the Tower Task process scores at Step 2 the total variance explained by the model as a whole was increased to 18.8%, $F (5, 90) = 4.17, p = .002.$ The Tower Task process scores explained an additional 16% of the variance in Externalizing Behaviour, $R^2$ squared change = .16, $F$ change (4, 90) = 4.34, $p = .003.$ As shown by Table 15 below, examination of the beta coefficients revealed that the process scores of Time per Move Ratio and Rule Violations explained a significant amount of variance in Externalizing Behaviour. Children who were reported by parents as having higher levels of Externalizing Behaviour were likely to show EF difficulties in the specific scales of Time per Move Ratio, suggesting a slower response time per move on the task and a higher number of rule violations per item.
Table 15

*Predicting Externalizing Behaviour from Age and the D-KEFS Tower Task Process Scores*

<table>
<thead>
<tr>
<th>Predictor</th>
<th>B</th>
<th>95% CI for B</th>
<th>( \beta )</th>
<th>( r )</th>
<th>( sr^2 )</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>LB</td>
<td>UB</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Step 1</td>
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<td></td>
<td></td>
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<tr>
<td>Age</td>
<td>-1.02</td>
<td>-2.24</td>
<td>.20</td>
<td>-.17</td>
<td>-.17*</td>
</tr>
<tr>
<td>Step 2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Age</td>
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<td>-2.36</td>
<td>1.22</td>
<td>-.17</td>
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<tr>
<td>Move Accuracy Ratio</td>
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<tr>
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<td>2.33</td>
<td>.02</td>
<td>-.16</td>
</tr>
<tr>
<td>Time Per Move Ratio</td>
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<td>-3.26</td>
<td>-.21</td>
<td>-.29</td>
<td>-.30*</td>
</tr>
<tr>
<td>Rule Violations per Item</td>
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<td>-4.26</td>
<td>-.43</td>
<td>.25</td>
<td>-.30*</td>
</tr>
</tbody>
</table>

Model 1: \( p = .100 \), \( R = .17 \), \( R^2 = .03 \), \( Adj \ R^2 = .02 \).

Model 2: \( p < .01 \), \( R = .43 \), \( R^2 = .19 \), \( Adj \ R^2 = .14 \).

* Correlation is significant at the 0.05 level (one tailed).

Based on the multiple regression model for the influence of the D-KEFS Tower Task subscales on Internalizing and Externalizing Behaviour scores, and after considering the variance accounted for by each subscale, it is clear that the subscales of Rule Violations per Item Ratio and Time per Move Ratio account for unique variance in Externalizing scores, while Time per Move Ratio also accounts for unique variance in Internalizing scores (see Figure 14 below).
Figure 14. Partial correlations from the multiple regression analyses showing the unique variance in internalising and externalising scores on the parent reported CBCL accounted for by EF performance as measured by the D-KEFS Tower Task process variables.

Note. M 1st Move: Mean First Move Time; Move Acc = Move Accuracy; Time p Move = Time per Move Ratio; Rule Vio = Rule Violations per Item Ratio.

* = $p < .05$.

As shown in Figure 15 below, greater inability to follow task rules is significantly correlated with higher Externalising Behaviour, $r = -.249$, $p = .017$, but not with Internalising Behaviour $r = -.087$, $p = .410$. However, these partial correlations with Rule Violations per Item Ratio are not significantly different. The partial correlations between Internalising and Externalising Behaviour scores and the remaining Tower Task process variables were also not significant.
Figure 15. Partial correlations from the multiple regression analyses showing the unique variance in internalising and externalising scores on the parent reported CBCL accounted for by EF performance as measured by the D-KEFS Tower Task process variables of time per move ratio and rule violations per item ratio.

Note. Rule Vio = Rule Violations per Item Ratio

* = p < .05.
6.6 Discussion: Executive Function and Behaviour

It was firstly hypothesised that both indices of problem behaviour, internalising and externalising, would be associated with problems in executive functioning. This hypothesis was partially supported as links between both CBCL subscale scores and some EF indices were found.

The BRIEF is a parent report of the child’s relative strengths and weaknesses in a number of different areas of EF. The BRIEF-GEC(t) was found to account for 16% of the variance in internalizing behaviour and 32% of the variance in externalizing behaviour. Parents who reported higher levels of internalizing or externalizing behaviour in their children (as measured by the CBCL) were also likely to endorse higher levels of EF difficulties in behaviour regulation and meta-cognition as assessed by the BRIEF.

The most parsimonious explanation for the significant correlations between reported EF and behaviour was that the parent questionnaires may just be asking the same questions. After looking at each questionnaire’s items and checking for similarity among questions it was decided that there is some cross over between the two questionnaires in terms of some of the constructs being assessed by both these parent report measures. For example, both the BRIEF and the CBCL ask questions about attention (BRIEF: “Does not finish long term projects”, “Is impulsive”, “Has trouble waiting for turn”, “Is fidgety”; CBCL: “Fails to finish things he/she enjoys”, “Impulsive or acts without thinking”, “Can’t sit still, restless or hyperactive”). For the CBCL these questions load onto the subscale of Attention Problems, but for the BRIEF, these questions do not load onto any of the clinical subscales used in the current analyses. Furthermore, the Attention Problems items of the CBCL do not load onto the scales for estimating internalizing or externalizing behaviour. Therefore while the measures ask similar questions, they are not both loading onto the
scales used in the current research and therefore would not be influencing the high correlation between the BRIEF and the CBCL.

In addition, the CBCL looks at Aggressive and Rule Breaking Behaviour as the two subscales which make up the scale of Externalising Behaviour. The BRIEF however does not ask any questions relating to either of these behavioural subscales. Finally, the CBCL looks at Somatic Complaints, Anxious Depressed Mood, and Depressed Withdrawn Mood which make up the scale of Internalizing Behaviour. The BRIEF on the other hand, does not ask any questions relating to Somatic Complaints or Depressed, Withdrawn Mood and only has one item that is similar to that asked by the CBCL subscale of Anxious Depressed Mood (BRIEF: “Becomes tearful easily”; CBCL: “Cries a lot”). Thus, the items which do load onto the subscales used in this study were not being assessed by both measures. This suggests that although the scores co-vary, the two parent report measures are in fact assessing two distinct areas of functioning and are not likely to be measuring the same underlying constructs.

The CBCL and the BRIEF were administered to the same respondents; the child’s parent. Consequently, it must also be acknowledged that the significant correlation between problem behaviour and EF may be partly the result of shared methods variance. However, as recommended in the literature, a number of elements exist between these measures which may help avoid shared methods variance. Firstly, the CBCL and the BRIEF employ different scale types and formats (Podsakoff, MacKenzie, Lee & Podsakoff, 2003). Further, parents were assured that their responses were confidential and anonymous, that there were “no right or wrong answers and that they should answer as honestly as possible” to reduce testing anxiety and the likelihood of socially desirable responding (Chang, Witteloosstuijn & Eden, 2010, p. 180). Finally, problem behaviour
and EF were also assessed using multiple other measurement methods in an attempt to avoid the spurious variance resulting from shared methods (Change et al., 2010; Podsakoff et al., 2003).

In light of the fact that the variance accounted for in both internalizing and externalising behaviour by scores on the BRIEF is not explained simply by overlap in the items on the BRIEF and the CBCL it appears that the BRIEF-GEC(t) is capturing some elements of the child’s executive functioning that may subserve the behavioural problems being identified by parents on the CBCL. This finding is consistent with the current literature which has repeatedly highlighted links between executive functioning and problem behaviours (Achenbach, 2001; Feifer & Rattan, 2007). It was difficult to ascertain however which specific areas of EF are most problematic for the behavioural types in the sample due to the composite nature of the BRIEF-GEC(t). In order to better identify the unique aspects of EF associated with internalizing and externalizing behavioural problems, additional analyses were run on the clinical subscales of the BRIEF. The results of these analyses will now be discussed.

Important to the hypotheses was that children with strengths in executive functioning would also be better at self-regulation due to the relationship between higher order cognitions and emotional and behavioural control. The BRIEF assesses self-regulation through the composite index of Behaviour Regulation and its clinical subscales called Inhibition, Emotional Control, and Shifting. For the current thesis, self-regulation has been operationalised as meaning both emotional and behaviour regulation. Self-regulation is a highly complex task and can be demonstrated in a wide range of ways. This thesis focuses on measures that operationalise self-regulation as emotional and behavioural regulation as assessed by the BRIEF and, later, by the temperament questionnaires.
Through additional analyses of the subscales of the BRIEF it was found that elevations in both internalising and externalizing were related to problems on the BRIEF clinical subscale of Emotional Control. Emotional control was found to explain 9% of the variance in internalizing behaviour and 10% of the variance in externalizing behaviour. Parents who reported high levels of either internalizing or externalizing behaviour in their children (as measured by the CBCL) were also likely to endorse items suggesting problems in Emotional Control as assessed by the BRIEF.

Given prior theory suggested that children scoring high on internalising and externalising should differ in emotional control, with externalisers being less emotionally controlled (Eisenberg et al., 2000a) than internalisers, who are often reported as being overly controlled (Eisenberg et al., 1995; Eisenberg et al., 2001; Eisenberg et al., 2003), the author decided that an examination of individual items loading onto the scale of emotional control was necessary. This was done to determine if there was in fact a difference in emotional control between internalizing and externalizing behaviour at the item level or if they are actually similar in how they control their emotions. After looking at the items individually, it seemed that certain items were more reflective of externalizing behaviour (e.g., “Has, explosive, angry outbursts”) while other items were more reflective of internalizing behaviour (e.g., “Becomes tearful easily”). This may reflect poor self-regulation by both internalisers and externalisers, however the content of that emotional dysregulation may be different (sadness or distress versus anger, respectively). It also seemed that other items could be framed as being related to both problem behaviours (e.g., “Mood changes frequently”) but again the type of mood may be what differentiates the behaviour type. To gain a better understanding of the similarities and differences in parent reported performance on emotional control, a correlational analysis was run to determine
the relationship between internalizing and externalizing behaviours and the individual items loading onto emotional control. As shown in Figure 16 below, while all items correlated significantly with both internalizing and externalizing behaviour, there were some differences between behaviour types on the items which made up the BRIEF subscale of Emotional Control. For example, item 20 (“Becomes tearful easily”) was more often reported as descriptive of internalizing behaviour while items 7 (“Has explosive, angry outbursts”), 25 (“Has outbursts for little reason) and 62 (“Angry or tearful outbursts are intense but end suddenly”) were more often reported as descriptive of externalizing behaviour. Items 1 (“Overreacts to small problems”), 26 (“Mood changes frequently”), 45 (“Reacts more strongly to situations than other children”), 50 (“Mood is easily influenced by the situation”), 64 (“Small events trigger big reactions”) and 70 (“Becomes upset too easily”) were fairly equally reported as descriptive of both behavioural problem subtypes.

As depicted by the model in Figure 1 and described in the Introduction, these latter items all appear to be related to poor regulation or modulation of the initial emotional response, possibly due to temperamental factors or misinterpretation of the eliciting stimulus, and it is the nature of the emotional reaction that may be what differentiates the children.
Figure 16. Correlations between items on the BRIEF clinical subscale of emotional control and internalizing and externalizing problem behaviours.

Note. All correlations are significant at $p = .01$

While internalisers and externalisers were equally likely to be reported as high on Emotional Control, meaning that they had difficulties with regulating and controlling their emotional responses, after close examination of the individual items loading onto the subscale, it appears that children who are identified as being high in externalizing behaviour do differ somewhat in their Emotional Control to those children who are reportedly high in internalizing behaviour. Parents of externalisers are more likely to endorse items which identify difficulties with anger, while parents of internalisers are more likely to endorse items which identify difficulties with sadness. These findings have implications for the inclusion of self-report mood scales with children as will be addressed below.
As discussed above, both behavioural types were found to have problems with the EF of emotional control, but with some differences in the emotional content and therefore the demands on subsequent behavioural control mechanisms. For example, some may need to shift their attention away from thoughts that maintain sad mood while others may need to employ inhibitory processes to manage angry feelings. A distinct difference was found between the behavioural types on the executive functions of Shifting and Inhibition as indexed by the BRIEF. Internalisers were found to have difficulty with the EF of Shifting behaviour and cognition while externalisers were found to have difficulty with the EF of Inhibition. Scores on the Shifting subscale accounted for a statistically significant amount of the variance in internalizing scores as reported by parents, being positively correlated and explaining 3% of the variance. Scores on the Inhibition subscale accounted for a statistically significant amount of the variance in externalizing scores, again positively correlated and explaining 5% of the variance. These findings are consistent with some prior findings. However, although statistically significant it remains to be investigated whether these findings have clinical significance.

Although research is scarce, shifting and inhibition have begun to be reportedly tied to emotion regulation (Schmeichel, & Tang, 2014). Research has shown that people with behavioural problems often have difficulty with inhibiting behaviour, self-calming or modulating emotion. While two people may experience the same mood, or emotion, the difference in the individual with behavioural problems is that they are unable to suppress that emotion and associated behaviours and often respond impulsively (Barkley, 2010; Dimberg, Thunberg, & Gronedal, 2002). Research has suggested that the more externalizing behaviour is identified in a child, the more likely the child is to experience difficulties with inhibiting their behaviour (Barkley, 2010; Biederman et al., 2001; Bohlin,
Eninger, Brocki, & Thorell, 2012; Young et al., 2009). This may mean that when a child is feeling aggressive, hyperactive or impulsive, as is often found in externalizing children, they have difficulty inhibiting their inappropriate behaviours. They then behave in socially unacceptable ways, which creates tension, or may lead to punishment or inappropriate behaviours in others, and this can create a cycle of more aggression, impulsivity, and hyperactivity, continually contributing to their externalising patterns of behaviour.

On the other hand, it is suggested that when more internalizing behaviour is identified in a child, the more likely they are to experience difficulties with shifting their cognition and behaviour. This may mean that when a child is feeling anxious or withdrawn, as is often found in internalizing children, they have difficulty shifting their thinking from negative ideas to those which are more positive. They then become stuck in a negative thinking style which creates a cycle of more anxiety and further negative thinking, continually contributing to their internalising patterns of behaviour such as avoidance or social withdrawal (Barkley, 2010; Ghassabian et al., 2014). These research findings are consistent with the results of the current study which suggest that internalisers and externalisers differ slightly in their cognitive or EF profiles; differences which may help explain the behavioural diversity in coping with the emotions mentioned above.

The D-KEFS Tower Task is a neuropsychological test which assesses the executive functions of planning, problem solving, and impulse control. Scores on the Tower Task accounted for a significant amount of the variance in problem behaviour as reported by parents, explaining an additional 4% of the variance in internalizing behaviour and 2% of the variance in externalizing behaviour. Children who were reported by their parents as being higher in levels of internalizing or externalizing behaviour (as measured by the CBCL) were more likely to struggle in their performance on the D-KEFS Tower Task.
Although only accounting for a small amount of the variance, scores for both behavioural types were associated with Total Achievement Scores (TAS) on the D-KEFS Tower Task. However, due to the complexity of the Tower Task and the composite nature of the TAS, it was initially unclear which aspect of the measure was most problematic for children reported to have behavioural problems. To investigate which component of the Tower Task was most difficult for children with internalizing and externalizing behavioural problems, each of the four subscales were examined; Mean First Move Time, Time per Move Ratio, Move Accuracy Ratio and Rule Violations per item Ratio. While it was predicted that poor move accuracy would best reflect executive dysfunction, there was no significant relationship between move accuracy and behaviour as measured on the CBCL. The most significant relationship between problem behaviour and performance on the Tower Task was for the subscale of Time per Move Ratio. Higher levels of both internalizing and externalizing behaviour were associated with more time being devoted to each move. Time per Move scores explained 4% and 5% of the variance in internalizing and externalising behaviour respectively.

Higher levels of externalizing behaviours were also associated with more rule violations on the Tower task, explaining an additional 5% of the variance in externalizing behaviour. This suggests that both behavioural types were associated with a relatively slow response style, but only externalizing behaviour was associated with difficulty in following task rules. It is difficult to plan moves, decide on a behavioural response, follow task rules and remain calm under time pressure when struggling with components of EF such as emotional control, shifting attention and inhibition. Sacrificing speed for accuracy appeared to be the approach taken to cope with these challenges even in a relatively quiet lab environment. This potential explanation for the response to the Tower task by children
with both types of behaviour problems suggests an important consideration, in that timed
tasks may place these children at a disadvantage if speed of processing is used to judge
problem solving or planning ability on visuomotor tasks.

Although there was a clear trend ($r = .19, p = .058$) the D-KEFS Tower Task TAS was
not significantly correlated with the BRIEF-GEC(t). While both measures were used to
assess EF, the environments in which they are used differ significantly. When using the
BRIEF, assessment is based on the child’s behaviour in a more naturalistic setting with
more complex environments so perhaps executive dysfunction is more pronounced.
However, when using the D-KEFS Tower Task, assessment typically takes place in a more
controlled environment, like the research lab or clinic, so perhaps executive dysfunction is
not as obvious.

Research does support this position with reports that there seems to be some
disconnect between neuropsychological tests, formal, precise measures of EF and reports
of executive functioning in social environments based on observation or questionnaires
which may be more subject to bias but may more effectively capture executive functioning
as it naturally occurs (see Barkley, 1998, 2006; Bodner, Prahme, Cutting, Denckla, &
Mahone, 2007). Bodner et al. (2007) found that scores on EF can greatly differ depending
on the type of assessment used to measure it. These authors also found limited overlap
between parent reports of EF on the BRIEF and more performance-based measures of EF,
including a computerized Go/No Go task. Bodner et al. found that parent reports noted
more executive dysfunction than that found on the performance based tasks. The authors
suggest that perhaps the diverse approaches were measuring different aspects of EF. While
parent reports captured a fuller extent of problems with EF being experienced by the child
and the family across multiple settings, it may be that the lab based, performance tests
were measuring a purer element of EF, free from external distractions and social complexities. This may help explain the weak relationship between the BRIEF and the D-KEFS Tower Task in the current study.

As the D-KEFS Tower Task trends in the right direction for ecological validity, the relationships between the subscales on the BRIEF and the process scores of the D-KEFS Tower Task were investigated to determine what was driving the trend. Significant correlations were found between the BRIEF subscale of Emotional Control and the D-KEFS scores of TAS and Time per Move Ratio, suggesting that as parent reported problems in Emotional Control increased the child’s performance on the Tower Task decreased. The BRIEF subscale of Inhibition was also significantly correlated with Rule Violations, suggesting that as parent reported problems with inhibiting behaviour increased children violated more rules on the Tower Task. Lastly, the BRIEF subscale of Initiate was significantly correlated with Time per Move on the Tower Task, suggesting that as parent reported problems in behaviour initiation increased children spent more time making moves to create the towers. Due to the diverse nature of these measures there is no significant relationship between the composite scores on the BRIEF and the D-KEFS Tower Task. However, closer examination reveals significant relationships between the subscales which suggest that specific executive functions are correlated, and thereby demonstrates concurrent validity between some elements of the two different measures of EF.

The HeadMinder subtests as indices of EF were not found to account for a significant amount of the variance in problem behaviour scores as reported by parents. The lack of significant findings here could be for a number of reasons. For example, while the Cue Benefit variable was theoretically sound in that controlling for RT would help to determine
if participants were benefitting from the cue provided and therefore using higher order cognitions, it failed to capture EF as defined elsewhere in this project and did not relate well to variance in behaviour problems. It is possible that the variance in Cue Benefit scores in the current sample, after controlling for age, was insufficient as most children did well to use the cue as a signal of an upcoming target. On average they decreased their response speed by more than 13 msec when a cue was provided. But again this may not reflect a clinically significant difference that would allow a better understanding of why children with and without behaviour problems might respond differently in naturalistic environments. The subtest of Animal Decoding, a measure more frequently used as a clinical neuropsychological test of EF, was more sensitive to differences between internalizing and externalizing behavioural profiles.

The relationship between Response Time(t) on the HeadMinder subtest of Animal Decoding was significantly positively correlated with both internalising and externalizing behaviours as indexed by the CBCL. Correct Responses on the HeadMinder subtest of Animal Decoding was also significantly negatively correlated with both internalising and externalizing behaviours. This suggests that those with more reported behavioural problems of either type had slower response times but also fewer correct responses on this timed task. It appears that even when deciding more slowly they still made more errors.

Using the BRIEF-GEC(t) as the index of behavioural or executive functioning problems there was also a significant correlation with HeadMinder subtests. The BRIEF-GEC(t) was significantly positively correlated with Animal Decoding Response Time(t) and negatively correlated with Animal Decoding Correct Responses, suggesting that all three measures may be assessing aspects of EF and that the Animal Decoding task may have ecological validity as a screening tool. However, as the BRIEF-GEC(t) and the
Animal Decoding indices are significantly correlated it is understandable that Animal Decoding task did not account for unique variance in internalizing and externalizing behaviour in the multiple regression analysis. It appears that parent reported executive difficulties captured the problems that were also assessed in the lab-based, Animal Decoding task (e.g., attentional control or shifting, and response inhibition).

As the HeadMinder subtests are not age standardized, it was believed that age may be a factor influencing performance and the relationship between HeadMinder subtests and behaviour. Age was strongly and negatively correlated with the HeadMinder subtests of Animal Decoding Response Time (t) and Cue Benefit, and strongly and positively correlated with Animal Decoding Correct. However, when a partial correlation was performed to control for the effect of age on the HeadMinder subtests, all correlations with internalizing and externalising behaviour found previously were still significant. As noted previously, Cue Benefit was not significantly correlated with either problem behaviour profile, with or without controlling for age. These results suggest that despite the finding that age was related to performance on tasks that require fast visuo-motor speed, it did not have an effect on the relationship between task speed and reported problem behaviour.

Summarising these findings, it is obvious that the first hypothesis, that both problem behaviour types would show deficits in EF, has been partially supported. A higher level of both externalising and internalizing behaviour was related to higher levels of executive dysfunction. Some deficits in EF are shared between the behavioural types, with both having difficulties with emotional control and consistent response styles.

The question arises that if both internalisers and externalisers have difficulties with EF, why does their behaviour look different? One explanation may be that some deficits in EF were unique to each behavioural type, with internalisers struggling with shifting and
externalisers struggling with inhibition and following task rules; an explanation which seems consistent with how internalizing and externalizing are defined by Achenbach et al. (2001). The following discussions will look at the results from the influence of SIP, mood and temperament on behaviour in an attempt to better identify the similarities and differences between externalizing and internalizing behavioural types.
CHAPTER 7: SOCIAL INFORMATION PROCESSING AND BEHAVIOUR

The measures of social information processing (SIP) used for this study included the NEPSY II Affect Recognition (NAR) subtest and the Skill Level Activity (SLA) measure. The NAR subtest is a component of the social perception domain of the NEPSY II and is intended to assess the ability to recognize facial emotion (happy, sad, fearful, angry, neutral and disgust) in photographs of children’s faces (Korkman, Kirk, & Kemp, 2007). The child is asked to choose a face from a group of four to six, depending on difficulty level, that matches how the child pictured in the sample face is feeling. The SLA is a measure of SIP which assesses how a child encodes, interprets, and responds to social situations described in vignettes and depicted in drawings. The task consists of six short stories read by the examiner and accompanied by pictures of people interacting. Each child is presented with six social stories and asked about whether the characters were behaving in a friendly or hostile manner, which visual cues they used to help inform their decisions and what they would do if faced with the same situation (Fraser, 2006).

It would be reasonable to argue that SIP is an EF, as the author has done throughout this thesis; however, this construct has been included in a separate chapter because the SIP measures used involve more direct and possibly ecologically valid tests that assess selective encoding of socially relevant stimuli (e.g., facial features, verbal and visual information about interpersonal interactions). The tasks which specifically assess SIP may give more detail on children who have difficulty with SIP and about how they operate in the social environment than those tasks looking at EF in a purer way (e.g., speeded cognitive measures while resisting distraction and holding test rules in memory) which are relatively free from social influences. Directly examining responses to standard social scenarios have also offered information on individual differences in perception and
cognition not available from parent reports on EF (see Crick & Dodge 1996; Lansford et al., 2006; Quiggle et al., 1992).

Due to the complexity of the SLA data, a brief overview of the analysis plan will now be provided. The relationship between internalizing and externalising problem behaviours and SIP was firstly examined using standard scoring of the SLA measure. The standard score for the SLA attributions scale was the percentage of hostile attributions selected by the child; the number of times the child selects “being mean” as the intent of the story’s character/s divided by the number of stories responded to. The standard score for the cue encoding subscale was the percentage of prescribed cues selected by the child; the number of cues selected by the child as being relevant to understanding the social scenario divided by the number of stories responded to. The prescribed cues were selected by the SLA authors as being important during the development of the scale with a US sample. The standard score for the goal formation scale was the percentage of pro-social, or non-aggressive, goals selected by the child divided by the number of stories responded to and the standard score for the decision making scale was the percentage of pro-social, or non-aggressive decisions selected by the child divided by the number of stories responded to.

In addition to the standard scoring and analyses, new variables from the SLA data were created and tested with respect to their relationship to problem behaviour. Firstly, other relevant cues identified by children in the current sample were added to the number of prescribed cues identified by the SLA authors. This was because non-prescribed cues identified by the Australian children in the study could reasonably be considered relevant to the social story (e.g., glasses worn by the main character as possibly influencing the intent of the other characters behaviour). Another variable created was the number of cues identified by the child that seemed quite irrelevant to the social story (e.g., leaves on a tree
in the background of the visual component of the vignette). This allowed for the balance between relevant and irrelevant responses by the child to be quantified. These additional measures of cue encoding helped improve the cultural sensitivity of the SLA as other relevant cues used to inform attributions by Australian children were included. An additional index of general response style in reporting cues and some evidence of the quality of selective encoding was now also available.

The final set of analyses investigated the relationship among the standard SLA scales in order to determine whether there was a predictable interaction among Cue Encoding, Attributions, Goal Formation, and Decision Making that fit with the model of SIP discussed earlier in the literature review. The differences in these interactions relative to internalizing behaviour and externalizing behaviour were then examined. The first set of analyses below refers to standard scoring of the SLA. The additional variables are used in the analyses which follow.

7.1 Data Cleaning of SIP and Behaviour Variables

The descriptive statistics for the standard SIP variables are presented below in Table 16.

Table 16

<table>
<thead>
<tr>
<th>Descriptive Statistics for the SIP Measures</th>
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<tr>
<td>N</td>
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<tr>
<td>------------------------</td>
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<tr>
<td>NEPSY Affect Recognition</td>
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<td>SLA – Attributions</td>
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<tr>
<td>SLA – Cue Encoding</td>
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<tr>
<td>SLA – Goal Formation</td>
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<tr>
<td>SLA – Decision Making</td>
</tr>
</tbody>
</table>

*Note. SLA = Skill Level Activity.*

While there were a few univariate outliers across the SIP scales, these were scores <3 SDs above or below the sample mean and were retained in the data file for analysis (Pallant, 2011). The SLA Goal Formation scale had a single extreme outlier with participant #80 at three standard deviations above the mean. However, the trimmed mean and means values for the distributions were very similar (*M* = .89, *tM* = .91) so this outlying case was also retained in the data file for analysis (Pallant, 2011).

The maximum Mahalanobis distance was higher (22.86) than the critical value of 20.5 (with 5 variables) for case #80 suggesting that it was a multivariate outlier. Regression analyses were then run twice; once with case #80 excluded and then once with the multivariate outlier included. Results from the multiple regression analyses were fairly consistent regardless of whether the multivariate outlier was included or excluded. Due to the lack of great difference to the results between these separate analyses, case #80 was retained in the data file.

Due to a violation of normality, square root transformations were computed for the NEPSY Affect Recognition scale scores, and the SLA scales of Attributions, Goal Formation and Decision Making. Transforming the variables didn’t make much difference
to normality. Furthermore, a logarithmic transformation did not correct violations of normality for any of the variables. Because these transformations did not improve non-normality, it was decided that the original, non-transformed variables would be included in the analyses. It is believed that these particular distributions are skewed because the sample is made up of children who were expected to perform reasonably well given they were not identified as having a clinical disorder that would have impaired their performance on SIP.

### 7.2 Correlations among the SIP Variables

A correlation matrix revealed a number of significant inter-correlations among the SIP variables (see Table 17 below). Interestingly, a significant negative correlation was found between child performance on the NAR scale and the SLA Attributions scale. This suggests greater ability to recognize facial emotions was associated with a tendency to endorse fewer hostile attributions in social stories. Not surprisingly, significant positive correlations were found between the cue encoding variables with increases in Cue Encoding being associated with improvement in the selection of more relevant cues in the social stories. Finally, there was also a significant positive correlation between Goal Formation and Decision Making with increases in the endorsement of pro-social goals related to increases in the endorsement of pro-social decisions. In contrast to expectations, there was no significant relationship between the remaining SIP variables.
Table 17

Zero Order Inter-Correlations between the SIP Variables

<table>
<thead>
<tr>
<th>Scale</th>
<th>Attributions</th>
<th>Cue Encoding</th>
<th>Goal Formation</th>
<th>Decision Making</th>
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<td>NEPSY AR</td>
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<td>.01</td>
<td>.03</td>
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<td>Attributions</td>
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<tr>
<td>Cue Encoding</td>
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<tr>
<td>Goal Formation</td>
<td></td>
<td></td>
<td>.59**</td>
<td></td>
</tr>
</tbody>
</table>

** Correlation is significant at the 0.01 level (two tailed).
* Correlation is significant at the 0.05 level (two tailed).

