A developmental cognitive neuroscience approach to the investigation of conduct problems and classroom behaviour for learning

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Prepared under the supervision of

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I declare that the work presented in this thesis is my own, and that this work has not been submitted for any other degree or qualification.

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Abbreviations

ACC	Anterior cingulate cortex
ADHD	Attention Deficit Hyperactivity Disorder
ANOVA	Analyses of variance
ANS	Autonomic nervous system
APSD	Antisocial Process Screening Device
ASPD	Antisocial Personality Disorder
BASC-II	Behaviour Assessment System for Children-2
BRIEF-A	Behaviour Rating Inventory for Executive Function-Adult version
BRIEF-II	Behaviour Rating Inventory for Executive Function-2
BSI	Behavioural Symptoms Index
CBCL	Child Behaviour Checklist
CBST	Cognitive Behavioural Skills Training
CBT	Cognitive Behavioural Therapy
CD	Conduct disorder
CERQ-kids	Cognitive Emotion Regulation Questionnaire-kids
CP	Conduct problems
CP/CU-	Conduct problems without callous-unemotional traits
CP/CU+	Conduct problems with callous-unemotional traits
CPS	Child Psychopathy Scale
CSQ	California Child Q-Set
CU	Callous-unemotional
DASS	Depression Anxiety Stress Scales
DERS	Difficulties in Emotion Regulation Scale
dlPFC	Dorsolateral prefrontal cortex
dmPFC	Dorsomedial prefrontal cortex
DSM	Diagnostic and Statistical Manual of Mental Disorders
ECBI	Eysberg Child Behaviour Inventory
EDA/EDR	Electrodermal responsivity/ Electrodermal activity
EDF	Executive dysfunction
EDR	Emotion dysregulation

EEG	Electroencephalography
EF	Executive function
ER	Emotion regulation
ERC	Emotion Regulation Checklist
ERP	Event-related potential
ES	Effect size
fMRI	Functional magnetic resonance imaging
GWAS	Genome-wide association study
HPA	Hypothalamic-pituitary axis
ICD	International Classification of Diseases
ICU	Inventory of Callous-Unemotional Traits
KS2	Key stage 2
LGS	Let's Get Smart
LSA	Learning Support Assistant
MANCOVA	Multivariate Analyses of Covariance
MANOVA	Multivariate Analyses of Variance
MJTC	Mendota Juvenile Treatment Center
MMPI	Minnesota Multiphasic Personality Inventory
MST	Multi-Systemic Therapy
NICE	National Institute for Clinical Excellence
ODD	Oppositional Defiant Disorder
OFC	Orbitofrontal cortex
PATHS	Promoting Alternative Thinking Strategies
PCL-R/ PCL-YV	Psychopathy Checklist-Revised/ Psychopathy Checklist-Youth Version
PFC	Prefrontal cortex
PMT	Parent Management Training
PNS	Parasympathetic nervous system
RBBM	Reward-based behaviour management
RCT	Randomised control trial
SC	Skin conductance
SCT	Social Competence Training

SDQ	Strengths and Difficulties Questionnaire
SEMH	Social, Emotional and Mental Health Difficulties
SEN	Special Education Needs
SES	Socioeconomic status
SEST	Social-Emotional Skills Training
SNS	Sympathetic nervous system
SPPC	Self-Perception Profile for Children
SPSS	Statistical Package for the Social Sciences
S-T	Student-teacher
STR	Student-teacher relationship
STRS-sf	Student-Teacher Relationship Scale-short form
SWPBIS	School-Wide Positive Behavioural Interventions and Supports
TA	Teaching Assistant
TAU	Treatment as usual
vmPFC	Ventromedial prefrontal cortex
WASI-II	Weschler Abbreviated Scale of Intelligence-2
WCST	Wisconsin Card Sorting Task
WIAT-II	Weschler Individual Achievement Test-2
WM	Working memory
YPI	Youth Psychopathic Traits Inventory

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Abstract

With a high prevalence of conduct problems (CP) in school-aged children, effective interventions for these youths are of great importance. This thesis considers CP in the context of the classroom, including examinations of executive function (EF) and emotion-related skills; the development and evaluation of a classroom-based intervention to improve behaviours for learning; and an EEG investigation of cognitive control and emotion regulation (ER). The heterogeneous nature of CP is considered throughout, with an examination of the callous-unemotional (CU) traits subtype.

In two experimental studies, pupils with CP (with and without CU traits) were found to have deficits in EF and emotion-related skills. Low behavioural and academic self-perceptions and poor student-teacher relationships (STR) were also identified. For the first time, emotion lability/negativity was identified as a mechanism through which CP is associated with student-teacher conflict. A systematic review of intervention outcomes for CU traits indicated generally poorer outcomes for these youths, but demonstrated the potential for behaviour change. Based on this work, a cognitive neuroscience informed intervention for mainstream pupils with CP was developed and evaluated. The intervention yielded mixed results, with poor fidelity from teaching staff possibly accounting for this. Finally, a direct measure of cognitive and emotional control was addressed through a pilot study with adults, using an EEG emotion-induction go/no-go paradigm. A distinct N2 component was found, providing support for this tool as a measure of ER. Self-reported EF and ER were not associated with the N2 response; possible reasons for this are discussed.

The results in this thesis advance our understanding of CP in the school context, provide support for the utility of the CU traits distinction, and examine the effectiveness of intervention approaches for these pupils. Furthermore, measurement issues in EF and ER research are highlighted and related to a novel EEG measurement tool.

Chapter 1 Conduct Problems: A Literature Review

1.1 Introduction

The aim of this chapter is to introduce conduct problems (CP) within the context of antisocial behaviour across the lifespan, including a review of the literature on the risk factors and long term outcomes associated with CP. Research evidence of physiological correlates of CP, and how these findings may explain some of the behavioural and neuropsychological characteristics of children and adolescents with CP will also be presented. This chapter is a selective review of a large body of literature, focusing on research that is most relevant to the studies and research questions of this thesis. This includes a consideration of the heterogeneous nature of CP throughout this thesis. Therefore, the growing body of research investigating the distinct behavioural and biological profiles of a subgroup of antisocial youths with callous and unemotional traits (CU traits) will also be reviewed and considered in the formulation of research questions for this thesis.

1.2 Antisocial Behaviour

1.2.1 Oppositional Defiant Disorder

Young children diagnosed with Oppositional Defiant Disorder (ODD) present with persistent anger or irritable mood, are argumentative, and will blame others for their own misconduct (APA, 2013). While not aggressive, children with ODD show persistent defiance, hostility and disobedience, placing ODD within the broader term of antisocial behaviour. A history of ODD is often present in children later diagnosed with Conduct Disorder (see below) (Kazdin, 1995; Loeber, Keenan, Lahey, Green, & Thomas, 1993). However, not all children diagnosed with CD have a previous diagnosis of ODD, nor do all children with ODD go on to have CD (Loeber et al., 1993).

1.2.2 Conduct Disorder

Conduct Disorder (CD) is a diagnostic term used by the Diagnostic and Statistical Manual of Mental Disorders (DSM-5) (American Psychiatric Association; APA, 2013) and the International Classification of Diseases (ICD-10; World Health Organization, 1992), to describe a disorder of childhood or adolescence characterised by disruptive and antisocial behaviour. Youths with CD show behaviour which violates the rights of others and the rules of society, including excessive fighting, bullying, vandalism, fire setting, stealing, lying, and truancy. Disruptive behaviour is repeated and persistent and is more frequent and severe than would be expected for an individual of their age. The DSM-5 distinguishes subtypes of these youths based on age-of-onset (early- and adolescent-onset) and includes a *limited prosocial specifier* for youths who present with a particularly problematic pattern of behaviour characterised by a callous and unemotional interpersonal style (APA, 2013).

1.2.3 Conduct Problems

Whereas CD and ODD refer to clinical diagnoses, conduct problems (CP) is a broader term which refers to children and adolescents who present with similar disruptive and antisocial behaviours, but who may or may not have a clinical diagnosis. This may be because they do not meet the full diagnostic criteria for CD or ODD or they may not have been clinically assessed. Perhaps due to the broad range of problematic behaviours (aggression and violence, inattentiveness and hyperactivity, and dishonesty and defiance) characteristic of these youths, there is great variability in the terminology used to refer to CP. The context in which such behaviour is considered further influences the terminology used. Clinical psychology and psychiatry are most likely to use diagnostic criteria based on the DSM-5 or ICD-10. Education professionals may refer to these pupils as having 'challenging behaviour' or group these children under the umbrella term of 'social, emotional and mental health difficulties' (SEMH; Department for Education, 2016; Frederickson & Cline, 2009). Researchers have used both clinical criteria and definitions from non-clinical disciplines, depending on the area of research and the research question under examination. 'Externalising problems' refers more broadly to a group of outward behaviours which include conduct problems, aggression, hyperactivity and impulsivity[1].

1.2.4 Antisocial Personality Disorder

Diagnostic criteria for Antisocial Personality Disorder (ASPD) is similar to that for CD for adults aged 18 and over. By definition, all individuals diagnosed with ASPD had CD as a child or young adolescent (APA, 2013). A subgroup of adult offenders with a distinct set of interpersonal (manipulative behaviour, grandiosity, and superficial charm), affective (lack of guilt, lack of

[1] In this thesis, the terms antisocial behaviour and conduct problems will be used interchangeably to refer to the violation of social norms and rights of others, rather than as a clinical label. Behaviour problems or externalising problems will be used to refer more generally to a group of outward behaviours which include conduct problems, aggression, hyperactivity and impulsivity.

empathy, and shallow affect) and behavioural (impulsivity and irresponsibility) characteristics (Cleckley, 1941), commonly referred to as psychopathic traits, show particularly severe and violent antisocial behaviour. While ‘psychopathy’ is not an official diagnostic term, adults with these traits are likely to fall into the DSM-5 category of ASPD (Skeem, Polaschek, Patrick, & Lilienfeld, 2011).

1.3 Epidemiology

In large, nationally representative samples, estimates of ODD in children from community samples range from 2 to 16 percent, with symptoms usually lasting 5 to 6 years (Merikangas et al., 2010; Nock, Kazdin, Hiripi, & Kessler, 2007). In a report for The Office of National Statistics, based on surveys of over ten thousand 5- to 15-year-olds in the UK (between 1999 and 2004), antisocial behaviour was identified as the most common mental health problem, with 5.3% meeting the diagnostic criteria for CD (Meltzer, Gatward, Goodman, & Ford, 2003). This compares to 4.3% identified as having internalising disorders (anxiety and depression) and 1.4% with hyperkinetic disorders (inattention, hyperactivity and impulsivity). Less than 1% of the total sample met diagnostic criteria for other problems, such as eating disorders and psychotic disorders. A more recent meta-analysis of 25 epidemiological studies from 1987 to 2008 estimated that the worldwide prevalence of CD was 3.2%, with little variability across counties (Canino, Polanczyk, Bauermeister, Rohde, & Frick, 2010).

Not surprisingly then, the high prevalence of antisocial behaviour is evident in schools. The Department for Education reported that 40% of children with a statement of Special Education Needs (SEN)[2] or on School Action Plus (pupils identified as needing external support due to inadequate school progress) had CP as a primary feature (Department for Education, 2014).

1.3.1 Gender

A male predominance of antisocial behaviour has consistently been reported across ODD, CD and ASPD (e.g. Maughan, Rowe, Messer, Goodman, & Meltzer, 2004; Meltzer et al., 2003; Nock

[2]From 1 September 2014 statements of SEN were replaced with Education, Health and Care plans for pupils with complex needs. With these changes, 'school action' has been replaced with ‘SEN support’ for pupils with SEN who do not need an Education, Health and Care plan (Department for Education, 2014)

et al, 2007). In a cohort of 10,438 children in the UK (aged 5-15 years) over 2% of boys and less than 1% of girls met DSM-IV criteria for CD (Maughan et al., 2004). Some researchers have reported over a threefold difference in CD prevalence between girls and boys (Lahey, Miller, Gordon, & Riley, 1999). However, girls with CD tend to be diagnosed at an older age than boys, with the gender gap narrowing during mid-adolescence (Loeber, Burke, Lahey, Winters, & Zera, 2000). Furthermore, there have been reports suggesting that disruptive behaviour is increasing in girls (Leve, Chamberlain, & Reid, 2005) and that this behaviour is more severe than it is for males (Masi et al., 2008; Maughan et al., 2004).

Differences in the type of antisocial behaviour have also been noted between males and females. For example, studies of bullying behaviour suggest that boys are most often *direct* bullies, using verbal and physical aggression, while girls use *indirect* bullying methods, such as spreading rumours or purposefully isolating peers (Smith, Polenik, Nakasita, & Jones, 2012; Wolke, Woods, Bloomfield, & Karstadt, 2000). The different problem behaviours displayed by girls and boys may, in part, account for the gender differences in prevalence rates reported. It has been argued that the assessment methods and diagnostic criteria may be too heavily based on antisocial behaviour typical of males, such as physical aggression, rather than the more indirect antisocial behaviour seen amongst girls (Bierman, Bruschi, Domitrovich, Fang, & Miller-Johnson, 2004). This may have resulted in girls with behaviour problems not being diagnosed with CD (Masi et al., 2008). Furthermore, the finding that CD in females tends to be more severe could be explained by a late diagnosis of an earlier unidentified problem left untreated. More longitudinal research is needed with girls with antisocial behaviours to explore these possibilities.

1.3.2 Age

CD has been reported to be more prevalent in adolescents compared to young children. For example, Meltzer et al. (2003) found prevalence rates increased from 4.6% in children aged 5-10 years to 6.2% in those aged 11-15 years. This pattern was seen in both boys (from 6.5% to 8.6%) and girls (from 2.7% to 3.8%). However, the higher prevalence of CD in older youths could be due to a missed early diagnosis. This might be for several reasons, such as a reluctance for parents or practitioners to make a formal diagnosis or place a label on a young child, a hope that the child would simply grow out of this behaviour, or a worsening of behaviour with time. Nevertheless, it is now well-recognised in both research and clinical practice that there are two distinct subtypes of CD based on age-of-onset (APA, 2013), and that these subtypes may have some distinguishing characteristics in terms of risk factors, presenting behaviours, and long-term outcomes (Kim-Cohen, Arseneault, et al., 2005; Masi et al., 2008; Moffitt, 2003; Odgers et al., 2007). Subtypes of CP will be discussed in more detail below.

1.3.3 Ethnicity

Canino et al. (2010) found that the worldwide CD prevalence estimate of 3.2% did not vary significantly across countries or continents. However, the studies included in this meta-analysis were primarily conducted in North America and Europe and little is known about prevalence rates in other parts of the world. Nevertheless, prevalence statistics for youths from different ethnic groups living in America are available. One study found African-American adolescents to be more often diagnosed with CD compared to Caucasian adolescents (DelBello, Lopez-Larson, Soutullo, & Strakowski, 2001). In an American national epidemiological survey, Asian youths were found to be three times less likely than Caucasians to have CD, whereas Native Hawaiians/Pacific Islanders were two and half times more likely to have CD than Caucasians (Sakai, Risk, Tanaka, & Price, 2008). In a sample of 604 college students in California, Koreans had a higher rate of CD (15%) compared to White Americans (13%) and Chinese youths (6%) (Luczak, Wall, Cook, Shea, & Carr, 2004). Furthermore, Hispanic adolescents involved in antisocial and delinquent behaviour are over-represented in American correctional facilities (Yung & Hammond, 1997). The different prevalence rates across ethnic groups could be due to genetic influences or environmental factors which may differ between ethnic groups (e.g. socioeconomic status; SES) (Walsh & Kosson, 2007). Research comparing ethnic groups living in different environments is needed to examine this.

1.3.4 Co-morbidity

It is well-documented that a large proportion of youths with antisocial behaviour have co-occurring mental health difficulties, including Attention Deficit Hyperactivity Disorder (ADHD), substance abuse, anxiety, and depression (Costello, Mustillo, Erkanli, Keeler, & Angold, 2003; Kim & Miklowitz, 2002; Masi et al., 2008; Thapar, Harrington, & McGuffin, 2001; Wolff & Ollendick, 2006). In a clinical sample of 8- to 18-year-olds (*N*=198), Masi et al. (2008) found the most common co-morbidities with CD to be ADHD (61.6%) and mood disorders (45.9% bipolar disorder and 23.2% depressive disorder), followed by substance abuse (38.9%) and generalised anxiety disorder (34.8%). Further evidence suggests that girls are more likely to show co-morbid difficulties than boys, especially co-morbid internalising difficulties (Moffitt & Caspi, 2001), further adding to the disparity between girls and boys with CP.

Youths with antisocial behaviour and co-morbid disorders have been found to show more severe disruptive behaviours and have a poorer prognosis than those without co-morbidity, including higher rates of offending (Copeland, Miller-Johnson, Keeler, Angold, & Costello, 2007), more complicated substance abuse problems (Lindblad, Isaksson, Heiskala, Koposov, & Ruchkin, 2015) and poor school adjustment and relationships (Ezpeleta, Domènech, & Angold, 2006). It is not surprising then that co-morbidity has also been associated with higher service utilisation and greater financial costs on society (Shivram et al., 2009; Vostanis, Meltzer, Goodman, & Ford, 2003).

1.4 Subtyping Conduct Problems

Due to a large body of research suggesting that youths with CP are a heterogeneous group (e.g. Edens, Campbell, & Weir, 2007; Frick & White, 2008; Kimonis et al., 2006; Kruh, Frick, & Clements, 2005; Leistico, Salekin, DeCoster, & Rogers, 2008; Marsee & Frick, 2007), subtypes of CP have been established. Most prominently, subtypes of youths with CP have been distinguished based on age-of-onset and, more recently, a particularly problematic group with callous and unemotional traits has been identified.

1.4.1 Age-of-onset

Some youths show CD in childhood, while others appear to have no early behavioural difficulties yet show antisocial and disruptive behaviour in adolescence. As mentioned previously, these two groups of youths have been distinguished in the DSM-5 as early-onset (before 10 years of age) and adolescent-onset CD (APA, 2013). Early-onset CD has been associated with more severe and persistent behaviour and with poorer outcomes in adulthood, including more convictions for violent crime and a variety of mental and physical health problems (Kim-Cohen, Arseneault, et al., 2005; Masi et al., 2008; Moffitt & Caspi, 2001; Moffitt, Caspi, Harrington, & Milne, 2002; Odgers et al., 2007). Furthermore, early-onset CD has been shown to be more strongly correlated with dispositional (e.g. hyperactivity) and contextual (e.g. family dysfunction) factors, whereas adolescent-onset CD is more closely related to social processes, including affiliations with delinquent peers and conflict with authority (Moffitt, 2003). While these subtypes are helpful in terms of diagnosing and treating CD, more recent research has found that further heterogeneity exists. A subgroup of youths with early-onset CD who also show callous and unemotional traits has been identified (Dandreaux & Frick, 2009; Frick, O'Brien, Wootton, & McBurnett, 1994).

1.4.2 Callous-unemotional traits

Following a body of research which found similar interpersonal and affective characteristics in a subgroup of youths with CP, Frick and colleagues extended the construct of adult psychopathy to children and adolescents with callous and unemotional traits (CU traits) (see Frick et al., 2015). Unlike children with CP without CU traits (CP/CU-), children with CP and CU traits (CP/CU+) show low empathy and a lack of remorse for the effect of their behaviour on others (Frick & Marsee, 2006). These children also show shallow affect, with findings of abnormal physical responses, including reduced heart rate and reduced cortisol levels, to distressing or threatening stimuli (de Wied, van Boxtel, Matthys, & Meeus, 2012; Stadler et al., 2011).

Following the growing body of evidence and increased clinical interest in the CU traits subtype, the fifth revision of the DSM includes a *limited prosocial emotions* specifier for youth meeting the diagnostic criteria for CD who also show elevated CU traits (APA, 2013). Research has suggested that 25% to 30% of children with CD also meet the criteria for this specifier (Kahn, Frick, Youngstrom, Findling, & Youngstrom, 2012; Pardini, Stepp, Hipwell, Stouthamer-Loeber, & Loeber, 2012). However, reported prevalence rates for CU traits have varied, largely due to inconsistencies in assessment methods used and a lack of consensus on the appropriate cut-off score for high CU traits (Docherty, Boxer, Huesmann, O'Brien, & Bushman, 2016; Frick & Viding, 2009; Kahn et al., 2012). In a sample of 566 clinic-referred 5- to 18-year-olds, Kahn et al. (2012) reported that of youths with CD, 21-50% also had high CU traits dependent on the informant.

Despite a lack of consensus on a cut-off point for high CU traits (Docherty et al., 2016), research findings of significant differences between children grouped as CP/CU- and CP/CU+ suggest that the distinction is a valuable one for both researchers and clinicians (Frick, Ray, Thornton, & Kahn, 2014; Kimonis et al., 2015). In particular, CP/CU+ has been associated with a more aggressive and stable pattern of antisocial behaviour compared to CP/CU- in both boys and girls (Edens et al., 2007; Frick & White, 2008; Kimonis et al., 2006; Kruh et al., 2005; Leistico et al., 2008; Marsee & Frick, 2007). Furthermore, CU traits in childhood and adolescence are predictive of psychopathy in adulthood after controlling for CD and other childhood risk factors (Burke, Loeber, & Lahey, 2007; Lynam, Caspi, Moffitt, Loeber, & Stouthamer-Loeber, 2007). CP/CU+ have also been found to have a distinct neurocognitive profile (Jones & Viding, 2007) and have a stronger genetic risk than CP/CU- (Viding & Jones, 2008; Viding, Jones, Frick, Moffitt, & Plomin, 2008). Differences between these subtypes are discussed further throughout this chapter. Importantly, CP/CU+ have shown poorer outcomes compared to CP/CU- in interventions for youths with antisocial behaviour (Hawes & Dadds, 2007; Wilkinson, Waller & Viding, 2015). A systematic review of intervention outcomes for youths with CU traits is presented in Chapter Five.

1.5 Risk and Protective Factors

There appears to be no single developmental pathway for CP (Frick, 2016) and a myriad of biological and environmental risk and protective factors have been identified, as well as interactions between multiple factors (Murray & Farrington, 2010; Vanderbilt-Adriance et al., 2015). Findings of some of the well-documented risk and protective factors for CP are summarised below[3].

1.5.1 Genetic influences

Twin studies are a valuable behavioural genetics tool in which monozygotic (100% shared genes) and dizygotic (50% shared genes) twins are compared to determine the contribution of genetic and environmental influences to individual differences. Genetic influences may be additive, meaning that the total effect on a trait stems from one or more gene loci. A non-additive genetic influence means that just one allele (a variant of the gene) contributes as much as more than one of the same allele, or where alleles act differently depending on the other alleles present. The shared environmental influence refers to environmental factors that make the twin pair more similar than would be expected by genetics alone, while non-shared environmental influence refers to environmental factors that make the twin pair dissimilar to each other (Viding & McCrory, 2012).

[3] This thesis focuses on the cognitive and emotion-related processes related to behavioural regulation, therefore neurobiological correlates of CP will be reviewed separately in section 1.7 and in more detail in Chapter 2.

A meta-analysis of 51 twin and adoption studies (Rhee & Waldman, 2002) demonstrated that moderate additive genetic influences (.32), non-additive genetic influences (.09), shared environmental influences (.16), and non-shared environmental influences (.43) each accounted for significant variance in antisocial behaviour. More recent studies have suggested that psychopathic traits specifically have a strong genetic influence (Fontaine, Rijsdijk, McCrory, & Viding, 2010; Larsson, Viding, & Plomin, 2008; Taylor, Loney, Bobadilla, Iacono, & McGue, 2003; Viding, Blair, Moffitt, & Plomin, 2005; Viding et al., 2008). In a sample of 7,500 7-year-old twins, Viding et al. (2005) found that CP had a substantial total environmental influence (shared=.34; non-shared=.26), but only a moderate genetic influence (.30). However, a strong genetic influence was found for youths with CP/CU+ (.81), with no influence of shared environment. This finding was repeated with a sample of 1,865 9-year-old twins (Viding, Jones, Frick, Moffitt, & Plomin, 2008). In a sample of 1,219 twins and triplets, aged 9-10 years, Bezdjian, Raine, Baker, and Lynam (2011) found significant genetic and unique environmental influences on CU traits, with heritability estimates of .64 and .46 respectively in boys, and .49 and .58 respectively in girls. As in Viding and colleagues' twin studies, no shared environmental influences on CU traits were found. Taken together, these findings suggest that the CU traits subtype is genetically vulnerable to antisocial behaviour, whereas antisocial behaviour of children with CP/CU- may be more strongly influenced by their environment. Tuvblad, Bezdjian, Raine, and Baker (2014) extended this research by combining parent-reports and youth self-reports across different measures of psychopathy with 1,208 twins (aged 14-15). Genetic influences explained 69% of the variance in psychopathic traits, while non-shared environmental influences explained 31%.

A relatively new method for studying genetic influences are genome-wide association studies (GWAS). GWAS use DNA samples to examine the many common genetic variants in different individuals to see if any variant is associated with a particular trait. Although causality cannot be determined, if one type of the allele is more prevalent in individuals with the trait, the allele is said to be associated with that trait. In one GWAS, Dick et al. (2011) identified four genetic markers for CD symptoms that met the criteria for genome-wide significance, providing the first evidence of a specific gene associated with this behaviour. Viding et al. (2013) published the first GWAS to investigate the genetic influence on CU traits in a community sample of 2,930 children. However, no significant genetic markers were identified.

A gene-environment interaction for antisocial behaviour may also help explain the development of CP (Holz et al., 2016). In other words, there may be genetically determined individual differences in the child’s sensitivity to the environmental risk factors for CP (Moffitt, Caspi, & Rutter, 2005; Rutter & Silberg, 2002; Van Goozen, Fairchild, Snoek, & Harold, 2007). For example, there is a large body of evidence suggesting that genes involved in the regulation of serotonergic neurotransmission, in particular monoamine oxidase A, may predispose an individual to CP, but that CP only becomes evident in the presence of an environmental trigger such as maltreatment (Kim-Cohen et al., 2006).

1.5.2 Pre-natal influences

Mixed findings have been reported for the influence of maternal prenatal smoking on offspring CP (Button, Thapar, & McGuffin, 2005; Gaysina et al., 2013; Pratt, McGloin, & Fearn, 2006; Wakschlag & Keenan, 2001). It may be that characteristics of mothers or their environment associated with prenatal smoking play a role in this relationship. Maughan, Taylor, Taylor, Butler, and Bynner (2001) used data from 1,116 twin pairs in a British longitudinal study and found prenatal smoking had a strong, dose-response relationship with CP at ages 5 and 7 years. However, mothers who smoked during pregnancy were also more likely to have antisocial behaviour themselves, have children with antisocial men, have a history of depression, and live in more disadvantaged circumstances. Controlling for these and genetic factors reduced estimates of the effect of prenatal smoking on CP by 75-100%. Nevertheless, in Gaysina et al.'s (2013) examination of three large cohort studies in Wales, New Zealand, and the U.S, prenatal smoking significantly predicted CP when controlling for a range of maternal characteristics and the postnatal environment, including SES, family breakdown, parenting practices, and passive smoking. More research with diverse samples and advanced statistical methods is needed to try to separate out the unique influence of prenatal smoking on CP.

Prenatal cannabis-use has also been associated with CP. Day, Leech, and Goldschmidt (2011) found that the odds of adolescents being delinquent when exposed to one or more cannabis joints per day during the first trimester of pregnancy, were nearly double those of adolescents who were not exposed or who were exposed to lesser amounts. However, attention problems, depressive symptoms, mother's personality, and the home environment have all been found to mediate this association (Day et al., 2011).

A significant association between prenatal alcohol exposure and offspring CP has been found. In a sample of 592 adolescents, Larkby, Goldschmidt, Hanusa, and Day (2011) found that drinking one or more alcoholic drinks per day in the first trimester of pregnancy was associated with an increased rate of CD in offspring at age 16. Of youths with CD, 36% were exposed to at least one drink per day during the first trimester compared to 16% of youths without CD. This effect remained significant after controlling for postnatal environmental variables including maternal psychopathology and SES, and additional prenatal exposures. Prenatal exposure to nicotine, marijuana, cocaine, and other illicit drugs did not significantly increase the risk of CD, suggesting alcohol exposure may be the greatest prenatal exposure risk. Nevertheless, the possible mediating effects of genetic transmission on the association between prenatal substance use and CP has received little attention and more genetically sensitive research is needed to examine this.

1.5.3 Family functioning and parenting practices

During early childhood, parents set the guidelines for acceptable behaviour and teaching children the skills they need to succeed in later development (Dishion & Patterson, 2006; Vanderbilt-Adriance et al., 2015). It is not surprising then that a range of parenting and family factors have consistently been associated with CP. In particular, the influence of parental depression has been the focus of several studies examining risk for child behaviour problems (e.g. Ashman, Dawson, & Panagiotides, 2008; Kim-Cohen, Moffitt, Taylor, Pawlby, & Caspi, 2005; Matijasevich et al., 2015; Smith, Eryigit-Madzwamuse, & Barnes, 2013). In a cohort of 4,231 mother-child dyads, Brazil, Matijasevich et al. (2015) found that 6-year-old children of mothers with chronic and severe depression throughout the first six years of the child’s life, had the most severe behaviour problems, suggestive of an additive effect of depression severity over time on child behaviour outcomes.

The mechanism through which parental depression is associated with CP is not fully understood. It has been proposed that parental depression disrupts the caregiving environment. Mothers with depression have higher rates of irritability and aggression, and show parenting deficiencies in terms of inconsistency and lack of supervision (Cummings & Davies, 1994). These characteristics may cause distress to the child and result in their own behaviour problems. There may also be a reciprocal relationship between maternal well-being and child functioning. Children's behaviour problems may lead mothers to feel overwhelmed and frustrated, inducing or exacerbating maternal depression (Forbes et al., 2008; Frye & Garber, 2005). These negative changes in maternal functioning may further intensify the child's behaviour problems (Gross, Shaw, Moilanen, Dishion, & Wilson, 2008; Kim-Cohen, Moffitt, et al., 2005; Nicholson, Deboeck, Farris, Boker, & Borkowski, 2011). Both Nicholson's (2011) and Gross' (2008) research groups found that the influence of mothers' depressive symptoms on their child's behaviour was stronger than the influence of child behaviour on mothers' depression. However, both studies were susceptible to shared method variance, as the same-informant was used for parental depressive symptoms and child behaviour. Potential mediating variables, such as SES, marital conflict, additional mental health symptoms, or the genetic transmission of psychopathology, may also be involved. In a British cohort of 1,116 7-year-old twin pairs, Kim-Cohen, Moffitt, et al. (2005) found mothers' and fathers' ASPD symptoms accounted for one third of the association between maternal depression and children's antisocial behaviour. Nevertheless, maternal depression did remain a significant predictor of children's antisocial behaviour when accounting for parents' ASPD symptoms.

Smith et al. (2013) examined the association between paternal depression, marital conflict, and children's CP with 705 families in a longitudinal British community study. Controlling for SES and maternal mental health, paternal depression predicted parents' reports of child externalising problems at 4 years of age. However, marital conflict at 36 months mediated the relationship between paternal postnatal depression and children's CP, suggesting that paternal depression influenced child behaviour through marital conflict. Ashman et al. (2008) similarly found low marital satisfaction and high family conflict mediated the relationship between maternal depression and child behaviour. This could be due to modelling and desensitisation of aggressive behaviour on the child's own behaviour, distress or anger caused to the child resulting in behaviour difficulties, or the influence of marital conflict on parenting quality. In line with these findings, Reigstad and Kvernmo (2016) recently demonstrated that parental mental health problems and exposure to violence were the strongest predictors of CP in a large community sample of 4,881 adolescents.

Other parenting characteristics, such as poor parental discipline, have also been associated with CP. Patterson and colleagues argue that when parents fail to discipline disruptive behaviour, the child is likely to repeat the behaviour, parental frustration will increase, and the attachment between parent and child will be disrupted (Patterson, Dishion, & Yoerger, 2000). In line with this argument, negative parenting styles, including poor supervision, inconsistent rules, harsh discipline, a failure to reward positive behaviour, and a coercive style of interaction, have been associated with behaviour difficulties (Conger, Neppl, Kim, & Scaramella, 2003; Murray & Farrington, 2010; Reid, Patterson, & Snyder, 2002; Scott, Doolan, Beckett, Harry, & Cartwright, 2012). In Scott et al.'s (2010) sample of 278 families, 40% of children (aged 4-7) with parents who used harsh and inconsistent discipline had clinical behaviour problems, compared to 21% of children in families who did not use harsh and inconsistent parenting. This association remained after controlling for a number of child and family factors. However, this relationship may not be entirely environmental and again genetic transmission needs to be considered. Klahr, McGue, Iacono, and Burt (2011) examined the association between parent–child conflict and CP in a longitudinal study of 672 adopted adolescents. Parent–child conflict predicted CP four years later, whereas CP did not predict increases in parent–child conflict, suggesting parent-child conflict leads to CP, rather than problematic child behaviour causing parent-child conflict. Furthermore, since children do not share genes with adoptive parents, these findings suggest that the association between CP and parent–child conflict cannot be explained by genetic transmission.

Alongside exposure to conflict, physical abuse has been associated with CP (e.g. Jaffee et al., 2005; McCabe, Hough, Yeh, Lucchini, & Hazen, 2005; Murray & Farrington, 2010; Schulz-Heik et al., 2010). In a study of 423 high risk youths (12-17 years), McCabe et al. (2005) found that both exposure to community violence and child physical maltreatment independently predicted CD. A number of mechanisms could be involved in this association. Physical abuse may result in direct trauma to the brain; abused children may develop non-adaptive coping styles in response to an early hostile environment; or abuse may lead to a change in the family environment, such as being placed in care (Murray & Farrington, 2010). In a recent review, McCrory, De Brito, and Viding (2010) highlight evidence pointing to a number of neurobiological changes associated with child maltreatment, including structural changes in the prefrontal cortex (PFC) of victims of childhood abuse (Carrion, Weems, Richert, Hoffman, & Reiss, 2010). Since the PFC plays an important role in many aspects of cognitive control and behaviour regulation, changes to this region could be responsible for the behaviour difficulties of the maltreated child. A non-passive gene-environment interaction, in which parents react to children's genetically-influenced CP with maltreatment (Schulz-Heik et al., 2010), or a passive gene-environment interaction, in which both the parents' tendency to abuse their child and the child's behaviour problems are influenced by a genetic vulnerability to antisocial behaviour have also been suggested (Byrd & Manuck, 2014; Schulz-Heik et al., 2010). However, evidence of this interaction effect has not been consistent and gene-environment interactions on CP are still not well understood (Fergusson, Boden, Horwood, Miller, & Kennedy, 2011).

1.5.4 Neighbourhood and peer influences

In a sample of 588 adolescents, Deković (1999) found that community characteristics played a more important role in behaviour problems than did family factors. In particular, the adolescents' association with deviant peers was one of the strongest risk factors for externalising problems. Affiliation with delinquent peers of youths with CP has been frequently reported (e.g. Chen, Drabick, & Burgers, 2015; Finger et al., 2008; Vaillancourt & Hymel, 2006). However, it is not well-understood whether CP results directly from this affiliation, perhaps through modelling or reinforcement of antisocial behaviour, or whether some mediating mechanism, such as living in a disadvantaged neighbourhood, is at play. Furthermore, the association with deviant peers may be one of the negative outcomes of CP, as the antisocial child affiliates with other antisocial peers following rejection from non-delinquent peers (Bagwell, Coie, Terry, & Lochman, 2000). Disruptive youths may be viewed as deviant from their non-disruptive peers and be rejected in social interactions (Chen et al., 2015; Vaillancourt & Hymel, 2006). As a result, these youths are not exposed to positive social interactions and may fail to develop normative social skills (Fergusson, Swain-Campbell, & Horwood, 2002). A perpetuating cycle between associating with delinquent peers and the child's own antisocial behaviour has been reported. In two studies using data from 11- to 17-year-olds in the U.S National Youth Survey (Elliott & Menard, 1996; Keenan, Loeber, Zhang, Stouthamer-Loeber, & Van Kammen, 1995), the strongest pattern of the relationship between delinquent peers and CP was of a child moving from associating with non-delinquent peers to associating with slightly deviant peers, to committing minor offenses. This was then followed by a more frequent association with deviant peers and more serious offending, finally leading to the highest level of association with deviant peers.

Evidence suggests that low SES families and neighbourhoods characterised by poverty, poor social cohesion, and high crime, put the child at greater risk for CP (Leventhal & Brooks-Gunn, 2000; Sariaslan et al., 2013). Meltzer et al. (2003) found that CD was four times more likely in families with unskilled occupations compared to professional families. Yet again, the mechanisms through which these associations operate is less clear due to a number of factors associated with low SES or disadvantaged neighbourhoods and antisocial behaviour. It is likely that children from these families or neighbourhoods expose the child to a number of other risk factors, such as parental stress, poor parenting, family conflict, and associations with delinquent peers. In a sample of 7,077 children (4-13 years), Goodnight et al. (2012) found neighbourhood disadvantage was significantly associated with CP, controlling for family income and maternal antisocial behaviour. Dodge, Pettit, and Bates (1994) (*N*=585) found low SES at pre-school predicted CP in each of the school years assessed (preschool and primary years 1-3) and a number of socialisation variables, including harsh discipline, exposure to violence, stressful life events, low social support for the mother, and a lack of cognitive stimulation, significantly predicted teacher-rated externalising problems. The socialisation variables partially mediated the association between low SES and child behaviour problems, together accounting for 57% of variance in the effect of low SES on teacher-rated externalising problems and 50% on peer-nominated aggression. These findings suggest that a focus on just one of the many factors associated with antisocial behaviour may lead to oversimplified models of risk for CP.

1.5.5 Protective factors for CP

While there are a number of risk factors for CP, not all children exposed to these risks develop CP or have a lifelong trajectory of antisocial behaviour (Wasserman et al., 2003). Positive relationships with parents and peers have been investigated in several studies as potential protective factors. For example, a high-quality bond between children and their peers may protect children exposed to conflict at home by providing an alternative source of emotional support and by modelling prosocial behaviour. In Wasserstein and La Greca's (1996) study of 96 school-aged children, support from a close friend was found to moderate the relationship between parental conflict and teacher-reported behaviour problems. Importantly, support from other classmates did not moderate this association, suggesting a high-quality friendship may be necessary to operate as a protective factor. A positive parent-child relationship may also protect children at risk for CP. Parents who are attentive and responsive to their children may notice when their child needs emotional support or behavioural guidance (Brook, Brook, Gordon, Whiteman, & Cohen, 1990). Supplee, Unikel, and Shaw (2007) found parental involvement reduced the effects of poor neighbourhood quality on children's risk of CP in a sample of 120 male toddlers. Similarly, children whose parents show warmth are likely to respond positively to parental guidance and are less likely to engage in conflicting interactions (Kochanska & Coy, 2002). Indeed, Kim-Cohen, Moffitt, Caspi and Taylor (2004) found maternal warmth was associated with positive adjustment in children exposed to low SES in a large sample of 1,116 5-year-old twin pairs.

Individual child protective factors for CP have also been found. Prosocial skills, including assertion, responsibility, and self-control, may provide the child with the tools needed to problem solve in social situations, rather than resorting to antisocial behaviour. In a study of 1,207 children (aged 4-10), Holmes and colleaues found that children's prosocial behaviour and positive internalising wellbeing, and the caregiver's positive wellbeing, decreased the likelihood of CP (Holmes, Yoon, Voith, Kobulsky, & Steigerwald, 2015). Child wellbeing and prosocial skills, but not caregiver's wellbeing, also decreased the likelihood of CP 18 months later. The change in the protective effect of the caregiver's wellbeing suggests that parenting influences may become less relevant as the child gets older. Family-level factors may be more relevant for young children due to a higher level of dependence on caregivers compared to middle childhood or adolescence. Indeed, a meta-analysis by Nasvytienė, Lazdauskas, and Leonavičienė (2012) demonstrated that individual protective factors appear to have more stable and lasting effects on CP than family or community influences.

In one of the few studies examining resilience in school-aged children across individual, family and neighbourhood levels, Jaffee and colleagues found significant protective factors for CP at all three levels in a sample of maltreated children (Jaffee, Caspi, Moffitt, Polo-Tomas, & Taylor, 2007). Higher intelligence, parents' wellbeing, low-crime neighbourhoods, and neighbourhoods with high social control and cohesion, were all independently associated with resilience to maltreatment. However, resilience was reduced for children exposed to multiple risk factors. In 2- to 3-year-olds (N=731), Vanderbilt-Adriance et al. (2015) found children's inhibitory control, attention, and positive behaviour, parental social support satisfaction, and neighbourhood quality, were each associated with lower levels of CP at age 5. Each domain accounted for unique variance in protection against CP, demonstrating the importance of protective factors across individual, family, and neighbourhood levels.

1.5.6 Risk factors and protective factors for CU traits

As discussed previously, a genetic association with CU traits has been found and CU traits have been shown to have a stronger genetic influence than CP more generally (Bezdjian et al., 2011; Viding et al., 2008). There is also evidence to suggest that CP/CU+ is less strongly related to environmental risk factors compared to CP/CU- (Hipwell et al., 2007; Oxford, Cavell, & Hughes, 2003). However, there is now a growing body of research which has identified environmental risk factors for CU traits, most prominently parenting practices (Waller, Gardner & Hyde, 2013).

In early studies examining the role of parenting practices on CU traits, Wootton, Frick, Shelton, and Silverthorn (1997) and Oxford, Cavell, and Hughes (2003) found that CU traits moderated the association between poor parenting and CP, in that ineffective parenting was associated with CP in children without high CU traits only. These findings support the notion that children with CU traits are less influenced by negative dimensions of parenting, because they are less sensitive to negative stimuli and punishment (e.g. Blair, Colledge, Murray & Mitchell, 2001; Marsh et al., 2008). However, there is evidence that high parental harshness, coercion, and inconsistent discipline (Barker, Oliver, Viding, Salekin, & Maughan, 2011; McDonald, Dodson, Rosenfield & Jouriles, 2011; Mills-Koonce, Willoughby, Garrett-Peters, Wagner, & Vernon-Feagans, 2016; Waller et al., 2012) are related to CU traits. In a systematic review of 30 studies examining parenting practices and CU traits, Waller et al. (2013) conclude that there are still mixed findings regarding the relationship between negative parenting practices, CU traits and CP, likely due to the different methodologies and samples used. One important limitation to this research has been the use of parental reports of their own parenting practices.

The association between parental warmth and CU traits has been more consistent, with the finding that low parental warmth predicts CU traits (Kroneman, Hipwell, Loeber, Koot, & Pardini, 2011; Pardini, Lochman, & Powell, 2007; Pasalich, Dadds, Hawes, & Brennan, 2011). For example, Pasalich et al., (2011) coded observations and speech recordings of parent-child interactions in a group of 95 clinic-referred boys with CD (aged 4-12). CU traits were found to moderate associations between mothers' and fathers' parenting and child CP. While coercive parenting was more strongly associated with boys with CP/CU- compared to CP/CU+, parental warmth was more strongly negatively associated with CP/CU+ than CP/CU-. In line with these findings, parental warmth has been found to be a protective factor for CU traits (Kimonis, Cross, Howard, & Donoghue, 2013; Kochanska, Kim, Boldt, & Yoon, 2013; Pardini, Lochman & Powell, 2006; Robinson, Azores-Gococo, Brennan, & Lilienfeld, 2016). Kochanska et al. (2013) observed parent–child dyads (38 and 52 months of age) in a longitudinal study of 100 families. While no significant associations were found for children with low CU traits, shared positive affect between father and child, and a warm, mutually co-operative mother-child relationship predicted a decrease in future behaviour problems for children with CU traits. Similarly, Pardini et al. (2006) found that children exposed to higher levels of parental warmth and involvement, predicted decreases in CU traits over time. It may be that parental warmth and responsiveness can protect against the development of antisocial behaviour by promoting empathy and prosocial behaviour in the child.

Beyond everyday parenting practices, exposure to violence within the family and in the wider community have also been associated with CU traits (Hartman, Hageman, Williams, Mary, & Ascione, 2016; Howard, Kimonis, Muñoz, & Frick, 2012). Howard et al. (2012) found that exposure to community violence fully mediated the relationship between CU traits and violent delinquency in male adolescent offenders (*N*=88). Tatar, Cavanagh, and Cauffman (2016) suggest that chronic exposure to violence leads to desensitisation to others' distress and may influence the development of empathy and morality, resulting in an uncaring and callous personality. CU traits has similarly been associated with deviant peer affiliation (Kerr, Van Zalk, & Stattin, 2012; Muñoz, Kerr, & Besic, 2008; Tatar et al., 2016). For example, in Tatar et al.'s (2016) study of juvenile offenders, greater exposure to delinquent behaviour from peers was associated with more antisocial behaviour and the impact of peer influence on institutional misconduct was particularly pronounced for youths with high CU traits.

Taken together, this body of research suggests that while CU traits appears to be heritable, the youth's social environment also needs to be taken into account. While research into the risk and protective factors of CU traits needs more attention, especially in examining factors beyond parenting and any reciprocal relationships in these associations (e.g. Hawes et al, 2011), the findings presented further confirm that CU traits are a subgroup of children with CP who have distinct developmental pathways to problematic behaviour. Neurobiological abnormalities specific to this subgroup of antisocial youths have also been recognised and will be discussed later in this chapter.

1.6 Long-term Outcomes

Several associations between CP and later outcomes, including poor academic achievement and unemployment, criminality, adult mental health problems and mortality, have been found in a series of large longitudinal studies (e.g. D'Amico et al., 2014; Fergusson, John Horwood, & Ridder, 2005; Knapp, King, Healey, & Thomas, 2011). Furthermore, the high financial cost of CP on society has been examined (e.g. D'Amico et al., 2014; Raaijmakers, Posthumus, van Hout, van Engeland, & Matthys, 2011). Each will be discussed, followed by a consideration of long-term outcomes for youths with CU traits.

1.6.1 Academic achievement and employment

Youths with CP are reported to have lower intelligence than their peers, especially low verbal IQ (Murray & Farrington, 2010; Pinsonneault, Parent, Castellanos-Ryan, & Séguin, 2015; Stattin & Klackenberg-Larsson, 1993). Deficits in higher order cognitive skills, or executive functions, associated with learning and achievement (e.g. planning, inhibition, and working memory), have also been found in youths with CP (Casey, Tottenham, & Fossella, 2002; Duncan et al., 2007; Nigg, 2000). It is not surprising then that antisocial youths have consistently been found to have co-occurring and later academic difficulties (Malecki & Elliot, 2002; Masten et al., 2005; Risi, Gerhardstein, & Kistner, 2003).

However, the causality of these associations is less clear. Academic achievement may be a reflection of low IQ and cognitive deficits. Alternatively, poor academic achievement could be a consequence of disruptive behaviour leading to missed learning opportunities in the classroom. Blair (2002) suggests that poor emotion regulation characteristic of children with CP, inhibits the use of higher order cognitive processes required for learning. In a study of 325 5-year-old children, Graziano, Reavis, Keane, and Calkins (2007) found parents' reports of their child's emotion regulation was positively associated with teacher-reported academic success and productivity and with standardised mathematics and literacy scores after controlling for IQ. Whether a cause or effect of CP, children who struggle academically may be faced with criticism from teachers and peers and develop poor self-perception and motivation to succeed at school (Dotterer & Lowe, 2011; Gambin & Święcicka, 2015). This could lead to a downward spiral of disruptive behaviour and further disengagement from education (Meltzer, Reddy, Pollica, & Roditi, 2004). The association between academic achievement, executive function, emotion regulation, and CP will be discussed in more detail in Chapter 2.

Considering the associations with cognitive deficits and achievement, it is not surprising that children with CP are more likely to leave school without qualifications and have higher rates of unemployment, erratic employment, or employment in unskilled professions, compared to those without CP (Knapp et al., 2011). However, associations between early CP and later education and employment outcomes have been found to be no longer significant when controlling for child and family factors including child IQ, attention problems, substance use, truancy, and low family SES (Fergusson & Horwood, 1998; Fergusson et al., 2005). Nevertheless, CP remains a marker for poor education and employment outcomes.

1.6.2 Criminality

Rates of repetitive criminal behaviour for youths with CP are high and CP is associated with later violent and non-violent criminal activity (Salatino-Oliveira et al., 2016). Farrington (1995) reported that 40% of 8-year-olds with CD are repeatedly convicted of crimes, including theft, vandalism, and assault, in adolescence. Furthermore, 90% of repeating juvenile offenders had CD as a child, suggesting that childhood CD is a strong risk factor for later offending behaviour. Jakobsen, Fergusson, and Horwood (2012) used data from their birth cohort study (*N*=1,265) to examine the role of achievement in the association between CP and criminal activity. The authors found that the association between CP, school achievement and crime are best described by an additive model, in that underachievement makes a child with CP more likely to conduct crimes in adulthood. Further longitudinal studies are needed to investigate other possible pathways from CP to criminality, including possible protective factors.

1.6.3 Adult mental health and mortality

CP has been associated with a range of subsequent mental health problems in adolescence and adulthood (Dalsgaard, Mortensen, Frydenberg, & Thomsen, 2002; Kim-Cohen et al., 2003). In fact, there is evidence to suggest that CP is associated with more adult mental health problems than any other childhood disorder. In a prospective longitudinal study by Kim-Cohen et al. (2003), 470 of the 980 participants met criteria for a major DSM-IV diagnosis of a psychiatric disorder at 26 years of age. Of these individuals, 25-60% had a juvenile diagnosis of CD and/or ODD. Most notably, every adult disorder diagnosed in this sample, was associated with childhood CD and/or ODD. In contrast, other childhood diagnoses, including anxiety, depressive disorder, and ADHD, predicted some but not all adult psychiatric disorders. CP has also been found to predict more risky behaviours associated with poor psychological and physical well-being in adulthood and poorer overall health compared to other early psychological disorders (Bardone et al., 1998). In a sample of 459 adolescent girls, Bardone and colleagues found that CD at age 15 predicted alcohol, marijuana, and tobacco use and dependence; more sexual partners, sexually transmitted disease, and early pregnancies; lower body mass index; and more medical problems at age 21 years. The effect remained after controlling for earlier health and wellbeing. In contrast, adolescent depression only predicted adult tobacco dependence and more medical problems, and adolescent anxiety predicted more medical problems only.

It is perhaps not surprising then that adults with a history of CP are at an increased risk of premature mortality, both from natural and unnatural deaths (Laub & Vaillant, 2000; Maughan, Stafford, Shah, & Kuh, 2014; Piquero, Shepherd, Shepherd, & Farrington, 2011). A number of potential mechanisms for this association have been proposed (Angold, 2009). Firstly, premature mortality may be a direct result of psychopathology, such as death from a drug overdose or suicide. Adolescents and adults with a history of CP have a higher rate of substance abuse, self-mutilation behaviour, suicidal ideation and attempted suicide compared to those without CP (Odgers et al., 2007; Vander Stoep et al., 2011; Wei et al., 2016). Secondly, mortality may be a consequence of ongoing involvement in impulsive and dangerous behaviour (Piquero et al., 2011). Indeed, adolescent antisocial behaviour is associated with more injuries and accidents in early adulthood compared to adults without a history of CP (Farrington, 1995).

Early mortality from natural causes may result from physical diseases associated with psychopathology. Odgers et al. (2007) found that men with life-course persistent antisocial behaviour reported poorer general health than men with a low antisocial history. They were also more likely to be smokers, have visited a general practitioner or been hospitalised in the past year, and were at a greater risk for gum disease and chronic bronchitis. These men also had elevated levels of a marker for cardiovascular risk. Odgers and colleagues found similar outcomes for women in a later study (Odgers et al., 2008). Physical health problems could also be an indirect result of the environmental correlates of CP, including early life and ongoing stressors. Exposure to chronic stress early in development has been found to contribute to long-term health via several pathways including stress-related inflammation and allostatic load, i.e. the physiological wear and tear of the body's regulatory systems (Danese & McEwen, 2012; Raposa, Hammen, Brennan, O'Callaghan, & Najman, 2014).

1.6.4 Cost to society

Unemployment, service-utilisation, and criminal activity of antisocial individuals all incur financial costs on the individual, the family, and wider society (D'Amico et al., 2014; Raaijmakers et al., 2011). In the Great Britain National Study, with a sample of over 10,000 children aged 5-15 years, Vostanis et al. (2003) found that 55.3% of children with CD had received educational input for their behaviour difficulties, 37.7% had used primary health care services, 26.6% utilised specialist health services, and 26.8% had made contact with social services. Similarly, in a sample of 317 preschool children, Raaijmakers et al. (2011) found that children with a clinical level of aggression had a higher use of services over the first 4 years of life than children with low levels of aggression and that this service-use incurred more financial cost on the families. In a cohort of 3,215 boys with data spanning 20 years, D'Amico et al. (2014) found high levels of early childhood CP were associated with increased financial costs accounted for by contact with the criminal justice system, health service, and social care. For those with childhood CP, more than half the average cost was due to contacts with the criminal justice system. The financial costs associated with CP add to the importance of early interventions for children with CP, to reduce the economic burden on families and society as a whole.

1.6.5 Long-term outcomes for youths with CU traits

Evidence suggests that children and adolescents with CU traits have a particular severe and persistent pattern of antisocial behaviour (Frick, Stickle, Dandreaux, Farrell, & Kimonis, 2005). Considering the fundamental characteristics of CU traits and their stability, it is not surprising that youths with elevated CU traits are more likely to exhibit high levels of psychopathy as adults compared to youths low in these traits (Byrd, Loeber, & Pardini, 2012; Hawes, Byrd, Waller, Lynam, & Pardini, 2016; McMahon, Witkiewitz, & Kotler, 2010). This is particularly concerning considering the serious long term outcomes associated with adult psychopathy. For example, psychopathic adults are significantly more likely than non-psychopathic offenders to report engagement with high-risk behaviours, such as extreme substance use (Hopley & Brunelle, 2012; Stenason & Vernon, 2016), promiscuous and coercive sexual behaviour (Ali & Chamorro-Premuzic, 2010; Harris, Rice, Hilton, Lalumiere, & Quinsey, 2007), and violent criminal activity (Pedersen, Kunz, Rasmussen, & Elsass, 2010; Shaw & Porter, 2012). CU traits have similarly been associated with adolescent substance use (Baskin-Sommers, Waller, Fish, & Hyde, 2015; Ray, Frick, Thornton, Steinberg, & Cauffman, 2016) and risky sexual behaviour (McCauley, Shadur, Hoffman, MacPherson, & Lejuez, 2016; Wymbs et al., 2013).

Youths with CU traits have also been found to have greater subsequent contact with the police or the juvenile justice system (Frick et al., 2005) and a higher rate of recidivism in general, sexual, and violent offending in adolescence and adulthood (Baskin-Sommers et al., 2015; Kahn, Byrd, & Pardini, 2013; McMahon et al., 2010). In a longitudinal sample of children living in high- and low-risk neighbourhoods (*N*=754), CU traits in early adolescence were predictive of antisocial and criminal behaviour two years after leaving high school (McMahon et al., 2010). While CU traits did not predict self-reported serious crimes, possibly due to underreporting of their own offenses, CU traits did predict self-reported general delinquency, adult ASPD, and juvenile and adult arrests, beyond prior and concurrent CP symptoms. Moreover, CU traits were a stronger predictor of these outcomes than were other externalising symptoms (ODD, CD, and ADHD). These findings suggest that the presence of CU traits can provide unique information about the prediction of long-term criminal outcomes for antisocial youths. However, research is needed which follows these youths into later adulthood to assess the life-long criminal trajectories of this subgroup. Furthermore, individual differences within this subgroup need to be explored further. In McMahon et al.'s (2010) study, the relationship between CU traits and adult arrests was particularly strong for participants from an urban sample. Although not a consistent finding, previous research has also suggested that there may be weaker associations between CU traits and criminality among ethnic minorities (Edens et al., 2007; Kahn et al., 2013). These findings may put into question the clinical utility of CU traits for some groups. Replications of these findings are needed to examine this possibility.

Longitudinal studies examining the association between CU traits and academic outcomes are scarce. However, CU traits have been associated with higher intelligence than CP without CU traits (Loney, Frick, Ellis, & McCoy, 1998; Salekin, Neumann, Leistico, & Zalot, 2004) and in Pardini and Fite's (2010) study, CU traits did not uniquely predict parent- or teacher- reported academic achievement (reading, writing, mathematics, and spelling abilities). In contrast, Ciucci and colleagues found CU traits were associated with poor academic achievement in 6- to 8-year-olds (*N*=540) (Ciucci, Baroncelli, Franchi, Golmaryami, & Frick, 2014) and a recent study found CU traits to be associated with poorer maths and reading exam performance in a sample of 942 8-year-olds, controlling for CP (Horan et al., 2016). While more research to examine cognitive abilities and academic achievement in this subgroup would be helpful, one interesting moderating effect of the youth's cognitive skills on long-term outcomes has been found. Baskin-Sommers et al. (2015) tracked serious juvenile offenders (*N*=1,170) over 5 years from age 14 to 18, and found that violence and substance-use of those with CU traits was stronger among youths with high executive control. While unexpected, it may be that higher executive control, at least in terms of cognitive flexibility and resistance to interference assessed in this study, enables youths with CP/CU+ to successfully engage in violence or substance use by supporting the planning and implementation of strategies to obtain desired goals.

While research in this area is growing, it remains largely limited by the lack of long-term follow-up studies of individuals with CU traits into middle or late adulthood. Furthermore, information on physical health and mortality of these individuals is needed to assess whether the associations found for CP are modified by the presence of CU traits. Based on the findings reported here, it would be expected that the involvement in high-risk behaviours such as substance-use and criminal activity may result in higher rates of premature mortality, at least from unnatural deaths, than those with a history of CP without CU traits. Similarly, we can speculate that the severity and stability of these traits, alongside the greater association with criminal activity, may result in higher life-long financial costs for this particular subgroup of antisocial individuals. However, economic studies that assess the costs incurred by individuals with CU traits while controlling for CP are needed. Despite these gaps in the research, evidence suggests that CU traits are a unique predictor, beyond CP more generally, of poorer outcomes in adolescence and into early adulthood. These findings highlight the utility of identifying subgroups of youth based on CU traits for understanding the trajectories of antisocial behaviour (Baskin-Sommers et al., 2015). With increased recognition of the CU traits subtype, including the inclusion of the limited prosocial emotions specifier for CD in the DSM-5 (APA, 2013), and the development of measures used to assess CU traits in children and adolescents (e.g. Inventory of Callous-Unemotional Traits; Frick, 2004), long-term studies which track children with CU traits from childhood to late adulthood should be possible and will provide a bigger picture of the life-long trajectories of this group.

1.7 Neurobiological Models of Conduct Problems

It has been well-documented that antisocial individuals have distinct neurobiological characteristics. This includes evidence of altered physiological arousal of the autonomic nervous system (ANS) and the hypothalamic-pituitary axis (HPA), as well as structural and functional abnormalities in the frontal cortex and the limbic system (for a review, see Hyde, Shaw, & Hariri, 2013). These neurobiological abnormalities may account for the behaviour of antisocial youths such as impulsivity (Vitacco & Rogers, 2001) and risk taking (Robbins & Bryan, 2004) and associated problems such as poor academic achievement (Masten et al., 2005) and emotion regulation difficulties (Blair, 2002). Moreover, there is a growing body of research which suggests that children and adolescents with CP/CU+ have distinct neurobiological profiles to those with CP/CU-, which may account for the particular patterns of behaviour seen in youths with CU traits, such as a lack of empathy and reward-dominance (Finger et al., 2011; Frick et al., 2014; Rubia et al., 2009).

1.7.1 Reduced physiological arousal

1.7.1.1 Autonomic nervous system functioning

The autonomic nervous system (ANS), made up of the sympathetic nervous system (SNS) and the parasympathetic nervous system (PNS), functions to regulate the body's unconscious actions (Kreibig, 2010). While the PNS has a resting or inhibitory function (e.g. resting after meals for digestion), the SNS stimulates the neuronal and hormonal response to stress; also known as the fight-or-flight response (McCorry, 2007). One response of the SNS to aversive and stressful stimuli is the activation of the sweat glands. This activation can be a useful way to measure SNS responsivity, since the conductance of the skin varies with the activity of the sweat glands. Skin conductance (SC), or electrodermal responsivity (EDR) or activity (EDA), is a measure of variation in these electrical characteristics of the skin (Boucsein, 2012). Hypoactivity of the SNS, measured using SC methods, have been associated with aggression and CP in children and adolescents (e.g. Baker, Shelton, Baibazarova, Hay, & Van Goozen, 2013; Gao, Raine, Venables, Dawson, & Mednick, 2010b; Gao, Tuvblad, Schell, Baker, & Raine, 2015; Lorber, 2004). For example, Baker et al. (2013) measured SC in 1-year-old infants (*N*=70) during a fear induction, in which a robot was manoeuvred around the child while the mother was out of the room. Low SC during the fear induction predicted parent-reported aggressive behaviour when the children were 3-years-old.

Distinct patterns of SNS activity have also been found between different subtypes of antisocial behaviour. In a meta-analysis of 95 studies, Lorber (2004) found childhood CP was associated with lower levels of both resting and reactive SC. However, this association was not evident in adolescent samples. While it is not known whether these adolescents had childhood- or adolescent-onset CP, these results could be reflective of distinct SNS reactivity between subtypes of antisocial youths based on age-of-onset. While child participants had early-onset CP, some of the adolescents in these samples likely had late-onset CP, suggesting that early-onset CP may have a stronger biological influence than late-onset CP. While child CU traits were not assessed, Lorber (2004) found that low resting, task, and reactive EDA were each associated with adult psychopathy. However, aggression was associated with high EDA reactivity. The opposing direction of this association could offer a biological explanation for the different behaviours seen in antisocial individuals with and without psychopathic traits, and suggests that psychopathic traits in particular are characterised by low levels of SNS arousal.

More recently, SC has been measured in children and adolescents with psychopathic traits. In a sample of 9- to 10-year-olds, Isen et al. (2010) found SC hyperactivity during an aversive auditory task was characteristic of boys with psychopathic traits, but not those with CP without psychopathic traits. However, no association of hyperactivity for girls with psychopathic traits was found. In a similar study, Fung et al. (2005) found no differences in SC between youths with psychopathic traits and antisocial youths without psychopathic traits. Therefore, there is some evidence of distinct SNS activity in youths with psychopathic traits, especially for males. However the mixed findings suggest further research is needed to support this conclusion.

Heart rate can also be used as a measure of ANS activity. In a meta-analysis of 40 studies (5,868 total participants), Ortiz and Raine (2004) found antisocial behaviour in children and adolescents to be associated with reduced heart rate, with a mean effect size of -.44. The effect size for the nine studies measuring reactive heart rate in response to stressful stimuli was even larger (-.76). Importantly, this association has been shown to be independent of co-morbid hyperactivity often seen in youths with CP (Scarpa, Raine, Venables, & Mednick, 1997). In Lorber's (2004) meta-analysis, CP was found to be associated with lower resting heart rate in both children and adolescents. However age differences were found again, in that childhood CP, but not adolescent CP, was associated with increased reactive heart rate. A more recent meta-analysis of 114 studies demonstrated that increased resting heart rate in antisocial individuals, including those with psychopathy, are highly replicable. Overall, gender and age did not moderate this association (Portnoy & Farrington, 2015).

In contrast, children and adolescents with high CU traits have been found to have a lower reactive heart rate compared to antisocial youths without CU traits and healthy controls (Anastassiou-Hadjicharalambous & Warden, 2008b; de Wied, et al. 2012; Kavish et al., 2016). In de Wied et al.'s (2012) study, facial electromyographic and heart rate responses were monitored while adolescents watched film clips designed to evoke empathy. Verbal self-reports of empathy were also collected. There were significant differences in autonomic, but not verbal or facial, reactions to sadness. Adolescents with high CU traits had a lower heart rate change from baseline compared to adolescents with low CU traits or healthy controls. There were no differences in resting heart rate between the groups.

Taken together, these findings suggest that there is an association between SNS activity and antisocial behaviour, with further biological distinction found for psychopathic or CU traits. However, as Hyde et al. (2013) concluded in their review, further research is needed to account for inconsistencies in the results, with a consideration for the different tasks or measures used and sample characteristics such as age, gender, and subtypes of antisocial behaviour.

1.7.1.2 Hypothalamic–pituitary axis functioning

Differences in the functioning of the HPA of youths with antisocial behaviour provides further evidence of biological markers of CP and subtypes of antisocial behaviour. The HPA is part of the neuroendocrine system and regulates many bodily processes including stress reactions and emotions (Besedovsky, Chrousos, & Rey, 2008). Reduced activity of cortisol, a hormone released from the adrenal gland of the HPA in response to stress (Takahashi et al., 2005), has been found in children and adolescents with CP (e.g. Oosterlaan, Geurts, Knol, & Sergeant, 2005; Van Bokhoven et al., 2005; Van Goozen et al., 2007), and remains when controlling for ADHD symptoms (Snoek, Van Goozen, Matthys, Buitelaar, & Van Engeland, 2004). Differences in levels of cortisol have also been found between subtypes of antisocial behaviour (Loney, Butler, Lima, Counts, & Eckel, 2006; Stadler et al., 2011). For example, Stadler et al. (2011) took salivary cortisol probes before and after a speech and arithmetic test designed to induce stress. Participants with ADHD scoring high on CU traits had reduced cortisol levels compared to participants with ADHD and low CU traits following the stress induction.

Evidence also suggests that serotonin, a neurotransmitter of the HPA involved in both mood and cognition, is a biological marker of antisocial behaviour (e.g. Kruesi et al., 1992; Rylands et al., 2012; Unis et al., 1997). In a sample of 43 male juvenile offenders (aged 13–17), Unis et al. (1997) found whole blood serotonin was positively correlated with the severity of violent offences and with staff ratings of social skills impairment. Serotonin levels were significantly greater in adolescents with early-onset CP than in adolescents with late-onset CP, suggesting serotonin may be a particular marker for early-onset CP. More recent evidence of serotonin system function of antisocial youths comes from molecular genetics research, which suggests that the serotonin system may be specifically altered in youths with CU traits (Brammer, Jezior, & Lee, 2016; Moul, Dobson-Stone, Brennan, Hawes, & Dadds, 2013; Sadeh et al., 2010).

Taken together, these studies provide further evidence of biological markers of antisocial behaviour in children and adolescents. Moreover, HPA functioning appears to be particularly altered in youths with early-onset CP and CU traits. These physiological differences, and the possible genetic basis of such alterations, may again account for the distinct behavioural profiles of these subtypes of CP.