Note. NEPSY AR = Affect Recognition; Rel-Irrel. Cue Enc. = Relevant – Irrelevant Cue Encoding.

7.3 Correlations among SIP and Behaviour Variables

The relationships between internalising and externalizing problem behaviour (as reported by parents on the CBCL) and SIP (as measured by the SLA measure and the NAR scale), were first investigated using Pearson product-moment correlation coefficients.

The relationships between age and internalizing and externalizing behaviour were not significant. Furthermore, the SIP measures of NAR scaled scores, SLA Attributions, SLA Cue Encoding and SLA Decision Making were not significantly correlated with age. Significant correlations were found between age and the measure of SLA Goal Formation ($r = .23, n = 96, p = .027$) and SLA Decision Making ($r = .21, n = 96, p = .041$) with increases in age associated with the endorsement of more pro-social goals and decisions.
As presented in Table 18 below, significant negative correlations were found between Externalizing Behaviour as reported by parents on the CBCL and the SIP measures of SLA Goal Formation and Decision Making. As Externalizing Behaviour increased, goals and decisions became less pro-social. In contrast to expectations, there was no significant relationship between reported Internalizing Behaviour and SIP variables. The lack of correlations between reported problem behaviours of either Internalizing or Externalizing forms and facial emotion recognition, attributions or cue encoding, was also notable.

Table 18

*Zero Order and Age-based Partial Correlations between Internalising and Externalising Scores on the parent reported CBCL and SIP as measured by the Standard Scales of the SLA and the NAR Scale.*

<table>
<thead>
<tr>
<th>Scale</th>
<th>NEPSY AR</th>
<th>Attributions</th>
<th>Cue Encoding</th>
<th>Goal Formation</th>
<th>Decision Making</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Zero Order</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Internalising Beh</td>
<td>-.11</td>
<td>.01</td>
<td>-.06</td>
<td>-.06</td>
<td>.12</td>
</tr>
<tr>
<td>Externalising Beh</td>
<td>-.04</td>
<td>-.13</td>
<td>-.20</td>
<td>-.37**</td>
<td>-.23*</td>
</tr>
<tr>
<td><strong>Partial (Age)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Internalising Beh</td>
<td>-.14</td>
<td>.04</td>
<td>-.06</td>
<td>-.02</td>
<td>.16</td>
</tr>
<tr>
<td>Externalising Beh</td>
<td>-.06</td>
<td>-.10</td>
<td>-.20</td>
<td>-.35**</td>
<td>-.20</td>
</tr>
</tbody>
</table>

** Correlation is significant at the 0.01 level (two tailed).
* Correlation is significant at the 0.05 level (two tailed).
As the SLA measures are not age standardized, a partial correlation was performed to control for the variable of age on the SLA scales. As shown in Table 18 above, while the SLA scales of Goal Formation remained significantly correlated with Externalizing Behaviour, the scale of Decision Making was no longer significantly related to Externalizing Behaviour once the variance associated with age was removed.

To further explore the relationship among these variables, a multiple regression analysis was performed to assess the ability of SIP variables to predict problem behaviour.

7.4 Multiple Regression of SIP on Behaviour Variables

Before conducting the multiple regression analysis, a correlation matrix was generated to check for multicollinearity. There was no evidence of multicollinearity among SIP variables used to predict internalizing behaviour (tolerance values for all predictors were above .10 and VIF values were all <10; no highly correlated [>.7] dependent variables identified) or externalizing behaviour (tolerance values for all predictors were above .10 and VIF values were all <10; no highly correlated [>.7] dependent variables identified). There was also no evidence of sequential dependence for either Internalizing Behaviour (Durbin-Watson = 1.80) or Externalizing Behaviour (Durbin-Watson = 1.92).

A hierarchical multiple regression was performed to assess the ability of SIP variables to predict levels of Internalising and Externalising Behaviour after controlling for the influence of age. Five independent variables were used: The NAR scale and the scales of
the SLA; Attributions, Cue Encoding, Goal Formation, and Decision Making. Age was included as a sixth predictor to control for any age related performance on the SLA measure. The dependent variables were Internalising Behaviour and Externalising Behaviour and these were entered separately into independent multiple regression analyses.

7.4.1 Internalising Criterion.

Age was entered at Step 1 explaining 2.9% of the variance in internalizing behaviour. After the entry of the SIP measures at Step 2 the total variance explained by the model as a whole was increased insignificantly to 10%, $F(6, 89) = 1.64, p = .145$. The SIP measures only explained an additional 7.1% of the variance in Internalizing Behaviour, $R^2$ change = .07, $F$ change (5, 89) = 1.41, $p = .230$. However, as shown by Table 19 below, examination of the beta coefficients revealed that the SLA Decision Making scale did explain a significant amount of variance in Internalizing Behaviour. Children who were reported as having higher levels of Internalizing Behaviour as reported by parents on the CBCL were likely to endorse more pro-social decision making options when asked about hypothetical social stories.

Table 19

*Predicting Internalizing Behaviour from Age and Measures of Social Information Processing*

<table>
<thead>
<tr>
<th>Predictor</th>
<th>B</th>
<th>95% CI for B</th>
<th>$\beta$</th>
<th>$r$</th>
<th>$sr^2$</th>
<th>LB</th>
<th>UB</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
7.4.2 Externalising Criterion.

Age was entered at Step 1 explaining 2.8% of the variance in Externalizing Behaviour. After the entry of the SIP measures at Step 2 the total variance explained by the model as a whole was significantly increased to 19%, $F(6, 89) = 3.47, p = .004$. The SIP measures explained an additional 16.1% of the variance in Externalizing Behaviour, $R^2$ change = .16, $F$ change (5, 89) = 3.54, $p = .006$. As shown by Table 20 below, examination of the beta coefficients revealed that the SLA scale of Goal Formation in particular explained a significant amount of variance in Externalizing Behaviour. Children who were reported as having high levels of Externalizing Behaviour as reported by parents on the
CBCL were likely to endorse more aggressive goal options when children were asked about hypothetical social stories.

Table 20

Predicting Externalizing Behaviour from Age and Measures of Social Information Processing

<table>
<thead>
<tr>
<th>Predictor</th>
<th>B</th>
<th>95% CI for B</th>
<th>β</th>
<th>r</th>
<th>sr²</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>LB</td>
<td>UB</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Step 1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Age</td>
<td>-1.10</td>
<td>-2.40</td>
<td>.22</td>
<td>-.17</td>
<td>-.17</td>
</tr>
<tr>
<td>Step 2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Age</td>
<td>-.55</td>
<td>-1.85</td>
<td>.75</td>
<td>.08</td>
<td>-.17</td>
</tr>
<tr>
<td>NEPSY AR</td>
<td>-.37</td>
<td>-1.37</td>
<td>.64</td>
<td>-.07</td>
<td>-.04</td>
</tr>
<tr>
<td>SLA Attributions</td>
<td>-6.21</td>
<td>-19.34</td>
<td>6.92</td>
<td>-.09</td>
<td>-.13</td>
</tr>
<tr>
<td>SLA Cue Encoding</td>
<td>-12.18</td>
<td>-25.59</td>
<td>1.23</td>
<td>-.17</td>
<td>-.20*</td>
</tr>
<tr>
<td>SLA Goal Formation</td>
<td>-22.54**</td>
<td>-37.92</td>
<td>-7.15</td>
<td>-.35</td>
<td>-.37**</td>
</tr>
<tr>
<td>SLA Decision Making</td>
<td>1.01</td>
<td>-11.62</td>
<td>13.64</td>
<td>.02</td>
<td>-.23*</td>
</tr>
</tbody>
</table>

Model 1: $p = .10, R = .17, R² = .03, Adj R² = .02.$

Model 2: $p < .01, R = .44, R² = .19, Adj R² = .14.$

** Correlation is significant at the 0.01 level (one tailed).

* Correlation is significant at the 0.05 level (one tailed).

Note. NEPSY AR = Affect Recognition; SLA = Skill Level Activity.
7.5 Thinking beyond the Standard Measures

After looking at the SLA data the author realized that children’s responding on the scale of cue encoding was more complex than what had been uncovered by standard scoring. Children often selected cues that were not identified as prescribed by the measure’s authors. The author of the current study wanted to give children credit for choices which reflected possible cultural differences or simply represented the child’s subjective viewpoint and creativity. While children often selected cues that were relevant to the social story (e.g., glasses worn by the main character as a cue to why other children may be laughing), others were not relevant, and at times seemed illogical (e.g., leaves on the trees in the background of the scene being viewed as important in understanding a character’s behaviour). It was decided that these illogical or irrelevant cues should be accounted for and that the difference between the number of relevant and irrelevant cues selected by the child could be assessed as a supplementary index of EF during the processing of social information.

7.5.1 Data Cleaning of the New SIP Variables.

As shown below in Table 21, two additional SLA variables were created; Relevant Cues ($M = 13.15, SD = 5.42$), which was the total number of cues selected by the child which were deemed relevant to the social story by the author, and Relevant_Irrelevant ($M = 11.04, SD = 4.93$), which was the total number of relevant cues selected by the child minus the total number of irrelevant or illogical cues selected by the child.
Table 21

*Descriptive Statistics for the Additional SIP Measures*

<table>
<thead>
<tr>
<th></th>
<th>N</th>
<th>Mean</th>
<th>Standard Deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>SLA – Relevant Cues</td>
<td>96</td>
<td>13.2</td>
<td>5.4</td>
</tr>
<tr>
<td>SLA – Relevant_Irrelevant</td>
<td>96</td>
<td>11.0</td>
<td>4.9</td>
</tr>
</tbody>
</table>

*Note. SLA = Skill Level Activity.*

There were no univariate or multivariate outliers for the new SLA variables. There was also no issue with normality with Kolmogorov-Smirnov values (> .05) for both SLA – Relevant_Irrelevant and SLA – Relevant Cues.

**7.5.2 Correlations among New SIP Variables and Behaviour Variables.**

The relationship between problem behaviour (as reported by parents on the CBCL) and the additional variables of SIP (as measured by the SLA) was again investigated using Pearson product-moment correlation coefficient.

The new SIP measures of Relevant Cue Encoding and Relevant_Irrelevant Cue Encoding were not significantly correlated with age. In contrast to expectations, the relationship between Internalising Behaviour and the new variables of SIP were not significant. However, as presented in Table 22 below, significant correlations were found between Externalizing Behaviour as reported by parents on the CBCL and the new SIP measures of Relevant Cue Encoding and Relevant_Irrelevant cue encoding. As
Externalizing Behaviour increased, both Relevant Cue Encoding and the difference between relevant and irrelevant cue encoding decreased. Of interest, there was a decrease in relevant cues rather than an increase in irrelevant cues in the Relevant-Irrelevant comparison as Externalising Behaviour increased.

Table 22

Zero Order and Age-based Partial Correlations between Internalising and Externalising Behaviour Scores and the Additional Measures of Social Information Processing

<table>
<thead>
<tr>
<th>Scale</th>
<th>Relevant Cue Encoding</th>
<th>Relevant_Irrelevant Cue Encoding</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Zero Order</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Internalising Beh</td>
<td>-.08</td>
<td>-.06</td>
</tr>
<tr>
<td>Externalising Beh</td>
<td>-.23*</td>
<td>-.21*</td>
</tr>
<tr>
<td><strong>Partial</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Internalising Beh</td>
<td>-.08</td>
<td>-.04</td>
</tr>
<tr>
<td>Externalising Beh</td>
<td>-.22*</td>
<td>-.20</td>
</tr>
</tbody>
</table>

* Correlation is significant at the 0.05 level (two tailed).

As the new SLA measures are not age standardized, a partial correlation was performed to control for the age. As shown in Table 22 above, the new SLA scale of Relevant Cue Encoding remained significantly correlated with Externalizing Behaviour, however, the SLA scale of Relevant_Irrelevant Cue Encoding was no longer significant.
The negative correlation between the new Cue Encoding variables and Externalising behaviour mirrors what was found above with the standard SLA Prescribed Cue Encoding score. However, a paired samples t-test was performed to determine if there was a difference between the Prescribed Cue Encoding total and the new cue encoding scale which included all relevant cues selected by the child. There was a statistically significant increase in the selection of relevant cues from the Prescribed Cue Encoding variable ($M = 12.26, SD = 4.92$) to the new Relevant Cue Encoding variable ($M = 13.17, SD = 5.42$), $t(95) = -7.31, p < .001$. Due to the complexity of the childrens’ cue encoding for this sample in which selected cues were often times not acknowledged by standard scoring, the new relevant cue encoding variable provided a less restrictive and possibly more valid scoring of a child’s performance on the SLA.

A second multiple regression was performed to further explore the relationships among these new variables and internalizing and externalizing problem behaviours.

7.5.3 Multiple Regression of New SIP Variables on Behaviour Variables.

Before conducting the multiple regression analysis, a correlation matrix was generated to check for multicollinearity among the new variables, the other SLA measures, NEPSY scores and the measures of problem behaviour. While the Relevant Cue Encoding and Relevant_Irrelevant cue encoding variables were highly correlated (.83) as expected there was no evidence of multicollinearity among the new SIP variables used to predict internalizing behaviour (tolerance values for all predictors were above .10 and VIF values were all <10) or externalizing behaviour (tolerance values for all predictors were above .10 and VIF values were all <10). There was also no evidence of sequential dependence for
either Internalizing Behaviour (Durbin-Watson = 1.80) or Externalizing Behaviour (Durbin-Watson = 1.95).

A hierarchical multiple regression was again performed to assess the ability of SIP to predict levels of Internalising and Externalising Behaviour after controlling for the influence of age, with the inclusion of the additional two variables of cue encoding. Six independent variables were used: the NEPSY Affect Recognition scale, the standard scales of the SLA; Attributions, Goal Formation and Decision Making as well as the new SLA cue encoding variables of Relevant Cue Encoding and Relevant_Irrelevant cue encoding. Age was included as a seventh predictor to control for any age variance in the SLA measures and behavioural reports. The dependent variables were Internalising Behaviour and Externalising Behaviour and these were entered separately into independent multiple regression analyses.

*Internalising Criterion.*

Age was entered at Step 1 explaining 2.9% of the variance in Internalizing Behaviour. After the entry of the original and additional SIP measures at Step 2 the total variance explained by the model as a whole was increased to 10.3%, $F (7, 85) = 1.39, p = .221$. The SIP measures explained only an additional 7.4% of the variance in Internalizing Behaviour, $R^2$ change = .07, $F$ change (6, 85) = 1.17, $p = .330$. This was not a statistically significant contribution. As shown by Table 23 below, examination of the beta coefficients revealed that the SLA Decision Making scale did again explain a significant amount of variance in Internalizing Behaviour. As noted previously, children whose
parents reported high levels of internalizing behaviour on the CBCL were likely to endorse more pro-social decision making options on the SLA measure.

Table 23

Predicting Internalizing Behaviour from Age and Additional Measures of Social Information Processing

<table>
<thead>
<tr>
<th>Predictor</th>
<th>B</th>
<th>95% CI for B</th>
<th>B</th>
<th>r</th>
<th>$sr^2$</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>LB</td>
<td></td>
<td>UB</td>
<td></td>
</tr>
<tr>
<td>Step 1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Age</td>
<td>-1.02</td>
<td>-2.26</td>
<td>.22</td>
<td>-.17</td>
<td>-.17*</td>
</tr>
<tr>
<td>Step 2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Age</td>
<td>-1.23</td>
<td>-2.57</td>
<td>.04</td>
<td>-.21</td>
<td>-.17*</td>
</tr>
<tr>
<td>NEPSY AR</td>
<td>-.65</td>
<td>-1.65</td>
<td>.36</td>
<td>-.14</td>
<td>.11</td>
</tr>
<tr>
<td>SLA Attributions</td>
<td>2.89</td>
<td>-10.31</td>
<td>16.09</td>
<td>.05</td>
<td>.1</td>
</tr>
<tr>
<td>Relevant Cue Encoding</td>
<td>-.18</td>
<td>-.91</td>
<td>.55</td>
<td>-.09</td>
<td>.08</td>
</tr>
<tr>
<td>Rel_Irrel Cue Encoding</td>
<td>-.04</td>
<td>-.86</td>
<td>.78</td>
<td>-.02</td>
<td>.06</td>
</tr>
<tr>
<td>SLA Goal Formation</td>
<td>-10.44</td>
<td>-25.94</td>
<td>5.05</td>
<td>-.17</td>
<td>-.06</td>
</tr>
<tr>
<td>SLA Decision Making</td>
<td>13.84*</td>
<td>1.07</td>
<td>26.61</td>
<td>.28</td>
<td>.12</td>
</tr>
</tbody>
</table>

Model 1: $p = .11$, $R = .17$, $R^2 = .03$, $Adj \, R^2 = .02$.

Model 2: $p = .33$, $R = .32$, $R^2 = .10$, $Adj \, R^2 = .03$.

* Correlation is significant at the 0.05 level (one tailed).

Note. NEPSY AR = Affect Recognition; SLA = Skill Level Activity.

Externalising Criterion.
Age was entered at Step 1 explaining 2.8% of the variance in Externalizing Behaviour. After the entry of the additional SIP measures at Step 2 the total variance explained by the model as a whole was increased to 20.1%, $F (7, 85) = 3.05, p = .007$. The SIP measures explain an additional 17.2% of the variance in Externalizing behaviour, $R^2$ change = .17, $F$ change (6, 85) = 3.06, $p = .009$. As shown by Table 24 below, examination of the beta coefficients revealed that the SLA scale of Goal Formation again explained a significant amount of variance in Externalizing Behaviour with increasing Externalizing Behaviour being associated with more aggressive Goal Formation. The new cue encoding indices did not account for unique variance in Externalizing Behaviour.

Table 24

Predicting Externalizing Behaviour from Age and Additional Measures of Social Information Processing

<table>
<thead>
<tr>
<th>Predictor</th>
<th>B</th>
<th>95% CI for B</th>
<th>$\beta$</th>
<th>$r$</th>
<th>$sr^2$</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>LB</td>
<td>UB</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Step 1</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Age</td>
<td>-1.10</td>
<td>-2.43</td>
<td>.25</td>
<td>-.17</td>
<td>-.17</td>
</tr>
<tr>
<td><strong>Step 2</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Age</td>
<td>-.49</td>
<td>-1.83</td>
<td>.84</td>
<td>-.08</td>
<td>-.17</td>
</tr>
<tr>
<td>NEPSY AR</td>
<td>-.38</td>
<td>-1.97</td>
<td>.69</td>
<td>-.07</td>
<td>-.04</td>
</tr>
<tr>
<td>SLA Attributions</td>
<td>-5.69</td>
<td>-19.13</td>
<td>7.75</td>
<td>-.09</td>
<td>-.13</td>
</tr>
<tr>
<td>Relevant Cue Encoding</td>
<td>-.32</td>
<td>-1.06</td>
<td>.42</td>
<td>-.15</td>
<td>-.23$^*$</td>
</tr>
<tr>
<td>Rel_Irrel Cue Encoding</td>
<td>-.14</td>
<td>-.97</td>
<td>.69</td>
<td>-.06</td>
<td>-.21$^*$</td>
</tr>
<tr>
<td>SLA Goal Formation</td>
<td>-23.11$^{**}$</td>
<td>-38.89</td>
<td>-7.34</td>
<td>-.36</td>
<td>-.37$^{**}$</td>
</tr>
<tr>
<td>SLA Decision Making</td>
<td>1.62</td>
<td>-11.38</td>
<td>14.63</td>
<td>.03</td>
<td>-.23$^*$</td>
</tr>
</tbody>
</table>
Model 1: $p = .11$, $R = .17$, $R^2 = .03$, $Adj R^2 = .02$.
Model 2: $p < .01$, $R = .45$, $R^2 = .20$, $Adj R^2 = .14$.

** Correlation is significant at the 0.01 level (one tailed).
* Correlation is significant at the 0.05 level (one tailed).

*Note. NEPSY AR = Affect Recognition; SLA = Skill Level Activity.*

Based on the multiple regression model for the influence of the SIP measures on Internalizing and Externalizing Behaviour scores, and after considering the variance accounted for by each measure, it is clear that the subscale of Goal Formation accounts for a significant amount of the variance in Externalizing scores while Decision Making accounts for a significant amount of the variance in Internalizing scores (see Figure 17 below). Although separately correlated with CBCL Externalizing scores, the new cue encoding variables were not found to be useful predictors of behaviour after other variables were taken into account.
Figure 17. Partial correlations, after controlling for age, between internalising and externalising scores on the parent reported CBCL and SIP as measured by the SLA and the NAR subtest.

Note. NAR = NEPSY Affect Recognition Score; Att = SLA Attributions; Pres Cue = SLA Prescribed Cue Encoding; Rel Cue = SLA Relevant Cue Encoding; Rel_Irrel Cue = SLA Cue Difference; Goal = SLA Goal Formation; Decision: SLA Decision Making.

* = p < .05. ** = p < .01

Also of note is that the subscale of Decision Making was correlated with Internalizing Behaviour significantly more than Externalizing Behaviour as reported by parents on the CBCL. As shown in Figure 18 below, greater pro-social decision making was associated with higher Internalising Behaviour, r = .228, p = .034, but not associated with Externalising Behaviour r = .027, p = .805. In addition, the correlations between pro-social decision making are significantly different, t = -2.119, p < .05. The differences between correlations with Internalising and Externalising Behaviour scores for the remaining SIP measures were not significant.
Figure 18. Partial correlations, after controlling for age, between internalising and externalising scores on the parent reported CBCL and SIP as measured by the SLA scales of goal formation and decision making.

Note. Goal = SLA Goal Formation; Decision: SLA Decision Making.

* = p < .05. ** = p < .01

7.5.4 MANOVA with New SIP Variables and Behaviour Variables.

Given reports that appraisal regarding intent is typically linked to possible encoding problems and subsequent behaviour, a combination of SIP variables was examined which might predict attribution style. A MANOVA was then run using levels of Attributional style as the IV and the other standard and additional SLA variables of Cue Encoding, Goal Formation and Decision Making and CBCL scores as dependent variables.

Firstly, the SLA scale of Attribution was transformed into three groups (low level hostile attributions = 0; mid-level hostile attributions = 1, and high level hostile attributions = 2) to run a MANOVA to determine the relationship between intent and the
other variables of the SLA; that is, whether SLA scores on Cue Encoding, Goal Formation and Decision Making and CBCL scores could predict Intent group.

Secondly, on examination of the Goal Formation variable it was believed that this variable may not be a useful measure in understanding the differences between children, as approximately 60% of children chose the pro-social goal 100% of the time. Due to the limited variance among children on this measure, it was decided that this measure be re-calculated into groups of children who either selected all pro-social responses or those who had selected at least one aggressive goal (SPSS: pro-social (-1 through 0) = 0, aggressive (1 through 6) = 1). As only approximately 34% of children chose the pro-social decision 100% of the time, it was decided that this variable should remain uncategorized. A second MANOVA was run to determine the relationship between Goal Formation and the other variables; that is, whether SLA scores on intent, cue encoding, and decision making and CBCL scores could predict Goal formation group.

**MANOVA – Intent Group.**

A MANOVA was run to determine the relationship between four scales of the SLA to better understand the SIP of the study’s sample. The dependent variables were SLA Decision Making, SLA Relevant Cue Encoding, SLA Relevant_Irrelevant Cue Encoding, and Goal Formation as well as the scores on Internalizing and Externalizing Behaviour as reported by parents. The independent variable was Intent group. Age was included as a potential covariate.

Due to unequal and small N values, Pillai’s Trace was reported despite little discrepancy between Pillai’s Trace and Wilk’s Lambda. As shown below in Table 25,
there was no statistically significant association between age and the combined dependent variables, $F(6, 84) = 1.70, p = .131$; Pillai’s Trace = .11; partial eta squared = .11. There was also no statistically significant multivariate effect of intent group on the combined dependent variables, $F(6, 84) = 1.61, p = .093$; Pillai’s Trace = .20; partial eta squared = .10.

Table 25

*Summary of MANOVA: Intent Groups and the relationship to SIP Variables and Internalising and Externalising Behaviour*

<table>
<thead>
<tr>
<th>IV</th>
<th>DV</th>
<th>Pillai’s Trace</th>
<th>Multivariate</th>
<th>Univariate</th>
<th>$\eta^2$</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>$F (6, 84)$</td>
<td>$F (2, 89)$</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Intent</strong></td>
<td></td>
<td>.20</td>
<td>1.61</td>
<td>.10</td>
<td></td>
</tr>
<tr>
<td>Relevant Cue</td>
<td></td>
<td>1.21</td>
<td>.03</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rel_Irrel Cue</td>
<td></td>
<td>.95</td>
<td>.02</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Goal Formation</td>
<td></td>
<td>.41</td>
<td>.01</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Decision Making</td>
<td></td>
<td>.82</td>
<td>.02</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Internalising Beh</td>
<td></td>
<td>.27</td>
<td>.01</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Externalising Beh</td>
<td></td>
<td>2.03</td>
<td>.04</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Age</strong></td>
<td></td>
<td>.11</td>
<td>1.70</td>
<td>.11</td>
<td></td>
</tr>
<tr>
<td>Relevant Cue</td>
<td></td>
<td>.48</td>
<td>.01</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rel_Irrel Cue</td>
<td></td>
<td>.87</td>
<td>.01</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Goal Formation</td>
<td></td>
<td>4.31*</td>
<td>.05</td>
<td></td>
<td>.05</td>
</tr>
</tbody>
</table>
To reduce the risk of a Type 1 error when examining the results for the dependent variables separately, a Bonferroni adjustment was used giving a new alpha level of .0125. As shown above in Table 25, using the new alpha level of .0125, there were no significant univariate effects of age or intent on any of the dependent variables.

As shown above in Table 25, using an original alpha level of .05, there was a significant effect of age on Goal Formation, $F(1, 89) = 4.31, p = .041$; partial eta squared = .05 and Decision Making $F(1, 89) = 4.27, p = .042$; partial eta squared = .05. As the child’s age increased so did their willingness to endorse pro-social Goals and Decisions in hypothetical social stories.

**MANOVA – Goal Group.**

A MANOVA was conducted to determine the relationship between four scales of the SLA and CBCL scores to better understand the SIP of the study’s sample. The dependent variables were SLA Decision Making, SLA Relevant Cue Encoding, SLA Relevant_Irrelevant Cue Encoding, and Attributions as well as the scores on internalizing and externalizing behaviour as reported by parents. The independent variable was Goal Formation group. Age was included as a potential covariate.
Due to unequal and small N values, Pillai’s Trace was reported despite little discrepancy between Pillai’s Trace and Wilk’s Lambda. As shown below in Table 26, there was no statistically significant multivariate effect of age on the combined dependent variables, $F (6, 85) = 1.63, p = .148$; Pillai’s Trace = .10; partial eta squared = .10. There was, however, a statistically significant multivariate effect of Goal Formation Groups on the combined dependent variables, $F (6, 85) = 4.09, p = .001$; Pillai’s Trace = .22; partial eta squared = .22.

Table 26

*Summary of MANOVA: Goal Formation Groups and the relationship to SIP Variables and Internalising and Externalising Behaviour*

<table>
<thead>
<tr>
<th>IV</th>
<th>DV</th>
<th>Pillai’s Trace</th>
<th>Multivariate</th>
<th>Univariate</th>
<th>$\eta^2$</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>$F (6, 85)$</td>
<td>$F (2, 89)$</td>
<td></td>
</tr>
<tr>
<td>Goal Formation</td>
<td>Relevant Cue</td>
<td></td>
<td>.15</td>
<td>.00</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Rel_Irrel Cue</td>
<td></td>
<td>.01</td>
<td>.00</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Decision Making</td>
<td></td>
<td>16.22**</td>
<td>.15</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Attributions</td>
<td></td>
<td>.66</td>
<td>.01</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Internalising Beh</td>
<td></td>
<td>.15</td>
<td>.00</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Externalising Beh</td>
<td></td>
<td>6.07*</td>
<td>.06</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>.10</td>
<td>1.63</td>
<td>.10</td>
<td></td>
</tr>
<tr>
<td>Age</td>
<td>Relevant Cue</td>
<td></td>
<td>.61</td>
<td>.00</td>
<td></td>
</tr>
</tbody>
</table>
To reduce the risk of a Type 1 error when examining the results for the dependent variables separately, a Bonferroni adjustment was used giving a new alpha level of .0125. As shown above in Table 26, using the new alpha level of .0125, there were no significant univariate effects of age on any of the dependent variables.

Using the new alpha level of .0125, there was a significant difference between Goal Formation groups on Decision Making, \(F(2, 89) = 16.22, p < .001; \) partial eta squared = .15 and Externalizing Behaviour scores \(F(2, 89) = 6.07, p = .016; \) partial eta squared = .06. An inspection of the mean scores indicated that those children who reported higher levels of aggressive goals in hypothetical social situations were more likely to also endorse more aggressive decisions \((M = .85, SE = .03)\) than those children who reported higher levels of pro-social goals \((M = .67, SE = .03)\). Those children who reported higher levels of aggressive goals in hypothetical social situations were also more likely to be reported by parents on the CBCL as higher in Externalizing Behaviour \((M = 53.40, SE = 1.78)\) than those children who reported higher levels of pro-social goals, who in turn were more likely to be reported by parents on the CBCL as lower in Externalizing Behaviour \((M = 47.78, SE = 1.41)\).
7.6 Discussion: Social Information Processing and Behaviour

It was hypothesized that both behavioural types, internalisers and externalisers, would have problems in SIP. This hypothesis was partially supported as those children identified as being high in externalising behaviour were found to have elements of maladaptive bias in SIP and children identified as being high in internalising behaviour were found to have minimal problems with SIP. It appears that SIP is rather distinct between children who exhibit internalizing behaviour to those who exhibit externalizing behaviour. Thus, these relationships will now be discussed in more detail.

The SLA subscale of decision making was found to be significantly associated with problem behaviour explaining 5% of the variance in internalizing behaviour. Children who were reported by parents as having high levels of internalizing behaviour were likely to endorse more pro-social decision making options in the hypothetical social stories of the SLA measure. Alternatively, the SLA subscale of Goal Formation was found to be significantly associated with reported externalising problem behaviour, explaining 8% of the variance in this CBCL subscale. Children who were reported by parents as having high levels of externalizing behaviour were likely to endorse more aggressive goal options in the hypothetical social stories. In contrast to expectations, there was no significant relationship between parent-reported behaviour on the CBCL and performance on the remaining tests of SIP.

There is limited research on the SIP patterns of both externalizing and internalizing children, with research predominantly focused on aggressive children. However, Burgess et al. (2006) looked at the similarities and differences between the behavioural types in children aged 9 to 13 years. The most common coping strategies employed by all children in the Burgess et al. (2006) paper were adult intervention or appeasement. This should
probably not be surprising as soliciting adult intervention is often recommended throughout schools to children of this age group and may account for its common use, even in hypothetical social stories. Appeasement is a socially acceptable response and one that would be helpful if the child’s goals were to maintain a friendship or reduce the possibility of continued conflict, an outcome that internalising children, with their increased levels of stress and anxiety, would strive to achieve (Rose & Asher, 1999).

Another study which looked at internalizing behaviours and their relationship to SIP was conducted by Wichmann, Coplan and Daniels (2004). Their results indicated that children who were socially withdrawn displayed a performance deficit rather than a knowledge deficit. That is, internalizing type children understood the pro-social behaviours expected of them in social situations but often failed to engage in such behaviours due to EF deficits, specifically in response activation. The authors suggested that they were less assertive in attempting to reach their social goals, favouring the use of non-assertive and more passive strategies to deal with conflict, and thereby maintaining negative views of themselves and their efficacy in social settings.

Thus, children identified as relatively high in internalizing behaviour in the current sample may be endorsing higher numbers of pro-social decisions in the hypothetical social stories because these decisions represent the least combative or conflict-related options for them, and therefore may be seen as likely to reduce negative repercussions. These options may reduce the child’s anxiety, reinforcing the selection of such behavioural responses in the future, consequently continuing their internalizing patterns of behaviour.

Unfortunately these decisions or level of internalizing behaviour did not seem to be associated with, or presumably informed by, encoding more relevant cues, better facial emotion processing or more pro-social goals in the current study so it is uncertain as to
why children reportedly high on internalizing behaviour are more likely to endorse pro-social decisions in hypothetical social stories. Perhaps it is a result of the factors discussed above, with internalisers more passive in their strategies for dealing with social conflict, independent of social cues in the SLA task. Further, it may be that the pro-social options available in the SLA are open to be interpreted as more passive, or non-assertive, strategies. Finally, it may also be that the hypothetical nature of the decision making situation is less anxiety producing therefore providing better opportunities to act on knowledge, rather than conditioning. An examination of the interpretive issues of the SLA was beyond the scope of the current study but future recommendations to look at this element of the measure are discussed in more detail in Chapter 12.

Externalising children have been consistently shown to be more hostile in all aspects of SIP (see Burgess et al., 2006; Crick & Ladd, 1990; Dodge & Schwartz, 1997; Quiggle et al., 1992). Children high in externalizing behaviour in the current sample were also more likely to endorse fewer pro-social or more aggressive goals in response to the social stories. However, these children were not more likely to endorse antisocial decisions in those same scenarios. While they tended to endorse the more aggressive goals, these goals did not seem to translate into stated choices about behavioural responding.

This disconnection between Goal Formation and Decision Making may be an outcome of the fact that the options for socially desirable or correct responses in the hypothetical social stories used in the current study were quite obvious, so the more externalizing children simply knew which options they were meant to select rather than endorsing items which were consistent with their beliefs about how to respond to such a situation in real life. An alternative understanding may be that in a regression model of analysis the unique variance in the CBCL subscale accounted for by Decision Making may have already been
accounted for by the index of Goal Formation. In support of this argument, the inter-correlations among the SIP measures presented earlier in Table 17 show that the variables of Goal Formation and Decision Making are in fact moderately correlated ($r = .57, p < .001$). There were a number of rather similar options in Goals and Decisions that were offered to the child (e.g., Goal: “To hurt the kid”; Decision: “Push him under the water” or Goal: “Check your shoes”; Decision: “Clean your shoes”). Thus, this overlap may have therefore masked the unique variance accounted for in the behavioural measure. This finding does suggest that the effect of rewording the options regarding Goals and Decisions on the SLA may be worth investigating as it may better define the component processes, however it may just be that stated goals and decisions about reaching those goals are very tightly linked in children.

There are a number of factors inherent in the SLA that may have also contributed to the results. Firstly the SLA is not time restricted and some children took full advantage of this, spending a considerable amount of time responding to each item. This was especially true during their selection of relevant cues to assist in their understanding the social story. Although response time was recorded as a process variable in the current study, it appeared that some children took advantage of the “no time limit” in responding, while other children responded rather quickly as if they imposed their own rule in terms of what constituted good performance.

Interestingly, greater externalizing behaviour, typically associated with impulsivity, was negatively correlated with number of reported relevant cues. It is difficult to ascertain the reason for this finding or the diverse response styles, but the role of general temperament will be explored below in relation to this. Some children may have been certain in their responses and hence, responded promptly while others may have been less
certain and responded hesitantly. However, this may not have always been the case. As can occur with the timed EF tasks reported on above, some children may have sacrificed speed for accuracy or vice versa. Those who took their time to respond may simply have been thinking more deeply or carefully about their response, and those who were rapid responders may have thought little about their response selections. While this aspect of the assessment task was not looked at in the current study, the author acknowledges response style as an important component of SIP and something that should be investigated further in the future, possibly through an additional, more qualitative research component that queried the children about their testing experience. Using a fixed exposure time has also been used in studies of social information processing in children (cf. Dadds et al., 2008) and could be applied as an index of encoding efficiency with the pictorial component of the SLA task, however the differential increase in performance anxiety may interfere with processing for some children and confound the interpretation of the results.

An interesting secondary finding was the significant negative correlation between the NEPSY II Affect Recognition score and the SLA Attributions score ($r = -.22, n = 96, p = .028$). These results suggest that children who are more adept at recognizing facial emotions are less likely to endorse hostile attributions in social stories, this is consistent with prior reports by Dadds et al. (2008) and Crick and Dodge (1994). These studies also found that children who had a greater ability to correctly identify the emotions in others were more likely to display pro-social behaviours in social settings. Further support for this comes from the increased use of pro-social behaviours in social interactions following the implementation of training programs which teach children to attend to facial cues to more accurately identify emotions in others (Dadds et al., 2008). Dadds et al. (2008) found that rather than only attending to partial cues, or making misattributions based on limited
knowledge, children who are instructed to attend to complete stimuli (including attending to the eyes of others) have increased accuracy in identifying the emotional state of others. This improvement in attention and encoding has also been found to improve social competence with children who are involved in SIP training programs more likely to engage in pro-social behaviours when interacting with others (Fraser et al., 2005).

Another consideration concerned the relationship among the steps involved in SIP. Based on the model of social and emotional processing (Crick & Dodge, 1994), in a social situation, the following can be expected to happen:

![Figure 19. Typical SIP leading to pro-social behaviour](image)

**Caption:** When children attend to and encode relevant social cues, including perceiving more of the stimulus, capturing goal relevant contextual cues, and spending less time on irrelevant or distracting cues, they may be more likely to develop pro-social goals which subsequently influence the selection of pro-social decisions.
**Figure 20.** Atypical SIP leading to aggressive or reduced pro-social behaviour

**Caption:** When children attend to and encode irrelevant social cues, including attending to only part of a cue or making misattributions about cues, they may be more likely to develop less pro-social goals which subsequently influence the selection of less pro-social decisions about their behavioural responses.

Based on the above SIP types, it was a secondary hypothesis that children who scored higher on the selection of irrelevant cues or maybe selective attention to limited social cues would have higher levels of aggressive goals and decisions than children who scored lower on the selection of these cues. However, a correlational analysis showed that there was no significant relationship between the selection of pro-social goals and relevant-irrelevant cue encoding or irrelevant cues. The selection of pro-social decisions was also unrelated to the number of relevant or irrelevant cues. For the current sample, the type of cue encoding, used as an index of selective attention, did not seem to influence the subsequent selection of pro-social or aggressive options in the later stages of SIP for either behavioural type.

### 7.6.1 SIP and EF
Another secondary hypothesis was that there would be a relationship between EF and SIP given that the executive functions are closely connected with the processing of social information. Consistent with this hypothesis, there are elements of EF that are consistently related to SIP. These results will now be discussed.

The SLA subscale of Goal Formation was found to be significantly negatively correlated with the BRIEF-GEC(t) suggesting that children who were reported by parents as having deficits in EF were less likely to endorse pro-social goals in hypothetical social stories. However, when age was controlled for, due to the SLA not being age standardized, the SLA scale of Goal Formation was no longer significantly related to the BRIEF-GEC(t). In contrast to expectations, the relationship between EF and the remaining SLA variables were not significant, with and without controlling for age. While an overall measure of EF, as assessed by the BRIEF GEC(t), did not relate to specific SIP factors, a secondary correlational analysis was run to explore the relationships among SIP and the BRIEF clinical subscales. The subscale which was found to significantly relate to SIP was Inhibition which was significantly negatively correlated with Cue Encoding, Goal Formation, and Decision Making. This suggests that children who reportedly have difficulty with inhibiting behaviour are also more likely to select fewer relevant social cues and subsequently endorse less pro-social goals and decisions in social interactions.

An additional investigation on the relationship between the HeadMinder subtasks and the SIP variables of the SLA was also performed to determine if SIP could be explained by some aspect of stimulus response time. It was theorized that some biases in SIP may be the result of poor attention to relevant cues or an inability to resist distraction by irrelevant cues. To determine whether ability to quickly scan and encode visual details differentiated children with varying levels of SIP, the HeadMinder Symbol Search scores were included.
The only significant correlation found was between Symbol Search Average Response Time and the SLA measure of Relevant_Irrelevant Cue Encoding ($r = -.23$, $p = .042$), two scores that reflect the balance between accurate cue detection and efficient avoidance of attention to irrelevant information. As response time on Symbol Search decreased, relevant to irrelevant cue encoding increased. That is, a quicker response time was associated with an increase, or improvement, in selective attention to relevant cues. Again however, when age was controlled for on the Symbol Search task and the SLA measure, the SLA scales of Relevant_Irrelevant Cue Encoding they were no longer significantly correlated. Interestingly though, the variable of Prescribed Cue Encoding – Number became significant correlated with Symbol Search once age was controlled for; as Symbol Search response time decreased, Prescribed Cue Encoding increased. That is, as response time quickened, or improved, more cues were correctly encoded in the hypothetical social stories.

The secondary hypothesis surrounding EF and SIP, that executive functioning would be associated with SIP, has thus been partially supported, with Inhibition being related to Cue Encoding, Goal Formation and Decision Making, while better performance in Symbol Search scores are related to the encoding of more relevant cues in hypothetical social stories. An investigation of how a child’s fundamental temperament might impose risk for behavioural problems versus adaptive functioning will now be examined. Temperament may also set the stage for SIP tendencies which will also be examined below.
CHAPTER 8: TEMPERAMENT AND BEHAVIOUR

The two temperament scales used for this research were the Early Adolescent Temperament Questionnaire (EATQ; Ellis & Rothbart, 2001) and the Temperament in Middle Childhood Questionnaire (TMCQ; Simonds, & Rothbart, 2004) which assess temperament in children ages 7-9 and 10-13, respectively. Both of these temperament scales include four factors: Affiliativeness, Effortful Control, Negative Affect, and Surgency. The questionnaire’s authors define the Affiliativeness factor as the desire for warmth and closeness with others; showing interest in the activities of others. Negative Affect is defined as the internalized emotions of sadness, frustration, anger, and depression. Surgency is defined as a willingness to approach the environment; feelings of high activity and impulsivity with low levels of shyness, and Effortful Control is defined as the executive attentional system which is involved in the regulation of emotion and behaviour.

Both questionnaires are completed by the parent using a 5-point Likert scale to indicate which answer best describes how well each item related to their child. The EATQ measures eight elements of temperament, including Fear, Activation Control, Frustration, Affiliation, Attention, High Intensity Pleasure, Inhibitory Control, and Shyness as well as two elements of behaviour including Depressive Mood and Aggression. The TMCQ measures 17 elements of child temperament including Anger, Sadness, Attention Focusing, Impulsivity, Activation Control, Soothability, Perceptual Sensitivity, Low Intensity Pleasure, High Intensity Pleasure, Fear, Fantasy/Openness, Discomfort, Assertiveness/Dominance, Affiliation, Activity Level, and Inhibitory Control. These subscales load onto four factor scores of temperament; Effortful Control, Negative Affect, Surgency and Affiliativeness. For the factor scores, the authors claim that a low score
represents a low level of that attribute while a high score represents a high level of that attribute.

8.1 Data Cleaning of Temperament and Behaviour Variables

The descriptive statistics for the temperament questionnaires are presented below in Table 27. As the factors scores for the two temperament questionnaires have a different number of items between the EATQ and the TMCQ, z scores were computed to ensure participant’s scores were comparable. All subsequent analyses after Table 27 will use these z-scores.

Table 27

*Descriptive Statistics for the Temperament Questionnaires*

<table>
<thead>
<tr>
<th></th>
<th>N</th>
<th>Mean</th>
<th>Standard Deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Temp – Effortful Control</strong></td>
<td>96</td>
<td>3.3</td>
<td>0.67</td>
</tr>
<tr>
<td><strong>Temp – Negative Affect</strong></td>
<td>96</td>
<td>2.6</td>
<td>0.56</td>
</tr>
<tr>
<td><strong>Temp – Surgency</strong></td>
<td>96</td>
<td>3.4</td>
<td>0.53</td>
</tr>
<tr>
<td><strong>Temp – Affiliativeness</strong></td>
<td>96</td>
<td>4.0</td>
<td>0.52</td>
</tr>
<tr>
<td><strong>EATQ</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Effortful Control</td>
<td>70</td>
<td>3.3</td>
<td>0.73</td>
</tr>
<tr>
<td>Negative Affect</td>
<td>70</td>
<td>2.5</td>
<td>0.51</td>
</tr>
<tr>
<td>Surgency</td>
<td>70</td>
<td>3.4</td>
<td>0.53</td>
</tr>
</tbody>
</table>
Affiliativeness       70  4.1  0.51

**TMCQ**

<table>
<thead>
<tr>
<th></th>
<th>Mean</th>
<th>SD</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Effortful Control</td>
<td>26</td>
<td>3.3</td>
<td>0.46</td>
</tr>
<tr>
<td>Negative Affect</td>
<td>26</td>
<td>2.8</td>
<td>0.64</td>
</tr>
<tr>
<td>Surgency</td>
<td>26</td>
<td>3.3</td>
<td>0.51</td>
</tr>
<tr>
<td>Affiliativeness</td>
<td>26</td>
<td>3.8</td>
<td>0.41</td>
</tr>
</tbody>
</table>

*Note. TEMP = Temperament Scale; EATQ: Early Adolescent Temperament Questionnaire; TMCQ: Temperament in MIDDLE Childhood Questionnaire*

While there were a few univariate outliers across the temperament factors these were scores < 3 SDs above or below the sample mean and were retained in the data file for analysis (Pallant, 2011). The maximum Mahalanobis distance was lower (13.26) than the critical value of 18.5 (with four variables) suggesting no multivariate outliers (Tabachnick & Fidell, 2007). There was also no issue with normality with Kolmogorov-Smirnov values (>0.05) for any of the factor scores.

### 8.2 Correlations among Temperament and Behaviour Variables

The relationships between internalising and externalizing problem behaviour (as reported by parents on the CBCL) and temperament (as measured by the EATQ and the TMCQ) were first investigated using Pearson product-moment correlation coefficients.

The relationship between age and the temperament factor scores of Affiliativeness, Surgency, Negative Affect and Effortful Control were not significant. As presented in
Table 28 below, significant correlations were found between Internalizing Behaviour as reported by parents on the CBCL and the temperament scales of Effortful Control, Surgency, Negative Affect and Affiliativeness. Higher parent reported Internalizing Behaviour was associated with lower parent reported Effortful Control, Surgency, and Affiliativeness, but also with higher reported Negative Affect. In addition, significant correlations were found between Externalizing Behaviour as reported by parents on the CBCL and the temperament scales of Effortful Control, Negative Affect and Affiliativeness. Higher parent reported externalizing behaviour was associated with lower parent reported Effortful Control and Affiliativeness but also with higher reported Negative Affect. In contrast to expectations, the relationship between externalising behaviour and Surgency was not significant.

Table 28

Zero Order and Age-based Partial Correlations between Internalising and Externalising Behaviour Scores and the Standardised Temperament Factors

<table>
<thead>
<tr>
<th>Scale</th>
<th>Effortful Control</th>
<th>Negative Affect</th>
<th>Surgency</th>
<th>Affiliativeness</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Zero Order</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Internalising Behaviour</td>
<td>-.32**</td>
<td>.57**</td>
<td>-.30**</td>
<td>-.29**</td>
</tr>
<tr>
<td>Externalising Behaviour</td>
<td>-.60**</td>
<td>.61**</td>
<td>.09</td>
<td>-.28**</td>
</tr>
<tr>
<td><strong>Partial (Age)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Internalising Behaviour</td>
<td>-.32**</td>
<td>.58**</td>
<td>-.27**</td>
<td>-.27**</td>
</tr>
</tbody>
</table>
Externalising Behaviour  

<table>
<thead>
<tr>
<th></th>
<th>-.61**</th>
<th>.62**</th>
<th>.13</th>
<th>-.31**</th>
</tr>
</thead>
</table>

** Correlation is significant at the 0.01 level (two tailed).

Although two temperament scales were used to cover the age range of the sample, the age bands for the standardized scores were wide for use with children. Given what can be a steep developmental trend in young children, a partial correlation was performed to control for any additional age effects on the combined standardised factor scores. As shown in Table 28 above, all of the temperament factors remained significantly correlated with Internalizing and Externalizing behaviour. The correlations between Externalizing Behaviour and Surgency remained insignificant.

To further explore the relationship among these variables, a multiple regression analysis was conducted to assess the ability of temperament features to predict problem behaviour.

### 8.3 Multiple Regression of Temperament Subscales on Behaviour Variables

Before conducting the analyses, a correlation was performed to check for multicollinearity. There was no evidence of multicollinearity among temperament variables used to predict internalizing behaviour (tolerance values for all predictors were above .10 and VIF values were all <10; no highly correlated (> .7) dependent variables identified) or externalizing behaviour (tolerance values for all predictors were above .10 and VIF values were all <10; no highly correlated (> .7) dependent variables identified).
There was also no evidence of sequential dependence for either Internalizing Behaviour (Durbin-Watson = 1.62) or Externalizing Behaviour (Durbin-Watson = 1.57).

Hierarchical multiple regression was used to assess the ability of the temperament subscales of Affiliativeness, Effortful Control, Negative Affect, and Surgency to predict levels of Internalising and Externalising Behaviour after controlling for the influence of age. Age was included as an additional predictor to control for any age related variance in the Temperament subscales. The dependent variables were Internalising Behaviour and Externalising Behaviour and these were entered separately into independent multiple regression analyses.

### 8.3.1 Internalising Criterion.

Age was entered at Step 1 explaining 2.9% of the variance in Internalizing Behaviour. After the entry of the temperament measures at Step 2 the total variance explained by the model as a whole was increased to 38.4%, $F (5, 90) = 11.22, p < .001$. As shown by Table 29, examination of the beta coefficients revealed that the subscale of negative affect explained a significant amount of unique variance in Internalizing Behaviour. The temperament measures explained an additional 35.5% of the variance in Internalizing Behaviour, $R^2$ change $= .36$, $F$ change $(4, 90) = 12.98, p < .001$. Parents who reported high levels of internalizing behaviour in their children were also likely to endorse high levels of Negative Affect as assessed by the TMCQ/EATQ.
Table 29

*Predicting Internalizing Behaviour from Age and Four Standardised Factors of Temperament*

<table>
<thead>
<tr>
<th>Predictor</th>
<th>B</th>
<th>95% CI for B</th>
<th>β</th>
<th>r</th>
<th>sr²</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>LB</td>
<td>UB</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Step 1</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Age</td>
<td>-1.02</td>
<td>-2.24</td>
<td>.20</td>
<td>-17</td>
<td>.17*</td>
</tr>
<tr>
<td><strong>Step 2</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Age</td>
<td>-1.02</td>
<td>-2.06</td>
<td>.03</td>
<td>-17</td>
<td>.17**</td>
</tr>
<tr>
<td>Effortful Control</td>
<td>-.79</td>
<td>-2.75</td>
<td>1.17</td>
<td>-08</td>
<td>-.32**</td>
</tr>
<tr>
<td>Surgency</td>
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<td>-3.23</td>
<td>.67</td>
<td>-12</td>
<td>-.30**</td>
</tr>
<tr>
<td>Negative Affect</td>
<td>5.22**</td>
<td>3.20</td>
<td>7.24</td>
<td>.49</td>
<td>.58**</td>
</tr>
<tr>
<td>Affiliativeness</td>
<td>-.80</td>
<td>-2.77</td>
<td>1.17</td>
<td>-08</td>
<td>-.24**</td>
</tr>
</tbody>
</table>

Model 1: \( p = .100, R = .17, R^2 = .03, \) Adj \( R^2 = .02 \).
Model 2: \( p < .01, R = .62, R^2 = .38, \) Adj \( R^2 = .35 \).

** Correlation is significant at the 0.01 level (one tailed).
* Correlation is significant at the 0.05 level (one tailed).

**8.3.2 Externalising Criterion.**

Age was entered at Step 1 explaining 2.8% of the variance in Externalizing Behaviour. After the entry of the temperament measures at Step 2 the total variance explained by the model as a whole was increased to 64.6%, \( F (5, 90) = 32.83, p = <.001 \). As shown by Table 30 below, examination of the beta coefficients revealed that all four subscales of temperament explained significant amounts of variance in Externalizing Behaviour. The temperament measures explain an addition 61.8% of the variance in Externalizing
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Behaviour, \( R \) squared change = .62, \( F \) change (4, 90) = 39.26, \( p < .001 \). As assessed by the EATQ/TMCQ, parents who reported higher levels of externalizing behaviour in their children were also likely to endorse higher levels of Negative Affect and Surgency as well as lower levels of Effortful Control and Affiliativeness.

Table 30

*Predicting Externalizing Behaviour from Age and Four Standardised Factors of Temperament*

<table>
<thead>
<tr>
<th>Predictor</th>
<th>B</th>
<th>95% CI for B</th>
<th>( \beta )</th>
<th>( r )</th>
<th>( sr^2 )</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>LB</td>
<td>UB</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Step 1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Age</td>
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<td>-2.40</td>
<td>.22</td>
<td>-.17</td>
<td>-.17</td>
</tr>
<tr>
<td>Step 2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Age</td>
<td>-1.80</td>
<td>-2.66</td>
<td>-.95</td>
<td>-.28</td>
<td>-.17</td>
</tr>
<tr>
<td>Effortful Control</td>
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<td>-5.59</td>
<td>-2.38</td>
<td>-.35</td>
<td>-.60**</td>
</tr>
<tr>
<td>Surgency</td>
<td>4.07**</td>
<td>2.29</td>
<td>8.87</td>
<td>.35</td>
<td>.09</td>
</tr>
<tr>
<td>Negative Affect</td>
<td>5.55**</td>
<td>7.24</td>
<td>13.73</td>
<td>.48</td>
<td>.61**</td>
</tr>
<tr>
<td>Affiliativeness</td>
<td>-2.66*</td>
<td>-6.80</td>
<td>-.11</td>
<td>-.23</td>
<td>-.28**</td>
</tr>
</tbody>
</table>

Model 1: \( p = .103 \ R = .17, R^2 = .03, Adj R^2 = .02 \).

Model 2: \( p < .01, R = .80, R^2 = .65, Adj R^2 = .63 \).

** Correlation is significant at the 0.01 level (one tailed).

* Correlation is significant at the 0.05 level (one tailed).

Based on the multiple regression model for the influence of the temperament on Internalizing and Externalizing Behaviour scores, and after considering the variance
accounted for by each subscale, it is clear that the subscales of Effortful Control, Surgency, Negative Affect and Affiliativeness account for the majority of the variance in Externalizing Behaviour while Negative Affect also accounts for a significant amount of the variance in Internalizing Behaviour (see Figure 21 below).

Figure 21. Partial correlations from the multiple regression analyses showing the unique variance in internalising and externalising scores on the parent reported CBCL accounted for by parent reported temperament as measured by the EATQ and the TMCQ, after controlling for age.

Note. EC = Effortful Control; NA = Negative Affect; Surg = Surgency; Affil = Affiliativeness. * = p < .05. ** = p < .01.

Also of note is that the Effortful Control and Surgency factors were correlated with Externalizing Behaviour significantly more than internalizing behaviour as reported by parents. As shown in Figure 21 above, Effortful Control was minimally associated with
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Internalising Behaviour, $r = -0.08, p = 0.426$ but significantly negatively correlated with Externalising Behaviour $r = -0.46, p < 0.001$ and these correlations with Effortful Control were significantly different, $t = -3.38, p < 0.05$. Surgency was minimally associated with Internalising Behaviour, $r = -0.14, p = 0.195$ but significantly positively correlated with Externalising Behaviour $r = 0.47, p < 0.001$ and these correlations with Surgency were also significantly different, $t = 10.55, p < 0.01$. The difference between correlations of Internalising and Externalising Behaviour scores and the remaining temperament factor scores were not significant.

8.4 Negative Affect Follow Up Analyses

As mentioned previously, the Temperament in Middle Childhood Questionnaire (TMCQ) and the Early Adolescent Temperament Questionnaire (EATQ) assess temperament in ages 7-9 and 10-13, respectively. These temperament scales both include four factors: Affiliativeness, Effortful Control, Negative Affect, and Surgency. Due to the significant unique contribution of the Negative Affect factor to both the Internalizing and Externalizing Behaviour scores, an investigation of which specific items on the temperament questionnaires were predicting Internalizing and Externalizing problem behaviours was conducted.

The specific subscales and items contributing to the high scores on Negative Affect for both the Internalisers and Externalisers were examined to see if there was in fact a difference in the types of Negative Affect being reported. This is illustrated below in Figure 22. Internalizing Behaviour was associated with Frustration and Sadness. Externalizing Behaviour was associated with Frustration, Sadness, Aggression, and
Depression. As both behavioural types were reportedly associated with Frustration and Sadness, the specific items loading onto each of these subscales was further examined to see if there was in fact a difference in the types of Negative Affect being reported.

Figure 22. Partial correlations, controlling for age, between Negative Affect subscales and internalizing and externalizing problem behaviours.

*Note.* Frust EA = Frustration Early Adolescent; Agg. EA = Aggression Early Adolescent; Dep. EA = Depression Early Adolescent; Frust MC = Frustration Middle Childhood; Sadness MC = Sadness Middle Childhood.

** *p = <.01.*

As shown in Figure 23, for the EATQ it appears that Items 45 (“Gets irritated when I will not take him/her someplace he/she wants to go”) and 57 (“Hates it when people don’t agree with him/her”) were significantly correlated with Externalizing scores but not Internalizing scores. Item 58 (“Gets very frustrated when she/he makes a mistake in his/her
school work”) was significantly correlated with Internalizing scores but not Externalizing scores. These items suggest that children high in Externalizing Behaviour are more likely to be reported as getting frustrated with external or interpersonal factors while children high in Internalising Behaviour are more likely to be reported as getting frustrated with more internal or intrapersonal factors.

![EATQ Frustration Subscale](image)

**Figure 23.** Partial correlations between the frustration subscale items on the EATQ and internalizing and externalizing problem behaviours for children age 10-13.