1.7.1.3 Low-fear model

The low-fear or fearlessness theory of antisocial behaviour proposes that low levels of arousal in the SNS and HPA of antisocial children and adolescents are biological markers of low levels of fear (Raine, 2002). Since cortisol is typically released from the adrenal gland in response to stress (Takahashi et al., 2005) and serotonin neurotransmission is implicated in sensitivity to aversive stimuli and punishment (Berridge & Waterhouse, 2003; Cools, Roberts, & Robbins, 2008), evidence of reduced cortisol and serotonin activity found in youths with CP may account for their high risk and antisocial behaviour. If these individuals have reduced levels of fear or sensitivity to aversive stimuli, they may be less concerned by the negative consequences of their actions, such as physical injury or punishment by an authority figure, and may be less likely to be deterred from using antisocial behaviour to achieve their goals (Frick & White, 2008).

With a reduced sensitivity to aversive stimuli, antisocial youths may not learn to associate their disruptive and antisocial behaviour with negative consequences. Indeed antisocial children and adolescent youths have shown reduced fear conditioning compared to healthy individuals (Fairchild, Stobbe, Van Goozen, Calder, & Goodyer, 2010; Fairchild, Van Goozen, Stollery, & Goodyer, 2008; Gao, Raine, Venables, Dawson, & Mednick, 2010a; Gao et al., 2015). Fear conditioning is a form of Pavlovian conditioning in which individuals learn to associate an aversive event (such as a loud noise or electric shock) with a previously neutral stimulus following a series of pairings between the two (Maren, 2001). In Gao et al.’s (2015) study (*N*=306), parents ratings of children’s reactive aggression (impulsive acts in response to a stimulus or provocation) and proactive aggression (without provocation, controlled, and goal directed) were collected when the child was 10, 12, 15, and 18-years-old. SC when they were 18-years-old was measured during a fear conditioning task in which a neutral tone was paired with aversive stimuli, such as an image of an attacking dog and a burst of white noise. Adolescents with persistent reactive aggression were responsive to the fear conditioning, while adolescents with persistent proactive aggression demonstrated reduced fear conditioning, suggesting youths with proactive aggression in particular may not learn from the negative consequences of their actions.

While both CP/CU- and CP/CU+ typically show reactive aggression, proactive aggression is characteristic of CP/CU+ (Nouvion, Cherek, Lane, Tcheremissine, & Lieving, 2007; Orue, Calvete, & Gamez-Guadix, 2016). Therefore, Gao et al.'s (2015) finding of reduced fear conditioning in individuals with proactive aggression only is suggestive that youths with CU traits in particular may have low-fear. This is supported by the evidence of reduced physiological activity of the SNS and HPA in youths with CU traits in particular (e.g. de Wied et al., 2012; Isen et al., 2010; Loney et al., 2006; Stadler et al., 2011). Furthermore, recent neuroimaging studies have demonstrated that children and adolescents with CU traits have reduced volume, function, and connectivity of the frontal cortex and the amygdala, two brain areas involved in fear processing (Cain & Sullivan, 2016; Cohn, Popma, Raine, & Cima, 2016; Giustino & Maren, 2015). In particular, evidence of reduced activation in response to fearful expressions (Jones, Laurens, Herba, Barker, & Viding, 2009; Koenigs, 2012; Marsh & Blair, 2008; Sylvers, Brennan, & Lilienfeld, 2011) supports the low-fear model of CU traits.

Moreover, there is behavioural and neuroimaging evidence to suggest that youths with CP/CU+ show reduced fear, while CP/CU- actually show an increased response to fearful stimuli (Cohn et al., 2013; Fanti, Panayiotou, Lombardo, & Kyranides, 2016). Recent behavioural evidence provides additional support for this theory (Fanti et al., 2016; Klingzell et al., 2016; Song, Waller, Hyde, & Olson, 2015). Alongside an assessment of physiological reactivity (SC) to fearful imagery, Fanti et al. (2016) collected caregiver reports of children's fearfulness (*N*=73, mean age 11.21 years). A positive association was found between both the physiological and behavioural measures of fearfulness and CP/CU+, while a negative association was found between these measures and CP/CU-. This again suggests that not only may the low-fear model account primarily for those with CU traits, but children with CP/CU- may have an abnormal increased fear response.

1.7.1.4 Sensation-seeking model

An alternative account of reduced physiological arousal in CP is the sensation-seeking model. Sensation-seeking is defined as '*the tendency to seek varied, novel, complex, and intense sensations and experiences and the willingness to take risks for the sake of such experiences'* (Zuckerman, 2008; p1). According to this model, individuals with low arousal levels seek-out novel, intense, and risky situations, such as committing an aggressive assault or vandalising property, in order to raise their arousal to an optimal level. Behavioural evidence suggests that antisocial individuals do have sensation-seeking traits (Klingzell et al., 2016) and self-reported sensation-seeking in delinquent adolescent boys has been associated with physiological under-arousal (Gatzke-Kopp, Raine, Loeber, Stouthamer-Loeber, & Steinhauer, 2002; Sijtsema et al., 2010). In a large study of boys and girls (*N*=1,752), Sijtsema et al. (2010) found physiological under-arousal (reduced heart rate) in boys was associated with aggression and rule-breaking in adolescence. Furthermore, the association between heart rate and rule-breaking was mediated by self-reported sensation-seeking in adolescence (but not in pre-adolescence). However, heart rate was not associated with antisocial behaviour for girls and no mediation effects were found. These findings suggest that the relationship between physiological under-arousal and antisocial behaviour may depend on age and gender, with male adolescents showing the strongest pattern for this association. Further research with females is needed to address this potential gender difference.

While both the low-fear and sensation seeking models can account for the reduced physiological arousal found in antisocial youths, it is not known whether both of these theories hold true for all children and adolescents with CP. Portnoy et al. (2014) tested both models of reduced physiological arousal in a community sample of 335 adolescent boys. Heart rate was measured during cognitive, stress, and rest tasks and participants completed self-report measures of state fear, impulsive sensation-seeking, and aggressive and nonaggressive antisocial behaviour. Self-reported aggression was associated with reduced heart rate and with impulsive sensation-seeking. Importantly, impulsive sensation-seeking, but not fearlessness, mediated the association between heart rate and aggression, providing support for the sensation-seeking model. However, more work is needed which tests both models with a sample that includes females and distinguishes subtypes of antisocial behaviour.

1.7.2 Brain structure and function

The primary brain regions implicated in antisocial behaviour are those of the PFC and the limbic system (Hyde, Shaw, & Hariri, 2013; Noordermeer, Luman, & Oosterlaan, 2016). The amygdala, a key structure of the limbic system, is important in many emotion and self-regulatory processes, including fear response, regulation of arousal, and emotional learning (Cardinal, Parkinson, Hall, & Everitt, 2002; Whalen & Phelps, 2009). The PFC is the cognitive control centre of the brain, co-ordinating information and directing action through its neural connections to all other functional parts of the brain (Siddiqui, Chatterjee, Kumar, Siddiqui, & Goyal, 2008; Smolker, Depue, Reineberg, Orr, & Banich, 2015). The PFC is made up of several parts, including the orbitofrontal cortex (OFC), the dorsolateral and dorsomedial PFC (dlPFC, dmPFC), the ventromedial PFC (vmPFC), and the anterior cingulate cortex (ACC). While these regions have overlapping cognitive functions, each has been associated with specific functions, such as the inhibitory control of the vmPFC (Etkin, Egner, & Kalisch, 2011); execution of long term goals of the dlPFC and dmPFC (Wood & Grafman, 2003); and attention, working memory, and self-monitoring of the ACC (Adolphs, 2003; Botvinick, Cohen, & Carter, 2004). Located between other regions of the PFC and the amygdala, the ACC bridges these cognitive control and emotion centres and has been implicated in assessing the salience of emotional and motivational information (Bush, Luu, & Posner, 2000; Cardinal et al., 2002). These frontal regions, in particular the OFC, have also been implicated in reward processing and decision making (Berridge & Kringelbach, 2008; Kringelbach, 2005; O'Doherty, Kringelbach, Rolls, Hornak, & Andrews, 2001). Similarly, the amygdala is involved in learning the association between undesirable behaviours and punishment (Balleine & Killcross, 2006; Cardinal et al., 2002; Gupta, Koscik, Bechara, & Tranel, 2011).

Abnormalities in brain regions associated with cognitive control and emotion regulation will be discussed in relation to children's behaviour and learning in Chapter 2. However, two other prominent models of CP which relate to abnormalities in these brain regions will be presented here.

1.7.2.1 Reward-dominance

Several brain imaging and functional studies have found children and adolescents with CP have abnormalities in the amygdala and the PFC during tasks requiring the processing of reward and punishment (e.g. Finger et al., 2011; Morgan, Bowen, Moore, Savage, & van Goozen, 2014; Rubia et al., 2009; Veroude et al., 2016). In Rubia et al.’s (2009) functional magnetic imaging (fMRI) study, 48 male participants (aged 9–16) carried out a rewarded Continuous Performance Test, in which a stream of letters were presented and participants were instructed to respond to target letters only. Following successful responses, participants received a message on screen that their monetary reward had increased. Unsuccessful responses were followed by a message of a decrease in the monetary reward. Boys with CD showed under-activation of the OFC during the reward task. Furthermore, these participants did not have co-morbid ADHD, and under-activation of the OFC was not found in participants with ADHD only or in healthy comparisons, suggesting this reward-related abnormality is specific to CD. Abnormalities in reward processing provides one functional neural explanation for the repeated disadvantageous decisions made by youths with CP to act in an antisocial and destructive manner.

It has been proposed that children and adolescents with CU traits in particular have a reward-dominant response style. These individuals appear to be more motivated by potential gain or rewards than deterred by potential loss or punishment (Allen, Morris, & Chhoa, 2016; White, Brislin, Meffert, Sinclair, & Blair, 2013). The decreased autonomic response to negative emotions seen in children and adolescents with CU traits, alongside the neurobiological evidence that children with CU traits show a reduced sensitivity to punishment, provide evidence for the reward-dominance model of CU traits. Importantly, several studies directly compared children with CP/CU+ to children with CP/CU- and the punishment abnormalities were only found in those with CP/CU+ (Brislin, Buchman-Schmitt, Joiner, & Patrick, 2016; Frick et al., 2003). Behavioural evidence further suggests that a reward-dominant response style may be specific to CU traits. Pardini, Lochman and Frick (2003) found adolescents with CP/CU+ were more likely to focus on positive aspects of aggression, e.g. social dominance, than the negative consequences of aggressive behaviour, i.e. punishment, compared to CP/CU- adolescents. Similarly, Morgan et al. (2014) found a heightened drive to seek rewards and lowered punishment sensitivity in adolescent male offenders (*n*=85) compared to non-offenders (*n*=50). Response to reward was associated with both CP and CU traits, while reduced punishment sensitivity was found in CU traits specifically, but not in CP more generally. This pattern of results has recently been replicated in a sample of 39 12- and 13-year-old school pupils (Allen et al., 2016). These findings suggest that while a reward-dominance may be present for antisocial youths more generally, a reduced sensitivity to punishment is specific to those with CU traits. Importantly, these findings could explain the reduced effectiveness of interventions found for children and adolescents with CU traits compared to those with CP without CU traits which utilise sanctions and punishment strategies. This will be explored in the systematic review of interventions for CU traits in Chapter 5.

1.7.2.2 Low empathy

Low empathy is one of the defining characteristics of youths with CU traits. Some studies have also found youths with CU traits have deficits in cognitive empathy (i.e., the ability to take the perspective of others) (Dadds et al., 2009; Lui, Barry, & Sacco, 2016), but most suggest deficits are specific to affective empathy (i.e., experiencing negative emotions due to the harm caused to others) (Anastassiou-Hadjicharalambous & Warden, 2008a; Dadds, Cauchi, Wimalaweera, Hawes, & Brennan, 2012; Schwenck et al., 2012). Importantly, these effects remain after controlling for CP, aggression, and impulsivity (Jones, Happé, Gilbert, Burnett, & Viding, 2010; Pardini & Byrd, 2012).

Neurobiological models may account for the lack of empathy characteristic of youths with CU traits. Evidence of reduced physiological arousal of the SNS and HPA suggests youths with CU traits have reduced arousal to their own fear or stress. These individuals may not be able to empathise with others showing distress, as they have little experience of heightened distress themselves (Blair, 2010). Cheng, Hung, and Decety (2012) found that adolescents with psychopathic traits demonstrate reduced sensitivity to their own pain and abnormal brain activity in response to stimuli showing others in pain. The reduced physiological arousal and fearless temperament may interfere with the development of the child's empathy and guilt for the effect of their behaviour on others (Fowles & Kochanska, 2000).

Evidence from neuroimaging studies showing reduced responses to body posture, vocal tones, and fearful and sad facial expressions in youths with CU traits (e.g. Blair, 2008; Marsh & Blair, 2008; Yoder, Lahey, & Decety, 2016) further supports this theory. Deficits recognising and processing emotional cues in others is also likely to impact the child's ability to feel empathy for others. Most prominently, adolescents with CP/CU+ have been found to show less amygdala responsiveness to fearful faces compared to healthy controls (Jones et al., 2009; Lozier, Cardinale, VanMeter, & Marsh, 2014; White et al., 2012) and compared to children with CP/CU- (Viding, Fontaine, & McCrory, 2012; Viding, Sebastian, et al., 2012). Viding, Sebastian, et al. used fMRI to measure responses to fearful and calm faces in boys with CP/CU+ (*n*=15), CP/CU- (*n*=15), and in typically developing boys (*n*=16). A greater amygdala response was seen in boys with CP/CU- than those with CP/CU+ when viewing fearful faces, while controlling for symptom severity of CD, ADHD, and internalising difficulties, demonstrating differential amygdala activity to fearful expressions of others in children with different subtypes of CP.

Reduced amygdala activity in response to another person's distress has also been demonstrated in youths with CP/CU+ when presented with stories of characters with affective states (Sebastian, McCrory, et al., 2012) and images of other people in pain (Marsh et al., 2013; Yoder et al., 2016). In Marsh et al.'s (2013) fMRI task, photographs of pain-inducing injuries were presented to 14 adolescents with ODD or CD and 21 matched typically developing adolescents. Participants were instructed to either imagine the pain happening to themselves or to somebody else. Adolescents with CU traits showed reduced activity in regions associated with empathic pain, including the rostral anterior cingulate cortex, ventral striatum, and amygdala, as the depicted pain increased. The reduction in amygdala activity was particularly pronounced when the injury was perceived as occurring to somebody else, suggesting that adolescents with CU traits have a reduced biological empathic response.

1.8 Summary

The literature reviewed in this chapter highlights the multiple pathways to antisocial behaviour and the heterogeneous nature of CP. Amongst the many environmental risk factors, prenatal exposure to smoking, alcohol and cannabis have been implicated in childhood and adolescent CP (e.g. Gaysina et al., 2013; Day et al., 2011; Larkby et al., 2011), but small effect sizes suggest that prenatal factors only explain some of the risk. A number of parenting and family factors, including parental psychopathology, poor parenting practices, family disruption, and child maltreatment have consistently been found to play a role in CP (e.g. Smith et al., 2013; Matijasevich et al., 2015; McCabe et al., 2010). CP has also been associated with living in disadvantaged neighbourhoods and affiliation with deviant peers (e.g. Goodnight et al., 2012). Importantly, protective factors for CP across individual, family and neighbourhood levels which attenuate the effect of risks for CP have also been identified (e.g. Holmes et al., 2015; Nasvytienė, et al., 2012; Vanderbilt-Adriancea et al., 2015). There is some evidence of a genetic influence on the development of CP, especially for children and adolescents with CP and CU traits (e.g. Bezdjian et al., 2011; Viding et al., 2008). Gene-environment interactions are also likely to be at play (Salvator et al., 2016). Currently it is difficult to identify which risk factors have direct causal effects and which are markers for other risk factors of CP. Further longitudinal studies are needed which examine changes in risk factors and CP over time to help understand causality.

Longitudinal studies have also examined the long-term outcomes for youths with CP. Evidence suggests that these children and adolescents are at risk of poor academic achievement and unemployment, higher rates of criminality, a wide range of adult mental health difficulties, and premature mortality (e.g. D'Amico et al., 2014; Fergusson et al., 2005; Knapp et al., 2011).

Antisocial behaviour also incurs immediate and long-term financial cost to the individual, the family, and wider society (D'Amico et al., 2014; Raaijmakers et al., 2011).

Research examining the neurobiological characteristics of children and adolescents with CP was introduced in this chapter. Youths with CP have been found to have altered physiological arousal of the ANS and the HPA, as well as structural and functional abnormalities in the frontal cortex and the limbic system (Hyde, et al., 2013). These neurobiological models of CP may account for the behaviour of antisocial youths and associated difficulties, such as risk-taking (due to low physiological responses to fear), poor emotion regulation and impulsivity (due to poor cognitive and emotional control), and academic underachievement (due to deficits in executive functions). Chapter 2 provides a more detailed review of cognitive and emotion processing deficits and their influence on classroom behaviour, social relationships, and academic success.

Finally, research studying a particularly problematic subgroup of youths with CP was considered in this chapter. Evidence suggests that children and adolescents with CP/CU+ differ from youths with CP/CU- in many ways. This includes distinct risk factors for CU traits, such as genetic influences (Bezdjian et al., 2011; Viding et al., 2008), lack of parental warmth (Pasalich et al., 2011), and deviant peer affiliation (Tatar et al., 2016), which have each been found to be more strongly associated with CP/CU+ than CP/CU-. Moreover, CU traits have a particular severe and persistent pattern of antisocial behaviour (Longman et al., 2016; Frick et al., 2014), with a greater risk for later serious offending compared to antisocial individuals without these traits (Baskin-Sommers, et al., 2015; Kahn, et al., 2013). There is a growing body of research which suggests that children and adolescents with CP/CU+ have distinct neurobiological profiles (Finger et al., 2011; Veroude et al., 2016), which may account for the particular patterns of behaviour seen in youths with CU traits, such as low empathy and reduced sensitivity to punishment (Frick et al., 2014; Allen et al., 2016). These distinct pathways, long-term outcomes, and neurobiological characteristics of youths with CP/CU+ compared to those of CP/CU- provide support for the utility of the DSM-5 specifier for CD, for both researchers and clinicians. In particular, these findings have important implications for interventions, in that subtypes of CP must be considered when developing and evaluating intervention approaches.

1.9 Thesis Aims and Research Questions

The high prevalence of CP amongst school-aged children (Department for Education, 2016) and the associated concurrent and long-term difficulties for these youths, their families, and society (e.g. D'Amico et al., 2014; Frick, 2016; Knapp et al., 2011) presented in this review suggests that effective interventions for pupils with CP are of great importance. The primary aim of this thesis then, was to develop and evaluate a novel intervention for mainstream pupils with CP.

To achieve this, CP is examined in the context of the classroom, with Chapter Two presenting a literature review of neuropsychological deficits in children with CP and associated difficulties with learning and school success (e.g. Blair & Raver, 2015; Noordermeer et al., 2016; Pinsonneault et al., 2015). I propose that a teacher-led classroom-based intervention, which targets these deficits in cognitive and emotional control processes may be a novel and effective intervention approach which overcomes some of the issues inherent in more traditional parenting or social cognitive skills training programmes (Baker et al., 2011; Plath, Crofts, & Stuart, 2016; see Chapter Five), and which accounts for the heterogeneous nature of CP (Frick et al., 2015). To develop and evaluate this intervention approach, three overarching aims were addressed and are outlined below.

1.9.1 Neuropsychological profiling of primary school pupils with CP

The first aim of this thesis was to extend the literature reviewed in Chapters One and Two by providing a detailed neuropsychological profile of primary school pupils with CP. The primary aim was to examine associations between CP and cognitive and emotional control, but also to investigate associated difficulties in the classroom. Therefore, the study in Chapter Three addressed the following research questions;

1) *Is CP associated with deficits in executive function?*
2) *Is CP associated with poor emotion regulation and lability?*
3) *Is CP associated with lower maths and reading achievement?*
4) *Is CP associated with self-perceived behavioural, scholastic, and social competence?*

A series of exploratory research questions were also addressed to obtain a more detailed profile of pupils with CP and to consider some methodological issues in this area of research, both of which may account for previous discrepancies in the literature and can further inform the development of an effective intervention.

5) *Do children with CP have domain-general or domain-specific difficulties in these areas (i.e. executive function, emotion regulation and lability, academic achievement, and self-perceptions)?*
6) *Are there any differences in these associations between pupils in a mainstream school and those in a special SEMH provision?*
7) *Are there any differences in these associations between pupils with CP/CU- and CP/CU+?*
8) *Are these associations the same for teacher-reports, child self-reports, and performance-based measures?*

To extend this CP profiling work further in the context of the classroom, I consider the association between CP and the student-teacher relationship (STR) in Chapter Five. Due to the lack of previous research examining the mechanisms involved in the association between CP and a the STR, in particular the role emotion regulation difficulties and CU traits may play in this relationship, the following research questions were addressed;

1) *Does CP predict the STR?*
2) *Does CP predict emotion regulation and lability?*
3) *Do emotion regulation and/or lability predict the STR?*
4) *Do emotion regulation and/or lability mediate the relationship between CP and the STR?*
5) *Do CU traits moderate the relationship between CP and the STR?*

1.9.2 Intervention outcomes for children and adolescents with subtypes of CP

Importantly, the work in this thesis aims to account for the heterogeneous nature of CP in the development and evaluation of interventions for CP. This is achieved by investigating the neuropsychological deficits and classroom difficulties of pupils with both CP/CU- and CP/CU+ (Chapters Three and Four), and also through an examination of intervention outcomes for children with CP/CU- and CP/CU+ (Chapters Five and Six).

In Chapter Five, an extensive systematic review of intervention outcomes for CU traits is carried to address the following research questions.

1) *Can interventions reduce CU traits in children and adolescents?*
2) *Are youths with high CU traits responsive to treatment and do levels of these traits influence treatment outcomes?*
3) *Do other individual characteristics of youths with CU traits influence intervention outcomes?*
4) *Which components of interventions are particularly effective at treating CU traits?*

This is followed by an evaluation of a novel cognitive-neuroscience informed classroom-based intervention developed for children with CP/CU- and CP/CU+ in Chapter Six. The following research questions were addressed.

1) *Are there any changes in executive function, emotion regulation and lability, academic achievement, self-perceptions, or the STR, from pre- to post-intervention for pupils with CP?*
2) *Are there any changes in CU trait symptoms from pre- to post-intervention?*
3) *Do intervention outcomes differ between pupils with CP/CU- and pupils with CP/CU+?*

1.9.3 Use of neuroscience methods to study cognitive control and emotion regulation

The final aim of this thesis was to extend previous intervention research by considering the use of neuroscience methods in the evaluation of interventions for CP. Research has increasingly turned to neuroscience methods to improve our understanding of the aetiology of antisocial behaviour (Snyder, Beauchaine, & Hinshaw, 2015) and findings from neuroscience are now being considered in the development of interventions for CP (e.g. Frederickson, Jones, Warren, Deakes, & Allen, 2013). Nevertheless, evaluations of interventions for CP predominantly rely on behavioural methods (Cornet et al., 2015). Chapter Eight presents my final study, in which an adaptation of an EEG paradigm developed by Lewis and colleagues (e.g. Lewis et al., 2008) was piloted with adults as a preliminary examination of its use as a direct measure of cognitive control and emotion regulation. The following research questions were addressed;

1) *Is there a distinct neural response associated with cognitive control and emotion regulation?*
2) *Is this measure of neural response associated with self-reported behavioural measures of emotion regulation and cognitive control?*

Based on the results of this study, the utility of this neuroscience method as a future tool to evaluate interventions for children with CP is considered.

Chapter 2 Executive Function and Emotion Regulation in the Classroom: A Literature Review

2.1 Introduction

Evidence from behavioural studies and neuroscience suggest that youths with CP have deficits in cognitive and emotional control processes (Gross, 2013; Johnson, 2015). In this chapter, these processes, or executive functions (EF) and emotion regulation (ER), will be discussed. The typical development and neurobiological bases of these processes will be outlined followed by a discussion of deficits in these areas which appear to be characteristic of children and adolescents with CP. Evidence of such deficits may help explain the disruptive classroom behaviour and poor academic achievement evident in these pupils. Current literature which can help inform our understanding of the relationship between EF and ER abilities, classroom behaviour, and academic success will be reviewed in this chapter, as an introduction to the experimental investigation of CP in the context of the classroom presented in Chapters Three and Four.

2.2 Executive Functions

EF is a broad term used to describe a set of complex cognitive processes that control and regulate our behaviour, including inhibitory control, working memory (WM), and cognitive flexibility (Blair, 2016; Miyake et al., 2000). More specifically, EF skills are necessary for goal-directed behaviour, through the self-regulation of actions in our daily lives and a consideration of the longer term consequences of our behaviour (Kaufman, 2010). Successful goal-directed behaviour depends on our ability to focus attention on the task-at-hand and inhibit impulsive actions or prepotent responses. Incoming information needs to be held in WM, or our cognitive workspace, while we mentally manipulate and integrate this information with our existing knowledge (Kaufman, 2010). Cognitive flexibility, or set-shifting, allows us to adapt our approach in novel situations. Other complex cognitive skills, such as problem-solving, planning, task initiation, and monitoring, also fall within the umbrella term of EF (Diamond & Lee, 2011) and are important for learning and goal achievement (Caine, Caine, McClintic, & Klimek, 2015; Clements & Sarama, 2015; St Clair-Thompson & Gathercole, 2006).

A distinction has been made between so called hot and cool EFs. Hot EFs are those considered to operate in motivational or affective contexts, such as during a reward-based task or affective decision-making, while cool EFs operate in non-emotive situations, such as sorting by colour or shape (De Brito, Viding, Kumari, Blackwood, & Hodgins, 2013; Zelazo & Carlson, 2012). This hot/cool distinction has been helpful in understanding the role of EF skills in different aspects of learning and academic achievement (Brock, Rimm-Kaufman, Nathanson, & Grimm, 2009) and in understanding EF deficits associated with different forms of psychopathology (Dinn, Robbins, & Harris, 2001; Poland, Monks, & Tsermentseli, 2015), as will be discussed later in this chapter.

2.3 Emotion Regulation

The hot EF label has sometimes been used synonymously with the term emotion regulation (ER) (e.g. Woltering, Lishak, Hodgson, Granic, & Zelazo, 2016). While ER is often considered to fall *within* the umbrella term of EF (Kauffman, 2010), others have studied ER as a separate construct and taken the view that ER *involves* EF skills (e.g. Schmeichel & Tang, 2015)[4]. There is no universally agreed definition of ER (Gross, 2013; Thompson, 1994) and there is considerable overlap with other terms such as effortful control (Eisenberg, Fabes, Guthrie, & Reiser, 2000), and emotion-related self-regulation (Eisenberg, Spinrad, & Valiente, 2016). This is likely due to the fact that ER encompasses a broad range of processes, including physiological and neurological arousal, and cognitive appraisal (Cole, Martin, & Dennis, 2004). Nevertheless, there is a general consensus that ER is a cognitive control process which is required to achieve goals and is needed for adaptive functioning. For example, ER has been defined as '*the extrinsic and intrinsic processes responsible for monitoring, evaluating, and modifying emotional reactions...to accomplish one's goals'* (Thompson, 1994, pp.27-28).

Importantly, ER is not just the down-regulation or inhibition of an emotional response, rather it determines changes in the quality (intensity, latency, and duration) of the experience and expression of the emotion (Campos, Mumme, Kermoian, & Campos, 1994; Eisenberg, Hofer, & Vaughan, 2007; Thompson, 1994). Emotional responses need to be adaptive to different situations. A particular emotional response may be functional in one context, but socially

[4] Due to the relevance of emotion processes in CP and CU traits, executive function and emotion regulation will be referred to as separate but related constructs throughout this thesis.

unacceptable or detrimental to cognitive demands and goal achievement in another. Similarly, some ER strategies may be functional in the short-term, but can be maladaptive in the long-term. For example, avoidance of a highly emotive situation or repression of a difficult emotion may serve to help the individual function in the present, but could have a long-term negative impact on the individual's physical or mental health (Bonanno, Keltner, Holen, & Horowitz, 1995). A non-exhaustive list of ER strategies documented in the literature are presented in Table 2.1.

Table 2.1: *Emotion regulation strategies*

Strategy	Description
Attentional Deployment or Distraction	Manage the input of emotionally arousing information by directing attention away from threatening stimuli and/or towards non-threatening information. E.g. Young children spontaneously avert their gaze from aversive situations, while adults may redirect attention by 'thinking nice thoughts' or by engaging in a distracting behaviour.
Cognitive Change	Reinterpret the information to change its emotional significance or change the way we view our capacity to manage a difficult situation. Includes reappraisal, denial, projection, displacement, and suppression. E.g. A child may tell themselves that the character in the story "didn't really die, they just went away".
Social Display	Increase access to external coping resources. E.g. A child will cry to seek nurturance from others, while adults may turn to friends or family for advice, comfort, and reassurance.
Situation Selection or Avoidance	Choosing a lifestyle with manageable emotional demands. E.g. Work-life, family, and social relationships may be selected to suit personal emotional boundaries to minimise the likelihood of needing to manage challenging emotions.

(See Gross, 2015; Okon-Singer, Pessoa, & Shackman, 2015; Thompson, 1994.)

Being a cognitive control process, it is not surprising that individual differences in ER have been associated with other cognitive and EF abilities (Hendricks & Buchanan, 2016; Schmeichel & Tang, 2015; Sudikoff, Lordo, Stroup, & Kaufman, 2015). Longstanding evidence has shown that emotional arousal and emotion distracters can impair cognition and goal-oriented behaviour (Dolcos & McCarthy, 2006; Eysenck, 2012; Eysenck, Derakshan, Santos, & Calvo, 2007). Negative emotions in particular have been found to impair EF abilities, such as WM and inhibitory control (Curci, Lanciano, Soleti, & Rimé, 2013; Pessoa, Padmala, Kenzer, & Bauer, 2012).

However, emotions can also help organise and direct thinking, learning, and behaviour (Carlson & Wang, 2007; Ursache, Blair, & Raver, 2012). For example, while intense negative affect impaired inhibitory control in a stop-signal task, Pessoa et al. (2012) found that mild negative affect (viewing fearful and happy faces) improved inhibition. Similarly, positive emotions have been shown to increase distractibility, but enhance cognitive flexibility (Dreisbach & Goschke, 2004; Phillips, Bull, Adams, & Fraser, 2002). This complex relationship between emotion and cognition is likely due to the overlapping and interconnecting neural systems involved in both these processes (Dolcos & McCarthy, 2006).

While emotions influence cognitive processes (emotions as regulating), EF processes work to modify emotional reactions in order to achieve a suitable emotional state for goal achievement (emotions as regulated). Evidence for this comes from findings that individual differences in EF predict differences in success at ER (for a review, see Schmeichel & Tang, 2015). WM, cognitive flexibility (or set-shifting), and inhibition abilities have all been associated with successful reappraisal (or cognitive change; see Table 2.1), suggesting these EF skills may facilitate use of this ER strategy (McRae, Jacobs, Ray, John, & Gross, 2012; Schmeichel & Demaree, 2010; Schmeichel, Volokhov, & Demaree, 2008). When reappraising, the salience and behavioural response to the initial appraisal must be inhibited, alternative interpretations generated and kept in WM, and the most appropriate reinterpretation selected (shifting) (McRae et al., 2012). While other ER strategies have been studied less, inhibitory control may similarly enable suppression of outward emotional reactions. In von Hippel and Gonsalkorale's (2005) study, a Chinese experimenter asked non-Asian participants to taste a chicken foot, which he claimed was a national dish of China. Participants who performed better on a measure of inhibition (Stroop task) showed less negative responses (facial expressions and verbal utterances) in the chicken foot scenario. While direct causality cannot be determined, these findings provide initial evidence that individual differences in EF contribute to successful ER.

2.4 Neurobiology of Executive Functions and Emotion Regulation

The association between neurobiology and antisocial behaviour, in particular structures of the PFC and the amygdala (e.g. Cappadocia, Desrocher, Pepler, & Schroeder, 2009; Hyde et al., 2013; Lewis, Granic, & Lamm, 2006; Noordermeer et al., 2016; White et al., 2012), were introduced in Chapter One. Here, the role of these brain regions in EF and ER will be discussed in more detail before considering how abnormalities in these systems relate to the cognitive and emotional control difficulties evident in youths with CP.

2.4.1 Neural correlates of executive functions

It is well-established that the PFC serves the executive functions (Anderson, Jacobs, & Anderson, 2010). Whereas the temporal, parietal and occipital lobes receive, process, and store sensory information from the environment (Hale & Fiorello, 2004), it is the frontal cortex that coordinates this knowledge and directs action and self-regulatory behaviour (Blair, 2004; Kaufman, 2010). Due to the complexity of these cognitive processes and the fact that most tasks and neuropsychological measures tap multiple EFs, it is difficult to pinpoint specific frontal regions to specific EFs (Alvarez & Emory, 2006). Nevertheless, brain imaging and lesion studies have found evidence of associations between specific frontal regions and different EF domains. For example, the dlPFC has been implicated in cool EFs including cognitive flexibility, WM, attention, and planning (Amiez & Petrides, 2007; Petrides, 2000; Stuss & Levine, 2002). The OFC on the other hand has been associated with hot EFs, including affective decision making, response inhibition, and the anticipation of reward and punishment (Bechara, Damasio, & Damasio, 2000, 2003; Gupta et al., 2011; Murray, O'Doherty, & Schoenbaum, 2007; Rolls, 2004; Wallis, 2007). The OFC interacts with the dlPFC, but also receives information from all sensory modalities and has extensive connections with the limbic system (Carmichael & Price, 1995; Miller & Cohen, 2001), making the OFC well-suited to behavioural and emotional control (De Brito & Hodgins, 2009).

The medial PFC, more specifically the ACC, has been associated with cool EFs, including attention, WM, and monitoring, as well as hot cognitive processes such as affective decision-making, the evaluation of reward-related information, motivation and persistence (Botvinick et al., 2004; Critchley, 2005; Phillips, Drevets, Rauch, & Lane, 2003; Van Veen, Cohen, Botvinick, Stenger, & Carter, 2001). Evidence from functional imaging studies has suggested that the rostral and dorsal regions of the ACC serve affective and cognitive functions respectively (Allman, Hakeem, Erwin, Nimchinsky, & Hof, 2001; Botvinick et al., 2004; Bush et al., 2000; Rushworth, Walton, Kennerley, & Bannerman, 2004). However, this affective–cognitive distinction of the ACC remains debatable, with a substantial body of evidence suggesting that each region may not be functionally distinct (Critchley, 2005; Davis et al., 2005; Eisenberger & Lieberman, 2004).

The contribution of structures of the PFC to EF remains controversial, especially with findings that individuals with frontal lesions perform within normal limits on EF tests (Critchley et al., 2003; Fellows & Farah, 2005; Shallice & Burgess, 1991). There is also evidence that non-frontal brain lesion patients perform just as poorly on EF tests (Anderson, Damasio, Jones, & Tranel, 1991; Axelrod et al., 1996), suggesting EF performance may not be exclusive to frontal cortex functioning (Alvarez & Emory, 2006). Interestingly, although some patients with frontal lobe damage have been found to perform well on traditional neuropsychological tests, there are reports that these patients still experience difficulties in everyday life activities (Shallice & Burgess, 1991; Vriezen, Pigott, & Pelletier, 2001), which raises concerns about the ecological validity of EF measures.

It has been argued that there are large discrepancies between experimental EF tasks and tasks requiring EF skills in everyday life (Chan, Shum, Toulopoulou, & Chen, 2008). For example, the Wisconsin Card Sorting Test (WCST), designed to assess abstract reasoning and cognitive flexibility, is one of the most widely used tests of prefrontal function (Barceló, 2001), but may have little relevance to real-world EF demands (Parsons, Carlew, Magtoto, & Stonecipher, 2015). In the WCST, participants sort a series of cards (pictures differing in colour, shape, and quantity), without being informed of the categorising rule. Through trial and error, the participant learns the rule for sorting, but then the classification rule changes and the participant must switch to a new sorting strategy (Strauss, Sherman, & Spreen, 2006). Such a structured task, most likely carried out in a sterile lab environment, without other competing cognitive demands, may not reflect the complexities of EF demands in everyday life. The ecological validity of EF measures have been the focus of several studies and reviews (e.g Burgess et al., 2006; Chan et al., 2008; Pickens, Ostwald, Murphy-Pace, & Bergstrom, 2010; Vriezen & Pigott, 2002). The need for developmentally sensitive measures of EF in young children have also been highlighted (Carlson, Faja, & Beck, 2016; Griffin, Freund, McCardle, DelCarmen-Wiggins, & Haydon, 2016). This has led to the development of more ecologically valid measures of EF. For example, the Behaviour Rating Inventory for Executive Function (BRIEF; Gioia, Isquith, Guy, & Kenworthy, 2000) uses parent- and teacher-reported observations or self-reports of everyday functioning across a range of scales of different EF skills. Vriezen and Pigott (2002) found that neuropsychological tests of child EF were not significantly associated with parents' reports of children's everyday EF (BRIEF), again highlighting the discrepancy between these types of assessments. A new generation of function-led neuropsychological assessments, including the use of virtual environments, are currently under development and evaluation (Parsons et al., 2015), providing promise for future ecological valid measures of EF.

2.4.2 Neural correlates of emotion regulation

While cognition and emotion were traditionally considered as distinct mental processes, there is now considerable evidence demonstrating that they have overlapping and interacting neural systems (for reviews, see Okon-Singer, Pessoa, et al., 2015; Shackman et al., 2011). In particular, there is growing evidence that the PFC is involved in the regulation of emotion (Kohn et al., 2014; Okon-Singer, Hendler, Pessoa, & Shackman, 2015).

Imaging studies have consistently demonstrated dorsal and ventral regions of the PFC, including the dlPFC, vlPFC, ACC, and the OFC, to be active during ER (for a review, see Gross, 2015). Imaging studies of ER have typically examined reappraisal; requiring participants to down- or up-regulate their emotional response to emotion-eliciting stimuli, such as images of negative faces, films, or autobiographical prompts. For example, in a recent study of 62 adults, Uchida et al. (2015) used fMRI during three conditions: 1) attending to neutral pictures; 2) attending to negative pictures; and 3) reappraising negative pictures. Participants with more successful reappraisal (based on the difference between self-reported negative affect attending to negative pictures and self-reported negative affect reappraising negative pictures) had greater activation in medial and lateral PFC regions. Consistent with these findings, Feeser and colleagues found that transcranial direct current stimulation to the dlPFC enhanced participants' success at reappraisal, with reduced self-reported emotional arousal and skin conductance responses (Feeser, Prehn, Kazzer, Mungee, & Bajbouj, 2014).

Since imaging studies of ER have primarily focussed on reappraisal, evident in several meta-analyses (e.g. Buhle et al., 2014; Diekhof, Geier, Falkai, & Gruber, 2011; Kohn et al., 2014), these findings can only be interpreted in relation to this specific ER strategy. Indeed, there is evidence that suppression involves different brain regions to those activated during reappraisal. Giuliani, Drabant, and Gross (2011) found the volume of the dorsal ACC was positively associated with reappraisal, but not suppression, while anterior insula volume was positively associated with suppression, but not reappraisal. This research has implications for drawing conclusions about the neural associations of ER more broadly, as it may depend on which strategy a participant uses during the task. More structural and functional studies are needed to investigate the different ER strategies to gain a more comprehensive understanding of the brain regions involved in different aspects of ER.

Evidence from brain lesion studies have further added to the role of the PFC in ER, in that damage to this area has significant effects on affective behaviour (Barrash, Tranel, & Anderson, 2000; Berlin, Rolls, & Kischka, 2004; Blair & Cipolotti, 2000; Young, Camprodon, Hauser, Pascual-Leone, & Saxe, 2010). Berlin et al. (2004) found that patients with OFC damage reported more impulsivity and anger and less happiness than participants with non-OFC damage and healthy participants. OFC patients also performed more impulsively on behavioural tests and performed worse on a stimulus-reinforcement association reversal task. Similarly, Blair and Cipolotti (2000) report on a patient who suffered trauma to the OFC. The patient showed no reversal learning impairment, but had severe difficulty in the recognition of, and autonomic responding to, angry and disgusted expressions, attributing the emotions of fear, anger and embarrassment to story protagonists, and identifying violations of social behaviour. These lesion studies demonstrate the role of the PFC, especially the OFC, in behaviours related to emotion processing and regulation.

Studies using electroencephalography (EEG) have also contributed to this literature, with evidence that frontal event-related potential (ERP) components are activated during inhibitory control under challenging emotional conditions. For example, greater N2 amplitudes have been reported while viewing angry faces in a go/no-go task, during a negative emotion induction go/no-go task, and during negative emotional evaluations (Lewis, Lamm, Segalowitz, Stieben, & Zelazo, 2006; Lewis, Todd, & Honsberger, 2007; Tucker et al., 2003). The ERP method and research using these tasks will be discussed in Chapter Seven.

The interaction between the PFC and the amygdala has also been found to be critical in ER (Beauregard, Levesque, & Bourgouin, 2001; Hariri, Bookheimer, & Mazziotta, 2000; Hariri, Mattay, Tessitore, Fera, & Weinberger, 2003), with evidence that PFC activation is reciprocally related to amygdala activation (Ochsner & Gross, 2005; Ochsner, Silvers, & Buhle, 2012). In a study by Goldsmith, Pollak, and Davidson (2008), participants were trained to down- or up-regulate emotion using reappraisal while viewing a negative emotional image. Activation of the vmPFC, including the ventral ACC, was reciprocally related to amygdala activation. The up-regulate condition produced the highest levels of amygdala activation, a control condition produced an intermediate level of amygdala activation, and the down-regulate condition produced the lowest amygdala activation. Participants with the largest decrease in amygdala activation during the down-regulate condition (compared to the control condition) had the greatest activation in the vmPFC. Furthermore, dispositional reappraisal (i.e. a natural tendency to use reappraisal) in response to aversive emotional stimuli has been associated with reduced activity of the amygdala, insula, and hippocampus, and with greater dlPFC and dorsal ACC activation (Carlson & Mujica-Parodi, 2010; Drabant, McRae, Manuck, Hariri, & Gross, 2009; Hermann, Keck, & Stark, 2014; Zelazo & Carlson, 2012). This reciprocal relationship between the PFC and the limbic system has also been found during other ER strategies, such as suppression, distraction and detachment (Dörfel et al., 2014).

While the PFC and amygdala can work adaptively together, intense emotional arousal may result in, what has been referred to as, an amygdala hijack (Kaufman, 2010). This intense emotion may 'use-up' WM to its full capacity, leaving little processing space for cognitive functioning (Klein & Boals, 2001). In a demonstration of this competition for processing space, Dolcos and McCarthy (2006) presented emotional distracters to 15 adult participants during the delay interval of a WM task. Compared with neutral distracters, emotional distracters evoked strong activation in emotion processing regions including the amygdala and the vlPFC, while simultaneously evoking strong deactivation in areas associated with WM, including the dlPFC and posterior cingulate cortex. Furthermore, WM performance was impaired, demonstrating how emotional activation in the brain can influence behaviour.

This body of research demonstrates that emotion and cognition are deeply interconnected in the brain. However, most studies of emotion and cognition and their interactions rely on well-controlled but highly artificial paradigms (Coan & Allen, 2007). The neural underpinnings of ER in the real-world are still not well-understood (Okon-Singer, Pessoa, et al., 2015). Difficulties measuring ER, especially in young children, and the development of methods to address this issue, will be discussed further in Chapter Seven.

2.5 Development of Executive Functions and Emotion Regulation

The large body of literature examining the development of EF and ER skills is beyond the scope of this chapter; but it should be noted that children are not born with the ability to inhibit impulses, plan and execute strategies for goal achievement, or to regulate challenging emotions (Best & Miller, 2010; Chevalier, 2015). Behavioural and neurobiological evidence suggests that these skills emerge during the first few years of life and strengthen throughout childhood and adolescence and into adulthood (Best & Miller, 2010; Blakemore & Choudhury, 2006; Chevalier, 2015; Schore, 2015).

While some argue that EF skills are indistinguishable from each other up to 9 years of age (e.g. Brydges, Reid, Fox, & Anderson, 2012), there is a large body of evidence from developmental research which suggests that different EF skills have different developmental trajectories. In a review of the EF literature, de Luca and Leventer (2010) propose that the first signs of working memory and inhibition skills emerge as early as 7-8 months, while planning and goal-directed behaviour is not observed until 5 years of age. Similarly, there is evidence to suggest that young children use inhibition more than older children (Senn, Espy & Kaufman, 2004; Huizinga & van der Molen, 2007). The early development of inhibitory control is perhaps reflective of the need to first become competent at the ability to ignore irrelevant stimuli in the environment, before more advanced EF skills, such as cognitive shifting and planning, can be used for effective goal achievement (Best et al, 2009). In line with this argument, there is evidence to suggest that attention and working memory, EFs considered to be fundamental to other cognitive functioning, develop before more complex skills, such as planning and organisation (Smidts, Jacobs, & Anderson, 2004).

Parallels have also been found between the structural maturation of the frontal cortex and functional emergence of these EF skills, from infancy, through adolescence, and into adulthood (Casey, Giedd, & Thomas, 2000; Steinberg, 2005). For example, evidence suggests that behavioural improvements in inhibition from childhood into adolescence (e.g. Huizinga et al., 2006; Leon-Carrion, Garcia-Orza, & Perez-Santamaria, 2004) parallel refinements in brain activity of the frontal lobes (Durston, Davidson & Tottenham et al, 2006; Liston et al, 2006; Lamm, Zelazo, & Lewis, 2006). In one such study, Lamm et al. (2006) found decreases in N2 amplitudes, a neural marker of inhibition, from ages 7 to 17 years, using a go/no-go EEG paradigm. The authors conclude that these developmental differences reflect increased cortical efficiency with age, as the individual becomes more proficient in inhibitory control (see Chapter Seven for a more detailed discussion of this neural marker of inhibitory control and research by Lamm, Lewis and colleagues). Similarly, brain activity during WM tasks is predominantly found in the thalamus and basal ganglia in childhood, moving to the PFC and ACC during adolescence and adulthood (Scherf, Sweeny, & Luna., 2006). There are fewer developmental studies examining changes in brain activity for cognitive flexibility, but there is some evidence that mature task shifting is related to increased activation in frontal regions and the ACC (Smith, Taylor, Brammer & Rubia, 2004).

Nevertheless, there are some discrepancies regarding the developmental trajectories of EF skills. For example, in contrast to the evidence presented above (Huizinga et al., 2006; Lamm et al, 2006; Leon-Carrion, et al, 2004), Romine and Reynolds (2005) found that inhibition develops rapidly in infancy and middle childhood, but shows no further improvements into adolescence or adulthood. Inhibition is a term used to refer a range of cognitive functions, including interference control, motor control, and emotion regulation, which is often not well-defined in EF research (Best et al, 2009; Nigg, 2000). Furthermore, measures of EF require a number of different cognitive skills which are difficult to separate when interpreting performance on these tasks. These issues inherent in EF research, may account for inconsistencies in conclusions drawn about the developmental trajectories of EF skills. Furthermore, the complexity of the task and the way in which competency is defined, may influence conclusions drawn about mastery of EF skills. For example, 3-4 year olds are reported to show mastery shifting between two simple responses on tasks with clear rules (Hughes, 1998), but further improvement in shifting is reported on more complex tasks in 5 and 6 year olds (Luciana & Nelson, 1998). Similarly, there is evidence of a linear increase in performance from age 4 to 16 years on a range of WM tasks, with proficiency on more complex tasks continuing to develop in the latter of these years (Gathercole, Pickering, Ambridge, and Wearing, 2004; Luciana, Conklin, Hooper, & Yarger, 2005).

Finally, of particular relevance to this thesis, it is important to consider individual differences in the development of these skills, in light of the fact that children with CP show deficits in cognitive and emotion control processes (e.g. Morgan & Lilienfeld, 2000; Kim Schoemaker, Mulder, Deković, & Matthys, 2013; Northover, Thapar, Langley, & Van Goozen, 2015). Such deficits in children with CP will be the focus of the next section, however research examining individual differences in EF within typical populations suggests that EF development is influenced by genetic and environmental factors. While Friedman et al. (2008) argue EF are among the most heritable of psychological traits, there is also a considerable amount of evidence to suggest that EF abilities are influenced by environmental factors (for a review, see Carlson, 2009). For example, in a review examining the influence of SES on the developing brain, Hackman and Farah (2009) concluded that SES is an important predictor of EF, both in behavioural performance and on a neural processing level. Parenting behaviour and attachment styles have also been found to play a role in the development of EF, independent of general cognitive ability and other family factors (for a review, see Fay-Stammbach, Hawes, & Meredith, 2014). For example, Bernier, Carlson, Deschenes, and Matte-Gagne (2011) found that composite scores of parental behaviour and child attachment were related to child performance on WM and cognitive flexibility tasks. In particular, attachment security was related to EF performance at 3 years, above and beyond what was explained by a combination of other factors including prior EF, verbal ability, and SES. Further evidence that the child's environment can influence EF abilities, are studies of interventions shown to improve EF competencies. This includes a number of computerised training programmes, physical exercise, and mindfulness (for a review, see Diamond & Lee, 2011). Despite evidence of strong genetic influences on EFs then, it seems EF skills are open to the influence of experience and therefore malleable to change.

2.6 Executive Dysfunction and Emotion Dysregulation: A CP neurocognitive profile

Several developmental disorders, including ADHD and Autistic Spectrum Disorders, have been associated with deficits in EF (Gioia, Isquith, Kenworthy, & Barton, 2002; Rosenthal et al., 2013) and ER (Gross & Jazaieri, 2014; Musser, Galloway-Long, Frick, & Nigg, 2013; Samson et al., 2014). Of key relevance to this thesis, is the large body of research which suggests that youths with CP have an executive dysfunction (EDF) (Morgan & Lilienfeld, 2000; Kim Schoemaker, et al., 2013) and emotion dysregulation (EDR) (Beauchaine, 2012; Northover, et al., 2015; Schoorl, van Rijn, de Wied, van Goozen, & Swaab, 2016). Such difficulties likely reduce the child's ability to think ahead and control their behaviour, resulting in their characteristic impulsive and risky behaviour (Johnson, 2015). In this section, a review of the literature, from behavioural studies and neuroscience, demonstrating an EDF and EDR account of CP will be presented, followed by a discussion of the influence of these deficits on classroom behaviour and learning.

2.6.1 Behavioural evidence of an executive dysfunction in youths with CP

Systematic and meta-analytic reviews show that antisocial adults and youths perform poorly on a range of neuropsychological tests of EF (Morgan & Lilienfeld, 2000; Ogilvie, Stewart, Chan, & Shum, 2011; Pinsonneault et al., 2015) even when controlling for more general cognitive abilities or IQ (Séguin, Pinsonneault, & Parent, 2015). Morgan and Lilienfeld (2000) examined 39 studies assessing EF in a total of 4,589 adults and youths, using six well-validated measures, including the WCST (cognitive flexibility), Porteus Mazes Q score (impulsivity), and the Stroop Interference Test (selective attention). Antisocial groups were found to have poorer performance than comparison groups, with a medium to large effect size (d=.62). In a larger meta-analysis of 126 studies (14,768 participants), Ogilvie et al. (2011) found support for an EDF in antisocial individuals, with a medium effect size (d=.44). However, great variability in effect sizes was found across studies, possibly due to the different sample characteristics and methodologies employed. The association between antisocial behaviour and EDF also varied across EF domains, with deficits in WM, inhibition, and attention showing the greatest effect sizes, suggesting that antisocial individuals have more prominent deficits in some EF skills than in others.

The idea that antisocial individuals may have deficits in specific EF skills rather than a global EDF has also been suggested in studies examining hot and cool EF. In a study of 106 children, Poland et al. (2015) examined the role of cool and hot EF in teacher-reported aggression. Children completed laboratory tasks measuring cool (inhibition, planning, working memory) and hot EF (affective decision-making, delay of gratification). Cool, but not hot, EF skills significantly contributed to childhood aggression. In contrast, Woltering et al. (2016) found that children with disruptive behaviour (n=93; aged 7-12) had significantly poorer performance on hot EF tasks (emotion-induction go/no-go inhibition task and an affective-decision making task) compared to typically developing peers (n=63), but not cool EF tasks (digit span WM task, go/no-go inhibition task, and Stroop inhibition task).

EF deficits have been found in youths with stable and unstable antisocial behaviour (Séguin, Boulerice, Harden, Tremblay, & Pihl, 1999; Séguin, Pihl, Harden, Tremblay, & Boulerice, 1995), and in those with early- and late-onset CD (Johnson, 2015). However, many studies have not controlled for the possible influence of co-morbid ADHD symptoms on EF abilities. Nevertheless, the relationship between antisocial behaviour and EF deficits has been found to remain after controlling for attention problems or ADHD (Oosterlaan, Logan, & Sergeant, 1998; Raaijmakers et al., 2008; Saarinen, Fontell, Vuontela, Carlson, & Aronen, 2015; Schoemaker et al., 2012). Saarinen et al. (2015) measured visuospatial WM in 26 patients with ODD or CD, and 26 healthy controls. A computer based *n*-back task was used, in which a sequence of stimuli are presented and the participant is required to indicate when the current stimulus matches the one from *n* steps earlier. Youths with ODD/CD, both with and without co-morbid ADHD, had significantly poorer performance on the task than controls, suggesting ADHD symptoms are not accountable for poor visuospatial WM. Nevertheless, it is still possible that the association between antisocial 1behaviour and EDF may be due to co-morbid ADHD or other co-morbid difficulties on some neuropsychological tests and therefore co-morbidity needs to be considered when designing and interpreting research of this kind.

2.6.2 Behavioural evidence of emotion dysregulation in youths with CP

Although difficulties with emotions are typically associated with internalising disorders, the importance of emotion in externalising disorders is now evident, as demonstrated in several reviews (Cole, Michel, & Teti, 1994; Eisenberg, Spinrad, & Eggum, 2010; Mullin & Hinshaw, 2007; Röll, Koglin, & Petermann, 2012). Findings of deficits in hot EF tasks provide some evidence of EDR in these youths, since hot EF tasks typically require cognitive control in the presence emotional arousal. Woltering et al. (2016) found that children with disruptive behaviour had deficits in hot EF tasks, and self-reported emotion scales, in conjunction with physiological recordings of heart rate, confirmed that emotions were elicited during these tasks.

Externalising difficulties have also been associated with ER in parent-reported questionnaires and observational laboratory tasks, which more explicitly aim to measure ER. In Graziano and colleagues' (2007) study of 325 five-year-olds, parent-reports of children's ER (Emotion Regulation Checklist; Shields & Cicchetti, 1997) was a significant predictor of behaviour difficulties. Using an alternative method, Calkins and Dedmon (2000) presented 99 two-year-olds with a series of emotionally and behaviourally challenging tasks. Tasks included the presentation of a large, realistic moving spider (fear-eliciting); a difficult puzzle (problem solving); audiotape of a crying toddler (empathy situation); and a clear container of cookies that the child could not open (frustration). Children were observed for negative affect and ER behaviours during the tasks. ER behaviours included self-comforting (e.g. thumb sucking or hair twirling); mother orientation (e.g. looking at mother, or talking, touching or pulling on mother); and distraction (attending to or manipulating an object other than the task object). In each task, children with externalising behaviour showed more negative affect and weaker ER behaviours and were more likely to resort to tantrums or aggression than children without externalising behaviours. These findings suggest that children with early externalising difficulties do not have a repertoire of adaptive regulation strategies in challenging situations. Children who fail to use ER strategies may instead vent their emotions and show aggressive and destructive behaviour (Eisenberg, Fabes, Nyman, Bernzweig, & Pinuelas, 1994; Fabes & Eisenberg, 1992).

It is also important to note that successful ER requires an understanding of one's own emotions and those of others. Emotion understanding involves being able to attend to emotion information in the environment, identify and label experienced and expressed emotions, have knowledge of the causes of emotions and strategies for coping with emotions, and an understanding of social and cultural display rules of emotions (Eisenberg et al., 2007; Southam-Gerow & Kendall, 2002). Each is likely to play a role in successful ER and therefore each is a potential area of deficit for children with ER difficulties. For example, children with disruptive behaviour have been found to have poorer vocabularies for describing affective states (Speltz, DeKlyen, Calderon, Greenberg, & Fisher, 1999), poorer understanding of causes of emotion (O'Kearney, Salmon, Liwag, Fortune, & Dawel, 2016), and are poorer at recognising and interpreting emotion cues in facial expressions and story vignettes (Izard et al., 2001; Martin, Boekamp, McConville, & Wheeler, 2010). Children with disruptive behaviour also show a poorer understanding of the ability to modify emotions. In Tergwot and colleagues' studies (Terwogt, 1990; Terwogt, Schene, & Koops, 1990) children with behaviour difficulties were more likely to hold the distorted belief that it is not possible to change their emotions. Cole, Dennis, Smith-Simon and Cohen (2009) found that preschool children who were poor at choosing appropriate ER strategies in a series of puppet vignettes, were more likely to show disruptive behaviour and less appropriate ER strategies in a frustration task, in which the wrong set of keys were given to the child to open a transparent box holding a desired toy.

2.6.3 Neurobiological evidence of EF and ER deficits in youths with CP

In Chapter One, findings of neurobiological abnormalities associated with CP were presented. Evidence of reduced cortisol, abnormal serotonin neurotransmission, and SNS hyporeactivity supports the low-fear and sensation-seeking models of CP. It was also noted that these neurobiological abnormalities may account for the reward-dominance and low empathy characteristics of youths with CU traits. The EDF and EDR deficit model of CP presented in this chapter have similarly been supported by evidence from neuroscience (for reviews, see Cappadocia et al., 2009; Matthys, Vanderschuren, & Schutter, 2013). In an fMRI study with 9- to 15-year-old boys (*N*=27), Sterzer, Stadler, Krebs, Kleinschmidt, and Poustka (2005) found participants with CD had less activation in the left amygdala and deactivation in right dorsal anterior cingulate gyrus while viewing negative affective pictures, relative to healthy control participants. Stadler et al. (2007) replicated these findings in a later study. This deactivation suggests impairment in processing emotional cues and decreased emotional control. Such functional impairments may explain the reduced inhibition of emotional behaviour and an increased tendency for impulsive aggression in children with CD. Although a large proportion of participants had co-morbid ADHD, and the group scored high on internalising symptoms, the association remained when controlling for attention, depression and anxiety scores.

While the PFC is strongly associated with cognitive control, it has also been implicated in social behaviour. Studies of patients with damage to the frontal lobe in particular have highlighted the association between PFC abnormalities and antisocial behaviour. For example, Anderson, Bechara, Damasio, Tranel, and Damasio (1999) document the case of a 20-year-old who suffered frontal lobe damage aged 15 months. The child appeared to make a full recovery, but by age 14, displayed disruptive behaviours characteristic of CP, including aggression, lying, stealing, and noncompliance to rules or punishment. The adolescent had normal scores for basic cognitive abilities, but scored low on EF tasks requiring planning and reasoning. Neuroimaging in adulthood showed damage to prefrontal regions and no other brain area, providing evidence that abnormalities in the PFC are responsible for EF deficits and antisocial behaviour.

Imaging studies with children with CD have found structural and functional abnormalities in the frontal lobes and limbic structures (Fairchild et al., 2011; Fairchild et al., 2013; Kruesi, Casanova, Mannheim, & Johnson-Bilder, 2004). In Fairchild and colleagues' studies, adolescents with CD showed reduced right dlPFC volume and reduced amygdala grey matter volume compared to healthy controls. Reduced grey matter volume was also found in the anterior insula, another structure associated with cognitive function and emotion (Phan, Wager, Taylor, & Liberzon, 2002) and the right striatum, a structure associated with cognition and reward processing (Yager, Garcia, Wunsch, & Ferguson, 2015). Studies using EEG have also found abnormalities in neural activity associated with the PFC in children with externalising behaviour (Lewis et al., 2008; Woltering, Granic, Lamm, & Lewis, 2011). This work is discussed further in Chapter Seven.

There are now several reviews providing support of these structural and functional brain abnormalities in antisocial individuals (Noordermeer et al., 2016; Rogers & De Brito, 2016; Yang & Raine, 2009). In a meta-analysis of 43 imaging studies, Yang and Raine (2009) found significantly reduced PFC volume and function in antisocial individuals, in particular the right OFC, left dlPFC, and right ACC. Moreover, sample characteristics (including age, gender, and co-morbidity) and methodological characteristics did not moderate these results, confirming replicability of PFC abnormalities in these individuals. Noordermeer et al. (2016) conducted a meta-analysis of 29 imaging studies with children with CD or ODD. Children with CD/ODD had smaller and lower brain activity in bilateral amygdala; structural (but not functional) abnormalities in the insula and left frontal gyrus; and functional (but not structural) abnormalities in the striatum and the fusiform gyrus. Moreover, this was irrespective of ADHD co-morbidity. Results were also suggestive that abnormalities in the amygdala in particular were specific to CD/ODD rather than ADHD. Beyond ADHD, these meta-analyses have not taken into account other co-morbid symptoms, such as anxiety and depression, which are also associated with abnormalities in some of these brain regions, especially the amygdala (Machado-de-Sousa et al., 2014; Qin et al., 2014; Young et al., 2014). Furthermore, although child studies have been separated from adult studies in these meta-analyses, youth samples still cover a wide age range, often spanning from childhood into adolescence (e.g. Noordermeer et al., 2016). Substantial changes in brain development take place during this time (Giedd et al., 2009) and therefore developmental patterns need to be taken into account.

2.6.4 EF and ER deficits in youths with CU traits

While there is strong behavioural and neuroscience evidence of EDF and EDR in CP, fewer studies have examined these deficits in the CU traits subtype. Nevertheless, it has been proposed that psychopathic adults' '*impulsive, ill-conceived, and self-defeating behaviour'* is attributable to a deficit evaluating and modifying their behaviour when in pursuit of goal achievement (Wallace & Newman, 2004, pp.179-180). Early studies assessing EF skills in adult offenders found no association between psychopathy and an EF deficit (e.g. Hare, 1984; Hart, Forth, & Hare, 1990; Kandel & Freed, 1989). However, in a meta-analysis of adult offenders, Morgan and Lilienfeld (2000) found a small but significant overall effect (d=.25) indicating EF deficits are present to some extent in adult offenders with psychopathy. Such discrepancies between studies might be explained by the different neuropsychological measures used, which tap different EFs and require different regions of the EF neurological system (De Brito & Hodgins, 2009). Hare (1984) and Hart et al.'s (1990) research used traditional measures which assessed the cool aspects of EF only (e.g. WCST). Therefore, the finding that psychopathic offenders did not perform differently to non-psychopathic offenders on these tasks, suggests this subgroup may not have a deficit in cool EFs, but does not tell us anything about their performance in tasks requiring hot EFs. More recent evidence that psychopathic offenders do not show an EF deficit in cool EFs, including WCST and Spatial Attention tasks, has been found in several studies (for a review, see De Brito & Hodgins, 2009). Several other studies have found support for a deficit in hot EFs in adult offenders, including deficits in an affective decision making task (Mitchell, Colledge, Leonard, & Blair, 2002; Mitchell et al., 2006) and a deficit in hot EF was found for both adults and children with CU traits in Budhani and colleagues' studies using a probabilistic response reversal paradigm (Budhani & Blair, 2005; Budhani, Richell, & Blair, 2006).

However, the EDF distinction between subtypes of antisocial behaviour may not be as simple as hot or cool deficits. In assessments using a battery of cool EF measures, Lapierre, Braun, and Hodgins (1995) and Roussy and Toupin (2000) found no impairment on the WCST in adult or adolescent offenders. However, both studies found psychopathic offenders performed worse than non-psychopathic offenders on other measures of cool EFs; specifically those requiring response inhibition (go/no-go task and Stop task). This evidence suggests offenders with psychopathy may have a specific deficit in cool EF which tap the ventral lateral cortex or OFC, but not in cool EFs that tap the dorsolateral prefrontal cortex (dlPFC) (e.g. WCST) or the dorsal ACC (e.g. Stroop task) (Blair et al., 2006; De Brito & Hodgins, 2009; Pham, Vanderstukken, Philippot, & Vanderlinden, 2003). However, De Brito et al. (2013) did find impairments in cool EFs tapping the dlPFC (verbal WM; Digit Span Backward task) for adults with ASPD and psychopathy, further complicating the neurocognitive profile of psychopathy. In their battery of cool and hot EF measures, De Brito et al. found no differences between ASPD with psychopathy and ASPD without psychopathy on any of the tasks, suggesting that some EF deficits are present in adult offenders with psychopathy, and that they may not have a distinct EF profile to antisocial offenders without psychopathy. Moreover, De Brito et al.'s findings are supported by their brain imaging work which found no differences in grey matter volume of the amygdala, vmPFC or dlPFC between antisocial offenders with psychopathy and those without psychopathy. Differences in grey matter volume of the medial PFC and temporal poles were found, suggesting some neurobiological differences between these subtypes. Nevertheless, small sample sizes of participants with psychopathy means that these studies may lack statistical power to detect group differences.

In addition to studies examining the cognitive processing of individuals with psychopathic traits, adults and youths with these traits have been found to have a dysfunction in emotion processing associated with the amygdala, the OFC, and the ACC (for a review, see Blair, 2013). In an fMRI study by Jones et al. (2009) (*N*=30; mean age=11 years), boys with CU traits had reduced right amygdala activity while viewing fearful faces, compared to healthy controls. Similarly, adolescents with psychopathic traits showed reduced amygdala activity and reduced functional connectivity between the amygdala and OFC during a moral judgment task in which they were required to categorise illegal and legal behaviours (Marsh et al., 2011). In a later study by Marsh and colleagues, adolescents with psychopathic traits and ODD or CD and healthy controls (*N*=25) viewed photographs of pain-inducing injuries during fMRI (Marsh et al., 2013). Youths with psychopathic traits showed reduced activity within regions associated with empathic pain, including the rostral ACC, ventral striatum, and amygdala, as the depicted pain increased. Reductions in amygdala activity were particularly pronounced when adolescents were asked to imagine the injury was occurring to another person, rather than to themselves. These empathic pain responses within the amygdala and rostral ACC were negatively correlated with the severity of psychopathic traits.

These studies did not include a group of children with CP without CU traits, therefore we cannot conclude that it was CU traits specifically rather than CP symptoms in general that are associated with these abnormalities. However, Fairchild et al. (2013) observed structural abnormalities in brain regions involved in emotion processing, reward, and empathy in female adolescents with CD (*n*=20) and healthy controls (*n*=20), and while aggressive symptoms were negatively correlated with right dlPFC volume, CU traits were positively correlated with bilateral OFC volume. Sebastian et al. (2016) found male youths with CP (*n*=60) had reduced bilateral OFC volume compared to healthy controls (*n*=29), but only CU traits, not CP symptoms, predicted reduced left OFC volume. Sebastian, McCrory, et al. (2012) compared amygdala activity of children with CP/CU+ and children with CP/CU-. While viewing complex emotional scenes, children with CP/CU- had increased amygdala activity, whereas CP/CU+ had reduced amygdala activity, suggesting differences between these subtypes of CP in amygdala function while viewing emotional stimuli. CU traits have also been compared with other externalising problems without CU traits. Jones et al. (2009) found amygdala abnormalities remained after controlling for ADHD symptoms. Similarly, Marsh et al. (2008) (*N*=36) found adolescents with CU traits had reduced amygdala activation while processing fearful expressions compared to healthy participants and youths with ADHD only. Youths with CU traits also had reduced functional connectivity between the amygdala and the vmPFC compared to the other groups, and symptom severity of CU traits was negatively correlated with connectivity. While CP without CU traits were not controlled for in these studies, the findings suggest that these abnormalities are not characteristic of externalising difficulties more broadly.

As discussed previously, psychopathic traits have been associated with reduced neural responses to negative stimuli, punishment, and others' distress (see Chapter One). However, there is less work examining the regulation of emotions in CU traits. Since brain regions involved in these emotion processing tasks, in particular the amygdala and frontal cortex, are also associated with the regulation of emotions (Banks, Eddy, Angstadt, Nathan, & Phan, 2007; Motzkin, Philippi, Wolf, Baskaya, & Koenigs, 2015), the abnormalities in these areas found in individuals with psychopathic traits are suggestive of deficits in ER. There is some recent behavioural evidence to suggest that children with CU traits have a unique ER profile, distinct from children with externalising behaviour without CU traits, but the direction of association is mixed. Lotze, Ravindran, and Myers (2010) studied 50 boys and girls (aged 6–12) while attending a residential summer camp for children with incarcerated mothers. Adult mentors from the camp completed reports of child behaviour and ER, as did children themselves. Adult-reported ER explained 64% of variance related to externalizing behaviours, 27% of variance to internalizing behaviours, and 36% of variance to CU traits, after controlling for age and gender. Both adult- and self-reports showed that children with poorer ER engaged in more problem behaviours. However, only adult-reports showed an association between CU traits and ER. Mentors reported that children with CU traits were able to regulate and control their emotions, while other children with problematic behaviour had ER difficulties. In contrast, a recent study by O'Connor, Humayun, Briskman and Scott (2016) found that adolescents with CP/CU+ showed greater ER in a series of problem-solving tasks compared to adolescents with CP/CU- (*N*=271). While this evidence suggests CU traits have a unique ER profile, research in this area is still very limited and more work is needed to examine the direction of this association. The experimental investigation of ER in children with CP/CU- and CP/CU+, presented in Chapters Three and Four, aims to address this gap in the literature.

2.7 Executive Functions and Emotion Regulation in the Classroom

The evidence that children and adolescents with CP have deficits in EF and ER has implications for these youths in the classroom, since EF and ER abilities play an important role in school success (for a review, see Blair & Raver, 2015). In this section, evidence of the association between EF and ER abilities and academic achievement will be presented, including a discussion of how learning-related behaviours and social relationships in the classroom play a role in this association.

2.7.1 Executive functions and academic achievement

Learning in the classroom relies on a myriad of EF skills (Jacob & Parkinson, 2015). The pupil must attend to the teacher and learning materials, hold instructions in WM, identify task goals, select strategies to problem-solve, plan and organise materials, monitor the quality of their work, and shift flexibly between tasks. The ability to inhibit inappropriate impulses and regulate emotions is also needed in order for pupils to access learning opportunities and make effective use of their cognitive skills (Blair & Raver, 2015; Brock et al., 2009). It is not surprising then that EF proficiency has been linked to academic achievement from preschool through to secondary school, documented in several reviews (Casey et al., 2002; Cragg & Gilmore, 2014; Duncan et al., 2007; Nigg, 2000; Willoughby, Magnus, Vernon-Feagans, Blair, & Investigators, 2016). Moreover, this association remains when controlling for general cognitive ability, and there is evidence of a stronger association between EF skills and school readiness than between IQ or early maths and reading abilities and school readiness (Kimberg, D'Esposito, & Farah, 1997). Taken together these findings provide strong evidence that these higher order cognitive skills play an important role in academic success beyond general intelligence.

Nevertheless, the complexities of this relationship are not well-understood. While a link between academic achievement and EF as a domain-general construct is well established, there has been debate as to which specific EF skills account for this association. Inhibition and planning have frequently been associated with both maths and reading achievement (Blair & Razza, 2007; Bull, Espy, & Wiebe, 2008; Protopapas, Archonti, & Skaloumbakas, 2007; St Clair-Thompson & Gathercole, 2006). WM has also consistently been associated with maths and reading, with several reviews dedicated to this association (e.g. Carretti, Borella, Cornoldi, & De Beni, 2009; Friso-van den Bos, van der Ven, Kroesbergen, & van Luit, 2013; Raghubar, Barnes, & Hecht, 2010). However, evidence of the relationship between academic achievement and cognitive flexibility has been documented less, with some evidence to suggest that cognitive flexibility does not relate to maths or reading (Espy et al., 2004; Latzman, Elkovitch, Young, & Clark, 2010; Mayes, Calhoun, Bixler, & Zimmerman, 2009; van der Sluis, de Jong, & van der Leij, 2007), while a recent meta-analysis concluded that cognitive flexibility was associated with both maths (18 studies, N=2,330, r=.26) and reading performance (16 studies, N=2,266, r=.21) (Yeniad, Malda, Mesman, van IJzendoorn, & Pieper, 2013).

A number of factors may account for discrepancies in the literature, including differences in the measures used to assess EF and achievement and the analytic methods employed. For example, using two different measures of cognitive flexibility, Clark et al. (2010) found the Flexible Item Selection Task to be correlated with achievement while controlling for IQ and other EF skills, whereas the Shape School Switch task, was not associated with achievement with the same children. The authors point out that these two tasks require different additional skills, including WM, inhibition and linguistic abilities. It is therefore difficult to compare results across studies which use a wide variety of EF and academic measures. The sample used is also likely to impact the results and make comparisons difficult. In particular, there is evidence to suggest that these relationships depend on age (Altemeier, Jones, Abbott, & Berninger, 2006; Bull et al., 2008). Bull et al. (2008) carried out a battery of EF measures with preschool children and collected maths and reading scores at school entry and at the end of the first and third year of primary school. WM, inhibition, planning and monitoring correlated significantly with both maths and reading achievement at the beginning and end of the first year of primary school, suggesting a domain-general EF association with achievement. However, by 7-8 years of age, differences between specific EF skills and the two disciplines emerged. In particular, visual-spatial WM predicting maths achievement while verbal WM predicted reading achievement. Similarly, studies with older children suggest that cognitive flexibility may be important for more complex mathematical problem solving assessed later in primary school, than it is for early academic tasks (Bull & Scerif, 2001; van der Sluis, de Jong, & van der Leij, 2004).

In Yeniad et al.'s meta-analysis (2013) of cognitive flexibility and achievement, no moderating effects were found based on methodology (design, task, or length of study) or sample characteristics (including age, gender, and SES). Nevertheless, only a small number of studies were available for each analysis, making conclusions about these moderating effects tentative. In a recent meta-analysis of 67 studies, Jacob and Parkinson (2015) found a moderate overall association between EF and academic achievement. This effect remained approximately the same for different EF skills (inhibition, attention control, attention shifting, and WM), different measurement types (naturalistic observations and laboratory tasks), and different age groups (3-5, 6-11, and 12-18). However, there was some evidence that the association differed between academic disciplines, in that inhibition and attention control were more strongly associated with maths than reading, but WM and attention shifting was associated with maths and reading equally.

While there is a large body of research documenting an association between EF skills and academic achievement, there remain important gaps in this literature. For example, there is limited research examining other academic disciplines. One recent study (*N*=278) found that 4-year-olds' performance on inhibition, WM, and cognitive flexibility tasks significantly predicted children's science scores (Nayfeld, Fuccillo, & Greenfield, 2013). Moreover, since EF skills are associated with other child and family risk factors for poor achievement, such as low SES (Ardila, Rosselli, Matute, & Guajardo, 2005; Li-Grining, 2007; Noble, Norman, & Farah, 2005), a direct causal relationship cannot be assumed. While some longitudinal studies have found that EF skills contribute to academic achievement rather than vice versa (Bull et al., 2008; Hitch, Towse, & Hutton, 2001; Miller & Hinshaw, 2010), more research is needed which allows for analyses of causal relationships including possible mediating and moderating influences.

2.7.2 Emotion regulation and academic achievement

There are considerably fewer publications examining the role of emotions on academic achievement, and even fewer addressing the ER in the context of the classroom (Valiente, Lemery-Chalfant, & Swanson, 2010). As discussed previously, emotion and cognitive processes are closely related, with overlapping and interacting neural networks (Goldsmith et al., 2008). When high emotional arousal occurs, an amygdala hijack may reduce the efficiency of cognitive functioning (Kaufman, 2010). Furthermore, the effort required to achieve and maintain a regulated state by individuals with poor ER abilities, may drain cognitive resources needed for learning (Scheibe & Blanchard-Fields, 2009). It is likely then that high emotional arousal, or poor regulation of this arousal, may have a negative effect on academic achievement (Blair, 2002).

Emotional arousal has also been negatively associated with children and adolescents' academic achievement (Pekrun & Linnenbrink-Garcia, 2012; Valiente et al., 2010; Villavicencio & Bernardo, 2013). In terms of emotion regulation, adults' performance on cognitive tasks have been found to be significantly impaired by their attempts at managing positive and negative emotion (McRae et al., 2012; Schimmack & Derryberry, 2005). McRae et al. (2012) found that adults' with a greater ability to regulate negative emotion using reappraisal strategies had greater WM and cognitive flexibility. There is also some evidence that ER abilities, assessed in both lab tasks and adult-reports, are associated with children's standardised maths and reading scores (Best, Miller, & Naglieri, 2011; Graziano et al., 2007; Trentacosta & Izard, 2007). Interestingly, each of these studies also found relationships between ER and classroom behaviour, or learning-related behaviour, such as productivity, school engagement, and social interactions in the classroom, suggesting that ER skills may contribute to academic success indirectly through self-regulated behaviours in the classroom. A discussion of the relationship between EF and ER, academic achievement, and learning-related behaviours follows.

2.7.3 Learning-related behaviours and social skills

In addition to the thinking skills required for academic success, EF and ER are also associated with classroom behaviours and social skills needed for learning (Brock et al., 2009; Neuenschwander, Röthlisberger, Cimeli, & Roebers, 2012; Sasser, Bierman, & Heinrichs, 2015; Ursache et al., 2012). Children who are engaged with the learning materials, are motivated to complete academic tasks, can work independently, and can co-operate and communicate with teachers and peers, are likely to have greater access to learning opportunities than those who do not demonstrate positive learning-related behaviours (Blair & Raver, 2015). Not surprisingly then, learning-related behaviours have been associated with children's maths and reading achievement (McClelland, Morrison, & Holmes, 2000; Ponitz, McClelland, Matthews, & Morrison, 2009; Stipek, Newton, & Chudgar, 2010), with evidence that these relationships remain significant after controlling for several variables including IQ, early maths and reading skills, parent's education, and the home literacy environment (Brock et al., 2009; McClelland et al., 2000). Reports from teachers regarding school readiness support the notion that learning-related behaviours are key to school success, with teachers rating a child's attention, ability to follow instructions, self-discipline, enthusiasm, curiosity, and communication skills, as more important school readiness skills than the child’s ability to count or knowledge of the alphabet (Heaviside, 1993; Lin, Lawrence, & Gorrell, 2003).

Mediation analyses have been conducted in several of these studies, with mixed findings. In a sample of 173 kindergarteners, Brock et al. (2009) found that performance on two inhibition tasks at the start of the year predicted learning-related behaviour and maths achievement at the end of the year. However, neither teacher-reported learning-related behaviours, nor observations of children's classroom engagement mediated the relationship. Neuenschwander et al. (2012) (N=459) found EF (inhibition, set-shifting, and WM tasks) predicted teacher-reported learning-related behaviour, school grades, and standardised achievement scores in maths, reading and writing one year later. Learning-related behaviour mediated the association between EF and school grades, but not between EF and standardised achievement scores. The mediation found for school grades may have been due to shared-method variance, since school grades and learning-related behaviour both came from teacher-reports. Nevertheless, both studies examined this relationship in just the first year of the child's education and it is possible that EF skills influence the development of learning-related behaviours over a longer period of schooling. In a longer-term study with 164 children, Sasser et al. (2015) found teacher-reported learning-related behaviours mediated the relationship between pre-school EF (inhibition and set-shifting tasks) and third-grade reading skills. However, learning-related behaviours did not mediate the association between EF and maths skills or overall teacher-rated academic functioning. It may be that inhibition and set-shifting are directly related to maths due to the thinking skills required in this discipline, such as shifting from one mathematical operation, formula, or method to another. Reading may not directly require such skills, but may necessitate learning-related behaviours such as engagement and concentration to develop literacy skills. However, this can only be speculated as more longitudinal research is needed to examine these inconsistencies using different measures of EF and achievement.

The ability to regulate emotions may also influence classroom behaviours and academic habits. High emotional arousal may lead the pupil to focus on the emotional trigger, diverting cognitive resources away from the teacher's instruction and educational materials (Valiente, Swanson, & Eisenberg, 2012). A child with poor ER then, may have reduced access to learning opportunities (Gross, 2013). Several studies examining ER and academic achievement have supported this view. In their sample of 325 kindergarten children, Graziano et al. (2007) found that parent-reported ER was positively associated with standardised maths and reading scores and teacher-reported productivity in the classroom. Valiente and colleagues found children demonstrating weaker regulatory abilities and more negative affect had poorer academic performance, as well as lower participation in class, more school absenteeism, less school liking, and lower quality student-teacher relationships, compared to children with good ER (Valiente, Lemery-Chalfant, & Castro, 2007; Valiente, Lemery-Chalfant, Swanson, & Reiser, 2008).

One study addressing mediation in this relationship was carried out by Howse, Calkins, Anastopoulos, Keane, and Shelton (2003), in which two-year-old's (*N*=122) participated in two tasks designed to elicit frustration. One required children to draw impossibly perfect circles and the other presented children with the wrong keys to open a transparent box holding a desirable toy. Greater parent-reported ER was positively associated with maths and reading scores and with listening comprehension at school entry. This relationship was mediated by children's learning-related behaviours, including concentration, motivation, and independence in school work. Nevertheless, the lab task measures of ER were not significantly correlated with academic achievement. This study highlights the need for caution when interpreting results from a single measure of ER. Parent-reported ER and these lab tasks may be measuring different constructs, which needs to be considered in the design and interpretation of such research. Methodological difficulties in the assessment of children's ER are discussed in Chapter Seven.

Both EF and ER abilities also allow the child to initiate and co-ordinate behaviour in response to social expectations, and are therefore important for making and maintaining relationships with peers and teachers (Sasser et al., 2015). For example, WM is needed to process multiple variables in a social situation and consider the consequences of actions, while inhibition is required to delay immediate gratification and withhold prepotent responses which may not be socially desirable (Kaufman, 2010). Several reviews demonstrate evidence of an association between EF and social skills (McClelland et al., 2007; Moriguchi, 2014; Riggs, Jahromi, Razza, Dillworth-Bart, & Mueller, 2006). ER skills are needed to manage emotional arousal and control the overt expression of these emotions in a socially acceptable manner. There is evidence to suggest that ER predicts children's social competence (Blair, Denham, Kochanoff, & Whipple, 2004; Lemerise & Arsenio, 2000).

Social skills, including co-operation and communication, are important for learning in the classroom (Ansari & Gershoff, 2015; McClelland et al., 2000; Rabiner, Godwin, & Dodge, 2016). Positive interactions with peers allows for engagement in group learning activities and peer support and encouragement; opportunities which may be missed by pupils with poor social skills and weak peer relationships (Mcclelland, Morrison, & Kessenich, 2003; Wentzel, Baker, & Russell, 2009). Similarly, a high quality student-teacher relationship (STR) supports the child's learning through guidance and discipline and reinforces academic success through encouragement and praise (Graziano et al., 2007; Hamre & Pianta, 2001). A warm, and supportive STR has been found to motivate the student to achieve (Urdan & Maehr, 1995), whereas a low quality STR has been associated with poor school engagement, low participation in the classroom, and more negative school attitudes (Ladd & Burgess, 2001; McCormick, O'Connor, Cappella, & McClowry, 2013; Pianta, Hamre, & Allen, 2012). It is not surprising then that a low quality STR is associated with poor academic achievement (Graziano et al., 2007; Hamre & Pianta, 2001; Jerome, Hamre, & Pianta, 2009). Graziano et al. (2007) examined the relationship between ER, the STR, academic success, and behaviour difficulties. In their sample of 5 year-old children, parent-reported ER was a significant predictor of teacher-reported STR quality. Furthermore a positive STR predicted teacher-reports of productivity and academic success and standardised assessments of literacy and mathematics. Interestingly, behaviour difficulties did not predict academic success when accounting for the STR quality, suggesting behaviour difficulties may have an indirect effect on academic success through their low quality STR. While this study provides insight into the complexities of these associations, these relationships in pupils with CP, and especially in children with CU traits, are not well understood. The role of the child's ER difficulties in the association between CP and the STR are examined in Chapter Four.

Finally, it is worth considering the emotional and motivational impact of having EF and ER deficits and poor academic success on the child's behaviour and school engagement. The EF and ER demands of the classroom may be so effortful for a pupil with these deficits that they become overwhelmed and frustrated by a task that other pupils find simple. Repeated effort, failure, and frustration may lead to destructive, aggressive, or oppositional behaviour (Walker & Sprague, 1999), as well as reduced self-efficacy (Gambin & Święcicka, 2015) and lowered persistence and motivation (Pintrich, 2003; Zimmerman, 2000). This in turn may have a detrimental impact on future academic performance (Ferla, Valcke, & Schuyten, 2010; Mega, Ronconi, & De Beni, 2014; Walker, Greene, & Mansell, 2006). Research is needed which considers the role of children's self-perceptions in the relationship between EF and ER abilities, academic achievement, and CP, as breaking this cycle could be the target of intervention for these pupils. The self-perceptions of pupils with CP are examined in the experimental study in Chapter Three.

2.8 Summary

To achieve long-term goals, we must inhibit immediate desires and gratification (Kaufman, 2010). However, evidence from neuroscience suggests that children and adolescents with CP lack the prefrontal cortical capacity to withhold pre-potent responses, or to *stop and think* before acting. Similarly, abnormalities in the amygdala alongside these cognitive control deficits may account for the poor regulation of emotions in these individuals. Therefore, EDF and EDR accounts of CP are suggestive that the antisocial and aggressive behaviours characteristic of these youths, reflect abnormalities in the neurobiological systems involved in cognitive control processes and the management of emotional arousal.

These findings have important implications for pupils with CP, since evidence suggests that EF and ER are linked to academic achievement (e.g. Blair & Raver, 2015; Jacob & Parkinson, 2015). However, research is inconsistent concerning whether EF is domain-general and needed in various academic skills, or domain-specific and related differentially to academic skills. It is also not fully understood whether ER influences academic achievement directly through the competing use of the physiological systems required for both ER and learning, or indirectly through missed learning opportunities due to poor management of behaviour in the classroom or poor social relationships with peers and teachers (Blair & Raver, 2015). Furthermore, the cognitive and emotional control demands placed on school pupils may result in frustration, repeated academic failure, and low self-perceptions, leading to a cycle of poor academic success and disruptive behaviour. However, research which examines the complexities of these associations for pupils with CP is lacking. EF, ER, and academic achievement, as well as self-perceptions and the STR, will be examined in two detailed profiling studies of school pupils with CP in Chapters Three and Four.

This research also has important implications for the development of interventions for children with CP. Classroom behaviour stemming from EF and ER deficits, such as inattention or impulsive behaviour, may be viewed by teachers as a choice behaviour under the child's control. However, as Kaufman (2010) emphasises, the very nature of an EDF and EDR is a deficit in control processes. This is important when thinking about how to change this dysfunctional behaviour. Teachers and parents must be made aware that these children have these deficits, rather than choosing to be lazy or impulsive. The development and evaluation of a classroom-based intervention based on the EDF and EDR account of CP will be presented in Chapter Six.

Chapter 3 A Neuropsychological Profiling Study of Primary School Pupils with Conduct Problems

3.1 Introduction

There is a large body of evidence to suggest that children and adolescents with CP have deficits in EF and ER (for reviews, see Ogilvie et al., 2011; Pinsonneault et al., 2015; Röll et al., 2012; Kim Schoemaker et al., 2013; Séguin et al., 2015). Furthermore, evidence from neuroscience demonstrates structural and functional abnormalities in brain regions associated with EF and ER in these youths (Cappadocia et al., 2009; Matthys et al., 2013). This literature was reviewed in Chapter Two, and the implications of these deficits in the context of the classroom were discussed. In this chapter, a behavioural profiling study is presented which aims to provide further evidence for these associations and to refine the cognitive and affective profiles of primary school pupils with CP.

It was also proposed in the previous chapter that a pupil's neuropsychological deficits and associated problematic behaviour could lead to low self-perceptions in pupils with CP. However, the self-perceptions of youths with CP are not fully understood and there are discrepancies in the literature. While there is some evidence that antisocial behaviour is associated with a negative self-concept (Donnellan, Trzesniewski, Robins, Moffitt, & Caspi, 2005; Fanti, 2013; Guerra, Williams, & Sadek, 2011), others have found antisocial individuals have a more positive, although possibly unrealistic, self-concept (Barry, Grafeman, Adler, & Pickard, 2007; Ha, Petersen, & Sharp, 2008; Sandstrom & Herlan, 2007). The mixed findings suggest a need for further research in this area. In particular, research is needed which examines the different dimensions of these self-concepts and their possible unique associations with CP (Ostrowsky, 2010; Taylor, Davis-Kean, & Malanchuk, 2007). Therefore, self-perceptions, across several domains, of pupils with and without CP are investigated in this profiling study.

Importantly, a consideration of subtypes of pupils with CP are also examined in this study. As discussed in Chapters One and Two, children and adolescents with CU traits have been found to have distinct cognitive, emotional, and social characteristics, as well as unique genetic and neurobiological profiles (Ciucci, Baroncelli, Golmaryami, & Frick, 2015; Frick et al., 2014). Nevertheless, there remain gaps in the research concerning differences between pupils with CP/CU+ and those with CP/CU-, especially in the context of the classroom. Understanding the characteristics of children with CP/CU+ is critical for designing more effective interventions for this particularly problematic group.

3.2 Hypotheses and Research Questions

Based on evidence in the literature outlined in Chapters One and Two, the follow research questions and hypotheses were proposed;

1) *Is CP associated with deficits in executive function?*
2) *Is CP associated with poor emotion regulation and lability?*
3) *Is CP associated with lower maths and reading achievement?*

It was hypothesised that compared to children without CP, children with CP would have poorer EF skills, poorer ER, and poorer academic achievement.

4) *Is CP associated with self-perceived behavioural, scholastic, and social competence?*

It was also hypothesised that children with CP would differ in their self-perceptions to children without CP. However, based on discrepancies in the literature regarding self-perceptions of individuals with antisocial behaviour, the direction of this effect was not predicted.

A series of exploratory research questions, based on these main hypotheses, were also addressed to obtain a more detailed profile of pupils with CP and to consider some methodological issues in this area of research.

5) *Do children with CP have domain-general or domain-specific difficulties in executive function, emotion regulation and lability, academic achievement, and self-perceptions?*
6) *Are there any differences in these associations between pupils in a mainstream school and those in a special SEMH provision?*
7) *Are there any differences in these associations between pupils with CP/CU- and CP/CU+?*
8) *Are these associations the same for teacher-reports, child self-reports, and performance-based measures?*

The rationale for these exploratory research questions are set out below.

3.2.1 General versus specific deficits

Relationships between CP and multiple components of EF, ER, academic achievement, and self-perception will be explored to investigate whether pupils with CP have general difficulties in these areas or have more specific deficits. For example, Chapter Two presented mixed evidence in the literature as to which EF skills are problematic for children with CP (for a review, see De Brito & Hodgins, 2009). Therefore, there is a need for a more detailed analysis of deficits in sub-domains of EF skills. A range of teacher-reported and child-assessed EF skills will therefore be assessed in the current study to examine whether pupils with CP have a general EDF or deficits in specific EF sub-domains. Similarly, it is not clear which aspects of ER are problematic for children with CP. This is largely due to the fact that ER does not have a universal definition (Gross, 2013) and different aspects of emotion processing and regulation are investigated across studies (see Chapter Two). An analysis of multiple self-reported and teacher-reported emotion-related abilities, including emotion lability and negativity, emotion understanding and empathy, and cognitive emotion regulation strategies, will address this issue to help clarify the mixed findings in the literature.

In Chapters One and Two, mixed evidence from the literature was also presented as to whether EF skills are associated with all academic disciplines or only specific disciplines, and whether children with CP have domain-general or domain-specific academic difficulties (e.g. Best et al., 2011; Hinshaw, 1992; van der Sluis et al., 2007). Therefore, both reading comprehension and mathematical reasoning skills will be explored separately in relation to multiple EF skills and CP.

Finally, multiple dimensions of pupils' self-perceptions will be examined. Self-perception is a concept that has been used interchangeably with other self-constructs, such as self-concept (the knowledge you have about the kind of person you are and your capabilities), or self-esteem and self-worth (the attitude you have about the kind of person you are and your capabilities) (Emler, 2001). These self-constructs are thought to be multi-dimensional. For example, people have separate beliefs about their intellectual, physical, emotional, and social aspects of themselves (Marsh, Craven, & Martin, 2013). Therefore, in the current study, global self-worth as well as separate components of self-perception, including perceptions of social acceptance, scholastic competence and behavioural conduct, in pupils with CP are investigated.

3.2.2 School provision

While studies of CP have frequently used samples from juvenile offender institutions, clinical settings, or at risk community populations, there is a lack of research using primary school-aged children attending a full-time special educational provision for SEMH. In the current study, primary-school pupils were recruited from a special SEMH provision and a mainstream primary school. While no specific hypotheses were proposed regarding school provision, recruiting pupils from both schools allows for profiles of an unrepresented population to be investigated and any differences between pupils with CP in a mainstream school and those in a special SEMH provision to be explored.

3.2.3 CU traits subtype

While there has been increased clinical acknowledgement of the CU traits subtype, and increased research interest in differentiating children with CP/CU+ and those with CP/CU-, differences between these subgroups in terms of neuropsychological profiles and academic achievement are still not well understood. A particular area of interest for CU traits research has been the distinct emotional characteristics found in these youths compared to those with CP/CU- (Ciucci et al., 2015). This includes the characteristic lack of empathy (e.g. Frick et al., 2014; Lui et al., 2016; Pardini & Byrd, 2012), deficits in the recognition of emotional expressions (e.g. Fairchild et al., 2010; White et al., 2016), and reduced amygdala activation to fearful facial expressions and emotional social situations (e.g. Jones et al., 2010; Marsh & Blair, 2008; Sebastian, Fontaine, et al., 2012). Nevertheless, there is little research on the regulation of emotions in youths with CU traits, in terms of the cognitive and behavioural strategies used to self-regulate and to control the display of socially appropriate emotional expression. While Ciucci et al. (2015) carried out an analysis of several emotional characteristics of school children with CU traits, more support is needed, especially in light of the different conceptualisations of ER.

The self-perceptions of children with CU traits are also not well-understood. The few studies which have addressed self-concepts have found mixed evidence in terms of the direction of an association between CU traits and self-esteem (Fanti, Demetriou, & Kimonis, 2013; Fanti & Henrich, 2014; Warren et al., 2015), and there is very little research examining differences in self-perceptions between youths with CP/CU+ and CP/CU- (Haas et al., 2015). A comparison of pupils with CP/CU+ and pupils with CP/CU- across EF, ER, academic achievement, and self-perceptions was carried out in this study to address some of these gaps in the literature.

3.2.4 Multi-informant

Child behaviour is often assessed through teacher- or parent-reports. However, there are issues of bias in reporting favourably or unfavourably, and there are likely to be inaccuracies reporting unobservable processes such as emotions and self-perceptions (De Los Reyes & Kazdin, 2005). On the other hand, lab tasks lack ecological validity and child self-reports are subject to social-desirability bias. Discrepancies between informants, especially between adults' reports and children's self-reports are well-documented (e.g. Kolko & Kazdin, 1993; Salbach-Andrae, Klinkowski, Lenz, & Lehmkuhl, 2009). Informant reports of child behaviour have also been found to correlate poorly with performance-based tests, including measures of EF (Blair, 2016). The range of different methods used to investigate child behaviour may therefore go some way to explain the mixed findings in the literature with regard to the profiles of children with CP. The current study used a multi-informant approach, including teacher-reports, child self-reports, and performance-based assessments to consider the profile of pupils with CP using these different methods.

3.3 Method

3.3.1 Participants

Pupils were recruited from a mainstream primary school and a special primary school provision for pupils with SEMH. The age of children asked to participate was based on the current age range of pupils in the SEMH provision to allow comparison across groups. Participants were split into three groups based on school provision and behaviour:

1) *SEMH school group:* All 33 pupils attending a special primary school provision who were expected to remain at the school for the full academic year were invited to participate. All pupils at the school had a statement of SEN with SEMH identified as the primary need. Pupils were placed at this provision based on the decision that they were unable to access the National Curriculum within a mainstream environment.

2) *Mainstream CP group:* All 134 key stage 2 (KS2) pupils in the mainstream school were invited to participate. Teacher-reports of child behaviour were collected to screen all KS2 pupils for behaviour difficulties. A subsample of 30 children with the highest scores of CP symptoms formed the mainstream CP group and were invited for further assessment.

3) *Mainstream no-CP group*: 30 children without behaviour difficulties (based on the teacher behaviour screen) matched with the mainstream CP group for age and gender, were selected from the same school to form a comparison group of pupils without CP.

Parental consent for teacher questionnaires and child assessments was given in the form of an opt-out letter and pupils gave verbal assent at each testing session with the researcher. Ethical approval was granted from Goldsmiths, University of London Research Ethics Committee. Teacher reports of behaviour were not collected for 20 pupils due to parents opting out of the study, pupils moving schools, or teachers failing to return questionnaires. This resulted in a sample of 73 participants (12 female) aged 6 to 10 years (M=8.47 years, SD=.87), with 28 participants in the SEMH school group, 25 participants in the mainstream CP group, and 20 participants in the mainstream no-CP group.

3.3.2 Measures

Measures were selected based on tools with multiple scales to allow for a more detailed profile of pupils with CP to be examined; i.e. those which measure multiple domains of broad constructs of interest, specifically EF, emotion-related abilities, and self-perceptions.

3.3.2.1 Behaviour Assessment System for Children-2 (BASC-II)

The BASC-II (Reynolds, Kamphaus, & Vannest, 2011) is an assessment of the behaviour and personality of children and adolescents. The 139-item Teacher Rating Scales for children aged 6-11 years were used in this study. Statements of behaviours are rated on a four-point scale from ‘Never’ to ‘Almost Always’. Subscales of clinical problems are summed to make broader composite scores: Externalising Problems (Hyperactivity, Aggression, and Conduct Problems subscales); Internalising Problems (Anxiety, Depression, and Conduct Somatisation subscales); and School Problems (Attention Problems and Learning Problems subscales). Greater clinical subscale and composite scores reflect more problems. Adaptive skills subscales are summed to create the Adaptive Skills Composite (Adaptability, Social Skills, Leadership, Study Skills, and Functional Communication subscales). Greater adaptive skills subscales and composite scores reflect fewer problems. The Behavioural Symptoms Index (BSI) is a broad composite of the overall level of problem behaviours derived from the three clinical composite scales plus the Atypicality and Withdrawal subscales. Each subscale has a mean t-score range of 41-59. Pupils with t-scores of ≥70 on the clinical scales are classified as having 'clinically significant' problem behaviour. Pupils with t-scores of ≤30 on the adaptive scales are classified as having 'clinically significant' adaptive problems. High reliabilities have been reported for BASC subscales and composites (α=.78 to .97) (Reynolds, 2004) with comparative reliabilities in the current sample (α=.75 to 96).

3.3.2.2 Inventory of Callous-Unemotional Traits (ICU)

The ICU (Kimonis et al., 2008) is a 24-item questionnaire which assesses three areas thought to underlie CU traits (uncaring, callousness, and unemotional). Statements of child behaviour are rated on a four-point scale ranging from 'Not at all true' to 'Definitely true'. Higher scores indicate greater problems, with a highest possible total score of 72. The ICU has strong validity and internal consistency reliability (α= .92) (Roose, Bijttebier, Decoene, Claes, & Frick, 2010). Reliability for Total ICU scores in the current sample was α= .91. Although there is no widely accepted cut-off score, previous studies have used a median split to create 'high CU traits' and 'low CU traits' groups (e.g. Jones et al., 2010; Schwenck et al., 2012). A median split within the subsample of pupils with high CP was used in the current study.

3.3.2.3 Behaviour Rating Inventory of Executive Function-2 (BRIEF-II)

The BRIEF-II (Gioia et al., 2000) is an assessment of EF skills in the daily life of children and adolescents. The teacher-report consists of 86 statements of child behaviours which are rated on a four-point scale from 'Never' to 'Almost always'. The Behavioural Regulation Index is comprised of three subscales: Inhibition (ability to control impulses and stop behaviour appropriately), Shifting (flexibly solve problems and move from one activity or aspect of a problem to another), and Emotional Control (ability to appropriately modulate emotional responses). The Metacognition Index is comprised of five subscales: Initiation (ability to begin a task and generate ideas), Working Memory (ability to hold information in mind to complete a task), Planning/Organising (ability to anticipate future events, set goals, and develop appropriate steps to carry out tasks), Organisation of Materials (ability to keep work space, play areas, and materials orderly), and Monitoring (ability to check work, assess performance to ensure goal achievement, and keep track of the effect of one's own behaviour). A total Global Executive Composite can be summed from all subscales. Each subscale and the GEC have a mean score of 50 and a mean t-score range of 41-59, with higher scores reflecting poorer EF. Clinically significant EDF is indicated by a t-score ≥65. The BRIEF has high internal consistency (α=.80 to .98) with comparative reliability across scales and composites in this sample (subscales α=.92 to .97; GEC α=.89). Good test-retest reliability (α=.83 to .92) on all teacher-rated subscales and good convergent validity with other measures of behavioural functioning have also been reported (Gioia et al., 2000).

3.3.2.4 Emotion Regulation Checklist (ERC)

The ERC (Shields & Cicchetti, 1997) is a 24-item measure of emotionality and ER in school-aged children. Teachers rate frequency of statements of child behaviour on a 4-point Likert-type scale from Never to Always. The Emotion Regulation subscale consists of 8 items assessing the appropriateness of emotional expressions, emotional understanding, and empathy (e.g., 'can say when s/he feels sad, angry or mad'; 'Is empathic toward others'). Lower scores indicate greater dysregulation (maximum score=32). The Emotion Lability/Negativity subscale consists of 15 items assessing emotional reactivity, intensity and flexibility, and expression of negative emotions (e.g., 'is prone to angry outbursts'; 'exhibits wide mood swings'). Higher scores reflect greater dysregulation (maximum score=60). The ERC has good construct validity and inter-rater reliability (Shields & Cicchetti, 1997). In the current sample, Cronbach's alphas were .75 for the Emotion Regulation subscale and .92 for the Emotion Lability/Negativity subscale.

3.3.2.5 Weschler Abbreviated Scale of Intelligence-2 (WASI-II)

The WASI-II (Weschler & Psychological Corporation, 2011) is a measure of intelligence in children and adults aged 6-89 years. The two-subtest form, consisting of Vocabulary (word knowledge, verbal concept formation, and fund of knowledge) and Matrix Reasoning (visual information processing and abstract reasoning skills) subtests were used to provide an estimate of general intellectual ability in the current study.

3.3.2.6 Weschler Individual Achievement Test-2 (WIAT-II)

The WIAT-II (Weschler & Psychological Corporation, 2001) assesses academic strengths and weaknesses across reading, mathematics, and language in children and adults. The Reading Comprehension and Mathematical Reasoning subtests were selected for the present study to reflect core academic skills in primary schools and to allow for comparison with previous studies using these measures of achievement (e.g. Frederickson et al, 2013). The WASI and WIAT have been shown to have good construct validity and reliability (e.g. Canivez, Konold, Collins, & Wilson, 2009; Saklofske, Caravan, & Schwartz, 2000).

3.3.2.7 NEPSY-II

The NEPSY-II (Korkman, Kirk, & Kemp, 2007) assesses developmental neuropsychological processes in children and adolescents aged 3-16 years across six domains (Executive Function and Attention, Language, Memory and Learning, Sensorimotor, Visuospatial Processing, and Social Perception). Good to very good reliability for the subtests has been reported for 7- to 12-year-olds (α=.59 to .95), with high inter-scorer agreement (.98 to .99) (Korkman et al., 2007). Subtests were selected based on the current research questions and previous findings of school-aged children with CP. Scaled subtest scores from the Executive Function and Attention (Auditory Attention, Design Fluency, and Inhibition), Language (Comprehension of Instructions), and Memory and Learning (Word List Interference) domains were used (see Appendix A. NESPY-II subtest descriptions and scoring). The NESPY-II scaled scores have a mean standardised score of 10, with greater scores reflecting fewer problems, and a score less than 10 representing performance below the expected ability for the child's age.

3.3.2.8 Cognitive Emotion Regulation Questionnaire-kids (CERQ-kids)

The 36-item CERQ-Kids (Garnefski, Kraaij, & van Etten, 2005), adapted from the adult CERQ (Garnefski, Kraaij, & Spinhoven, 2002), measures cognitive emotion regulation strategies in children when faced with threatening or stressful life events across nine subscales: Self-blame (thoughts of blaming yourself for what you have experienced), Acceptance (thoughts of resigning to what has happened), Rumination (thinking all the time about the feelings and thoughts associated with the event), Positive Refocusing (thinking of other, pleasant matters instead of the actual event), Refocus on Planning (thinking about what steps to take in order to deal with the event), Positive Reappraisal (thinking of attaching a positive meaning to the event in terms of personal growth), Putting into Perspective (thoughts of playing down the seriousness of the event when compared to other events), Catastrophising (emphasising the terror of the experience), and Other-blame (thoughts of putting the blame for what you have experienced on others). Each child is asked, 'When something unpleasant happens to you, what do you usually think?' followed by an ER cognitive strategy statement (e.g. 'I think that I can’t do anything about it', 'I think of nicer things', or 'I think of how I can change it') to rate on a 5-point Likert-type scale from 1 ('almost never') to 5 ('almost always'). The mean of the four items creates each subscale score (maximum mean score = 5). The higher the score, the more the child uses this strategy. Subscales of the adult CERQ have good internal consistency ranging from .68 to .86 (Garnefski et al., 2002). Reliability of the CERQ-kids is less known. Cronbach alphas for the current study ranged from .51 to .72.

3.3.2.9 Self-Perception Profile for Children (SPPC)

The SPPC (Harter, 1985) is a 36-item self-report measure which assesses five domains of self-adequacy (Scholastic Competence, Athletic Competence, Social Acceptance, Physical Appearance, and Behavioural Conduct) and a broader measure of Global Self-Worth (GSW; the extent to which a child likes him/herself as a person) in youths aged 8-15 years. The child is told that there are no correct responses, but is asked to decide which kind of child he/she is most like by reading two contrasting alternatives (e.g. 'some children often forget what they learn but other children can remember things easily'). The child is then asked to rate their decision as ‘sort of true’ or ‘really true’. The SPPC has reported good factorial validity and reliability (e.g. Muris, Meesters, & Fijen, 2003), with subscale internal consistencies from α=.71 to .86 (Harter, 1985) and α=.59 to .75 in the current study.

3.3.3 Procedure

In the autumn term, class teachers or Learning Support Assistants (LSAs) completed the BASC-II for all pupils at the SEMH provision and all KS2 pupils at the mainstream school. The BASC-II scores were used to select pupils for further assessment as detailed above. Teachers then completed the ICU and ERC for all participating pupils. It was specified that teaching staff needed to have worked with the pupil on a daily basis over a period of at least one month to complete the questionnaires, to ensure they were familiar with the child’s behaviour.

In the same academic term, pupil assessments were carried out by myself or one of three MSc Psychology students trained in using these measures. Assessments took place one-to-one in a quiet area of the school during the school day. Each pupil was seen across multiple sessions (two to four sessions), dependent on the pupil’s ability to attend to the test materials for sustained periods of time, totalling approximately 90 minutes for each pupil. Pupils were encouraged to participate for as long as it was felt they were attending to the tasks, but were allowed to return to the classroom if requested.

3.3.4 Data analysis

Data were analysed using the Statistical Package for the Social Sciences, version 22 (SPSS, 2013). Scaled scores from each of the standardised measures (BASC-II, BRIEF-II, NESPY-II, WIAT-II, and WASI-II) were used to allow analyses across ages and comparison to a normative population. Raw total scores and subscale scores were used for the non-standardised measures (ICU, ERC, CERQ-Kids, and SPPC).

Multiple performance scores can be calculated for each of the NESPY-II subtests. In the current study, combined scaled scores, which combine standardised time and accuracy scores, were used. For the Inhibition and Word Interference subtests, contrast scores were used to create Inhibition, Switching and Word Interference (verbal working memory) standardised scores. (See Appendix A. NESPY-II subtest descriptions and scoring, for details regarding subtest scoring.)

Data analysis had three main stages:

1) To address research questions 1-6, a series of Multivariate Analyses of Variance (MANOVAs) were conducted to compare group means between the three school behaviour groups. Multivariate Analyses of Covariance (MANCOVAs) were also carried out with a subsample of pupils with available IQ data to control for differences in IQ between behaviour groups.

2) To examine research question eight, Pearson's bivariate correlations were carried out to examine agreement between teacher-reports and child-assessments of EF and ER. These analyses were carried out on the whole sample, rather than by group, to reflect the broader research question regarding agreement between informants rather than correlations based

on CP, CU traits, or school provision. Bivariate correlations were also used to examine associations of IQ and academic achievement with EF, ER, and self-perceptions.

3) The final stage of data analysis addressed research question seven. The SEMH school pupils and the mainstream pupils with high CP underwent a median-split based on ICU total scores to form two subtype groups; pupils with high CP and high CU traits (CP/CU+) and pupils with high CP and low CU traits (CP/CU-). MANOVAs were used to compare group means in EF, ER, achievement, and self-perception, between pupils with CP/CU+, CP/CU- and the Mainstream no-CP group, correcting for multiple comparisons.

3.4 Results

3.4.1 Missing data

The teacher-reported and self-report emotion regulation questionnaires (ERC and CERQ-Kids) were collected at the mainstream school only as the SEMH provision was unavailable for data collection at this time of testing. All 73 teacher-report questionnaires were completed for the BASC-II, ICU, and BRIEF-II. Teachers did not return the ERC for three pupils in the mainstream no-CP group. Missing items on teacher-report questionnaires underwent mean imputation where other items were present, as instructed in the manuals for each measure. Following data-imputation, the BRIEF-II for one pupil still had missing items on the Plan/Organise subscale. This subscale and the Global EDF score was removed from analyses for this pupil, but the other subscales scores for this pupil were still included in the analyses.

Several pupils were unable to complete the full assessment battery due to school absence or challenging behaviour. Some pupils needed several breaks between subtests (either at the pupil's request or due to the researcher noting poor attention or lack of engagement with the materials). While pupils were encouraged to continue if the researcher judged this to be appropriate, it was decided for some pupils that continuing the assessments was inappropriate. Assessments were discontinued if the researcher or class teacher felt that further assessment would cause disruption to the pupil's lessons; attention to the assessment materials was too poor to collect reliable data; or if it was deemed ethically inappropriate (i.e. the environment was too challenging for this pupil). In addition, the Switching subtests of the NESPY-II were not completed by participants below the lower age limit of 7 years for this subtest. To prevent data loss in the analyses, incomplete subtest data were removed, but data from these pupils' complete subtests remained in the analyses. As a result, sample sizes vary between analyses and are reported separately in the tables.

3.4.2 Participant characteristics

A series of one-way analyses of variance (ANOVA) and Chi-square tests were conducted to determine differences in the demographic variables and behaviour of pupils in the three school behaviour groups. Means and standard deviations of participant characteristics for each school behaviour group, and tests of group differences are presented in Table 3.1.

3.4.3 Comparison of group means by school behaviour group

A series of MANOVAs and post-hoc tests (Bonferroni adjustment for multiple comparisons) were conducted to compare mean EF, ER, academic achievement, and self-perception scores between the three school behaviour groups. Mean scores, standard deviations, and between group tests are presented in Table 3.2. Groups were assigned labels A (SEMH school), B (Mainstream CP), and C (Mainstream no-CP) for clarity of comparisons. Levene's test showed significant homogeneity of variances in the BRIEF-II and NESPY-II data, therefore conservative Pillai's Trace statistics are reported for multivariate tests and Games-Howell statistics are reported for post-hoc comparisons. IQ was not assessed for all pupils (see above), therefore was not included in the original MANOVAs. However, due to the significant difference in IQ between school behaviour groups, exploratory MANCOVAs with IQ as the covariate were carried out on the subsample of participants with available IQ data and are reported separately.

3.4.3.1 Executive function

There was a significant multivariate effect of group on BRIEF-II scores, $F(16, 128)=6.80$, $p<.001$; Pillai's Trace=.460, partial $\eta^2=.46$. Post-hoc tests demonstrate that the SEMH group (A) had a significantly greater EDF than the mainstream no-CP group (C) for each subscale of the BRIEF-II. The Mainstream CP group (B) also had a significantly greater EDF than the Mainstream no-CP group (C) for each subscale of the BRIEF-II. The SEMH group (A) had a significantly greater EDF than the Mainstream CP group (B) for the Shift and Organisation of Materials subscales. When covarying for IQ, the multivariate effect was also significant, $F(16,94)=5.80$, $p<.001$; Pillai's Trace=.994, partial $\eta^2=.50$, as were associations for each subscale.

Table 3.1: *Participant characteristics for each school behaviour group*

	Mean (SD)						Between-subjects effects		
	A SEMH school ***n*=28**		B Mainstream CP ***n*=25**		C Mainstream no-CP ***n*=20**		*F (df)*		*Significant comparisons*
Gender (male)	26	(92.9%)	19	(76%)	16	(80%)	2.99[d]	(2)	NS
Age (years)	8.68	(1.05)	8.22	(.74)	8.48	(.65)	1.95	(2, 70)	NS
IQ[a]	97.94	(14.61)	93.14	(14.49)	105.28	(11.06)	3.99	(2, 54)*	C>B*
Conduct Problems[b]	59.46	(10.66)	61.40	(9.62)	41.95	(1.76)	32.58	(2, 70)***	A>C*** B>C***
Callous-unemotional traits[c]	33.81	(12.70)	35.72	(10.24)	17.89	(6.38)	19.01	(2, 70)***	A>C*** B>C***

[a]Wechsler Abbreviated Scale of Intelligence-2 (WASI-II), standardised scores (*n*=17; 22, and 18 respectively); [b]Behaviour Assessment system for Children - 2 (BASC-II), standardised scores; [c]Inventory of Callous Unemotional Traits (ICU), raw total scores; [d]Gender comparison uses Pearson's chi-square. Significant at ****p*<.001, ** *p*<.01, * *p*<.05 (2-tailed).

There was a significant multivariate effect of group on NESPY-II scores, $F(12, 78)=2.13$, $p<.05$; Pillai's Trace=.494, partial $\eta^2=.25$. Tests of between-subject effects show significant group differences for Design Fluency scores only. Post-hoc tests demonstrate that the SEMH group (A) had significantly greater Design Fluency scores than the Mainstream CP group (B), but the Mainstream no-CP group (C) did not significantly differ from the other groups on the NESPY-II subtests. When covarying for IQ, the multivariate test was significant $F(12, 68)=1.90$, $p<.05$; Pillai's Trace=.502, partial $\eta^2=.25$, as were group differences for the Design Fluency subtest.

3.4.3.2 Emotion regulation

A MANOVA was conducted to compare teacher-reported ER mean scores (ERC) between the Mainstream CP group and the Mainstream No-CP group (ER measures were not completed for the SEMH school sample). There was a significant multivariate effect of group on ERC scores, $F(2, 39)=17.08$, $p<.001$; Pillai's Trace =.467. Post-hoc tests demonstrate that the Mainstream CP group (B) had significantly higher Lability/Negativity scores than the Mainstream No-CP group (C), but there was no significant difference between groups for the Emotion Regulation subscale. When covarying for IQ, the multivariate test was significant $F(2, 33)=9.56$, $p<.05$; Pillai's Trace=.367, partial $\eta^2=.37$, and group differences between Lability/Negativity scores were also significant.

A MANOVA was conducted to compare self-reported ER (CERQ-Kids) mean scores between the Mainstream CP group and the Mainstream No-CP group. The multivariate effect of group on CERQ-Kids scores was not significant, $F(9, 14)=1.34$, $p=.30$; Pillai's Trace=.57, partial $\eta^2=.46$. However, pairwise tests demonstrate that the Mainstream CP group (B) had significantly higher scores on the Acceptance subscale, and significantly lower scores on the Positive Refocusing and Refocus Planning subscales, compared to the Mainstream no-CP group (C). When covarying for IQ, the multivariate test was not significant $F(9,13)=1.61$, $p=.21$; Pillai's Trace=.526, partial $\eta^2=.53$, and only the Positive Refocusing subscale was significantly different between groups for this subsample.

Table 3.2: *Means and standard deviations (in parentheses) for each profiling variable by school behaviour group, and tests of group differences*

	Mean (SD)			Between-Subjects Effects		
	A SEMH school	B Mainstream CP	C Mainstream no-CP	*F*	Partial η^2	Post-hoc comparisons[g]
BRIEF-II[a]	***n*=28**	***n*=25**	***n*=20**	***df*=2, 70**		
Inhibit	66.86 (13.62)	64.56 (10.84)	45.00 (4.34)	27.10***	.44	A>C*** B>C***
Shift	74.14 (16.12)	63.84 (12.03)	47.40 (7.76)	25.15***	.42	A>C*** A>B* B>C***
Emotional Control	69.68 (19.64)	67.16 (14.14)	46.95 (7.78)	14.57***	.29	A>C*** B>C***
Initiate	68.61 (10.36)	63.36 (10.36)	45.45 (8.02)	34.37***	.50	A>C*** B>C***
Working Memory	68.46 (12.57)	61.96 (12.24)	44.10 (8.03)	27.50***	.44	A>C*** B>C***
Plan/Organise	69.96 (11.67)	63.36 (10.73)	45.85 (8.76)	30.93***	.47	A>C*** B>C***
Organisation of Materials	68.11 (17.02)	53.00 (8.99)	43.80 (2.97)	25.73***	.42	A>C*** A>B*** B>C***
Monitor	69.18 (11.45)	65.92 (9.07)	44.95 (5.37)	43.99***	.56	A>C*** B>C***

	Mean (SD)			Between-Subjects Effects		
	A SEMH school	B Mainstream CP	C Mainstream no-CP	*F*	Partial η^2	Post-hoc comparisons[g]
NEPSY[b]	***n*=20**	***n*=16**	***n*=10**	***df=2, 43***		
Comprehension of Instructions	12.25 (6.45)	8.44 (2.76)	10.50 (3.27)	2.78	.11	NS
Design Fluency	9.00 (2.92)	6.31 (2.27)	7.30 (2.16)	5.06*	.19	A>B**
Inhibition (contrast score)	9.60 (2.95)	7.75 (3.45)	10.10 (3.51)	2.09	.09	NS
Switching (contrast score)	9.05 (1.76)	8.81 (3.19)	10.90 (2.96)	2.25	.10	NS
Word List Interference (recall score)	9.25 (3.26)	7.87 (3.98)	9.80 (2.90)	1.20	.05	NS
Word List Interference (contrast score)	9.55 (2.74)	7.88 (3.93)	8.70 (2.45)	1.26	.06	NS
ERC[c]		***n*=25**	***n*=17**	***df*=1, 40**		
Lability/ Negativity	-	34.44 (6.78)	22.87 (5.28)	35.01***	.47	B>C***
Emotion Regulation	-	21.20 (3.50)	22.89 (3.43)	2.40	.06	NS

	Mean (SD)			Between-Subjects Effects		
	A SEMH school	B Mainstream CP	C Mainstream no-CP	*F*	Partial η^2	Post-hoc comparisons[g]
CERQ-kids[d]		***n*=13**	***n*=11**	***df*=1, 22**		
Self-Blame	-	9.69 (1.89)	9.55 (4.08)	.13	.00	NS
Acceptance	-	11.62 (2.66)	8.82 (3.52)	4.91*	.18	B>C*
Rumination	-	12.31 (3.35)	11.45 (3.47)	.37	.02	NS
Positive Refocusing	-	12.00 (4.20)	15.64 (2.77)	6.01 *	.21	C>B*
Refocus Planning	-	11.92 (3.12)	15.09 (3.02)	6.33*	.22	C>B*
Positive Reappraisal	-	11.15 (3.08)	11.36 (3.01)	.03	.00	NS
Putting into perspective	-	12.44 (4.30)	12.00 (3.26)	.08	.00	NS
Catastrophising	-	11.67 (3.67)	11.18 (3.37)	.11	.01	NS
Other Blame	-	9.85 (3.65)	8.00 (2.72)	1.91	.08	NS

	Mean (SD)			Between-Subjects Effects		
	A SEMH school	B Mainstream CP	C Mainstream no-CP	*F*	Partial η^2	Post-hoc comparisons[g]
WIAT-II[e]	***n*=10**	***n*=20**	***n*=10**	***df*=2, 37**		
Mathematical Reasoning	98.40 (11.46)	93.85 (14.23)	104.50 (13.84)	2.09	.10	NS
Reading Comprehension	94.70 (11.08)	99.35 (9.10)	101.50 (11.16)	1.20	.06	NS
SPPC[f]	***n*=22**	***n*=21**	***n*=13**	***df*=2, 53**		
Scholastic Competence	2.45 (.36)	2.44 (.68)	3.09 (.66)	6.48***	.20	C>A** C>B**
Social Acceptance	2.51 (.44)	2.88 (.61)	2.95 (.60)	3.63*	.12	NS
Athletic Competence	2.45 (.37)	2.81 (.75)	2.94 (.77)	2.87	.10	NS
Physical Appearance	2.54 (.50)	3.22 (.55)	2.94 (.72)	7.64***	.22	B>A**
Behavioural Conduct	2.51 (.44)	2.71 (.58)	3.28 (.67)	8.10 ***	.23	C>A** C>B*

[a]Behaviour Rating Inventory of Executive Functions-2, standardised scores (higher scores reflect greater dysfunction); [b]NEPSY, standardised scores; [c]Emotion Regulation Checklist, raw scores; [d]Cognitive Emotion Regulation Questionnaire-kids, raw scores; [e]Weschler Individual Achievement Test-2, standardised scores; [f] Self-Perception Profile for Children, raw scores; [g]Adjusted for multiple comparisons (Bonferroni); BRIEF-II, NEPSY, and SPPC adjusted for heterogeneity of variances (Games-Howell); NS= No significant post-hoc comparison. Significant at ***p<.001, ** p<.01, * p<.05 (2-tailed).

3.4.3.3 Academic achievement

CP symptoms were significantly negatively associated with Mathematical reasoning (r=-.39, p<.001), but were not significantly associated with reading comprehension (r=-.04, p=.78). There was no significant multivariate effect of group on academic achievement, F(4, 74)=1.66, p=.17; Pillai's Trace=.17, partial η^2=.08, and neither Reading Comprehension or Mathematical reasoning were significantly different between groups.

3.4.3.4 Self-perception

There was a significant multivariate effect of group on self-perception, F(10, 100)=4.37, p<.001; Pillai's Trace=.608, partial η^2=30. Post-hoc tests demonstrate that the Mainstream no-CP group (C) had significantly greater scores on the Scholastic Competence and Behavioural Conduct subscales compared to both the SEMH school group (A) and the Mainstream CP group (B). The Mainstream CP group (B) had significantly greater scores on the Physical Appearance subscale compared to the SEMH school group (A).

When covarying for IQ, the multivariate test was significant F(10,86)=3.13, p<.01; Pillai's Trace=.534, partial η^2=.27 and group differences for Scholastic Competence and Behavioural Conduct subscales were also significant. However group means were not significant for the Physical Appearance subscale when controlling for IQ in this subsample.

3.4.4 Bivariate correlations

3.4.4.1 Associations between teacher-reports and child assessments

Pearson's correlations (Bonferroni-corrected) between teacher-reported EDF and child-assessed EF are presented in Table 3.3. Teacher-reported Organisation of Materials (BRIEF-II) was positively associated with child-assessed Comprehension of Instructions (NESPY-II). There were no other significant associations between teacher-reported and child assessed EF.

Pearson's correlations (Bonferroni-corrected) between teacher-reported and child self-reported ER are presented in Table 3.4. Teacher-reported Lability/Negativity was negatively associated with child self-reported Positive Refocusing and Refocus Planning subscales. There were no other significant associations between teacher-reported and child self-reported ER.

Table 3.3: *Correlations between academic achievement, teacher-reported executive dysfunction and child-assessed executive function*

	Mathematical Reasoning[a]	Reading Comprehension[a]	Comprehension of Instructions[c]	Design Fluency[c]	Inhibition (contrast)[c]	Switching (contrast)[c]	Word List Interference (Recall)[c]	Word List Interference (contrast)[c]
Mathematical Reasoning[a]	-	-	.29	-.05	.20	.29	.31	.19
Reading Comprehension[a]	-	.29	-.11	-.03	-.11	.39	.30	.03
Inhibit[b]	-.27	-.09	.05	-.04	-.13	-.02	-.08	-.06
Shift[b]	-.23	-.19	.20	.09	-.14	-.25	-.01	.06
Emotional Control[b]	-.16	-.07	.14	.04	-.17	-.04	-.08	-.10
Initiate[b]	-.44*	-.39	.20	-.12	-.25	-.12	-.22	-.02
Working Memory[b]	-.40	-.18	.24	-.14	-.26	-.08	-.17	.01
Plan/Organise[b]	-.37	-.17	.22	-.07	-.24	-.11	-.12	.00
Organisation of Materials[b]	-.23	-.32	.46*	.06	-.09	-.06	-.07	.05
Monitor[b]	-.35	-.15	.22	-.04	-.17	-.05	-.19	-.08
Behavioural Regulation[b]	-.24	-.13	.14	.04	-.16	-.11	-.07	-.04
Metacognition[b]	-.35	-.21	.31	-.02	-.11	-.19	-.10	.06
Global Executive Composite[b]	-.36	-.21	.25	-.02	-.20	-.12	-.13	-.01

[a]Weschler Individual Achievement Test-2 (WIAT-II), teacher-reports; [b]Behaviour Rating Inventory of Executive Functions-2 (BRIEF-II), teacher-reports; [c]NEPSY, child-assessed.
*Significant at Bonferroni adjusted alpha level of *p*<.003 (.05/19).

Table 3.4: *Correlations between academic achievement, teacher-reported emotion regulation, and child self-reported emotion regulation*

	Mathematical Reasoning[a]	Reading Comprehension[a]	Self Blame[c]	Acceptance[c]	Rumination[c]	Positive Refocusing[c]	Refocus Planning[c]	Positive Reappraisal[c]	Putting into Perspective[c]	Catastroph-ising[c]	Other Blame[c]
Mathematical Reasoning[a]	-	-	-.14	-.48	-.17	.10	.33	.12	.38	-.40	-.18
Reading Comprehension[a]	-	.29	-.09	-.41	-.15	.19	.40	-.08	.23	-.31	-.34
Lability/ Negativity[b]	-.30	.01	-.05	.21	.00	-.43	-.48	-.32	-.23	-.10	.20
Emotion Regulation[b]	.12	.12	.19	.12	-.06	.06	.31	.09	.02	.07	.18

[a]Weschler Individual Achievement Test-2 (WIAT-II), teacher-reports; [b]Emotion Regulation Checklist (ERC), teacher-reports; [c]Child Emotion Regulation Questionnaire-kids (CERQ-kids), child self-reports. *Significant at Bonferroni adjusted alpha level of $p<.004$ (.05/13).

3.4.4.2 Associations between academic achievement and EF, ER, and self-perceptions

Pearson's correlations (Bonferroni-corrected) of academic achievement with teacher-reported EDF and child-assessed EF are presented in Table 3.3. Mathematical reasoning was negatively associated with the Initiate subscale of the BRIEF-II, but was not significantly associated with any other subscale or composite of the BRIEF-II or with any performance-based EF skills (NEPSY-II). Reading Comprehension was not significantly associated with any subscale or composite of the BRIEF-II or with any performance-based EF skills (NEPSY-II).

Pearson's correlations (Bonferroni-corrected) of academic achievement with teacher-reported and child self-reported ER are presented in Table 3.4. Neither Mathematical Reasoning nor Reading Comprehension were significantly associated with any subscale of teacher-reported or self-reported ER.

Pearson's correlations (Bonferroni-corrected) between children's self-perceptions (SPPC) and academic achievement and EDF (BRIEF-II) are presented in Table 3.5. Mathematical Reasoning and Reading Comprehension were not significantly associated with Global self-worth or any subscale of the SPPC. Global self-worth was negatively associated with a global EDF and both the Metacognition and the Behavioural Regulation Indices of the BRIEF-II.

Table 3.5: *Correlations between academic achievement, teacher-reported executive dysfunction, and children's self-perceptions*

	Scholastic Competence[c]	Social Acceptance[c]	Athletic Competence[c]	Physical Aptitude[c]	Behavioural Conduct[c]	Global Self-Worth[c]
Mathematical Reasoning[a]	.25	.09	.19	.07	.25	.09
Reading Comprehension[a]	.22	.28	.13	.37	.12	.34
Behavioural Regulation[b]	-.21	-.15	-.22	-.09	-.21	-.37*
Metacognition[b]	-.30	-.25	-.32	-.14	-.26	-.38*
Global Executive Composite[b]	-.32	-.28	-.31	-.17	-.29	-.46*

[a]Weschler Individual Achievement Test-2 (WIAT-II); [b]Behaviour Rating Inventory of Executive Functions-II (BRIEF-II); teacher-reports; [c]Self Perception Profile for Children (SPPC); child self-reports. *Significant at Bonferroni adjusted alpha level of p<.005 (.05/11).

3.4.5 Comparison of group means by CU traits subtype

A median-split was carried out on ICU total scores for pupils with high CP to form a CP/CU+ group (n=26) and a CP/CU- group (n=26). Table 3.6 presents participant characteristics for each CP subtype group and tests of between group differences. The CP/CU+ and CP/CU- groups did not significantly differ in age, gender, IQ, or CP.

None of the participants in the Mainstream no-CP group had CU traits above the median-split, therefore this group of pupils were used as a low CP/low CU traits comparison group in the analyses. A series of MANOVAs and post-hoc tests (Bonferroni adjustment for multiple comparisons) were conducted to compare mean EF, ER, academic achievement, and self-perception scores between the CP/CU+, CP/CU-, and the Mainstream no-CP groups. Mean scores, standard deviations, and between group tests for each measure are presented in Table 3.7. Groups were assigned labels D (CP/CU+), E (CP/CU-), and F (no-CP) for clarity of comparisons. Levene's test showed significant homogeneity of variances in the BRIEF-II, NESPY-II, and SPPC data, therefore conservative Pillai's Trace statistics are reported for multivariate tests and Games-Howell statistics are reported for post-hoc comparisons.

3.4.5.1 CU traits and executive functions

A significant multivariate effect of CU traits subtype group was found for BRIEF-II scores, $F(16,126)=4.57$, $p<.001$; Pillai's Trace=.735, partial $\eta^2=.37$. Post-hoc tests demonstrate that the no-CP group had significantly lower EDF scores on the BRIEF-II compared to both the CP/CU+ (D) and CP/CU- (E) groups. There were no significant differences on any subscale of the BRIEF-II between the CP/CU+ (D) and the CP/CU- (E) groups.

There was no significant multivariate effect of CU traits subtype group for NESPY-II scores, $F(12, 76)=1.41$, $p=.18$; Pillai's Trace=.182, partial $\eta^2=.18$. However, post-hoc tests demonstrate that the CP/CU- group (E) had significantly greater performance scores on the Inhibition subtest compared to CP/CU+ group (D). There were no other significant post-hoc comparisons on the NESPY-II subtests

Table 3.6: *Participant characteristics and tests of group differences for CP/CU+ and CP/CU- subtypes*

	Mean (SD)				**Between-Subjects Effects**	
	CP/CU+ *n*=26		CP/CU- *n*=26		*t (df)*	*p* value
Gender (male)	22	(84.6%)	22	(84.6%)	.22(2)[c]	.90
Age (years)	8.49	(.83)	8.43	(1.06)	.25 (50)	.80
IQ[a]	96.94	(16.30)	93.05	(13.00)	.81 (36)	.43
Conduct Problems[b]	63.23	(10.26)	58.23	(9.03)	1.87 (50)	.07

[a]Wechsler Abbreviated Scale of Intelligence, standardised scores (*N*=18, 20, and 18 respectively); [b] Behaviour Assessment System for Chidlren - 2 (BASC-II), standardised scores; [c]Gender comparison uses Pearson's chi-square. Significant at ****p*<.001, ** *p*<.01, * *p*<.05 (2-tailed).