*Note.** **p = <.01. * p = .05.

As shown in Figure 24, for the TMCQ it appears that Item 94 (“Gets angry when he/she has trouble with a task”) was significantly correlated with Externalizing scores but not Internalizing scores. Item 99 (“Gets angry when he/she makes a mistake”) was significantly correlated with Internalizing scores but not Externalizing scores. Again this
suggests that children high in Internalising Behaviour are more likely to be reported as getting frustrated with more intrapersonal factors, such as their task performance.

![TMCQ Frustration Subscale](image)

**Figure 24.** Partial correlations, controlling for age, between the frustration subscale items on the TMCQ and internalizing and externalizing problem behaviours for children age 7-9.

*Note.* **p = <.01. * p = .05.*

As shown in Figure 25, for the TMCQ it appears that Items 35 (“Cries sadly when a favourite toy gets lost or broken”) and 144 (“Tends to feel sad even when others are happy”) were significantly correlated with Externalizing scores but not Internalizing scores. However, all other significant correlations on the TMCQ were found for both Internalizing and Externalizing scores. These items suggest contrary to popular belief, children reportedly high on Internalizing behaviour were not more likely to experience sadness than children high on Externalizing behaviour.
Figure 25. Partial correlations, controlling for age, between the Sadness subscale items on the TMCQ and internalizing and externalizing problem behaviours for children age 7-9.

Note. ** p = <.01. * p = .05.

8.5 Concurrent Validity: Effortful Control and EF

While Effortful Control is assessed as a measure of temperament using the EATQ and TMCQ in the current study, it also correlates at -.80 with the BRIEF-GEC(t). It could, therefore, be argued that Effortful Control is also an index of EF and can serve as a concurrent validity check. A correlation matrix was generated to test whether the Effortful Control temperament factor was related to any of the additional measures of executive functioning used in the current study.

As shown below in Figure 26, Effortful Control was significantly correlated with all of the clinical subscales of the BRIEF as well as with the HeadMinder subtest of Animal Decoding Response Time, even after controlling for the effect of age. These relationships suggest that Effortful Control is also measuring EF in a fundamental way as defined in this
study; children who are reported by parents as having higher levels of Effortful Control, or the capacity to attend to stimuli as well as being able to appropriately inhibit and activate behaviour, are less likely to be reported as having difficulties with EF as measured by the BRIEF clinical subscales. They are also more likely to have quicker response times on the HeadMinder subtask of Animal Decoding.

*Figure 26.* Partial correlations between z scores on the EATQ and TMCQ Effortful Control subscales and the measures of EF, after controlling for age.

*Note:* Ini = Initiate; WM = Working Memory; EC = Emotional Control; Plan/Org = Planning/Organisation; Org Mat = Organisation of Materials; Mon Monitor; TT = D-KEFS Tower Task; AD RT = Animal Decoding Response Time; Cue Benefit = (RT-CRT/RT+CRT*100).

** p = <.01.
8.6 Discussion: Temperament and Behaviour

It was hypothesized that children described as exhibiting higher levels of internalising or externalising behaviours, would be reported by parents as having difficult temperaments. In terms of the biopsychosocial model, temperament was thought to have a possible influence on selective cue encoding, the relations between emotion and cognition, and subsequent behavioural tendencies. It was specifically theorized that children high in internalizing behaviour would be reported to be low in Affiliativeness and Surgency but high in Effortful Control while the opposite would be true for those children high in externalising behaviour. It was hypothesised that children scoring high on either CBCL scale would be high in Negative Affect but that differences would exist in how that negative affect would be displayed: Internalisers would be reported as exhibiting higher levels of depression-related symptoms and Externalisers reported as exhibiting higher levels of frustration and aggressive symptoms. Consistent with this hypothesis, there is some evidence that both internalizing and externalizing behaviour are related to various aspects of temperament as measured by the scales employed.

In support of the hypothesis, those children who were identified by parents as being high in internalizing behaviour and those identified as being high in externalizing behaviour were equally likely to score high on parent reports concerning Negative Affect. Negative Affect was found to be a significant unique contributor to problem behaviour, explaining 20% of the variance in internalizing behaviour and 18% of the variance in externalizing behaviour. This relationship suggests that children who have externalizing and internalizing behaviour problems are temperamentally more likely to have an increased risk of aggression, frustration and depression related symptoms (TMCQ: Simonds, & Rothbart, 2004; EATQ: Ellis & Rothbart, 1999). These results are consistent
with the current literature with research often reporting similar temperamental difficulties in negative affect for both internalisers and externalisers (Eisenberg et al., 2005; Muris, Meesters, & Blijlevens, 2007).

Internalisers and externalisers were equally likely to be reported as high on Negative Affect, and in conflict with popular belief, children high in internalizing behaviour were no more likely to experience sadness than children high in externalizing behaviour. However, after closer examination of the individual items loading onto the factor score of Frustration across both questionnaires, it appears that children who are identified as being high in externalizing behaviour do differ somewhat in their negative affect to those children who are reportedly high in internalizing behaviour. Parents of those scoring higher on internalising are more likely to endorse items which attribute frustration to personal mistakes, while parents of externalisers are more likely to endorse items which attribute frustration to external causes.

Most research in the area of negative affect has consistently reported that internalizing children are more likely to experience sadness and social withdrawal, while externalizing children are more likely to experience anger and frustration (see Eisenberg et al., 2005). It is only when research looks at the more extreme levels of behaviour problems that anger and frustration also becomes associated with internalizing behaviour (Lemery, Essex, & Smider, 2002). Our sample did include a number of children who were placed in the clinical range for behaviour problems and this may have influenced the significant relationship found between internalising behaviour scores and the negative affect subscale of frustration for both temperament questionnaires. However, these children were not found to be statistically significant outliers relative to the rest of the sample.
Of note, neither of the temperament scales specifically asked about symptoms of anxiety, except for questions about shyness or fear which could be an indirect index of worry about social outcomes. As mentioned above, those scoring higher on internalising did seem to exhibit more frustration about their own performance after the fact, but parents were not asked about their child’s anxiety or concern about future events which could affect social behaviour such as avoidance as a strategy to manage negative affect. However, anxiety ratings from the child’s perspective were examined and are reported below.

Also consistent with expectations, higher parent reported externalizing behaviour was related to low Effortful Control. Effortful Control was found to be a significant unique contributor to problem behaviour, explaining 10% of the variance in externalizing behaviour. This relationship suggests that children who have externalizing behaviour problems may be temperamentally more likely to experience difficulties with Effortful Control; the ability to attend to environmental stimuli as well as activate and inhibit behaviour as necessary (TMQ: Simonds, & Rothbart, 2004; EATQ: Ellis & Rothbart, 1999). Again, these results are consistent with the current literature with research often reporting poor effortful control in children identified as high in externalizing behaviour problems (Eisenberg et al., 2001; Eisenberg et al., 2005; Olson, Sameroff, Kerr, Lopez, & Wellman, 2005).

Those who were reported to be high on externalising behaviour were also more likely to be reported by parents as having high Surgency, with 10% of externalizing behaviour being explained by this factor. This relationship suggests that children who are reported to be higher in externalizing behaviour problems may be temperamentally more likely have a willingness to approach the environment, high levels of activity and impulsivity with low
levels of fear and shyness in social situations (TMCQ: Simonds, & Rothbart, 2004; EATQ: Ellis & Rothbart, 1999). In contrast, those scoring higher on the externalizing subscale were more likely to be reported by parents as having low Affiliativeness with 4% of externalizing behaviour being explained by this factor. This relationship suggests that children who are reportedly high in externalizing behaviour problems may be temperamentally less likely to have a desire to be with others (TMCQ: Simonds, & Rothbart, 2004; EATQ: Ellis & Rothbart, 1999), however this relationship was weaker than other findings.

While not as commonly researched, there are some reports of high Surgency in children identified as high in externalizing behaviour (e.g., Berden, Keane, & Calkins, 2008; Gartstein, Putnam, & Rothbart, 2012) which is consistent with one finding of the current study. It is important to note that while these children may be willing to approach their environment, they may also be having problems behaving appropriately when engaging with others, due to their poor effortful control or even a lack of knowledge about what to do once they have engaged with others. This may help explain the negative correlation between high levels of externalizing behaviour and low Affiliativeness; children high in externalizing behaviour are willing to approach others and have low shyness in social interactions (high levels of Surgency), yet due to factors such as impulsivity, aggression and hyperactivity they may not be as socially competent in peer interactions, making them less likely over time to want to be close to other children or take an interest in others’ activities (Berdan, Keane, & Calkins, 2008). It may be useful in future studies to differentiate the tendency to approach the environment and the experience of social contacts in those who score high on Surgency and externalizing behaviours. While a moderate level of Surgency would be viewed as an adaptive component of socialization -
linking to outgoing behaviour and interest in one’s environment, it becomes problematic when more extreme levels of Surgency are reported. When combined with insufficient socially informed, effortful control and social skill characteristics, this temperamental trait may lead children to explore their environment with a disregard for rules and a lack of consideration for others (Berden et al., 2008).

Many of the subscales of the TMCQ/EATQ are moderately correlated with the CBCL. It was again considered whether this was due to the parent questionnaires asking the same questions. After looking at each questionnaire’s items and checking for similarity among questions it was decided that there was some cross over between the two questionnaires which suggested that a similar underlying set of constructs may be estimated by both parent report measures. For example, both the TMCQ/EATQ and the CBCL ask questions on Attention (TMCQ-EATQ: “Has a hard time paying attention”, “Gets distracted when trying to pay attention in class”; CBCL: “Can’t concentrate, can’t pay attention for long”, “Inattentive or easily distracted”). For the CBCL these items load onto the Attention subscale, but as mentioned previously, Attention subscale scores do not load onto the scale of internalizing or externalizing behaviour. For the EATQ/TMCQ these items load onto the scale of Effortful Control. Both the temperament scales and the CBCL ask questions about Fear and Shyness (TMCQ/EATQ: “Is shy”, “Feels scared when entering a darkened room at night”, “Is nervous being home alone”; CBCL: “Fears certain animals, situations, or places”, “Too shy or timid”). For the CBCL these items load onto the subscales of Anxiety/Depressed Mood and Withdrawn/Depressed Mood which make up the internalizing behaviour score. For the EATQ/TMCQ these items load negatively onto the scale of Surgency. Finally, both parent-report measures ask questions on Aggression (TMCQ/EATQ: “Slams doors when angry”, “If very angry, might hit someone”; CBCL:
“Temper tantrums or hot temper”, “Physically attacks people”). For the CBCL these items load onto the Aggressive Behaviour subscale which primarily makes up the externalizing behaviour score, along with the Rule Breaking Behaviour scale. For the EATQ/TMCQ these items load onto the scale of Negative Affect. Such overlaps demonstrate that the CBCL and the temperament measures do ask similar questions, which load onto the scales used in the current project. Due to these commonalities, and the relatively low unique variance accounted for in the CBCL, any relationship between the temperament subscales and the CBCL behaviour scores will of necessity be interpreted cautiously.

The CBCL and the Temperament Questionnaires (TMCQ and the EATQ) were administered to the same respondents; the child’s parent. As mentioned earlier in relation to BRIEF it must also be acknowledged that the significant correlation between problem behaviour and Temperament may be partly the result of shared methods variance. However, the same elements exist between these two measures as do between the CBCL and the BRIEF which may help avoid the spurious variance resulting from shared methods, including the use of different scale types and formats (Podsakoff, MacKenzie, Lee & Podsakoff, 2003), the assurance of confidentiality and anonymity (Chang, Witteloostuijn & Eden, 2010, p. 180) and that problem behaviour was also assessed using multiple other measurement methods (Change et al., 2010; Podsakoff et al., 2003).

Of interest is that while included as a temperamental variable; the subscale of Effortful Control was found to be significantly correlated with many areas of EF, suggesting concurrent validity between these measures as used to assess executive functioning in the current study.

The final hypothesis, that scores for both problem behaviour types would show a relationship with temperamental differences, was partially supported. A higher level of
externalising and internalizing behaviour was related to higher levels of Negative Affect. The differences in temperament between these behavioural profiles relates to the higher levels of Surgency and lower levels of Affiliativeness and Effortful Control for children identified as high in externalizing behaviour. In conflict with some of the related literature the children who were identified as high in internalizing behaviour in the current sample were not reported to have low Effortful Control (Muris et al., 2007), low Surgency (Gartstein, Putman, & Rothbart, 2012) or low Affiliativeness. As discussed earlier in the literature review, it may be that children with internalizing behaviour problems may not be viewed as having temperamental difficulties due to not causing disruption in social settings.

8.6.1 Correlations among Temperament and SIP Variables.

Given that temperamental variables involve a tendency to approach social situations as a source of positive experiences versus a tendency to view interactions as unpleasant, it was thought that temperament might be associated with how a child selectively attended to or encoded social cues or how they made attributions about what they saw or heard. The relationship between temperament (as measured by the EATQ and the TMCQ) and the SIP variables (as measured by the SLA and the NAR scale) was therefore explored by first using Pearson product-moment correlation coefficients.

As presented in Table 31 below the only relationship which was significant was between Goal Formation and Effortful Control ($r = .21, n = 96, p = .042$), with higher parent reported effortful control, or the ability to regulate emotion and behaviour, being associated with an increase in the selection of pro-social goals in hypothetical social
stories. In contrast to expectations, the relationships between all other areas of temperament and SIP were not significant.

Table 31

*Zero Order Correlations between parent-reported Temperament Factors and SIP as measured by the standard and new scales of the SLA and the NEPSY II Affect Recognition scale.*

<table>
<thead>
<tr>
<th>Scale</th>
<th>Effortful Control</th>
<th>Surgency</th>
<th>Negative Affect</th>
</tr>
</thead>
<tbody>
<tr>
<td>NEPSY AR</td>
<td>-.01</td>
<td>-.04</td>
<td>.04</td>
</tr>
<tr>
<td>Attributions</td>
<td>.19</td>
<td>.10</td>
<td>.04</td>
</tr>
<tr>
<td>Cue Encoding</td>
<td>.12</td>
<td>-.06</td>
<td>-.10</td>
</tr>
<tr>
<td>Rel. Cue Encoding</td>
<td>.13</td>
<td>-.01</td>
<td>-.09</td>
</tr>
<tr>
<td>Rel-Irrel. Cue</td>
<td>.09</td>
<td>-.03</td>
<td>-.03</td>
</tr>
<tr>
<td>Goal Formation</td>
<td>.21*</td>
<td>-.07</td>
<td>-.15</td>
</tr>
<tr>
<td>Decision Making</td>
<td>.15</td>
<td>-.15</td>
<td>-.06</td>
</tr>
</tbody>
</table>

* Correlation is significant at the 0.05 level (two tailed).

*Note. NEPSY AR = Affect Recognition; Rel. Cue Encoding = Relevant Cue Encoding; Rel-Irrel. Cue = Relevant – Irrelevant Cue Encoding.*

Again, although two temperament scales were used to cover the age range of the sample, due to the lack of standardized scores a partial correlation was performed to
control for age on the temperament scales. As shown in Table 32 below, all of the correlations between temperament and SIP variables remained non-significant, with the exception of Goal Formation which remained positively significantly correlated with Effortful Control.

Table 32

*Partial Correlations between parent-reported Temperament Factors and SIP as measured by the standard and new scales of the SLA and the NEPSY II Affect Recognition scale.*

<table>
<thead>
<tr>
<th>Scale</th>
<th>Effortful Control</th>
<th>Surgency</th>
<th>Negative Affect</th>
<th>Affliativeness</th>
</tr>
</thead>
<tbody>
<tr>
<td>NEPSY AR</td>
<td>-.01</td>
<td>-.10</td>
<td>.04</td>
<td>.03</td>
</tr>
<tr>
<td>Attributions</td>
<td>.19</td>
<td>.06</td>
<td>.04</td>
<td>.11</td>
</tr>
<tr>
<td>Cue Encoding</td>
<td>.13</td>
<td>-.06</td>
<td>-.10</td>
<td>.09</td>
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<tr>
<td>Rel. Cue Encoding</td>
<td>.12</td>
<td>-.02</td>
<td>-.09</td>
<td>.13</td>
</tr>
<tr>
<td>Rel-Irrel. Cue</td>
<td>.08</td>
<td>-.06</td>
<td>-.04</td>
<td>.15</td>
</tr>
<tr>
<td>Goal Formation</td>
<td>.21*</td>
<td>-.12</td>
<td>-.15</td>
<td>.14</td>
</tr>
<tr>
<td>Decision Making</td>
<td>.15</td>
<td>-.20</td>
<td>-.07</td>
<td>.09</td>
</tr>
</tbody>
</table>

*Correlation is significant at the 0.05 level (two tailed).

Note. NEPSY AR = Affect Recognition; Rel. Cue Encoding = Relevant Cue Encoding; Rel-Irrel. Cue = Relevant – Irrelevant Cue Encoding.
Another secondary hypothesis was that there would be a relationship between Temperament and SIP given that temperamental variables involve reactions to social situations and may influence a child’s attention to and encoding of social cues. In this respect, there was only one component of temperament, as assessed by the current research, which was consistently related to SIP.

The temperament subscale of Effortful Control was found to be significantly correlated with the SLA variable of Goal Formation suggesting that children whose parents reported higher levels of Effortful Control on the temperament questionnaires were more likely to endorse higher numbers of pro-social goals on the SLA measure. This relationship remained significant even after the effects of age were controlled. As mentioned earlier, the processes involved in Effortful Control; the ability to shift attention to deal with task demands or to shift attention away from emotion-provoking stimuli, may help a child to suppress inappropriate responses and to also engage in more socially acceptable, and pro-social, responses (Eisenberg et al., 1995; Eisenberg et al., 2000a). In contrast to expectations, the relationship between temperament and the remaining SIP variables were not significant, with and without controlling for age.
CHAPTER 9: MOOD AND BEHAVIOUR

This is a brief chapter about the relationship among reported mood by the child and internalizing and externalizing behaviour and temperamental negative affect as reported by parents. Of note, the multiple regression analysis of temperament on behaviour revealed that Negative Affect accounted for a significant amount of the variance in both internalizing and externalizing behaviour. Due to this finding it was deemed important to check whether child and parent reports covaried and whether specific child reports on mood and self-concept related to other variables.

The measures of mood used for this study included the scales of the BYI (Beck, Beck, Jolly, & Steer, 2005). The BYI consists of five independent inventories which look at a child’s strengths and relative weaknesses in social and emotional functioning from the child’s own perspective. These inventories include the youth versions of the Beck Self Concept Inventory (BSCI-Y) which assesses feelings of self-worth and confidence; the Beck Anxiety Inventory (BAI-Y) which assesses feelings of anxiety, both physiological symptoms of arousal, and worries, and fears; the Beck Depression Inventory (BDI-Y) which assesses symptoms of depression such as concerns about the future, feelings of sadness and problems with sleep; the Beck Anger Inventory (BANI-Y) which assesses feelings of anger and attributions about the things that happen to them; and the Beck Disruptive Behaviour Inventory (BDBI-Y) which assesses the child’s view on the frequency of their own anti-social thoughts and behaviours.

9.1 Data Cleaning of Mood and Behaviour Variables

The descriptive statistics for the measures of mood are presented below in Table 33.
Table 33

Descriptive Statistics for the Mood Measures

<table>
<thead>
<tr>
<th></th>
<th>N</th>
<th>Mean</th>
<th>Standard Deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>BYI – Self concept</td>
<td>96</td>
<td>49.82</td>
<td>8.00</td>
</tr>
<tr>
<td>BYI – Anxiety</td>
<td>96</td>
<td>48.46</td>
<td>10.08</td>
</tr>
<tr>
<td>BYI – Depression</td>
<td>96</td>
<td>47.57</td>
<td>9.57</td>
</tr>
<tr>
<td>BYI – Anger</td>
<td>96</td>
<td>46.19</td>
<td>10.28</td>
</tr>
<tr>
<td>BYI – Disruptive Behaviour</td>
<td>96</td>
<td>46.71</td>
<td>8.85</td>
</tr>
</tbody>
</table>

*Note. BYI = Beck Youth Inventory.*

While there were a few univariate outliers across the BYI scales, these were scores <3 SDs above or below the sample mean. Due to the lack of great difference to the remaining distribution, these outlying cases were retained in the data file for analysis (Pallant, 2011).

The maximum Mahalanobis distance was higher (28.64) than the critical value of 20.5 (with five variables) suggesting multivariate outliers. A look at the Mahalanobis distance variable revealed cases #56 (25.97), #57 (24.34) and #66 (28.64) as multivariate outliers. Regression analyses were then run twice; once with multivariate outliers excluded and then once with multivariate outliers included. Results from the multiple regression analyses were fairly consistent regardless of whether multivariate outliers were included or excluded. There was a lack of great difference to the results between these separate analyses; however, the removal of these multivariate outliers improved the normal
distribution for the BYI scales of BSCI-Y and BDI-Y so cases #56, #57 and #66 were removed from the data file (Tabachnick & Fidell, 2007).

Due to a moderate violation of normality, square root transformations were computed for the BDBI-Y. However, transforming the variable didn’t make any difference to normality. Furthermore, logarithmic transformation did not correct violations of normality. Regression analyses were run twice; once with the variable of the BDBI-Y untransformed and then once with this variable transformed (Tabachnick & Fidell, 2007). Results from the multiple regression analyses were consistent regardless of whether variables were transformed or not. Due to the lack of difference to the results between these separate analyses, it was decided to retain the untransformed BDBI-Y variable in the data file for analysis.

9.2 Correlations among Mood and Behaviour Variables

The relationship between internalizing and externalizing problem behaviour (as reported by parents on the CBCL) and behaviour and mood (as reported by children on the BYI) was first investigated using Pearson product-moment correlation coefficients.

The relationship between age and the Beck Youth Inventories of Self-Concept, Anxiety, Anger and Disruptive Behaviour were not significant. However, there was a positive correlation between age and the Beck Depression Inventory, \( r = .25, n = 96, p = .015 \). As children’s age increased, they reported higher scores on Depression related symptoms. As presented in Figure 27 below, in contrast to expectations, no significant correlations were found between Internalizing Behaviour as reported by parents on the CBCL and the individual Beck Youth Inventory scales. Significant correlations between
parent reports of Externalizing Behaviour and child reports on the BYI were limited to the Disruptive Behaviour subscale. Encouragingly, as parent-reported Externalizing Behaviour increased so did self-reported levels of Disruptive Behaviour.

Figure 27. Zero order correlations between Internalising and Externalising scores on the parent reported CBCL and self-reported self-concept, dysphoric mood and disruptive behaviour.

Note: SC = Self Concept; Dis Beh = Disruptive Behaviour.

** = p < .001.

To further explore the relationship among these variables, a multiple regression analysis was conducted to assess the ability of the BYI subscales to predict problem behaviour.

9.3. Multiple Regression of Mood on Behaviour Variables
Before conducting the multiple regression analysis a correlation matrix was generated to check for multicollinearity (see Table 34 below), and also to assess the association between child-reported mood and behaviour. While parent-reported child behaviour was related to the child’s reports of their own behaviour, whether a child’s self-reported behaviour correlated with their own self-reported mood was also investigated. The questions here was whether the child’s self-reported level of disruptive behaviour relate to their reported levels of Anxiety, Self-Concept, Anger, and Depression? As shown below in Figure 28, behaviour was significantly correlated with all other subscales of the BYI. This suggests that the children’s reports of their Disruptive Behaviour are related to their report of Self-Concept, Anxiety, Depression, and Anger. As children’s’ reports of Anxiety, Depression-related symptoms, and Anger increased, their reported disruptive behaviour increased. In contrast, as their view of their own Self-Concept increased, their reported level of Disruptive Behaviour decreased.

Table 34

*Correlations among the BYI Subscales*

<table>
<thead>
<tr>
<th></th>
<th>BSCI-Y</th>
<th>BAI-Y</th>
<th>BDI-Y</th>
<th>BANI-Y</th>
<th>BDBI-Y</th>
</tr>
</thead>
<tbody>
<tr>
<td>BSCI-Y</td>
<td></td>
<td>.37**</td>
<td>.52**</td>
<td>.43**</td>
<td>.41**</td>
</tr>
<tr>
<td>BAI-Y</td>
<td></td>
<td></td>
<td>.69**</td>
<td>.69**</td>
<td>.32**</td>
</tr>
<tr>
<td>BDI-Y</td>
<td></td>
<td></td>
<td></td>
<td>.77**</td>
<td>.53**</td>
</tr>
<tr>
<td>BANI-Y</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>.64**</td>
</tr>
</tbody>
</table>

*Note. BSCI-Y: Beck Self Concept Inventory – Youth; BAI-Y: Beck Anxiety Inventory – Youth; BDI-Y: Beck Depression Inventory – Youth; BANI-Y: Beck Anger Inventory – Youth; BDBI-Y: Beck Disruptive Behaviour Inventory – Youth.*
Figure 28. Correlations between Disruptive Behaviour and mood, as were reported by the child.

*Note. SC = Self Concept

* = p < .05. ** = p < .01.

While the Beck Youth Inventories were significantly correlated with one another, the only one with a correlation value >.7 was the BDI-Y and the BANI-Y; \( r = .77 \). However, there was no evidence of multicollinearity among the Mood variables used to predict internalizing behaviour (tolerance values for all predictors were above .10 and VIF values were all <10) or externalizing behaviour (tolerance values for all predictors were above .10 and VIF values were all <10). There was also no evidence of sequential dependence for either Internalizing Behaviour (Durbin-Watson = 1.77) or Externalizing Behaviour (Durbin-Watson = 2.05).
A hierarchical multiple regression was performed to assess the ability of BYI subscales to predict levels of internalising and externalising behaviour after controlling for the influence of age. Five independent variables were used: the Beck Youth Inventories of Self-Concept, Anxiety, Depression, Anger, and Disruptive Behaviour. Age was included as a sixth predictor to control for any age related effects on self-reported moods and behaviour. The dependent variables were Internalising Behaviour and Externalising Behaviour and these were entered separately into independent multiple regression analyses.

9.3.1 Internalising Criterion.

Age was entered at Step 1 explaining 1.8% of the variance in Internalizing Behaviour. After the entry of the mood scales at Step 2 the total variance explained by the model as a whole was increased to 3.5%, $F(6, 86) = .513, p = .797$. The BYI scales explained only an additional 1.6% of the variance in Internalizing Behaviour, $R^2$ squared change = .016, $F$ change (5, 86) = .293, $p = .915$, which was not a statistically significant contribution. As shown in Table 35 below, examination of the beta coefficients revealed that none of the BYI scales explained a significant amount of variance in Internalizing Behaviour. In contrast to expectations, there was no relationship between Internalizing Behaviour, as measured by the CBCL, and self-reported mood, self-concept or behaviour, as measured by the BYI.
Table 35

*Predicting Internalising Behaviour from Age and the BYI Subscales*

<table>
<thead>
<tr>
<th>Predictor</th>
<th>B</th>
<th>95% CI for B</th>
<th>β</th>
<th>r</th>
<th>sr²</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>LB</td>
<td>UB</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Step 1</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Age</td>
<td>-.80</td>
<td>-.20</td>
<td></td>
<td>.43</td>
<td>-.14</td>
</tr>
<tr>
<td></td>
<td></td>
<td>-.14</td>
<td></td>
<td></td>
<td>.02</td>
</tr>
<tr>
<td><strong>Step 2</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Age</td>
<td>-.74</td>
<td>-.20</td>
<td></td>
<td>.57</td>
<td>-.13</td>
</tr>
<tr>
<td></td>
<td></td>
<td>-.14</td>
<td></td>
<td></td>
<td>.01</td>
</tr>
<tr>
<td>BSCY-I</td>
<td>-.11</td>
<td>-.47</td>
<td>.25</td>
<td>-.08</td>
<td>-.08</td>
</tr>
<tr>
<td></td>
<td></td>
<td>.00</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>BAI-Y</td>
<td>.03</td>
<td>-.30</td>
<td>.36</td>
<td>.03</td>
<td>.01</td>
</tr>
<tr>
<td></td>
<td></td>
<td>.00</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>BDI-Y</td>
<td>-.08</td>
<td>-.54</td>
<td>.37</td>
<td>-.07</td>
<td>.01</td>
</tr>
<tr>
<td></td>
<td></td>
<td>.00</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>BANI-Y</td>
<td>-.02</td>
<td>-.45</td>
<td>.41</td>
<td>-.02</td>
<td>.04</td>
</tr>
<tr>
<td></td>
<td></td>
<td>.00</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>BDBI-Y</td>
<td>.15</td>
<td>-.24</td>
<td>.54</td>
<td>.11</td>
<td>.11</td>
</tr>
<tr>
<td></td>
<td></td>
<td>.00</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Model 1: \( p = .20, R^2 = .14, Adj R^2 = .02 \).
Model 2: \( p = .92, R^2 = .19, Adj R^2 = .04 \).

*Note.* BSCI-Y = Beck Self Concept Inventory – Youth; BAI-Y = Beck Anxiety Inventory – Youth; BDI-Y = Beck Depression Inventory – Youth; BANI-Y = Beck Anger Inventory – Youth; BDBI-Y = Beck Disruptive Behaviour Inventory – Youth.