Table 3.7: *Means and standard deviations (in parentheses) for each profiling variable, and tests of group differences by CU traits subtype*

	Mean (SD)			Between-Subjects Effects		
	D CP/CU+	E CP/CU-	F No-CP	*F*	Partial η^2	Post-hoc comparisons[g]
BRIEF-II[a]	***n*=26**	***n*=26**	***n*=20**	***df*=2, 69**		
Inhibit	67.73 (10.51)	64.69 (13.40)	45.00 (4.34)	30.03***	.47	D>F*** E>F***
Shift	69.58 (12.68)	69.96 (16.98)	47.40 (7.76)	20.15***	.37	D>F*** E>F***
Emotional Control	69.04 (13.99)	68.92 (19.76)	46.95 (7.78)	15.30***	.31	D>F*** E>F***
Initiate	66.96 (10.43)	66.08 (19.76)	45.45 (8.02)	33.39***	.49	D>F*** E>F***
Working Memory	67.85 (13.24)	63.92 (11.28)	44.10 (8.03)	27.68***	.45	D>F*** E>F***
Plan/Organise	69.27 (10.31)	65.54 (11.54)	45.85 (8.76)	31.94***	.48	D>F*** E>F***
Organisation of Materials	60.88 (13.86)	17.76 (61.42)	43.80 (2.97)	11.68***	.25	D>F*** E>F***
Monitor	70.00 (9.02)	66.35 (10.33)	44.95 (5.37)	52.34***	.60	D>F*** E>F***

	Mean (SD)			Between-Subjects Effects		
	D CP/CU+	E CP/CU-	F No-CP	*F*	Partial η^2	Post-hoc comparisons[g]
NEPSY[b]	***n*=18**	***n*=17**	***n*=10**	***df*=2, 42**		
Comprehension of Instructions	10.17 (5.25)	10.88 (5.90)	10.50 (3.27)	.08**	.92	NS
Design Fluency	7.33 (2.79)	8.06 (3.05)	7.30 (2.16)	.37*	.69	NS
Inhibition (contrast score)	7.44 (3.24)	10.12 (2.87)	10.10 (3.51)	3.83	.03	E>D*
Switching (contrast score)	9.56 (1.89)	8.18 (2..86)	10.90 (2.96)	3.75	.03	NS
Word List Interference (recall score)	8.56 (3.60)	8.59 (3.59)	9.80 (2.90)	.49*	.62	NS
Word List Interference (contrast score)	8.83 (3.05)	8.71 (3.87)	8.70 (2.45)	.01***	.99	NS
ERC[c]	***n*=15**	***n*=10**	***n*=17**	***df*=2, 39**		
Lability/ Negativity	35.80 (7.21)	32.40 (5.82)	22.87 (5.28)	18.78***	.49	D>F*** E>F***
Emotion Regulation	19.93 (2.74)	23.10 (3.78)	22.89 (3.43)	4.12*	.17	F>D*

	Mean (SD)			Between-Subjects Effects		
	D CP/CU+	E CP/CU-	F CP/CU+	*F*	Partial η^2	Post-hoc comparisons[g]
CERQ[d]	***n*=8**	***n*=5**	***n*=11**	***df*=2, 21**		
Self-Blame	9.88 (2.17)	9.40 (1.52)	9.55 (4.08)	.04	.00	NS
Acceptance	11.75 (2.49)	8.82 (3.52)	8.81 (3.52)	2.37	.18	NS
Rumination	12.13 (4.02)	12.60 (2.30)	11.45 (3.47)	.21	.02	NS
Positive Refocusing	12.50 (3.93)	11.20 (4.97)	15.64 (2.77)	3.11	.23	NS
Refocus Planning	12.25 (3.01)	11.20 (3.58)	15.09 (3.02)	3.17	.23	NS
Positive Reappraisal	11.25 (3.11)	11.36 (3.01)	11.36 (3.01)	.02	.00	NS
Putting into perspective	12.21 (4.28)	12.80 (8.97)	12.00 (3.26)	.07	.01	NS
Catastrophising	11.21 (4.28)	12.40 (2.70)	11.18 (3.37)	.22	.02	NS
Other Blame	7.88 (2.36)	13.00 (3.16)	8.00 (2.72)	6.95**	.40	E>D** E>F**

	Mean (SD)			Between-Subjects Effects		
	D CP/CU+	E CP/CU-	F CP/CU+	*F*	Partial η^2	Post-hoc comparisons[g]
WIAT-II[e]	***n*=14**	***n*=15**	***n*=10**	***df*=2, 36**		
Mathematical Reasoning	93.93 (14.82)	96.53 (12.69	104.50 (13.84)	1.80	.98	NS
Reading Comprehension	101.07 (9.54)	94.93 (9.85)	101.50 (11.16)	1.82	.99	NS
SPPC[f]	***n*=18**	***n*=24**	***n*=13**	***df*=2, 52**		
Scholastic Competence	2.39 (.63)	2.49 (.47)	3.09 (.66)	6.47**	.20	F>D** F>E**
Social Acceptance	2.58 (.59)	2.76 (.54)	2.95 (.60)	1.55	.06	NS
Athletic Competence	2.53 (.70)	2.72 (.54)	2.94 (.77)	1.48	.05	NS
Physical Appearance	3.01 (.59)	2.78 (.65)	2.94 (.72)	.65	.02	NS
Behavioural Conduct	2.7 (.57)	2.54 (.49)	3.28 (.67)	7.49***	.22	F>D* F>E***

[a]Behaviour Rating Inventory of Executive Functions-2; standardised scores (higher scores reflect greater dysfunction); [b]NEPSY; standardised scores; [c]Emotion Regulation Checklist, raw scores; [d]Child Emotion Regulation Questionnaire, raw scores; [e] Weschler Individual Achievement Test, standardised scores; [f] Self Perception Profile for Children; raw scores ;[g]Adjusted for multiple comparisons (Bonferroni); BRIEF-II and NEPSY adjusted for heterogeneity of variance (Games-Howell); NS= No significant post-hoc comparisons Significant at ****p*<.001, ** *p*<.01, * *p*<.05 (2-tailed).

3.4.5.2 CU traits and emotion regulation

A significant multivariate effect of CU traits subtype group was found for ERC scores, $F(16,126)=4.57$, $p<.001$; Pillai's Trace=.735, partial $\eta^2=.37$. The no-CP group (F) had significantly lower emotion Lability/Negativity compared to the CP/CU+ group (D) and the CP/CU- group (E). The CP/CU+ group (D) had significantly poorer scores on the Emotion Regulation subscale compared to the no-CP group (F). There were no other significant group differences on the ERC subscales.

A significant multivariate effect of CU traits subtype group was found for CERQ-Kids scores, $F(18, 28)=1.63$, $p=.12$; Pillai's Trace=1.02, partial $\eta^2=.51$. The CP/CU- group (E) had significantly higher scores on the Other Blame subscale of the CERQ-Kids compared to the CP/CU+ (D) group and the no-CP group (F). There were no other significant group differences on the CERQ-Kids subscales.

3.4.5.3 CU traits and academic achievement

No significant multivariate effect of CU traits subtype group was found for WIAT-II scores, $F(4, 78)=8.07$, $p=<.001$; Pillai's Trace=.586, partial $\eta^2=.29$, and post-hoc tests showed no significant between-subjects effects.

3.4.5.4 CU traits and self-perception

A significant multivariate effect of CU traits subtype group was found for SPPC scores, $F(10, 98)=2.49$, $p<.01$; Pillai's Trace=.406, partial $\eta^2=.20$. The no-CP group (F) had significantly higher self-perception scores on the Scholastic Competence and Behavioural Conduct subscales compared to the CP/CU+ group (D) and the CP/CU- group (E). There were no other significant group differences on the SPPC subscales.

3.5 Discussion

The primary aim of this study was to build a neuropsychological profile of pupils with CP and to investigate relationships between neuropsychological abnormalities and academic achievement. To obtain a detailed profile of these pupils, an investigation of the CU traits subtype of CP was also carried out. Secondly, due to a lack of research which investigates the self-perceptions of pupils with CP, the relationship between CP and self-perceptions were examined. Each hypotheses will be addressed in turn alongside a discussion of the related research questions set out in section 3.2. This will be followed by a discussion of the strengths and limitations of this study and implications for interventions and future research.

3.5.1 Executive functions

As predicted, pupils with high CP had a significantly greater teacher-reported EDF than pupils with low CP, with a moderate effect size (partial η^2=.46), providing support for previous research (e.g. Raaijmakers et al., 2008; Schoemaker et al., 2010). While IQ could only be controlled for in a subsample of pupils due to missing data, the results also suggest that the lower IQ often reported in pupils with CP (Pinsonneault et al., 2015) was not responsible for the EDF found in these pupils.

The current study extends this finding by addressing the need for an examination of a general versus specific EDF in children with CP. Both mainstream pupils with high CP and pupils attending the SEMH school had deficits across each teacher-reported EF skill. These findings are in contrast to evidence which suggests antisocial individuals have specific deficits in hot EFs but not cool EFs (see De Brito & Hodgins, 2009). Previous studies, especially early reports, have relied on lab tasks to measure cool EFs (e.g. Hare, 1984; Hare et al., 1990). In the current study, teachers were asked to report on the child's everyday EF skills, over a period of several weeks, across a number of tasks and situations that naturally occur in the school day. In a secluded lab setting, it may not be as difficult for these pupils to manage EF tasks compared to the challenges of everyday school life. It is not surprising then that an EDF is more evident in teacher-reports of everyday behaviour than a more artificial lab setting.

Performance-based EF skills were also investigated in the current study. While multivariate analyses suggest pupils with high CP had significantly poorer EFs than pupils with low CP, and again this was not accounted for by differences in IQ, post-hoc comparisons suggest that only the Design Fluency subtest was significantly different between groups. Furthermore, this significant group difference for Design Fluency was between the SEMH school pupils and the Mainstream CP pupils, and these groups did not significantly differ to the mainstream no-CP pupils on any of the NESPY-II subtests. The Design Fluency subtest is designed to assess task initiation, the ability to sustain behaviour, productivity, cognitive flexibility, monitoring, problem-solving, and comprehension and adherence to rules. Any one of these EF skills may have been more problematic for pupils in the SEMH school compared to those in the mainstream school, therefore it is difficult to pinpoint which skill or which combination of skills may have resulted in this difference between groups. In addition, low scores on the Design Fluency subtest may also reflect poor psychomotor speed or visuo-perceptual skills (Korkman et al., 2007); therefore this difference between groups may not reflect differences in EF skills.

This discrepancy between neuropsychological assessments and teacher-reported EF has been documented previously (e.g. Chan et al., 2008; Vriezen & Pigott, 2002) and supports the idea that performance-based EF tasks measure something different to everyday EF. The current study found standardised scores from the teacher-reports and child-assessed subscales designed to measure the same EF skill or deficit in school-aged children were not significantly associated with each other. Recent reviews have documented the long-standing confusion surrounding the conceptualisation and operationalisation of EF and that different measures of EF correlate moderately, if at all (Baggetta & Alexander, 2016; Toplak, West, & Stanovich, 2013). Toplak et al. (2013) examined 20 adult and child studies, using both clinical and non-clinical samples, and found only 68 (24%) of the 286 relevant correlations were statistically significant, with an overall median correlation of .19. Furthermore, as the authors point out, these values are likely to be on the high-side since non-significant effects are often not published (i.e. the file-drawer phenomenon); some of the published studies did not report values for non-significant correlations; and since multiple correlations were examined, a Type 1 error may be responsible for some of the associations reaching significance.

It has been proposed that performance-based measures likely reflect efficiency of information processing mechanisms in the brain, whereas informant-reports take account of the individual's goals and beliefs (Stanovich, 2009; Toplak et al., 2013). This may explain the discrepancies between the performance-based NESPY-II and the teacher-reported BRIEF-II in the current study. Gioia, Isquith, and Kenealy (2008) argue that '*individuals with substantial executive dysfunction can often perform adequately on well-structured tests when the examiner is allowed to cue and probe for more information, relieving the individual of the need to be appropriately* *inhibited, flexible, strategic in planning, and goal directed*.' (p. 180). In the child assessed NESPY-II, pupils may have benefitted from working one-to-one with an adult, by the researcher offering encouragement or by keeping the child on-task. Pupils may have also been more motivated to attend to the tasks and to try their best compared to their everyday classroom behaviour due to the novelty of the situation, including the unfamiliar researcher or stimulating assessment materials.

Alternatively, discrepancies between associations with the different EF measures may be due to a teacher bias, with a possible tendency in the current study for teachers to over-report pupil deficits. This could be due to teachers wishing to raise awareness of difficulties in the classroom or wanting to find a reason to explain difficult classroom behaviour management or poor achievement scores. In addition, shared reporter variance may have resulted in significant associations between teacher-reported CPs and teacher-reported EF, but not researcher-assessed EF. Parent reports or experimenter observations in addition to teacher-reports and child assessments could provide further insight into this. Either way, these discrepancies highlight the need to use a multi-informant approach when designing research and to interpret single-informant approach findings in the literature with caution.

Differences between pupils in the two school provisions were also found for teacher-reported EDF. Children in the SEMH school group had greater deficits in Shift and Organisation of Materials than the mainstream CP group. Children in the SEMH school group did not differ in CP or CU traits or IQ, suggesting some other characteristic of SEMH pupils besides CP symptoms made these EF skills particularly more problematic than for mainstream pupils with CP. Pupils in the SEMH provision have complex difficulties. Co-morbid hyperactivity or internalising difficulties for example, may account for these differences between school provisions. Differences found between schools has important implications for other studies of CP as the sample may influence results and conclusions drawn.

3.5.2 Emotion regulation

The hypothesis that pupils with high CP would have poorer ER than pupils with low CP was partly supported from both teacher- and self-reports. Findings from self-reports suggest that pupils with high CP have a non-adaptive self-regulation style of Acceptance, i.e. these children tend to think they must just resign to what has happened in negative situations (e.g. 'I think that I have to accept the situation', 'I think that I cannot change anything about it'). Pupils with high CP also showed a lower use of Refocus on Planning, i.e. thinking about what steps to take in order to deal with the event (e.g. 'I think about how to change the situation', 'I think about a plan of what I can do best') and Positive Refocusing, i.e. thinking of more positive things rather than the negative event (e.g. 'I think of pleasant things that have nothing to do with it', 'I think of something nice instead of what has happened') compared to pupils with low CP. These findings are in line with research suggesting that children with CP have inappropriate or non-adaptive ER strategies (e.g. Calkins & Hill, 2007; Cole et al., 2009; Graziano et al., 2007). The current findings further refine this theory to suggest children with CP have a specific dysfunctional coping style of high acceptance and low use of refocusing strategies. This is also in line with research which suggests that children with disruptive behaviour do not think that they can modify their emotions (Terwogt, 1990; Terwogt et al., 1990). Nevertheless, when covarying for IQ, the Acceptance and Refocus on Planning subscales were not significantly different between groups. However, this analysis could only be carried out with a subsample of participants due to missing IQ data. Furthermore, Positive Refocusing scores remained significantly lower for children with CP compared to those without CP when covarying for IQ, suggesting these children still may have difficulty redirecting to positive thoughts.

In line with recent reports that negative emotionality is associated with CP (Forslund, Brocki, Bohlin, Granqvist, & Eninger, 2016), results from the teacher-reports suggest that pupils with high CP have high emotion lability and/or negativity. However, pupils with high CP did not differ from pupils with low CP on the Emotion Regulation subscale. These findings could reflect an association between CP and lability/negativity in particular, rather than the regulation of emotions. However, the Emotion Regulation subscale of the ERC may not measure what has been referred to as ER elsewhere in this thesis. When looking at the items of the Emotion Regulation scale, it appears to assess emotion processing and emotion expression, including the child's awareness or understanding of their own emotions (e.g. 'Can say when s/he is feeling sad, angry or mad, fearful or afraid', 'displays flat affect') and empathy ('Is empathic towards others') rather than the ability to formulate and use strategies to regulate emotions. This highlights the importance of defining which constructs of ER are being measured when reporting findings. The ERC may not inform the use of appropriate or adaptive strategies to regulate emotions in pupils with CP, but the findings do suggests that these pupils have labile emotions and a tendency to express negative emotions which are socially inappropriate. Results from the Emotion Control subscale of the BRIEF-II, which assesses emotion lability and the child's ability to regulate emotional arousal in the classroom (e.g. 'Mood changes frequently'; 'Overreacts to small problems'; 'Reacts more strongly to situations than other children'), also supports this theory. From this we may be able to infer that adaptive ER strategies are not being used by these pupils with high CP.

A further note on the different conceptualisations of ER comes from the finding that there were no significant associations between teacher- and self-reported measures of ER. These measures assess quite different conceptualisations of ER. While the CERQ-Kids assesses cognitive self-regulating strategies (i.e. what the child thinks) (Garnefski et al., 2002), the ERC and the Emotional Control subscale of the BRIEF-II assess behavioural emotion expression (i.e. what the child does). ER is difficult to assess. While teachers, parents, or researchers can only report observable behaviour, offering little in the way of what the child was thinking or feeling when they acted, school children may be too immature to self-reflect and communicate their internal thoughts and feelings. Again, these discrepancies demonstrate the need for the use of multiple methods in research, especially with complex processes such as ER. An alternative approach to assessing ER would be to use neuroscience methods, such as EEG, to directly measure the biological response to situations in which emotion needs to be regulated (Lewis & Stieben, 2004; Lewis et al., 2007; Stieben et al., 2007). This approach will be considered further in Chapter Seven.

3.5.3 Academic achievement

Due to the focus of CP in the context of the classroom, several questions regarding academic achievement were addressed in this study. Firstly, in line with a large body of evidence which suggests that EF is associated with academic achievement (see Blair & Raver, 2015), mathematical reasoning was significantly associated with initiation skills. However, no other teacher-reported or child-assessed EF skill was associated with achievement. Similarly, in contrast to the literature showing positive associations between ER and maths and literacy achievement (Best et al., 2011; Graziano et al., 2007), no measure of emotion-related skills in the current study was associated with reading comprehension or mathematical reasoning.

While CP was significantly associated with poor mathematical reasoning, CP was not associated with reading comprehension, and neither maths nor reading achievement were significantly different between high and low-CP groups. This is surprising considering the wealth of evidence that pupils with CP have poor academic achievement (e.g. Malecki & Elliot, 2002; Masten et al., 2005; Risi et al., 2003). It may be that other areas of mathematics and literacy not measured in this study are problematic for pupils with CP. It may also be that co-morbid ADHD, highly prevalent in children with CP, accounts for associations with academic achievement in other studies. It has been suggested that ADHD is particularly implicated in the link between behaviour problems and reading difficulties (Clark, Prior, & Kinsella, 2002; Smart, Sanson, & Prior, 1996; Willcutt & Pennington, 2000). Clark et al. (2002) found that CP with co-morbid ADHD was associated with poor reading scores, but CP alone was not. As ADHD was not assessed in the current study, this can only be speculated here. Alternatively, since only a subsample of participants had available achievement data, the lack of significant group differences may have been due to a lack of statistical power, especially for mathematical reasoning which was significantly correlated with CP.

The associations between EF and academic achievement, and between CP and EF, raises questions about the relationship between CP and academic achievement. Mediating influences of the previously found association between CP and academic achievement were not explored in the current study due to the non-significant group differences in achievement. Larger sample sizes are needed to try to disentangle the relationship between CP, EDF and ER, and academic achievement. A measure of learning-related behaviours as discussed in Chapter Two, could also help understand direct and indirect associations between classroom behaviour and academic performance. The association between classroom behaviour and learning-related social skills, in particular the student-teacher relationship, will be examined in Chapter Four.

3.5.4 Self-perception

Due to the mixed evidence in the literature on the association between antisocial behaviour and self-esteem (Ostrowsky, 2010; Walker & Bright, 2009), a directional hypothesis was not formulated in the current study. Results show that pupils in the SEMH provision and mainstream pupils with high CP had lower perceptions of their behavioural conduct and their scholastic competence than mainstream pupils with low CP. This finding partially supports a large body of evidence suggesting that antisocial individuals, including children with CP, have a low self-concept or poor self-esteem (e.g. Fanti et al., 2013; Fong, Vogel, & Vogel, 2008; Guerra et al., 2011) and is in line with Taylor et al.'s (2007) finding that aggressive behaviour is associated specifically with low scholastic self-concept.

It has been speculated that individuals with low self-esteem may attempt to protect themselves from feelings of inadequacy by externalising blame for their problems or failures, which may lead to aggression toward others. Aggressive acts may also serve to provide individuals with low self-esteem with an increased feeling of power (Ostrowsky, 2010). However, it has also been argued that violence or risky decision making characteristic of antisocial individuals (e.g. Fanti et al., 2016) requires self-confidence; therefore we would not expect to see low self-perceptions of one's own capabilities in children with CP (Baumeister, Campbell, Krueger, & Vohs, 2003). The current findings also partially support this latter theory, as pupils with CP did not show low self-perceptions on most dimensions of self-perception measured in this study.

The current findings did not support a third theory which suggests that antisocial individuals have high self-perceptions. There is evidence that high self-esteem and high self-perceptions are associated with antisocial behaviour (e.g. Barry et al., 2007; Ha et al., 2008; Sandstrom & Herlan, 2007). It has been suggested that aggressive behaviour may be a way of defending a highly favourable view of oneself against anyone who tries to question it (Baumeister et al., 2003; Salmivalli, 2001). These mixed findings in the literature may be accounted for by a non-linear relationship between self-esteem and antisocial behaviour. Perez, Vohs, and Joiner (2005) found that students with very low self-esteem and students with very high self-esteem were more likely to be aggressive than students with moderate levels of self-esteem. The current findings may also help explain the mixed literature. Previous studies have used different measures of self-concepts and some have measured global constructs while others have focused on a more specific sub-domain of self-perception (e.g. Kirkpatrick, Waugh, Valencia, & Webster, 2002; Taylor, et al., 2007; Webster & Kirkpatrick, 2006). Examining multiple sub-domains of self-perception in the current study has shown that pupils with CP may have poor self-perceptions of their scholastic competence and behavioural conduct, but do not have low self-perceptions in other areas such as athletic competence or social competence.

Despite discrepancies in the direction of the relationship between CP and self-perceptions, abnormalities in self-perceptions may have important implications for the child's functioning and need to be considered when designing interventions for these pupils. Firstly, we should consider whether low self-perceptions of scholastic competence and behavioural conduct are necessarily problematic for pupils with CP. These low self-perceptions may actually be accurate views of the pupils' behavioural misconduct and poor academic performance. After all, poor behavioural conduct is the very nature of CP and previous studies suggest that pupils with CP have poor academic achievement (Malecki & Elliot, 2002; Masten et al., 2005; Risi et al., 2003). However, in the current sample, pupils with high CP did not have significantly poorer academic achievement than pupils with low CP and Scholastic Competence was not significantly associated with academic achievement, suggesting that the pupils in this sample may have an inaccurate negative self-perception of their scholastic abilities. An interesting area of study would be to further investigate whether self-perceived scholastic competence of pupils with CP reflect accurate perceptions of their true capabilities in other samples, as has previously been addressed in terms of social acceptance (Lynch, Kistner, Stephens, & David-Ferdon, 2016; McQuade, Breaux, Gómez, Zakarian, & Weatherly, 2016; Sandstrom & Herlan, 2007).

An unexpected finding in the current study was the difference in self-perception between pupils in the SEMH school and mainstream pupils with CP. SEMH pupils had lower self-perceptions of their physical appearance than pupils in the mainstream CP group, but the CP group did not have poorer self-perceived physical appearance than the no-CP comparison group. This suggests that some other characteristic of the SEMH school pupils, besides CP symptoms, may account for their lower self-perception of their physical appearance. A detailed examination of the self-perceptions of pupils in mainstream schools compared to pupils in special provisions is needed to further understand these differences and again highlights the need to consider the sample when interpreting CP research.

Surprisingly, there were no differences between any of the groups on children's self-perceptions of Social Acceptance. While children with CP characteristically show antisocial behaviour and are often rejected by peers (e.g. Miller-Johnson, Coie, Maumary-Gremaud, & Bierman, 2002; Waller, Hyde, Baskin-Sommers, & Olson, 2016), this finding suggests that these pupils may have a distorted view of their own social competence. In studies by Barry et al. (2008) and Warren et al.

(2015), antisocial behaviour was positively associated with peer rejection, but was not associated with self-perceptions of social functioning (inclusion and popularity). The authors suggest that these children may report higher social competence than reality in response to social rejection or negative feedback to buffer against developing a negative self-image. Alternatively, these pupils may develop their social self-concept based on the success of achieving their own social goals of power and dominance in the classroom, rather than being sensitive to negative social feedback (Warren et al., 2015).

3.5.5 CU traits subtype

While there is a large body of evidence from both behavioural and neuroscience studies of EF and ER deficits in CP, few have investigated these abnormalities in youths with the CU traits subtype (see Chapter Two). As discussed, there has been increased interest in CU traits in recent years, with evidence of behavioural and neurological differences between children and adolescents with CP/CU+ and those with CP/CU- (for a review, see Frick et al., 2014). The current study aimed to build upon this research by profiling pupils with CU traits in the context of the classroom to help inform intervention design for these children.

3.5.5.1 CU traits and executive functions

Pupils with high CP had significantly greater teacher-reported EDF irrespective of CU traits. This supports De Brito et al.'s (2013) behavioural finding of no differences between ASPD with psychopathy and ASPD without psychopathy on any hot or cool EF tasks, and their brain imaging findings of no differences in grey matter volume of the amygdala, vmPFC or dlPFC between antisocial offenders with psychopathy and those without psychopathy. Taken together, this research suggests that EF deficits are present in psychopathy, but that they may not have a distinct EF profile to antisocial individuals without psychopathy or CU traits.

However, in the current study, pupils with CP/CU+ had significantly lower scores than CP/CU- on the Inhibition subtest of the performance-based child-assessments. This is in contrast to De Brito et al.'s (2013) finding and the current results from teacher-reports, but supports other studies which found adult and juvenile psychopathic offenders performed worse than non-psychopathic offenders on measures of EF requiring inhibition (Lapierre et al., 1995; Roussy & Toupin, 2000). These two studies used performance-based measures, rather than reports of everyday behaviour. Therefore, while everyday inhibition, but not performance-based tasks of inhibition, seem to be problematic for pupils with CP/CU-, both everyday and performance-based inhibition may be problematic for pupils with CP/CU+. Inhibitory control then may need to be a strong focus of intervention for pupils with CU traits.

3.5.5.2 CU traits and emotion regulation

While we may have expected pupils with CP/CU+ to have lower emotion lability due to their characteristic flat affect observed in neurophysiological studies (Fanti et al., 2016), pupils with CP in the current sample had greater teacher-reported emotion lability/negativity irrespective of CU traits, i.e. there was no significant difference between CP/CU- and CP/CU+. However, while CP/CU- did not significantly differ to the no-CP group on the Emotion Regulation subscale of the teacher-report, the CP/CU+ group had significantly lower scores on the ER subscale compared to the CP/CU- group. As discussed previously, items on this scale seem to address the child's awareness or understanding of their own emotions and empathy, rather than assessing the child's use of strategies to regulate their emotions. It is not surprising then that pupils with CP/CU+ scored poorly on this subscale. CU traits are defined in part by a lack of empathy and this is supported by both behavioural and neuroscience evidence with psychopathic adults and youths with CU traits (e.g. Ciucci et al., 2014; Frick et al., 2014; Lui et al., 2016). Children with CU traits have also been shown to have poor understanding of the causes and expression of emotions (e.g. Izard et al., 2001; O'Kearney et al., 2016). Therefore poorer scores on the ER scale of the ERC may reflect these characteristics of CU traits, rather than the ER in terms of strategy use.

While child self-reports of ER for the CP/CU+ group did not significantly differ to scores for the no-CP group, pupils with CP/CU- reported using other-blame (i.e. thoughts of blaming others for their own negative experiences) as an ER strategy significantly more than pupils without CP and significantly more than pupils with CP/CU+. It is not surprising that children with CP were found to use this strategy more than children without CP, as antisocial individuals have previously been found to hold self-serving and hostile attribution biases which include a tendency to externalise their problems and place blame on others (Dodge, Price, Bachorowski, & Newman, 1990; Iselin, McVey, & Ehatt, 2015; Vitale, Baskin-Sommers, Wallace, Schmitt, & Newman, 2015). The current findings suggest this may be more of a problem for youths without CU traits, which is in line with research suggesting that youths with CP/CU- are more prone to a hostile attribution bias than those with CP/CU+ (Frick et al., 2014). However, more research is needed to examine attribution bias differences between CP/CU+ and CP/CU-, as there are also suggestions that youths with CU traits have more deviant values and goals, which includes blaming others for their problems (Chabrol, van Leeuwen, Rodgers, & Gibbs, 2011; Van Leeuwen, Rodgers, Gibbs, & Chabrol, 2014).

While evidence is limited, one behavioural study suggested that children with CU traits may be better at regulating their emotions, according to adult reports on the ERC, than other children with externalising problems (Lotze et al., 2010). This seems to be the case in terms of self-blame in the current study. In Ciucci et al.'s (2015) study, CU traits were negatively associated with self-reported ER. However, Ciucci et al. used a measure of emotional intelligence which reflects how good children perceive themselves to be at regulating emotions, rather than what they actually think or do in negative situations. Again, the difference between measures of ER need to be considered.

3.5.5.3 CU traits and academic achievement

No specific hypothesis was made regarding CU traits and academic achievement. While there is research on intelligence of psychopathy, including evidence of a positive association with verbal intelligence and creativity, practicality, and analytic thinking (Galang, 2010; Salekin et al., 2004), there has been little research on academic achievement and CU traits, possibly due to the focus in past research on older adolescent samples rather than school-aged children. However, one study found CU traits to be associated with lower academic achievement in 10- to 16-year-olds (Ciucci et al., 2013). Nevertheless, only a modest amount of variance in these outcomes was found and achievement reflected an average score across all academic disciplines (including Art and Physical Education) which does not inform us of where difficulties lie. Findings from the current study suggest that maths and reading achievement does not significantly differ between pupils with CP/CU+ and pupils with CP/CU-. It may be that differences found in Ciucci and colleague's study were due to the different disciplines measured or the older sample. Clearly more work is needed on academic achievement in this subgroup of pupils with CP.

3.5.5.4 CU traits and self-perception

There is limited research on the role of CU traits in the self-perceptions of youths with CP. We might expect low self-perceptions in these pupils due to repeated sanctions and peer rejection (Barry et al., 2008; Warren et al., 2014), or high self-perceptions, since narcissism and a grandiose sense of self-worth are considered to be characteristic of adult psychopathy (Pastwa-Wojciechowska, Kaźmierczak, & Błażek, 2012). In the current study, pupils with high CP had lower self-perceptions of scholastic competence and behavioural conduct than pupils with low CP irrespective of CU traits, with no difference in these aspects of self-perception between CP/CU- or CP/CU+. This is in line with Warren et al.'s (2014) and Fanti et al.'s (2013) research which found that self-esteem or self-perceptions of behaviour for children with high CU traits were similar to children with low CU traits. In Fanti et al.'s (2013) study, adolescents with high CU traits, with or without CP, reported poor self-esteem. This is partially supported in terms of scholastic competence and behavioural conduct in the current study, however poor self-perceptions were not found for athletic competence, physical appearance or social competence. These findings again highlight the need to consider different sub-domains of self-concepts rather than measuring global self-esteem alone.

3.5.5.5 CU traits summary

While youths with CU traits are considered to be a particularly problematic group of antisocial children and adolescents in terms of severity and chronicity of antisocial behaviour (Frick et al., 2014), the current findings suggest that pupils with CP/CU+ are no more likely than CP/CU- to have problems with academic achievement, emotion lability/negativity, self-perception, and most EF skills. However, pupils with CP/CU+ may be at greater risk for deficits in inhibition and may have deficits in emotion-related skills, especially in terms of empathy and awareness and understanding of their own emotions. Interestingly, pupils with CP/CU-, but not CP/CU+, were more likely to blame others for negative experiences. Importantly, the CP/CU+ and CP/CU- groups did not differ in terms of gender, age, IQ, or CP, suggesting that these participant characteristics were not accountable for the differences in inhibition and emotion-related abilities found between these groups. However, findings need replicating in future studies.

Overall, the current findings provide support for a distinction between CP/CU- and CP/CU+ in terms of some emotion-related processes and inhibitory control. The current findings extend previous research on CU traits, suggesting that these youths may not differ to children with CP/CU- in terms of most EF skills or academic achievement.

3.5.6 Strengths and limitations

A key strength to the current study was the consideration of the heterogeneous nature of pupils with CP (Frick et al., 2014). In order to refine profiles of pupils with CP and improve the suitability and success of interventions for these children, it is important that subtypes are differentiated in research. This was achieved in two ways in the current study. Firstly, by recruiting pupils from both a special school and a mainstream school, it was possible to make a distinction between non-referred mainstream pupils with high levels of CP and a group of pupils who have been excluded from mainstream school and are currently attending a special provision for their behaviour difficulties. Secondly, the inclusion of the SEMH school participants allowed me to oversample pupils with behaviour difficulties and CU traits; allowing group comparisons between the CU traits subtype of CP. While the SEMH group allowed examination of a specialist group of pupils, the inclusion of the mainstream pupils allowed an investigation of behaviours that occur within a typical classroom (such as fighting, defiance, and breaking rules) and to study a group of pupils who are at risk for severe behaviour problems later in life (Ciucci et al., 2015). Importantly, the mainstream sample also allowed for a comparison group of pupils without CP. Comparisons of high and low CU traits between mainstream pupils and pupils from the SEMH provision were not carried due to the small number of pupils with high CU traits. Despite the advantage of using these two types of school provision, all participants were recruited from one mainstream school and one special school, therefore we cannot be sure that these results are representative of pupils in other schools. In particular, the mainstream school was known to have a high intake of pupils from low SES neighbourhoods and may therefore be under-representative of higher SES pupils.

While the current study allowed distinctions to be made between the child's school provision and the presence, or lack of, CU traits, the influence of co-morbidity with other behaviour difficulties were not explored. CP has high rates of co-morbidity with ADHD and internalising problems (see Waschbusch, 2002). Due to the association between ADHD and EF deficits and poor academic outcomes in previous research, the current relationships found between CP and these outcomes may have been due, at least in part, to co-morbid hyperactivity symptoms. Indeed, Clark et al. (2002) found that CD with co-morbid ADHD, but not CD without ADHD, was associated with an

EDF. While this would not influence implications of the current findings in terms of CP interventions, it may help further refine the neuropsychological profiles of subtypes of CP and call for further individualisation of intervention programmes. For example, based on Clark and colleague's finding, it may be that only children with CP with co-morbid hyperactivity would benefit from interventions which address EF deficits. Another consideration is that some of these pupils may have been taking medication for their symptoms, which could influence their behaviour and performance in the research assessments. Future work could collect information about medication to account for this in the analyses.

A further consideration when subtyping pupils with CP which was not considered in the current study is gender differences. While gender did not confound the results in terms of differences between behaviour groups (there were a similar number of females present in each group) and the current sample reflects the common male dominance of CP (Frick et al., 2014), the male dominant sample makes the results difficult to generalise to females. As in many studies of CP, small numbers of girls in each group resulted in insufficient power to address potential gender differences. Gender differences are often found in healthy samples, especially in terms of emotion processing abilities (Chaplin & Aldao, 2013; McRae, Ochsner, Mauss, Gabrieli, & Gross, 2008; Schienle, Schäfer, Stark, Walter, & Vaitl, 2005) and there is some evidence of gender differences in neuropsychological and emotion processing profiles of children with CP (e.g. Beauchaine, Hong, & Marsh, 2008; Ciucci et al., 2015). More females are needed in future CP research to further examine these possible gender differences.

The current study extends previous research through a more detailed examination of broad constructs such as EF and self-perception in relation to CP. For example, CP was found to be associated with low self-perceptions in terms of scholastic competence and behavioural conduct, but not athletic competence or social acceptance. A significant association between CP and a global measure of self-esteem may lead to the assumption that children have poor self-perceptions across different areas of functioning, while a non-significant association may lead to the conclusion that children with CP do not have poor self-perceptions at all. These findings demonstrate the need to consider the components of global constructs, and doing so may help explain inconsistencies reported in the literature.

Despite these strengths, there were limitations to the analyses that were possible. Firstly, the cross-sectional nature of the study meant that the direction of associations could not be determined. For example, while the current findings suggest pupils with CP have an EDF, we cannot say whether this EDF is a result of CP or that having an EDF leads to behaviour difficulties, or whether there is no direct relationship between CP and EDF and actually some other variable is associated with both. Furthermore, missing data from incomplete child assessments reduced the amount of available data for analyses and may have biased the results. The decision to terminate assessments due to challenging behaviour prevented unreliable data from being obtained from pupils performing below their capability or providing inaccurate self-reports due to poor attention. Missing data then may reflect tasks which were particularly challenging for these children to complete. Since data were not available to include in the analyses for these pupils on these particular tasks, the current findings may not fully reflect the extent of these pupils' deficits. The aim of the current study was to obtain a detailed profile of pupils with CP, therefore several measures were included. However, it may be necessary to narrow the focus in future studies when working with children with behaviour difficulties, to allow shorter assessments which can be completed without missing data.

Finally, the measures used have some important limitations to consider. While the ICU has good psychometric properties (Roose et al., 2010; Vaughn et al., 2011), there is currently no widely accepted cut-off score (Docherty et al., 2016). Therefore results from the median-split grouping pupils into high and low CU traits should be interpreted with caution. Nevertheless, this is a frequently used method in the CU trait literature and the current median ICU score was similar to that reported in previous samples (e.g. Frederickson et al., 2013; Sakai, Dalwani, Gelhorn, Mikulich-Gilbertson, & Crowley, 2012).

The stronger associations between teacher-reports and child behaviour compared to child self-reports or performance-based measures and child behaviour may be due to shared method variance, since CP and CU traits were based on teacher-reported measures only. Alternatively, discrepancies may be due to teacher bias in reporting problems in these pupils or, as discussed previously, measures assessing different constructs. Particular attention is needed to the conceptualisation and measurement of ER. Discrepancies between teacher-reports and performance-based measures in the current study highlight the need to consider a multi-informant approach when designing research, and to interpret studies using only one method or informant with caution. In addition to the teacher-reports and performance-based measures used in the current study, parent-reports could also be collected. This would not only provide an additional account of these pupils, but could also examine differences and similarities between children's behaviour at school and at home.

3.5.7 Summary and implications

The main aim of this study was to develop a detailed cognitive and affective profile of pupils with CP to extend previous research and inform intervention development. Despite some limitations, the current results add to a growing body of research suggesting that deficits in EF and emotion-related skills are important for understanding antisocial behaviour. More specifically, pupils both in mainstream schools and those in special provisions for behaviour difficulties, and pupils with and without CU traits, have deficits across a full range of EF skills in everyday school functioning. These findings provide further support for the novel approach to intervention for pupils with CP which targets EF deficits in the classroom (Frederickson et al., 2013). This intervention approach will be discussed in Chapter Six.

While other studies have found distinct characteristics between children with and without CU traits, the current findings suggest that an intervention approach which targets EF deficits could be helpful for both pupils with CP/CU+ and CP/CU-. However, in terms of emotion-related abilities, in support of previous literature which demonstrates differences in emotion processing between CP/CU+ and CP/CU- (e.g. Ciucci et al., 2015; Dadds et al., 2012), the current findings suggest that interventions which address high emotion lability/negativity could be useful to both CP/CU+ and CP/CU-, whereas interventions that target deficits in emotion understanding or empathy are needed for students with CP/CU+, but may not be needed for pupils with CP/CU-. Importantly, these findings support Ciucci et al.'s argument that approaches such as Restorative Justice, which assume empathy and emotional understanding are present in all individuals, are unlikely to change the behaviour of youths with CU traits.

The current findings of pupils' self-reported cognitive ER strategies suggest that while pupils with CP may not have problems using some functional strategies, such as putting things into perspective or positive reappraisal, and may not over-use some non-adaptive strategies, such as rumination and catastrophising, support could be provided to reduce the tendency of these pupils to just accept negative situations and the belief that they are helpless to make changes to these difficult situations. Pupils could be trained to make more use of refocussing strategies, i.e. thinking about more positive things and planning steps to make positive changes. While some interventions for CP have aimed to improve emotion recognition and understanding (Dadds et al., 2012; Datyner, Kimonis, Hunt, & Armstrong, 2016; Powell et al., 2011), there is currently little in the way of building a better ER strategy repertoire and training in effective use of these strategies. Frederickson et al. (2013) reports a pilot intervention for pupils with SEMH which makes positive steps in this direction, but which needs investigating with additional pupils and across different school provisions. The tendency to just accept negative situations and resign to the idea that nothing can be done to change the situation also has important implications for intervention in terms of motivation and engagement with the programme. If these pupils do not believe that they can modify their emotions, they may have a helpless attitude towards change through intervention.

The current findings also provide an understanding of children's external attributions, in that pupils with CP/CU- rather than pupils with CP/CU+ showed a tendency to blame others for their negative experiences. External attributions have important implications for intervention in terms of motivation to change. It has been proposed that psychopathic adults or children with CU traits may be resistant to intervention as they do not engage in therapy due to a perceived lack of need to change (Högström, Enebrink, & Ghaderi, 2013; Richards, Casey, & Lucente, 2003). The current findings suggest that it is children with high CP without CU traits that may need extra attention to realise that with intervention, beneficial changes could be made.

The self-concepts of pupils with CP, whether with or without CU traits, should also be considered in interventions for these pupils. Low self-perceptions of their behaviour and academic abilities (and physical appearance for SEMH pupils) could have detrimental impacts on these pupils' social and academic functioning and, more specifically, may reduce their belief that they can behave well and be successful at school. Interventions may need to address these self-concept issues before trying to work on EF skills and ER abilities. On the other hand, it may be viewed that low self-perceptions in behavioural conduct and scholastic competence show that these pupils have a realistic view of their deficits and may therefore accept and be motivated to engage in an intervention which aims to improve these skills.

Finally, the findings from this study have implications for the interpretation of previous research and the design of future studies. Scores from the two measures of EF were not significantly associated with each other, even on subscales designed to measure the same EF component. As discussed, it may be that the BRIEF-II and NESPY-II do not actually assess the same construct of EF. The current findings do not tell us whether teacher-reports or performance-based measures are a more accurate assessment of EF skills, but these findings do have implications for other research in that a consideration of a multimethod approach with multi-informants is important when designing research and interpreting findings. Furthermore, the better performance of children in the performance-based assessment of EF could be interpreted as an indicator of how well the child would do in the classroom if additional structure and support were given (Toplak et al., 2013). Therefore the deficits identified in the BRIEF-II could indicate the child's problem with the traditional classroom structure, compared to the child’s potential if the right support were provided.

Chapter 4 Conduct Problems and the Student-Teacher Relationship: Examining the Role of Emotion Regulation and Lability and CU Traits

4.1 Introduction

An important consideration when examining CP in the context of the classroom is the interactions these children have with their teacher. The quality of the student-teacher relationship (STR) has consistently been associated with academic success (e.g. Graziano et al., 2007; McCormick et al., 2013; Pianta et al., 2012). Moreover, research has shown that child externalising problems are associated with the STR (Miller-Lewis et al., 2014; Runions et al., 2014). However, little is known about the mechanisms involved in this association.

Based on a review of the literature and findings from the profiling study in Chapter One, two possible avenues which may help explain the association between CP and the STR are explored. Firstly, in addition to aggressive behaviour and poor social skills, research shows that children with CP have deficits in emotion-related abilities, including emotion understanding, empathy, and the expression and regulation of emotions (e.g. Cole et al., 2009; Graziano et al., 2007; O'Kearney et al., 2016; see Chapter Two for a review). This was supported by the CP profiling study in Chapter Three, in which pupils with CP were found to have significantly poorer emotion lability and/or negativity, compared to children without CP. However, the influence of these deficits on the STR is not known. Secondly, as has been discussed, children with the CU traits subtype of CP have a distinct set of characteristics in terms of their behaviour and emotion-related abilities (Frick et al., 2014). The profiling study in Chapter Three supported this distinction, demonstrating a specific deficit for children with CP/CU+ in empathy and/or emotion understanding. Nevertheless, the association between CU traits and the STR has received very little attention (Crum, Waschbusch, & Willoughby, 2016). Therefore, the aim of this study was to investigate the association between CP and the STR by examining the influence of CU traits and the role of emotion-related abilities in the association between CP and the STR.

4.1.1 CP and the student-teacher relationship

Several longitudinal studies have found that the quality of the STR in early childhood predicts later externalising problems, including hyperactivity, aggression, and CP (Hughes & Cavell, 1999; O'Connor, Collins, & Supplee, 2012; Runions et al., 2014). Measures of the STR typically assess difficulties and friction between the teacher and child, i.e. student-teacher conflict (S-T conflict); affection, warmth and open communication, i.e., S-T closeness; and the child's dependency on the teacher's help and support, i.e. S-T dependency (e.g. Student-Teacher Relationship Scale; Pianta & Nemitz, 1991). In a sample of 1,114 children, Runions (2014) found that teacher reports of S-T conflict in preschool predicted higher reactive aggression and hyperactivity, as well as peer victimisation, in the first year of primary school. Similarly, a positive STR, characterised by warmth and closeness, has been found to decrease children's subsequent aggressive behaviour in the classroom (Hamre & Pianta, 2001; Howes, Hamilton, & Matheson, 1994; Miller-Lewis et al., 2014; Pianta, Steinberg, & Rollins, 1995). In a study of 460 children transitioning from preschool to primary school, Miller-Lewis et al. (2014) found children with a high quality and stable STR at age 4 had lower parent- and teacher-reported CP and hyperactivity and greater prosocial behaviour at age 6 (adjusting for early mental health problems).

While these studies suggest a negative STR precedes behaviour problems, early externalising problems have also been associated with subsequent student-teacher relations. Research by Ladd and colleagues found that behaviour in kindergarten is associated with the quality of relationships that children form with teachers and peers in middle childhood (Ladd, 2003; Ladd & Burgess, 2001). Henricsson and Rydell (2004) measured the STR in 95 7- and 8-year-olds through both teacher- and child-reports. Classroom observations of student-teacher interactions were also carried out and rated for negative interactions from both the child (disobeying the teacher, disruptive talk, and angry or irritated remarks to the teacher) and the teacher (restraining the child, dismissing the child, and angry or irritated remarks to the child). Children with externalising problems had a more negative attitude towards the STR compared to children without behaviour difficulties. Similarly, teachers reported more conflict in their relationship with children with externalising problems than those without behaviour difficulties. Nevertheless, student-teacher closeness (S-T closeness) did not significantly differ between these groups of children. Analyses of classroom observations found that children with externalising problems had more interactions with the teacher, but they had a higher proportion of negative mutual interactions compared to children without behaviour difficulties.

Taken together, this evidence suggests that the STR can influence children's behaviour, and that behaviour difficulties may lead to S-T conflict. Findings that the STR and externalising problems predict each other across time provides support for this suggestion of a reciprocal relationship (Doumen et al., 2008; Stipek & Miles, 2008; Zhang & Sun, 2011). Using longitudinal data from 148 children over one preschool year, Doumen et al. (2008) found that children's aggressive behaviour at the start of the year led to increases in S-T conflict by the middle of the year. Mid-year S-T conflict then led to an increase of aggressive behaviour at the end of the academic year. It seems that children with CP then, may be prone to a problematic cycle of negative student-teacher interactions and poor behaviour.

Despite the wealth of evidence demonstrating an association between child behaviour and the STR, little is known about the possible mechanisms involved in this relationship. One mechanism which has been explored is academic achievement. As presented in Chapters One and Two, there is a breadth of evidence linking CP with poor academic achievement (e.g. Masten et al., 2005; Risi, Gerhardstein, & Kistner, 2003). There is also evidence that the STR is associated with academic achievement, as well as academic engagement, productivity, and motivation to learn (Graziano et al., 2007; Ladd et al., 2003; Ladd & Burgess, 2001). In a sample of 325 5-year-olds, Graziano et al. (2007) found that children who had a positive STR were more likely to approach school work with thoroughness and accuracy, and complete work in a timely manner. Furthermore, behaviour problems did not predict academic achievement or classroom productivity once the quality of the STR was accounted for, highlighting the importance of the STR on academic success. A high quality STR provides the child with academic and behavioural support through the challenging school environment by offering encouragement, guidance, and discipline (Tyson, 2000). If the child does not receive this support, behaviour difficulties and poor achievement may result. There is evidence that teachers show more criticism and punishment to pupils with behaviour difficulties compared to other children (Crum et al., 2016; Nelson & Roberts, 2000). Furthermore, these pupils are given fewer opportunities to respond to academic requests (Van Acker, Grant, & Henry, 1996; Wehby, Symons, & Shores, 1995), and are less likely to receive positive attention for their appropriate behaviour and receive less praise for correct academic responding (Van Acker et al., 1996; Wehby, Lane, & Falk, 2003).

Additionally, poor academic success may lead the teacher to feel frustrated and exhausted when a pupil is not grasping a concept, when more time and effort is required to teach the pupil, or when their teaching efforts are not reflected in the pupil's academic grades (Rosenfeld & Rosenfeld, 2008). Similarly, the child may become frustrated and develop a negative view of the teacher when they receive negative feedback or fail to achieve academically. It is easy to see then how a conflicting STR could develop. In a study of 332 pre-schoolers, Gallagher (2013) found poor literacy skills mediated the association between the STR and child aggression, offering one possible mechanism through which CP is related to the STR. However, more research is needed which specifically addresses the mediating role of academic success in the association between CP and the STR to support these limited findings to date.

In addition to their academic abilities, specific characteristics of children with CP, such as their poor social skills, physical or verbal aggression, or deficits in self-regulation and emotion-related abilities may influence the STR. For example, good social skills are needed to develop and maintain positive interpersonal relations. In a sample of 230 preschool and primary-school children, Fowler and colleagues found that children with externalising problems and high prosocial behaviour had a significantly better STR than children with externalising problems with low prosocial behaviour (Fowler, Banks, Anhalt, Der, & Kalis, 2008). However, in Henricsson and Rydell's (2004) study of 95 7- and 8-year-olds, social competence did not moderate the STR of children with behaviour problems. Additional research then is needed to examine the influence of social skills on the STR for children with CP. Studies of teacher's attitudes towards different child behaviours can inform our understanding of their role in the association between CP and the STR. Research has shown that teachers perceive externalising behaviours, especially reactive aggression, as more problematic and disturbing than internalising symptoms, such as shyness or anxiety (e.g. Arbeau & Coplan, 2007; Coplan, Bullock, Archbell, & Bosacki, 2015). In Coplan et al.'s (2015) study, preschool teachers were asked to rate their reaction to a range of child behaviours depicted in fictional vignettes. Aggression, especially physical aggression, was found to be the most negatively viewed behaviour, with teachers stating they had the least tolerance for this behaviour, were most likely to intervene, and were most likely to react with negative emotions (particularly anger). This reaction is possibly due to the disruptive and potentially dangerous effect child aggression can have in the classroom compared to the symptoms of pupils with internalising problems (Sugawara & Cunningham, 1988). In addition, Trachtenberg and Viken (1994) found that children with externalising problems respond to teacher difficulties with aggression, which in turn may escalate the problematic STR.

4.1.2 Emotion-related abilities and the student-teacher relationship

Alongside antisocial and aggressive behaviour, children with CP have deficits in a range of emotion-related abilities, including emotion understanding and the management and expression of emotions (e.g. Cole et al., 2009; Graziano et al., 2007; O'Kearney et al., 2016; see Chapter Two for a review). Child and adolescent behaviour problems are associated with high levels of negative emotionality, such as anger and frustration (Eisenberg et al., 2001; Eisenberg et al., 2010; Kim & Deater-Deckard, 2011; Oldehinkel, Hartman, Ferdinand, Verhulst, & Ormel, 2007; Rydell, Berlin, & Bohlin, 2003), more labile emotions (Eisenberg, Fabes, Guthrie, et al., 1996; Eisenberg, Fabes, Karbon, et al., 1996; Sobanski et al., 2010), and less effective use of ER strategies (Silk, Steinberg, & Morris, 2003). Furthermore, as discussed in Chapter Two, CP has been associated with biological correlates of emotion processing, including structural and functional abnormalities of the amygdala and interacting cognitive control areas of the PFC (for reviews, see Cohn et al., 2016; Portnoy et al., 2013).

A child who is emotionally labile presents emotional displays which are disproportionate to the child's current situation, with emotional reactions occurring more frequently, more rapidly, and more intensely than those of a child who is not emotionally labile (Kim-Spoon, Haskett, Longo, & Nice, 2012; Pietromonaco & Barrett, 2009). Such self-regulation difficulties are likely to cause disruption in the classroom and prevent the pupil, and possibly their peers, from learning (Blair & Diamond, 2008). This disruption may lead to conflict between the pupil and the teacher. Emotion difficulties may also influence the STR more directly if the child has a poor understanding of their own or other's emotions, has a lack of empathy for others and lacks remorse for any harm caused to others, or shows too much emotion negativity or is unable to regulate their emotions during social interactions. It is plausible then that any one of these emotion-related difficulties could be a mechanism through which CP is associated with a poor STR.

There is evidence that children who do not appropriately regulate emotions are more likely to have poor interpersonal skills (Rydell et al., 2003; Rydell, Thorell, & Bohlin, 2007). Research into child-adult relationships suggests that how negative emotions in a relationship are processed and expressed is central to the quality of that relationship (Kerns, Abraham, Schlegelmilch, & Morgan, 2007; Stuhlman & Pianta, 2002). Teachers are frequently exposed to children's emotions in the classroom (Hamre & Pianta, 2001) and therefore how children manage their emotions is likely to play an important role in the quality of the STR (Stuhlman & Pianta, 2002). Indeed, there is some evidence that pupils with better emotion skills have a better relationship with their teachers (Graziano et al., 2007).

While this research is limited, related evidence into child-adult attachments could provide support for the idea that ER is associated with the STR. There is a breadth of evidence suggesting that the child's emotion-related abilities are related to the quality of the child's attachment to their parents. In particular, a secure attachment has been associated with better ER and fewer externalising problems (Cassidy, 1999; Clark et al., 2002; Thompson, 2008). Over the past two decades, the focus on the child-parent attachment has been broadened to include the STR as a form of attachment (e.g. Bergin & Bergin, 2009; Commodari, 2013; Verschueren & Koomen, 2012). Similar patterns between child-parent attachments and child-teacher relationships have been reported, including security-seeking at school entry, separation-reunion behaviour, comfort-seeking, and avoidance behaviours (Ahnert, Pinquart, & Lamb, 2006; Koomen & Hoeksma, 2003). Taking an attachment theory (Ainsworth, 1978; Bowlby, 2008) perspective then, it is possible that a child's emotion-related abilities will also be associated with the STR. This will be investigated in the current study.

4.1.3 CU traits and the student-teacher relationship

A second limitation to the research on the STR in pupils with CP is that the heterogeneous nature of CP is generally not accounted for. Despite the fact that subtyping by CU traits has proven valuable to understanding CP, there is little research examining CU traits in the context of the classroom. In particular, the role of CU traits in the STR has only been examined very recently in (Crum, et al., 2016; Horan, Brown, Jones, & Aber, 2016). As discussed in the previous chapters, children with CP/CU+ have distinct and particularly severe behavioural and emotional characteristics (Frick et al., 2014) which are likely to be present in the classroom too. In one of the few studies examining CU traits in the classroom, Waschbusch, Graziano, Willoughby, and Pelham (2015) found CU traits were associated with elevated rates of rule violations after controlling for CP and ADHD symptoms. Severe and chronic antisocial behaviour and rule violations are likely to result in more conflicts in the classroom and more frequent discipline from teachers. Teachers report aggressive, mean-spirited behaviour to be particularly problematic to their teaching (Gest, Madill, Zadzora, Miller, & Rodkin, 2014). This severe antisocial behaviour, alongside the characteristic lack of empathy, lack of remorse, and lack of closeness with others of children with CP/CU+, may make it particularly difficult for these children to develop and maintain positive relationships with their teacher in the classroom.

While there is a lack of research on the STR in children with CU traits, psychopathic characteristics in children and adolescents have been associated with poor social skills and poor interpersonal relationships with peers and parents (Barry, Barry, Deming, & Lochman, 2008; Muñoz et al., 2008). In a study of 80 children with aggressive behaviour, Barry et al. (2008) found that teacher-reports and child self-reports of social competence, and peer-rated social preference, were each negatively associated with psychopathic traits. Similarly, in a sample of 667 school-aged children and adolescents, Muñoz et al. (2008) found that adolescents with psychopathic traits reported conflict in their relationships with peers. The lack of remorse and lack of affection displayed by children with CP/CU+ has also been found to cause adults to withdraw from these children (Kimonis et al., 2013; Muñoz, Pakalniskiene, & Frick, 2011). Not surprisingly then, it has been shown that among children with CP, children with CU traits are more likely to experience disruptions in the parent-child attachment relationship (Pasalich, Dadds, Hawes, & Brennan, 2012).

From this evidence, we can speculate that children with CP/CU+ may also have STRs which are particularly problematic. This theory was tested recently in Crum and colleague's (2016) study of 1,554 boys and girls (aged 5 to 12 years). Using teacher-rated behaviour, including a brief 3-item report of CU traits, children were grouped as either CP/CU-, CP/CU+, CU traits alone, or no behaviour problems. Children with CP/CU+ were found to have the highest teacher-reported S-T conflict and lowest S-T closeness, with significantly more S-T conflict than children with CP/CU- or CU traits alone, and less S-T closeness than children with CP/CU-. Horan et al. (2016) similarly found lower quality STR in 8-year-old children with CU traits while accounting for CP. These results suggest that the STR is particularly impaired in children with CP/CU+ and therefore it is important to consider CU when examining the STR in children with CP. However, neither of these studies used a well-established measure of CU traits and, as these are the only studies to the best of my knowledge which investigate the STR in children with CU traits, more research is needed to support these findings.

4.2 Hypotheses and Research Questions

The aim of the current study was to confirm previous research examining the association between CP and the STR and to extend this research by exploring the role of the child's emotion-related abilities in the STR. Due to the heterogeneous nature of CP and the lack of research examining CU traits in the context of the classroom, the role of CU traits in the association between CP and the STR was also investigated.

The following research questions and hypotheses were proposed;

1) *Does CP predict the STR?*

   In line with previous research, it is expected that greater CP will predict a poorer STR.

2) *Does CP predict emotion regulation and lability?*

   In line with previous research, it is expected that greater CP will predict poorer emotion regulation and greater emotion lability.

3) *Do emotion regulation and lability predict the STR?*

   Based on the view that the STR is a type of attachment, and that emotion-related abilities are associated with the quality of a child's attachment relationships, it is predicted that deficits in the child's emotion regulation and lability will predict a poorer quality STR.

4) *Do emotion regulation and lability mediate the relationship between CP and the STR?*

   An exploratory mediation analysis will explore whether poor emotion regulation and lability act as a mechanism through which CP predicts the STR.

5) *Do CU traits moderate the relationship between CP and the STR?*

An exploratory moderation analysis will explore whether level of CU traits influences the association between CP and the STR.

4.3 Method

4.3.1 Sample

Forty-eight pupils in the mainstream sample of the CP profiling study (see Chapter Three) had available data for the current study. To increase statistical power and generalisation beyond a single school, a second round of recruitment took place. Five teachers and three Teaching Assistants (TAs) from five additional mainstream primary schools across England agreed to participate, completing questionnaires for 60 pupils. Taking both stages of recruitment together, 11 teaching staff provided data for a total of 108 pupils (66 male) aged 6-11 years (Mean=8.88, SD=1.78).

4.3.2 Procedure

Teaching staff completed questionnaires of pupil behaviour, the child's emotion-related abilities (emotion understanding, lability and negativity), and the STR. For teachers in the first round of recruitment, hard copies of questionnaires were given to the teachers at the school. For teachers in the second round of recruitment, all questionnaires were completed online. For the mainstream school pupils from the CP profiling study (*n*=48), IQ and academic achievement was also assessed by the researcher using standardised measures. The research team had no direct contact with any of the other children in this study.

Ethical approval was granted from Goldsmiths, University of London Research Ethics Committee. Teaching staff were given an information sheet outlining the purpose of the study, contact details of the research team, and their right to withdraw at any time. For online assessments, any identifying information about the pupil was not collected. For those pupils in the CP profiling study, pupil names were provided to match teacher questionnaires to the IQ and achievement assessments. For these pupils, parental consent was given in the form of an opt-out consent letter sent from the school and pupils gave verbal assent at the start of each assessment session with the researcher.

4.3.3 Measures

Teacher-report measures of CP (BASC-II; Reynolds et al., 2011), CU traits (ICU; Kimonis et al., 2008), and emotion regulation and lability (ERC; Shields & Cicchetti, 1997) used in the profiling study were also utilised in this study. A full description of each measure can be found in Chapter Three. In the current sample, Cronbach's alphas were as follows: BASC-II, Conduct Problems subscale α=.88; ICU, total scores α=.91; ERC, emotion regulation subscale α=.79; ERC, emotion lability/negativity subscale α=.93. WASI-II (Weschler & Psychological Corporation, 2011) and WIAT-II (Weschler & Psychological Corporation, 2001) data were collected for the pupils from the profiling study only, as no direct contact was made with the children in the second round of recruitment.

In the current study, the 15-item Student-Teacher Relationship Scale-short form (STRS-sf; Pianta, 2001) was also used. The STRS-sf assesses the teacher's perception of the quality of their relationship with a particular pupil, using a 5-point Likert-type scale from 1 (Definitely does not apply) to 5 (Definitely applies). The 7-item Closeness scale assesses affection, warmth and open communication between the teacher and pupil, e.g. 'the child openly shares his/her feelings and experiences with me'. High Closeness scores indicate that the teacher feels effective and has a sense of knowing that the pupil is well and can use the teacher as a resource/source of support (maximum score=35). The 8-item Conflict subscale measures difficulty and friction between the teacher and pupil, e.g. 'this child and I always seem to be struggling with each other'. High Conflict scores indicate that the teacher struggles with the pupil, perceives the child as angry or unpredictable and feels drained and ineffective (maximum score=40). Both subscales have been shown to have good internal reliability. Cronbach's alphas were .90 for the Closeness subscale and .90 for the Conflict subscale. S-T dependency was not assessed, as this scale is not included in this short form which was chosen to reduce the amount of demand on teachers.

4.3.4 Data analyses

Data were analysed using SPSS version 22 (SPSS, 2013). Preliminary assumption checks established that the data were suitable for parametric testing. All teacher reports were complete and therefore no data imputation was used. Scaled scores from each of the standardised measures (BASC-II, WASI-II, and WIAT-II) were used to allow analyses across ages and comparison to a normative population. Raw scale scores were used as continuous measures of the non-standardised measures (ICU, ERC, and STRS-sf).

Preliminary analyses were carried out using bivariate correlations to examine associations between participant demographics and subscales of each measure. To address questions 1-3, hierarchical linear regressions were then conducted to assess significant predictors of scores on the ERC and the STR. Question 4 was explored through a mediation analysis using Preacher and Hayes' Indirect macro for SPSS (Preacher & Hayes, 2004; 2008). Finally, a moderation analysis was conducted to assess the interaction effect of CP and CU traits on the STR.

Several methods to test for mediation effects have been proposed and were considered in the current study. Figure 4.1 presents a simple mediation model in which *a* represents the direct effect of the independent variable (IV) on the potential mediator (M); *b* represents the direct effect of M on the dependent variable (DV); *c* represents the direct effect of P on the DV; and *c′* represents the indirect effect of P on the DV, through M. The most commonly used method has been Baron and Kenny's (1986) causal steps strategy. A mediation effect is said to be occurring using this method if each of the following criteria are met: X predicts Y; X predicts M; M predicts Y in the presence of X; and the effect of X on Y decreases substantially in the presence of M. Another established method is the Sobel test (Sobel, 1982). This method computes the ratio of *ab* to its estimated standard error and a *p*-value for this ratio is computed to test for statistical significance. An alternative, nonparametric method to test for mediation uses bootstrapping. Bootstrapping involves resampling from the data set thousands of times and then estimating the indirect effect in each resampled data set. An approximation of the sampling distribution of *ab* is constructed and confidence intervals are used to test for a mediation effect. Despite its frequent use, the causal steps method for mediation has been criticised, as a significant total effect of X on Y may not be necessary for mediation to occur (MacKinnon, Cheong, & Pirlott, 2012; MacKinnon, Krull, & Lockwood, 2000; MacKinnon, Lockwood, Hoffman, West, & Sheets, 2002; Shrout & Bolger, 2002), while the Sobel test is based on a normal distribution and therefore is only suitable for large sample sizes (Preacher & Hayes, 2008). Furthermore, in simulations to test these methods, MacKinnon et al. (2002) found the bootstrapping method had greater power while still maintaining relative control of Type I error rate, compared to the causal steps method and the Sobel test.

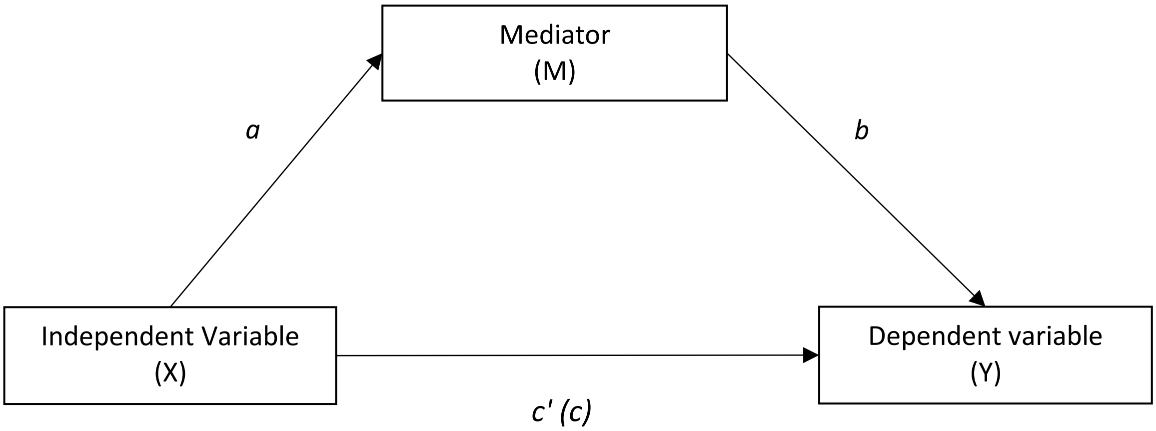


Figure 4.1: *Simple mediation model*

Due to these findings and the relatively small sample size in the current study, the bootstrapping method was used to test for mediation in the current analyses. While this method is suitable for multiple mediators, issues of collinearity may result in an incorrect conclusion that a variable is a mediator when it is not, or that a variable is not a mediator when it is. Therefore, it is recommended that only unique constructs, which are not highly correlated, be used as multiple mediators in a multiple mediation model (Preacher & Hayes, 2008). Therefore, in the current analyses, two separate simple mediation models were created; one model with emotion lability/negativity as a potential mediator and one model with the emotion regulation subscale as a potential mediator.

4.4 Results

4.4.1 Descriptive statistics and bivariate correlations

Means and standard deviations for all measures and subscales are presented in Table 4.1 and bivariate correlations are presented in Table 4.2. There were statistically significant positive relationships between CP and the Emotion Lability/Negativity and the Emotion Regulation subscale of the ERC. There was also a statistically significant positive association between CP and S-T Conflict, but CP was not significantly associated with S-T Closeness. CU traits was significantly positively associated with S-T Conflict and Emotion Lability/Negativity, and significantly negatively associated with S-T Closeness and ER. Emotion Lability/Negativity was significantly positively associated with S-T Conflict, and the ER subscale was significantly negatively associated with S-T Conflict. Pupils' age and gender were not associated with any variables of interest, therefore were not included in the regression analyses.

Due to the nature of the STR and the environment in which this relationship develops, the STR may be influenced by the pupil's academic success. Since CP has previously been associated with lower IQ and academic achievement (e.g. Jakobsen et al., 2012; Pinsonneault et al., 2015), and there is some evidence that academic achievement plays a role in the relationship between behaviour and the STR (Gallagher, 2013), it is important that these characteristics are accounted for in models examining the relationship between CP and the STR. Therefore, for participants with available data, bivariate correlations were conducted between the STR and IQ and academic achievement. S-T Closeness was not significantly associated with IQ or academic achievement. However, S-T Conflict was associated with IQ and mathematical reasoning (but not reading comprehension). Therefore, these variables were considered as control variables in a regression model for S-T Conflict.

Table 4.1: *Means and standard deviations for all measures and subscales*

	n	**Mean**	**SD**
IQ[a]	42	8.88	1.78
Reading Comprehension[b]	39	101.08	10.87
Mathematical Reasoning[b]	39	96.63	16.07
Conduct Problems[c]	108	53.81	11.44
CU traits[d]	108	26.51	12.57
Conflict[e]	108	17.28	7.49
Closeness[e]	108	24.43	5.58
Emotion Regulation[f]	108	22.77	3.86
Emotion Lability/Negativity[f]	108	28.23	8.66

[a]Weschler Abbreviated Scale of Intelligence-2 (WASI-II), standardised scores; [b]Weschler Individual Achievement Test-2 (WIAT-II), standardised scores; [c]Behaviour Assessment System for Children-2 (BASC-II), standardised scores; [d]Inventory of Callous Unemotional Traits (ICU), raw scores; [e]Student-Teacher Relationship Scale - Short Form (STRS-sf), standardised scores; [f]Emotion Regulation Checklist (ERC), raw scores

Table 4.2: *Correlations between pupil behaviour, academic achievement, the student-teacher relationship, and emotion regulation and lability*

	Age	Gender	IQ[e]	Reading Comprehension[f]	Mathematical Reasoning[f]	Conflict[c]	Closeness[c]	Emotion Regulation[d]	Lability/ Negativity[d]
Conduct Problems[a]	.13	-.10	-.59**	-.23	-.43**	.69**	-.01	-.20*	.75**
CU traits[b]	.10	-.03	-.35*	-.04	-.33*	.62**	-.53**	-.63**	.49**
Conflict[c]	.16	-.08	-.48**	-.17	-.41*	-	-.21*	-.38**	.85**
Closeness[c]	-.15	.27	-.08	.22	.00	-	-	.68**	-.02
Emotion Regulation[d]	.00	.05	.21	.18	.13	-	-	-	-.30**
Lability/Negativity[d]	.06	-.15	-.44**	-.10	-.31	-	-	-	-

[a]The Behaviour Assessment System for Children (BASC-II); [b]Inventory of Callous Unemotional Traits (ICU); [c]Student-Teacher Relationship Scale - Short Form (STRS-sf); [d]Emotion Regulation Checklist (ERC); [e]Weschler Abbreviated Scale of Intelligence-2 (WASI-II) (n=42); [f]Weschler Individual Achievement Test (WIAT-II) (n=39). Significant correlations at *p<.05; **p<.01; ***p<.001.

4.4.2 Linear regressions

4.4.2.1 Does CP predict the student-teacher relationship?

In a linear regression with CP as the IV and S-T Conflict as the DV, CP was a significant predictor of S-T Conflict, β=.69, $t(106)=9.92$, $p<.001$, and explained a significant proportion of variance in S-T conflict *scores*, $R^2=.48$, $\Delta F(1, 106)=98.37$, $p<.001$. Furthermore, using the subsample of participants with available data, CP remained a significant predictor of S-T Conflict when IQ and mathematical reasoning were included in the model β=.39, $t(34)=2.10$, $p<.05$. Mathematical reasoning, β=-.17, $t(34)=-1.03$, $p=.31$, and IQ, β=-.14, $t(34)=-.71$, $p=.48$, were not significant predictors of S-T Conflict in this model.

4.4.2.2 Does CP predict emotion regulation and lability skills?

In a linear regression with CP as the IV and Emotion Regulation scores as the DV, CP was a significant predictor of Emotion Regulation scores, β=-.20, $t(106)=-2.07$, $p<.05$, and explained a significant proportion of variance in Emotion Regulation scores, $R^2=.04$, $\Delta F(1, 106)=4.29$, $p<.05$. In a separate linear regression, with CP as the IV and Emotion Lability/Negativity as the DV, CP was a significant predictor of Emotion Lability/Negativity, β=.75, $t(106)=11.80$, $p<.001$, and explained a significant proportion of variance in Emotion Lability/Negativity scores, $R^2=.57$, $\Delta F(1, 106)=139.35$, $p<.001$.

4.4.2.3 Do emotion regulation and lability predict the student-teacher relationship?

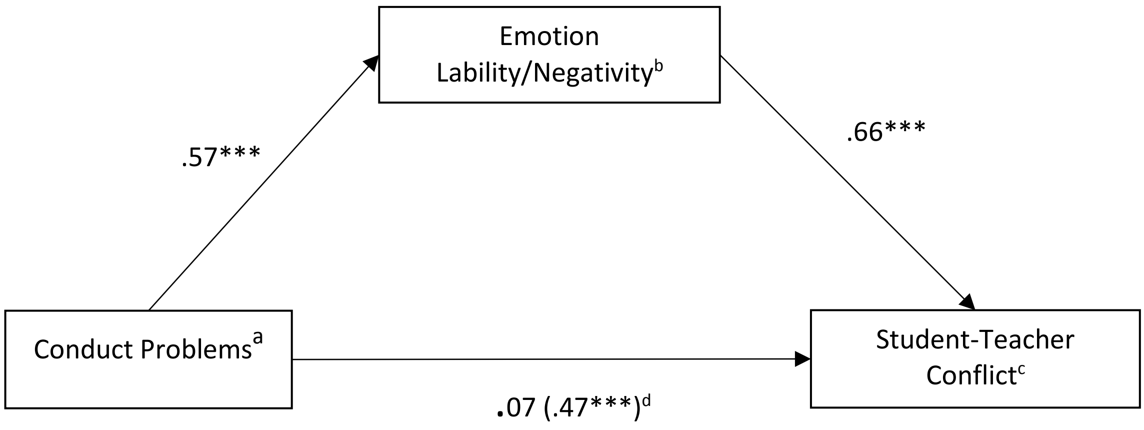
To address question 3, two separate linear regressions were conducted with emotion regulation and lability abilities as the IV and S-T Conflict as the DV. CP was also entered into these models due to the significant associations found in the previous analyses. Emotion Regulation was found to be a significant predictor of S-T Conflict, while controlling for CP, β=-.26, $t(106)=-3.80$, $p<.001$, and Emotion Regulation scores explained a significant proportion of variance in S-T Conflict scores, $R^2=.54$, $\Delta F(2, 105)=62.61$, $p<.001$.

In a separate linear regression, Emotion Lability/Negativity was found to be a significant predictor of S-T Conflict, while controlling for CP, β=.76, $t(106)=9.89$, $p<.001$, and Emotion Lability/Negativity explained a significant proportion of variance in S-T Conflict scores, $R^2=.73$ $\Delta F(2, 105)=143.04$, $p<.001$.

4.4.3 Mediation analyses

To address question 4, *Do emotion regulation and lability mediate the relationship between CP and the Student-Teacher Relationship?* a bootstrapping method with bias-corrected confidence estimates was used. The 95% confidence interval of the indirect effects was obtained with 5000 bootstrap resamples, as recommended by Preacher and Hayes (2008). As IQ and achievement data were only available for a small group of participants and these variables did not significantly predict S-T Conflict when in the model with CP, IQ and achievement were not included in the mediation models.

In the first model, Emotion Lability/Negativity was entered as a potential mediator between CP and S-T Conflict. Unstandardised coefficients of direct and indirect effects are presented in Figure 4.2.



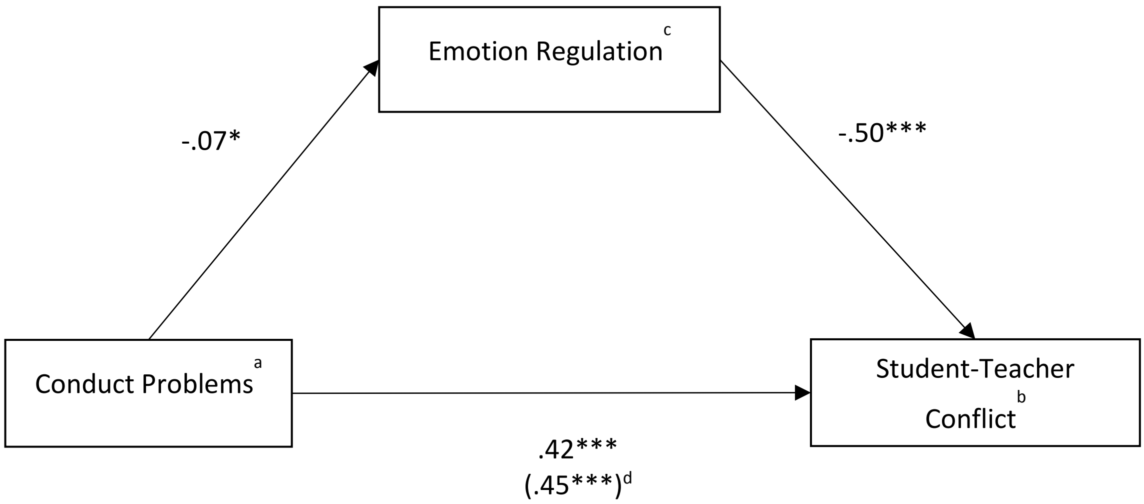
Model summary: R^2=.73, $F(2, 105)$=143.04, p<.001

[a]Behaviour Assessment System for Children-2 (BASC-II); [b] Emotion Regulation Checklist (ERC); [c] Student-Teacher Relationship Scale-short form (STRS-sf). [d]The regression coefficient between conduct problems and student-teacher conflict controlling for emotion lability/negativity is in parentheses. Significant coefficient at **p*<.05, ***p*<.01, ****p*<.001.

Figure 4.2: *Unstandardised regression coefficients for the relationship between conduct problems and student-teacher conflict as mediated by emotion lability/negativity.*

Results demonstrate a significant direct effect of CP on S-T Conflict (*a* path), B=.57, t(106)=11.80, p<.001; a significant direct effect of Emotion Lability/Negativity on S-T Conflict (*b* path), B=.66, t(106)=9.89, p<.001; and a significant total effect of CP on S-T Conflict (*c* path), B=.45, t(106)=9.89, p<.001. Results of the bootstrapping analysis confirmed the mediating effect of Emotion Lability/Negativity in the relation between CP and S-T Conflict (B=.38, CI=.27 to .50). Furthermore, the direct effect of CP on S-T Conflict became non-significant when controlling for Emotion Lability/Negativity (*c′* path), B=.08, t(106)=1.56, p=.12, suggesting Emotion Lability/Negativity fully mediated the relationship between CP and S-T Conflict.

In a separate model, Emotion Regulation subscale score was entered as a potential mediator between CP and S-T conflict. Unstandardized coefficients of direct and indirect effects are presented in Figure 4.3. Results demonstrate a significant direct effect of CP on S-T Conflict (*a* path), B=-.07, t(106)=-2.07, p<.05; a significant direct effect of Emotion Regulation on S-T Conflict (*b* path), B=-50, t(106)=-3.80, p<.001; and a significant total effect of CP on S-T Conflict (*c* path), B=.45, t(106)=9.92, p<.001. Results of the bootstrapping analyses confirmed the mediating role of Emotion Regulation subscale score in the relation between CP and S-T Conflict (B=.03, CI=.01 to .07). However, results indicated that the direct effect of CP on S-T Conflict remained significant when controlling for Emotion Regulation (*c′* path), B=.42, t(106)=9.57, p<.001, suggesting Emotion Regulation subscale scores only partially mediated the relationship between CP and S-T Conflict.



Model summary: R^2=.54, $F(2, 105)$=62.61, p<.001

[a]Behaviour Assessment System for Children -2 (BASC-II); teacher reports, standardised scores; [b]Emotion Regulation Checklist (ERC), teacher-reports, raw scores; [c]Student-Teacher Relationship Scale-short form (STRS-sf); teacher-reports, raw scores. [d]The regression coefficient between conduct problems and student-teacher conflict controlling for emotion regulation is in parentheses. Significant coefficient at *p<.05, **p<.01, ***p<.001

Figure 4.3: *Unstandardised regression coefficients for the relationship between Conduct Problems and student-teacher conflict as partially mediated by emotion regulation*

4.4.4 Moderation analyses

To address question 5, *Do CU traits moderate the relationship between CP and the STR?,* CP and CU traits scores were centred on the mean and entered into a regression, followed by an interaction term between CP and CU traits.

Due to the conceptual overlap between CP and CU traits, collinearity diagnostic factors were used to assess for multicollinearity between the predictor variables. The tolerance statistic is calculated as 1 - R^2, i.e. 1 minus the amount of variance in each independent variable explained by the other independent variables. The variance inflation factor is the reciprocal of the tolerance statistic and assesses how much the variance of an estimated regression coefficient increases if the predictors are correlated. In the current data, tolerance statistics for CP, CU traits, and the interaction term were .66, .68, and .95 respectively, and the variance inflation factor was 1.53, 1.48, and 1.05 respectively. Since a tolerance statistic below .20 and a variance inflation factor above 5 are considered to suggest cause for concern in terms of collinearity (Fields, 2013), we can assume that multicollinearity was not a problem in the current model.

Standardised coefficients and change statistics for predictors of S-T Conflict and S-T Closeness are presented in Tables 4.3 and 4.4 respectively. Looking at the main effects, both CP and CU traits significantly predicted higher S-T Conflict ($p<.001$). CU traits also significantly predicted lower S-T Closeness ($p<.001$). However, CP significantly predicted *higher* S-T Closeness ($p<.001$). In the moderation models, the interaction between CP and CU traits did not significantly predict S-T Conflict or S-T Closeness, suggesting CU traits do not moderate the relationship between CP and the STR.

Table 4.3: *Regression coefficients and change statistics for predictors of Student-Teacher Conflict*

	Coefficients			Change Statistics		
Variable	***B***	***β***	***t***	R^2	ΔR^2	ΔF *(df)*
Main Effects				.56	.56	66.12 (2,105)***
Conduct problems	.33	.51	6.48***			
CU traits	.20	.52	4.25***			
Moderation Model				.56	.001	.32 (1, 104)
Conduct problems	.34	.52	6.43***			
CU traits	.20	.33	4.12***			
Conduct problems* CU traits interaction	-.002	-.04	-.57			

Dependent variable: Student-Teacher Conflict (STRS-sf); N=108. All predictor variables are adjusted to be centred on the mean. Significant coefficients at *$p<.05$; **$p<.01$; ***$p<.001$.

Table 4.4: *Regression coefficients and change statistics for predictors of Student-Teacher Closeness*

	Coefficients			Change Statistics		
Variable	***B***	***β***	***t***	R^2	ΔR^2	ΔF *(df)*
Main Effects				.41	.41	35.73 (2,105)***
Conduct problems	.21	.42	4.63***			
CU traits	-.34	-.77	-8.45***			
Moderation Model						
Conduct problems				.42	.01	2.08 (1,104)
CU traits	.19	.39	4.23***			
Conduct problems* CU traits interaction	-.33	-.75	-8.22***			

Dependent variable: Student-Teacher Closeness (STRS-sf); *N*=108. All predictor variables are adjusted to be centred on the mean. Significant coefficients at *p<.05; **p<.01; ***p<.001.

4.5 Discussion

The aim of the current study was to support previous research suggesting an association between CP and the STR, and to extend this research by exploring possible mechanisms involved in this association. In particular, the role of emotion regulation and lability and the influence of CU traits were examined.

4.5.1 Does CP predict the STR?

The hypothesis that CP would predict the STR was partially supported, in that greater CP symptoms predicted more S-T conflict. However, bivariate analyses showed no significant association between CP and S-T closeness. This is I -line with previous findings that CP is associated with high S-T conflict, but not low S-T closeness (Henricsson & Rydell, 2004;

O'Connor et al., 2012; Zhang & Sun, 2011) and supports research which suggests that teachers have a low tolerance for pupils with behaviour difficulties and interact with these students in a more critical manner with greater discipline (Coie & Koeppl, 1990). Importantly, high conflict scores on the STRS-sf are also reflective of the teacher's belief that their teaching is ineffective or that they feel emotionally drained from trying to work with the pupil (Pianta, 2001). Due to the disruption CP can cause to the classroom, it is not surprising that CP would be associated with a teacher's feelings of ineffectiveness and emotional exhaustion.

One consideration was whether the child's academic success would play a role in the relationship between CP and the STR. Theoretically, teachers and pupils may have more conflict if the pupil is not performing to the teacher's expectations, or if the pupil needs more time and attention spent teaching them in order to succeed academically. This could result in frustrations from the teacher and/or pupil, in turn resulting in conflict between teacher and pupil (Rosenfeld & Rosenfeld, 2008). IQ and academic achievement data were available for some pupils in the current study. Therefore, analyses were repeated with this subsample to control for IQ and achievement in the prediction of S-T conflict. While IQ and mathematical reasoning were negatively associated with S-T conflict, they did not predict S-T conflict when included in a model with CP. Furthermore, CP remained a significant predictor of S-T Conflict while controlling for IQ and mathematical reasoning. This finding is in contrast to evidence which suggests that achievement plays a role in the relationship between CP and the STR (Gallagher, 2013). Nevertheless, these analyses could only be carried out with a small subsample and therefore need replicating in a larger sample.

4.5.2 Does CP predict emotion regulation and lability?

The hypothesis that CP would significantly predict deficits in emotion regulation and emotion lability was partially supported. CP predicted teacher-reported emotion lability/negativity, but not the emotion regulation subscale of the ERC. It is important to note that while the Emotion Regulation subscale of the ERC was used, as discussed in Chapters Two and Three, ER is not clearly conceptualised in the literature and items from the ER subscale of the ERC appear to reflect emotional understanding and empathy, rather than ER in terms of the use of strategies to manage emotions and their expression. Therefore, while ER is referred to in this chapter due to the established label for this subscale of this particular measure, results relating to this subscale may actually reflect emotion understanding and empathy, rather than emotion regulation per se.

The current results then, suggest that CP predicts emotion lability/negativity in particular, rather than emotion understanding or empathy, and does not tell us about the use of ER strategies per se. Nevertheless, high emotion lability and/or negativity may suggest that the child has poor use of ER strategies, as emotions are not being managed effectively enough to reduce lability or overly negative expression of emotions. As discussed previously, this highlights the importance of defining which constructs of ER are being measured when reporting findings, and calls for the use of further measures of ER, such as self-reports, or even more direct measures of the neural mechanisms of ER, measured through methods from neuroscience such as EEG (see Chapter Seven).

4.5.3 Do emotion regulation and lability predict the STR?

The role of emotion-related processes in the classroom on the STR has received little research attention. However, evidence suggests that pupils who do not appropriately regulate emotions are more likely to have poor interpersonal skills (Dunn & Brown, 1994; Rydell et al., 2003) and poor parent-child attachment relationships (Weinfield, Sroufe, Egeland, & Carlson, 1999). Therefore, it was hypothesised that a pupil's difficulties with emotion-related processes may predict a poor STR. This hypothesis was partially supported in that emotion lability/negativity significantly predicted S-T conflict, but not S-T closeness. This relationship remained significant while controlling for CP. Conversely, the Emotion Regulation subscale of the ERC (assessing emotion understanding and empathy) did not predict S-T conflict, but did significantly predict S-T closeness, while controlling for CP. These findings suggest that high lability and/or negativity is associated with S-T conflict, while greater emotion understanding and/or empathy is associated with S-T closeness. Graziano et al. (2007) also used the ERC and the STRS-sf to examine this relationship and similarly found that scores on the ER subscale predicted the STR. However, only the ER subscale and total STRS-sf scores were used, therefore direct comparisons to the current findings are not possible.

The closeness subscale of the STRS-sf measures the degree to which the teacher feels warmth and affection, the level of open communication between pupil and teacher, and a sense from the teacher that they know the pupil well and the pupil will come to them for support (Pianta, 1992). Speculatively, a child with strong emotion understanding and empathy will be able to communicate their feelings to the teacher effectively and the teacher will feel like they know the child better and have a warmer relationship than with a child who is unable to do so. The current findings provide support for this theory and prompt the need for more research in this area to examine the associations between emotion regulation and emotion lability and the STR. In light of the associations between CP and the STR, these associations have important implications for research examining classroom behaviour and interventions to improve school success, which should be given research attention.

4.5.4 Do emotion regulation and lability mediate the relationship between CP and the STR?

Using Preacher and Hayes' (2008) bootstrapping method, emotion lability/negativity was found to fully mediate the relationship between CP and S-T conflict. This relationship has not been investigated previously, but is in line with the proposed theory that the way in which pupils manage and express their emotions in the classroom is a mechanism through which pupils with CP have a conflicting relationship with their teacher. These pupils may be more difficult to manage in the classroom, when their high negativity and/or emotional lability disrupts teaching and learning, and requires more time and effort from the teacher (Graziano et al., 2007). Furthermore, pupils who have emotion processing difficulties are more likely to have poor interpersonal skills (Dunn & Brown, 1994; Rydell et al., 2003), and therefore both the pupil and teacher may find it difficult to form a positive relationship.

This finding has important implications for interventions which aim to improve classroom behaviour, as not only does the STR need to be considered, but this also offers a way to improve the STR for these pupils, i.e. by addressing their emotion lability/negativity. Moreover, these findings highlight the importance of considering emotion dififuclties, in particular the management and expression of emotions, in children with CP rather than just addressing problems with aggression and general social skills.

4.5.5 Do CU traits moderate the relationship between CP and the STR?

Although children with CP are a heterogeneous group, research on the influence of different subtypes of CP on the STR is limited. The CU traits subtype is considered to be a particularly problematic group of children with CP (Frick et al., 2014). The presence of CU traits may therefore influence the association between CP and the STR. In the bivariate associations, CU traits was positively associated with S-T Conflict and Emotion Lability/Negativity. Nevertheless, the interaction between CP and CU traits did not significantly predict S-T conflict, suggesting that the influence of CP on S-T conflict does not vary depending on the child's level of CU traits.

However, the main effects in this analysis did find some interesting differences between CP and CU traits in the prediction of S-T closeness. When both CP and CU traits were entered into the same regression model, unlike CP, CU traits significantly predicted lower S-T closeness. This finding is not surprising due to the characteristic callous traits and severe antisocial behaviour of children with CU traits. Adults have been found to withdraw from such behaviours (Kimonis et al., 2013; Muñoz et al., 2011), and teachers may do the same in the classroom, reducing the likelihood of developing a warm and caring interpersonal relationship. This offers new insight into CU traits in the context of the classroom and provides further evidence of a distinction between children with and without this subtype of CP.

4.5.6 Strengths and limitations

Despite research showing an association between CP and the STR, the mechanisms of this association are not understood. The current study addresses this research gap by examining the role of emotion-related processes, known to be associated with CP, in the association between CP and the STR. Importantly, the current analyses also took into consideration the different dimensions of emotion-related processes and the STR which indeed were found to have different associations with CP. IQ and academic achievement, important factors in the context of the classroom, were also included in an examination of these associations. Finally, the heterogeneous nature of CP was considered by examining the influence of the CU traits subtype in the association between CP and the STR.

Nevertheless, the current study has some methodological limitations. Firstly, only teacher-reports of behaviour, emotion regulation and lability and the STR were assessed. Furthermore, as these questionnaires were collected at the same time, shared reporter variance may have resulted in the significant associations between these measures. Parent-reported and/or child-reported ER, as well as more direct methods of assessing ER, such as EEG, could be used in future research. Child-reports of the STR would also be useful to assess the pupil's view of their relationship with the teacher and whether there are any discrepancies between these two views. The current method was also restricted to assessing the STR with just one member of teaching staff. It may be that the pupil has a distinct relationship with this particular teacher, but not other teaching staff in the classroom.

Based on the current findings, academic achievement does not appear to play a role in the association between CP and the STR. However, only mathematical reasoning and reading comprehension scores were assessed. While these were standardised measures of two key academic disciplines, some other aspect of maths or reading (other than reasoning or comprehension), or some other aspect of academic success not addressed in this study such as classroom engagement or participation, may influence the STR. Moreover, achievement data were only available for a subsample of participants, reducing the statistical analyses possible. In a larger study using longitudinal data, it would be interesting to examine the complexities of the well-documented association between CP and achievement, taking account of the STR. For example, behaviour difficulties may lead to S-T conflict, which may in turn influence school engagement and academic success. There is some evidence of such a relationship in a study of 403 children followed from kindergarten to 10 years of age. Stipek and Miles (2008) found that S-T conflict partially mediated the association between behaviour difficulties and academic achievement.

Furthermore, while emotion deficits were found to play a role in the association between CP and the STR, there may also be other mechanism involved in this association. Other characteristics of children with CP, such as physical aggression, bullying behaviour, or school attendance and truancy, may mediate or moderate the association between CP and S-T conflict. Research into these possible mechanisms is needed. Nevertheless, the current findings extend the literature by providing evidence of one mechanism, emotion lability/negativity, which plays a role in this association.

Finally, due to the cross-sectional nature of this study, the direction of associations cannot be determined. While the current study comes from a theoretical standpoint that difficult classroom behaviour leads to a problematic STR, and that the child's emotion deficits may be a reason for such conflict, evidence has also suggested that a poor STR may lead to behaviour problems or that a reciprocal relationship exists (Doumen et al., 2008; Stipek & Miles, 2008; Zhang & Sun, 2011). It may be that a positive STR allows a child to develop stable and positive emotionality, which in turn is protective against behavioural problems. A longitudinal design with a larger sample would allow for more complex analyses to analyse causal relationships.

Despite these limitations, this study is the first to examine the role of different emotion-related deficits in the relationship between CP and the STR, demonstrating one way in which CP may be related to the STR and highlighting the need to consider the emotional climate of the classroom when trying to understand or intervene with pupil behaviour difficulties. Moreover, this is one of the few studies to investigate the role of CU traits in an educational context especially in terms of the role of CU traits in the STR.

4.5.7 Summary and implications

The finding that children with CP are at risk of S-T conflict has a number of important implications for the classroom. Since previous research has shown that the quality of the STR influences children's later behaviour (Hughes et al., 1999; O'Connor et al., 2012; Pianta et al., 1995; Runions, 2014), the S-T conflict found for pupils with CP in the current study may lead to further behaviour difficulties in these children. Similarly, research has shown that the STR, in terms of the amount of sensitivity and attention received from the teacher, influences children's physiological reactivity in the classroom (Badanes, Dmitrieva, & Watamura, 2012), suggesting that children's emotional functioning may be shaped by their classroom experiences. The S-T conflict found in the pupils with CP then may perpetuate these children's behaviour difficulties and emotional reactivity and regulation. In this way, children and teachers may get caught in a downward spiral of challenging child behaviour and S-T conflict.

Secondly, the quality of the STR has been found to be predictive of classroom attention, engagement, productivity, and academic achievement, especially for primary school pupils (for a review, see Roorda, Koomen, Spilt, & Oort, 2011). Furthermore, greater effect sizes for this association have been found for children who are academically or behaviourally at risk (Hamre & Pianta 2001; Liew, Chen, & Hughes, 2010). S-T conflict in children with CP may then account for the well-documented poor academic achievement found in these pupils. As discussed above, limitations to the current dataset did not allow for this to be examined. However, Stipek and Miles

(2008) demonstrated that the relationship between aggression and poor achievement was partially mediated by S-T conflict. More attention then must be given to the STR for children with CP in order to address underachievement typically found in these pupils.

The association found between CP and S-T Conflict also has implications for the teacher. Since the STRS-sf Conflict subscale measures the teacher's feelings of inefficiency and emotional exhaustion when working with these pupils (Pianta, 2001), the association of S-T Conflict with CP may suggest that these teachers are at greater risk of teacher burnout (Brouwers & Tomic, 2000; Skaalvik & Skaalvik, 2014, 2016). The extent of this problem was demonstrated in a survey which found that nearly one half of mainstream school teachers report thinking about leaving their job because of their experience working with disruptive behaviours in the classroom (Westling, 2010). In turn, teacher stress and absences may have detrimental effects on the learning of the whole class (Miller, Murnane, & Willett, 2008).

Alongside previous evidence, the current findings suggest that the STR and the emotional climate of the classroom should be considered when developing interventions for pupils with CP (Blair & Raver, 2015; Reyes, Brackett, Rivers, White, & Salovey, 2012). Furthermore, it has been shown that without intervention, STR conflict increases in children with behaviour difficulties and that the longer the child is exposed to S-T conflict, the poorer their academic outcomes become (Spilt, Hughes, Wu, & Kwok, 2012). In addition, a positive STR may work as a protective factor for children with behaviour difficulties, in particular for children with CP/CU+. Evidence suggests that high-quality interactions with an adult figure, characterised by warmth and involvement, can reduce antisocial behaviour and CU traits over time (Pardini et al., 2007). The same may be true for a high quality STR, again supporting the suggestion that these relationships should be addressed in classroom interventions. A recent study evaluated a novel school-based intervention Playing-2-gether aimed at decreasing externalising problems by improving the STR (Vancraeyveldt, Verschueren, Van Craeyevelt, Wouters, & Colpin, 2015; Vancraeyveldt, Verschueren, Wouters, et al., 2015). After 12 weeks, the intervention group showed a larger decrease in S-T conflict, CP, and inattention compared to children in an education-as-usual condition. Furthermore, all positive effects were found after the S-T quality component, providing support for the potential of classroom-based interventions which target the S-T relationship on pupils with behaviour difficulties. Nevertheless, this study relied on teacher-reports which may have resulted in over-reporting of improvements, and importantly, CU traits were not examined. Findings from the current study would suggest that it would be valuable to evaluate outcomes for CU traits following such an intervention in future research.

In summary, the association between CP and the STR may have a series of negative knock-on effects which are detrimental to the child, the teacher and other pupils in the class. Longitudinal studies which examine changes in behaviour, emotion-related abilities, and the STR over time are needed to unravel casual relationships in these associations. Importantly, regardless of the direction of these associations, we can conclude that interventions for CP need to move beyond the problem child approach to consider relations in the classroom and the perceptions, expectations, and behaviour of teachers when working with these pupils. Support could be offered to teachers to improve the STR with children with CP, including a better understanding of emotion deficits in these pupils.

Chapter 5 Intervention Outcomes for Children and Adolescents with Psychopathic Traits: A Systematic Review

5.1 Introduction

Based on extensive research which suggests there is subtype of children with CP who show psychopathic-like CU traits (e.g. Dadds, Fraser, Frost, & Hawes, 2005; Frick, 2006; Frick & Dickens, 2006; Frick & Marsee, 2006; Kimonis, Frick, Boris, Smyke, Cornell, Farrell & Zeannah, 2006), a specifier for youths with limited prosocial emotions has been added to the classification of CD in the fifth edition of the DSM (APA, 2013). The inclusion of the specifier should help specialise care and encourage further research into the development and treatment of these children and adolescents (Herpers, Rommelse, Bons, Buitelaar, & Scheepers, 2012). Indeed, while there have been several publications of studies examining intervention outcomes for children and adolescents with CU traits, there is still no recommended treatment approach for young people with these characteristics, and scepticism around the treatability of this particularly disruptive group remains. Reviews of interventions for individuals with such characteristics are currently limited, with most focusing on interventions for adult psychopathy or having restrictive inclusion criteria in terms of research methodology or intervention approach (Harris & Rice, 2006; Hawes, Price, & Dadds, 2014; Salekin, 2002; Salekin, 2006). There is a need for an updated and extensive systematic review of intervention outcomes for children and adolescents with CU traits to improve our understanding of the treatability of this subgroup and to inform the development of interventions. In this chapter, psychopathy and its application to children and adolescents will be introduced in more detail. Intervention approaches for antisocial youths more broadly will be briefly reviewed, followed by an extensive systematic review of intervention outcomes for youths with CU traits.

5.1.1 Psychopathy defined

There is long-standing evidence that there is a subgroup of adult offenders with psychopathic traits (Frick & Dickens, 2006). These individuals have particularly severe and violent antisocial behaviour and show a distinct set of interpersonal (manipulative behaviour, grandiosity, and superficial charm), affective (lack of guilt, lack of empathy, and shallow affect) and behavioural (impulsivity and irresponsibility) symptoms (Cleckley, 1941; Leistico, Salekin, DeCoster, &

Rogers, 2008). While psychopathy is not an official diagnosis in the DSM-5, adults with psychopathic traits are likely to fall into the DSM-5 category of Antisocial Personality Disorder (ASPD) (Skeem, Polaschek, Patrick, & Lilienfeld, 2011), which specifies that the individual has a pervasive disregard for the rights of others, and may have a history of crime, lying and manipulation, and impulsive and aggressive behaviour (APA, 2013). Hare (1991) proposed a two-factor model of psychopathy, with Factor 1 referring to callous and unemotional characteristics, and Factor 2 referring to aggressive and impulsive behaviour. This second factor alone is more akin to ASPD, and therefore the term psychopathy tends to refer to antisocial individuals with additional callous and unemotional features.

Importantly, research has demonstrated that individuals with psychopathic traits have neurological, cognitive and emotional characteristics which are distinct from antisocial individuals without psychopathic traits (e.g. Blair, Richell, Mitchell, Leonard, Morton & Blair, 2006; Glenn & Raine, 2008; Kiehl, Smith, Hare, Mendrek, Forster, Brink & Liddle, 2001; Levenston, Patrick, Bradley, & Lang, 2000). This evidence suggests there may be a different developmental pathway between antisocial individuals with psychopathic traits and those without (Frick & Dickens, 2006). Research has shown that adults with psychopathic traits often have a history of severe antisocial behaviour in childhood, but not all children with antisocial behaviour go on to show adult psychopathic traits (Patrick & Brislin, 2007). An examination of subtypes of antisocial behaviour in children and adolescents may then improve our understanding of the developmental pathways to adult psychopathy.

5.1.2 Applying psychopathy to childhood and adolescence

As discussed throughout this thesis, CP represents a heterogeneous group of antisocial children and adolescents and this heterogeneity has led to attempts to differentiate subtypes of CP (see Chapter One). There has been extensive research support for distinguishing childhood-onset and adolescent–onset CD (Frick, 2006; Moffitt, Caspi, Harrington & Milne, 2002) and these subgroups are recognised in the DSM-5 (APA, 2013). Compared to adolescent-onset CD, childhood-onset CD is associated with more aggressive and criminal behaviour later in life (Moffitt et al., 2002) and with affective and behavioural characteristics similar to adult psychopathy (Dandreaux & Frick, 2009; Silverthorn, Frick & Reynolds, 2001). Childhood-onset CD may then be a particular risk indicator of adult psychopathy.

However, further differences within the childhood-onset group have been found which suggest that a more specific subgroup of children may be at risk of adult psychopathy. Based on evidence that some children and adolescents with childhood-onset CD show emotional arousal and distress at the effect of their behaviour on other people, while others show a lack of guilt, lack of empathy, and shallow affect (Michalska, Zeffiro, & Decety, 2015; Frick, Wall, Barry & Bodin 2015), a callous and unemotional (i.e. CU traits) subtype of antisocial youth was proposed (Frick, 2006). Of those with CP, children with high CU traits have the most severe and chronic trajectory of antisocial behaviour (Frick et al., 2014). Antisocial youths with CU traits also show the distinctive affective (reduced reactivity to emotional stimuli; reduced trait anxiety), behavioural (reactive and proactive aggression; thrill-seeking behaviour) and cognitive (passive avoidance learning; reward-dominance) characteristics of adult psychopathy (e.g. Allen, Morris, & Chhoa, 2016; Jones, Happé, Gilbert, Burnett, & Viding, 2010; Pardini, Lochman, & Frick, 2003; Vitale, Newman, Bates, Goodnight, Dodge & Pettit, 2005). Not surprisingly then, research has found that childhood CU traits are associated with adult psychopathy, even when controlling for CP and other antisocial behaviour risk factors (Burke, Loeber, & Lahey, 2007; Lynam, Caspi, Moffitt, Loeber & Southamer-Loeber, 2007).

An increased interest in subtypes of early antisocial behaviour has led to the development of measurement tools for childhood and adolescent psychopathic-like or CU traits. The well-established Psychopathy Checklist-Revised (PCL:R; Hare, 1991) originally developed in the 1970's to assess psychopathy in adults, has been adapted for use with children and adolescents. The Psychopathy Checklist: Youth Version (PCL:YV; Forth & Kosson, 2003) is a clinician-rated tool, utilising semi-structured interviews and case history information to provide an in-depth assessment of the youth's interpersonal, affective, and behavioural characteristics. While the PCL:YV has been shown to have good psychometric properties (e.g. Dolan & Rennie, 2006; Pechorro, Barroso, Maroco, Vieira & Goncalves, 2014), it requires training, is time intensive, and may have limited use with non-offender populations who are unlikely to have documented history to base the assessment on (Kotler & McMahon, 2005; Edens, Skeem, Cruise & Caufman, 2001). Furthermore, the PCL:YV is not designed for children younger than 12 years of age. The Antisocial Process Screening Device (APSD; Frick & Hare, 2001) was designed to assess the same characteristics, with items written in a more developmentally appropriate way, and designed for use by parents and teachers. A self-report version for older children and adolescents has also been developed (Muňoz & Frick, 2007). Studies of the psychometric properties of the APSD have shown mixed results, with the self-report version, in particular the CU traits subscale, showing poor internal consistency across studies (Dembo, Wareham, Poythress, Cook, & Schmeidler, 2006). Both the PCL:YV and the APSD have been criticised in their use for measuring CU traits, due to the limited number of items (3-4 items) and response options (3-point scale) for measuring severity of these characteristics.

Alternative measures, also theoretically based on the PCL-R, are the Child Psychopathy Scale (CPS; Lynam, 1997) and the Youth Psychopathic Traits Inventory (YPI; Andershed, Kerr, Gustafson & Stattin, 2002). The CPS is made up of items taken from the Child Behaviour Checklist (CBCL; Achenbach, 1991) and the California Child Q-Set (CSQ; Block & Block, 1980), with more items for each facet of psychopathy compared to the PCL:YV and APSD. There is some support for the use of the CPS in terms of the validity of the antisocial-impulsive facet of psychopathy, but it is less clear whether the CPS sufficiently captures the affective-interpersonal, or CU traits, facet of psychopathy (Verschuere, Candel, Van Reenan & Korebrits, 2012). The YPI is a self-report psychopathy instrument designed to address the challenges of measuring psychopathic traits from self-reports due to typical lack of insight into their own behaviour and the deceitful, lying, and manipulative characteristics of these individuals (Andershed, Kerr, et al., 2002; Kotler & McMahon, 2005). The YPI presents traits in a way which are designed to appear admirable to the informant, in an attempt to overcome this challenge. There is research support for the YPI as a psychometrically sound self-report measure of psychopathic-traits in youths (Declercq, Markey, Vandist & Verhaeghe, 2009). However, the YPI is limited in its use across samples as it is only designed for youths aged 12 and older.

The Inventory of Callous Unemotional Traits (ICU; Kimonis et al., 2008) was designed to overcome some of the limitations to earlier measures of youth psychopathic traits. In particular, the ICU assesses the affective-interpersonal facet of psychopathy, with multiple items measuring each of the core characteristics of CU traits. A parent, teacher and self-report version, and a version for pre-school children (Ezpeleta, Osa, Granero, Penelo, Domenech, 2013) are available. Several studies have provided evidence of good psychometric properties of the ICU (Ciucci, Baroncelli, Golmaryami, & Frick, 2015; Frick & Ray, 2015). Nevertheless, the ICU is not a standardised measure of CU traits and there is no widely accepted cut-off score to suggest when CU traits are non-normative (Docherty et al., 2016). Furthermore, in clinical settings, a more in-depth assessment may be needed. The Clinical Assessment of Prosocial Emotions (Frick, 2013), which includes more in-depth semi-structured interviews with the child and at least one other informant, is currently in development for this purpose.

Despite the increased research interest, and the development of assessment tools for CU traits, applying psychopathy to childhood has received criticism (Hart, Watt, & Vincent, 2002, Seagrave & Grisso, 2002). In particular, it has been argued that early psychopathic-like personality traits may change over development and labelling children as psychopathic has connotations for parents, teachers, clinicians, and the general public, especially in terms of perception that psychopathy is untreatable (e.g. Cleckley, 1941; Hare, 1991). However, research suggests that personality traits in general, and in psychopathy in particular, are stable across adolescence into adulthood (e.g. Caspi et al., 2002; Frick, Kimonis, Dandreaux, & Farell, 2003; Lynam et al., 2005). Furthermore, identification of individuals with these problematic traits at an early age should improve their chances of being appropriately treated, when there are opportunities to intervene at multiple levels and before negative consequences have accumulated (Lynam & Gudonis, 2005).

5.1.3 Intervention approaches for CP

Despite the lack of consensus on the aetiology of psychopathy, CU traits are now accounted for in the DSM-5 (APA, 2013) and it is recognised that children within this subgroup may have a different treatment response to those without the specifier (Hawes & Dadds, 2007; Wilkinson et al., 2015). Nevertheless, there is limited evidence of intervention approaches designed specifically for children and adolescents with CU traits and there is no common consensus on the most effective intervention for these individuals (Frick et al., 2014). An extensive systematic review of intervention outcomes for youths with CU traits will follow. First, intervention outcomes for children and adolescents with antisocial behaviour more broadly will be summarised.

Guidelines from the National Institute for Clinical Excellence (NICE) for the treatment of CD recommend psychosocial interventions at the child, parent, and school level (Pilling et al., 2013). Selective prevention is recommended for children aged 3-7 years in schools where classes have a high proportion of children at risk of externalising problems (e.g. low SES, poor parental mental health, or contact with the criminal justice system). These programmes should aim to increase pupils' awareness of their own and others' emotions, teach behavioural self-control, develop problem-solving skills, and promote positive peer relations. Group parent training, using a Social Learning Theory approach, is recommended for parents/guardians of at-risk children aged 3-11, and child-focused social and cognitive problem solving programmes are suggested for high-risk children aged 9-14 years. For youths aged 11-17 with CD, multi-modal interventions are recommended in which a professional provides intensive support to the youth and their family in the home, school and community. Whilst not an exhaustive review, these intervention approaches are briefly presented below, with key findings and limitations discussed. (For more extensive reviews of interventions for CP, see Frick et al., 2001; Fossum, Handegård, Adolfsen, Vis, and Wynn, 2016; Smedler et al., 2015).

5.1.3.1 Parenting interventions

Parenting and family interventions are primarily based on Social Learning Theory and evidence that CP is a result of learnt behaviour established from inconsistent and harsh parenting and negative parent-child interactions (e.g. Frederickson & Cline, 2009; Patterson, DeGarmo & Knutson 2000). Parent Management Training (PMT) aims to change problematic parenting behaviours and improve parent-child interactions. Parents are taught how to implement contingency management plans at home, which includes learning to set appropriate rules and demands, monitoring and supervising the child, reinforcing positive behaviour through praise and rewards, and using non-coercive negative consequences for inappropriate behaviour (e.g. time-out or loss of privileges).

The Incredible Years is a well-established parenting programme for young children at risk of CP (Reid, Webster-Stratton & Hammond, 2003). The programme consists of weekly group sessions running over approximately 12 weeks and makes use of vignettes and video recorded interactions to model appropriate parenting behaviour (Gardner, Hutchings, Bywater & Whitaker, 2010). Parents observe effective parent-child interactions and, through group discussion and problem solving, identify appropriate parenting behaviours. The Incredible Years PMT has been shown to be effective at reducing problem behaviours in pre-school children at risk of CP (Hutchings, et al., 2007; Reid et al., 2003). However, it is not known whether is suited to older children or those with established CP. Triple-P is a similar parenting programme that promotes parenting skills, confidence and resourcefulness, to offer a more nurturing and safe environment for the child (Nowak & Heinrichs, 2008; Sanders et al., 2003). Triple-P comprises a diverse set of options for families from different backgrounds and offers differing degrees of intensity. In a meta-analysis of Triple-P evaluations, Nowak and Heinrichs (2008) found overall effect sizes to range from .17 and .48. However, the study was limited in terms of control groups and the majority of studies only investigated the more intense levels of treatment, leaving the lower levels of intensity unexplored. Furthermore, there is a heavy focus on parental report in these studies, with possible over-reporting of improvements in parenting and child behaviours.

Recent reviews and meta-analyses suggest that parenting interventions show improvements in child behaviour, parental attitudes and behaviours, parental stress, and parent-child interactions (Karjalainen, Santalahti, & Sihvo, 2016; Kazdin, 2016; Pacho & Triñanes, 2011; Piquero et al., 2016). However, while PMT may change behaviour in the home, generalisability of improved behaviour to the classroom, and long-term outcomes have been put into question (Webster-Stratton, 1990). Moreover, families of children with CP report difficulties participating in treatment programmes due to work conflicts and travel arrangements, additional life stressors, or a lack of motivation (Niec, Barnett, Prewett, & Shanley, 2016; Plath et al., 2016; Webster Stratton & Reid, 2003). Of particular concern, a lack of effectiveness of parenting interventions has been found for the most dysfunctional families and engagement by the neediest parents is poor (Baker et al., 2011). Of those families that do participate, a large number do not complete treatment (Baker et al., 2011). The documented effectiveness of these interventions then may be biased as they do not account for these hard-to-reach families or those who drop out.

5.1.3.2 Child-directed interventions

Child-directed interventions, such as Social Competence Training (SCT) or Cognitive Behavioural Skills Training (CBST), are based on findings that children with CP have cognitive and social skills deficits (Dodge, Bates, & Pettit, 1990). These interventions aim to improve social and emotional competence by challenging the child or adolescent's cognitive distortions and teaching adaptive social problem-solving skills, including conversational skills, perspective-taking, and self-control strategies. Programmes are run in groups where behaviours are modelled and children can practice skills through role-play.

The Dina Dinosaur Social Skills and Problem Solving Child Training Programme consists of 18-22 weekly sessions delivered by mental health practitioners, with a focus on compliance training (Webster-Stratton & Reid, 2003). Puppet and videotape modelling, fantasy play and role play is used to promote social problem solving skills, emotional literacy (labelling and recognising feelings), perspective taking, and empathy. In a one-year follow-up, Webster-Stratton and Reid (2003) found that the intervention group had significantly fewer behaviour problems, more positive behaviours, better problem-solving skills, and lower parental stress, compared to a waitlist group. However, many children still present clinically significant behavioural difficulties following treatment and teachers report school behavioural problems remained (Webster-Stratton and Reid, 2003). Furthermore, reviews of social cognitive training interventions for CP have reported that only a few of these studies support the effectiveness of this approach, and most studies reported short-term improvements only (Brestan & Eyberg, 1998; Taylor, Eddy, & Biglan, 1999).

5.1.3.3 School-based programmes

School-wide programmes are primarily preventative in nature, with all pupils in the school participating. While these programmes do not solely target children with CP, they aim to address problematic behaviours characteristic of CP, such as rule-breaking and negative social interactions. For example, the School-Wide Positive Behavioural Interventions and Supports (SWPBIS) programme aims to improve the school's capacity to promote positive behaviour in all pupils by changing the school's organisational structure and putting in place a set of behaviour support strategies, including positively formulated school rules; consistent and systematic praise and encouragement for positive behaviour; and small-group social skills training. The SWPBIS also includes individual behaviour support plans and parent collaboration strategies for pupils identified as requiring support beyond the universal approach (Horner, Sugai, & Anderson, 2010). The SWPBIS is well-established in the U.S., reaching over 16,000 schools (Bradshaw, Goldweber, Fishbein, & Greenberg, 2012), with several studies, including large randomised control trials (RCTs), providing evidence of significant reductions in children's behaviour problems, including lower rates of bullying and suspensions, fewer concentration problems, improved social-emotional functioning, more prosocial behaviour, and improvements in school attendance (Bradshaw et al., 2012; Waasdorp, Bradshaw, Leaf, 2012).

These findings provide promise for a school-wide approach to CP. However, evidence is primarily based on teacher-reports who were not blind to the intervention, possibly resulting in biased accounts of improvement. Indeed, child self-reports have not always supported teacher-reports of improved behaviour on the SWPBIS (Sørlie, Ogden, & Olseth, 2015). Furthermore, school-wide programmes have practical limitations which may make them less well-suited to some schools. The SWPBIS involves changing the whole organisation of the school, requiring all involved to be willing and able to make changes to their teaching practice. School-wide programmes have been shown to have limited long-term effects due to difficulties maintaining the interventions, with some schools struggling to implement programmes alongside their regular curriculum and duties (Roland, 2000). Furthermore, school-wide interventions have been criticised for not providing teachers with the support to manage individual pupils with severe challenging behaviour (Farmer, Reinke, & Brooks, 2014). It may be that some children, especially those already presenting with CP, may need a more focused approach on their individual difficulties.

At the classroom-level, behaviour contingency management strategies have been utilised by teachers. For example, the Incredible Years Teacher Classroom Management Training Programme aims to improve child behaviour by improving teacher competencies in managing classroom behaviour (Hickey et al., 2015). Through teacher workshops or coaching, teachers are taught effective classroom management strategies for discouraging disruptive behaviour and increasing prosocial behaviour. This includes strategies for managing specific behaviours, staying calm when dealing with difficult pupils, and effective methods for communicating with parents. In a recent RCT of the Incredible Years, teachers reported an increase in the use of positive classroom management strategies and a reduction in negative strategies, as well as improvements in classroom behaviour in a high-risk group of pupils (Hickey et al., 2015). However, again these findings are based on teacher-reports and were not supported by classroom observations. Nevertheless, Reinke et al. (2014) found that when additional coaching was given to teachers, decreased rates of disruptive behaviour and increased prosocial behaviour were found in both teacher-reports and classroom observations. A classroom management approach may then be beneficial to high-risk children, but extra support may be needed for the teachers to implement this effectively. Indeed in other studies in which teachers are trained to use more positive classroom management strategies, teachers have been found to still use negative strategies, such as negative remarks to pupils and low praise (Leflot, van Lier, Onghena, & Colpin, 2010; Stormont, 2002).

Peer-mediation programmes offer an alternative classroom-based approach to reduce disruptive classroom behaviour. A long-standing example is the Good Behaviour Game (Barrish, Saunders & Wolf, 1969). The Good Behaviour Game requires pupils to work together to earn group points towards a shared reward. Peers without behaviour problems can model appropriate behaviour, and pupils with CP have the opportunity to practice communicating and co-operating with peers. The Good Behaviour Game has been shown to reduce disruptive behaviour and increase on-task behaviour in pupils across multiple settings and multiple populations (for reviews, see Hwang et al., 2016; Tanol et al., 2010). There is also evidence of a reduction in associated long-term problems, such as substance abuse, violent offenses, and ASPD in young adulthood (Kellam et al., 2011; Storr, Ialongo, Kellam, & Anthony, 2002).

In a meta-analysis of 99 school-based intervention studies, including over 5,000 pupils (550 with clinically significant CD/ODD), Stage and Quiroz (1997) report that 78% of children showed a significant reduction in disruptive behaviour and concluded that these interventions are as effective as non-school interventions (based on results from meta-analyses of psychotherapy). Nevertheless, 68% of aggressive or CD pupils did not show a reduction in disruptive classroom behaviour. It may be that current school-based interventions can be effective at preventing or reducing disruptive behaviour in children with low levels of CP, but that an alternative approach, or additional support, is need for pupils with more established or severe antisocial behaviour.

5.1.3.4 Multi-modal approaches

The multi-modal approach incorporates child-directed and parenting or family interventions to address youth antisocial behaviours. Schools are also often involved in these programmes. One such established approach is Multi-Systemic Therapy (MST), which views individuals as being nested within a complex of interconnected systems encompassing individual, family and extra familial (peer, school, neighbourhood) factors which influence child behaviour (Henggeler, Melton, & Smith 1992; Henggeler & Sheidow, 2012). MST takes an individualised approach by assessing each child’s social context and understanding the individual’s needs within this context. Treatment is tailored to include an amalgamation of child-directed, parenting, and school interventions deemed suitable for that child and their family. Many MST outcome studies have been published, including several large RCTs. The majority of these support the capacity of MST to reduce youth antisocial behaviour. For example, improvements in family relations and decreased long-term recidivism have been reported (for a review, see Henggeler, 2012).

The Coping Power Program is a multi-modal approach based on a Social Cognitive model of youth antisocial behaviour, which posits that social interactions, experiences, and outside influences play a role in youth antisocial behaviour. Like MST, the Coping Power Program addresses individual risk factors as well as risks in the family, neighbourhood, and classroom contexts (Lochman et al., 2009). Coping Power includes a 34 session child component, which may be delivered in individual or group formats, and a shorter 16-session parent component. It addresses emotional literacy, relaxation techniques, goal setting, social skills, and the management of peer pressure. Parents also receive instruction in how to manage their stress and how to foster family cohesion and communication. Studies report significant reduction in overall problem behaviours and increased prosocial behaviour, as well as less parent-reported substance abuse, compared to children in a care-as-usual (Lochman & Wells, 2003; 2004; Muratori et al., 2015). Furthermore, improvements were most apparent for those receiving the full Coping Power Program with parent and child components, compared to those receiving the child component alone (Lochman & Wells, 2004), suggesting the value of the multi-modal approach. Despite some promising findings from these multi-modal approaches, these programmes are lengthy and can be demanding for families. Family disengagement and high attrition for the programmes have been reported (Lochman et al., 2012; Lofholm, Olsson, Sundell, & Hansson, 2009).

5.1.3.5 Pharmacotherapy

There is no specific medication for CP alone, but rather for associated symptoms, such as irritability or co-morbid disorders such as ADHD. Many different drugs have shown improvements in levels of aggression in young people, including stimulants, anticonvulsants, neuroleptics, and antipsychotics (Connor, 2002; Connor, Barkley, & Davis, 2000; Donovan et al., 2000; Hinshaw, Heller, & McHale, 1992). In a series of studies, youths with ADHD and either CD or ODD underwent a trial of parent training and a psychostimulant (usually Osmotic Release Oral System methylphenidate), and youths were randomised to either Risperidone or a placebo drug. Youths receiving Risperidone were reported to experience greater reductions in parent-rated disruptive behaviour, peer aggression, and anxiety, compared to comparison children. However, there was variable improvement from case-to-case, and some found no significant reduction in CD symptoms, with effect sizes ranging from small to moderate (Aman et al., 2014; Gadow et al., 2014).

Furthermore, there is little evidence that medication reduces CP in children without co-morbid ADHD and benefits have been found to disappear when the medication stops and can even wear off by the end of the day (Abikoff & Klein, 1992). Importantly, many pharmacological trials for CP are still in their early stages and therefore little is known about their long-term benefits or potential adverse effects (Hambly, Khan, McDermott, Bor, & Haywood, 2016). Farmer et al. (2015) reported adverse events were seen following Risperidone administration, such as gastrointestinal upset and weight gain. Dosage must be carefully monitored to account for individual differences in response to any pharmacological treatment (Pelham, 1993). As a result of these caveats, pharmacotherapy remains a controversial treatment option for young people (Hambly et al., 2016).

5.1.4 Interventions for children and adolescents with CU traits

Despite some promising findings in the prevention and treatment of CP, each approach has its limitations and several reviews and meta-analyses of psychological interventions for CD have concluded that most interventions show limited effectiveness (Bakker et al., 2016; Fossum et al., 2016; Frick, 2001). In Bakker et al.'s (2016) recent meta-analysis of 17 intervention studies for youths with CP, small to moderate effect sizes for parent-reported (.36), teacher-reported (.26) and blind observer (.26) outcomes were found. Effect sizes for self-reported outcomes were not significant. In a recent meta-analysis of long-term intervention outcomes for youths with CP (56 studies, 2,589 children aged 2-17), Fossum et al. (2016) report an overall small effect size of .08 for a mean follow-up period of 8.9 months.

While some children show improvements following intervention, some interventions have been found to be less effective for youths with more severe antisocial behaviour. For example, school programmes have been found to be least effective for pupils with high levels of disruptive behaviour or clinical CD, showing only small effect sizes compared to non-clinical disruptive peers

(Kellam & Anthony, 1998; Storr et al., 2002). Similarly, PMT has been shown to have reduced effectiveness for the most dysfunctional families (Miller & Prinz, 1990). It may be that some of these more severe cases of disruptive behaviour have additional CU traits, and it is youths with these traits that do not respond to the intervention. It has been proposed that children and adolescents with CU traits may be more difficult to treat than those with CP without CU traits and that this may be due to the failure of interventions to address the causal mechanisms of the behaviour (Frick, 2001). Most interventions do not account for different subtypes of CP and evaluation studies do not report outcomes for subtypes of CP or changes in CU traits. Moreover, NICE guidelines for the treatment of CP explicitly recommend group-based interventions based on a Social Learning Theory account of antisocial behaviour (Akers & Jensen, 2009; Pilling et al., 2013). Such interventions aim to shape behaviour through social feedback. However this approach assumes that all children are inherently social and are motivated by social approval and connectedness with adults and peers, yet not all children share these social motivations (Warren, 2010). These treatment recommendations therefore fail to account for individual differences between antisocial youths with and without CU traits.

5.1.4.1 Early interventions to treat child psychopathy

Although CU traits was only recently distinguished as a subtype of CP, child psychopathy and the uncertainty of how best to treat these youths, has been documented for several decades. Pharmacotherapy studies from the 1940s found Benzedrine to have a soothing effect on children with psychopathic-like traits (Davidoff & Goodstone, 1942; Lindsley & Henry, 1943). Others found no effect of pharmacotherapy (Bender & Cottington, 1942). Based on the assumption that a child with psychopathic traits lacks a loving environment, one psychotherapist is reported to have fostered a child, described as aggressive and guiltless, into his home. The psychotherapist reported that the boy eventually sought affection, developed a conscience, and successfully went to college (Lipman, 1949). In a later review of psychotherapy, seven of eight studies report some kind of improvement in children with psychopathic traits (LeVine & Bornstein, 1972). However, most of these studies were based on one or two children and other early studies reported that no kind of individual therapy benefits children with psychopathic traits (e.g. Szurek, 1949). While these studies give an insight into early approaches to intervention for the 'psychopathic child', we cannot determine whether individuals from early therapists' reports such as this did actually meet the profile of psychopathy or CU traits, or whether success reported by these therapists is unbiased.

Working with a larger group of youths, psychoanalyst and educator August Aichorn opened a home for neurotic and psychopathic delinquents in 1918. The home was based on Milieu therapy, which assumes that a radical change of environment, with affection and kindness from others, is needed to make lasting changes to the child's personality. Aichorn considered his intervention to be a success, reporting that all boys developed a conscience and adapted well to society (see Millen, Somerson, Davis & Birket-Smith, 2003 for Aichorn's early accounts of psychopathy). In contrast, Powdermaker, Levis, and Touraine (1937) reported no success treating 81 girls described as psychopathic with a similar intervention. These contrasting results could be due to the gender differences of the samples, with girls being less responsive to milieu therapy than boys. However, again Aichorn's conclusion of success is questionable as it relies on Aichorn's own reports, with no evidence of any objective pre-treatment or outcome measures. It is difficult to make reliable conclusions from these early studies due to the lack of detail provided regarding the participants, the intervention programme, or the research method. In particular, it is not always clear whether the intervention outcomes refer to delinquent participants in general or to psychopathic participants specifically (e.g. McCorkle, Bixby, Lovel, & Elias, 1958; Weeks, 1958). Moreover, with no common definition of psychopathy, and the lack of the more recently validated measures of psychopathic traits, we cannot say whether the effect of intervention on these participants would apply to children and adolescents classified as having CU traits today.

5.1.4.2 Reviews of intervention outcomes for youths with psychopathic or CU traits

Early theorists claimed psychopathy was untreatable (Cleckley, 1941; McCord & McCord, 1964; Suedfeld & Landon, 1978). In response to this therapeutic pessimism, Salekin (2002) carried out a meta-analysis of intervention studies with psychopathic adults. Of the 42 publications included, 62% of patients were found to benefit from treatment, with a variety of promising outcomes reported, including improved interpersonal relationships, increased remorse and empathy, lower recidivism, and increased rates of employment. Despite growing clinical and research interest in childhood psychopathic or CU traits, comprehensive reviews of outcome studies for these children and adolescents are limited. In a review of family-based interventions for child psychopathy, Hawes et al. (2014) found that 9 of the 16 studies report children with high CU traits have poorer intervention outcomes compared to those with low CU traits. This remained true when controlling for severity of CP, parenting skills, parental stress and depression, and SES (Dadds et al., 2012; Hawes & Dadds, 2005; 2007; Hogstrom et al., 2013). Despite this finding, three of the four RCTs included in the review did show reduced CU traits following intervention. While Hawes et al.'s (2014) review focuses on interventions for children and adolescents with psychopathic or CU traits, it only included parenting and family therapies. Since the aetiology of CU traits is not fully known, and parenting and family therapies have not always been found to be effective, other intervention approaches need to be considered.

Following his meta-analysis of interventions for psychopathy, which predominantly included adult samples (Salekin, 2002), Salekin (2006) conducted a review of interventions for children and adolescents with psychopathic traits. Across a range of treatment approaches, adolescent psychopathic traits were found to predict poorer treatment outcomes and treatment non-compliance compared to antisocial youths without psychopathic traits. Nevertheless, Salekin reports that there is some evidence that both child and parent interventions can significantly reduce levels of psychopathic-like traits (Hawes & Dadds, 2005; Rogers, Jackson, Sewell, & Johansen, 2004) and that youths with these traits have been found to have better outcomes following treatment compared to youths in a treatment-as-usual (TAU) comparison group (Caldwell, Skeem, Salekin, & Van Rybroek, 2006). Furthermore, Salekin (2006) reports that some studies have found psychopathic-like traits do not predict intervention response (e.g. Catchpole, 2003; Gretton et al., 2001) and concluded that although adolescents with high psychopathic-like traits may be more difficult to treat, there is evidence that these individuals can benefit from treatment.

Despite this optimism for the treatability of youths with psychopathic-like traits, Salekin's (2006) review was limited in breadth. Firstly, most of the studies reviewed were based on adolescent, but not child, samples. In addition, studies were restricted to those using the PCL:YV or APSD to operationalise psychopathy only. With the development of other measures of psychopathic-like traits, in particular those which assess CU traits (Frick, 2004), and CU traits now being identified in preschool aged children (Ezpeleta, Osa, Granero, Penelo, & Domenech, 2013), Salekin's review needs extending to include younger samples and studies which operationalise psychopathic-like traits using additional measurement tools. Moreover, with the inclusion of the limited prosocial specifier in the DSM-5 (APA, 2013), and an increase in research and clinical interest in CU traits in recent years, an updated and more extensive examination of intervention outcomes for childhood and adolescent CU traits is needed.

In two more recent and inclusive reviews, Frick et al. (2014) and Wilkinson et al. (2016) found that in the majority of studies, youths with high CU traits had poorer treatment outcomes to antisocial youths without these traits. However, both reviews documented evidence of improvements for youths with CU traits and Frick et al. (2015) concluded that youths with CU traits can show improvements in interventions which are *'tailored to their unique emotional, cognitive, and motivational styles*' (2015, p.111). For example, a programme for juvenile offenders showed targeting empathy skills and taking a reward-oriented approach resulted in those with psychopathic-like traits showing less recidivism compared to those in a standard correctional programme which did not target these unique CU trait characteristics (Caldwell et al., 2006). The authors concluded that children with CU traits are a *'treatment challenge, but they are not untreatable*' (2015, p.111). More evidence of such tailored approaches is needed to guide future intervention development and further inform the unique aetiology of this subgroup of antisocial individuals.

5.2 Current Systematic Review: Aims and Research Questions

The aim of the current chapter was to conduct an updated and comprehensive systematic review of interventions for early psychopathic or CU traits which broadens findings from previous reviews with restrictive inclusion criteria. Due to the increasing development and use of different measurement tools for child psychopathy, restricting the review to just those studies that used the PCL:YV or APSD as previous researchers have, would prevent us from learning from the vast amount of studies that use alternative tools. Furthermore, while a recent review has addressed the previously restrictive inclusion criteria in these intervention outcome reviews (Wilkinson et al., 2015), the current review aims to extend this further by considering the effectiveness of individual intervention components on CU traits, the influence of individual differences on intervention outcomes within the CU traits subtype, and the particularly problematic issue of engagement and attrition from treatment for antisocial individuals and their families (Baker et al., 2011; Kazdin et al., 2016; Plath et al., 2016).

A systematic review rather than a meta-analysis was considered most appropriate for the current study. Although a meta-analysis can help with some methodological problems, such as small sample sizes, it cannot resolve other methodological limitations highly prevalent in the psychopathy intervention literature such as male-dominant samples and single-informant reports (D'Silva, Duggan, & McCarthy, 2004; Rice & Harris, 2006). Furthermore, the breadth of intervention approaches, disparity within these, and wide range of outcome variables reported, make these studies difficult to compare in meaningful statistical analyses.

The current review aims to address the following questions:

5) Can interventions reduce CU traits in children and adolescents?
6) Are youths with high CU traits responsive to treatment and do levels of these traits influence treatment outcomes?
7) Do other individual characteristics of youths with CU traits influence intervention outcomes?
8) Which components of interventions are particularly effective at treating CU traits?

5.3 Method

A computerized search was used to locate all studies that examined treatment approaches for childhood and/or adolescent psychopathic traits. The search involved the PubMed and Psych INFO databases, an examination of current literature reviews, and reference sections of related publications. Database searches were made up of three search terms which specified psychopathic traits (psychopathy, psychopathic, callous), age (child*, adolescen*, youth, juvenile, infant) and intervention outcome (treatment, intervention, therap*, program*, management, cure, modification) in the article or book chapter title or abstract. For example, ‘psychopathy AND child* AND treatment’.

The review was limited to studies which examined intervention outcomes of psychopathic or CU traits[5] specifically (i.e. not antisocial behaviour in general). Studies of ‘delinquents’ or ‘character disorders’ were not included unless the author stated that the participant/s had been diagnosed

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[5] ‘Psychopathy’, ‘psychopathic traits’ and ‘CU traits’ are used interchangeably herein. When referring to particular studies, the term used in the original publication is reported.

with, or assessed to show, psychopathy or CU traits or alternatively, where psychopathy/CU traits were used as an outcome variable. Studies were not excluded based on co-morbidity of psychopathic traits with other disorders or where psychopathic traits were not the main intervention target for analyses. The search was limited to childhood and adolescent interventions, where participants were 17 years or younger at the start of participation in the intervention. All methodologies were included, including those with no control or comparison group and case studies. While no start date was specified, publications which did not document the research methodology and/or treatment outcomes in enough detail to be of use were not included in the systematic review, resulting in most studies from the early to mid-1900's being excluded (see above for brief reviews of these studies).