### 9.3.2 Externalising Criterion.

Age was entered at Step 1 explaining 1.8% of the variance in Externalizing Behaviour. After the entry of the mood scales at Step 2 the total variance explained by the model as a whole was increased to 15.8%, \( F(6, 86) = 2.68, p = .020 \). The BYI subscales explained an additional 14% of the variance in Externalizing Behaviour, \( R^2 \) squared change = .14, \( F \) change (5, 86) = 2.85, \( p = .020 \). As was noted in the correlational analysis above, and as
shown in Table 36 below, examination of the beta coefficients revealed that the BYI Disruptive Behaviour subscale explained a significant amount of variance in Externalizing Behaviour. Children who were reported as having high levels of Externalizing Behaviour as reported by parents on the CBCL were likely to self-report higher levels of Disruptive Behaviour in the BDBI-Y.

Table 36

*Predicting Externalizing Behaviour from Age and the BYI Subscales*

<table>
<thead>
<tr>
<th>Predictor</th>
<th>B</th>
<th>95% CI for B</th>
<th>β</th>
<th>r</th>
<th>sr²</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>LB</td>
<td>UB</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Step 1</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Age</td>
<td>-.83</td>
<td>-2.10</td>
<td>.45</td>
<td>-.13</td>
<td>-.13</td>
</tr>
<tr>
<td><strong>Step 2</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Age</td>
<td>-.46</td>
<td>-1.73</td>
<td>.82</td>
<td>-.07</td>
<td>-.13</td>
</tr>
<tr>
<td>BSCI-Y</td>
<td>-.02</td>
<td>-.36</td>
<td>.33</td>
<td>-.01</td>
<td>-.07</td>
</tr>
<tr>
<td>BAI-Y</td>
<td>-.06</td>
<td>-.38</td>
<td>.27</td>
<td>-.05</td>
<td>-.04</td>
</tr>
<tr>
<td>BDI-Y</td>
<td>-.26</td>
<td>-.70</td>
<td>.19</td>
<td>-.20</td>
<td>.004</td>
</tr>
<tr>
<td>BANI-Y</td>
<td>.05</td>
<td>-.37</td>
<td>.46</td>
<td>.40</td>
<td>.11</td>
</tr>
<tr>
<td>BDBI-Y</td>
<td>.59**</td>
<td>.21</td>
<td>.97</td>
<td>.43</td>
<td>.33*</td>
</tr>
</tbody>
</table>

Model 1: \( p = .20 \) \( R = .13, R^2 = .02, Adj R^2 = .01 \).

Model 2: \( p = .02, R = .40, R^2 = .16, Adj R^2 = .10 \).

** Correlation is significant at the 0.01 level (one tailed).

*Note.* BSCI-Y = Beck Self Concept Inventory – Youth; BAI-Y = Beck Anxiety Inventory – Youth; BDI-Y = Beck Depression Inventory – Youth; BANI-Y = Beck Anger Inventory – Youth; BDBI-Y = Beck Disruptive Behaviour Inventory – Youth.
Based on the multiple regression model for testing the influence of BYI scores on behaviour scores, and after considering the variance accounted for by each subscale, it is clear that no individual subscale accounts for a significant amount of the variance in Internalizing scores. However, there is a significant relationship between Externalizing Behaviour as reported by parents on the CBCL and Disruptive Behaviour as self-reported by the child on the BYI.

Also of note is that the subscale of Disruptive Behaviour is correlated with Externalizing Behaviour significantly more than Internalizing Behaviour as reported by parents on the CBCL. As shown in Figure 29 below, greater self-reported Disruptive Behaviour is associated with higher Externalising Behaviour, $r = .315, p < .001$ and lower Internalising Behaviour, $r = -.083, p = .444$. These correlations with Disruptive Behaviour are significantly different, $t = 4.445, p < .01$. 
Figure 29. Partial correlations from the multiple regression analyses showing the unique variance in Internalising and Externalising scores on the parent reported CBCL accounted for by self-reported disruptive behaviour.

*Note.* ** = \( p < .01 \).

### 9.4 Mood, Self-Concept, Behaviour, and Executive Functioning

The relationship between executive functioning and self-reported mood as measured by the Beck Youth Inventory (BYI) was also examined as it was predicted that a child’s typical emotional state would have an effect on their performance on tests of executive functioning.

#### 9.4.1 Correlations among EF and the BYI subscales.

The relationship between mood (as measured by the BYI) and executive functioning (as measured by the BRIEF-GEC(t), the D-KEFS Tower Task and the HeadMinder
variables of Animal Decoding Response Time(t) and Cue Benefit was investigated using Pearson product-moment correlation coefficients.

The relationship between age and the EF variables has been discussed above and will therefore not be discussed again here. Furthermore, the relationship between age and mood is discussed later in Chapter 10 so will not be presented here. As presented in Table 37 below, a significant negative correlation was found between Self-Concept and the BRIEF composite score for EF. Disruptive Behaviour and Dysphoric moods, except for child reported Anxiety, were positively correlated with parent reported EF on the BRIEF. Children who noted themselves as high on Self-Concept were more likely to be reported by parents as having strengths in executive functioning while those describing themselves as higher on Depression, Anger, and Disruptive Behaviour were more likely to be reported by parents as having problems with EF. In contrast to expectations, there was no relationship between mood and overall performance on the formal tests of EF. Individual differences on Tower Task process variables are discussed below.

Table 37

Correlations among Child Reported Self-Concept, Mood, and Disruptive Behaviour, Parent Reported Executive Functioning and Test Performance

<table>
<thead>
<tr>
<th>Scale</th>
<th>BSCI-Y</th>
<th>BAI-Y</th>
<th>BDI-Y</th>
<th>BANI-Y</th>
<th>BDBI-Y</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Zero Order</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>BRIEF-GEC(t)</td>
<td>-.21*</td>
<td>.07</td>
<td>.23*</td>
<td>.29**</td>
<td>.45**</td>
</tr>
<tr>
<td>Tower Task</td>
<td>.05</td>
<td>-.07</td>
<td>.00</td>
<td>.03</td>
<td>-.01</td>
</tr>
</tbody>
</table>
**Correlation is significant at the 0.01 level (two tailed).**

* Correlation is significant at the 0.05 level (two tailed).

**Note.** BRIEF-GEC = Behaviour Rating Inventory of Executive Functioning – Global Executive Composite (transformed); AD RT = Animal Decoding Response Time (transformed); BSCI-Y = Beck Self-Concept Inventory—Youth; BAI-Y = Beck Anxiety Inventory – Youth; BDI-Y = Beck Depression Inventory – Youth; BANI-Y = Beck Anger Inventory – Youth; BDBI-Y = Beck Disruptive Behaviour Inventory – Youth.

As the HeadMinder subtests are not age standardized, a partial correlation was performed to control for age. As shown in Table 37 above, even after controlling for age, there was no significant relationship between the HeadMinder subtests and any BYI subscale.

As presented in Table 38 below, significant correlations were found between dysphoric moods as reported on the BYI and the Tower Task Process Variables. Children who noted themselves as high on Anxiety were more likely to score higher on Time per
Move Ratio and Total Rule Violations. Those reporting higher levels of Anxiety took more time per Tower Test move but still made more errors in terms of violating task rules. Children who noted themselves as high on Depression and Disruptive Behaviour were also more likely to commit more rule violations. Self-concept was not related to any Tower Task process variable, and Time per Move Ratio and Move Accuracy on the Tower Task was not associated with a child’s self-reported Disruptive Behaviour in other settings.

Table 38
Zero Order Correlations between Child-Reported Self-Concept, Mood and Disruptive Behaviour, and the Tower Task Process Variables

<table>
<thead>
<tr>
<th>Scale</th>
<th>BSCI-Y</th>
<th>BAI-Y</th>
<th>BDI-Y</th>
<th>BANI-Y</th>
<th>BDBI-Y</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean First Move Time</td>
<td>.03</td>
<td>-.11</td>
<td>-.02</td>
<td>-.06</td>
<td>-.04</td>
</tr>
<tr>
<td>Time Per Move Ratio</td>
<td>.03</td>
<td>-.23*</td>
<td>-.13</td>
<td>-.15</td>
<td>-.12</td>
</tr>
<tr>
<td>Move Accuracy</td>
<td>.01</td>
<td>.19</td>
<td>.17</td>
<td>.09</td>
<td>.05</td>
</tr>
<tr>
<td>Total Rule Violations</td>
<td>-.06</td>
<td>-.21*</td>
<td>-.23*</td>
<td>-.18</td>
<td>.22*</td>
</tr>
</tbody>
</table>

* Correlation is significant at the 0.05 level (two tailed).

Note. BSCI-Y = Beck Self-Concept Inventory-Youth; BAI-Y = Beck Anxiety Inventory – Youth; BDI-Y = Beck Depression Inventory – Youth; BANI-Y = Beck Anger Inventory – Youth; BDBI-Y = Beck Disruptive Behaviour Inventory – Youth.

Given the overall the relationship between mood subscales and executive functioning as measured by the BRIEF-GEC(t), the links between the BYI and BRIEF subscales were
investigated. As presented in Table 39 below, significant correlations were also found between subscales on the BYI and the clinical subscales of the BRIEF. Children who endorsed items indicating a more positive Self-Concept were more likely to be reported by parents as being better at inhibiting or monitoring behaviour, and working memory abilities. Children who endorsed items indicating higher levels of symptoms associated with Depression, Anger, and Disruptive Behaviour were more likely to be reported by parents as having difficulties with the executive functions of inhibiting and monitoring behaviour, working memory, planning, and organizing behaviour. Children who noted themselves as higher on Anger and Disruptive Behaviour were also more likely to be reported by parents as having difficulties with the executive functions of shifting and initiating behaviour. Finally, children who endorsed a higher number of Disruptive Behaviours were more likely to be reported by parents as having difficulties with emotional control. In contrast to expectation, there was no significant correlation between Anxiety, as self-reported on the BYI, and any of the clinical subscales of the BRIEF. Organisation of Materials as measured by the BRIEF was not associated with any BYI subscale.

Table 39

*Zero Order Correlations between Child Reported Self-Concept, Mood and Disruptive Behaviour, and the Clinical Subscales of the BRIEF*

<table>
<thead>
<tr>
<th>Scale</th>
<th>BSCI-Y</th>
<th>BAI-Y</th>
<th>BDI-Y</th>
<th>BANI-Y</th>
<th>BDBI-Y</th>
</tr>
</thead>
<tbody>
<tr>
<td>Emotional Control</td>
<td>-.18</td>
<td>-.04</td>
<td>.03</td>
<td>.20</td>
<td>.36**</td>
</tr>
</tbody>
</table>
### 9.4.2 Correlations among EF and Behaviour, Controlling for Self-Concept, Disruptive Behaviour and Dysphoric Moods.

The relationship between behaviour (as measured by the CBCL) and executive functioning (as measured by the BRIEF-GEC(t), the D-KEFS Tower Task and the HeadMinder subtests of Animal Decoding Response Time(t) and Cue Benefit) was investigated using Pearson product-moment correlation coefficients. To control for the potential influence of self-concept, disruptive behaviour, and dysphoric moods on the

<table>
<thead>
<tr>
<th></th>
<th>Inhibit</th>
<th>Shift</th>
<th>Initiate</th>
<th>Working Memory</th>
<th>Plan/Organise</th>
<th>Organisation</th>
<th>Monitor</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inhibit</td>
<td>.31**</td>
<td>.04</td>
<td>.22*</td>
<td>.27**</td>
<td>.54**</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Shift</td>
<td>-.12</td>
<td>-.02</td>
<td>.15</td>
<td>.23*</td>
<td>.36**</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Initiate</td>
<td>-.10</td>
<td>.01</td>
<td>.15</td>
<td>.23*</td>
<td>.29**</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Working Memory</td>
<td>-.33**</td>
<td>.13</td>
<td>.33**</td>
<td>.34**</td>
<td>.45**</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Plan/Organise</td>
<td>-.13</td>
<td>.09</td>
<td>.21*</td>
<td>.27**</td>
<td>.42**</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Organisation</td>
<td>.03</td>
<td>.02</td>
<td>.00</td>
<td>-.04</td>
<td>-.06</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Monitor</td>
<td>-.21*</td>
<td>.09</td>
<td>.27**</td>
<td>.27**</td>
<td>.48**</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

** Correlation is significant at the 0.01 level (two tailed).
* Correlation is significant at the 0.05 level (two tailed).

Note. BSCI-Y = Beck Self-Concept Inventory- Youth; BAI-Y = Beck Anxiety Inventory – Youth; BDI-Y = Beck Depression Inventory – Youth; BANI-Y = Beck Anger Inventory – Youth; BDBI-Y = Beck Disruptive Behaviour Inventory – Youth; Organisation = Organisation of Materials
relationships among behaviour and EF, individual partial correlations were performed with each individual BYI subscale accounted for.

As presented in Table 40 below, correlations between EF and Internalizing and Externalizing Behaviour remained significant even after Self-Concept, Disruptive Behaviour and Dysphoric moods were controlled for. It appears that the relationship between children’s behaviour and executive functioning, as reported by parents and performance based measures, is not influenced by self-concept, behaviour, and dysphoric moods as self-reported by children.

Table 40

Correlations between Behaviour and Executive Functioning after Controlling for Self-Concept, Disruptive Behaviour and Dysphoric Moods

<table>
<thead>
<tr>
<th>Scale</th>
<th>BRIEF-GEC(t)</th>
<th>Tower Task</th>
<th>AD RT(t)</th>
<th>Cue Benefit</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Self Concept</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Internalising Behaviour</td>
<td>.50**</td>
<td>-.29**</td>
<td>.33**</td>
<td>.09</td>
</tr>
<tr>
<td>Externalising Behaviour</td>
<td>.68**</td>
<td>-.28**</td>
<td>.38**</td>
<td>.10</td>
</tr>
<tr>
<td><strong>Anxiety</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Internalising Behaviour</td>
<td>.52**</td>
<td>-.29**</td>
<td>.32**</td>
<td>.08</td>
</tr>
<tr>
<td>Externalising Behaviour</td>
<td>.69**</td>
<td>-.29**</td>
<td>.38**</td>
<td>.09</td>
</tr>
<tr>
<td><strong>Depression</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
** Correlation is significant at the 0.01 level (two tailed).

* Correlation is significant at the 0.05 level (two tailed).

Note. BRIEF-GEC = Behaviour Rating Inventory of Executive Functioning – Global Executive Composite (transformed); AD RT(t) = Animal Decoding Response Time (transformed); Cue Benefit = (RT-CRT/RT+CRT*100).

### 9.5 Mood and SIP

The relationship between the measures of SIP and self-reported mood as measured by the Beck Youth Inventory (BYI) was examined. In line with previous reports it was predicted that a child’s typical emotional state might have a performance effect on measures of SIP. In particular it was thought that mood might affect selective attention, or
lead to distortions in the processing of emotional faces or mood congruent attributions about the socially relevant scenarios.

9.5.1 Correlations among SIP and the BYI Subscales.

The relationship between mood (as measured by the BYI) and SIP (as measured by the SLA) and the NEPSY II Affect Recognition scale was investigated using Pearson product-moment correlation coefficients.

The relationship between age and the SIP variables has been discussed above and will therefore not be repeated here. As noted earlier, the only significant relationship between age and BYI scores was for the Depression subscale, $r = .24$, $n = 96$, $p = .017$, with increases in age associated with higher self-reported, depression related symptoms. As presented in Table 41 below, significant correlations were found between BYI subscales and the SIP measures. Children who scored high on Self-Concept were more likely to select a higher number of cues in hypothetical social scenarios when either the standard or new Relevant Cue variables were used. However, the relative number of irrelevant to relevant cues did not correlate with any BYI subscale score. Children who scored high on self-reported Disruptive Behaviour were less likely to endorse pro-social Goals and Decisions in hypothetical social scenarios. In contrast to expectations, the relationships between the BYI mood subscales of Anxiety, Depression and anger and the SIP variables were not significant.
Table 41

*Correlations between the BYI Subscales and Measures of Social Information Processing*

<table>
<thead>
<tr>
<th>Scale</th>
<th>BSCI-Y</th>
<th>BAI-Y</th>
<th>BDI-Y</th>
<th>BANI-Y</th>
<th>BDBI-Y</th>
</tr>
</thead>
<tbody>
<tr>
<td>NEPSY AR</td>
<td>.06</td>
<td>-.19</td>
<td>-.06</td>
<td>-.07</td>
<td>-.06</td>
</tr>
<tr>
<td>Hostile Attributions</td>
<td>-.15</td>
<td>.11</td>
<td>.08</td>
<td>.03</td>
<td>.06</td>
</tr>
<tr>
<td>Pres. CueEncoding</td>
<td>.23*</td>
<td>.10</td>
<td>-.05</td>
<td>-.10</td>
<td>-.11</td>
</tr>
<tr>
<td>Rel. Cue Encoding</td>
<td>.23*</td>
<td>.13</td>
<td>-.04</td>
<td>-.09</td>
<td>-.12</td>
</tr>
<tr>
<td>Rel_Irrel. Cue Encoding</td>
<td>.04</td>
<td>.08</td>
<td>.11</td>
<td>-.04</td>
<td>-.12</td>
</tr>
<tr>
<td>Goal Formation</td>
<td>.09</td>
<td>-.04</td>
<td>-.10</td>
<td>-.13</td>
<td>-.49**</td>
</tr>
<tr>
<td>Decision Making</td>
<td>.11</td>
<td>-.15</td>
<td>-.04</td>
<td>-.06</td>
<td>-.35**</td>
</tr>
</tbody>
</table>

** Correlation is significant at the 0.01 level (two tailed).
* Correlation is significant at the 0.05 level (two tailed).

*Note.* NEPSY AR = Affect Recognition; Rel. Cue Encoding = Relevant Cue Encoding; Rel_Irrel. Cue Encoding = Relevant – Irrelevant Cue Encoding.

As the SLA measures are not age standardized, a partial correlation was performed to control for age when testing the relationships between SIP and BYI scores. As shown in Table 42 below, even after controlling for age, children who scored high on Self-Concept were still more likely to select a higher number of relevant cues in hypothetical social
scenarios. Children who scored high on self-reported Disruptive Behaviour were still less likely to endorse pro-social goals and decisions in hypothetical social scenarios.

Table 42

Correlations between BYI Subscales and Measures of Social Information Processing after Controlling for Age

<table>
<thead>
<tr>
<th>Scale</th>
<th>BSCI-Y</th>
<th>BAI-Y</th>
<th>BDI-Y</th>
<th>BANI-Y</th>
<th>BDBI-Y</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hostile Attributions</td>
<td>-.14</td>
<td>.08</td>
<td>.04</td>
<td>.01</td>
<td>.08</td>
</tr>
<tr>
<td>Pres. Cue Encoding</td>
<td>.23*</td>
<td>.10</td>
<td>-.06</td>
<td>-.11</td>
<td>-.11</td>
</tr>
<tr>
<td>Rel. Cue Encoding</td>
<td>.24*</td>
<td>.12</td>
<td>-.05</td>
<td>-.09</td>
<td>-.12</td>
</tr>
<tr>
<td>Rel_Irrel. Cue Encoding</td>
<td>.04</td>
<td>.06</td>
<td>.09</td>
<td>-.05</td>
<td>-.11</td>
</tr>
<tr>
<td>Goal Formation</td>
<td>.11</td>
<td>-.09</td>
<td>-.16</td>
<td>-.17</td>
<td>-.49**</td>
</tr>
<tr>
<td>Decision Making</td>
<td>.13</td>
<td>-.20</td>
<td>-.09</td>
<td>-.09</td>
<td>-.34**</td>
</tr>
</tbody>
</table>

** Correlation is significant at the 0.01 level (two tailed).
* Correlation is significant at the 0.05 level (two tailed).

Note. NEPSY AR = Affect Recognition; Rel. Cue Encoding = Relevant Cue Encoding; Rel_Irrel. Cue Encoding = Relevant – Irrelevant Cue Encoding.

9.6 Mood and Temperament
Given the lack of association between parent reports on the CBCL, some of which related to mood, and the BYI emotion subscales, an examination of other presumably related measures was examined. This provided a measure of how well parent and child reports of dysphoric mood covaried in the assessments.

9.6.1 Correlations among Temperament and the BYI Subscales.

The relationship between Self-Concept, Mood and Disruptive Behaviour (as reported by children on the BYI) and temperament (as measured by parent report on the TMCQ and EATQ) was investigated using Pearson product-moment correlation coefficients. A correlation matrix was generated that included the standardised factor scores of the TMCQ or EATQ and the BYI subscales with age included or not as a potential covariate.

The relationship between age and temperament has been discussed above and will therefore not be repeated here. Also, the relationship between age and the BYI is discussed later in Chapter 10 so again, will also not be discussed here. As presented in Table 43 below, significant correlations were found were between the BYI subscales and parent reported temperament. Children who rated themselves higher on Self-Concept were more likely to be reported as having higher levels of Effortful Control. Conversely, children who scored high on Depression and Disruptive Behaviour were more likely to be reported as having problems with Effortful Control. Children who rated themselves higher on Disruptive Behaviour were also more likely to be reported as having higher levels of Negative Affect. In contrast to expectations, Surgency was unrelated with any BYI subscale. Furthermore, no significant correlations were found between the temperament subscale of Negative Affect and mood as measured by the BYI subscales of Anxiety,
Depression, and Anger. This suggests that parent and child reports of dysphoric mood were not consistent and thereby highlight the importance of including direct input from children when undertaking mood related measures.

Table 43

Correlations between Child Reported Self-Concept, Mood and Disruptive Behaviour, and Temperament

<table>
<thead>
<tr>
<th>Scale</th>
<th>BSCI-Y</th>
<th>BAI-Y</th>
<th>BDI-Y</th>
<th>BANI-Y</th>
<th>BDBI-Y</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Zero Order</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Effortful Control</td>
<td>.24*</td>
<td>-.06</td>
<td>-.24*</td>
<td>-.18</td>
<td>-.31**</td>
</tr>
<tr>
<td>Negative Affect</td>
<td>-.16</td>
<td>.02</td>
<td>.02</td>
<td>.12</td>
<td>.24*</td>
</tr>
<tr>
<td>Surgency</td>
<td>-.10</td>
<td>-.07</td>
<td>.01</td>
<td>-.02</td>
<td>.09</td>
</tr>
<tr>
<td>Affiliativeness</td>
<td>.10</td>
<td>-.04</td>
<td>-.05</td>
<td>-.08</td>
<td>-.19</td>
</tr>
<tr>
<td><strong>Partial (Age)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Effortful Control</td>
<td>.24*</td>
<td>-.07</td>
<td>-.25*</td>
<td>-.18</td>
<td>-.31**</td>
</tr>
<tr>
<td>Negative Affect</td>
<td>-.16</td>
<td>.02</td>
<td>.01</td>
<td>.11</td>
<td>.24*</td>
</tr>
<tr>
<td>Surgency</td>
<td>-.08</td>
<td>-.11</td>
<td>-.04</td>
<td>-.05</td>
<td>.11</td>
</tr>
<tr>
<td>Affiliativeness</td>
<td>.09</td>
<td>-.01</td>
<td>-.02</td>
<td>-.06</td>
<td>-.21*</td>
</tr>
</tbody>
</table>

** Correlation is significant at the 0.01 level (two tailed).

* Correlation is significant at the 0.05 level (two tailed).
As the temperament scales are not age standardized, partial correlations were performed to control for age. As shown in Table 43 above, even after controlling for age, all previously significant relationships between BYI subscales and temperament remained. In addition, children who scored high on Disruptive Behaviour were more likely to be reported as having lower levels of Affiliativeness once age was controlled for.
9.7 Discussion: Mood, Behaviour, Temperament, and SIP

An additional secondary hypothesis of the thesis was that there would be a relationship between child reports on the BYI and parent reported behaviour. Specifically, it was hypothesized that anger and disruptive behaviour as reported by the child on the BYI would correlate with parent-reported externalizing behaviour, and that depression and anxiety as reported by the child would correlate with parent-reported internalizing behaviour. In addition, whether child-reported mood (Self-Concept, Anxiety, Depression, and Anger) correlated with their own reports of Disruptive Behaviour on the BYI was examined. In an effort to assess the relations between parent-reported temperamental Negative Affect in their child and the child’s own report of dysphoric mood, the correlations between these measures were conducted. The results of these investigations will now be briefly discussed.

It was firstly considered that perhaps the relationship between externalizing behaviour as measured by the CBCL and the BDBI-Y was simply due to both measures asking the same questions. After looking at each questionnaire’s items and checking for similarity among questions it was decided that there is some cross-over between the two questionnaires, which suggests the measurement of a more fundamental construct is being reported by both these behaviour report measures. For example, both the BDBI-Y and the CBCL ask questions on Rule Breaking Behaviour (BDBI-Y: “I steal”, “I think about running away from home”, “I break the rules”; CBCL: “Runs away from home”, “Steals at home”, “Steals outside the home”, “Breaks rules at home, school or elsewhere”). For the CBCL these items load onto the scale of Externalizing Behaviour. They both also ask questions about Aggressive Behaviour (BDBI-Y: “I argue with adults”, “I break things when I am mad”, “I fight with others”; CBCL: “Argues a lot”, “Destroys his or her own
things”, “Gets in many fights”). Again, for the CBCL these items load onto the scale of Externalizing Behaviour. These findings suggest concurrent validity across parent and child reports however the coefficients of association are below the standard required to demonstrate adequate concurrent validity (with .5 being considered the minimum standard). While this is a statistically significant correlation, knowing the child’s self-report of Disruptive Behaviour only accounts for 9% of the variance in parent-reported Externalising Behaviour. In contrast to expectations, there was no correlation between the other BYI scales and the CBCL; there was no relationship between self-reported Anxiety or Depression and Internalizing Behaviour or between Anger and Externalizing Behaviour.

It is important to note that the children themselves report a strong relationship between their Disruptive Behaviour and Mood. Most research on the relationship between emotional experiences and behaviour is based on parent report (Boughton & Lumney, 2011) yet research has consistently found that self-report is more sensitive to the experiences of children. Children with internalizing behaviour problems are more likely to report issues of anxiety and mood disturbances than their parents, while externalizing behaviour problems are over-reported by parents in contrast to self-report (Boughton & Lumney, 2011; Howells & Lachar, 1998; Van der meer, Dixon, & Rose, 2008). The current study also supports these findings with Disruptive Behaviour, as reported by the child, significantly positively correlated to parent-reported Externalising Behaviour while Internalising Behaviour did not reach significance with any reports of dysphoric mood by the child. This common divergence in self-report to parental reports of problem behaviour highlights the need to incorporate both approaches in comprehensive assessments of child functioning to avoid missing important self-evaluations by the child.
Of interest was the high correlation between the BDI-Y and the BANI-Y. This is consistent with the literature which suggests that anger toward others may be a projection of feelings of anger toward the self as a result of the cognitions (e.g. perceived hopelessness) and emotions (e.g. sadness, frustration) which often characterise depression. Alternatively, depression is often referred to as ‘anger turned inward’ with research showing that both adults (Biaggio & Godwin, 1987) and children (Riley, Treiber & Woods, 1989) with depression show a higher level of hostility and anger than people without depression. Research has also shown that when anger co-exists with depression, depressive symptoms are often more severe in terms of greater intensity, higher frequency and episodes of longer duration episodes (Sheeber, Allen, Leve, Davis, Shortt, & Katz, 2009). It is essential to assess both anger and depression symptoms in children in order to implement an intervention for negative affect, which addresses both moods and associated cognitions, thus increasing the likelihood of effective treatment.

It is supported by research and intuitive that when a child is experiencing elevated levels of anger, their levels of disruptive behaviour may increase (Harty, Miller, Newcorn & Haperin, 2008). It is less intuitive however, and not as often researched, that a child’s experience of increased anxiety and depressive symptoms influence increased levels of disruptive behaviour. It is possible that a child who is destructive, aggressive or defiant may in fact be reacting to anxiety or depression and may not know of any other way to respond when they lack emotion regulation skills. Some studies have indicated that when children feel threatened or unheard, they may react with escape and avoidance behaviour, as commonly seen in internalisers, or with meltdowns and tantrums, which are more common in externalisers (Miller, 2013; Spiro, 2013). Bubier & Drabick (2009) examined the co-morbidity of anxiety and disruptive disorders in children and adolescents, and found
that many disruptive behaviours, including reactive aggression, attention problems, and hyperactivity, are preceded by anxiety symptoms. Research has also shown that children who are identified as anxious at age 6 are later identified as aggressive, or higher in disruptive behaviour, at ages 10-12 (Vitario et al., 2002).

9.7.1 Mood and EF.

Given previous reports in adults about the links between dysphoric mood and some aspects of cognition (c.f. Schlosser et al., 2011 for a discussion on the link between depression and selective attention), it was predicted that a child’s reports on the BYI subscales would be related to parent reports on the child’s EF. Significant relationships were found between the BYI inventories of Self-Concept, Depression, Anger and Disruptive Behaviour and the BRIEF-GEC(t), all in expected directions.