5.4 Results

5.4.1 Study characteristics

A systematic search yielded 45 studies meeting the inclusion criteria. Publication dates span over more than 50 years, from 1964 to 2016, but the majority of studies (60.0%) were published in the last five years. Sample characteristics and details of intervention format and delivery for each publication are presented in Table 5.1. Twenty-two studies (48.9%) examined child-directed interventions, 10 (22.2%) examined parent-directed interventions, and 13 (28.9%) combined parent and child approaches. Each intervention varied greatly in terms of the frequency and duration of sessions. Interventions ran from as few as three individual sessions (Hyde et al., 2013) to daily sessions for almost 3 years (Caldwell et al., 2007). Furthermore, homework, in which skills were practiced between sessions, formed part of several interventions, making it difficult to assess the dosage of each intervention. Interventions were based in a clinic, at school, at home or in the community, or were residential, i.e. a juvenile detention facility or hospital inpatient. The intervention setting was not specified in several studies.

Three case studies with a single participant were included. Sample sizes for the other studies ranged from 11-731 participants. Participants were aged 3-26 years (one study included child and adult participants) at time of intervention. Age data were not provided in five studies. All studies included male participants (where gender was reported) and had a male dominant sample; with 19 studies (42.2%) including males only. The majority of participants were clinic-referred to intervention, based on disruptive or antisocial behaviour, such as CP, CD, ODD or Disruptive Behaviour Disorder (25 studies, 56.8%), or court-ordered as part of a juvenile offender programme (17 studies, 37.8%). Four studies used high-risk community samples from teacher-referred pupils with disruptive behaviour or from school screenings designed for research purposes.

Research methodology varied greatly across studies in terms of design, group allocation, and analyses. For the current systematic review, each study was categorised into one of five design types (see Tables 5.1, 5.2 and 5.3). Almost half of the studies (46.7%) used a design in which all participants received the same intervention, without a no intervention or treatment as usual (TAU) comparison group, and in which the sample was split into high and low psychopathic or CU traits for analyses. Only 18 studies (40.0%) included a no intervention or TAU group and two studies included a healthy comparison group. Twenty-eight studies (62.2%) examined the association between psychopathic or CU traits and behaviour outcomes following intervention (e.g. externalising problems, social skills, offending) and 17 studies (37.8%) reported pre- to post-intervention changes in psychopathic or CU trait symptoms. Twenty-seven studies (60.0%) report carrying out a follow-up. Four of these studies included a long-term follow-up, spanning from 10 to 40 years. Of the 23 studies with shorter term follow-ups, periods ranged from 5 months to 55 months (M=21.33months).

Most studies used established measures of youth psychopathic or CU traits. The APSD (Frick & Hare, 2001) was the most frequently used measure, with 23 studies using the full instrument or subscales from it. One study used an older version of the APSD, the Psychopathic Screening Device (PSD; Frick, 1994). The PCL (Hare, 1991) was used in 8 studies and the ICU (Kimonis et al, 2008) was used in 8 studies. A combination of items or subscales from these and other measures, such as the Minnesota Multiphasic Personality Inventory (MMPI; Hathaway & McKinley, 1983) and the SDQ (Goodman, 1997) were used as a measure of psychopathic traits in 12 studies. Three studies did not specify how psychopathy was operationalised. Thirty-two studies (71.1%) report using a single-informant to assess psychopathic or CU traits. Eleven of these relied on parent-reports, 11 relied on self-reports; five on teacher-reports; two from youth interviews; two from records on file; and one relied on the intervention founder’s judgement. In four studies, the informant/s for psychopathic or CU traits was not specified.

Results of the systematic review by intervention type are presented below. A brief description of the interventions that fall within each group is given, followed by details of relevant outcomes from each study included. Tables 5.2, 5.3, and 5.4 present intervention outcomes relevant to CU traits, grouped by intervention type. Effect sizes are given in the main text where reported in the original publication.

5.4.2 Child-directed interventions

5.4.2.1 Social-Emotional Skills Training (SEST)

Teaching of functional social and emotional skills to the child or adolescent. This may include training in perspective-taking; communicating and interacting with peers and adults; identifying and labelling emotions; emotion understanding; and cognitive and affective empathy.

Two studies report CU traits as a predictor of behaviour outcomes following SEST (without combined CBT). Dadds, Cauchi, Wimalaweera, Hawes and Brennan (2012) and Haas, Waschbusch, Pelham, King, Andrade and Carrey (2011) found CU traits predicted treatment responsiveness, but in opposite directions. Dadds et al. (2012) (N=195) found participation in Emotion Recognition Training (ERT) was associated with a decrease in CP (d=0.26) and improvements in affective empathy (d=0.38) for children with high CU traits (APSD; SDQ) only (controlling for CD). Following a Summer Treatment Program, which combines social skills training with academic and recreational activities and reward-based behaviour management, Haas et al. (2011) (N=70) found high CU traits (APSD) predicted more negative behaviours in time-out (β=.40, p<.01), and poorer staff-reported problem solving (β=–.39, p<.05) and social skills (β=–.47, p<.05) after controlling for CP. Nevertheless, CU traits did not uniquely predict length of time in time-out, behaviour during sport, or peer sociometrics. While one study found CU traits predicted better intervention outcomes and the other poorer outcomes, the two studies used very different outcome measures. For example, one of the main outcomes reported in Haas et al.'s (2011) study, was behaviour during time-out, which is not applicable to Dadds et al.'s (2012) study as reward-based behaviour management was not used. Both the outcome measures used, and the actual content of the SEST intervention then may have led to these conflicting results.

Table 5.1: *Sample characteristics and details of intervention format and delivery for all publications included in the systematic review*

Reference	*N*	Sample[a]	% male	Age (Mean, S.D)[b]	Psychopathy Measure[c d]	Intervention	Frequency/ Duration	Control/Comparison
Blader et al. (2013)	160	ADHD, ODD or CD and aggression	79	6-13 (9.31, ±2.02)	APSD (P)	Community Parent Education Program (COPE) & Methylpenidate	Medication once daily. Dosage individualised. Stimulant given for a mean of 70.22 (SD = 37.48) days.	N/A
Butler et al. (2011)	108	Juvenile offenders, court referral	82	15.15	APSD (P, Y)	Multisystemic Therapy	Home visits 3 times/week and available 24/7, for 11-30 weeks (M= 20.4).	TAU - tailored range of NICE recommended interventions to prevent re-offending.
Caldwell et al. (2006)	141	Juvenile offenders, court referral	100	Not available	PCL:YV (Y)	Mendota Juvenile Treatment Center program	Duration of stay (mean not available).	TAU - juvenile corrections institutions
Caldwell et al. (2007)	86	Juvenile offenders, court referral	100	Not available	PCL:YV (Y)	Mendota Juvenile Treatment Center program	Several hours/day. 1-146 weeks (M=45, SD=29).	N/A
Caldwell (2011)	248	Juvenile offenders, court referral	100	Mean at release = 17.08	PCL:YV (Y)	Mendota Juvenile Treatment Center program	Duration of stay (mean not available).	TAU - juvenile corrections institutions
Caldwell et al. (2012)	127	Juvenile offenders, court referral	100	(16.1 ±0.89)	APSD (Y)	Mendota Juvenile Treatment Center program	Duration of stay (up to 180 days)	N/A
Coleman, et al. (1992)	39	Behavioural disorder in residential treatment	74	13-18 (15.75, ±10.17)	MMPI, Psychopathic Deviate scale (Y)	Aggression replacement training program	50 hours over 10 weeks, plus homework practice.	TAU - Academic or vocational lessons
Craft et al. (1964)	50	Juvenile offenders, court referral	100	13-26	MMPI (Y)	Group psychotherapy	40 mins- 2 hour sessions, 2-3 times/week.	Authoritarian unit-removal of privileges or isolation for non-compliance.

Reference	*N*	Sample[a]	% male	Age (Mean, S.D)[b]	Psychopathy Measure[c d]	Intervention	Frequency/ Duration	Control/Comparison
Dadds et al. (2012)	195	Referred for behavioural and/or emotional problems	76	Mean = 10.52	APSD and SDQ, prosocial scale (P, T, Y)	Emotion Recognition Training	4 x 90min sessions	TAU-Manualised parent training programme
Datyner et al. (2016)	1	CD and ADHD diagnosis; clinic-referred	100	7.0	ICU-Preschool (P, T)	Coaching and Rewarding Emotional Skills	6 x 60min sessions	N/A
Dembo et al. (2006)	164	Juvenile offenders	52	11-18 (14.4, ±1.71)	APSD and YPI (P, T)	Arbitrations Intervention Worker	16 weeks	TAU - JA program to reduce recidivism.
Farmer et al. (2015)	168	Severe aggression, Disruptive Behaviour Disorder and ADHD	77	6-10 (8.89, ±2.01)	Items from NCBRF, CASI-4R and KSADS (P)	Treatment of Severe Childhood Aggression	9-weeks (3 weeks STIM and PT, 6 weeks risperidone).	Stimulant and parent training with placebo
Frederickson et al. (2013)	29	Pupils at a special school for SEMH	93	5-11 (8.72, ±1.71)	ICU (T)	Let's Get Smart (LGS)	6hours/day, 5 days/week, for 1 year.	N/A
Fried (1995)	242	Behaviour disorders	64	4-18	Founder’s records	Mellansjo home for ‘psychopathic’ children	Mean stay 2.1 years	N/A
Gretton et al. (2001)	220	Adolescent sex offenders	100	12-18	PCL:YV; files on record	Sex offender treatment program	Not given	N/A
Haas et al. (2011)	70	CP and ADHD diagnosis	70	7-12 (9.48, ±1.58)	APSD, CU scale (P)	Summer Treatment Program	9hours/day, 5 days/week, for 8 weeks.	Healthy controls participated in the same intervention.
Hawes & Dadds (2005)	56	ODD/CD diagnosis, community health service or self-referred	100	4-8 (6.29, ±1.55)	Items from APSD and SDQ (P, T)	Manualised parent training	1hr/week, 9 weeks	N/A
Hawes & Dadds (2007)	56	ODD/CD diagnosis, community health service or self-referred	100	4-8 (6.29, ±1.55)	Items from APSD and SDQ (P, T)	Manualised parent training	1hr/week, 9 weeks	N/A
Hawes et al. (2013)	95	Clinic-referred CP	71	3-9 (5.4, ±1.0)	Items from APSD and SDQ (P, T)	Manualised parent training	1hr/week, 9 weeks (number of sessions mean = 5.22)	N/A

Reference	*N*	Sample[a]	% male	Age (Mean, S.D)[b]	Psychopathy Measure[c d]	Intervention	Frequency/ Duration	Control/Comparison
Högström et al. (2013)	57	CP	54	3-11 (6.65, ±2.29)	APSD, CU scale (P)	Comet	1.5hrs x 7 sessions	N/A
Hornsveld & Kraaimaat (2011)	283	Outpatient violent adolescents with ODD or CD	100	15-21 (17.35)	PCL-R (C)	Aggression control therapy	1.5 hours/week for 15 weeks with three 5-week intervals	Waitlist
Hyde et al. (2013)	731	At high risk for CP	51	Followed from age 2 years to 4 years	Deceitful-Callous Behaviour Factor (P)	Family Check-Up	3 sessions (duration not specified)	N/A
Ingram et al. (1970)	>40	'Psychopathic delinquents'	100	Not specified	Quay-Peterson Behavior Problem Checklist (Quay & Peterson, 1964); informant not specified	National Training School for Boys	7 days a week, duration not specified	TAU – not specified
Kimonis et al. (2014)	63	CP and at-risk for developmental delay	73	(3.87, ±1.2)	Items from ASEBA (P)	Parent-Child interaction Therapy	1hr/week for a mean of 12.16 weeks (S.D. =3.43)	N/A
Kimonis & Armstrong (2012)	1	Clinic-referred co-morbid CD and ADHD diagnosis	100	5.83	ICU-Preschool (P, T)	Parent-Child Interaction Therapy with reward-based behavior modification	CDI: 8 x 1hr sessions, plus daily 5 minutes play at home. PDI: 11 x 1hr sessions plus daily 5 minutes play.	N/A
Kolko et al. (2009)	208	Clinically referred, ODD or CD diagnosis	85	6-11 (8.8)	APSD, CU and narcissm scales (T)	Modular treatment	Weekly. Mean = community 21.6 sessions (22 weeks), clinic 15.4 sessions (20 weeks).	Healthy controls participated in the same intervention.
Kolko & Pardini (2010)	177	Clinic-referred early onset DBD	Not specified	6-11	APSD (T)	Modular treatment	Approx. 1 weekly session for 21 weeks.	TAU – range of family, individual, and group therapies. Some also on medication.

Reference	*N*	Sample[a]	% male	Age (Mean, S.D)[b]	Psychopathy Measure[c d]	Intervention	Frequency/ Duration	Control/Comparison
Lochman et al. (2014)	241	School moderate to high levels of aggression	63	9-12 (10.7, ±0.56)	APSD (T)	Coping Power Programme - Abbreviated and Booster	Child: 24 sessions (50-60mins each) and monthly individual contacts (20-30mins). Parents: 10 sessions. Child booster: 5-10 sessions/month for 10 months (10-90mins).	TAU - not specified
Manders et al. (2013)	256	Court-ordered, health care referred, or self-referred adolescents with severe and violent antisocial behaviour	73	12-18 (16.0, ±1.31)	APSD, narcissism and impulsiveness scales, and ICU (P)	Multisystemic Therapy	Weekly family sessions to monitor progress for 4-6months. Therapist available 24/7.	TAU - selection of community treatments (supervision by probation officer, individual counselling or, family therapy)
Masi et al. (2011)	38	Diagnosed CD or ODD	74	6-14 (13.1,±2.6)	APSD and ICU (P, Y)	Multimodal Intervention	6 months, weekly	N/A
Masi et al. (2013)	118	Clinic-referred DBD	86	6-14 (11.1, ±2.50)	APSD (P)	Multimodal Intervention	4hr session, once a week, for 12 months	N/A
McCord (1985)	340	Court referred delinquents	100	9-13	Not specified	Wiltwyck school	18 months or more	Lyman Training school - formal education and agriculture; discipline oriented
McDonald et al. (2011)	66	Mothers and children departing from domestic violence shelters	<100 (not specified)	4-9 (6.16, ±1.66)	PSD (P)	Project Support	Up to 8 months, average of 20 sessions (SD=9, range= 2-40)	TAU - emotional or instrumental support, but not clinical services on parenting or child behaviour.
Miller et al. (2014)	11	Co-morbid ADHD with ODD or CD and clinical CU traits	91	7-11 (9.5, ±1.2)	APSD, ICU, and CPS-R (P, T)	Summer treatment program	9hrs/day, 5 days/week, 7 weeks.	Academic classes and recreational activities
O'Neill et al. (2003)	64	Referred for substance abuse, post-arrest	100	Mean = 16	PCL:YV; files on record	Substance Abuse Program	7hrs/day, 5days/week, 3months	N/A

Reference	*N*	Sample[a]	% male	Age (Mean, S.D)[b]	Psychopathy Measure[c d]	Intervention	Frequency/ Duration	Control/Comparison
Ridenour et al. (2003)	28	Juvenile offenders	100	14-16 (15.95, ±0.97)	PCL-R; (C)	Residential behavioural program	Duration of residential stay (M=133.88 days)	N/A
Rogers et al. (2004)	82	Inpatient juvenile offenders with substance abuse and behavioural disruptive disorders	65	14-16 (15.37, ±0.91)	SALE, psychopathy-screen scale (Y)	Generic forensic treatment program	Duration of hospital stay (M= 4.6 months, SD=2.17)	N/A
Salekin et al. (2012)	24	Juvenile offenders in secure residential facility	100	13-15 (14.67, ±0.83)	APSD (Y)	Mental Models intervention	12 sessions	N/A
Schmideberg (1978)	1	Diagnosis of psychopathy	100	16.5	Not specified	Psychoanalysis	Daily therapy for 9 months and follow-up daily therapy for one month (two years later)	N/A
Scott et al. (2014)	183	Study 1) Clinic-referred antisocial behaviour Study 2) community antisocial behaviour	Not specified	Study 1) 3-7 Study 2) 4-6	APSD (P)	The Incredible Years videotape parent training	Study 1) 13-16 weeks, mean 9 sessions Study 2) mean 15 sessions	Study 1) TAU - parent and child psychotherapy. Some children also received medication (methylphenidate). Study 2) TAU - Parent telephone helpline.
Shenk et al. (2014)	66	ODD or CD, some with history of interpersonal violence	100	6-11 (8.98 , ±1.71)	APSD (T)	Modular behavioural intervention	20-24 weeks	No interpersonal violence group participated in the same intervention
Spain et al. (2004)	85	Juvenile offenders in secure residential facility	100	11-18 (15.77, ±1.35)	PCL:YV (C), CPS and APSD (Y)	Rational Emotive Behavioural Treatment	Daily, 9-12 months	N/A
Somech & Elizur (2012)	209	High risk community sample, teacher referred	78	2.7-5.3 (4.0)	APSD-Preschool and ICU-Preschool; informant not specified	Hitkashrut theory-based, common elements parent training program	14 x 2 hour meetings	TAU - consultation session and referrals to community care

Reference	*N*	Sample[a]	% male	Age (Mean, S.D)[b]	Psychopathy Measure[c d]	Intervention	Frequency/ Duration	Control/Comparison
Waschbusch et al. (2007)	37	ADHD with CD or ODD (some CU)	78	7-12 (9.67, ±1.63)	APSD (P, T)	Summer Treatment Programme	BT: 9hrs/day, 5 days/week, 8 weeks. Medication /placebo drug twice daily (5-30mg for 4-9 days)	N/A
White et al. (2013)	134	Juvenile offenders	72	11-17 (15.34, ±1.34)	ICU (Y)	Functional Family Therapy	3-5 months, 1-19 sessions (M=9.6, S.D = 4.12).	N/A
Spain et al. (2004)	85	Juvenile offenders in secure residential facility	100	11-18 (15.77, ±1.35)	PCL:YV (C), CPS and APSD (Y)	Rational Emotive Behavioural Treatment	Daily, 9-12 months	N/A
Somech & Elizur (2012)	209	High risk community sample, teacher referred	78	2.7-5.3 (4.0)	APSD-Preschool and ICU-Preschool (NS)	Hitkashrut theory-based, common elements parent training program	14 x 2 hour meetings	TAU - consultation session and referrals to community care
Waschbusch et al. (2007)	37	ADHD with CD or ODD (some CU)	78	7-12 (9.67, ±1.63)	APSD (P, T)	Summer Treatment Programme	BT: 9hrs/day, 5 days/week, 8 weeks. Medication/ placebo twice daily (5-30mg for 4-9 days)	N/A

[a]Age (years) reported at time of intervention; mean and standard deviation reported in parenthesis where available. [b]CP, Conduct problems; CD Conduct Disorder; ODD, Oppositional Defiant Disorder; DBD, Disruptive Behaviour Disorder; CU, Callous-unemotional traits; ADHD, Attention Deficit Hyperactivity Disorder.. [c]PCL-R, Psychopathy Checklist-Revised (Hare, 1991); PCL:YV, Psychopathy Checklist: Youth Version (Hare, 1991); APSD, Antisocial Processing Screening Device (Frick & Hare, 2001); CPS-R, Child Psychopathy Scale-Revised (Lynam, 1997); ICU, Inventory of Callous Unemotional Traits (Frick, 2004), Inventory of Callous Unemotional Traits- Preschool (ICU-Preschool, Frick, 2004); SDQ, Strengths and Difficulties Questionnaire (Goodman, 1997); SALE, Survey of Attitudes and Life Experiences (Rogers et al., 2002); PSD, Psychopathic Screening Device (Frick et al., 1994); ASEBA, Achenbach System of Empirically-Based Assessment (Achenbach, 2009); NCBRF, Nisonger Child Behavior Form (Aman, Tassé, Rojahn & Hammer, 1996); CASI-4R, Child & Adolescent Symptom Inventory-4R (Gadow & Sprafkin, 2012); KSADS, Kiddie Schedule for Affective Disorders and Schizophrenia (Kaufman et al., 1997); MMPI, Minnesota Multiphasic Personality Inventory (Hathaway & McKinley, 1983); YPI, Youth Psychopathic Traits Inventory (Andershed et al., 2002). [d]Y, youth self-report; P, parent-report; T, teacher-report; C, clinician assessment/interview; NS, informant not specified.

Table 5.2: *Outcomes and methodological limitations of child-based interventions*

Reference	Intervention Type[a]	Design[b]	Outcomes	Methodological Limitations
Caldwell et al. (2006)	SEST; CBT; Reward-based Behaviour Modification	C	All high CU: Intervention better behaviour outcomes than TAU	Non-random group assignment. No low psychopathy comparison group.
Caldwell et al. (2007)	SEST; CBT; Reward-based Behaviour Modification	A	Behaviour across delinquent participants improved No significant difference between outcomes for high psychopathy and low psychopathy when controlling for baseline behaviour. Longer duration of treatment predicted better behaviour outcomes.	Non-random treatment exposure design.
Caldwell (2011)	SEST; CBT; Reward-based Behaviour Modification	D	Intervention better behaviour outcomes than TAU High interpersonal facet better behaviour outcomes than other high PCL facets.	Non-random group assignment.
Caldwell et al. (2012)	SEST; CBT; Reward-based Behaviour Modification	E	CU symptoms improved Improvement in CU symptoms predicted improvement in other behaviour.	No low psychopathy or TAU comparison group. No follow-up.
Coleman et al. (1992)	SEST; CBT	D	Intervention better behaviour outcomes (not all) than TAU.	Non-validated measure of psychopathy. No follow-up
Craft et al. (1964)	Psychotherapy	B	Psychopathy symptoms did not improve in either intervention. No difference in psychopathy symptoms between interventions. Main behaviour outcomes did not improve in either intervention, but Authoritarian intervention improved IQ and Group Psychotherapy improved social adjustment.	Baseline differences between groups (but no difference in psychopathy traits); self-reported psychopathy

Reference	Intervention Type[a]	Design[b]	Outcomes	Methodological Limitations
Dadds et al. (2012)	SEST	D	Intervention greater improvements in behaviour outcomes than TAU for high CU traits only. High CU greater improvements in behaviour outcomes than low CU traits.	Analyses did not control for wide age-range.
Datyner et al. (2016)	SEST; CBT; Reward-based Behaviour Modification	E	Behaviour improved. CU symptoms improved. Improvements short term but not long term.	Simultaneous ADHD and aggression medication. Single child. Follow-up mother-reports only.
Frederickson et al. (2013)	Teacher training; SEST; Reward-based Behaviour Modification	A	Behaviour across delinquent participants improved High CU poorer behavioural outcomes than low CU (not all)	Small sample size, one school. No control group. No follow-up. Only teacher-reports.
Fried (1995)	Milieu	A	Behaviour across delinquent participants improved No significant difference between outcomes for high psychopathy and low psychopathy. Males were found to have poorer long-term outcomes than females.	Diagnoses of psychopathy questionable (circa 1930s). Some records illegible and reliability not checked. Improvement based on founder's judgement.
Gretton et al. (2001)	Not specified	A	High psychopathy poorer behavioral outcomes than low psychopathy	No non-treatment group. Used behaviour records only. Lacks details of intervention.
Haas et al. (2011)	SEST; Reward-based Behaviour Modification	A	Behaviour across delinquent participants improved. High CU predicted poorer outcomes on 3 of 9 behaviour outcomes.	Small sample. Some on medication. All had co-morbid ADHD. No follow-up.

Reference	Intervention Type[a]	Design[b]	Outcomes	Methodological Limitations
Hornsveld & Kraaimaat (2011)	SEST; CBT	D	High psychopathy had greater attrition Psychopathy could not be analysed further due to high attrition	Self-report. High attrition from participants with high psychopathy scores preventing analyses. No follow-up.
Ingram et al. (1970)	Reward-based Behaviour Modification; Psychodrama	C	All high psychopathy: Intervention better behaviour outcomes than TAU	All male sample. Non-validated measure of psychopathy. No follow-up
McCord (1985)	Milieu	D	High psychopathy and general behaviour disorders better behaviour outcomes than neurotic or borderline disorders. Intervention better behaviour outcome than comparison up to age 25 years. Intervention poorer behaviour outcome than comparison after age 25 years.	Psychopathic and non-psychopathic not compared. Ethnicity differed between schools.
Miller et al (2014)	Reward-based Behaviour Modification	C	All high CU: Intervention better behaviour outcomes than TAU Greatest improvements in behaviour during low-punishment condition and standard condition (moderate punishment and moderate rewards)	Assessors not blind to treatment. Behaviour only recorded during sport and time-out. Small sample. Possible order effects. No follow-up.
O'Neill et al (2003)	SEST; CBT	A	Behaviour across delinquent participants improved High psychopathy poorer behaviour outcomes than low psychopathy	Excluded charges of substantially violent offences, sexual offences, and arson. No control group. Only official arrest records used for 12 month follow-up.
Ridenour et al (2003)	Reward-based Behaviour Modification	A	High psychopathy poorer behaviour outcomes than low psychopathy	Small sample size. Improvements in behaviour or psychopathic symptoms not reported.

Reference	Intervention Type[a]	Design[b]	Outcomes	Methodological Limitations
Rogers et al (2004)	Reward-based Behaviour Modification	A	Psychopathic symptoms improved in 25% of high psychopathy participants High psychopathy some poorer behaviour outcomes (only 1 of 4) than low psychopathy	No control group. No follow-up. Weak outcome measures.
Salekin et al (2012)	SEST; CBT; Reward-based Behaviour Modification	E	Psychopathy symptoms improved Interpersonal factor showed the greatest improvements.	No control group and no low vs. high CU traits comparison. No follow-up. No parent-reports. No behavioural outcomes.
Schmideberg (1978)	Psychotherapy	E	Behaviour improved. Psychopathy symptoms improved	Single case study. Vague description of intervention. All reports based on therapist and self-report. Follow-up outcomes based on a letter from patient.
Waschbusch et al 2007)	Reward-based Behaviour Modification; Pharmacotherapy	A	BM with pharmacotherapy better behaviour outcomes than BM without pharmacotherapy. BM: High CU poorer behaviour outcomes than low CU. BM with Pharmacotherapy: No difference between behaviour outcomes for high CU and low CU.	Low statistical power for interaction effects. No control group. All co-morbid ADHD. No follow-up.

[a]CBT, Cognitive Behaviour Therapy; SEST, Social-Emotional Skills Training. [b]Design A: 1 or 2 groups: intervention (high psychopathy) vs. intervention (low psychopathy); Design B: 2 groups, intervention (delinquency) vs. no intervention (delinquency). Outcome = Psychopathy symptoms. Design C: 2 groups, intervention (high psychopathy) vs. no intervention (high psychopathy); Design D: 3 or 4 groups, intervention (high psychopathy) vs. intervention (low psychopathy) vs. no intervention (high and low psychopathy); Design E: One group or single case study, intervention (high psychopathy).[c]'Psychopathy' or 'CU' reflect terminology used in the publication

Table 5.3: Outcomes and methodological limitations of parent or family-based interventions

Reference	Intervention Type[a]	Design[b]	Outcomes	Methodological Limitations
Hawes & Dadds (2005)	PMT	A	Behaviour across delinquent participants improved (short and long term) CU symptoms improved High CU poorer behaviour outcomes than low CU (short and long term) High CU poorer response to time-out strategies than low CU traits. No significant difference between high and low CU in response to rewards	Parent-report only. All male.
Hawes & Dadds (2007)	PMT	A	Behaviour across delinquent participants improved (short and long term) CU symptoms improved (short and long-term) Stable-high CU poorer response to time-out strategies than unstable CU traits	Parent-report CU traits and outcome measures only. All male.
Hawes et al. (2013)	PMT	A	Behaviour across delinquent participants improved High CU poorer behaviour outcomes than low CU (long-term)	No control group
Högström et al. (2013)	PMT	A	Behaviour across delinquent participants improved. High CU poorer behaviour outcomes than low CU (for emotional problems only)	No control group. Only parent-reports for CU traits and behavioural outcomes. Small sample. No follow-up.
Hyde et al. (2013)	Parent consultation	A	No significant difference in intervention outcomes between high psychopathy and low psychopathy.	Only young children. Measure of psychopathy not validated.
Kimonis et al. (2014)	PMT	A	CDI phase (rewarding child-led play): No significant difference between behaviour outcomes for high CU and low CU PDI phase (time-out strategies): High CU poorer behaviour outcomes than low CU	Small sample. Co-morbid developmental delay. No follow-up.

Reference	Intervention Type[a]	Design[b]	Outcomes	Methodological Limitations
Kimonis & Armstrong (2012)	PMT; Reward-based Behaviour Modification	E	PMT CDI phase (rewarding child-led play): Behaviour improved PMT PDI phase (time-out strategies): Behaviour did not improve. PMT with Reward-based BM: behaviour improved (not all) Long-term CU symptoms improved (not all)	Simultaneous ADHD and aggression medication. Co-morbid ADHD. Mother-reports mainly. Only one child.
McDonald et al. (2011)	PMT	B	CU symptoms improved Intervention better psychopathy symptoms than comparison group (short and long-term) Changes in psychopathy were mediated by mother's parenting	Domestic violence only. Mother-reports only.
Scott et al. (2014)	PMT	B	Behaviour (some) improved in clinic-referred sample Psychopathy traits improve din clinic-referred sample Behaviour did not improve in community high-risk sample Clinic participants had significantly better outcomes than community sample	Missing data (although further analyses suggest this did not influence results). Small control group size.
Somech & Elizur (2012)	PMT; Reward-based Behaviour Modification	B	CU symptoms improved (short and long-term) Intervention better improvement in CU symptoms than TAU Intervention better behaviour outcomes than TAU Changes in behaviour were mediated by mother's parenting	High attrition
Hawes & Dadds (2005)	PMT	A	Behaviour across delinquent participants improved (short and long term) CU symptoms improved High CU poorer behaviour outcomes than low CU (short and long term) High CU poorer response to time-out strategies than low CU traits No significant difference between high CU and low CU in response to reward	Parent-report only. All male.

Reference	Intervention Type[a]	Design[b]	Outcomes	Methodological Limitations
Hawes & Dadds (2007)	PMT	A	Behaviour across delinquent participants improved (short and long term) CU symptoms improved (short and long-term) Stable-high CU poorer response to time-out strategies than unstable CU traits	Parent-report CU traits and outcome measures only. All male.
Hawes et al. (2013)	PMT	A	Behaviour across delinquent participants improved High CU poorer behaviour outcomes than low CU (long-term)	No control group
Högström et al. (2013)	PMT	A	Behaviour across delinquent participants improved. High CU poorer behaviour outcomes than low CU (for emotional problems only)	No control group. Only parent-reports for CU traits and behavioural outcomes. Small sample. No follow-up.
Hyde et al. (2013)	Parent consultation	A	No significant difference in intervention outcomes between high psychopathy and low psychopathy.	Only young children. Measure of psychopathy not validated.
Kimonis et al. (2014)	PMT	A	CDI phase (rewarding child-led play): No significant difference between behaviour outcomes for high CU and low CU PDI phase (time-out strategies): High CU poorer behaviour outcomes than low CU	Small sample. Co-morbid developmental delay. No follow-up.
Kimonis & Armstrong (2012)	PMT; Reward-based Behaviour Modification	E	PMT CDI phase (rewarding child-led play): Behaviour improved PMT PDI phase (time-out strategies): Behaviour did not improve PMT with Reward-based BM: behaviour improved (not all) and long-term CU symptoms improved (not all) Intervention did improve behavioural outcomes CU symptoms improved (not all)	Simultaneous ADHD and aggression medication. Co-morbid ADHD. Mother-reports mainly. Only one child.

Reference	Intervention Type[a]	Design[b]	Outcomes	Methodological Limitations
McDonald et al. (2011)	PMT	B	CU symptoms improved Intervention better psychopathy symptoms than comparison group (short and long-term) Changes in psychopathy were mediated by mother's parenting	Domestic violence only. Mother-reports only.
Scott et al. (2014)	PMT	B	Behaviour (some) improved in clinic-referred sample Psychopathy traits improve din clinic-referred sample Behaviour did not improve in community high-risk sample Clinically referred participants had significantly better outcomes than the high risk community sample.	Missing data (although further analyses suggest this did not influence results). Small control group size.
Somech & Elizur (2012)	PMT; Reward-based Behaviour Modification	B	CU symptoms improved (short and long-term) Intervention better improvement in CU symptoms than TAU Intervention better behaviour outcomes than TAU Changes in behaviour were mediated by mother's parenting	High attrition
Hawes & Dadds (2005)	PMT	A	Behaviour across delinquent participants improved (short and long term) CU symptoms improved High CU poorer behaviour outcomes than low CU (short and long term) High CU poorer response to time-out strategies than low CU traits No significant difference between high and low CU in response to reward	Parent-report only. All male.
Hawes & Dadds (2007)	PMT	A	Behaviour across delinquent participants improved (short and long term) CU symptoms improved (short and long-term) Stable-high CU poorer response to time-out strategies than unstable CU traits	Parent-report CU traits and outcome measures only. All male.

Reference	Intervention Type[a]	Design[b]	Outcomes	Methodological Limitations
Hawes et al. (2013)	PMT	A	Behaviour across delinquent participants improved High CU poorer behaviour outcomes than low CU (long-term)	No control group
Högström et al. (2013)	PMT	A	Behaviour across delinquent participants improved High CU poorer behaviour outcomes than low CU (for emotional problems only)	No control group. Only parent-reports for CU traits and behavioural outcomes. Small sample. No follow-up.

[a]PMT, Parent Management Training. [b]Design A: 1 or 2 groups: intervention (high psychopathy) vs. intervention (low psychopathy); Design B: 2 groups, intervention (delinquency) vs. no intervention (delinquency). Outcome = Psychopathy symptoms. Design C: 2 groups, intervention (high psychopathy) vs. no intervention (high psychopathy); Design D: 3 or 4 groups, intervention (high psychopathy) vs. intervention (low psychopathy) vs. no intervention (high and low psychopathy); Design E: One group or single case study, intervention (high psychopathy).[c]Terms 'psychopathy' or 'CU' reflect terminology used in the publication.

Table 5.4: *Outcomes and methodological limitations of combined parent and child interventions*

Reference	Intervention Type[a]	Design[b]	Outcomes[c]	Methodological Limitations
Blader et al. (2013)	Family and Pharmacotherapy	A	Behaviour improved CU symptoms improved No significant difference in intervention outcomes between high CU and low CU	No control group. Concurrent family therapy.
Butler et al. (2011)	MST	B	Behaviour improved CU symptoms improved (parent-report, but not self-report) Intervention better behaviour outcomes (not all) than comparison Intervention better CU symptoms improvement than comparison	Small sample. No follow-up regarding APSD symptoms or differences between high and low psychopathy.
Dembo et al. (2006)	Family	D	No significant different outcomes between intervention and TAU No significant difference in intervention outcomes between high psychopathy and low psychopathy. CU subscale alone was marginally significantly negatively associated with number of days until first arrest.	
Farmer et al. (2015)	PMT and Pharmacotherapy	D	High CU better improvements than low CU No significant difference in behaviour outcomes between intervention and TAU	CU composite not a validated measure. Did not correct for multiple comparisons. No follow-up.
Kolko & Pardini (2010)	Multimodal	D	No significant difference in behaviour outcomes between intervention and TAU No significant difference in intervention outcomes between high CU and low CU	Teacher-reports only. TAU poorly documented.

Reference	Intervention Type[a]	Design[b]	Outcomes[c]	Methodological Limitations
Kolko et al. (2009)	Multimodal	E	Behaviour improved (short and long-term) CU symptoms improved (short and long-term)	No no-treatment control group.
Lochman et al. (2014)	Multimodal	B	CU symptoms improved (short and long-term) Intervention better behaviour outcomes than comparison Intervention better CU symptoms than comparison (intervention had no effect on Narcissm)	High attrition at follow-up.
Manders et al. (2013)	MST	D	Behaviour improved for low psychopathic traits only. Intervention better behaviour outcomes than TAU, but for low psychopathy only. No significant difference in psychopathy symptoms improvement between intervention and TAU. CU subscale score did not improve, but Narcissm and Impulsiveness scores did improve.	Used 2 scales from APSD and CU from ICU. Other studies use full APSD. Only parent reports on psychopathy. No follow-up. No objective data such as offending records.
Masi et al. (2011)	Multimodal	A	Behaviour improved for approximately half of the sample No significant difference in intervention outcomes between high CU and low CU	Small sample. No non-treatment group. No follow-up.
Masi et al. (2013)	Multimodal	A	Behaviour improved for approximately half of the sample High CU poorer behaviour outcomes than low CU	Assessor and therapist not blind to CU traits. Some on medication. No non-treatment group. No follow-up.
Shenk et al. (2014)	Multimodal	A	Behaviour across the sample improved. CU symptoms improved (but only if no prior interpersonal violence, IPV)	Only young children. All males. Did not compare outcomes for high and low CU.

Reference	Intervention Type[a]	Design[b]	Outcomes[c]	Methodological Limitations
Spain et al. (2004)	Multimodal	A	Self-reported psychopathic symptoms predicted poorer treatment outcomes. Clinician assessed psychopathic symptoms did not predict treatment outcomes.	Study not designed to evaluate intervention. No control group. No follow-up.
White et al. (2013)	Family	A	Behaviour across delinquent participants improved High CU better behaviour outcomes than low CU (not all)	No control group. Only official records of offending were used - may underestimate offending behaviour.
Blader et al. (2013)	Family and Pharmacotherapy	A	Behaviour improved CU symptoms improved No significant difference in intervention outcomes between high and low CU	No control group. Concurrent family therapy.
Butler et al. (2011)	MST	B	Behaviour improved CU symptoms improved (parent-report, but not self-report) Intervention better behaviour outcomes (not all) than comparison Intervention better CU symptoms improvement than comparison	Small sample. No follow-up regarding APSD symptoms or differences between high and low psychopathy.
Dembo et al. (2006)	Family	D	No significant different outcomes between intervention and TAU No significant difference in intervention outcomes between high psychopathy and low psychopathy. CU subscale alone was marginally significantly negatively associated with number of days until first arrest.	
Farmer et al. (2015)	PMT and Pharmacotherapy	D	High CU better improvements than low CU No significant difference in behaviour outcomes between intervention and TAU	CU composite not a validated measure. Did not correct for multiple comparisons. No follow-up.

Reference	Intervention Type[a]	Design[b]	Outcomes[c]	Methodological Limitations
Kolko & Pardini (2010)	Multimodal	D	No significant difference in behaviour outcomes between intervention and TAU No significant difference in intervention outcomes between high and low CU	Teacher-reports only. TAU poorly documented.
Kolko et al. (2009)	Multimodal	E	Behaviour improved (short and long-term) CU symptoms improved (short and long-term)	No no-treatment control group.
Lochman et al. (2014)	Multimodal	B	CU symptoms improved (short and long-term) Intervention better behaviour outcomes than comparison Intervention better CU symptoms than comparison (no effect on Narcissm)	High attrition at follow-up.
Manders et al. (2013)	MST	D	Behaviour improved for low psychopathic traits only Intervention better behaviour outcomes than TAU for low psychopathy only No significant difference in psychopathy symptoms improvement between intervention and TAU CU subscale score did not improve, but Narcissm and Impulsiveness improved	Used 2 scales from APSD and CU from ICU. Other studies use full APSD. Only parent reports on psychopathy. No follow-up. No objective data such as offending records.
Masi et al. (2011)	Multimodal	A	Behaviour improved for approximately half of the sample No significant difference in intervention outcomes between high and low CU	Small sample. No non-treatment group. No follow-up.

[a]PMT, Parent Management Training; CBT, Cognitive Behaviour Therapy; SEST, Social-Emotional Skills Training; Reward-based BM, Reward-based Behaviour Modification; MST, Multisystemic Therapy. [b]Design A: 1 or 2 groups: intervention (high psychopathy) vs. intervention (low psychopathy); Design B: 2 groups, intervention (delinquency) vs. no intervention (delinquency). Outcome = Psychopathy symptoms. Design C: 2 groups, intervention (high psychopathy) vs. no intervention (high psychopathy); Design D: 3 or 4 groups, intervention (high psychopathy) vs. intervention (low psychopathy) vs. no intervention (high and low psychopathy); Design E: One group or single case study, intervention (high psychopathy).
[c]Terms ‘psychopathy’ or ‘CU’ reflect terminology used in the publication.

5.4.2.2 Social-Emotional Skills Training (SEST) with Cognitive Behavioural Therapy (CBT)

SEST interventions which also include an individual or group talking therapy to teach and encourage the use of cognitive-behavioural strategies to modify thinking and behaviour.

Three studies report psychopathic traits as a predictor of behaviour outcomes following an intervention which combines SEST and cognitive-behavioural techniques. In all three studies, high psychopathic traits were found to show poorer treatment responsiveness. Coleman, Pfeiffer and Oakland (1992) report a study of 39 adolescents in a residential unit for behavioural disorders participating in Aggression Replacement Training or TAU (academic classes). Aggression Replacement Training teaches social skills and moral reasoning through role-play and feedback, and anger management is addressed through cognitive and relaxation techniques. One staff-reported measure of social skills showed significantly better improvement for adolescents in ART than TAU, with psychopathy scores (MMPI) accounting for 26% of the variance. A similar intervention, Aggression Control Therapy, for violent adolescent outpatients was examined by Hornsveld and Kraaimaat (2011) (N=283). However, patients who dropped out of treatment prematurely scored significantly higher on psychopathy (PCL-R) and consequently psychopathic traits were not analysed further. In the hospital Substance Abuse Program, evaluated by O'Neill, Lidz and Heilbrun (2003), 64 juvenile offenders participated in SEST combined with CBT and a life-skills and education programme. Higher psychopathic traits (PCL:YV) were associated with poorer clinical improvement, fewer clean urine screens, and a higher number of re-arrests at 12 months follow-up.

A series of studies by Caldwell and colleagues studied the residential Mendota Juvenile Treatment Center (MJTC) programme which combines SEST, CBT, and behaviour contingency. In a sample of 86 adolescents in the MJTC programme, Caldwell, McCormick, Umstead and Van Rybroek (2007) found no significant difference between outcomes for participants with high psychopathic traits and low psychopathic traits (PCL:YV) when controlling for baseline behaviour. Only duration of treatment predicted treatment outcomes when controlling for baseline behaviour and demographic factors (β=.31 for behavioural change, β=.28 for final behaviour rating; and β=.26 for change in number of security days; all p<.001). In Caldwell, McCormick, Wolfe and Umstead's (2012) and Caldwell's (2011) studies, the full sample were juvenile offenders with psychopathic traits (PCL:YV), therefore treatment outcomes comparing MJTC and TAU (Juvenile

Correction Institution), rather than psychopathy as a predictor of outcomes, are reported. In the earlier sample of 141 adolescents, Caldwell et al. (2006) found MJTC treatment was associated with slower and lower rates of serious recidivism compared to TAU (Odds Ratio=3.3, $p<.05$). Two years after release only 21% of the MJTC group had been involved in violence and none had been charged with homicide, whereas 49% of the TAU group were involved in violence and 10.6% had been charged with homicide. MJTC had no impact on nonviolent offending in this sample. Nevertheless, in a later sample of 241 adolescents, MJTC was associated with a decrease in both violent and nonviolent offending (Caldwell, 2011). There was also evidence that certain psychopathic characteristics may influence treatment responsiveness. Participants with a highly arrogant and deceitful interpersonal style (PCL:YV Interpersonal scale) had the fewest violent offense charges (interpersonal η^2=.09, affective η^2=.09, behavioural η^2=.11, antisocial η^2=.10) in the follow-up period (24-79 months; M=54 months).

Three studies of SEST with CBT report pre- to post-intervention changes in psychopathic or CU traits; all suggesting these traits reduce with treatment. In the most recent MJTC sample of 127 male adolescents, Caldwell, McCormick, Wolfe and Umstead (2012) found total psychopathic traits scores improved (η^2=.37), as did scores on each scale of the APSD (CU traits η^2=.29, Narcissim η^2=.14, Impulsivity η^2=.34). Moreover, changes in psychopathy scores predicted improvement in other institutional behaviour and treatment compliance (β=-.71, $p<.01$). Nevertheless, no long-term outcomes were reported for this sample. Salekin, Tippey and Allen (2012) studied 24 juvenile offenders in a similar secure residential unit. Adolescents participated in a Mental Models programme which combined cognitive-behavioural, motivational, and metallization techniques with SEST and positive reinforcement. Psychopathy scores (APSD) reduced from pre- to post-intervention (Cohen’s d=0.67), and in line with Caldwell's (2011) finding, interpersonal characteristics (APSD Interpersonal facet) showed the greatest change (d=0.35). Callousness and impulsivity also improved, but only small effect sizes were found (CU traits d=0.10; Impulsivity d=0.12). No long-term follow-up is reported; therefore these improvements may only be short-term.

A case study of a 7-year-old boy with CD and co-morbid ADHD is presented by Datyner, Kimonis, Hunt and Armstrong (2016). The child had previously shown some improvements in CP following a parenting intervention and reward-based behaviour management aged 5 years (see Kimonis &

Armstrong, 2012 below). The later Coaching and Rewarding Emotional Skills (CARES) intervention used cognitive-behavioural strategies, social stories, parent modelling and role-play, and positive reinforcement to assist empathy and emotional development. The child showed improvements in CU scores (ICU), emotion recognition and empathic responding following this intervention. Most treatment gains appeared to be a reduction in callous behaviours (mother's report), while uncaring behaviours reduced less. However, the child's teacher reported only slight changes in both callous and uncaring behaviours. Furthermore, the child's mother reported problematic behaviours had returned to pre-treatment levels at a 24-month follow-up, suggesting improvements from SEST combined with CBT, as reported above, may only be short-lived.

5.4.2.3 Behaviour Contingency or Modification

Behavioural strategies, including token economies, point systems, and positive reinforcement, aim to decrease the child's inappropriate behaviour and increase appropriate behaviour. Variations of behavioural strategies are used across intervention approaches. Stepped-programmes allow the child to progress up or be demoted down levels of the programme based on their behaviour during treatment, with the highest level resulting in discharge. Reward-based behaviour management programmes have a strong emphasis on rewarding positive behaviours with little or no punishment given for negative behaviour.

Although behavioural strategies are often a component of interventions for delinquency and are included in other interventions presented elsewhere in this review, four studies were found which either had an intervention that focused on behaviour contingency through a stepped programme (Ridenour, Treloar & Dean, 2003; Rogers, Jackson, Sewell & Johansen, 2004) or analyses examined behavioural modification or components of behavioural modification separately (Miller et al., 2014; Waschbusch, Carrey, Willoughby, King and Andrade, 2007).

In a residential stepped behaviour contingency programme for juvenile offenders (*N*=28), Ridenour et al. (2003) found juveniles with high psychopathic traits (PCL-R) achieved lower contingency levels, had more setbacks, and showed more offences during the one year follow-up period. In a similar stepped programme for juvenile offenders in an inpatient hospital unit, Rogers et al. (2004) (*N*=82) found psychopathic traits (Survey of Attitudes and Life Experiences, SALE) did not predict time to discharge, but high psychopathic traits did predict more antisocial behaviour during treatment (β=.23, p<.0.01) and psychopathic traits was the only predictor of level of improvement (β=.24, p<.05) as reported by treatment staff, independent of CD symptoms. However, breadth of poly-substance abuse was a stronger predictor of antisocial behaviour during treatment and 25% of adolescents did show significant reductions in psychopathic traits over the duration of their stay, suggesting that some individuals with psychopathic traits may be amenable to this intervention approach. Nevertheless, no follow-up was conducted, therefore long-term outcomes are not known.

Miller et al. (2014) examined reward and punishment in 11 children with ADHD and clinical levels of co-morbid CU traits (APSD, ICU, and the Child Psychopathy Scale-Revised; CPS-R) in a Summer Treatment Program. Treatment was modified into four conditions: low punishment (moderate reward or neutral feedback with low punishment), high-reward (more opportunity to earn rewards, moderate punishment), combined (low-punishment and high rewards), and standard (moderate rewards and moderate punishment). Significant differences were found between treatment conditions for levels of negative behaviour (aggression, teasing, stealing) during sports activities (ηp^2=.37) and time-out (ηp^2=.64). Low-punishment and standard conditions showed the greatest improvements, with rates of negative behaviour in time-out at post-intervention close to zero for both conditions, and with no significant difference between the two conditions for either sports activity or time-out behaviours. The combined condition showed the most negative behaviour (Hedges g for combined condition with low punishment =.92 and 1.44, high reward =.92 and .84, and standard condition =.69 and 1.35, during sports activities and time-out respectively). However, there was substantial variability across the sample, with several children demonstrating improvement during the modified conditions.

Washbusch et al. (2007) studied 37 juvenile offenders in a Summer Treatment Program which included a behavioural points and reward system (and pharmacotherapy for some participants; reported below). Of the participants receiving behaviour modification alone, those with high CU traits (APSD) had poorer post-intervention scores compared to those with low CU traits, including more rule violations, more non-compliance, and more CP symptoms regardless of baseline levels of CP. Effect sizes comparing children with and without CU traits following behaviour modification were moderate to large (average Cohen's d=0.87 for negative behaviours, and d=-0.55 for positive behaviours).

5.4.2.4 Pharmacotherapy

Pharmaceutical drugs used to treat one or several symptoms of the child or adolescent's problematic behaviour.

Pharmacotherapy was included in six studies (Blader et al. 2013; Farmer et al., 2015; Kolko et al., 2009; Kolko & Pardini, 2010; Masi et al., 2013; Waschbusch et al., 2007), but no studies examining pharmacotherapy as a stand-alone intervention were found (older studies using pharmacotherapy which did not meet the inclusion criteria for the current review are summarised earlier in this chapter). Nevertheless, two studies examined the influence of pharmacotherapy with a comparison placebo condition, allowing the effects of a pharmacotherapy intervention component to be explored.

In Farmer et al.'s (2015) examination of the Treatment of Severe Childhood Aggression (TOSCA), Parent Management Training (PMT) was combined with either Risperidone or a placebo drug (N=188). Higher CU traits predicted better outcome on disruptive behaviour at post-intervention. However, there was no difference between the Risperidone and the placebo conditions. It is also worth noting that this study used a unique and non-validated measure of CU traits (items from Nisonger Child Behaviour Form, NCBRF; Child & Adolescent Symptom Inventory-4R, CASI-4R; and Kiddie Schedule for Affective Disorders and Schizophrenia, KSADS), which puts into question whether children who responded better to treatment were actually higher on CU traits as operationalised in other studies. In Waschbusch et al.'s (2007) study of a Summer Treatment Programme reported above, behaviour modification therapy with pharmacotherapy (Methylphenidate) showed better behaviour outcomes, in terms of CP and non-compliance, than behaviour modification with a placebo drug. There were negligible differences between outcomes for high and low CU traits (measured using the APSD in this study) in the pharmacotherapy condition (mean effect sizes for negative behaviours d=0.08, and positive behaviours d=-0.17), suggesting that unlike behaviour modification alone, behaviour modification with Methylphenidate may be an effective treatment option for antisocial youths regardless of level of CU traits. Nevertheless, all participants in this study had co-morbid ADHD, therefore improvements may be due to the effect of stimulant medication on ADHD symptoms and Methylphenidate may not how improvement in antisocial children without ADHD.

5.4.2.5 Psychotherapy

Individual or group talking therapy in which a psychotherapist helps patients to interpret and understand their own behaviour and motives.

Two older studies report mixed outcomes for psychotherapy as a stand-alone intervention for adolescents with psychopathic traits. In 1964, Craft, Stephenson, Granger and Clive (*N*=50) studied male offenders aged 13-26 years participating in small group psychotherapy on an inpatient hospital ward. Therapy took a non-directive approach with a council of staff and patients making joint decisions about how the unit should be run. Recreational activities and work occupational therapy were also included and good behaviour was rewarded with money to spend in the canteen. A comparison group were treated in a unit with a contrasting authoritarian approach. The unit had similar recreational activities and rewards, but took a firm approach with a hierarchical system of doctors and nurses and only superficial psychotherapy was available. Non-compliance on the authoritarian unit resulted in sanctions (e.g. removal of privileges or isolation). At post-intervention, there was no significant difference between groups in terms of self-reported psychopathy (MMPI) or behavioural adjustment scores and neither group showed significant improvement in psychopathy scores. However, the psychotherapy patients, but not the authoritarian unit patients, showed a significant improvement in social adjustment scores, while the authoritarian unit group showed greater obedience and more concern to please others than psychotherapy participants. Two years after treatment, the psychotherapy patients showed poorer clinical well-being and had significantly poorer re-admission and re-conviction rates than the authoritarian unit group. Significantly fewer authoritarian unit participants (25%) than psychotherapy participants (>50%) were considered by a magistrate or doctor to still need institutional care, suggesting that overall, the authoritarian approach was more effective for these individuals than psychotherapy.

Schmideberg (1978) reports a case study of a 16-year-old male with behaviour suggestive of psychopathy. The male received high intensive clinic-based psychoanalysis (daily sessions for 9 months). The therapist reports taking a sympathetic approach showing friendliness and indignation over the negative treatment the boy had received from his parents. The therapist concluded that the patient 'normalised'. He showed an increase in ability to experience guilt, developed career plans, found work, and formed meaningful relationships. In a letter to the therapist 10 years after therapy, the patient considered himself 'normal in every respect' and reported that he was 'truly happy'. As discussed above, early reports of psychopathic traits and intervention outcomes are difficult to evaluate due to the lack of well-established assessment tools and reliance on therapists accounts or self-reports.

5.4.2.6 Milieu Therapy

A therapeutic community in which participants are encouraged to take responsibility for themselves and their peers. Psychoanalytical techniques are also used. Milieu Therapy has been used to treat severe behaviour disorders based on the assumption that a change in the individual's environment, from a hostile and punitive background to a warm and affectionate one, is needed to make changes to the individual's personality.

Following Aichorn's (1918) early reports of success from his Milieu Therapy (see above), two more recent studies of residential schools using the same approach to treat delinquents were found and included in this review. Both programmes included academic and recreational activities, with an emphasis on a home-like, loving and secure environment and for staff to make personal relations with pupils, including eating together and socialising in a way that staff could be considered substitute parents, friends or leaders, with little attention given to negative behaviour. Both programmes showed improvements in participants' behaviour with no significant differences in response between pupils with high and low psychopathic traits. Nevertheless, in one study 'psychopathy' was based on the founder's own subjective diagnosis records, and the other study does not report how psychopathy was operationalised.

In an examination of the Mellansjö school-home for psychopathic children based in Sweden between 1928 and 1940, Fried (1995) reports on the outcomes of a sample of 242 boys and girls (20 considered by the founder to have high psychopathic traits) who were aged 4 to 18 years during their stay. The mean duration of stay was 2.1 years, after which time 67% of the full sample were considered to have improved or much improved and 17% were symptom-free, according to the founder's records, with no significant differences reported between pupils with high and low psychopathic traits. At a 30 year follow-up, 55% of male graduates and 89% of female graduates had not been convicted of a crime or been registered with alcoholism. Of the graduates considered to have high psychopathic traits, 63% had developed criminality and/or addictions as adults, but this was not significantly greater than those without psychopathy.

The Wyltwick residential school in the USA took a very similar approach. In a sample of 340 court-ordered juvenile males aged 9-13 years, McCord and Sanchez (1982) report that pupils with a general behaviour disorder or those considered to have psychopathic traits showed decreases in actual and fantasised aggression, an increase in internal control, and had a more realistic response to frustration. These pupils also showed a less hostile view of authority, increased feelings of guilt, and more positive self-perceptions. In comparison, neurotic or borderline psychotic boys showed no improvements. Moreover, after 18 months or more at Wyltwick School pupils showed better behaviour outcomes than pupils in a comparison discipline-oriented school (Lyman Training School) and had lower recidivism rates after leaving the school. However, beyond age 25, Wyltwick graduates had poorer recidivism rates than Lyman graduates. Nevertheless, only a minority of either sample did reoffend, and the higher proportion of youths from minority ethnic groups at Wytwick school may account for this longer-term poorer outcomes due to reduced opportunities in society.

5.4.2.7 Other child-directed interventions

Child-directed interventions which do not fall into any of the above categories or where not enough detail is provided to categorise the study by intervention type.

Full details of the sex offender treatment programme reported by Gretton, Mcbride, Hare, O'Shaughnessy, and Kumka (2001) (*N*=220) are not provided. Nevertheless, the authors report that five years after treatment, the odds that an adolescent in the high psychopathy group (PCL:YV) would commit an offense were between three and four times the odds that an adolescent in the low psychopathy group would commit an offense (general offense, 4.13, CI: 1.66-10.26; violent offence, 3.01, CI: 1.22-7.46; and sexual offense, 3.01, CI:1.03-8.76).

Two child-directed studies are distinctive from the others in this review in terms of the theoretical underpinnings of the intervention, intervention delivery, and research design. In 1970, Ingram, Gerard, Quay, and Levinson published a report of a novel intervention for the psychopathic delinquent. The programme was based on the sensation-seeking model of psychopathy and used an action-oriented approach, swapping traditional verbal therapies with non-verbal games and techniques to reduce boredom and improve engagement with therapy. While daytime hours were occupied with academic lessons and vocational training, each evening and weekend comprised of a novel recreational activity, such as slot car racing, athletic competitions and excursions, and psychodrama. The programme also used behavioural contingency with rewards for good behaviour and time-out for negative behaviour. Rewards were constantly changed to improve motivation. Youths had significantly fewer days in segregation, fewer assaultive offences, and fewer disciplinary transfers or instances of unauthorised leave, compared to psychopathic youths in a control condition. Qualitative reports from staff also showed positive results, including improvements in relationships with staff, and increased interest, attention, cooperation, and participation with the programme. While all participant were considered to have psychopathic traits, how psychopathy was operationalised in not reported in this study, therefore results may apply to antisocial youths more broadly rather than psychopathic or CU traits more specifically.

More recently, Frederickson et al. (2013) used both quantitative and qualitative methods to examine Let's Get Smart (LGS), a teacher-led intervention designed to addresses the neurocognitive profiles of children with CU traits. Teachers and pupils used classroom strategies throughout the school day to reduce demands on weaknesses including executive functions, emotion regulation, and communication. LGS also utilizes some cognitive-behavioural techniques and reward-based behaviour management with an emphasis on reducing sanctions. In a sample of 29 pupils, improvements in externalising behaviour were found for children with both high and low CU traits (ICU), but improvement did not differ between these groups. However, significant interactions between time and CU traits group were found for teacher-reported EF, in that only the low CU group showed improvement in behavioural regulation (η^2=.19) and metacognition (η^2=.21).

5.4.3 Parent-directed interventions

5.4.3.1 Parent Management Training (PMT)

One or both parents receive direct training in managing and modifying their child's problematic behaviour. Children are not directly involved in these therapy sessions. PMT aims to decrease child problematic behaviour, increase child prosocial behaviour, and improve child-parent *interactions. Skills are taught through modelling, role-play, feedback, and homework to practice the skills.*

Changes in psychopathic or CU traits following PMT as a stand-alone intervention were examined in five studies; all of which found both short and long-term improvements in child psychopathic or CU symptoms. Hawes and Dadds (2007) (*N*=56) found that the proportion of children with clinical CU traits (items from APSD and SDQ) at baseline, reduced from 50.0% to 22.5% following PMT (*d*=.49), and reduced further to 20.5% at a six month follow-up. Although the lack of control group makes it difficult to attribute these changes to the intervention, McDonald et al., (2011) (*N*=66) found that children with parents attending another PMT intervention, Project Support, had a greater reduction in parent-reported psychopathic symptoms (PSD) compared to those receiving no parenting or child behaviour services (TAU), while controlling for changes in CP (Cohen's *d*=.95). Improvements remained at a 20 month follow-up (baseline to follow-up Cohen's *d*=0.89), whereas TAU psychopathy scores worsened with time. Changes in psychopathy symptoms were mediated by mothers' parenting behaviour, providing further support that improvements in child behaviour were due to the PMT. Somech and Elizur (2012) (*N*=209) also found positive changes following the Common Elements programme, in which both parents receive PMT alongside couples' communication and self-regulation skills training. Compared to the control group, children in the treatment group showed significantly greater improvement on all outcome measures (*d*=.76), including improvement in CU traits (*d*=.85) (measured using scales from the APSD-preschool and ICU-preschool). Improvements remained at one-year follow-up, whereas the control group showed an increase in CU traits and an increase in parent distress. Again, improvements in children's behaviour (CP) were mediated by improvements in mother's inconsistent parenting and parental distress. In Scott, Briskman and O'Connor's (2014) evaluation of the Incredible Years programme, parents underwent a videotape version of PMT. Treatment was associated with improvements in parenting, parent-reported antisocial behaviour, and psychopathy traits (APSD) for clinic-referred children (*N*=93) with medium to large effect sizes (*d*=.70 to .90) at a 4-10 year follow-up. However clinical observations and teacher reports of CP did not show any significant improvement. Furthermore, in a high-risk community-sample (*N*=90) there were no improvements at follow-up on any outcome measure. The difference between outcomes for the clinic-referred and community sample was significant, controlling for baseline behaviour and demographics. The number of PMT sessions did not predict intervention outcomes.

CU traits as a predictor of CP or other behaviour outcomes following PMT were examined in four further studies. With the same sample as their study discussed above, Hawes and Dadds (2005; 2007) found CU traits were associated with a range of poor outcomes, independently of CP, following PMT and at six month follow-up. Parent reports suggest children with high CU traits were less responsive to time-out, reacting with less negative affect, compared to those with low CU traits. Furthermore, those with stable high CU traits had a poorer response to time-out than those with unstable high CU traits or low CU traits (η^2=0.14). However, CU traits did not influence parent-reported effectiveness of reward strategies. Using the same intervention, Hawes, Dadds, Brennan, Rhodes and Cauchi (2013) found that in a sample of 93 children, high CU traits (items from the APSD and SDQ) was associated with more severe ODD symptoms at the six month follow-up (β=.33, p< 0.05), independent of baseline symptoms and demographic variables. 12% of the low CU group and 27% of the high CU group with pre-treatment diagnostic ODD maintained full diagnostic ODD at post-treatment.

In Högström, Enebrink and Ghaderi's (2013) study, parents of 57 children participated in a five hour internet-based PMT programme, CoMet. Following the intervention, there was no significant difference between parenting skills of children with high CU traits and children with low CU traits (APSD) nor was there any improvement in behaviour for either group according to one parent-report measure (Strengths and Difficulties Questionnaire; SDQ). However, on the parent-reported Eyberg Child Behavior Inventory (ECBI), children with low CU traits showed a 25% reduction in CP intensity, whereas children with high CU traits showed no improvement in parent-reported CP (η^2=.14). Nevertheless, parents report that the actual number of everyday problem areas had decreased significantly for children with low CU traits and those with high CU traits.

5.4.3.2 Other parent-directed interventions

Parent-directed interventions also include brief parent consultation meetings in which the child's behaviour and related family issues are discussed, or programmes which primarily address communication and interactions between parent-child dyads, where the parent(s) are the direct recipient of therapy.

In Kimonis, Bagner, Linares, Blake and Rodriguez's (2014) study, 63 families participated in Parent-Child Interaction Therapy (PCIT). PCIT consists of highly rewarding child-led play (Child–Directed Interaction phase; CDI) followed by parent-led play with consistent punishment for non-compliance (Parent-Directed Interaction phase; PDI). Children were grouped into high and low CU-traits, assessed using items from the Achenbach System of Empirically-Based Assessment (ASEBA). Following the CDI phase, there was no significant difference in outcomes for children with high and children with low CU traits. However, following the full PCIT (i.e. CDI and PDI) children with high CU traits had significantly more CP symptoms compared to children with low CU traits, controlling for baseline CP. Nevertheless, this difference between high and low CU traits was found for children with co-morbid developmental delay (β=.57, p<.01), but not for children who were only at risk of developmental delay (β=-.15, n.s.). Using the same intervention, Kimonis and Armstrong (2012) present a case study of a 5-year-old boy with CD and ADHD (same individual reported in Datyner et al., 2016). Reports from the child's mother suggest PDI was ineffective, in that the child rarely complied with time-out. Nevertheless, when a reward-based behaviour modification component was introduced, CP improved. However, non-compliance and verbal aggression continued. At the five month follow-up, the boy's mother's report using the ICU showed that some CU symptoms had improved, such as expression of emotions and feelings of remorse, but improvements were not reported for concern about other people's feelings or school performance.

The Family Check-Up (FCU) is a brief preventative intervention for young children at high risk for CP (Hyde et al., 2013). Parents meet with a consultant to raise concerns for their child's behaviour and discuss current family issues that are critical to their family's functioning. The FCU involves an initial contact meeting, an assessment meeting, and a feedback session with the option for follow-up sessions. In the feedback session, motivational interviewing techniques are used to highlight parenting strengths and also those needing attention. Referrals to appropriate services can be made and parents are given the choice to participate in follow-up sessions that use PMT techniques. In a longitudinal RCT with a large community sample of 731 parents of young children, improvements in children's problem behaviour after four years did not differ between children with high CU traits and children with low CU traits. Nevertheless, a non-validated measure of CU traits, using selected items from the Child Behaviour Checklist (CBCL), the

Eysberg Child Behaviour Inventory (ECBI) and the STRS (adapted for use by parents) was used, making it difficult to draw firm conclusions about the influence of CU traits as operationalised elsewhere on treatment outcome.

5.4.4 Combined parent and child interventions

5.4.4.1 Family Therapy

Interventions in which the youth's behaviour is explored within the context of the family, and family issues beyond parent management of behaviour are addressed (e.g. family mental health, marital conflict, and family finance). Family interventions are typically carried out in the home or community with both the child and parent(s), and sometimes other family members, present.

Two studies report CU traits as a predictor of CP or other behaviour outcomes following family therapy. Dembo, Wareham, Poythress, Cook and Schmeidler (2006) report outcomes following a 16 week in-home case management service for juvenile offenders and their families (*N*=164). CU traits (APSD and YPI) was negatively associated with the number of days until first re-arrest, and significantly predicted more arrests during a 12 month follow-up period, after controlling for baseline demographics. However, no significant difference in recidivism rates was found between the intervention group and TAU when controlling for other offense factors and psychosocial factors. In an alternative family intervention for juvenile offenders, Functional Family Therapy (FFT), White, Frick, Lawing and Bauer (2013) (*N*=134) found youths with high CU traits (ICU) still had the poorest adjustment and greatest violent offending following FFT compared to those with low CU traits. However, in contrast to most other studies, CU traits were associated with greater improvements in parent-reported CP (r=.27, p<.01) and aggression (r=.40, p<.001) and child-reported emotional symptoms (r=.24, p<.05), but was not significantly associated with change in interpersonal relationships.

5.4.4.2 Multimodal or Multisystemic Treatment (MST)

Parent interventions, such as PMT, and child interventions, such as SEST and CBT, can be combined into a multimodal programme. MST in particular takes a whole-systems approach, viewing the youth's behaviour problems as embedded in family, peer, and community systems. MST programmes typically address family relationships, peer affiliations, and school functioning through intense contact with youths and their families.

Changes in psychopathic or CU traits following a multimodal intervention were examined in five studies. Kolko et al. (2009) studied a weekly multimodal intervention for children with CD or ODD (*N*=208) comprising of either community or clinic-based PMT and family therapy alongside child CBT, social skills training, pharmacotherapy (for ADHD symptoms), crisis management and school programming. Significant improvements in CU traits (APSD) were found at post-intervention (*d*=0.44) and a three-year follow-up (*d*=0.48). Furthermore, at follow-up, 36% of the community group and 47% of the clinic group no longer met criteria for ODD or CD. However, in Kolko and Pardini's (2010) later study (*N*=177) of the same treatment which included a comparison group, no significant difference in treatment response was found between the intervention group and TAU (family therapy, pharmacotherapy and some child therapy) and CU traits (APSD) did not significantly predict any outcome when controlling for baseline measures. In Lochman et al.'s (2014) study of a preventative multimodal programme (Abbreviated Coping Power), 241 families of high-risk children underwent PMT, family psychoeducation, and child CBT and social skills training. Some children were also taking medication for ADHD symptoms. Externalising problems, proactive and reactive aggression, CU traits (APSD) and impulsivity (but not narcissism) improved significantly more than the TAU group. Children who attended a follow-up CBT session did not differ in treatment outcomes compared to those not attending the booster session. Shenk, Dorn, Kolko, Rausch and Insana (2014) studied the effect of interpersonal violence (IPV) on treatment outcomes in a sample of 66 children with ODD or CD. Families underwent community or clinic PMT, family therapy and child CBT. As in Kolko et al. and Lochman et al.'s studies, disruptive behaviour improved after this multimodal intervention. However, change in CU traits (APSD) was dependent on prior IPV. Those without prior IPV showed an improvement in CU traits, whereas CU traits did not change in the group with prior IPV (change in CU traits by IPV group *d*=0.88). Following MST with adolescent offenders, Butler, Baruch, Hickey and Fonagy (2011) (*N*=108) found parent-reported psychopathy scores (APSD) improved significantly more than TAU (non-family based interventions) (Hedge’s g=0.53, 95% CI: 0.14, 0.93; Hedge’s g =0.06, 95% CI:-0.34, 0.47 for MST and TAU respectively). However, self-reported psychopathy scores (APSD) showed no improvement in either group.

Two studies examined changes in CU traits and CU traits as a predictor of other behaviour outcomes following a multimodal intervention. In Manders and colleagues' study, 256 adolescents and their families were randomly assigned to MST or TAU (array of social and mental health treatments usually offered to juvenile delinquents) for 4-6 months (Manders, Deković, Asscher, van der Laan & Prins, 2013). Narcissism and Impulsiveness subscales of the APSD were found to improve from pre- to post-intervention, but there was no significant improvement in CU symptoms (ICU). Moreover, there was no significant difference in improvements in any psychopathic facet between the intervention group and TAU, indicating that MST was not more effective than TAU in decreasing psychopathic traits. However, the intervention group had significantly better behaviour outcomes than TAU, but this was only the case for youths with low psychopathic traits (d=0.44, 95% CI: 0.19, 0.69, and d=0.43, 95% CI: 0.18, 0.68, for adolescent-reported and parent-reported externalising problems respectively). Blader et al. (2013) found that children involved in a family-based psychosocial intervention (Community Parent Education Program) combined with child pharmacotherapy (methylphenidate) (N=160) showed reduced aggression and CU traits (APSD). However, 7.46% who were classified as not meeting the criteria for the CU specifier at baseline, did meet criteria for the CU specifier at the end of treatment (i.e. CU symptoms worsened for these participants). 42% of children with high pre-treatment CU traits met criteria for aggression remission; however this was not significantly different to remission rates for low CU participants (53%) (OR=0.94, 95% CI: 0.80, –1.11).

CU traits as a predictor of CP or other behaviour outcomes following a multimodal intervention were examined in four further studies. Spain, Douglas, Poythress and Epstein (2004) studied 85 juvenile offenders housed in a secure residential treatment facility for 9-12 months. The programme primarily used a multi-step reward system, but also included family therapy, academic classes and career counselling. As in Butler et al.'s study, different outcomes were found between adult-reported and self-reported psychopathy symptoms. However, in Spain et al.'s study, clinician assessed psychopathic symptoms (PCL:YV) did not predict treatment outcomes, while youths with self-reported high psychopathic traits (APSD and the Childhood Psychopathy scale, CPS) did. All subscales and the total score of the CPS were significantly related to each type of disciplinary infraction during treatment, with effects of moderate size for most outcomes (r=0.30+). The APSD also correlated with most disciplinary incidents, with significant correlations ranging in size from 0.25-0.40. The CPS Affective factor also significantly predicted whether a participant would drop a treatment level due to misbehaviour or non-compliance (OR=2.20), but no other subscale of any psychopathy measure significantly predicted this. Finally, most subscales scores on the self-reported APSD and CPS were significantly positively correlated with time to treatment level promotion (r=0.21-0.31), but the clinician assessed PCL:YV was not.

In a multimodal intervention of PMT with child social and cognitive skills training and some children receiving pharmacotherapy, Masi et al. (2011) report that 55.3% responded to treatment while 44.7% were non-responders based on the Clinical Global Impression scales of functional impairment. Non-responders had higher CU traits (APSD and ICU), but these differences did not survive a Bonferroni correction for multiple comparisons. Masi et al. (2013) found pre-treatment CU (APSD) was the only significant predictor of non-response (OR=1.3, 95% CI:1.1-1.6, p<.05). 60% of children with low CU traits compared to 35% of children with high CU traits showed improvement, controlling for other variables.

A recent study by Farmer et al. (2015) examined the effect of Risperidone on children with disruptive behaviour and co-morbid ADHD (N=168). Although all families received parent training and stimulant medication for child ADHD symptoms, only half the sample also received Risperidone (the other half received a placebo drug). Higher CU traits (Items from NCBRF, CASI-4R, and KSADS) predicted better treatment outcome (parent-reported disruptive behaviour), however there was no difference in outcomes between the Risperidone and placebo groups.

5.4.5 Intervention satisfaction, engagement, and attrition

Engagement or user satisfaction with the intervention was reported in several of the studies. Hornsveld and Kraaimaat (2011) report that parents did not support their child's therapy, with many parents regarding the decision of the court for children to attend Aggression Control Therapy as a judicial error. Scott & Weems (2014) reports that families in the Incredible Years PMT programme attended just 55% of sessions offered and Kimonis et al. (2014) reports that 35% of families in Parent-Child Interaction Therapy dropped out of treatment before post-intervention assessments were carried out.

In contrast, Somech and Elizur (2012) found that holding between-session check-ups during their PMT intervention enhanced parent engagement. 100% of mothers and 86% of fathers attended at least 10 of the 14 sessions. At a one-year follow-up, 96% of parents in the treatment group reported that they were satisfied with change in the child's behaviour. Datyner et al.’s (2016) case study of SEST and CBT report that the child's mother appeared motivated and completion of the Therapy Attitude Inventory showed she had a positive attitude towards the therapy. Salekin's (2012) report of SEST and CBT Mental Models intervention found that 100% of youth participants reported they believed the programme was helpful, 96% said they appreciated staff and liked the sessions, and 100% of staff reported that youth spoke of appreciating the programme.

Both Hornsveld and Kraaimaat's (2011) and O'Neil et al.'s (2003) studies of child SEST and CBT interventions found that higher psychopathic traits was associated with poorer attendance and higher attrition from treatment. White et al.'s (2013) study of Functional Family Therapy did not find CU traits to be associated with attrition. However, CU traits were found to be associated with less perceived change over treatment by youths and their parents (even though parent and child measures suggest high CU traits had the greatest change).

Gretton et al. (2001) found that of those with high PCL:YV scores, only 30% who completed the programme reoffended compared to 80% of adolescents with high PCL:YV scores who did not complete treatment. Importantly, this implies that adolescents with high psychopathic traits do benefit from treatment, but only if they attend the full programme, i.e. poor success rates may be due to high drop-out of participants with high psychopathic traits.

5.5 Discussion

5.5.1 Can interventions reduce psychopathic or CU traits?

Despite concerns that psychopathy may be untreatable, this extensive review has found evidence from a number of intervention approaches that psychopathic or CU trait symptoms in childhood and adolescence are amenable to change.

Evidence from interventions which work directly with the child or adolescent suggest that social and emotional skills training (SEST) combined with cognitive behavioural techniques and reward-based behaviour management (RBBM) can improve CU symptoms (Caldwell et al., 2011; Salekin et al., 2012; Datyner et al., 2016). Nevertheless, changes in CU symptoms have not been reported in studies of any of these treatment approaches alone, therefore it is not known which of these components (SEST, CBT, or RBBM) are having a positive effect on these youths or whether it is the combination of these approaches that is needed to make changes in CU symptoms. Moreover, long-term effects of these interventions are mainly unknown, and one case study suggests that improvements from one such intervention may only be short-term (Datyner et al., 2016).

There is some suggestion that youth psychotherapy can improve symptoms of psychopathy (Schmideberg, 1978). However, this dated study relied on one therapist's report of a single patient and objective measurable treatment outcomes were not used. Furthermore, the only other study of youth psychotherapy found that group psychotherapy did not improve psychopathy symptoms (Craft, Stephenson, & Granger, 1964). The limited evidence of the benefits of psychopathy to reduce CU or psychopathic traits may be due to the individual's level of motivation to change, their emotional engagement, and the therapeutic relationship required in psychotherapy. It has been reported that psychopathic individuals do not view their behaviour as undesirable and they have a tendency to make external attributions for their problems (i.e. blame others) (Hare & Thorvaldson, 1970; Ingram, 1990). As a result, these individuals likely lack motivation to change and are more likely to just go-along with therapy rather than engage emotionally with the process. It has also been reported that psychopathic characteristics of manipulation and deceit make it difficult for the therapist to form a relationship with the patient (Atkinson & Tew, 2012; Kiehl & Hoffman, 2011; Salekin, 2006; Skeem, Polashek, & Manchak, 2009). Nevertheless, since only early studies of the effectiveness of psychotherapy were found, it is difficult to draw firm conclusions about this intervention approach. In particular, findings from studies with young psychopathic participants must be treated with caution, since the early conceptualisation of youth psychopathy is likely to differ to the modern operationalisation of psychopathic or CU traits. Indeed, the concept of CU traits had not been put in place, nor were well-established assessment tools for these traits in children and adolescents available.

More reliable and consistent evidence of improvements in psychopathy symptoms comes from parenting interventions. All six studies examining psychopathic traits following PMT found a reduction in these symptoms, with evidence of both short and long-term improvements (Hawes & Dadds, 2005; 2007; Kimonis & Armstrong, 2012; McDonald et al., 2011; Scott et al., 2014; Somech & Elizur, 2012). Furthermore, both studies that compared PMT to TAU, found the intervention group had greater improvements in psychopathy symptoms than the TAU group

(McDonald et al., 2011; Somech & Elizur, 2012). Despite these encouraging findings, it should be noted that these studies predominantly relied on parent-reports. Parents may show a particular bias in evaluations of parenting interventions, as they are the main recipients of the intervention and therefore may have a tendency to over-report improvements due to a belief that outcomes are a reflection of their own success or effort to change their parenting practice. Indeed, in one of these PMT studies, parent-reports showed improvements, while observations of parenting and self-reported and teacher-reported child behaviour did not show improvements (Scott et al., 2014).

While modular programmes which combine child and parent interventions show some positive findings in terms of reductions in CU traits, results were mixed and can be difficult to interpret due to the variability in intervention components, research design used, and limited long-term reports. In the two studies evaluating a modular intervention of PMT or family therapy combined with child pharmacotherapy, CU symptoms were shown to improve (Blader et al., 2013; Farmer et al., 2015), but neither study carried out a follow-up assessment. MST was found to show improvements in CU symptoms in one study (Butler et al., 2011), but long-term outcomes for CU traits were not reported. Another found improvements in some psychopathy facets (narcissism and impulsivity), but not in CU traits specifically (Manders et al., 2013) and again, no follow-up is reported. Furthermore, each of these studies relied on parent-reports alone, which should be interpreted with caution due to bias. Indeed, Butler et al. (2011) found improvements from parent-reports, but self-reported behaviour did not change.

5.5.2 Are youths with high CU traits responsive to treatment and do levels of these traits influence treatment outcomes?

Some evidence that youths considered to have high levels of psychopathy or CU traits are responsive to intervention was also found. Findings from the current review suggest that youths with high CU traits are responsive to social, emotional and cognitive skills training and RBBM, either as stand-alone interventions or combined (Caldwell et al., 2006; Dadds et al., 2012; Frederickson et al., 2013; Ingram et al., 1970; Miller et al., 2014; Rogers et al., 2004). However, most of these studies did not report any follow-up outcomes. Nevertheless, those that did, found intervention benefits were notable 6-24 months later (Caldwell et al., 2006; Dadds et al., 2012). Importantly, attrition from these child-based interventions was reported as greater for youths with high psychopathic traits in two studies (Hornsveld & Kraaimaat, 2011; O'Neill et al., 2003), therefore it is possible that these individuals may miss out on the opportunity to benefit from treatment.

Despite some evidence of improvements for youths with high psychopathic traits, the evidence also suggests that youths with these traits have poorer outcomes than those with low psychopathic traits. This includes greater recidivism and antisocial behaviour following child-directed SEST and RBBM (O'Neill et al. 2003; Ridenour et al., 2003; Rogers et al., 2004; Waschbusch et al., 2007) and greater substance abuse following a sex offender programme (Gretton et al., 2001) compared to antisocial youths without psychopathic traits. Similarly, while children with high or low CU traits showed improvements in externalising problems following Frederickson et al.'s (2013) evaluation of the school LGS programme, only those in the low CU group showed improvement in EF deficits.

However, there is a similar body of evidence suggesting that CU traits do not predict child-directed intervention outcomes, both short and long-term (Caldwell et al., 2007; Fried, 1995; Waschbusch, Walsh, Andrade, King, & Carrey, 2007). Moreover, one study found that after controlling for CD, children with high CU traits had greater improvements in CP and affective empathy than those with low CU traits 6 months after an SEST intervention, with small to medium effect sizes reported (Dadds et al., 2012) and youths with high psychopathic traits were found to show greater outcomes following Milieu therapy in terms of aggressive behaviour, self-regulation, feelings of guilt, and self-perceptions, compared to those with other behaviour disorders (McCord & Sanchez, 1985). There was also some evidence of long-term benefits in this study, including low recidivism rates 25 years later. However study limitations in terms of early operationalisation of psychopathic traits, neurotic and psychotic traits of individuals in the non-psychopathic comparison group, and differences in ethnicity between groups, makes this evidence difficult to interpret.

Results from most of the studies examining the role of psychopathy traits in intervention outcomes following PMT suggest that youths high in these traits have poorer intervention outcomes, both short and long-term, than youths low in these traits (Hawes & Dadds, 2005; 2007; Hawes et al., 2013; Högström et al., 2013). Again, this was not for all behaviour outcomes (Hogstrom et al., 2013). However, the type of outcome and the tools used to measure these may influence the findings, as CU traits predicted behaviour on one parent-reported measure, but not another in Högström et al.'s (2013) study. CU traits did not predict intervention outcomes following a parenting consultation intervention (Hyde et al., 2013), but it is difficult to compare this with findings from PMT studies as it was a brief three session check-up programme.

The role of psychopathy symptoms on family therapy was unclear, with one study finding youths with high CU traits had the poorest outcomes (Dembo et al., 2006), while the other found high CU traits had better outcomes than youths with low CU traits 6-12 months later (White et al., 2013). Similarly, parenting interventions combined with child pharmacotherapy have shown no intervention outcome differences between high and low CU traits in one study (Blader et al., 2013), while another found high CU showed better outcomes than low CU (Farmer et al., 2015). However, no long-term outcomes are reported for either of these pharmacotherapy evaluations.

Studies examining the effect of CU traits on MST or other modular intervention outcomes found parent- and self-reported high CU traits had poorer outcomes than youths with low CU traits (Manders et al., 2013; Masi et al., 2013; Spain et al., 2004), but clinician-assessed or teacher-reported traits did not influence outcomes (Kolko & Pardini, 2010; Spain et al., 2004). Again, this could be due to differences in reporting of the direct recipients of this type of treatment (i.e. youths and parents) compared to outsider reports, and highlights the need for a multi-informant approach when evaluating intervention outcomes. The influence of CU traits on long-term outcomes for MST or other modular interventions are also needed, as of those included in this review, only Kolko and Pardini (2010) conducted a follow-up.

Overall, there is evidence to suggest that children and adolescents with high psychopathic or CU traits may not respond to treatment as well as youths with low psychopathic or CU traits. However, there is also evidence to suggest that even youths high in these traits can respond to child-directed, parent-directed and combined interventions to a certain extent and therefore these individuals should not be set aside as untreatable. Nevertheless, follow-up studies are needed to evaluate the long-term effectiveness of these interventions. Importantly, despite concerns that interventions for individuals with psychopathy may have an iatrogenic effect, i.e. increase problematic behaviour (Bayer, Pintoff, & Pozen, 2004; Rice, Harris, & Cormier, 1992), this review found no evidence of negative effects of intervention. This finding offers support to arguments that there is not enough evidence to suspect treatment has damaging effects for these individuals (Tanasichuk & Wormith, 2007; D'Silva, Duggan & McCarthy, 2004; Kiehl & Hoffman, 2014) and suggests we should not be deterred from trying to treat these individuals in fear of worsening the problem.

5.5.3 Do other individual characteristics of youths with CU traits influence intervention outcomes?

Perhaps due to the small sample sizes of youths with psychopathic or CU traits, analyses of the influence of other characteristics of these individuals on intervention outcomes were scarcely found. In particular, few studies compared analyses by age or gender, and those that did lacked statistical power. For example, Dadds et al. (2012) found that when the sample was split by gender, ERT was associated with a significant reduction in CP for high CU traits males, but not females. However, the analysis of females lacked statistical power. Fried (1995) found males had poorer outcomes in terms of criminality and addictions in a 10-40 year follow-up of Milieu Therapy, but did not control for baseline gender differences. Nevertheless, there is some evidence to suggest that there may be further individual characteristics of these individuals which influence treatment outcome. For example, improvements following intervention were seen for youths with developmental delay but not those at risk of developmental delay, and for clinic-referred children but not children in a high-risk community sample in Scott et al.'s (2014) evaluation of a videotaped version of the Incredible Years PMT programme. Similarly, Shenk et al. (2014) found improvements in CU symptoms following a modular PMT, family therapy, and child CBT intervention, were only seen for youths without a history of family violence.

Ethnicity was also found to play a role in treatment response of psychopathic youths, with participants from minority ethnic groups (Black, Hispanic, and French Canadians) showing poorer long-term recidivism rates than White participants following Milieu therapy (McCord & Sanchez, 1985). The authors conclude that while White graduates were likely welcomed back into society, Blacks, Hispanics, and French Canadians did not have established communities to return to and were given few opportunities in terms of education, jobs, and housing. The finding that such individual differences may influence outcomes for individuals with psychopathic traits, emphasises the importance of considering long-term outcomes in the evaluation of treatment approaches. Reintegration into society following treatment, where a supportive and 'safe' environment is no longer present, may not effectively counteract the negative influences of society on some individuals with psychopathic traits.

This review found evidence to suggest that different dimensions of psychopathy may respond differently to treatment. Psychopathy itself is comprised of a number of symptoms or broader facets as depicted in the PCL:YV (interpersonal, affective, lifestyle, and antisocial) and the APSD (callous and unemotional, narcissism, and impulsivity). Symptoms of the interpersonal facet of psychopathy (e.g. glibness, grandiosity, lying, and manipulation) have been found to show greater improvement than other facets following social skills training combined with cognitive techniques and RBBM (Caldwell et al., 2011; Salekin et al., 2012). Differences in APSD subscales have also been found, with all three dimensions showing improvements with treatment in some studies (e.g. Caldwell, et al., 2012), while some, but not all, dimensions have improved in others (Lochman et al., 2013; Manders et al., 2013). Further, one study found evidence to suggest that youths with the most stable CU traits are less responsive to treatment than those with unstable CU traits (Hawes & Dadds, 2007).

Each of these findings come from just one or two studies and need replicating to draw firm conclusions. However, they do highlight the need for continued consideration of individualisation in terms of developing and evaluating interventions for children with antisocial behaviour, even beyond the CU traits subtype. In other words, not all children with high CU traits can be assumed to respond to treatment in the same way, nor can each symptom or facet of the youth’s traits necessarily be improved with treatment.

5.5.4 Which components of interventions are effective in treating CU traits?

By considering which components or features of an intervention result in changes in children and adolescents with psychopathic or CU traits we can further our understanding of the aetiology of psychopathy and inform the development of future interventions.

In this extensive review, very few studies were found which examined individual components of interventions. However, the role of reward and punishment strategies within intervention programmes was explored in several studies and the results are mainly consistent with the theory of a reward-dominance in individuals with high psychopathic traits (Blair, 2013; Frick, et al., 2003; Frick et al., 2014). Punishment, in the form of time-out, was found not to reduce behaviour problems or CU symptoms, however use of reward strategies did (Hawes & Dadds, 2005; Kimonis & Armstrong, 2012; Miller, 2014). Furthermore, youths with high CU traits had a poorer response to time-out strategies than those with low CU traits, whereas there was no significant difference between high CU and low CU participants in response to reward strategies (Kimonis et al., 2014; Hawes & Dadds, 2005). This supports the idea that youths with high CU traits are less sensitive to punishment, while reward strategies work equally well for high and low CU traits. A high drive for self-gain alongside low fearful inhibitions (Frick et al., 2003; Hawes and Dadds, 2005) may make children with CU traits more responsive to reward-based interventions or reward-based components of interventions and less responsive to those using punishment (Manders et al., 2013). Nevertheless, one study found substantial individual variability in treatment response, and although a low punishment condition showed the greatest improvements, the poorest outcomes were found following a condition which combined low punishment with high rewards (Miller, 2014). However, the different conditions in this study were run consecutively with the same participants; therefore order effects may have influenced behaviour. A counterbalanced or between-groups design is needed to explore this further.

Some evidence was also found that adding pharmacotherapy to a behaviour management programme improved outcomes and, while BM alone was more effective for ADHD children with low CU traits than high CU traits, the addition of Methylphenidate resulted in equal outcomes for ADHD children with high CU traits and low CU traits in Washbusch et al.'s (2007) study. This finding suggests that children with co-morbid ADHD and CU traits may not show a sufficient response to behaviour therapy alone, but that a combination of behaviour therapy and pharmacotherapy may be especially important for this group.

Salekin's (2002) review of interventions for adults with psychopathy suggested several features of interventions that are associated which improved treatment outcome. These include combining individual and group therapy, the inclusion of family members, and greater frequency and duration of therapy. In the current review, similar evidence was found to support the idea that longer duration of treatment improves outcomes (Caldwell et al., 2007). However, Scott et al. (2014) found that the number of PMT sessions did not predict intervention outcomes. Furthermore, youths attending a follow-up CBT session in Lochman et al.'s (2014) study did not differ in treatment outcomes compared to those not attending a booster session. Other characteristics of interventions, such as those in Salekin's review, still need exploring in interventions for children and adolescents, as modifications to the delivery format of current interventions may influence their effectiveness.

5.5.5 Methodological limitations of intervention studies for CU traits

As documented previously, studies of intervention outcomes for psychopathy or CU traits have many methodological limitations (D'Silva, Duggan & McCarthy, 2004; Rice & Harris, 2006; Salekin, 2006). This has led to publications not being included in previous reviews. With a wider inclusion criterion in the current review, it is important that these limitations are considered before making conclusions.

A prevailing limitation was the lack of control group and the variability of treatment as usual (TAU) conditions (only 40.0% of studies included a no intervention or TAU group). For those that did include an intervention comparison group, TAU varied from minimal support (e.g. academic schooling and recreational activities; Coleman et al., 1992; Miller et al., 2004) or referrals to community care (Somech & Elizur, 2012) to a host of psychological services (e.g. family and/or play therapy with pharmacotherapy; Kolko & Pardini, 2010). Therefore, it should not be assumed that TAU is equivalent across studies, and many had overlapping intervention components with the treatment group (e.g. Kolko & Pardini, 2010). Furthermore, some reports did not provide sufficient detail about the TAU to make clear comparisons between groups.

There are also limitations in terms of the characteristics of participants included in these studies. Firstly, females were underrepresented (42.2% of studies included males only); a common occurrence in studies of behavioural disorders. Although CP and CU traits are male dominant disorders, high CU traits have been reported in females (Buckley, 2013; Fontaine, Rijsdijk, McCrory, & Viding, 2010; Gill & Stickle, 2016) and there is evidence that females with behaviour problems may have more problematic symptoms than males (Gill & Stickle, 2016; Masi et al., 2008; Maughan et al., 2004). Therefore females need to be included in intervention evaluation studies and, where possible, analyses should examine any gender differences in response to treatment. Secondly, participants were reported to have co-morbid ADHD in several studies in the current review (e.g. Farmer et al., 2015; Kimonis & Armstrong, 2012; Miller et al., 2014). Co-morbidity was not an exclusion criteria for this review, as co-morbidity is known to be high in children with CP (e.g. Masi et al., 2008). Nevertheless, it must be noted that results from these studies may be due to the effectiveness of the intervention on symptoms of ADHD rather than CU traits per se. Furthermore, in some studies, some children were taking medication for ADHD symptoms (e.g. Lochman et al., 2014), making it difficult to conclude that changes in behaviour were due to the intervention under evaluation rather than the medication. Furthermore, most studies relied on a single-informant to assess psychopathic or CU traits (68.9%), meaning the identification of youths with high and low psychopathic or CU traits may not be reliable in itself.

Moreover, these results need to be considered in the context of the 'real world'. This may be especially the case for intensive residential interventions, as residents may not generalise their improved behaviour to life outside the facility, especially when faced with previous environmental triggers for their negative behaviour and without the support received while in therapy (Howells, 1986). Indeed Blud, Thornton and Ramsey-Heimmermann (2003) found individuals with high psychopathic traits were less likely to maintain and generalise skills learnt in treatment than those with lower psychopathic traits. Despite this, 40% of included studies did not report a follow-up; therefore we do not know whether any improvements in these studies had lasting-effects beyond the intervention period. While some of those that did include a follow-up found continued long-term improvements (e.g. Hawes & Dadds, 2005; 2007, Hawes et al., 2012; Lochman et al., 2014), others found improvements disappeared (e.g. Datyner et al., 2016). Therefore the stability of these improvements is important to consider when drawing conclusions about the success of an intervention.

Finally, several studies had missing information, reducing the ability to draw firm conclusions from the results. Three studies did not say how psychopathic traits were operationalised; four studies did not specify who the informant/s for the assessment of psychopathic or CU traits was; five studies did not provide the age of participants; three did not report the gender of participants, and the setting of the intervention was not specified in several studies.

5.5.6 Strengths and limitations of the current Systematic Review

The broad inclusion criteria and the systematic search for the current review allowed an extensive and up-to-date examination of intervention outcomes for children and adolescents with psychopathic or CU traits. The inclusion of 45 studies demonstrates the restrictive content of previous reviews. For example, nearly 50% of all studies included examined child-directed interventions, which were not included in Hawes and Dadd's (2013) review. Similarly, the majority of studies (60%) were published in the last five years, which, in addition to the recent DSM-5 inclusion of the limited prosocial emotions specifier (APA, 2013), demonstrates that an up-to-date review of the literature was needed. While a recent review of this literature has been published (Wilkinson et al., 2016), the current work extends this report by considering the effectiveness of individual intervention components, the influence of individual differences on intervention outcomes within the CU traits subtype, and the particularly problematic issue of engagement and attrition from treatment.

While one of the aims of the current review was to be more inclusive than those conducted previously, this extensive examination of all intervention types and methodological designs comes with its limitations. In particular, large differences between studies made direct comparisons between results difficult. Studies ranged broadly in terms of the research design, sample size (1-731 participants); age of participants (3-26 years); and the duration and frequency of treatment (three stand-alone sessions to daily sessions over three years). The operationalisation of psychopathic-traits and outcome measures also varied between studies. While most used the well-established APSD (51%), PCL:YV (18%), or the ICU (18%) (or items from these measures) to identify psychopathic or CU traits, 27% of studies used some other measure, or a combination of items from these and other measures.

Indeed, one key difference between the current review and that of previous reviews was the inclusion of studies which use a range of measures, including self-created measures, of psychopathic traits. While this made studies difficult to compare, some of these measures (e.g. combining items from the APSD and SDQ) actually show superior internal reliability to the more mainstream APSD (e.g. Dadds et al. 2012; Hawes & Dadds, 2005; 2007; Hawes et al, 2013), and therefore these studies should not be disregarded based on their use of these non-typical measures. This broader inclusion criteria also helped to shed light on a possible reason for some of the mixed finings in the literature. In particular, evidence was found which demonstrated that while some dimensions of psychopathy are responsive to treatment, others may not be (Caldwell et al., 2011; Lochman et al 2013; Manders et al., 2013; Salekin et al., 2012). It is therefore plausible that characteristics measured by one instrument may be responsive to treatment while those measured by another may not. This could result in different conclusions being drawn about the effectiveness of an intervention between studies using different measurement tools (Salekin, 2012). Similarly, when examining the influence of CU traits on intervention outcomes, classification of high CU traits varied between studies, both through the use of different measurement tools and through different criteria for high psychopath being used across studies using the same measurement tool. For example, Miller et al. (2014) classified high psychopathy as APSD total scores above 65; Dadds et al. (2012) defined high CU traits as participants with APSD scores in the top 50% of the sample; while Kolko and Paridni (2010) used scores from the CU subscale of the APSD only.

Similarly, unlike Harris and Rice (2006) who argued that only studies examining recidivism should be considered, the current review included publications with a wide variety of outcome types and a range of measurement tools used to assess these. Indeed, recidivism is probably not the most useful criterion for assessing effectiveness of interventions for youths, since children may have psychopathic or CU traits, but not yet have committed crimes. By broadening this criteria, it was possible to consider associated characteristics and behaviour of children and adolescents with psychopathic traits which may lead to future offending. Nevertheless, while considering a broader range of outcomes in the interpretation of the success of an intervention, it is important to be aware that while an intervention may change some characteristic or behaviour associated with psychopathy (e.g. moral reasoning, executive functions, or social inclusion), changes in antisocial or criminal behaviour may remain unchanged (Loeber & Stouthamer-Loeber, 1998). Similarly, we cannot say that reports of reductions in antisocial behaviour or recidivism have also changed possible underlying cognitive or emotional features of psychopathy (Caldwell et al., 2006) and this could be the reason why short-term, but not long-term improvements are sometimes found. Therefore, caution when interpreting these findings and clarity when reporting results is needed to establish what we mean by intervention success.

This review also highlights the importance of accounting for the measurement tools and informants of these when drawing conclusions about the success of an intervention. For example, one parent measure of child externalising problems found improvements in behaviour while in the same study, another measure of externalising problems found no changes (Hogstrom et al., 2013). Similarly, some studies demonstrated that a difference in intervention success may be found between child and adult informants and between intervention participants and external evaluators (Kolko & Pardini, 2010; Spain et al., 2004). As suggested previously, a multi-informant approach should be used where possible in future research.

While this review was able to assess individual differences within youths with psychopathic of CU traits, there were few studies available which assessed this, meaning conclusions could only be made on single studies alone. Furthermore, two further variants of psychopathic traits; primary and secondary psychopathy, which have long been speculated in adults (Skeem et al., 2007) and more recently in youths (Gill et al., 2016; Kimonis et al., 2011), could not be accounted for in this review as studies did not include this information. Primary psychopathy is characterised by callous and harmful behaviour with high social adeptness, confidence, and few psychiatric symptoms (Blader et al., 2013; Skeem et al., 2007). Secondary psychopathy reflects an acquired affective disturbance, with individuals showing greater trait anxiety, poorer interpersonal functioning, and more symptoms of other mental health disorders, such as depression and psychoticism (Docherty et al., 2015; Kimonis et al., 2011; Skeem et al., 2007). Since secondary psychopathic symptoms are thought to result from adverse experiences or psychopathology, it is possible that individuals with secondary psychopathy may be more responsive to treatment than those with primary psychopathy (Blader et al., 2013) and this may be another consideration when deciding which subtypes of antisocial youths respond to which treatment.

Finally, as with any review of the literature, the current study is susceptible to the 'file-drawer' phenomenon as there may be a bias towards publishing studies with significant results only. A note on the categorisation of studies in the current review is also needed. Since this review aimed to be inclusive, categorising studies based on intervention type or research design was not a simple one. While useful for consolidation of a breadth of information and formulation of conclusions across similar studies, the categorisations used in the current review must be used with caution.

5.5.7 Summary and future directions

Despite some reservations on the inclusion of multiple methodological designs in reviews of the psychopathy intervention literature (Rice & Harris, 2006), the current systematic review responded to a call for a broader approach (Salekin, 2006). This review extends our understanding of the treatability of early psychopathic traits, by considering results from all published evaluations of interventions for children and adolescents with psychopathic traits.

In summary, evidence was found that symptoms of psychopathic or CU traits can be reduced with treatment and that high CU traits are not always associated with poorer outcomes. This dispels early scepticism that psychopathy is untreatable. Furthermore, as with adults with psychopathic traits, there are particular concerns of treatment motivation and attrition for children and adolescents with psychopathic or CU traits (Högström et al., 2013; Ogloff, Wong, & Greenwood, 1990; Rice & Harris, 2006; Richards, Casey & Lucente, 2003). Importantly, this review can shed some light on how these issues might be addressed. Firstly, motivation may be improved by addressing the sensation-seeking temperament of individuals with psychopathic traits by ensuring interventions are action-oriented and novel (Ingram et al., 1970), and by taking advantage of the reward-dominance evident in these individuals, through an increase in immediate rewards and a reduction in sanctions (Caldwell 2011; Caldwell et al., 2006; 2007; 2001; 2013; Frederickson et al., 2013). Caldwell and colleagues, Ingram and colleagues, and Frederickson and colleagues, all report improvements for youths with high CU traits following residential or school-based child-directed interventions which include these principles. Although control groups without these components were not always used, these interventions could form the basis of a controlled between-groups study which examines this motivational aspect of intervention for youths with psychopathic or CU traits.

Finally, with increases in research examining the aetiology and development of CU traits, there is promise that novel interventions which utilise these findings can be developed. In particular, there are suggestions that advances in cognitive neuroscience may be the way forward to understanding psychopathic traits and developing more effective interventions for these individuals (Rice & Harris, 2006; Wallace & Newman, 2004). Frederickson et al.'s (2013) study found promising results to suggest that interventions modelled on findings from cognitive neuroscience can lead to improvements in early psychopathic traits and associated problematic behaviour and school functioning. Furthermore, there is the potential for measurement tools typically used in cognitive neuroscience research, such as electroencephalogram (EEG) recordings, to be used as an evaluation tool for such interventions (Lewis et al., 2010). Such a method could help address whether changes in behaviour following intervention coincide with physical changes in the brain, and whether such physical changes are associated with longer-term improvements. This offers exciting opportunities for future research.

This extensive review could not clear-up problems around the lack of consensus on defining psychopathy nor could firm conclusions be made about the best treatment approach. However, the evidence presented can direct future research in a number of ways. Firstly, replications of intervention studies are needed which examine different interventions while using the same design methodology to allow comparisons between interventions. Larger sample sizes would improve the scope for comparisons within groups, such as the influence of gender, age and co-morbidity on intervention outcomes. Evaluation studies should consider using multiple outcome measures across multiple informants to allow for any bias. Finally, and perhaps most importantly, results need to be disseminated to practitioners to inform them that there is a distinct subtype of CP, that these children and adolescents may respond to interventions differently, and that these individuals are not untreatable (Frick, 2001).

Chapter 6 A Cognitive Neuroscience Informed Classroom-based Intervention for Mainstream Pupils with CP

6.1 Introduction

The high prevalence of CP (Department for Education, 2016; Pilling et al., 2013) and the associated difficulties these youths and their families face, including poor academic achievement, unemployment, mental health difficulties, and criminal convictions (e.g. D'Amico et al., 2014; Knapp et al., 2011), alongside the high cost of CP to society (e.g. Raaijmakers et al., 2011; Vostanis et al., 2003), suggest that effective interventions for CP are of paramount importance (see Chapter One for a review of the literature). Traditional interventions for children with CP have shown limited effectiveness in terms of long-term changes and generalisability beyond the therapeutic setting (Frick, 2001), especially for those with the most severe antisocial behaviour and the most dysfunctional families (e.g. Miller & Prinz, 1990; Storr et al., 2002). Furthermore, as discussed throughout this thesis, there is a particularly problematic group of children with CP who have additional CU traits (Frick et al., 2014). Despite the recognition of this subtype of CP in the literature, there are few interventions which have been designed with the distinct characteristics of this subgroup in mind (see Chapter Five for a systematic review). A novel approach is needed which takes the heterogeneous nature of CP into account in the design and evaluation of the intervention.

Neurological abnormalities evident in children with CP, including the distinct neurological profiles of those with and without CU traits (e.g. Noordermeer et al., 2016; Johnson, 2015) may help inform the development of a more effective intervention approach for these children (Frick et al., 2014). This chapter presents the evaluation of a classroom-based pilot intervention which was informed by cognitive neuroscience and which considers the individual characteristics of children with and without CU traits. The rationale for this intervention will be discussed followed by an outline of the development of the intervention for a mainstream school. An evaluation of this pilot intervention in a sample of mainstream primary school pupils will then be presented.

6.1.1 Rationale for a cognitive neuroscience informed classroom-based intervention

6.1.1.1 Informed by cognitive neuroscience

There is a large body of evidence suggesting that children and adolescents with CP have a deficit in EFs and ER (Gross, 2013; Johnson, 2015; see also Chapter Two). Further support for these neuropsychological deficits was found in the CP profiling study in Chapter Three, in which both mainstream pupils and pupils in a special provision for SEMH were found to have deficits across a full range of EF skills in everyday school functioning. Taken together, these findings suggest that the neurocognitive profiles of pupils with CP should be considered when designing interventions for children and adolescents with CP. However, traditional interventions for CP have been largely based on the Social Learning Theory model of antisocial behaviour (Bandura, 1978) and neglect the role of the individual's neuropsychological deficits in their behavioural difficulties (Frick, 2001).

Social Learning Theory (Bandura & Walters, 1977) was originally proposed as an alternative account to the traditional stimulus-response theories of behaviour, by emphasising the role of the interpersonal context and the internal cognitive processes in learning and behaviour. The theory proposes that learning takes place in a social context through observing behaviour (modelling) and observing and internalising the consequences of behaviour (vicarious learning). There is evidence supporting the Social Learning Theory account of antisocial behaviour (Akers & Jensen, 2006, 2011; Bandura, 1978; Bartholow & Anderson, 2002), and there are some successful outcomes of treatment approaches for adults and youths with antisocial behaviour which utilise the principles of this theory (e.g. Cullen, Wright, Gendreau, & Andrews, 2003; Lipsey, Chapman, & Landenberger, 2001; Miller & Prinz, 1990). Nevertheless, as outlined in Chapter Five, these interventions have shown limited effectiveness (for reviews, see Frick, 2001; McCart, Priester, Davies, & Azen, 2006). In particular, poor treatment compliance, low generalisability beyond the therapeutic setting, and limited long-term effectiveness have been reported for PMT and SCT (Baker et al., 2011; Datyner et al., 2016; Forehand, Furey, & McMahon, 1984; Frick, 2001; Reid et al., 2003; Taylor et al., 1999). A meta-analysis by Pratt et al. (2010) put into question the use of Social Leaning Theory to explain antisocial behaviour, with low effect sizes found for the role of modelling and differential reinforcement on antisocial behaviour. While interventions based on Social Learning Theory are the recommended treatment of choice by the NICE guidelines (Pilling et al, 2013), these interventions do not account for the wealth of research which now shows the children have distinct neurocognitive profiles, and which may account for the limited long-term effectiveness of these interventions.

Indeed, despite evidence of the association between CP and an EDF (Gross, 2013; Johnson, 2015), there is little in the way of interventions which target EF deficits of children and adolescents with CP. While the association between antisocial behaviour and ER is less clear cut, findings from the profiling study in Chapter Three suggest that pupils with CP show more negative and labile emotions and have poorer use of some ER strategies compared to children with low CP. In particular, pupils with CP showed a tendency to just accept negative situations and make less use of refocusing strategies, i.e. they do not try to think of more positive things to cope with negative emotions or make plans to make positive changes. While some interventions for CP have addressed emotion-related difficulties (e.g. Dadds et al., 2012; Datyner et al., 2016; Denham & Burton, 1996), these have often focused on promoting emotion recognition and understanding, rather than helping children build a better emotion regulation strategy repertoire and improving the use of such strategies. Frederickson et al. (2013) report a pilot intervention LGS which addressed these EF and ER deficits in pupils at a special provision for SEMH. Frederickson et al.'s study and other interventions which aim to improve EF skills will be discussed below.

6.1.1.2 Accounts for individual differences

As presented in the previous chapters of this thesis, it is now well-established that children and adolescents with CP are a heterogeneous group (Bloomquist & Schnell, 2002; Frick, Cornell, Bodin, et al., 2003; Frick & Morris, 2004). This has led to the inclusion of a limited prosocial emotions specifier for CD in the DSM-5 (APA, 2013) which reflects the lack of empathy and shallow affect of children with CU traits (Frick & Marsee, 2006). However, traditional interventions have not typically accounted for individual differences amongst children with CP. Evaluation studies which have considered the role of CU traits in intervention outcomes have found that children with this subtype of CP are often particularly resistant to improvements from intervention (Frick et al., 2014). As reviewed in Chapter Five, children with high CU traits have been found to have poorer intervention outcomes than those with low CU traits (e.g. Dembo, Wareham, Poythress, Cook, & Schmeidler, 2006b; Hawes & Dadds, 2005, 2007; Hawes et al., 2013; Högström et al., 2013; O'Neill et al., 2003), and youths with high CU traits have shown greater attrition from therapy than those with low CU traits (Hornsveld & Kraaimaat, 2011).

Nevertheless, unlike early theorists who claimed that psychopathy was untreatable (Hare et al., 1991; McCord & McCord, 1964; Suedfeld & Landon, 1978), the systematic review in Chapter Five presents evidence to suggest that CU traits can be reduced with treatment and that youths with CP/CU+ do not always have poorer intervention outcomes than those with CP/CU- (e.g. O'Neill et al., 2003; Ridenour et al., 2003; Rogers et al., 2004). With an increase in research examining the aetiology of CU traits, including evidence of distinct neurological profiles (e.g. Fairchild et al., 2013; Sebastian, Fontaine, et al., 2012), there is promise that novel interventions which utilise these findings can be developed which will prove more successful in treating this subgroup of antisocial youths (Frederickson et al., 2013; Wallace & Newman, 2004). For example, findings from the profiling study in Chapter Three suggest that, in addition to the associations of CP more generally, such as deficits in EF skills, high emotion lability/negativity, and poor use of ER strategies, pupils with high CU traits have particular deficits in empathy and emotion understanding. This research supports behavioural and neuroscience findings of emotion processing and empathy deficits in children with CU traits, such as reduced activity of the amygdala in response to other people's distress (Jones et al., 2009; Marsh et al., 2013) and abnormal activity of the prefrontal cortex in response to punishment (Finger et al., 2011; Finger et al., 2008). Therefore, approaches which assume all children understand emotions and have the ability to show empathy, will be unlikely to change the behaviour of pupils with CU traits (Ciucci et al., 2015; Sutton & Altarriba, 2011). Similarly, interventions which rely on sanctions to reduce problematic behaviour are unlikely to be effective for these children who have a reduced sensitivity to punishment (Blair, 2015; Frick, Cornell, Bodin, et al., 2003).

6.1.1.3 Considers motivation to change

One difficulty in treating antisocial individuals is that interventions require considerable effort from the participant, yet these individuals may lack the motivation to engage in the therapeutic process (Salekin et al., 2012; Wallace & Newman, 2004). As the systematic review in Chapter Five demonstrates, there are particular concerns regarding treatment motivation of youths with CU traits, with high rates of attrition found for these individuals (Hornsveld & Kraaimaat, 2011; Högström et al., 2013; O'Neill et al., 2003). The neuropsychological profiles of antisocial individuals need to be considered when thinking about the child's motivation to engage in the intervention and make behaviour changes. The child's self-concept and beliefs about their ability to change, the role of social reinforcement, and the effect of reward and punishment, may all influence the child's motivation to engage with the intervention programme (Salekin et al., 2012). The beliefs the child or adolescent holds about their behavioural conduct and associated difficulties will likely influence their motivation to make changes to their behaviour. Research evidence suggests that individuals with psychopathic traits have a tendency to blame others for their problems (i.e. make external attributions), rather than viewing a negative situation as a problem within themselves (Batson, Gudjonsson, & Gray, 2010). It may be then that these individuals do not view their behaviour as undesirable or in need of change. As a result, they will lack motivation to change their behaviour and are more likely to just go-along with the programme, possibly to attain extrinsic rewards such as privileges or discharge from the programme, rather than engage emotionally in the therapeutic process (Salekin et al., 2012; Wallace & Newman, 2004). In the profiling study in Chapter Three, pupils with CP/CU- showed a tendency to blame others for their negative experiences, suggesting that lack of motivation to make changes due to external attributions may be also be a problem for children without CU traits.

While the literature on self-concepts of antisocial individuals is mixed, some studies have found that those with psychopathic or CU traits have high and possibly unrealistic self-perceptions (Barry et al., 2007; Ha et al., 2008; Hughes, Cavell, & Grossman, 1997). This supports the idea that the antisocial individual may hold a belief that they do not need to change their own behaviour. Nevertheless, the profiling study in Chapter Three found that pupils with CP, both with and without CU traits, have low self-perceptions of their behavioural conduct and scholastic competence. A child with such self-perceptions may believe that they cannot succeed at school and cannot behave well, which again could result in lack of motivation to engage with the intervention programme. The profiling study also found that pupils with CP, regardless of CU traits, showed a tendency to accept negative situations, resigning to the idea that nothing can be done to change the situation. Similarly, other studies have found that children with CP do not believe that they can modify their emotions (Terwogt, 1990; Terwogt et al., 1990). Children with CP then, may have a helpless attitude towards change, which could also affect motivation to engage with an intervention.

In addition to the beliefs the child has about him or herself, the way in which the child is concerned with their social environment is also likely to influence their motivation to change. As discussed previously, traditional interventions for CP are largely based on the principles of Social Learning Theory, aiming to improve behaviour by setting clear boundaries of socially acceptable behaviour and to shape behaviour through social feedback (Akers & Jensen, 2006, 2011; Bandura, 1978). While these interventions may result in behaviour change for some children, this approach assumes that all children are inherently social and are therefore motivated to conform to society's rules and norms to attain social acceptance and will seek social connectedness with adults and peers (Warren, 2010). However, not all children share these social motivations. This was demonstrated in Warren's (2010) study of 900 children aged 8-17 years. Using self-reports on a specially developed questionnaire, Warren found that children and adolescents vary in the extent of their need for, or interest in, social connectedness and social approval. For example, some children reported that they do not think it is important to play fairly or that they do not feel guilty if they hurt or upset peers, and some report that they are not interested in what their teacher or peers think and say about their behaviour and that they do not respond to social feedback. Furthermore, some children show a need for social dominance or control, reporting that they want to be in charge and will break rules or be unkind to people if it helps them get what they want. In an extension of this work, Warren (2010) reports that in a study of 54 children with CP (aged 8–11 years), those with CU traits had a particularly low interest in social connectedness and social approval and a particularly strong need for social control. This work has important implications for intervention design, especially when considering the CU trait subtype of CP. Children and adolescents with a low need for social connectedness and approval will be unlikely to respond to interventions based on Social Learning Theory. Instead, these children appear to prioritise their own goals and interests and therefore will more likely be motivated by personal gain and gratification.

Finally, individual differences in response to reward and punishment must be considered when thinking about children's motivations. As discussed in Chapters One and Two, behavioural and neuroscience studies have found children and adolescents with CU traits have low sensitivity to fear and punishment (e.g. Blair, 2015; Blair, et al., 2001; Frick, Cornell, Barry, et al., 2003). It is not surprising then that interventions which aim to change behaviour through sanctions have been found to be unsuccessful for children and adolescents with CU traits. As documented in the systematic review in Chapter Five, the role of reward and punishment strategies were explored in several intervention studies and the results were consistent with the theory of a reward-dominance in individuals with high CU traits. Punishment, in the form of time out, did not reduce behaviour problems or CU symptoms and youths with high CU traits had a poorer response to time-out strategies than those with low CU traits (Hawes & Dadds, 2005; Kimonis & Armstrong, 2012; Kimonis et al., 2014; Miller et al., 2014). Reward strategies, on the other hand, did reduce behaviour problems and CU traits, suggesting reward rather than punishment may be an effective way to motivate children with CP/CU- *and* those with CP/CU+ in interventions.

Since these children are found not to be interested in social acceptance and social connectedness (Warren, 2010), children with CU traits are unlikely to be deterred by the social rejection they receive for their antisocial behaviour, and are more likely to be motivated by personal tangible rewards (Frederickson et al., 2013). In addition, research suggests that children with CP have difficulties with delayed gratification (Gilliom, Shaw, Beck, Schonberg, & Lukon, 2002; Krueger, Caspi, Moffitt, White, & Stouthamer-Loeber, 1996). Therefore rewards may need to be immediate and individualised for each child to ensure that they will be motivated to make positive changes (Frick, 2001; Wallace & Newman, 2004; Warren, 2010). This theory has been put into practice in recent intervention studies with promising results. Caldwell and colleagues (Caldwell et al., 2006; Caldwell, 2011; Caldwell et al., 2012) and Frederickson et al. (2013) report improvements for youths with high CU traits following interventions which reduce sanctions and increase tangible rewards.

6.1.1.4 Classroom-based approach

Limitations to current interventions for CP include poor generalisability beyond the therapeutic setting, poor attendance of parents and/or youths, and high costs of service delivery (e.g. Datyner et al., 2016; McMahon & Forehand, 2003; Scott, et al., 2001; Taylor, et al., 1999; Webster-Stratton & Hammond, 1997). Furthermore, children spend a large proportion of their day in school and challenging behaviour in the classroom may result in missed learning opportunities for the individual and their peers and teacher burn-out (Hastings & Bham, 2003; Hastings & Brown, 2002; see also Chapter Two). Therefore, it is important that any improvements in behaviour from an intervention are operating in the classroom. Furthermore, often the most common request for assistance from teachers is for help with problematic behaviour and classroom management (Brouwers & Tomic, 2000; Elam, Rose, & Gallup, 1996; Lewis & Sugai, 1999).

A classroom-based intervention which aims to improve CP may then overcome some of the problems inherent in other intervention approaches for CP (Jakobsen et al., 2012). For example, Niec et al. (2016) reports that although interventions for CP have shown some improvements in child behaviour, a large proportion of children in need of these interventions do not receive them. Holding an intervention in the classroom may help overcome this problem (Baker et al., 2011). School is a compulsory and consistent part of the child's day, therefore problems with motivation to attend therapy outside of these hours or practicalities which may result in poor attendance and attrition, such as time and travel costs, will not be a problem for classroom-based interventions. In a recent study, Plath et al. (2016) found that offering screening and an intervention for CP within school improved intervention engagement. Many parents reported that they would not have sought help had this not been done through the school. A classroom-based intervention could also offer a cost-effective way to treat CP. CP comes with high costs to society, not just from costs incurred through criminal acts on property and victims, but also from the high use of service provisions (Ford, Hamilton, Meltzer, & Goodman, 2007; Raaijmakers et al., 2011; Shivram et al., 2009; Vostanis et al., 2003). By incorporating an intervention into the classroom, delivered by the teaching staff and using the current classroom resources, intervention costs can be kept to a minimum.

Research demonstrates that teachers' understanding of child development and their knowledge of neuroscience influences their teaching practice (Daniels & Shumow, 2003; Dubinsky, Roehrig, & Varma, 2013). However, there is evidence to suggest that teachers place little importance on child development and cognitive psychology in their teaching practice (Laski, Reeves, Ganley, & Mitchell, 2013; McDevitt & Ormrod, 2008) and teachers’ knowledge of educational neuroscience is poor, with many holding misconceptions or neuromyths (Dekker, Lee, Howard-Jones, & Jolles, 2012; Howard-Jones, 2014). In an online survey of 96 teachers, only 16% said that they had learnt about the importance of EF skills in their initial teacher training or later professional development (Gilmore & Cragg, 2014). The level of awareness increased with teaching experience, but only after 10 years of teaching, suggesting that it may take many years of experience for teachers to become aware of the importance of EF skills without any specific training. Moreover, if awareness of the importance of EF on learning in general is poor, it is unlikely that teachers realise the influence of these skills on a child's behaviour and the prevalence of deficits in EF in pupils with CP.

Evidence of distinct neuropsychological profiles of children with CP examined throughout this thesis, alongside research to suggest teachers have poor awareness of the important role EF skills play in learning and behaviour, suggests a classroom-based approach in which teachers are made aware of the role of EF, are trained to identify EF deficits in individual pupils, and can modify EF demands in the classroom, is needed to reduce challenging behaviour (Farmer et al., 2014). Moreover, the classroom offers a suitable environment for promoting EF and ER. The classroom is inherently a learning environment for children (Catalano, Arthur, Hawkins, Berglund, & Olson, 1998), therefore an intervention which aims to teach children new skills will be well-placed in an environment which is already set-up to develop the acquisition of skills. Indeed, there is evidence that EF and ER skills can be taught in the classroom (e.g. Bodrova & Leong, 2007; Diamond, 2012; Frederickson et al., 2013). Three examples of classroom-based interventions which promote EF and ER skills are presented below.

6.1.2 Classroom-based interventions to improve EF and ER

Three examples of interventions based on neuroscientific principles and delivered in the classroom are presented here. Tools of the Mind (Bodrova & Leong, 2007) promotes EF skills in normative young children; Promoting Alternative Thinking strategies (Greenberg et al., 1995) promotes inhibitory control and ER skills in mainstream schools and in special education classrooms; and LGS (Frederickson et al., 2013) promotes EF and ER in a special provision for primary school pupils with SEMH.

6.1.2.1 Tools of the Mind

Tools of the Mind (Bodrova & Leong, 2007) is a classroom-based programme designed to promote EF and self-regulation in normative young children, primarily through structured and supported play. The Tools curriculum is based on Vygotsky's (1978) view that the child learns through interacting with their environment with support from adults. The curriculum consists of forty EF-promoting activities, including planned dramatic play, group games, and external aids. Each are designed to facilitate the development of EF skills such as attention, memory, planning, and inhibition. For example, in a game of inhibitory control, music is played while the teacher shows children a picture of a stick-figure holding a specific pose that children must copy when the music stops. Through this game, children will practice controlling their behaviour by taking specific actions at specific times. In Play Planning, children plan their play by drawing or writing the role and actions they will take during make-believe play. Playing in this way encourages children to plan and organise their thoughts and actions, act in a controlled and purposeful manner, and inhibit behaviours to remain with their planned role.

Tools has shown promising outcomes across several studies, including RCTs (Barnett et al., 2008; Blair & Raver, 2014; Diamond, Barnett, Thomas, & Munro, 2007; Millaway, 2015). For example, in a study of 147 pre-school children either following the Tools curriculum or a Literacy programme, Diamond et al. (2007) found that while children in both groups performed similarly on non-EF tasks, Tools children performed significantly better than those in the Literacy programme on tasks requiring inhibition. Tools children also showed more self-confidence during the experimental tasks. However, the effect of the curriculum on academic achievement was not assessed. Furthermore, no pre-test measures were carried out for either group, making it difficult to say whether improvements from baseline were made. While evaluations of Tools suggest that EF skills can be improved in the classroom, it does not tell us about EF skills of children with CP. Furthermore, learning is centred on play and therefore may be more suited to young children.

6.1.2.2 Promoting Alternative Thinking Strategies

The Promoting Alternative Thinking Strategies (PATHS) programme is designed to develop children’s awareness of their own and others’ emotions, and to improve their ability to self-regulate emotions and behaviour and improve prosocial behaviour (Greenberg et al., 1995). Unlike Tools, which offers a full curriculum (i.e. the whole school day is run in a distinct way), PATHS is used as an add-on curriculum. PATHS is taught by the classroom teacher for 20-30 minutes, two to three times per week, with generalisation activities throughout the day. Lessons include group discussions, games, role-playing, story-telling, and attribution training. Key to the PATHS curriculum is the opportunity to practice self-regulation strategies. This is taught during curriculum lessons and through use of the Control Signals Poster. The Control Signals Poster is a traffic light model, with a red light signalling children need to “Stop and Calm Down", the yellow light signalling children need to “Slow Down and Think", and a green light signalling children should “Go, Try My Plan.” Similarly, children are taught to use visual, colour-coded feeling faces throughout the day to practice identifying and labelling their emotions and those of others. When they experience a challenging emotion, children are taught to stop, say what the problem is and how they feel, and then construct an action plan (Riggs, Greenberg, Kusché, & Pentz, 2006).

Supporting evidence for PATHS, including several RCTs, have shown improvements in externalising and internalising difficulties and in social and emotional competence, in mainstream schools and in special education classrooms, including pupils with CP (for a review, see Diamond & Lee, 2011). Following the PATHS programme, children have been found to have greater scores on attention, planning, and inhibitory control, and show an improved ability to identify their own and others' emotions, have greater empathy, and have higher school social functioning (e.g. Domitrovich, Cortes, & Greenberg, 2007; Kam, Greenberg, & Kusché, 2004; Riggs et al., 2006). Evaluations with high-risk samples have found that PATHS children, show lower rates of externalising and internalising problems, including CP, ADHD, and depressive symptoms, compared to a control group (Bierman et al., 1999; Kam et al., 2004). Furthermore, measures of academic achievement showed higher scores in reading, writing, and maths in PATHS children compared to a control group (Greenberg & Kusché, 1998; Schonfeld et al., 2015).

While PATHS involves social-emotional skills training, it is grounded in neuroscientific principles. Developers of the programme state that PATHS is based on the premise that addressing neurocognitive functioning is needed to improve social-emotional competence and behaviour (Greenberg, Kusché, & Riggs, 2004; Riggs et al., 2006). In particular, the PATHS activities are designed to improve neural connections between the limbic system (emotion processing) and the frontal lobes (cognitive control). By teaching children to use conscious strategies of self-control and to consciously label and talk about emotions, children make use of both parts of the brain and *'strengthen neural integration'* (Greenberg et al., 2004, p.175).

6.1.2.3 Let's Get Smart

Let's Get Smart (LGS) was similarly designed to promote EF and ER skills in the classroom, to help children self-regulate and break down barriers to learning (Frederickson et al., 2013). Unlike the interventions discussed previously, LGS was developed specifically for children with disruptive and antisocial behaviour at a special provision for pupils with SEMH. Moreover, unlike other classroom interventions, LGS used evidence of distinct neurocognitive profiles between subtypes of CP, to account for pupils with both low and high CU traits. This includes evidence from fMRI studies that youths with high CU traits have lower amygdala activity in response to others' distress (Jones et al., 2009) and have an atypical PFC response to punishment (Finger et al., 2011; Finger et al., 2008). Furthermore, LGS was not a prescriptive, manualised approach. Instead, teachers received an initial consultation and ongoing guidance from developmental and educational psychologists, but were fully involved in developing their own strategies in the context of their classrooms to allow flexibility to the demands of the school and the individual needs of the pupils.

One of the key changes to the school's previous approach to managing severe disruptive behaviour was the removal of sanctions. Instead, an emphasis was placed on immediate rewards to move away from the idea that all children are socially motivated and instead to make use of the child's motivation for personal gain. Alongside the removal of sanctions and increase in rewards, LGS used a variety of tools to promote the use of EF and ER strategies. For example, pupils were taught how to monitor their emotions by placing a marker on a visual colour-coded emotion thermometer. Pupils could alert the teacher if their emotions moved from green ('feeling calm') through to red ('feeling angry, frustrated, or anxious'). Similarly, a bank of consistent key phrases were used by both staff and pupils (e.g. ‘Smart Body’, ‘Ready to Learn’, and ‘Stop Button’) to facilitate communication and to prompt pupils to check-in on their behaviour. Children’s involvement in monitoring their progress towards their targets was emphasised to develop self-awareness and self-monitoring of their own behaviour and learning.

Frederickson et al., (2013) evaluated the LGS programme, which ran for one academic year in the special provision, with 29 pupils aged 5-11 years. As reported in the systematic review in Chapter Five, pupils showed improvements in teacher-reported EF skills and externalising behaviour. Teaching staff reported that pupils had a greater understanding of their own emotions and behaviour and were taking more responsibility for their behaviour compared to pre-intervention. School records also show a reduction in school exclusions and incidents of physical damage to the school. Despite these promising results, only one evaluation of this programme has taken place. Furthermore, there was no comparison group of pupils in a special provision without the intervention; therefore it is difficult to conclude that the positive effects were a direct result of the LGS intervention. It is also unknown whether this approach would be effective in a mainstream classroom for pupils with CP.

As discussed above, LGS was novel in several ways, and one such characteristic was the involvement of the teaching staff in the development of their own intervention strategies. When developing a new approach for the classroom, current practices within the school need to be carefully considered. Teachers are required to follow the academic curriculum and adhere to policies and practices that have been well-established in schools, as well as balance resources available to them (Farmer et al., 2014). As a result, the teacher may become overwhelmed if a novel classroom intervention is added to these current demands, especially if any conflict or confusion arises around which practice to follow. Therefore, as Farmer and colleagues argue, *'it is critical that evidence-based interventions and corresponding teacher training are 'real world' centred and are designed to be individualised and adapted to the teachers' specific circumstances. To do this, professional development training and classroom management consultation should focus on contextual responsiveness and general implementation criteria rather than on lockstep approaches'* (p.69). Training in the general and core components of an intervention strategy and placing an emphasis on how such strategies can be implemented in relation to other practices and characteristics of the classroom is therefore of great importance (Farmer et al., 2014). This is likely to be particularly important in a mainstream classroom, which may have less flexibility than the special school involved in the LGS evaluation.

6.2 Hypotheses and Research Questions

While each of the interventions presented in the previous section have their limitations, these examples demonstrate that improvements in EF, ER, and behaviour can be made through a classroom-based intervention which targets EF and ER skills. Importantly, evaluations of PATHS and LGS suggest that these improvements are also possible for pupils with behavioural difficulties. Furthermore, the LGS intervention demonstrates how such an intervention can be individualised to account for pupils with high CU traits. Nevertheless, the LGS approach needs more research support, especially with pupils in additional schools, including the mainstream classroom. The current study aims to build on this literature by piloting a classroom-based intervention based on the neuropsychological profiles of pupils with CP, including those with high CU traits, in a mainstream school.

Based on the deficits identified in the CP profiling study in Chapter Three and evidence that EF and ER can improve following a classroom-based intervention which promotes these skills, two main hypotheses were proposed:

4) EF skills of pupils with CP will improve from pre- to post-intervention
5) Emotion-related abilities, including emotion lability/negativity and emotion regulation strategies, of pupils with CP will improve from pre- to post-intervention.

A series of exploratory research questions were also investigated:
1) Will academic achievement improve from pre- to post-intervention?
2) Will self-perceptions improve from pre- to post-intervention?
3) Will the STR improve from pre- to post-intervention?
4) Will symptoms of CU traits improve from pre to post-intervention?
5) Will intervention outcomes differ between pupils with CP/CU- and pupils with CP/CU+?

Specific hypotheses were not made regarding academic achievement, self-perceptions, and the STR, as these areas were not addressed directly in the intervention and there is currently no evidence of the effect of such an intervention on these areas of school functioning. Research questions relating to CU traits were also exploratory. While some previous research has suggested greater intervention resistance for pupils with high CU traits, the current intervention was designed to account for the presence of CU traits, therefore it is possible that these pupils may not show resistance to this intervention in the same way that they have in previous treatment approaches.

6.3 Method

6.3.1 Participants

Participants for the current study were taken from the CP profiling sample in Chapter Three. All pupils in the mainstream CP group were invited to participate; i.e. participants in the current study were those with the 30 highest CP scores on the teacher-reported BASC-II from a larger screening of all 134 KS2 pupils in the school. A second school was recruited to form a no-intervention comparison group. However, the comparison school withdrew from the study due to their involvement in an incompatible intervention programme. As a result, there was no comparison group for the current study.

For the participating school, parental consent was given in the form of an opt-out letter and pupils gave verbal assent at each testing session with the researcher. Ethical approval was granted from Goldsmiths, University of London Research Ethics Committee. Data from two pupils were lost due to incomplete teacher questionnaires, two pupils left the school, and one child's parents opted out of the study. This resulted in a sample of 25 participants (6 female) available at both time points, aged 7 to 9 years (M=8.33 years, SD=.82) at pre-intervention.

6.3.2 Measures

6.3.2.1 Teacher-reports

Teacher-report measures of CP (BASC-II; Reynolds et al., 2011), CU traits (ICU; Kimonis et al., 2008), EF (BRIEF-II; Gioia et al., 2000), emotion regulation and lability/negativity (ERC; Shields & Cicchetti, 1997), and the STR (STRS-sf; Pianta, 2001) were used in this study. A full description of each measure can be found in Chapters Three and Four. In the current sample, Cronbach's alphas were as follows: BASC-II subscales α=.69 to 96; ICU total scores α=.88; BRIEF-II subscales α=.74 to .96; ERC Emotion Regulation subscale α=.80; ERC Lability/Negativity subscale α=.84; STRS-sf Closeness subscale α=.79; STRS-sf Conflict subscale α=.85.

6.3.2.2 Child assessments and self-reports

Child assessed IQ (WASI-II; Weschler & Psychological Corporation, 2011) and academic achievement (reading comprehension and mathematical reasoning subtests, WIAT-II; Weschler & Psychological Corporation, 2001) and child self-reported ER (CERQ-kids) and self-perceptions (SPPC; Harter, 1985) were used in this study. A full description of these measures can be found in Chapter Three. In the current sample, Cronbach's alphas for subscales of the CERQ-kids ranged from .51 to .72. Cronbach's alphas for subscales of the SPPC ranged from .56 to .70.