To eliminate the possibility that these correlations were simply due to the two measures asking the same questions, the questionnaires were examined and checked for similarity among items. While some items seem similar (BANI-Y: “When I get mad, I stay mad”; BRIEF: “Angry or tearful outburst are intense but end suddenly”), for the most part, the two questionnaires do not overlap and seem to be examining different constructs. The BYI focuses on how the child thinks and feels while the BRIEF assesses specific behavioural indicators of mood regulation, and executive functions such as planning, organization and memory. Due to the lack of overlap between the two measures it is argued that the relationships found between the BRIEF-GEC(t) and the Beck Youth Inventories are due potentially to the influence of mood on EF, and are not simply due to assessment of the same underlying constructs. These relationships will now be discussed.
Children who scored high on Self-Concept were more likely to be reported by parents as having strengths in executive functioning, as measured by the BRIEF-GEC(t). Children who scored high on Depression, Anger and Disruptive Behaviour were more likely to be reported by parents as having problems with executive functioning. Reports about the association between depression and EF in the literature are mixed but with most research findings opposing the current results. Several authors have found that self-reported depressive symptoms do not influence EF (Hill et al., 2013; Mangis, 2010; Smitherman, Huerkamp, Miller, Houle, & Jile, 2007). Alternatively however, there is some evidence that depression is associated with deficits in EF (Wagner, Muller, Helmeıreich, Huss, & Tadic, 2014). Wagner et al. (2014) found a number of cognitive deficits in children and adolescents diagnosed with major depression but it remains unclear if the link exists in subclinical samples when depression-related symptoms have been assessed. The range of scores for the BDI-Y (34-88) in the current study included only two children in the clinical range >70. This suggests that even in a subclinical sample, features of depressed mood may possibly be affecting EF by altering selective encoding about personally relevant information or by negatively affecting sustained attention during prescribed tasks. However, if mood was affecting EF via attentional or ruminative processes than reported anxiety should also be linked to reports of executive dysfunction.

In conflict with the literature, which has found that executive dysfunction, especially difficulty with the EF of shifting, (Affrunti & Woodruff-Borden, 2013), is associated with higher levels of child anxiety (Ursache & Cybele, 2014), anxiety was not significantly associated with parent-reported executive dysfunction in the current sample. Although some research findings are consistent with these results, with Smitherman et al. (2007) noting that self-reported anxiety was not related to performance on measures of EF, it was
considered whether the range of anxiety scores was broad enough to find the previously reported links to EF. Previous reports on the use of the BYI in normative samples indicated a mean of 48.43 and standard deviation of 9.35, which is comparable to those found in the current sample of children in the same age range ($M = 48.46$ $SD = 10.08$). Perhaps parents are not noting the executive dysfunction of anxious children or, alternatively, anxious children are not exhibiting EF indicators in their behaviour.

The current finding on the association between Anger, Disruptive Behaviour and parent reported EF is consistent with current literature, which has demonstrated links between cognitive deficits and angry mood, and aggressive and antisocial behaviour (Hughes, White, Shapen, & Dunn, 2010; Rankin, 2007; Schoemaker et al., 2012). While there is minimal literature surrounding the relationship between self-concept and EF, it seems intuitive that children who are struggling with social and academic demands may have relatively lower self-esteem than their more socially and academically competent peers. It is for this reason that interventions aimed at addressing EF deficits is likely to be important for the improvement of a child’s self-concept (Anderson, 1998; Powell & Powell, 2008; Riggs et al., 1996).

In contrast to expectations, there were limited relationships between mood and performance on formal tests of EF. From these results it appears that particular moods of the child may be related to their executive functioning but this may only be apparent when EF is assessed using parent-report. This suggests that again, different assessment tools may be capturing diverse elements of EF and may help explain the differences in findings on the relationship between mood and EF. Alternatively, the EF tests used in the current study were administered in a more controlled setting, and thus may have been insensitive to the
cognitive problems that are assumed to underlie behavioural difficulties as perceived by parents in more naturalistic settings.

The lack of relationship between mood and performance on the formal tests of EF in the current study may have also resulted from the sample including only two children reporting clinical levels of depression. Previous research has shown a link between depression and cognitive functioning (including memory, attention, and processing speed), for example but only in those with clinical levels (Brooks, Iverson, Sherman, & Roberge, 2010). This may indicate that perhaps more severe symptoms of dysphoric mood are required before the relationship to reaction time (as is measured by the HeadMinder subtests) becomes apparent, possibly due to psychomotor retardation or inattention which are often symptoms of clinical depression and have a significant negative effect on reaction time.

Irrespective of this, the hypothesis that a child’s typical emotional state would have an effect on estimates of executive functioning has been partially supported by the current findings. High Self-Concept was related to parent-reported strengths in EF, while high levels of Depression, Anger and Disruptive Behaviour were related to parental reports of various difficulties with EF. Formal tests of EF were not found to be significantly correlated with usual emotional state however, suggesting either good compliance during the testing session or the lack of ecological validity concerning how mood might be affecting these measures in terms of predicting how children in various emotional states might approach tasks in the classroom. Having an estimate of the emotional state of the child at the time of testing would help understand the immediate effects of emotion on EF however including a more precise state measure prior to testing may actually add to the distress of the child.
9.7.2 Mood and SIP.

Again, it was predicted that a child’s typical emotional state would have an effect on their performance on measures of SIP. Significant relationships were found between SIP variables and the Beck Youth Inventories of Self-Concept, and Disruptive Behaviour, both in expected directions. In contrast to expectations, the relationship between the self-reported mood scales of Anxiety, Depression, and Anger and the SIP variables were not significant. On one hand it is encouraging to know that children’s encoding and judgments about social scenarios may be immune to typical emotional state, however it seems unlikely that the tasks involved evoked emotional reactions that may be more likely in naturalistic settings. The current protocol did not make any attempt to elicit strong emotions and the lab setting with a friendly examiner did not create interpersonal stress that might be evoked with peers or adults in real life. Future studies might include a mood induction component to elicit both positive and negative emotional states (e.g., exposure to funny or sad film clips) but the ethical concerns about evoking emotion in children who may be at risk for dysphoric reactions is a realistic barrier to this approach.

There was also no significant association between BYI subscales and facial affect recognition on the NAR subtest. This match to sample task did not appear to be challenging for the children in the current sample so variance in scores was again quite small. Previous research has used the NAR subtest to discriminate children with and without social difficulties (Planche, 2014). Planche (2014) found that children with Autism performed poorer on facial affect recognition than neuro-typical children yet children diagnosed with Aspergers Disorder or High Functioning Autism did not differ in facial affect recognition to neuro-typical children. There have no other reports on the link between emotional state and facial recognition performance.
Modifying the task to eliminate possible ceiling effects in the subclinical population of children may be helpful. Decreasing exposure time, requiring emotion judgments of single faces, or using animated faces presented in a more naturalistic context that increase task complexity may have discriminated children with and without selective encoding problems in the current study. However future studies may require the inclusion of children with more significant social deficits before the NAR subtest is sensitive enough to detect differences that reflect the effects of emotional state or typical mood. The most parsimonious explanation would be that the children in the current sample did not have difficulty encoding the facial features required to match the sample to one of the choices and that differences in emotional state at the time of testing was insufficient to differentially affect performance at a significant level.

Children who ranked themselves higher on Self-Concept were more likely to select a higher number of prescribed cues in hypothetical social scenarios. Children who scored high on Disruptive Behaviour were less likely to endorse pro-social goals and decisions in hypothetical social scenarios. The relationship between Disruptive Behaviour and more aggressive goals and decisions in the SLA measure was expected. In particular, it was expected that children who endorse items that indicate aggressive responses on the BDBI-Y (e.g., “I do mean things”; “I hurt people”; “I like it when people are scared of me”) would also be more willing to endorse similar items on the SLA (e.g., “To hurt the kid”; “Push him/her back”). This relationship provides evidence for convergent validity of the measures and also indicates the validity of the samples’ responses. To the authors’ knowledge, this is also the first report supporting the concurrent validity of the SLA by using a self-report measure assessing typical behaviour.
Research is scarce surrounding the effect of self-concept on SIP in children or adolescents. The research that is available has typically found that poor self-concept, or self-esteem, is negatively related with social competence (Lowe, 2007; Rudolph, Hammen, & Burge, 1995). Children who report lower self-concept appear to have more negative views of their social environments, leading to dysfunctional engagements with others which in turn often lead to negative reactions from peers, continuing the cycle of poor SIP (Rudolph et al., 1995). Research has also begun to show a consistent link between disruptive behaviour and the endorsement of more hostile responding in social interactions (Andrade, 2006; Coyne, 2005; Orobio deCastro, Merk, Koops, Verman, & Bosch, 2005; Pinti, 2003). Similar to the findings of the current study, this research has found that children who are identified as high in anger, negative mood and aggression are more likely to show SIP biases towards negative cue encoding and maladaptive social responding in contrast to their less aggressive peers who were found to focus on more positive or neutral environmental cues and select more pro-social responses in hypothetical social scenarios.

The hypothesis that a child’s self-reported typical emotional state would have an effect on their performance on the assessment of SIP has also been partially supported, with high self-concept being related to an increased selection of Prescribed Cues in social stories. High levels of self-reported Disruptive Behaviour were also related to the endorsement of more aggressive options in both Goal Formation and Decision Making in hypothetical social stories.

9.7.3 Mood and Temperament.
Again, it was predicted that a child’s typical emotional state would be related to parent-reported measures of temperament. Significant relationships were found between temperament factor scores and the BYI inventories of Self-Concept, Depression, Anger and Disruptive Behaviour, all in expected directions. Surprisingly, self-reported Anxiety was unrelated to temperament estimates offered by parents about their children.

It was firstly considered that perhaps the relationship between temperament and the BYI was simply due to both measures asking the same questions. Some items seemed to be assessing similar underlying constructs (BDI-Y: “I feel like crying”; EATQ: “Feels like crying over very little on some days”; TMCQ: “Feels sad frequently”). For the temperament measures, these items load onto the scale of Negative Affect. In the current analyses however, Negative Affect and the BDI-Y subscale were not correlated. There is also some similarity in the assessment of Anger (BANI-Y: “I get angry”; EATQ: “If very angry, might hit someone”; TMCQ: “Gets made when provoked by other children”). For the temperament measures, these items also load onto the scale of Negative Affect. Again however, in the current analyses, Negative Affect and the BANI-Y scores were not correlated. There is also some similarity in the assessment of Anxiety (BAI-Y: “I am afraid I might get hurt”; EATQ: “Would be frightened by the thought of skiing fast down a steep slope”; TMCQ: “Is afraid of fire/is afraid of heights”). For the temperament measures, these items load onto the scale of Surgency. However, here the temperament scales seem to be directly looking at fear as opposed to anxiety in which fear is only one of multiple components of anxiety in the BAI-Y. Furthermore, in the current analyses, Surgency and the BAI-Y are not correlated. The temperament scales do not seem to be assessing self-concept or disruptive behaviour so there was no issue with overlap there. These findings suggest concurrent validity across parent and child reports, yet the coefficients of
association are below the standard required to demonstrate adequate concurrent validity (with .5 being considered the minimum standard).

Children who ranked themselves higher on Self-Concept were more likely to be reported as having higher levels of Effortful Control. Children who ranked themselves higher on Depression and Disruptive Behaviour were more likely to be reported as having lower levels of Effortful Control. Children who scored higher on Disruptive Behaviour were more likely to be reported as having higher levels of Negative Affect and lower levels of Affiliativeness.

Research is rather limited surrounding the relationship between child-reported mood and parent reported temperament. Most research looks at the relationship between mood and temperament as reported by parents and carers (Butcher & Niec, 2005; Duncombe, Havighurst, Holland, & Frankling, 2013; Martel, Gremillions & Roberts, 2012). For example, Butcher & Niec (2005) and Martel et al. (2012) highlighted the association between parent reported disruptive behaviour and high levels of negative affect. Martel et al. (2012) also highlighted the association between disruptive Behaviour and high levels of Surgency. Martel et al. (2012), and Duncombe, Havighurst, Holland & Frankling (2013) also showed that parent-reported disruptive behaviour was related to low levels of Effortful Control; results that provide support to the current findings that suggest that this feature of temperament is related to levels of disruptive behaviour in children. Some research, however, is beginning to look more closely at child reports of behaviour and mood and how these self-reports relate to parent reported temperament. For example, Robins, Donnellan, Lansing, Widaman, & Conger (2010) examined the relationship between child reported self-esteem and child- and parent-reported temperament with results revealing that children who reported higher levels of self-esteem were more likely
to score lower on levels of depression and aggression but higher on levels of effortful control; findings which are consistent with the current study. Finally, the link found between high levels of depression-related symptoms and poor effortful control has also been found throughout the literature with Verstraeten, Vasey, Raes, & Bijttebier (2009) and Muris, Van der Pennen, Sigmond & Mayer (2008) finding that child-reported levels of depression were negatively correlated with self-report and performance-assessed effortful control.

The hypothesis surrounding parent-reported temperament and child-reported mood, that a child’s report about typical feelings and behaviour would be related to ratings of their temperament has also been partially supported. Higher Self-Concept was related to increased levels of Effortful Control as reported by parents while higher levels of child-reported Disruptive Behaviour were related to lower levels of parent-reported Effortful Control and Affiliativeness as well as higher levels of parent-reported Negative Affect. The lack of association between self-reported Anxiety and parent-reported temperament variables is notable, given previous assumptions that anxious children may be perceived as over-controlled. Further, research suggests that the more anxious child is often rated lower on Surgency (Hagekull & Bohlin, 2002) and higher on effortful control (Derryberry & Rothbart, 1997); associations which were not found in the current study.
CHAPTER 10: EXECUTIVE FUNCTION AND SIP

Analyses were also run to determine whether SIP was related to executive functioning (as measured by the BRIEF – GEC(t) and the D-KEFS Tower Task). It was predicted that children who had higher levels of pro-social behaviour (as measured by the SLA subscales of Goal Formation and Decision Making) and performed better on the Affect Recognition subtest of the NEPSY II, would have strengths in EF.

10.1 Correlations among SIP and EF measured by the BRIEF and the D-KEFS Tower Task

The relationship between SIP and EF as measured by the BRIEF – GEC(t) and the D-KEFS Tower Task Total Achievement score was first investigated using Pearson product-moment correlation coefficients.

As the SLA measures are not age standardized, a partial correlation was performed to control for age effects on the SLA scales. As shown in Table 44 below, once age had been controlled for the only significant correlations were found between EF as measured by the D-KEFS Tower Task and the SIP measures of Affect Recognition and Decision Making on the SLA. As EF increased, facial Affect Recognition improved and Decisions in hypothetical social scenarios became more pro-social. In contrast to expectations, the relationship between EF and the remaining variables was not significant.
Table 44

*Correlations between the BRIEF-GEC(t) and Measures of Social Information Processing*

<table>
<thead>
<tr>
<th>Scale</th>
<th>Attributions</th>
<th>Pres. Cue Encoding</th>
<th>Rel_Irrel Cue Enc.</th>
<th>Goal Formation</th>
<th>Decision Making</th>
<th>NEPSY</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Zero</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>BRIEF – GEC(t)</td>
<td>.01</td>
<td>-.11</td>
<td>-.14</td>
<td>-.19</td>
<td>-.10</td>
<td>.02</td>
</tr>
<tr>
<td>Tower Task</td>
<td>-.11</td>
<td>.20</td>
<td>.07</td>
<td>.08</td>
<td>.19</td>
<td>.27**</td>
</tr>
<tr>
<td><strong>Partial (Age)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>BRIEF – GEC(t)</td>
<td>.03</td>
<td>-.11</td>
<td>-.13</td>
<td>-.18</td>
<td>-.08</td>
<td>.01</td>
</tr>
<tr>
<td>Tower Task</td>
<td>-.08</td>
<td>.20*</td>
<td>.09</td>
<td>.13</td>
<td>.24*</td>
<td>.25*</td>
</tr>
</tbody>
</table>

* Correlation is significant at the 0.05 level (two tailed).

**Note.** BRIEF-GEC(t) = Behaviour Rating Inventory of Executive Function – Global Executive Composite, (transformed); Pres. Cue Encoding = Prescribed Cue Encoding; Rel_Irrel. Cue Encoding = Relevant – Irrelevant Cue Encoding.

As an additional exploratory analysis, the HeadMinder, Symbol Search task was examined to see if it related to Cue Encoding on the SLA. It was hypothesized that a fundamental difficulty in scanning, visuo-spatial attention or feature detection may account for performance on both measures, but the Symbol Search Task would eliminate the SIP component.
10.2 Correlations among Cue Encoding on the SLA and the HeadMinder Symbol Search Task

The relationship between the SLA subscales of Cue Encoding (Prescribed, Relevant, and Relevant_Irrelevant) with EF as measured by the HeadMinder subtask of Symbol Search (SS Average Response and SS Number Correct) was first investigated using Pearson product-moment correlation coefficients.

As presented in Table 45 below, the only significant correlation was between the HeadMinder score of Symbol Search Average Response Time (ART) and the SLA measure of Relevant_Irrelevant Cue Encoding. As response time on Symbol Search decreased, Relevant to Irrelevant Cue Encoding increased. That is, a quicker response time was associated with an increase, or improvement, in relevant cue encoding.

Table 45
Correlations between the HeadMinder Subtasks of Symbol Search and Measures of Social Information Processing

<table>
<thead>
<tr>
<th>Scale</th>
<th>Pres. Cue Encoding</th>
<th>Pres. Cue Encoding #</th>
<th>Rel. Cue Encoding</th>
<th>Rel_Irrel Cue Encoding</th>
</tr>
</thead>
<tbody>
<tr>
<td>Zero</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Symbol Search ART</td>
<td>-.16</td>
<td>-.20</td>
<td>-.17</td>
<td>-.23*</td>
</tr>
<tr>
<td>Symbol Search #Correct</td>
<td>-.12</td>
<td>.12</td>
<td>.11</td>
<td>.14</td>
</tr>
<tr>
<td>Partial (Age)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Symbol Search ART</td>
<td>-.20</td>
<td>-.23*</td>
<td>-.19</td>
<td>-.20</td>
</tr>
</tbody>
</table>
As the SLA measures and Symbol Search scores are not age standardized, a partial correlation was performed to control for age. As shown in Table 45 above, the SLA scales of Relevant_Irrelevant Cue Encoding was no longer significantly correlated with Symbol Search speed once age had been controlled for, but a trend still existed. However, the correlation between Symbol Search speed and Prescribed Cue Encoding – Number became significant. As response time quickened, or improved, more prescribed cues were correctly encoded in the hypothetical social stories. It is apparent, however, that the amount of variance accounted for in SLA Cue Encoding by Symbol Search speed is minimal (approximately 5%).

Overall, the initial prediction, that children who had strengths in EF would have higher levels of pro-social behaviour and perform better on Affect Recognition, was partially supported.
CHAPTER 11: OVERALL BEHAVIOUR PROBLEMS

Some children in the current sample were reportedly high in both externalising and
internalising behaviour. It is difficult to ascertain however whether this subset of children
had a different profile of EF than children who were reportedly high in only one behaviour
type. Consequently, Internalising and Externalising standard scores were summed to
provide a measure of overall behavioural problems and exploratory correlational analyses
were then conducted to determine the relationship of overall behaviour to the SIP,
neuropsychological, BYI and temperament scores.

11.1 Correlations among Overall Behaviour Problems, EF, SIP, Temperament, and
Mood

The relationships between overall behaviour problems, EF, SIP, temperament, and
mood were investigated using Pearson product-moment correlation coefficients.

As shown in Table 46 below significant correlations were found between Overall
Behaviour Problems and EF as measured by the BRIEF-GEC(t), the D-KEFS Tower Task,
and the HeadMinder subscale of Animal Decoding Reaction Time. As shown in Table 47,
the only significant correlation found between Overall Behaviour Problems and SIP was
on the SLA subscales of Goal Formation. As shown in Table 48 significant correlations
were found between Overall Behaviour Problems and the Temperament scales of Effortful
Control, Negative Affect, and Affiliativeness. Finally, as shown in Table 49, significant
correlations were found between Overall Behaviour Problems and the BYI scales of Anger
and Disruptive Behaviour.
Table 46

*Correlations between Overall Behaviour Problems and EF*

<table>
<thead>
<tr>
<th></th>
<th>Overall Beh. Problems</th>
</tr>
</thead>
<tbody>
<tr>
<td>Zero</td>
<td></td>
</tr>
<tr>
<td>BRIEF-GEC(t)</td>
<td>.75**</td>
</tr>
<tr>
<td>D-KEFS TT</td>
<td>-.36**</td>
</tr>
<tr>
<td>HM AD RT</td>
<td>.41**</td>
</tr>
<tr>
<td>HM Cue Benefit</td>
<td>.09</td>
</tr>
</tbody>
</table>

** Correlation is significant at the 0.01 level (two tailed).

*Note.* BRIEF-GEC(t) = Behaviour Rating Inventory of Executive Function – Global Executive Composite, (transformed); D-KEFS TT = D-KEFS Tower Task; AD RT = Animal Decoding Response Time; Cue Benefit = (RT-CRT/RT+CRT*100).

Table 47

*Zero Order and Age-based Partial Correlations between Overall Behaviour Problems and measures of SIP*

<table>
<thead>
<tr>
<th></th>
<th>Overall Beh. Problems</th>
</tr>
</thead>
<tbody>
<tr>
<td>Zero</td>
<td></td>
</tr>
<tr>
<td>NEPSY Affect Recognition</td>
<td>-.08</td>
</tr>
</tbody>
</table>

*Partial (Age)*

<table>
<thead>
<tr>
<th></th>
<th>Overall Beh. Problems</th>
</tr>
</thead>
<tbody>
<tr>
<td>SLA - Attributions</td>
<td>-.01</td>
</tr>
<tr>
<td>SLA - Cue Encoding</td>
<td>-.17</td>
</tr>
</tbody>
</table>
Table 48

*Correlations between Overall Behaviour Problems and Temperament*

<table>
<thead>
<tr>
<th>Overall Beh. Problems</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Partial (Age)</strong></td>
<td></td>
</tr>
<tr>
<td>Effortful Control</td>
<td>-.62**</td>
</tr>
<tr>
<td>Negative Affect</td>
<td>.63**</td>
</tr>
<tr>
<td>Surgency</td>
<td>-.08</td>
</tr>
<tr>
<td>Affiliativeness</td>
<td>-.27**</td>
</tr>
</tbody>
</table>

**Correlation is significant at the 0.01 level (two tailed).**

Table 49

*Correlations between Overall Behaviour Problems and the BYI*

<table>
<thead>
<tr>
<th>Overall Beh. Problems</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Zero</strong></td>
<td></td>
</tr>
<tr>
<td>BYI – Self concept</td>
<td>-.20</td>
</tr>
</tbody>
</table>

*Correlation is significant at the 0.05 level (two tailed).* 

Note. SLA = Skill Level Activity.
<table>
<thead>
<tr>
<th>Measure</th>
<th>Correlation</th>
</tr>
</thead>
<tbody>
<tr>
<td>BYI – Anxiety</td>
<td>.04</td>
</tr>
<tr>
<td>BYI – Depression</td>
<td>.14</td>
</tr>
<tr>
<td>BYI – Anger</td>
<td>.20*</td>
</tr>
<tr>
<td>BYI – Dis. Beh.</td>
<td>.40**</td>
</tr>
</tbody>
</table>

* Correlation is significant at the 0.05 level (two tailed).

* Correlation is significant at the 0.05 level (two tailed).

**Note.** BYI = Beck Youth Inventory; Dis Beh = Disruptive Behaviour.

As expected, children who were reported to engage in higher levels of both internalising and externalising problem behaviours were also more likely to have difficulties with areas of EF, SIP, Temperament, and Mood.
CHAPTER 12: TEST-RETEST RELIABILITY

12.1 Test-Retest Correlations for Measures of Behavioural Difficulties

To evaluate the stability of the constructs assessed in the study, a subsample of children and their parents agreed to be assessed twice using the same battery. The average time between assessments was 14.1 months \((SD = 3.1)\). The follow up sample consisted of 22 children, aged between 7 and 13 years \((M = 9.9, SD = 1.7)\), predominantly coming from grade 3 through to grade 7 (96%) with females slightly outnumbering males (Females = 68%).

Assumption testing revealed no serious violations to normality, linearity, and homoscedasticity for any variable in the test-retest subsample. The relationship between age and internalizing and externalizing behaviour scores, at both time 1 and time 2 for the subsample, were not significant. A significant correlation was found between internalizing behaviour at time 1 and internalizing behaviour at time 2 \((r = .78, p < .001)\). In addition, a significant correlation was found between externalizing behaviour at time 1 and externalizing behaviour at time 2 \((r = .69, p = .002)\). These findings indicate stability of the CBCL subscales that is consistent with previously reported findings (Achenbach & Rescorla, 2001; Carlson, Geisinger, & Jonson, 2014).

12.2 Test-Retest Correlations for the Measures of EF, Temperament, and Mood

The consistency over time of the constructs of EF, Temperament, and Mood was also examined. As there are no parallel forms, the exact same versions of the SLA measures were used each time so consistency across sessions was expected to be enhanced due to
retained familiarity with the materials. All children were expected to benefit from practice on the Tower Task and the HeadMinder subtests, as prior reports indicated that EF improves as novelty decreases. The test-retest stability of the constructs was investigated using Pearson product-moment correlation coefficients. Age was again included as a covariate when appropriate.

The relationships between age and EF (as measured by the BRIEF-GEC(t) and the D-KEFS Tower Task), at both time 1 and time 2, were not significant. As shown below in Table 46, a significant correlation was found between parent reported scores on the BRIEF-GEC(t) \( (r = .80, p < .001) \), which is consistent with reports of test-retest reliability in normative samples (Gioia et al., 2000). As shown in Table 47 below, test-retest reliability was moderate to high for the BRIEF clinical subscales of Emotional Control \( (r = .65, p = .001) \), Shifting \( (r = .54, p = .009) \) and Inhibition \( (r = .78, p < .001) \) but poor test-retest reliability was found for the D-KEFS Tower Task process variables.

A significant correlation was also found between reaction time performance on the HeadMinder subtask of Animal Decoding \( (r = .43, p = .046) \). However once age was controlled, and due to the HeadMinder program not being standardised, this correlation was no longer significant \( (r = .38, p = .090) \). Independent of whether age was included as a covariate, the stability of the Animal Decoding subtest scores was below acceptable levels \( (r > .60) \) but consistent with prior reports of tests in children not remaining stable when test-retest intervals exceed 3 weeks. As shown below in Table 46, the stability coefficient for the derived HeadMinder subtest score of Relevant_Irrelevant \( (r = -.05, p = .846) \) was not significant and indicated poor test-retest reliability, even when these tests were administered in a consistently controlled quiet environment. However, this was the first attempt to demonstrate the reliability of the Relevant_Irrelevant variable in children in a
lab setting. Also shown below in Table 46, the stability coefficient for the D-KEFS Tower Task \((r = -0.29, p = 0.189)\) was not significant, indicating poor construct stability. These findings are highly inconsistent with previous reports regarding the stability of performance on the Tower Task TAS \((r = 0.44; \text{Delis et al., 2001})\) when assessed over 25 days.

Table 50

*Correlations between Measures of EF from Time 1 to Time 2, after controlling for age on the HeadMinder subtests*

<table>
<thead>
<tr>
<th>Scale</th>
<th>BRIEF GEC Time 1</th>
<th>Tower Task Time 1</th>
<th>AD RT Time 1</th>
<th>CRT/RT Time 1</th>
</tr>
</thead>
<tbody>
<tr>
<td>BRIEF GEC</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Time 2</td>
<td>.795**</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tower Task</td>
<td></td>
<td></td>
<td>-.291</td>
<td></td>
</tr>
<tr>
<td>Time 2</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>AD RT(t)</td>
<td></td>
<td></td>
<td>.386</td>
<td>-.045</td>
</tr>
<tr>
<td>Time 2</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cue Benefit</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Time 2</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

** Correlation is significant at the 0.01 level (two tailed)

*Note. AD = Animal Decoding; BRIEF GEC(t) = Behaviour Regulation of Executive Function - Global Executive Composite(transformed); Cue Benefit = (RT-CRT/RT+CRT*100)
Table 51

*Zero Order Correlations between BRIEF and Tower Test Subscales from Time 1 to Time 2*

<table>
<thead>
<tr>
<th>Scale</th>
<th>Emotional Control Time 1</th>
<th>Inhibition Time 1</th>
<th>Shifting Time 1</th>
<th>TT Move Accuracy Time 1</th>
<th>TT Rule Violations Time 1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Emotional Control</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Control Time 2</td>
<td>.646**</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Inhibition Time 2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>.777**</td>
</tr>
<tr>
<td>Shifting Time 2</td>
<td></td>
<td></td>
<td></td>
<td>-.045</td>
<td>.541**</td>
</tr>
<tr>
<td>TT Move Accuracy Time 2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>TT Rule Violations Time 2</td>
<td></td>
<td></td>
<td></td>
<td>.144</td>
<td></td>
</tr>
</tbody>
</table>

** Correlation is significant at the 0.01 level (two tailed)

*Note.* TT = Tower Task

There was a significant relationship between age and performance on the SIP subscale of Prescribed Cue Encoding at time 1 \( (r = .43, p = .047) \) and time 2 \( (r = .56, p = .007) \) suggesting that age was correlated with test scores at both points in time for the subsample included in the test-retest analyses. A significant correlation was also found between performance on the SIP subscale of Cue Encoding \( (r = .48, p = .024) \). However, as shown below in Table 48, once age was controlled, and due to the SLA not being standardised, this correlation was no longer significant \( (r = .33, p = .149) \). A significant correlation was found between performance on the SIP subscale of Goal Formation \( (r = .73, p < .001) \) and between performance on the SIP subscale of Decision Making \( (r = .45, p = .039) \), even
after controlling for age. Again, although statistically significant these stability coefficients are below expectations for measures of cognitive ability or personality when compared to the typical reports of test-retest reliability over 3 weeks. Lastly, a significant correlation was found between performance on the NAR ($r = .60$, $p = .003$). No significant test-retest relationship was found for performance on the SIP subscale scores for Attribution over time.

Table 52

*Correlations between the Subscales of SIP from Time 1 to Time 2, after Controlling for Age on the SLA*

<table>
<thead>
<tr>
<th>Scale</th>
<th>NEPSY Time 1</th>
<th>SLA Att. Time 1</th>
<th>SLA Cue enc. Time 1</th>
<th>SLA Goal Time 1</th>
<th>SLA Dec Time 1</th>
</tr>
</thead>
<tbody>
<tr>
<td>NEPSY Time 2</td>
<td>.597**</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SLA Att.</td>
<td></td>
<td>.339</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Time 2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SLA Cue Enc.</td>
<td></td>
<td></td>
<td>.327</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Time 2</td>
<td></td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>SLA Goal</td>
<td></td>
<td></td>
<td></td>
<td>.725**</td>
<td></td>
</tr>
<tr>
<td>Time 2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SLA Dec.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>.452*</td>
</tr>
<tr>
<td>Time 2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

** Correlation is significant at the 0.01 level (two tailed)

* Correlation is significant at the 0.05 level (two tailed)

Note. Att = Attributions; Enc = Encoding; Goal = Goal Formation; Dec = Decision Making
These results suggest that performances on the SIP measures of Affect Recognition, Goal Formation, and Decision Making at time 1 are associated with similar performance at time 2. This is consistent with reports by the NEPSY II authors who indicated test-retest estimates to range from .50 to .58 for children aged 7 to 13 years (Korkman et al., 2007). Test-retest reliability estimates are unavailable for the SLA, however, performance on Attributions and Cue Encoding were not found to be consistent in the current sample, which suggests different developmental trajectories across children, or that some children benefited or changed due to practice while others did not. Using a different set of SLA scenarios that were designed to be effective alternative forms would be a more traditional test-retest approach, but it is likely that stability coefficients would have even been lower in that circumstance.

In some ways it may be encouraging to consider that children can change their social information processing even over a period of 6-12 months, assuming that the changes are in the pro-social direction. In general, however, scores did not improve significantly toward more socially competent responding, with endorsement of hostile attributions from time 1 ($M = .52, SD = .17$) being similar at time 2 ($M = .51, SD = .21$), and increases in the selection of prescribed cues from time 1 ($M = .44, SD = .14$) also being similar to time 2 ($M = .48, SD = .13$). The fact that Cue Encoding and Attributions were not consistent across time but Goal Formation and Decision Making were relatively stable may also mean that response style was actually related to other factors such as the tendency for children to offer socially acceptable answers independent of what they saw or thought.

The relationships between age and Temperament, at both time 1 and time 2, were not significant. As shown below in Table 49, after controlling for age, a significant correlation was found between parent-reported scores on the Temperament subscale of Effortful
Executive Function & Problem Behaviour

Control ($r = .81, p = <.001$). A significant correlation was also found between parent-reported scores on the Temperament subscale of Negative Affect at time 1 with scores on Negative Affect at time 2 ($r = .61, p = .001$). Correlations between parent-reported scores on the Temperament subscales of Affiliativeness and Surgency at time 1 to scores on Affiliativeness and Surgency at time 2 were not significant.

Table 53

*Correlations between the Factors of Temperament from Time 1 to Time 2, after Controlling for Age*

<table>
<thead>
<tr>
<th>Scale</th>
<th>Effortful Control Time 1</th>
<th>Negative Affect Time 1</th>
<th>Affiliativeness Time 1</th>
<th>Surgency Time 1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Effortful Control Time 2</td>
<td>.81**</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Negative Affect Time 2</td>
<td>.607**</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Affiliativeness Time 2</td>
<td>.249</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Surgency Time 2</td>
<td>.412</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

** Correlation is significant at the 0.01 level (two tailed)

The relationships between age and mood (as measured by the subscales of the BYI), at both time 1 and time 2, were not significant. As shown below in Table 50, a significant test-retest correlation was found for child reported scores on the subscales of Anxiety ($r = .69, p = <.001$), Depression ($r = .49, p = .021$) and Anger ($r = .69, p = <.001$). These
findings are only slightly below previous reports regarding the test-retest reliability of the BYI over one week as reported by their authors (Beck et al., 2005). No significant test-retest relationships were found for the subscales of Self-Concept or Disruptive Behaviour.

Table 54

Zero Order Correlations between the Subscales of the BYI from Time 1 to Time 2

<table>
<thead>
<tr>
<th>Scale</th>
<th>Self-Concept Time 1</th>
<th>Anxiety Time 1</th>
<th>Depression Time 1</th>
<th>Anger Time 1</th>
<th>DB Time 1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Self-Concept</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Time 2</td>
<td>.283</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Anxiety</td>
<td></td>
<td>.693**</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Time 2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Depression</td>
<td></td>
<td></td>
<td>.488*</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Time 2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Anger</td>
<td></td>
<td></td>
<td></td>
<td>.685**</td>
<td></td>
</tr>
<tr>
<td>Time 2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>DB</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>.318</td>
</tr>
<tr>
<td>Time 2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

** Correlation is significant at the 0.01 level (two tailed)

* Correlation is significant at the 0.05 level (two tailed)

Note. DB = Disruptive Behaviour
12.3 Discussion: Test-Retest Reliability

In regards to the classification of problem behaviours as either internalizing or externalizing as reported by parents on the CBCL, test-retest data showed consistent identification of children as being high in internalising or externalising behaviour from time 1 to time 2. The consistency data from the current study is slightly below the test-retest data provided by the authors of the CBCL, with reports of consistency ranging from .78 to .97 for the problem behaviour scales at a one week interval. However, the difference in time between test and retest data collection in the current study to that of the author’s reports may have influenced the slightly lower coefficients in the current study.

In regards to the reliability of the current study’s measures of EF, SIP, temperament, and mood, most scales were found to have moderate to high consistency from time 1 to time 2. Parent-reported EF, as assessed by the BRIEF-GEC(t), was found to be highly stable over time ($r = .80, p = <.001$). This is similar to the test-retest data provided by the authors of the BRIEF with the GEC reported to have a reliability coefficient of .86. Construct stability was moderate to high for the clinical subscales of Emotional Control, Shifting, and Inhibition. However, this is slightly lower than the mean test-retest correlation for the clinical subscales as reported by the authors of these measures which were found to be .81 (range = .76 - .85). None of the other tests of EF, including the D-KEFS Tower Task or the subtasks of the HeadMinder program, were found to have significant test-retest reliability. The lack of consistency in performance on these measures may be due, in part, to the expected improvement in EF across developmental age and individual differences in this developmental or learning effect. Differential practice effects and retained familiarity with the tasks and the assessment process as a whole may have also contributed to the lack of consistency in scores. These findings suggest that the
stability of EF, when measured by neuropsychological tests, is questionable if the measures are used to track the effects of treatment, training, or injury recovery while parent-report may be more reliable and therefore potentially more valid.

Performance on the NAR scale was found to be stable from time 1 to time 2. This is a similar reliability value as provided by the authors, with the NAR scale reported to range from .67 - .87 across all age groups, and slightly better than the reports for children aged 7 to 13 years, with estimates reported to range from .50 to .58 (Korkman et al., 2007) over a mean test-retest interval of 21 days.

Performances on the SLA subscales of Goal Formation and Decision Making were also found to be stable from time 1 to time 2, even after controlling for age. However, it is to be noted that the SLA authors have not provided test-retest data to which the current findings might be compared. Performance on the remaining measures of SIP, being the Attribution and Cue Encoding subscales of the SLA, were not found to be stable in relation to the extended test-retest period included in the current study. Again, it may be that task familiarity differentially improved performance on the SLA, leading to inconsistent relative scores across time, or that these two aspects of SIP are the most unstable and subject to other factors (e.g., mood), while Goal Formation and Decision Making tap into a more enduring component of information processing.

Temperament was found to be highly stable from time 1 to time 2, even after controlling for age. These scores are only slightly below those coefficients provided by the authors of the EATQ and the TMCQ, with test-retest reliability data reported to range from .65 to .90 for all subscales. However, Affiliativeness and Surgency were inconsistent across time, based on parent reports. Similarly to SIP, it is possible that different aspects of temperament are more stable across time than others, with negative affect and effortful
control more consistent over time than Affiliativeness and Surgency which are more dependent on environmental factors and contexts to which the child was exposed during the period over which the parent observed their child’s behaviour. These findings suggest that Temperament, presumably a stable, trait-like construct, may in fact be malleable or variable depending on circumstances. This is consistent with work that challenges the construct of “personality” as a characteristic of someone that reportedly starts in childhood temperament and is supposedly consistent across time and situations (Novosad & Thoman, 1999; Thompson, Winer & Goodvin, 2011).

Finally, self-reported Anxiety, Depression, and Anger on the BYI were found to be highly stable from time 1 to time 2. These reliability values for the BYI scales are slightly below that provided by the authors with reports of coefficients ranging from .74 to .93 across ages 7-14 years over a seven day period. However, self-reported Self-concept and Disruptive Behaviour were not stable over time. It is again theorized, that similarly to SIP and temperament, it may be that anxiety, depression and anger are more stable attributes while self-concept and disruptive behaviour may be more transitory.

As the above discussion demonstrates, some of the constructs assessed in this study had moderate to high stability while others were highly unstable over 6-12 months in our paediatric sample. These results are therefore often times not as robust as the test-retest data provided by the authors of each measure, but the longer test-retest interval best explains these differences. Such discrepancies do highlight again the importance of interpreting paediatric test scores conservatively and recognising that their predictive validity may be poor given their low test-retest reliability or due to the instability of constructs in question. The relatively small sample size of the current study may be partially responsible for the lower reliability coefficients or it may be that many of the
underlying constructs assessed in this study are not stable. For example, children are expected to improve in EF as they age but it is reasonable that children develop EF skills at different rates. Further, children’s view of their typical mood is likely to change from one month to the next so their ranking relative to the others in the sample can also change. Overall, it may be more useful to track children by using individual item responses rather than normative data when trying to understand the effects of treatment or the effects of life events in children.
CHAPTER 13: GENERAL DISCUSSION

The central goal of this research was to investigate whether the behavioural problems of children can be explained by deficits in executive functioning. More specifically, it was hypothesized that divergent cognitive profiles, especially concerning the executive functions of SIP and self-regulation, may help explain the behavioural differences between children who externalize their behaviour to those who internalize their behaviour. It is believed that through a better understanding of the risk factors surrounding the development of childhood psychopathologies, including profiles of EF deficits subserving specific behavioural profiles of children, corresponding to either internalising or externalising behaviours, more effective remedial program development and implementation can occur (Biederman et al., 2001; Haskett & Willoughby, 2006).

13.1 Factors which Predict Behaviour

The figures below have been created to illustrate the similarities and differences in the cognitive profiles of children that correlate with scores on the internalising and externalising CBCL subscales. As shown below in Figure 30, there are a number of similarities between the behavioural types. Firstly, children who were identified by parents as being high in internalizing or externalizing behaviour were equally likely to also be reported by parents as having difficulties with the EF of emotional control; consistent with extant literature, both behaviour types were likely to have difficulties with regulating and controlling their emotional responses (Eisenberg et al., 1995; Eisenberg et al., 2000a; Eisenberg et al., 2001; Eisenberg et al., 2003). Further, those scoring higher on either CBCL subscales also employed a relatively slow approach in completing the Tower Task.
which is a relatively novel finding. Finally, children reportedly high on internalizing or externalising behaviour were equally likely to also be reported by parents as having issues with the temperamental factor of negative affect; consistent with extant literature, both behavioural types were likely to have an increased risk of aggression, frustration, and depression-related symptoms (Eisenberg et al., 2005; Muris, Meesters, & Blijlevens, 2007). Consistent with the proposed model outlined in Chapter 1 of the biopsychosocial factors influencing child behaviour, being temperamentally predisposed to experiencing more negative affect and difficulty regulating these emotional reactions, may give rise to tendencies to engage in both internalizing and externalizing problematic behaviour. These behaviours may be more likely to lead to even more social cues that provoke negative attributions and affect.

*Figure 30.* The factors which make significant contributions to both, internalizing and externalizing behaviour: executive dysfunctions in emotional control and increased time.
per move ratio on the D-KEFS Tower Task; and the temperamental factor of more negative affect.

As shown below in Figures 31 and 32, there were also a number of differences between those who were ranked as high on internalising versus externalising problem behaviours and as discussed in detail in chapters 5 through 11, were again consistent with extant literature.

Firstly, children ranked as high on internalizing behaviour were more also likely to be reported by parents as having difficulties with the EF of cognitive shifting and alternating attention, adapting to change and moving between activities (Barkley, 2010; Ghassabian et al., 2014), while children ranked as high on externalizing behaviour were also more likely to be reported by parents as having difficulties with the EF of behavioural inhibition, controlling their impulses and refraining from engaging in socially inappropriate behaviour, issues that may also be used to define them as externalisers (Barkley, 2010; Biederman et al., 2001; Bohlin, Eninger, Brocki, & Thorell, 2012; Young et al., 2009).

Children identified as being high in externalizing behaviour were also more often reported by parents as being high in Surgency but low in Affiliativeness (Berden, Keane, & Calkins, 2008; Gartstein, Putnam, & Rothbart, 2012) and Effortful Control (Eisenberg et al., 2001; Eisenberg et al., 2005; Olson, Sameroff, Kerr, Lopez, & Wellman, 2005); they appeared to be motivated to approach their environment, but seemed to lack the desire to engage with others and the ability to attend to environmental stimuli and activate or inhibit behaviour as required by their social situation.
Finally, children high in internalizing behaviour were more likely to endorse pro-social decisions in social situations (Rose & Asher, 1999; Wichmann et al., 2004), possibly due to hypervigilance regarding adherence to social rules, while children high in externalizing behaviour were more likely to endorse aggressive goals in the same scenarios (Burgess et al., 2006; Crick & Ladd, 1990; Dodge & Schwartz, 1997; Quiggle et al., 1992). As outlined in the introductory chapter and depicted in Figure 1, these differences in SIP and self-regulation both influence the child’s social environment and are, in turn, influenced by the child’s social environment; thus reflecting as well as perpetuating either an internalizing or externalizing behaviour type.
**Figure 31.** The factors which make significant contributions to internalizing behaviour: executive dysfunctions in emotional control, cognitive shifting, and time per move ratio on the Tower Task; the temperamental factor of more negative affect and the SIP component of more reported pro-social decision making.

**Figure 32.** The factors which make significant contributions to externalizing behaviour: executive dysfunctions in Emotional Control, behavioural Inhibition, increased Time per Move Ratio and Rule Violations on the Tower Task; the temperamental factors of more Negative Affect, Affiliativeness, Surgency and poor Effortful Control, and the SIP deficit of aggressive Goal formation.
Overall, the research hypotheses have been partially supported with both similarities and differences found in the cognitive profiles of internalizing and externalizing behaviour types. Due to the vital role of social competence in the prevention of numerous developmental psychopathologies (e.g., depression: Muris, Pennen, Sigmond, & Mayer, 2008; anxiety: Affrunti & Woodruff-Borden, 2013; Ursache & Raver, 2014; aggressive behaviour: Fraser et al., 2005), these findings have implications for the importance of assessing executive function in the development and implementation of early interventions. Although this is one of the first studies to examine these relationships, these profiles may help shape the development and implementation of effective remediation programs for children with problem behaviours. How well they assist in these roles will require further investigation in terms of intervention studies based on similar assessments.

13.2 Limitations and Future Research

A number of limitations need to be noted regarding the current study. These will now be discussed, along with recommendations for future research.

Perhaps the most critical limitation of this research was sample size. While sample size met recommended guidelines for significance tests of multiple R, significance tests were slightly underpowered for individual predictors (Tabachnick & Fidell, 2007) and analyses should therefore be interpreted with caution. The recruitment of children in the Mid North Coast proved difficult with schools in the public sector unable to assist. While sufficient numbers of participants were able to be recruited for the ‘control’ sample it was difficult to recruit participants who were identified by parents, or teachers as engaging in challenging behaviours (see Chapter 5 on Process Variables for more detail). In this
respect it appeared that parents, teachers, and schools were somewhat reticent to identify a child in terms of what may have been perceived as negative labelling. This is a sampling issue that is likely to persist in relation to future research, and will therefore require a specific sampling strategy for ongoing research in this area.

In addition, the current sample excluded children who had been diagnosed with clinical disorders (e.g. ADHD, ASD, Intellectual Disabilities etc.). While this was done to eliminate the confounding effects that these clinical samples would have had on the study’s results, it also means that the research findings may not generalise to children with such diagnoses, despite overlap with internalising and externalising problem behaviours. Follow-up studies which include a clinical sample are recommended to determine if similar cognitive profiles of EF are found in children with possibly more extreme internalising and externalising problem behaviours that lead to associated clinical diagnoses.

An associated limitation may be that internalising and externalising behaviour was assessed on a continuum, as opposed to using dichotomous constructs as they are often referred to in the literature (Achenbach & Rescorla, 2001; Eisenberg et al., 2001). It was believed that viewing the behaviours in a more discrete way, as separate constructs, would have disregarded valuable information about the child’s behavioural patterns. However, using a continuum approach was also problematic as children can be reported as engaging in both types of challenging behaviours. This type of multiple classification happened occasionally in the current study, with a subset of the sample being identified as engaging in both internalising and externalising behaviours as reported by parents on the CBCL ($r = .55, p = .01$). However, this is not an uncommon occurrence in research looking at behavioural problems, with both clinical and non-clinical populations often recruiting
participants with co-morbid conditions (Angold, Costello & Erkanli, 1999; Bubier & Drabick, 2009; Ferro & Klein, 1997), and such co-morbidity may be due to symptom overlap in diagnostic categories (Bubier & Drabick, 2009). In the current research, a number of questionnaires were found to have similar items that were endorsed for both behavioural types. This has been addressed throughout the discussion chapters (see Chapters 6, 8 and 9) and was taken into consideration in the interpretation of the data. However, it may also be that a subset of children identified with problem behaviours do engage in both internalising and externalising behaviours, due to some unique underlying cognitive profile or the specific social circumstances they face. As predicted, this study did find that children who were reportedly high on Internalising or Externalising Behaviour shared many similarities in EF deficits, including emotional control. However, differences were also found; including those children reportedly high on internalising behaviour experiencing more problems with cognitive shifting while those children reportedly high on externalising behaviour experiencing more problems with inhibition. It may be that while some EF deficits underlie both types of behaviour problems, specific differences influence their outward expression. To examine the effects for children who may have been elevated on both CBCL subscales, exploratory correlational analyses were conducted using a sum of the Internalising and Externalising standard scores as an overall index of behaviour problems, and its relations to the SIP, neuropsychological, BYI and temperament scores.

Overall, there was little significantly different to report beyond what was already uncovered about relationships among social information processing, mood, temperament and parent reports on behaviour when the subscales were examined individually. It is worth further investigation to determine whether some children with problematic
behaviour actually shift their style of cue encoding, cognitions and responses depending on
the situation. This may actually be adaptive and have implications for understanding
individual differences in EF. Those rigidly adhering to one approach, internalising or
externalising, as opposed to being rated as exhibiting both types of behaviour, may
actually be exhibiting an incapacity to shift. In the current study, those who scored higher
on Internalising were rated more often as also having problems with shifting attention or
behaviour as required. Although beyond the scope of the current project, it would be
helpful to know if those high on internalising and externalising actually had fewer
problems with shifting their mental set and behaviour than those high on internalising
alone.

It is therefore recommended that future research look into whether differences exist in
the executive functions of children who are identified as engaging in one type of behaviour
problem to those who are identified as engaging in both internalising and externalising
problem behaviours. If differences do exist, then an additional intervention strategy may
be needed to effectively remEDIATE the underlying deficits in EF unique to the subset of
children with co-morbid challenging behaviour. For example, helping the child and his
parents or teachers understand when maladaptive behaviours of either type are more likely
to occur and plan ahead with appropriate coping strategies. This metacognitive process of
considering the demands of various situations and adjusting one’s behaviour accordingly is
in itself an important executive function.

A second limitation of the current study concerns the multifaceted nature and
inconsistent definitions of constructs important to this thesis. For example, emotion
regulation involves diverse systems, including physiological arousal, behavioural
expression, and cognitive evaluations. Consequently, definitions and subsequent
assessment methods vary throughout the literature and make interpretation of findings difficult. Despite this limitation, the use of a multi-method approach in the assessment of emotion regulation in the normative and ‘at risk’ samples helps to provide a more complete understanding of emotion regulation processes in children and overcomes the gap in the current research literature which predominantly relies on a single method of assessing emotional regulation in children (Adrian et al., 2011).

An additional problem with complex definitions involves the distinction in aggressive behaviour; specifically between reactive and proactive aggression (Vitaro, Brendgen, & Tremblay, 2002). Differences in reactive and proactive aggression were not the focus of the current study. However, research has suggested that these two forms of aggression can be distinguished by unique SIP deficits (Crick & Dodge, 1994). Crick and Dodge (1994) found that children who exhibit reactive aggression have difficulty shifting their attention away from negative cues and also demonstrate a bias toward making negative or hostile attributions in ambiguous social situations. On the other hand, Crick and Dodge (1994) found that children who exhibit proactive aggression are more likely to value inappropriate responses, i.e. aggression or withdrawal, and anticipate a positive result from such a response. While it wasn’t the focus of the current study to look at the different types of aggression that children identified as externalising may have been engaging in, it would be interesting to include such a distinction in future research. It is therefore recommended that future research look at whether differences in EF exist between children identified with externalising problem behaviours who engage in distinct forms of aggression. Additional items could be included on the SLA so that opportunities for aggressive responses that are either reactive or proactive might be elicited. This future distinction may again lead to more informed intervention strategies.
For reasons related to the aim of offering a comprehensive paediatric assessment, the current study also included indices of EF that were limited in range and may have affected the results. As mentioned in Chapter 6, many EF deficits may not be picked up by neuropsychological measures employed in a laboratory setting. It is proposed that this could be due to the possibility of children using compensatory resources in more controlled settings, which may then be inaccessible once confronted with the array of additional distractions in the real world. This was an issue considered in the current study, with the D-KEFS Tower Task and the HeadMinder subtests offering minimal discriminant validity in predicting behaviour while the BRIEF explained a significant amount of variance for both internalising and externalising problem behaviours. It is recommended that additional research include more naturalistic measures, such as in situ observation, to more accurately identify the complete array of strengths and weaknesses in EF underlying the behavioural problems of children as they interact socially within their natural environments.

It is unclear whether a more comprehensive neuropsychological testing battery in subclinical samples, which would admittedly be more demanding for the children and possibly require two testing sessions, would have led to greater understanding of specific EF impairments than the questionnaires used in the current study. More specific computerized tests of EF, possibly using “pure” tests of cognitive switching, inhibition and working memory updating that have been used in recent studies of links between EF and socioeconomic risk factors (Miyake et al., 2000), might be a more efficient approach. Whether young children can cope with the demands of these tests from cognitive science research (cf. Baron, 2004) so that early detection of EF deficits can be detected remains to be tested. However, the ability to more precisely identify specific EF impairments in
relation to behaviour is viewed as crucial to the advancement of diagnostic understanding and efficacy in the area of early intervention, and therefore further research concerning this aspect of testing appears worthy of investigation.

Another measurement issue surrounds the inconsistency in the measure of temperament with different versions of the temperament questionnaires used depending on the age of the participant (the TMCQ was used for children aged 7-9 years and the EATQ was used for children aged 10-13 years). Nevertheless, it is believed that it was important to use these age specific temperament questionnaires, due to the extensive research already available on their previous use as well as the item relevance of each questionnaire between the age groups. Using z scores for correlational analyses helped address possible differences between scales, as this allowed the child to be ranked relative to others also assessed using the same age-appropriate measure.

A second consideration was that self-report methods, such as the BYI used in this research study, are limited by the inherent expectations that a child is not only aware of their emotions but can accurately identify and communicate those emotions. Although very important that an attempt was made to include the child’s perspective on their self-concept and dysphoric moods and disruptive behaviour, it is also important to note that items in the BYI may have been interpreted differently between children. For example participants often differed in their interpretation of the word “exploding” with some children interpreting it as being very angry while others interpreted this concept as becoming overwhelmed by too much external pressure (e.g. school expectations, parental demands) which technically might mean “imploding”. Based on examiner judgment, it seemed that differences here were related to age, with younger children adhering to the anger interpretation and older children adhering to an interpretation of external pressure.
This in itself may be a developmentally appropriate distinction as older children may be more sensitive to the effects of parents trying to exert control but may still indicate a need to clarify some items in order to understand how scores compare across age groups. Despite these possible limitations, self-report methodologies have been found to be an effective assessment tool with children and adolescents, and allow for the acquisition of important information that only the child is aware of, such as physiological arousal and cognitive processes. Furthermore, the current sample was at a developmental stage whereby the limitations of self-report should be minimal (Adrian et al., 2011).

Another measurement issue was in regards to the use of the SLA to assess SIP. While the SLA included both a vignette and visual stimuli to improve child engagement with the scenario, the process was basic in contrast to the complexity of a true social situation. The hypothetical social story may not have been emotionally salient to some children and may have therefore reduced the likelihood of realistic cue encoding, responses about attributions, goal formation, and decision making. This potentially affected the accuracy of results in that children may not have been able to place themselves into the scenario well enough to respond accurately. Furthermore, the child had as much time as they needed to reflect on and respond to each of the SIP questions. In reality, SIP may be much more instantaneous with little time for extensive reflection. Although some differences were found across children, this may have also reduced the ecological validity of the child’s responding as they spent additional time working through their responses, possibly reporting those that were most socially desirable. The addition of an observational methodology to observe the real life use of coping strategies and emotional responses in social situations may improve the identification of actual behaviours employed by children.
in challenging and complex social scenarios (Dodge & Coie, 1987; Dodge & Price, 1994; Hubbard, Dodge, Cillessen, Coie, & Schwartz, 2001).

There were also issues in the interpretation of the SLA. Even when children seemed to respond with obvious insight and self-reflection, it was still difficult for the researchers to accurately interpret the data. For example, the cue encoding task of the SLA was very ambiguous. Encoding is believed to be a rather automatic process so the use of self-report measures may not be accurate in objectively assessing what the child is attending to (Horsley, et al., 2010). What was deemed as relevant or irrelevant in the SLA, by standard scoring instructions (Fraser, 2008), was subjective, and depended to some degree on examiner beliefs. These issues with the cue encoding component of the SLA could be overcome by using an eye tracking strategy to collect the cue encoding data, where the child is objectively assessed as to where they look on the picture. Such an approach would help control for the more subjective current response strategy, which may be influenced by factors such as cognitive bias (see Horsley, et al., 2010). Noting differences between eye-tracking based data and self-report would also expose the possible effects of social desirability or oppositional behaviour, additional aspects of research considered important to the current investigation.

Another consideration given to the interpretation of the SLA concerned the transparency of responses. As alluded to earlier, on reflection of the options available to children in the SLA measure, it is probable that it was easy to pick the most socially accepted response (e.g. “Hit Lee on the head” versus “Say, I’ll go find another seat and will talk to you later”) and this may have been driving participant response style rather than their own beliefs on what they would do in each social situation. In an attempt to avoid the potential problem of socially desirable responding, an initial free response to the
scenario “what would you do?” could be provided before giving the standard range of possible responses. Despite this possibility of socially desirable responding, many children were still willing to endorse the more aggressive response despite the obvious pro-social option. This suggests that while it may be a limitation of the SLA measure in that it is quite easy to select the most socially desirable, or “correct”, response, many children were still willing to select aggressive goals and decisions.

Another limitation of the SLA, and similarly an issue that has been reported across a number of other studies looking at self-reported social behaviour of children (Schneider, Ledingham, Poirier, Oliver, & Byrne, 1984), is that many of the responses which were identified by the measure’s authors as aggressive, could have been interpreted by others as assertive or reasonable (e.g. “Tell your friends not to play with those mean kids”). Schneider et al. (1984) found that children who rated themselves as assertive (using the Children’s Assertiveness Inventory (CAI)) were viewed as aggressive by both teacher reports and peer ratings. In this respect Schneider et al. (1984) suggested that some of the items in the teacher reports may not discriminate between aggressive and assertive behaviours. For example, “When someone your age takes something that is yours, do you let him take it?” Such items may not discriminate between the underlying constructs sufficiently, leading to inconsistency between child and teacher ratings on aggression and assertiveness (Schneider et al., 1984). So while the use of self-report is advantageous, as it involves the child in the assessment of their social skills, it should also be used cautiously, as the child’s perspective on their behaviour may differ from that of others. More specifically, the child may not view their behaviour as aggressive and inappropriate, but rather as an appropriate, assertive response to a social situation. It may therefore be helpful
to first ensure that aggression and assertion are not significantly related in the measure being employed.

A common definition of aggression is a physical, verbal, or psychological attack on others which is often unprovoked, while assertion is commonly defined as a positive declaration which helps to insist on one’s rights (PRS, 2014). There may be some overlap between these constructs, and some children (and adults) may have a difficult time distinguishing between them. However, while it may be true that children self-report their behaviour more positively than others in their environment, this is likely more attributable to a self-reporting bias than an issue with the measure itself. It may still be valid that a child is in fact responding aggressively despite their own view that they are not. It would be interesting for further research to be conducted which specifically addresses whether children who engage in internalising or externalising problem behaviours do in fact rate their behaviours, and the responses on the SLA, as more or less assertive or aggressive than adults. One could administer the SLA to children and their parents, ask parents to offer their responses and also rate their child’s responses, not identified as such, to assist in understanding how parent views may have affected the cue encoding and attributional style of their child.

Finally, the SLA was unable to provide information on how the child encoded the social information in each vignette. In social situations, a child’s mental processing speed may subserve their difficulty in managing their social interactions. For example, rather than a child misinterpreting a social situation due to biased cue encoding, their interpretation may be poor due to a slower mental processing speed, and therefore extra time to process the information may be of more benefit to improving social competence than specific social skills training. The incorporation of the HeadMinder subtests into this
study helped to differentiate between difficulties in mental processing versus difficulties in SIP as assessed by the SLA and the NEPSY, with a significant association identified between a quicker response speed and how many cues were correctly encoded in the hypothetical social stories. It is therefore recommended that further research continue to address the important element of processing speed when looking at the SIP of children, to accurately identify the source of a child’s difficulties with social engagement. One could design an assessment that varied exposure time for various social scenes to test the effects on accuracy of cue encoding and possible biases related to mood, temperament, or attributional style. Again, eye-tracking data recorded in concert with self-report, or the inclusion of a timed cue encoding task like the HeadMinder Symbol Search subtest, and scores regarding cue relevancy would allow for a more comprehensive picture of the encoding stage.

Another issue with the measurement tools used in this research involves the use of the HeadMinder program. The HeadMinder subtests were developed for use in older children; those attending high school and over 13 years of age. In this respect, pilot data has been collected on samples of children as young as 8 years old in studies of concussion however, and there was no evidence of invalidated data using the criteria developed for older children (e.g., excessive error rates; excessively slow reaction times), and anecdotal data in these studies indicated that the children were not challenged at all by the complexity of the computerized tests given their exposure to far more complex computer games (Donnelly et al., 2005).

The current study is one of the first to use HeadMinder tasks with children under the age of 13 years in a study design with lengthy assessments. The use of computerized tasks in combination with a mood/behaviour questionnaire and other neuropsychological tests
may have been a factor influencing the lack of significant findings on the assessment of EF and problem behaviour. It is acknowledged that if the program subtests were simply too complex for younger children, or perhaps too long in duration, to maintain attention and concentration when given in combination with other measures, then children would not have been able to perform to the best of their ability, leading to invalid test results. It is of note, however, that no children in the current study complained of fatigue, breaks were taken as needed, and more challenging comprehensive batteries are routinely used even with clinical groups of children for diagnostic purposes. A more detailed analysis of the current dataset would help determine whether reaction times or error rates increased between the first half of the HeadMinder testing relative to the second half and whether these differences were a function of age, testing duration, or duration by age effects, and this analysis will form the basis for future examination.

Lastly, this research was correlational in design and as such, cause and effect statements are not possible. While a number of relationships were found between behaviour, both internalising and externalising, and EF, it cannot be ascertained as to the direction of such relationships or can the possibility of other factors that were not directly assessed in the study be ignored, such as parenting practices, family dynamics, and education influences. Behaviour is complex and the results of this research should be viewed critically, with the acknowledgement that multiple other factors may also be influencing internalising and externalising behaviour problems. This provides another reason for incorporating more naturalistic observations into ongoing research in this area, and thus supports the need to include such methodological additions in future studies. In addition, a large number of correlational analyses and findings were included, some of which were marginally significant and possibly spurious as they failed to remain
significant after controlling for age. It was encouraging that predicted relationships were supported and measures that should be concurrently valid tended to covary. This was notably true for behavioural reports by children and their parents, but notably not true for some indices of emotion rated by children and their seemingly less aware parents.

The internalising-externalising dichotomy may also not be the best way to categorise behaviour that is affected by EF. Given the implementation of teacher-report as behavioural screening tools in public schools it would be very helpful to test the relationships among difficulties and strengths identified by teachers and formal assessments of EF and parent reports on EF and behaviour. Using expert teacher insights based on their extended daily observations across various social conditions at school (e.g., classroom, lunchroom, playground, transitioning between settings), and across time, may provide valuable information about how behaviour might be subserved by specific EF profiles. This approach would obviously require close collaboration among students, teachers, school administrators, and counsellors, the DET, parents, and university staff that can provide specialist assessments and statistical expertise. The experience of conducting the current study certainly indicates that establishing this level of cooperation for the good of children would be a major achievement.

In sum, it is acknowledged that a number of limitations to the accuracy of the research findings of this thesis. However, suggestions have been provided for future research in order to find potential solutions to such problems.

13.3 Summary and Conclusions
As mentioned throughout this thesis, executive dysfunction can have a negative impact on multiple areas of a child’s life including academic achievement and social competence. Brain development appears to be crucially linked to early environmental input and this input is also linked to a child’s social competence. Specific types of deviant developmental experiences may determine the neuroanatomical and neurophysiological profiles in a child's brain, which then determine the child’s tendencies in encoding and processing information and possibly a specific type of executive dysfunction. In particular, it is proposed that individual differences in the functional capacity of certain cortical structures mediate the development of SIP and self-regulation problems. The profile of these EF problems subserve specific behavioural, cognitive, and emotional profiles that may in turn lead to distinct social difficulties in children, and that divergent control pathways, representing over-control or under-control, can be mapped onto internalised or externalised behavioural styles. While it is widely supported that the executive functions have a significant influence on behaviour, the role of SIP together with self-regulation are less well understood (Schmeichel & Tang, 2014). It was the aim of this thesis to investigate whether a more comprehensive assessment battery, including a combination of behavioural reports, and neuropsychological, SIP and self-regulation measures, would lead to a better understanding of where a child’s strengths and weaknesses in EF may lie: an understanding which might better inform remediation programs targeting internalising and externalising problem behaviours in middle childhood.

Common behaviours of childhood can potentially be misdiagnosed as psychological disorders (Batstra, Hadders, Nieweg, Van Tol, Piji, & Frances, 2012; Bruchmüller, Margraf, & Schneider, 2012; Diamond, Barnett, Thomas & Munro, 2007). For example,
Batstra et al. (2012) note the significant increase in ADHD, Autism, and Paediatric Bipolar Disorder in recent years and propose that lower diagnostic thresholds may partly explain the increase in diagnoses. Alternatively it is suggested that pressure from parents and teachers to diagnose problem behaviour in order to receive additional support may also be a driving factor. During diagnostic assessment, age and typical behaviour are accounted for by trained psychologists. However, if the role of executive function is not taken into consideration then a child’s behaviour may appear to be immature and atypical, potentially influencing a psychological diagnosis (Bruchmüller, Margraf, & Schneider, 2012). Often times, a child is responding rather appropriately to their environment and with their age-appropriate, limited executive functioning skills. The natural development of these skills over time will lessen the likelihood of problem behaviour in the future (Frances, 2013). Children who have biased SIP and/or poor self-regulation skills are more likely to be diagnosed with a psychological diagnosis simply because they are less able to respond appropriately to the common stresses and frustrations that regularly face children. When the demands of the environment outweigh a child’s resources to deal with those demands, challenging behaviours can result. However, if comprehensive assessments are conducted to determine the underlying factors influencing behaviour, both positive and negative, and strategies are then implemented which specifically target a child’s unique cognitive profile, challenging behaviours can be reduced, strengths can be accentuated, and the need for a psychological diagnosis and treatment can at times be eliminated (Beauchamp & Anderson, 2010; Diamond et al., 2007; Miller et al., 2004; Riggs et al., 2006).

Another reason as to why a comprehensive battery is important is that much overt behaviour can be misinterpreted by parents and teachers. For example, Miller (2013) highlights the common misdiagnosis of ‘bad behaviour’ when the underlying issue is
actually extreme anxiety. When demands and expectations are placed on an anxious child, some respond with aggression, hyperactivity, and defiance, simply due to a lack of the social skills needed to better handle their intense negative emotions. This behaviour is often misinterpreted by adults as acting out and is commonly punished, whereas the child really requires additional security and help in managing their anxiety, which can often be the result of poor executive functioning. If a psychological assessment can reveal the true cause of problem behaviour, appropriate and therefore more effective interventions can be put in place that will benefit the child, as well as those around them (Campbell-Sills & Barlow, 2007; Spiro, 2013).

The current study has shown that a number of different elements in a child’s personal system (as outlined in the proposed model of Figure 1 and discussed in the introductory chapter) can contribute to problem behaviour. Executive functions, mood, temperamental differences, and SIP are all associated with both internalizing and externalizing behaviours. A comprehensive assessment which investigates the contribution of each of these elements on a child’s behaviour helps ensure that remediation strategies are implemented that are in line with the child’s strengths and relative weaknesses. This improves the ability of an intervention to account for individual differences, in that a personal diagnostic profile is developed, rather than a mere categorisation of the child taking place.

There are many strategies that are broadly aimed at assisting children with executive dysfunction. Research has also shown that simple strategies such as taking brief breaks, engaging in physical activity, relaxing for at least three minutes, breathing exercises, arranging small but frequent rewards throughout tasks, techniques for distracting themselves from negative stimuli, and maintaining positive emotions can all boost self-
regulation skills (Barkley, 2012; Miller, 2013). The instructions and rules given to children with executive dysfunction must be clear and brief to ensure effective encoding. It is often beneficial to have children repeat rules and instructions back out loud and also softly to themselves as self-talk to support working memory. Poorly controlled internal information needs to be replaced with information that is externalised for improvement in performance to occur; distracters should be minimised, cues and prompts should be salient so that the individual can be constantly reminded of what is expected. This lessens the load on the child’s executive functions and allows them access to mental resources required for the task at hand. Importantly, it also maximises opportunities for success.

Children with executive dysfunction often have difficulty adhering to task rules and maintaining attention, so the above strategies can help preserve motivation and compliance. As with all children, reinforcements must be more frequent than punishments, but may also need to be of higher magnitude in order to be effective with children who have a history of social difficulties. Any negative consequences to behaviour, including removal of positive attention, must be delivered immediately and dispassionately, and information about pro-social behavioural expectations must be both modelled and explicitly taught. This creates a clear distinction between what is inappropriate and what is pro-social. Reinforcements should also be rotated regularly and even offered intermittently, to ensure novelty and therefore maintain their reinforcement value (Barkley, 2008).

EF training is most effective in the “moment” of the EF problem. This means that strategies for improving EF need to be implemented in the school system and at home as opposed to only being addressed once a week by a professional service (Barkley, 2012). Research has shown that behaviour modification and parent training in behavioural
management are more effective when used across settings in which executive dysfunction is prominent and when interventions are used long term as short term gains often reverse once interventions are removed (Barkley & Murphy, 2006; Powell & Powell, 2008). However, research is limited on whether these broad strategies for addressing difficulties in EF are effective for all types of executive dysfunction and resulting problem behaviour.

As the current research has shown, there are a number of similarities and differences in the cognitive profiles of children who are identified as engaging in high levels of externalising and internalising problem behaviours. While some strategies which target the executive functions of emotional control or the temperamental factor of negative affect would be beneficial for both types of problem behaviours, there are also strategies which need to be uniquely tailored to the individual behavioural type to be effective. For example, while the children in the current sample who reportedly engaged in high levels of internalising behaviour seemed to struggle with shifting cognition and behaviour, children who engaged in high levels of externalising behaviour seemed to have difficulties with inhibiting behaviour. Thus, interventions which target shifting in internalisers and inhibition in externalisers would be more effective than interventions which more broadly focus on EF.

It was also found that children who reportedly engaged in high levels of externalising behaviour were also reported to have high levels of Surgency but low levels of Affiliativeness and Effortful Control. Targeting these components of temperament in a child with internalising behaviour problems may not be as effective as targeting effortful control in children with externalising behaviour problems, which may improve their engagement in social interactions. Children who engaged in externalising problem behaviours in the current study, reportedly exhibiting negative affect, were also found to
have SIP biases with a higher likelihood of endorsing aggressive goals in hypothetical social scenarios. The child’s report of their emotions indicated that aggressive strategies may have actually fit the attributions subserving their behaviour. Conversely, it was found that children who engaged in internalising problem behaviours in the current sample, exhibiting equally high levels of negative affect but different qualitatively, were actually more likely to endorse pro-social decisions in hypothetical social scenarios. This suggests that when implementing a SIP training program, children with internalising behaviour problems would not benefit as much from training in pro-social goal formation and decision making to the same extent that their externalising peers would, but may instead benefit from assertiveness training. Certainly validating the challenging negative affect and noting the pro-social decisions for both types of children would be essential even if already well established in some.

Targeting the specific skills of SIP and self-regulation is important in helping children manage difficult behaviour. As discussed in Chapter 2, there are a number of specific programs currently being used to help manage the difficult behaviours of middle childhood by strengthening the social and emotional skills needed to improve social competence (e.g. The Aussie Optimism Program (Roberts, 2006), The Friends for Life Program (Farrell & Barrett, 2007), the Making Choices: Social Problem Solving Skills for Children (MC: Fraser et al., 2005) and the PATHS Curriculum (Riggs et al., 2006)). These programs focus on developing skills such as the inhibition of impulsive behaviour (Riggs et al., 2006), the identification, and regulation of negative emotions (Farrell & Barrett, 2007; Fraser et al., 2005; Riggs et al., 2006; Roberts, 2006), as well as the use of more pro-social problem solving, and decision making in social interactions (Fraser et al., 2005; Riggs et al., 2006; Roberts, 2006).
These programs have been found to be fairly effective in reducing challenging behaviour and improving social competence through their inferred focus on the executive functions of SIP and self-regulation. As shown by the results of the current study, many areas of SIP and self-regulation appeared to be underlying the internalising and externalising problem behaviours assessed in the study’s sample. Additional research is needed, however, on the effectiveness of these and other intervention programs, to determine whether similar, or enhanced, rates of improvement are found when the deficits of SIP and self-regulation for each behavioural profile are targeted more specifically.

It is therefore recommended that future research use the specific cognitive profiles of children with problem behaviours to inform remediation programs. It is believed that the efficiency and effectiveness of intervention programs and management strategies would be enhanced by identifying the strengths and weaknesses in executive functioning for each individual child at baseline/pre-intervention. By then targeting the specific strengths and weaknesses in each component of a biopsychosocial model, made possible through the use of a comprehensive assessment battery, interventions can be made more efficient and effective; leading to quicker and more stable benefits for the child themselves, their parents, and their educators.
REFERENCES


Retrieved from:

http://journals.cambridge.org/action/displayAbstract?fromPage=online&aid=43491&fileId=S0954579497001375


http://www.jstor.org/stable/1129373


behaviour problems: Contributions of temperament attributes in early childhood. 
*Infant Mental Health Journal, 33*(2), 197-211. doi: 10.1002/imhj.21312

role of executive functioning in preschoolers. *European Child & Adolescent 
Psychiatry, 23*(9), 729-741. doi: 10.1007/s00787-014-0542-y

skills and executive function in autism spectrum disorders. *Child Neuropsychology, 

Inventory of Executive Function: Professional manual*. Lutz, FL: Psychological 
Assessment Resources, Inc.

Publishers.

strategy*: US Department of Justice, Office of Justice Programs, Office of Juvenile 
Justice and Delinquency Prevention.

Hagekull, B., & Bohlin, G. (2003). Early temperament and attachment as predictors of the 
five factor model of personality. *Attachment & Human Development, 5*(1), 2-18. 
doi: 10.1080/1461673031000078643


persistence, and externalising problems during school-age years. *Developmental Psychology, 43,* 369-385. doi: 10.1037/0012-1649.43.2.369

Appendix A: Information Sheet and Consent Form

The Influence of Executive Function on the Externalising and Internalising Behaviours in Middle Childhood.

My name is Tara Kocek; I am a PhD student at Southern Cross University. I would like to invite you, and your child, to participate in a study which seeks to investigate how a child’s thinking about social information affects behaviour. This research will look at whether social behaviours are associated with differences in how children pay attention and think about what they see and hear from others. For example, how children pay attention to their environment, inhibit or control impulses, or plan their activities may determine their social behaviour. This project also aims to assess how a child’s ability to notice emotional information coming from others, think about social cues, and make social decisions might influence their behaviour.

Procedures to be followed

You will be asked to participate, with your child, and complete a number of questionnaires designed to understand your child’s behaviour. These activities will be conducted at the Coffs Harbour SCU Campus at a time convenient for you. We are also asking that you allow us to have your child’s teacher complete similar questionnaires about your child’s behaviour but this aspect of the project is not essential. If you would like to have your child’s teacher also complete the questionnaires, please do not hesitate to discuss this with the researcher at the assessment session.
Your child will be asked to complete a set of activities which aim to assess his/her level of self regulation skills and social information processing patterns. For example, they will press buttons on a keyboard to test their attention to pictures on the screen, tell what they think about stories involving social interactions of children, complete puzzles, and identify the emotions being expressed in pictures of faces. Your child will also complete a questionnaire about his/her thoughts, feelings, and things that they do well. These activities will be conducted in a single session with your child and will take approximately 60 minutes. The questionnaires completed by you will take approximately 60 minutes and will be completed at the same time.

**Potential Benefits**

The project is designed to look at relationships across factors affecting behaviour at the group level. It is designed to assess if differences can be detected using the proposed measures and whether this allows us to make suggestions about what might determine social success or difficulties. In some cases, the results of the project may provide some information about how your child attends to and thinks about social information and how this thinking might affect his/her behaviour. However, there is no guarantee that the information collected for this project will be helpful to you or your individual child as the processes proposed are experimental. A brief summary of your child’s results will be available to you.

**ADDITIONAL INFORMATION**

**Possible Discomforts and Risks**

There are no anticipated risks or discomforts associated with participation in this project. However, if you feel any discomfort or distress at any time during the project, you are free to withdraw at any time with no negative consequences to you or your child.
If you do experience discomfort or distress at any stage of the process, I encourage you to contact the primary project supervisor, Dr Jim Donnelly on telephone (02) 66593669 or by email at jim.donnelly@scu.edu.au. Dr Jim Donnelly will provide you with the details of local resources where needed.

**Responsibilities of the Researcher and Confidentiality**

The information collected for this project is highly confidential. Your name will only be used to help identify corresponding data. Individual participants will then be identified only by a numerical code which is used to help with later analyses. It is compulsory that you read and sign the consent form if you wish to participate. This will be held securely within the Department of Psychology at Southern Cross University. In the event that this research is published, no individual data or identifying information will be included as only group data will be reported.

**Freedom of Consent**

You do not have to participate in this study. Participation in this research is entirely voluntary. If you choose to participate you are free to withdraw your consent and discontinue participation at any time without question or any negative consequences.

**If you wish to participate in this exciting new research project, you are welcome to telephone or email the study’s researchers to advise us of your interest to participate (see details below). You will then be contacted to organise a suitable assessment time.**

**Enquires**

This form is yours to keep for future reference. If you require further information regarding this research project, please do not hesitate to ask. If you have any additional questions or concerns related to your participation, feel free to contact:

**Researcher:** Mrs Tara Kocek  
**Supervisor:** Dr Jim Donnelly

Health and Human Sciences  
Health and Human Sciences
This research has been approved by the Southern Cross University Human Research Ethics Committee. The approval number is: **ECN-11-170**

If you have concerns about the **ethical conduct** of the research, you may contact the ethics committee through the Ethics Complaints Officer:

The Ethics Complaints Officer  
Southern Cross University  
PO Box 157  
Lismore NSW 2480  
Email: ethics.lismore@scu.edu.au

All information is confidential.

**Thank you for your time.**
CONSENT FORM

The Influence of Executive Function on the Externalising and Internalising Behaviours in Middle Childhood.

Tick the box that applies, sign and date and give to the researcher

I agree to take part in the Southern Cross University research project specified above.  
Yes ☐  No ☐

I have been provided with information at my level of comprehension about the purpose, methods, demands, risks, inconveniences and possible outcomes of this research. I understand this information.  
Yes ☐  No ☐

I agree to complete questionnaires asking me about my child’s behaviour  
Yes ☐  No ☐

I understand that my participation is voluntary.  
Yes ☐  No ☐

I understand that I can choose not to participate in part or all of this research at any time, without consequence.  
Yes ☐  No ☐

I understand that any information that may identify me, will be de-identified at the time of data analysis to maintain confidentiality  
Yes ☐  No ☐

I understand that neither my name nor any identifying information will be disclosed or published.  
Yes ☐  No ☐

I understand that all information gathered in this research is confidential. It will be kept securely and confidentially at the University.  
Yes ☐  No ☐

I am aware that I can contact the Supervisor or other researcher at any time with any queries.  
Yes ☐  No ☐

I understand that the ethical aspects of this research have been approved by the SCU Human Research Ethics Committee.  
Yes ☐  No ☐

If I have concerns about the ethical conduct of this research, I understand that I can contact the SCU Ethics Complaints Officer.  
Yes ☐  No ☐

The ethical aspects of this study have been approved by the Southern Cross University Human Research Ethics Committee (HREC). The Approval Number is ECN-11-170.
If you have any complaints or reservations about any ethical aspect of your participation in this research, you may contact the Committee through the Ethics Complaints Officer:

The Ethics Complaints Officer
Southern Cross University
PO Box 157
Lismore NSW 2480
Email: ethics.lismore@scu.edu.au

All complaints, in the first instance, should be in writing to the above address. All complaints are investigated fully and according to due process under the National Statement on Ethical Conduct in Research Involving Humans and this University. Any complaint you make will be treated in confidence and you will be informed of the outcome.

I have read the information above and agree to participate in this study with my child. I am over the age of 18 years.

Name of Child Participant: ........................................................................................................

Name of Parent/Guardian Participant: ....................................................................................

Relationship to Child Participant: ...........................................................................................

Signature of Parent/Guardian Participant: ..............................................................................

Date: ........................................................................................................................................

☐ Please tick this box and provide your email address below if you wish to receive a summary of the results:

Email: ......................................................................................................................................
Appendix B: Demographics Screening Questionnaire

PARENT/CARER DEMOGRAPHIC QUESTIONNAIRE

If possible, would you please fill out and email this questionnaire back to me so we can determine if this project is the one best suited to you and your child? If you would like to talk about the questions in person during the assessment session that is also fine.

Child’s name: ________________________
Your name: ________________________

Relationship to the child:____________________
Phone number: ______________________

Email address: ________________________

Child’s gender: ________________________

What is your child’s date of birth: ____________________________________________________

What year of school is he/she in: ____________________________________________________

What is your child’s dominant hand? Please circle one:

Left  Right  Ambidextrous

A history of head injuries or medical conditions that affected your child’s thinking may suggest that he or she may need to be included in a separate study being conducted by Dr Donnelly. Would you please respond to the questions below so we can best decide how to include you and your child in this program of research?
1. Is your child currently taking any medication that affects his/her thinking, attention, or memory (e.g., medication for epilepsy, ADHD, sleep problems, narcotic pain medication)? Please just circle one:
   YES   NO

2. Has your child ever been diagnosed with a significant developmental delay, ADHD, autism or Asperger’s Syndrome.

_____________________________________________________________________

_____________________________________________________________________

3. Has your child ever had school-based or other support for learning or behaviour problems at school? Please provide a brief description:

_____________________________________________________________________

_____________________________________________________________________

4. Has your child ever sustained a blow to the face or head that caused her/his thinking to be momentarily disrupted or altered? He/she did not need to be knocked out or made unconscious. Please give the approximate date of the event(s) and a brief description:

_____________________________________________________________________

_____________________________________________________________________

5. Has your child ever sustained a traumatic injury to his body/limbs that required treatment in an emergency department or at a Doctor’s office? Please give the approximate date of the event(s) and a brief description:

_____________________________________________________________________

_____________________________________________________________________

6. Does your child have any problems with their vision? If so, is this corrected with glasses? Please give a brief description:

_____________________________________________________________________

Thank you for your time.
Appendix C: SCU Human Research Ethics Committee Approval

HUMAN RESEARCH ETHICS COMMITTEE (HREC)

NOTIFICATION

To: Dr James Donnelly/Tara Kocek
School of Psychology
james.donnelly@scu.edu.au, tara.kocek@scu.edu.au

From: Secretary, Human Research Ethics Committee
Division of Research, R. Block

Date: 18 February 2010

Project: The influence of executive function and social information processing on externalising and internalising behaviours of primary school children.

Approval Number ECN-10-017

This research project ethics application was first considered at the HREC meeting on 30 November 2009.

Thank you for the responses, dated 15/2/10, to the queries from the Chair/HREC. The Chair considers the responses as satisfactory and has now approved this research.

However, the approval is conditional upon the following:

1. Obviously, the researchers will not be able to commence their research without the approval of DET and SERAP protocols being completed. That the researchers provide to the HREC, all DET and SERAP documentation when it is approved. The University Research Office will be required to sign-off on the SERAP application (Insurance purposes). Please forward this form to Sue Kelly, who will organise the sign-off for you.
2. That the researchers forward to the HREC, any tools (other than those already submitted) being used in this research project. If a change of protocol is necessary, please use this form (available at the SCU website).

3. The approval is subject to the mandatory standard conditions of approval. Please note these and inform the HREC when the project is completed or if there are any changes of protocol.
HUMAN RESEARCH ETHICS COMMITTEE (HREC)

HUMAN RESEARCH ETHICS SUB-COMMITTEE (HRESC)

NOTIFICATION

To: Dr James Donnelly/Ms Tara Kocek
    School of Health and Human Sciences
    jim.donnelly@scu.edu.au; tara.kocek@scu.edu.au

From: Secretary, Human Research Ethics Committee
      Division of Research, R. Block

Date: 3 October 2013

Project name: The Influence of Executive Function and Social Information Processing on Internalising and Externalising Behaviours of Primary School Children

Old Approval Number ECN-12-301

New Approval Number ECN-13-253

The Southern Cross University Human Research Ethics Committee has established, in accordance with the National Statement on Ethical Conduct in Human Research – Section 5/Processes of Research Governance and Ethical Review, a procedure for expedited review and ratification by a delegated authority of the HREC.

Thank you for your annual report and renewal application dated 26 September 2013. This has been considered and approved by the HRESC, Coffs Harbour.
All ethics approvals are subject to standard conditions of approval. These must be noted by researchers as there is compliance and monitoring advice included in these conditions.

Ms Sue Kelly                              Professor Bill Boyd
HREC Administration                      Chair, HREC
T: (02) 6626 9139                           E. william.boyd@scu.edu.au
E: ethics.lismore@scu.edu.au
Appendix E: SERAP Approval

Mrs Tara Kocek
Southern Cross University Hogbin Drive
COFFS HARBOUR NSW 2450

Dear Mrs Kocek  
SERAP Number 2009158

I refer to your application for extension of your research project in NSW government schools entitled The Influence of Executive Function and Social Information Processing on Externalising and Internalising Behaviours of Primary School Children. The Influence of Executive Function and Social Information Processing on Externalising and Internalising Behaviours of Primary School Children. I am pleased to inform you that your application has been approved.

This approval will remain valid until 18/02/2013.

The following researchers or research assistants have fulfilled the Working with Children screening requirements to interact with or observe children for the purposes of this research for the period indicated:

<table>
<thead>
<tr>
<th>Name</th>
<th>Approval expires</th>
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</thead>
<tbody>
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<td>Jeffrey Michael Rogers</td>
<td>14/02/2013</td>
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<td>Tara Brea Kocek</td>
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<td>James Francis Donnelly</td>
<td>22/02/2013</td>
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<tr>
<td>Tony Yeigh</td>
<td>14/02/2013</td>
</tr>
</tbody>
</table>

When your study is completed please forward your report marked to Manager, Schooling Research, Department of Education and Training, Locked Bag 53, Darlinghurst, NSW 2010.

Yours sincerely

Dr Robert Stevens
Manager, Schooling Research

February 12