6.3.2.3 Strategy-Use Weekly Log

A short questionnaire was designed for Learning Support Assistants to monitor and evaluate their use of the intervention tools and strategies in the classroom every week (see Appendix B.

Strategy-Use Weekly Log). The log was designed as an intervention fidelity check and as an evaluation tool for LSAs to report their views of the intervention. The log was made up of three questions with a 6 point Likert-type scale in which LSAs must rate the frequency of their use of intervention tools or strategies (from 'not at all' to 'multiple times every day'); frequency of pupil use of strategies (from 'not at all' to 'all pupils every day'); and ease with which they have found using the strategies (from 'very easy' to 'very difficult'). The log also had three open-ended questions, asking the LSAs to comment on any positive experiences or success stories they had identifying or using strategies in the classroom; to report any negative experiences or difficulties they had identifying or using strategies in the classroom; and to write any other comment they had about the intervention in general. The logs were to be completed at the end of each week by each LSA.

6.3.3 Behaviours for Learning: A classroom-based intervention

6.3.3.1 Intervention Focus

Based on the rationale outlined in the introduction to this chapter, the Behaviours for Learning pilot intervention had the following key characteristics:

1) *Informed by cognitive neuroscience*

   The main aim of the pilot intervention was to address the EF and ER deficits of pupils with CP (Gross, 2013; Johnson, 2015) and to break down these barriers to learning (Blair & Raver, 2015). This included making teaching staff aware of these neuropsychological deficits and their role in behaviour and learning, and training teaching staff to identify these difficulties in their pupils and use strategies to break down these barriers to leaning. There was also an emphasis on teaching pupils to be self-aware of their difficulties in these skills and helping pupils learn to self-regulate their own behaviour through the use of EF and ER strategies. Evidence from neuroscience was also used to ensure the distinct characteristics of pupils with CU traits were accounted for (see below).

2) *Accounts for individual differences and individual motivations*

   The heterogeneous nature of antisocial behaviour, including the presence of CU traits in some pupils with CP, and the need to account for these individual differences when designing interventions (Frick, 2006) has been emphasised throughout this thesis. Therefore, training teaching staff to identify individual deficits in their pupils and to set individualised goals with individualised rewards for each pupil was of key importance in this intervention. This included a need for teaching staff to be flexible in their approach to the different and changing needs of their pupils, rather than following a restrictive manualised programme. Furthermore, based on the body of evidence suggesting that youths with CU traits are not sensitive to punishment and have a reward-dominance (Blair, 2013; Frick, Cornell, Barry, et al., 2003), teachers were encouraged to remove or reduce sanctions in the classroom and increase the use of immediate tangible rewards. This included rewarding pupils for making an effort to engage with the programme and using EF and ER strategies in the classroom.

3) *Classroom-based*

The intervention was incorporated into the normal school day and was delivered by the child's usual classroom teacher and LSAs. The school curriculum was not changed, nor were pupils with CP separated from their peers without CP. Instead, teaching staff were to teach, support, and encourage pupils with CP to use EF and ER strategies throughout the school day to manage their behaviour and break down barriers to learning. To make this intervention suitable for the mainstream school, it was considered important that the intervention did not require additional time from the teaching staff or additional resources in the classroom and that disruption to the normal lessons from the research team was kept to a minimum. The pilot intervention therefore took the format of an initial evening workshop with all teaching staff, followed by a guidance handbook for each teacher, with contact details of the research team made available for any additional support needed. Teaching staff were then to implement what they had learnt from the workshop and handbook into their everyday lessons.

6.3.3.2 Intervention Development

This pilot intervention was developed through a review of the literature presented in previous chapters of this thesis, alongside visits to the special provision in which the LGS intervention was implemented, and planning meetings with the participating mainstream school. From meetings with the mainstream school's Head teacher and Inclusion Manager, it was evident that teaching staff had very limited knowledge of the role of the different EF skills in learning and were unaware that pupils with CP had deficits in these cognitive processes. Therefore, in the development of the intervention workshop, emphasis was placed on improving teacher awareness of the different EF skills, improving their ability to detect these deficits in individual pupils, and identifying which strategies could help break down these barriers to learning.

A further concern raised by school staff was the perceived ineffectiveness of their current reward system. The school operated a Golden Time system across the school, in which pupils earned tokens or points throughout the day towards participating in a desirable activity at the end of the week. If a pupil did not earn enough points throughout the week, they were to spend Golden Time working in the classroom. The Head teacher reported that this system did not seem to be motivating some pupils, with particular pupils repeatedly missing out on Golden Time each week. As discussed previously, children with CP have difficulties with delayed gratification (Gilliom et al., 2002) and some of these pupils may not be motivated by social praise (Warren, 2010). Therefore, it is unlikely that a pupil with CP will manage to refrain from inappropriate behaviour for the full week based on tokens and social reinforcement from teaching staff. Furthermore, by having an end of the week reward system, these pupils may give up trying to behave well when they make an error early in the week. Therefore, this reward system was modified by encouraging teaching staff to give pupils immediate and tangible rewards, such as time on the computer or playing a favourite game, for short periods of time during the school day.

6.3.3.3 Intervention Workshop

All teaching staff in the school attended the intervention workshop one evening as part of their compulsory teacher training hours at the school. The workshop ran for 3 hours, led by myself and facilitated by two other members of the research team.

The workshop had three main goals:

1) To educate teaching staff on the role of the different EF and ER skills in learning and how disruptive classroom behaviour is associated with deficits in these cognitive control skills.
2) To train teaching staff to identify individual EF and ER deficits in their pupils and to be aware of the high level of EF demand that academic work and other classroom activities can place on these pupils.

3) To provide teaching staff with tools and strategies that could be used to break down these barriers to learning and ultimately improve behaviour and academic achievement. The aim was also for teaching staff to develop their own strategies to use with their pupils.

These goals were addressed through a presentation of both behavioural research and evidence from neuroscience which emphasised the biological basis of behavioural and learning difficulties. This included presenting teachers with findings from the CP profiling study (Chapter Three), to demonstrate that pupils with CP symptoms in their own school show deficits in a full range of EF. In addition to the presentation of the evidence behind the intervention, the workshop had a series of hypothetical classroom scenarios and practical group exercises to give teaching staff the opportunity to practice identifying EF demands in the classroom, identifying EF deficits in pupil behaviour, and developing strategies that they could use in their own classroom. (See Appendix C. Behaviours for Learning workshop activities.)

Due to the nature of the mainstream classroom, alongside the differing needs of each pupil, flexibility in this approach was considered to be important to its success (Farmer et al., 2014). Therefore, rather than taking a prescriptive approach, the aim of the current intervention was for teachers to have a toolbox of strategies that they could use flexibly in the classroom and that they could adapt to meet the diverse needs of each individual pupils. Therefore teachers were given examples of many different strategies which could be used to break down EF demands in the classroom and improve behaviours for learning. During the workshop, one of the authors of the Frederickson et al. (2013) evaluation of the LGS intervention gave a brief presentation and explanation of some of the intervention tools used in the special school, such as emotion thermometers and the inhibition stop button. Teachers were also shown how more familiar learning tools, such as counting blocks, note-taking, writing prompts, and planning worksheets, could be used to address specific EF deficits noted in individual pupils.

6.3.4 Data collection

Data from teacher-reported pupil behaviour (BASC-II, ICU), EF (BRIEF-II), emotion regulation and lability/negativity (ERC), and the STR (STRS-sf) collected for the studies in Chapters Three and Four were used as the pre-intervention data in the current study. Similarly, child assessments of IQ (WASI-II), academic achievement (WIAT-II), ER (CERQ-kids), and self-perception (SPPC) collected for the profiling study in Chapter Three were used as pre-intervention data.

All pre-intervention data were collected in the school autumn term. The three-hour intervention workshop was delivered at the start of the spring term and all KS2 LSAs were asked to complete the Intervention Logs once a week during this term. Post-intervention data were collected in the summer term. Pupil assessments (WIAT-II, CERQ-kids, and SPPC) were carried out by myself or one of three MSc Psychology students trained in using these measures. Assessments took place one-to-one in a quiet area of the school during the school day. Each pupil was seen across one to three sessions, dependent on the pupil's ability to attend to the test materials for sustained periods of time, totalling approximately 60 minutes for each pupil. Pupils were encouraged to participate for as long as it was felt that they were attending to the tasks, but were allowed to leave the assessment at any time. Teacher-reported questionnaires (ICU, BRIEF-II, ERC, STRS-sf) were also collected in the summer term.

6.3.5 Data analysis

Data were analysed using SPSS version 22 (SPSS; 2013). Scaled scores from each of the standardised measures (BASC-II, BRIEF-II, WASI-II and WIAT-II) were used to allow analyses across ages and comparison to a normative population. Raw total scores and subscale scores were used for the non-standardised measures (ICU, ERC, STRS-sf, CERQ-kids, and SPPC). The BASC-II was only collected at pre-intervention to identify pupils with the highest CP symptoms, and was not used in the evaluation analyses. The WASI-II was similarly only carried out at pre-intervention and used to test for group differences in IQ at pre-intervention only.

A series of mixed MANOVAs were carried out with scores on each subscale of the BRIEF-II, ERC, CERQ-kids, SPPC, STRS-sf, and WIAT-II as the dependent variables and time (pre-intervention or post-intervention) as the within subjects variable. A mixed ANOVA was carried out with total ICU scores as the dependent variable and time (pre-intervention or post-intervention) as the within subjects variable, to investigate changes in CU trait symptoms from pre- to post-intervention. To address the effects of the intervention on pupils with different subtypes of CP, the sample underwent a median split using pre-intervention ICU total scores to form two subtype groups;

pupils with CP with CU traits (CP/CU+) and pupils with CP without CU traits (CP/CU-). CU traits group (CP/CU+ and CP/CU-) was used as the between-groups variable in each MANOVA and the ANOVA. Significant interactions between time and CU trait group were followed up with simple effect tests to compare pre- to post-intervention changes for each CU traits group separately. Analyses were adjusted for multiple comparisons using Bonferroni corrections.

To account for the lack of no-intervention comparison group, standardised clinical classification scores from the BRIEF-II were analysed using non-parametric tests. McNemar tests were used to investigate changes in the frequency of pupils falling within the clinically significant classification for each EDF subscale from pre- to post-intervention.

Descriptive statistics for Questions 1 to 3 of the Strategy-use Weekly Log were used to assess the frequencies and means of response options for each item. The open-ended questions were analysed using content analysis to pick out any themes or patterns in responses.

6.4 Results

6.4.1 Missing data

BRIEF-II questionnaires at pre-intervention were not returned for two pupils. All other teacher-report questionnaires were completed at both time points. Missing items on teacher-report questionnaires underwent mean imputation where other items were present, as instructed in the manuals for each measure. An LSA from four of the six classes completed the Strategy-use Logs, with between 1 to 6 weeks of logs returned for each LSA, totalling 10 completed logs. Reasons for missing teacher and LSA data are unknown.

There was no attrition of pupils from the pre-intervention assessments to post-intervention. However, several pupils were unable to complete the full assessment battery at both time points due to school absence or challenging behaviour. Some pupils needed several breaks between subtests (either at the pupil's request or due to the researcher noting poor attention/lack of engagement with the materials). While pupils were encouraged to continue if the researcher judged this to be appropriate, it was decided for some pupils that continuing the assessments was inappropriate. Assessments were discontinued if the researcher or class teacher felt that further assessment would cause disruption to the pupil's classroom lessons; attention to the assessment materials was too poor to collect reliable data; or if it was deemed ethically inappropriate (i.e. the environment was too challenging for this pupil). For pupils who did not complete the full battery of assessments, data from all complete subscales of each measure were still included in the analyses (see Tables 6.2 and 6.3 for data available for each measure).

6.4.2 Participant characteristics

Participant characteristics for the total sample and each CU traits group are presented in Table 6.1. A chi-squared test and independent sample t-tests demonstrate that the CU trait groups did not significantly differ in terms of gender, $X(1)=.68$, $df=1$, $p=.41$; age $t(23)=-1.49$, $p=.16$; IQ, $t(22)=.09$, $p=.93$; or Conduct Problems, $t(23)=-.41$, $p=.69$.

Table 6.1: *Means and standard deviations (in parentheses) of pre-intervention characteristics for the total sample and CP/CU+ and CP/CU- groups*

	Total sample *n*=25		**CP/CU-** *n*=12		**CP/CU+** *n*=13	
Male	19	76.0%	10	83.3%	9	69.2%
Age (years)	8.33	(.82)	8.08	(.59)	8.55	(.96)
IQ[a]	92.63	(14.20)	92.91	(11.79)	92.38	(16.45)
Conduct Problems[b]	62.96	(10.17)	62.08	(10.02)	63.77	(10.65)

[a]Weschler Abbreviated Scale of Intelligence (WIAT-II); researcher-assessed, standardised scores. [b]Behaviour Assessment System for Chidlren-2 (BASC-II); teacher-reports, standardised scores.

6.4.3 Pre- to post-intervention repeated measures

Descriptive statistics for the total sample and for the CP/CU+ and CP/CU- groups at pre-intervention and post-intervention are presented for teacher-reports in Table 6.2 and child assessments in Table 6.3.

Sphericity was not a problem with these data as there were only two groups and Levene's test showed no problems with homogeneity of variances. All univariate tests were adjusted for multiple comparisons using Bonferroni corrections.

Table 6.2: *Means and standard deviations (in parentheses) of teacher-reported scores for the total sample and CP/CU+ and CP/CU- groups, at pre-intervention (Time 1) and post-intervention (Time 2)*

	Total Sample				**CP/CU-**				**CP/CU+**			
	Time 1		**Time 2**		**Time 1**		**Time 2**		**Time 1**		**Time 2**	
BRIEF-II[a]	***n*=22**				***n*=11**				***n*=11**			
Inhibition	64.68	(11.53)	78.09	(16.25)	60.64	(10.31)	78.09	(19.08)	68.73	(11.70)	78.09	(13.81)
Shift	63.36	(12.72)	71.18	(16.58)	63.45	(15.61)	67.00	(17.11)	63.27	(9.80)	75.36	(15.68)
Emotional Control	66.45	(14.93)	82.00	(19.12)	64.09	(17.67)	80.73	(20.04)	68.82	(11.97)	83.27	(19.04)
Initiate	62.77	(10.70)	64.27	(10.00)	61.82	(10.99)	62.27	(11.82)	63.73	(10.84)	66.27	(7.84)
Working Memory	61.23	(12.85)	67.55	(12.61)	57.27	(9.89)	64.73	(14.18)	65.18	(14.64)	70.36	(10.74)
Plan/Organise	62.00	(10.66)	66.73	(12.57)	58.55	(9.79)	63.27	(14.53)	65.45	(10.80)	70.18	(9.71)
Organise Materials	52.09	(8.77)	64.32	(16.63)	49.73	(6.41)	60.18	(17.27)	54.45	(10.40)	68.45	(15.64)
Monitor	65.82	(9.48)	72.86	(12.93)	61.27	(7.31)	71.82	(16.38)	70.36	(9.47)	73.91	(8.96)
ERC[b]	***n*=25**				***n*=12**				***n*=13**			
Lability/Negativity	34.00	(6.31)	36.47	(7.86)	33.25	(6.27)	35.96	(7.56)	34.69	(6.52)	36.95	(8.42)
Emotion Regulation	21.64	(3.72)	21.87	(2.78)	23.25	(4.05)	21.87	(1.57)	20.15	(2.76)	21.87	(3.63)

	Total Sample				CP/CU-				CP/CU+			
	Time 1		**Time 2**		**Time 1**		**Time 2**		**Time 1**		**Time 2**	
STRS-sf[c]	***n*=25**				***n*=12**				***n*=13**			
Conflict	22.09	(6.40)	20.48	(6.99)	20.86	(6.31)	19.69	(7.32)	23.23	(6.51)	21.21	(6.89)
Closeness	25.56	(4.54)	24.08	(6.20)	27.17	(4.63)	21.25	(6.03)	24.08	(4.07)	26.69	(5.31)
ICU[d]	***n*=25**				***n*=12**				***n*=13**			
Total score	34.92	(10.98)	32.68	(8.54)	25.16	(5.96)	32.75	(9.29)	43.92	(5.04)	32.62	(8.16)

[a]Behaviour Rating Inventory of Executive Function, standardised scores. [b]Emotion Regulation Checklist, raw scores. [c]Student-Teacher Relationship Scale-short form, raw scores. [d]Inventory of Callous-Unemotional Traits, raw scores.

Table 6.3: *Means and standard deviations (in parentheses) of child-assessed and self-reported scores for the total sample and CP/CU+ and CP/CU- groups, at pre-intervention (Time 1) and post-intervention (Time 2)*

	Total sample				**CP/CU-**				**CP/CU+**			
	Time 1		**Time 2**		**Time 1**		**Time 2**		**Time 1**		**Time 2**	
WIAT-II[a]	***n*=21**				***n*=10**				***n*=11**			
Reading Comprehension	99.19	(9.19)	97.76	(11.52)	95.90	(7.72)	94.70	(10.30)	102.18	(9.72)	100.55	(12.33)
Mathematical Reasoning	95.52	(13.32)	88.24	(21.06)	94.40	(12.30)	81.20	(24.67)	96.55	(14.70)	94.64	(15.65)
CERQ-kids[b]	***n*=15**				***n*=7**				***n*=8**			
Self-Blame	9.20	(2.31)	8.80	(2.62)	9.14	(1.35)	9.71	(3.04)	9.25	(3.01)	8.00	(2.07)
Acceptance	11.47	(2.56)	11.33	(3.77)	11.43	(2.64)	12.14	(3.24)	11.50	(2.67)	10.63	(4.27)
Rumination	12.00	(3.55)	12.20	(3.45)	12.71	(1.98)	11.57	(2.64)	11.38	(4.57)	12.75	(4.13)
Positive Refocus	12.47	(4.19)	14.27	(3.85)	11.71	(5.06)	13.57	(3.95)	13.13	(3.48)	14.88	(3.91)
Refocus Planning	12.13	(3.40)	12.87	(3.04)	12.43	(3.82)	12.57	(3.87)	11.88	(3.23)	13.13	(2.36)
Positive Reappraisal	11.67	(3.18)	13.73	(3.85)	11.14	(3.13)	14.00	(4.36)	12.13	(3.36)	13.50	(3.63)
Perspective	12.58	(4.00)	13.20	(2.93)	13.00	(4.90)	12.57	(2.07)	12.21	(3.33)	13.75	(3.58)
Catastrophising	11.24	(3.58)	9.93	(3.20)	11.29	(2.93)	9.86	(3.44)	11.21	(4.28)	10.00	(3.21)
Other blame	9.27	(3.71)	8.53	(2.30)	11.00	(4.32)	9.29	(1.98)	7.75	(2.43)	7.88	(2.48)

	Total sample				CP/CU-				CP/CU+			
	Time 1		Time 2		Time 1		Time 2		Time 1		Time 2	
SPPC[c]	***n*=22**				***n*=12**				***n*=10**			
Scholastic Competence	2.39	(.65)	2.76	(.64)	2.46	(.54)	2.71	(.65)	2.32	(.78)	2.82	(.65)
Social Acceptance	2.89	(.64)	3.12	(.73)	2.82	(.72)	3.00	(.80)	2.97	(.56)	3.27	(.64)
Athletic Competence	2.89	(.72)	2.88	(.74)	3.00	(.47)	3.04	(.64)	2.75	(.96)	2.68	(.84)
Physical Appearance	3.21	(.55)	3.11	(.64)	3.15	(.54)	3.01	(.62)	3.28	(.58)	3.23	(.68)
Behavioural Conduct	2.65	(.63)	2.58	(.69)	2.63	(.56)	2.61	(.71)	2.68	(.72)	2.53	(.71)

[a]Weschler Individual Achievement Test-2, standardised scores. [b]Cognitive Emotion Regulation Questionnaire-kids, raw scores. [c]Self Perception Profile for Children, raw scores

6.4.3.1 Changes in EF skills

A mixed MANOVA was conducted with each subscale score of the BRIEF-II as the dependent variables, CU traits group as the between-participants variable, and time (pre- and post-intervention) as the within-participants variable. No significant multivariate effect was found for group, $F(8,13)=96$, $p=.51$, Pillai's Trace=.370, partial $\eta^2=.37$, and follow-up ANOVAs revealed no significant differences between groups for any of the BRIEF-II subscales. No significant multivariate effect was found for time, $F(8,13)=1.99$, $p=.13$, Pillai's Trace=. 551, partial $\eta^2=.55$. However, follow-up ANOVAs revealed a significant change from pre- to post- intervention in Emotional Control, $F(1,20)=9.28$, $p<.05$, partial $\eta^2=.32$ and Organisation of Materials, $F(1,20)=10.13$, $p<.05$, partial $\eta^2=.34$, each showing an increase in EDF scores. There was no significant multivariate interaction between time and group, $F(8,13)=1.30$, $p=.32$, Pillai's Trace=.445, partial $\eta^2=.45$, and follow-up ANOVAs demonstrated no significant interactions between time and group for any of the BRIEF-II subscale scores.

Standardised scores on each subscale of the BRIEF-II were coded as falling within the range of a clinically significant EDF (coded 1) or no clinical significant EDF (coded 0) for each participant. McNemar's non-parametric test revealed that there were significant differences from pre- to post-intervention in frequencies of pupils with a clinical significant deficit in Organisation of Materials ($p<.001$). There were no significant differences in frequencies of clinically significant EDF for any of the other BRIEF-II subscales. Cross-tabulations demonstrate that there were more pupils with an Organisation of Materials deficit within the clinically significant range at post-intervention (18 pupils, 78.3%) compared to pre-intervention (17 pupils, 73.9%). 14 pupils (60.9%) had a clinically significant Organisation of Materials deficit at pre- and post-intervention. Four (17.4%) pupils who did not have a clinically significant Organisation of Materials before the intervention, had a clinically significant Organisation of Materials deficit at post-intervention. Three pupils (13.0%) who had a clinically significant Organisation of Materials deficit before intervention no longer had a significant Organisation of Materials deficit at post-intervention.

6.4.3.2 Changes in emotion regulation and lability

A mixed MANOVA was conducted with both subscales of the ERC as the dependent variables, CU traits group as the between-participants variable, and time (pre- and post-intervention) as the within-participants variable. No significant multivariate effect was found for group, $F(2,22)=1.40$, *p*=.27, Pillai's Trace=.113, partial η^2=.11 and follow-up ANOVAs demonstrated no significant differences between groups for either subscale of the ERC. No significant multivariate effect was found for time, *F*(2,22)=1.58, *p*=.23, Pillai's Trace=. 126, partial η^2=.13, and follow-up ANOVAs demonstrated no significant changes from pre- to post- intervention for either subscale of the ERC. There was no significant multivariate interaction between time and group, *F*(2,22)=1.73, *p*=.20, Pillai's Trace=.136, partial η^2=.14, and follow-up ANOVAs demonstrated no significant interactions between time and group for either of the ERC subscale scores.

A mixed MANOVA was conducted with each subscale of the CERQ as the dependent variables, CU traits group as the between-participants variable and time (pre- and post-intervention) as the within-participants variable. No significant multivariate effect was found for group, *F*(9,5)=.35, *p*=.94, Pillai's Trace=.353, partial η^2=.35 and follow-up ANOVAs demonstrated no significant differences between groups for any subscale of the CERQ. No significant multivariate effect was found for time, *F*(9,5)=1.03, *p*=.52, Pillai's Trace=.650, partial η^2=.65 and follow-up ANOVAs demonstrated no significant changes from pre- to post- intervention for any subscale of the CERQ. There was no significant multivariate interaction between time and group, *F*(9,5)=1.53, *p*=.33, Pillai's Trace=.734, partial η^2=.73, and follow-up ANOVAs demonstrated no significant interactions between time and group for any of the CERQ subscale scores.

6.4.3.3 Changes in academic achievement

A mixed MANOVA was conducted with both Mathematical Reasoning and Reading Comprehension subtest scores of the WIAT-II as the dependent variables, CU traits group as the between-participants variable, and time (pre- and post-intervention) as the within-participants variable. No significant multivariate effect was found for group, *F*(2,18)=1.31, *p*=.30, Pillai's Trace=.127, partial η^2=.13 and follow-up ANOVAs demonstrated no significant differences between groups for either subtest of the WIAT-II. No statistically significant multivariate effect was found for time, *F*(2,18)=2.65, *p*=.10, Pillai's Trace=.227, partial η^2=.23 and follow-up ANOVAs demonstrated no significant changes from pre- to post- intervention for either subtest. There was no significant multivariate interaction between time and group, *F*(2,18)=1.21, *p*=.32, Pillai's Trace=.118, partial η^2=.12, and follow-up ANOVAs demonstrated no statistically significant interactions between time and group for either of the WIAT-II subtests.

6.4.3.4 Changes in self-perception

A mixed MANOVA was conducted with each subscale of the SPPC as the dependent variables, CU traits group as the between-participants variable, and time (pre- and post-intervention) as the within-participants variable. No significant multivariate effect was found for group, $F(5,16)=.47$, $p=.79$, Pillai's Trace=.128, partial $\eta^2=.13$ and follow-up ANOVAs demonstrated no significant differences between groups for any subscale of the SPPC. No statistically significant multivariate effect was found for time, $F(5,16)=1.81$, $p=.17$, Pillai's Trace=.361, partial $\eta^2=.36$ and follow-up ANOVAs demonstrated no significant changes from pre- to post- intervention for any subscale of the SPPC. There was no significant multivariate interaction between time and group, $F(5,16)=.34$, $p=.88$, Pillai's Trace=.097, partial $\eta^2=.10$, and follow-up ANOVAs demonstrated no significant interactions between time and group for any of the SPPC subscale scores.

6.4.3.5 Changes in the STR

A mixed MANOVA was conducted with both subscales of the STRS-sf as the dependent variables, CU traits group as the between-participants variable, and time (pre- and post-intervention) as the within-participants variable. No statistically significant multivariate effect was found for group, $F(2,22)=88$, $p=.43$, Pillai's Trace=.074, partial $\eta^2=.07$ and follow-up ANOVAs demonstrated no significant differences between groups for either subscale of the STRS-sf. No statistically significant multivariate effect was found for time, $F(2,22)=2.16$, $p=.14$, Pillai's Trace=.164, partial $\eta^2=.16$, and follow-up ANOVAs demonstrated no significant changes from pre- to post- intervention for either subscale of the STRS-sf.

There was a significant multivariate interaction between time and group, $F(2,22)=5.88$, $p<.01$, Pillai's Trace=.348, partial $\eta^2=.35$. Follow-up ANOVAs demonstrated no significant interaction for the Conflict subscale. However, there was a statistically significant interaction between time and group for the Closeness subscale, $F(1,23)=11.95$, $p<.01$, partial $\eta^2=.34$, with a decrease in scores for the CP/CU- group and an increase in scores for the CP/CU+ group from pre- to post-intervention. This interaction effect is presented in Figure 6.1. Simple effects tests show that the change in Closeness scores for the CP/CU+ group was not significant, $p=.14$. However, for the CP/CU- group, Closeness scores significantly decreased from pre- to post-intervention, $p<.01$.

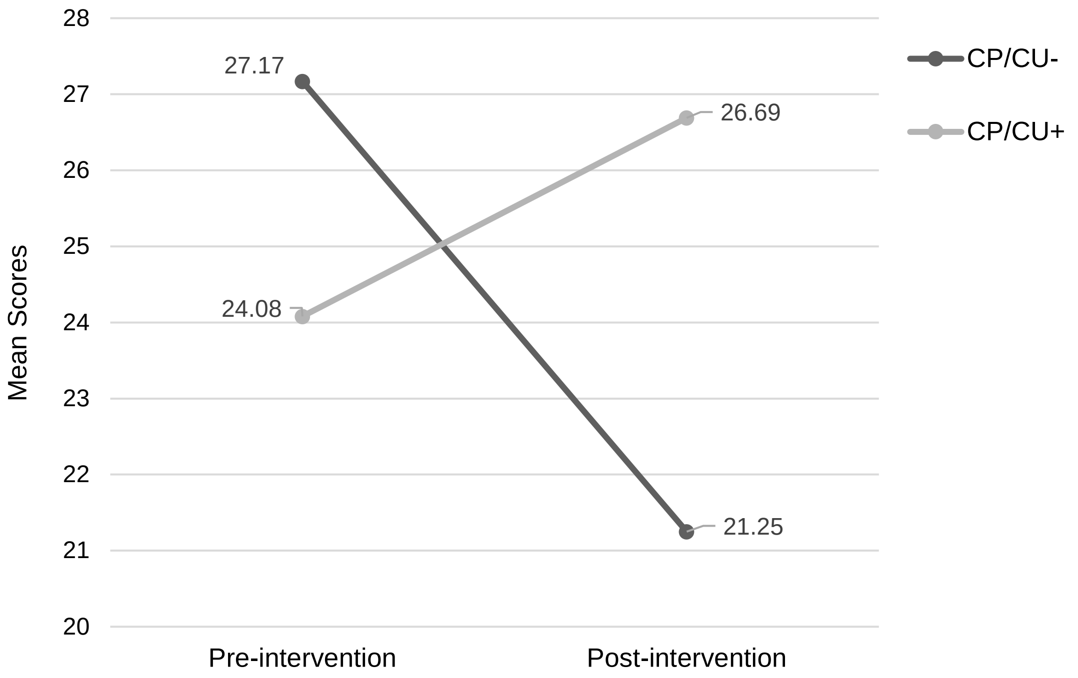

Figure 6.1: *Mean scores of student-teacher closeness (STRS-sf) at pre-intervention and post-intervention, for CP/CU- and CP/CU+ groups*

6.4.3.6 Changes in CU traits

A mixed ANOVA was conducted with total ICU scores as the dependent variable, CU traits group as the between-participants variable, and time (pre- and post-intervention) as the within-participants variable. A significant effect was found for group, $F(1,23)=14.46$, $p<.001$, partial $\eta^2=.39$. No significant effect was found for time, $F(1,23)=1.37$, $p=.25$, Pillai's Trace=.056, partial $\eta^2=.06$, but there was a significant interaction between time and group, $F(1,23)=35.46$, $p<.001$, Pillai's Trace=.607, partial $\eta^2=.61$. This interaction effect is presented in Figure 6.2. Simple effects tests showed that for the CP/CU- group, CU trait symptoms significantly increased from pre- to post-intervention, $p<.01$. For the CP/CU+ group, CU trait symptoms significantly decreased from pre- to post-intervention, $p<.001$.

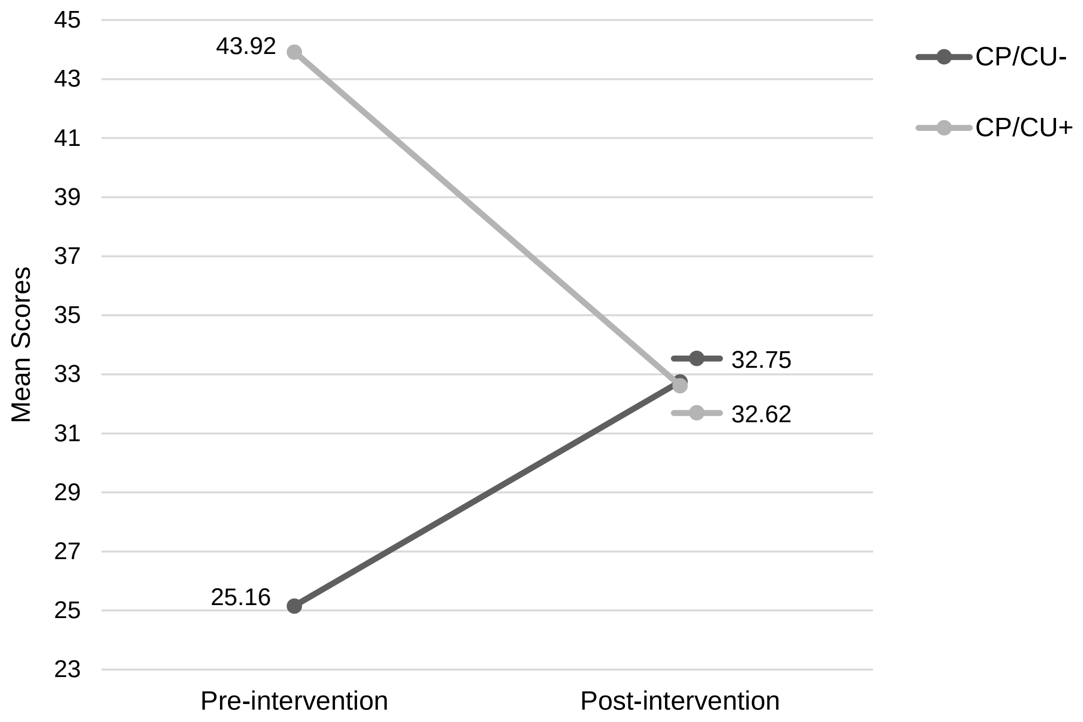

Figure 6.2: *Mean scores of total callous-unemotional traits (ICU) at pre-intervention and post-intervention, for CP/CU- and CP/CU+ groups*

6.4.4 Strategy-use

Frequencies and percentages of responses to the three quantitative items of the Strategy-use Weekly Log are presented in Table 6.4. Using content analysis for responses to the open-ended questions of the Strategy-use Weekly Log three main themes were identified: identification of barriers to learning; use of intervention tools and strategies; and effectiveness of intervention tools and strategies.

6.4.4.1 Identification of barriers to learning

Each LSA reported identifying a specific barrier to learning. Working memory, flexible shifting, self-monitoring, inhibition, and emotion regulation were each mentioned once, each on a separate occasion. For example, a year 6 LSA reports that she *'noticed problems in self-monitoring this week. Children, even though they said they had checked their work, still didn't pick up errors in their work*.' None of the responses mentioned pupils' identification of their own barriers to learning.

6.4.4.2 Use of intervention tools and strategies

Within this theme, a further three subthemes were identified; 1) use of specific intervention tools or strategies to break down barriers to learning; 2) use of reward or punishment; and 3) flexibility in the use of intervention tools.

Each LSA mentioned specific tools or strategies that they had used in the classroom that week to break down barriers to learning. This included repeating key information, reviewing information frequently, breaking down multi-step instructions, allowing more time for reading instructions and finding equipment, and using visual aids. For example, a LSA in a year 6 classroom reports using a visual intervention tool to help a pupil with difficulties in flexible shifting: *'I drew the pupil's attention to the Now and Next sheets. I allowed more time for the pupil to read the sheets and find the equipment needed for the task*.' Novel intervention tools presented in the workshop, such as the stop button or emotion thermometer, were not mentioned in any of the LSAs responses. None of the responses mentioned pupils independently using an intervention tool or strategy to break down a barrier to learning.

One year 6 LSA showed an understanding of the principles behind the use of reward and positive reinforcement in the classroom; *'It is important when teaching a new skill in behaviour that we try to reward with something pleasant. This helps to reinforce good behaviour. Incorrect responses need to be pointed out in a constructive manner. Emphasise on the positive not the negative to achieve good behaviour'*. Another year 6 LSA reported making use of immediate rewards; *'I used immediate reinforcement to reduce the barrier* [identified as inhibition and emotion regulation] *and gave the pupil plenty of positive praise'* (year 6 LSA). While social reinforcement was mentioned once, specific tangible rewards, or a reduction in sanctions, were not mentioned in any of the responses.

LSAs demonstrate flexibility in their use of different strategies to break down barriers to learning, responding to the fact that a particular strategy was not working for a pupil, by trying an alternative strategy. For example, an LSA from a year 4 class reported that after identifying Working Memory as a barrier to learning and trying strategies of *'repeating key information and reviewing the information frequently*', *'some pupils still failed to follow the instructions when given verbally; so I found writing them down on a white board enabled the pupils to complete the task.*'

6.4.4.3 Effectiveness of intervention tools and strategies

Some specific strategies were reported to be effective by the LSAs. For example, a year 4 LSA reports that, after she had identified a pupil's difficulty with working memory, she *'found breaking down multi-step instructions useful to the pupil*'. LSAs also report more general improvements in pupil's behaviour and self-regulation. For example, *'children are taking more responsibility for homework diaries, reading records, equipment and behaviour*' (year 6 LSA), and *'children are responding to warnings, five minutes time out/reflection time and golden point system. They know what is expected and required from them*' (year 6 LSA).

As documented above, one LSA reports that after using WM strategies, *'some pupils still failed to follow the instructions when given verbally*'. However, ineffectiveness of strategies were also reported to be followed up by alternative strategies which were more successful (as demonstrated in Flexibility in use of intervention tools above). The LSAs also questioned the effectiveness of immediate reinforcement, and reported that they used a time-out strategy instead, which they found to be more effective at decreasing negative behaviour. '*Immediate reinforcement didn't always work. I found removing the pupil from the learning environment for a few minutes calmed the pupil down. The pupil then settled back down in the learning environment and confidently completed the task*.'

Table 6.4: Frequencies and percentages (in parentheses) of Learning Support Assistant's reports of weekly strategy-use in the classroom

	Frequency (%)				
LSA strategy use[a]	*Not at all*	*One or two occasions*	*Multiple times, some days*	*Multiple times, most days*	*Multiple times, everyday*
	0 (0)	0 (0)	5 (50)	4 (40)	1 (10)
Pupil strategy use[b]	*Not at all*	*One or two pupils, on one or two occasions*	*A few pupils, most days*	*Multiple pupils, most days*	*All pupils, every day*
	1 (10)	6 (60)	3 (30)	0 (0)	0 (0)
Ease of strategy use[c]	*Very easy*	*Quite easy*	*Sometimes easy, sometimes difficult*	*Quite difficult*	*Very difficult*
	1 (10)	3 (30)	6 (60)	0 (0)	0 (0)

[a]'How often have you used, suggested, or taught learning or behaviour strategies in the classroom this week?' [b]'Have you seen or heard any pupils using the strategies on their own this week?' [c]'How easy or difficult have you found using strategies in the classroom this week?'

6.5 Discussion

The aim of the current study was to pilot a cognitive neuroscience-informed classroom-based intervention for mainstream pupils with CP and to evaluate the success of this intervention in terms of changes in pupils' school functioning and the suitability of this approach for the mainstream classroom.

6.5.1 Intervention outcomes for pupils with CP

LSA reports suggest the intervention was effective, reporting general improvements in pupils' behaviour and self-regulation, with examples of specific strategies that they felt were effective at breaking down barriers to learning. Any mention of strategies being ineffective were reported to be followed-up by alternative strategies which were more successful, suggesting that taking a flexible approach, LSAs were able to find a strategy that did help break down a barrier to learning. Moreover, self-awareness in pupils, reporting that pupils' understand what is expected and required from them and that they are taking more responsibility for their learning and behaviour. These results show promise for this intervention approach in the mainstream classroom. Nevertheless, the hypotheses that EF skills and ER would improve from pre- to post-intervention were not supported by results from teacher-reported questionnaires or child assessments and quantitative analyses also suggest that the intervention did not significantly improve academic achievement, self-perception, or the student-teacher relationship.

While predictions were not made about academic achievement, self-perception, or the student-teacher relationship, the lack of effectiveness of the intervention on neuropsychological functioning is in contrast to Frederickson et al.'s (2013) study which found improvements in EF following a similar intervention (LGS). Therefore these contrasting results may be due to the mainstream school setting or the way in which the intervention was delivered in the current study, rather than a problem with the theory behind this approach. Intervention delivery differed in a number of ways to Frederickson et al.'s study. Firstly, the current intervention was evaluated after just one school term, rather than following a full academic year of implementation. Greater duration of treatment has been shown to improve outcomes for both adults and youths with antisocial behaviour in other intervention studies (Caldwell et al., 2007; Salekin, 2002). This may be the case when trying to promote EF and ER skills. The Tools of the Mind intervention programme which aims to improve EFs in normative children, showed poor outcomes when it was used as an add-on programme in the classroom; but when Tools was made into a full curriculum, outcomes improved (Diamond, 2012). Similarly, the success of improving behaviour and EFs in the LGS intervention may be due to fact that the whole school curriculum was changed (Frederickson et al., 2013). Furthermore, in the special provision where LGS was implemented, there was a high teacher to pupil ratio, allowing one-to-one support from teaching staff. In a mainstream school, one-to-one support is usually not possible. It may be that this intervention needs one-to-one support to be effective, and therefore is only suitable in the mainstream classroom for pupils with high teaching assistant contact to provide this level of support. Indeed teacher to pupil ratios have been found to influence success in the Tools intervention (Bodrova, Leong, Norford, & Paynter, 2003).

While results suggest that the intervention had no effect on overall EDF, there was an unexpected trend for scores on each EF skill to worsen with time, with emotional control and organisation of materials skills becoming significantly poorer from pre- to post-intervention. It is possible that the EDF found in children with CP becomes more pronounced with time if left untreated. Therefore the worsening of scores in the current study may be due to the intervention having no effect, rather than an iatrogenic effect. A comparison group of pupils with CP with no intervention would be needed to test this hypothesis. Alternatively, these unexpected results may be due to an improved awareness of EDF by teaching staff. One aim of the intervention workshop was to improve awareness amongst teaching staff of the role of EF on learning and behaviour and the association between deficits in EF and CP. At pre- intervention, the Head teacher had expressed that teaching staff had little knowledge of the different EF skills and their association with challenging behaviour, i.e. when they completed the pre-intervention BRIEF-II. However in the Strategy-use Weekly Logs, LSAs demonstrated competence identifying EF deficits in pupils. It could be that the intervention workshop had a positive effect on teacher awareness and ability to identify EF, resulting in an increase in scores of EDF at post-intervention as teachers were now better able to identify these difficulties. A comparison of teacher reports on the BRIEF-II at three time points may help examine this possibility. Increases in reports of EDF from before the workshop (Time 1) to soon after the workshop (Time 2), but not from soon after the workshop (Time 2) to after the intervention has been fully implemented in the classroom (Time 3), would suggest that the current results are a reflection of improved awareness and ability to identify EDF rather than an iatrogenic effect of the intervention on pupils' EF.

Considering the lack of effect of the intervention of EF and ER skills, it is not surprising that significant improvements were not seen for academic achievement, self-perceptions, or the student-teacher relationship. These areas of functioning were not addressed directly through this intervention, rather it was speculated that improvements in EF and ER skills may result in an indirect effect of the intervention on these additional areas of functioning. It may be that if the EF and ER intervention tools are implemented by all staff and that pupils have chance to learn to use these independently, that as in Frederickson et al.'s (2013) similar intervention, improvements in neuropsychological functioning are seen. In turn, these improvements may have an indirect positive effect on academic achievement (due to the role of EF and ER on achievement; Blair & Raver, 2015), self-perceptions (due to the child being aware of increase success in the classroom and positive reinforcement from teachers), and on the STR (due to the mediating role of ER on the STR; see Chapter Four). However, the current results cannot shed light on this, and issues with the intervention duration and fidelity need to be addressed first.

6.5.2 Intervention outcomes and CU traits

An important aim of the current study was to investigate the effect of the intervention on symptoms of CU traits and to investigate whether the intervention had a different effect on pupils with CP/CU- compared to pupils with CP/CU+. No specific hypotheses were made about CU traits in the current study. The results suggest that the intervention had a significant effect on teacher-reported CU traits, but that the direction of this effect differed for pupils classified as CP/CU- and CP/CU+ at pre-intervention. For the CP/CU+ group, CU trait symptoms significantly decreased from pre- to post-intervention. However, for the CP/CU- group, CU trait symptoms significantly increased from pre- to post-intervention, suggesting that the intervention had a negative influence on pupils with low CU traits in terms of their CU trait symptoms.

CU traits did not influence intervention outcomes on EF, ER, academic achievement or self-perceptions. However, a significant effect was found in the interaction between CU traits group and time for the Closeness scale of the STRS-sf. While there was a trend for student-teacher closeness to improve from pre-to post-intervention for pupils with CP/CU+, this change was not significant. However, for the CP/CU- group, teachers report significantly lower Closeness scores at post-intervention compared to pre-intervention, suggesting that the intervention had a negative influence on the relationship between the teacher and pupils with low CU traits.

These results are in contrast to findings from other interventions studies that CU trait symptoms do not improve with intervention and that children with CP/CU+ have poorer intervention outcomes than children with CP/CU- (Dembo et al., 2006b; Hawes & Dadds, 2005, 2007; Hawes et al., 2013; Högström et al., 2013; O'Neill et al., 2003). The current intervention was designed to account for the presence of CU traits by considering the distinct neuropsychological profiles of these children, therefore pupils with CP/CU+ may not show resistance to this intervention in the same way that they have in previous treatment approaches. However, it is more difficult to explain the apparent negative effect of the intervention on CU trait symptoms and student-teacher closeness for pupils with CP/CU-. As suggested for the unexpected increase in EDF scores, it may be that CU trait symptoms and student-teacher closeness would have worsened with time if left untreated, and therefore these results are due to the lack of effect of the intervention for the pupils rather than an iatrogenic effect of the intervention. Again, a TAU group would be needed to test this hypothesis.

6.5.3 Intervention fidelity

It is important to consider the possibility that poor intervention fidelity could have resulted in the overall lack of effectiveness of this pilot intervention. Problems with intervention fidelity can result in non-significant findings that are not due to the design of the intervention itself, but to factors that influenced the intervention delivery (Horner, Rew, & Torres, 2006). Adherence and competence in delivering interventions has been found to influence intervention outcomes, including those which aim to improve EF and ER skills and interventions for CP (Bierman et al., 1999; Dusenbury, Brannigan, Falco, & Hansen, 2003; Greenberg et al., 2004).

Responses from the intervention logs completed in the current study suggest that the LSAs understood the principles of the intervention, were able to identify barriers to learning, and were using strategies to break down barriers to learning and manage behaviour in the classroom. Moreover, responses demonstrated that the LSAs were taking a flexible approach in their use of different strategies; responding to the fact that a particular strategy was not working well for a pupil by trying an alternative strategy. This suggests that staff did not need a prescriptive manual for implementing the intervention in the classroom. Nevertheless, there was a poor response rate for these Strategy-use Logs. Some LSAs did not complete any logs and no one returned a log for every week of the intervention. It may be that the LSAs who did not return these logs were not implementing the intervention. Furthermore, class teachers were not asked about their use of the intervention tools. Interviews with teaching staff would help address this issue.

Furthermore, while responses from these LSAs suggest good adherence and competence in delivering the intervention, some aspects of the intervention were not mentioned, which could suggest that the intervention was not being implemented in full. Novel intervention tools presented in the workshop, such as the stop button or emotion thermometer, were not mentioned in any of the LSAs' responses. It may be that the LSAs did not understand how to use these tools, found it difficult to use these tools, or did not think that they were appropriate. Interviews with teaching staff, which allow follow-up questions, would be helpful to explore these possibilities. Similarly, specific tangible rewards, or a reduction in sanctions, were not mentioned in any of the responses. Immediate rewards more generally were mentioned, but were reported to be ineffective. Again, interviews would help find out what rewards were being offered and in what circumstance. It may be that individualisation of rewards was not emphasised strongly enough in the intervention workshop, resulting in a lack of motivation from pupils.

Problems with intervention fidelity are not uncommon in schools. In particular, it has been reported that schools struggle to implement programmes alongside their regular curriculum and teaching duties (Solomon, Battistich, Watson, Schaps, & Lewis, 2000) and that teachers may need more support to make changes in the classroom (Leflot et al., 2010; Stormont, 2002). While the research team made an effort not to disrupt lessons in the current intervention, it may be that more input was needed from the research team to provide additional support and training to the teaching staff and to ensure that the intervention was being adhered to as planned.

The LSA logs also suggest that pupils themselves may not have been independently using the tools or strategies to break down barriers to learning. Most LSAs reported that pupils were 'rarely' seen or heard to be using strategies independently, and no-one responded that pupils were using strategies 'quite a lot' or 'a lot' by themselves. Similarly, in the open-ended questions, there was no mention of pupils identifying their own barriers to learning, or of pupils using intervention tools or strategies for themselves. It is likely that this had an impact on the effectiveness of the intervention. Again, more classroom support may be needed to teach pupils to use strategies for themselves. Since the intervention was implemented in the second academic term, pupils will have already become familiar with the way in which they work in the classroom. This may be particularly the case for KS2 pupils as they have already had several years at the school to become familiar with usual teaching practice. Therefore it may be more difficult to make changes with these pupils. The improvements seen in the LGS intervention may have been due to the fact that the mean age of pupils was younger (both KS1 and KS2 pupils were evaluated). Indeed Frederickson et al. (2013) report difficulties teaching new strategies to older pupils who are more familiar with the way of school before LGS was implemented. The current intervention then may be more successful if it were implemented at the start of the academic year and/or with pupils at a younger age.

6.5.4 Strengths and limitations

This study was the first to develop and evaluate a mainstream classroom-based intervention informed by cognitive neuroscience for pupils with CP which also accounted for the CU traits subtype. In addition to addressing CU traits in the development of the intervention, CU traits were also considered in the evaluation of the intervention. Intervention studies which have evaluated CU traits are limited in that they only assess changes in CU trait symptoms, or only compare changes on some other behavioural measure between CU trait groups. However, the current study employed both of these methods. This previous limitation has made it difficult to conclude whether interventions are effective for both CP/CU+ and CP/CU-, or whether some of the poor intervention outcomes documented can be explained by a reduced effectiveness of interventions on children with CU traits.

There were also strengths to the development and monitoring of the intervention. In addition to being based on scientific evidence and the evaluation of the LGS pilot, I visited the LGS school to ensure that I had a good understanding of the intervention and how it was implemented. Furthermore, meetings were held with the mainstream school Headteacher and Inclusion Manager to tailor the intervention to the specific needs of the school. LSA strategy-use records were also collected allowing an assessment of intervention fidelity. Intervention fidelity is a very important methodological aspect of an intervention evaluation which is often missed (Dumas, Lynch, Laughlin, Smith, & Prinz, 2001; Horner et al., 2006). Analysis of these data, especially the qualitative component, allowed a deeper understanding of the results from the quantitative behavioural data. In particular, these data suggests that the intervention may not have been adhered to in full and that an important component, the pupil's involvement in self-awareness of barriers to learning and independent-use of intervention tools, may have been missing. Therefore, by collecting this fidelity data, it can be recommended that further research could be carried out with the same intervention approach, but with extra attention paid to competence delivering the intervention.

A major limitation to the current study was the lack of a no-intervention comparison group. While a comparison school was recruited, withdrawal from the study by this school at short notice (without opportunity to recruit a second control school) had a detrimental impact on the analyses of data. Without a comparison group, we cannot assess whether functioning at post-intervention was a result of the intervention or not. For the current results in particular, it would have been useful to know whether pupils without an intervention had a worsening of EF skills with time or whether these unexpected results in the current study were due to some aspect of the intervention (such as improving teacher awareness and identification skills of pupils' EDF).

Furthermore, the current results are based on one school. Conclusions cannot be generalised to other schools or to different locations. While measures of SES were not collected for individual pupils, the school was located in an area with high levels of low SES families. SES and disadvantaged neighbourhood have been found to play a role in CP (Leventhal & Brooks-Gunn, 2000; Meltzer et al., 2003). It could be that a school in a more affluent area would have better outcomes following this intervention. Another demographic variable to consider in intervention effectiveness is gender. While females were included in the current study, there were not enough females in the sample to evaluate the effect of the intervention on each gender separately. The underrepresentation of females is often seen in studies of antisocial behaviour. Although CP are more prevalent in males (Maughan et al., 2004; Meltzer et al., 2003), females do make up a proportion of youths with CP, and high CU traits are also reported in females (e.g. Fontaine et al., 2010; Gill & Stickle, 2016). There is evidence that females with behaviour problems may have more problematic symptoms than males (Gill & Stickle, 2016; Masi et al., 2008; Maughan et al., 2004), suggesting that it may be important to examine gender differences in intervention outcomes. A much larger sample would be needed to ensure enough females were recruited to carry out these analyses. Nevertheless, the current study did consider some important demographic variables, and analyses demonstrated that age, gender, IQ, and CP did not significantly differ between the CU trait groups. Therefore we can be confident that the differences found between these groups were not due to these variables.

In addition to the loss of the comparison school, there was data loss from the participating school due to non-response from teaching staff or disruptive behaviour from pupils. Despite the strong rationale for a classroom-based intervention detailed in the introduction to this chapter, the data loss highlights difficulties of carrying out an intervention evaluation in a mainstream school. The suitability of the setting for the evaluation of the intervention, in addition to the delivery of the intervention, needs to be considered when designing an evaluation study.

While both teachers and pupils were involved in the evaluation of this pilot, only teacher-reports of EF were collected at post-intervention. This was due to the need to reduce the length of child assessments as it was evident in the CP profiling study (see Chapter Three) that some pupils had difficulties attending to the assessments for long periods of time. In the CP profiling study, scores from the teacher-reported and child-assessed measures of EF were not significantly associated with each other and it was concluded that these measures may measure different constructs of EF. The current study can only suggest that the intervention did not improve teacher-reported EDF; it may be that direct child assessments or classroom observations show different results.

6.5.5 Summary and implications

The overall poor outcomes for pupils in this intervention study, in contrast to Frederickson and colleagues' success with a similar intervention in a special provision, suggest that this approach may not be suited to mainstream pupils. Scott et al. (2014) similarly found improvements following their intervention for CP in clinic-referred children, but not in a community sample. Furthermore, unlike the school used in the current evaluation, staff at the special provision studied in Frederickson and colleagues' pilot had requested an intervention due to increases in severe challenging behaviour. We may need to consider the motivation of the school staff as well as motivations of pupils when implementing an intervention. Alternatively, this intervention may be better suited to KS1 pupils rather than KS2. In his review of CP interventions, (Frick, 2001) found that the greatest degree of improvement occurs in children younger than aged 8.

It should also be noted that while Frederickson and colleagues' evaluation of a cognitive neuroscience informed intervention to promote EF and ER in the classroom showed some success, this was the only evaluation of the LGS programme. Furthermore, there was not a no-intervention comparison group, making it difficult to conclude that any changes were due to the intervention. While interventions based on Social Learning Theory do not account for these neurocognitive deficits of pupils with CP, interventions which focus on EF and ER may also need to consider the role of the social environment of these children, including family relationships and their home neighbourhood, to be effective (Frick, 2001). As Frick concludes, there may not be a single best treatment for CP. After all, research suggests that CP is multi-determined; it is likely a complex interaction of cognitive, social, and parenting factors, and other environmental stressors (Frick, 2006; for a review, see Chapter One). Therefore, while interventions based on Social Learning Theory may neglect neurocognitive factors, the current approach may need to also consider the wider influences of antisocial behaviour beyond neurocognitive deficits and beyond the classroom.

The current study did however show promise for pupils with CP/CU+, especially in terms of a reduction in CU trait symptoms, which has important implications for future interventions. Primarily, this result refutes the traditional view that CU traits or psychopathic symptoms are untreatable (Hare et al., 1991) and adds to the growing body of evidence to suggest that CU traits are amenable to treatment (Caldwell et al., 2012; Datyner et al., 2016; Frederickson et al., 2013; Salekin et al., 2012). The distinct characteristics of this subgroup of children must be considered when designing interventions for CP. Differences in outcomes for subtypes of CP also supports the need for the inclusion of a limited prosocial emotions specifier for CP in the DSM-5 (APA, 2013). Interventions can be tailored to meet the needs of the individual child or adolescent dependent on the presence of this specifier.

Despite evidence of limited effectiveness of the current intervention from the quantitative data, it should not be ignored that qualitative data suggest the intervention did have some success. LSAs reported that they had observed positive changes in pupil behaviour and in the qualitative data, despite the lack of effect from BRIEF-II reports. It may be that despite overall no significant improvements, some pupils did benefit from this intervention. This gives promise that the intervention could be effective, but for reasons discussed relating to the short duration and poor fidelity of the intervention delivery, the benefits did not reach all pupils.

The limitations to the current study can inform the design of future intervention delivery and evaluation. Increasing the duration of the intervention, ensuring more one-to-one teacher to child support, and providing more teacher training or ongoing classroom input, may each improve the effectiveness of this intervention approach. The current results highlight the importance of a multimethod approach when evaluating interventions, as the quantitative and qualitative data show different outcomes. Furthermore, with ongoing fidelity checks, changes could be made along the way to ensure adherence to the intervention design.

Chapter 7 **Using EEG to Examine the Neural Correlates of Emotion Regulation and Inhibitory Control**

7.1 Introduction

Thompson's (1994) commonly used definition of emotion regulation (ER) as the *'processes responsible for monitoring, evaluating, and modifying emotional reactions…to accomplish one's goals'* (pp. 27–28) has been adopted throughout this thesis. However, as discussed in Chapter Two, there is not an agreed definition of the term emotion regulation, most probably due to the complex and overlapping systems involved in emotion-related processes (Mauss & Robinson, 2009). Many different dimensions of emotion and associated processes have been examined in children, including emotional states (e.g. emotional arousal and emotional valence), emotional traits (e.g. extraversion and neuroticism), and emotion knowledge (i.e. the understanding and awareness of one's own and others' emotions), as well as the lability and expression of emotions in relation to social display rules (see Scherer & Ekman, 2014). The lack of consistency on the conceptualisation of ER makes the comparison and interpretation of findings across studies problematic (Cole et al., 2004; Langlois, 2004). As demonstrated in the profiling study in Chapter Three, scores from child self-reports of ER and teacher-report measures of ER were not closely associated and, despite both being named as measures of emotion regulation (Child Emotion Regulation Questionnaire and Emotion Regulation Checklist), the items in the questionnaires measure quite different processes (see Chapter Three for a discussion). This highlights the need to interpret findings from a single measure with caution when examining complex processes such as ER and drawing comparisons across studies. This was further demonstrated in Adrian, Zeman, and Veits' (2011) review of studies investigating children's ER. Adrian and colleagues found that the measurement tools used across studies show great diversity in how ER is understood and assessed. Moreover, despite a call for a multimethod approach in the study of emotion-related processes (Larsen & Prizmic-Larsen, 2006), over 61% (96 studies) of published research relied on one method and there was no significant increase in the use of a multimethod over the 35 year review period (1975 to 2010).

The first aim of this chapter will be to present an overview of some of the current methods used to study children's ER and discuss the limitations of each. This includes a novel approach to study

ER directly through the use neuroscience methods (Lewis & Stieben, 2004). Moreover, of particular relevance to this thesis, Lewis and colleagues have documented the use of this neurobiological measure of ER in the evaluation of interventions for children with behaviour difficulties (Lewis et al., 2008; Woltering et al., 2011). Despite evidence to suggest that a neurobiological approach can help our understanding of anti-social behaviour, Lewis and colleagues work is one of the first to move beyond intervention evaluation research which relies on behavioural measures. Using a similar method to Lewis and colleagues, a pilot study which aims to assess the neural correlates of ER and how these relate to behavioural measures will be presented in this chapter.

7.1.1 Measures of Children's Emotion Regulation

The investigation of child ER in the literature comes from a combination of child self-reports, parent and teacher reports, observational methods, and neurophysiological techniques. Child self-reports for school-aged children include traditional pen and paper questionnaires, in which children respond to a series of items using a Likert-type scale to indicate to what extent they agree with a series of statements. For example, the CERQ-kids (Garnefski et al., 2002) and the Children’s Emotion Management Scales (Zeman, Shipman, & Penza-Clyve, 2001) assess children's reports of their own coping strategies used to manage negative emotions (e.g. ‘When I am feeling sad, I do something totally different until I calm down’). This traditional style questionnaire has also been adapted to make the assessment of ER more accessible to children, for example by using pictures and vignettes. The Emotion Regulation Interview (Suveg & Zeman, 2004) assesses the child's use of ER strategies, their decisions to express emotions, and their self-efficacy managing emotions using short vignettes followed by semi-structured interview questions. In the Child Pictorial Scale of Problems (Whitcomb & Merrell, 2013), a cartoon with a character in a negative situation (e.g. having a scary dream) is presented and the child is asked to point to a picture of an emotion thermometer that indicates how they would feel in that situation. While these simplified or pictorial response formats, have been recommended for children under 8 years old (Marsh, Craven, & Debus, 1998), the validity of children’s self-reports is still questionable (Durbin, 2010). In particular, it is argued that children may have unreliable and/or inaccurate reports about the self (Marsh et al., 1998). These methods require children to have self-awareness of their own emotions including recalling retrospectively how they felt, what they thought, or what action they took in a given situation; think hypothetically, i.e. how they might feel or think or what they would do in a given situation; and be able to communicate this effectively to the researcher (Adrian et al., 2011; Suveg, Payne, Thomassin, & Jacob, 2010).

Children's ER is often assessed using adult reports. For example, the Parents' Beliefs About Children's Emotions (Halberstadt et al., 2013) and the Children's Coping Strategies Checklist (Contreras, Kerns, Weimer, Gentzler, & Tomich, 2000) measure adults' perceptions of the child's emotionality and typical methods of managing emotional experiences. However, biases, including the adult's own psychopathology, are inherent in parent- and teacher-reports (De Los Reyes & Kazdin, 2005). Observational methods, on the other hand, are conducted by a trained researcher or clinician, reducing such bias. For example, Melnick and Hinshaw (2000) observed and coded children's body gestures, tone of voice, and facial expressions following an emotion induction in which children were asked to complete a puzzle from an incomplete set of pieces. These observations can all be informative of emotion management and expression (Adrian et al., 2011). However, it is questionable as to how well an adult's report or observation of behaviours reflects a child's thoughts and feelings. These tools are therefore limited to the assessment of the behavioural expression and management of emotion and cannot measure unobservable emotion-related processes (Adrian et al., 2011).

As discussed in Chapter Two, a number of neurophysiological systems are involved in the production and regulation of emotion (Curtis & Cicchetti, 2007). Tools which record activity in these systems can therefore provide a proxy measure of these emotion-related processes. For example, heart rate and respiration have been used to measure arousal by cardiac activity (e.g. (Scott & Weems, 2014). Similarly, cortisol, a hormone released from the adrenal gland in response to stress (Takahashi et al., 2005) can be measured through analysis of saliva samples (e.g. Schwartz et al., 1998), and activity of the ANS, involved in regulating emotions and stress reactions (Besedovsky et al., 2008) can be measured using skin conductance (e.g. (Beijersbergen, Bakermans-Kranenburg, Van IJzendoorn, & Juffer, 2008). However, taking Thompson's (1994) definition of ER adopted in this thesis, ER is not just the down-regulation of emotional arousal as many of these physiological measure, but involves the control and modification of one's actions to accomplish one's goals (Diamond & Aspinwall, 2003).

Since ER involves brain regions involved in both affective processing (e.g. the amygdala) and cognitive control and self-regulation (i.e. the frontal cortex) (Banks et al., 2007; Davidson, Putnam, & Larson, 2000), neuroimaging of these regions may also provide a more direct measure of ER. For example, fMRI studies examining the neural bases of the cognitive control of emotion have found the prefrontal and anterior cingulate regions and the amygdala to be involved in ER tasks (for a review, see Ochsner et al., 2012). However, despite its good spatial resolution, fMRI is not the optimal method for studying ER, as it does not have the sufficient temporal resolution to detect the temporally dynamic activity in these brain regions expected to take place during ER (Albares, Lio, & Boulinguez, 2015). Electroencephalography (EEG) has the advantage of a high temporal resolution, as well as lower cost and flexibility, making it a valuable tool for measuring ER in children, including clinical populations. Lewis and Stieben (2004) have developed a method to study ER through the measurement of neural activity during a goal-oriented self-regulatory task in which negative emotions are induced. An overview of this EEG method will be discussed below.

7.1.2 Using EEG to study Emotion Regulation

EEG measures electrical activity of the cortex by amplifying electrical signals from electrodes placed on the scalp (Light et al., 2010). Unlike behavioural measures or neuroimaging methods, EEG can provide a continuous measure of processing between a stimulus and a response, owing to its excellent temporal resolution. This can be achieved using the Event-Related Potential (ERP) technique, which involves time-locking EEG signals to the presentation of stimuli or a behavioural response (Luck, 2005). ERPs can detect specific sensory, motor, and cognitive task-related changes in electrical activity by averaging signals across trials to cancel out background brain activity and allow a measure of the morphology, amplitude, and timing of the neural response. Furthermore, ERPs provide a measure of processing even when there is no overt behavioural change; activity which would be missed by adult reports or observational methods.

ERP waveforms are made up of a series of positive and negative voltage deflections (Luck & Kappenman, 2012). Most components are referred to by the letters N (negative) or P (positive) to indicate polarity, followed by a number indicating either the latency in milliseconds or the ordinal position of the component in the waveform. For example, the first negative peak in the waveform typically occurs about 100 milliseconds after a stimulus is presented and is therefore referred to as the N100 (i.e. a negative peak, 100ms after stimulus presentation) or the N1 (i.e. the first negative peak). One ERP component of interest to the study of ER is the N2 (or N200, i.e. the second negative deflection). The N2, peaking between 200 and 350ms after stimulus onset, has consistently been linked to conflict monitoring and response inhibition in a number of laboratory tasks (e.g. Espinet, Anderson, & Zelazo, 2012; Folstein & Van Petten, 2008). For example, in the oddball paradigm, the continuous presentation of visual or auditory stimuli is sporadically interrupted by a rare stimulus. The N2 is observed on the presentation of the rare stimulus, reflecting conflict detection (Jongsma et al., 2013). In go/no-go tasks, participants are instructed to respond (button-press) to the presentation of a designated Go stimuli (e.g. a capital letter) and withhold a button-press following a designated No-go stimulus (e.g. a lower-case letter). The greatest N2 amplitudes are typically seen on correct no-go trials, suggesting the N2 is a marker for an inhibitory control response (e.g. Folstein & Van Petten, 2008). The N2 is usually detected in the frontal-central electrodes (Farbiash & Berger, 2015) and evidence suggests that the N2 is generated in medial prefrontal regions, including the dorsal and ventral ACC (Bekker, Kenemans, & Verbaten, 2005).

Due to the association between the N2 and inhibitory control, the N2 may also be involved in the inhibition of emotional responses, and may therefore be a useful biological marker of ER (Lewis & Stieben, 2004). To use the N2 as a marker of ER, a task that requires inhibitory control in an emotionally challenging situation is needed. Lewis et al. (2007) examined the N2 across different emotional conditions in 4- to 6-year-olds using an adaptation of the go/no-go paradigm. Children viewed images of angry, neutral, and happy faces and were instructed to press a button if the image was a woman, but to withhold a response if it was a man. The greatest N2 amplitudes were observed when children viewed angry faces, while happy faces produced the smallest amplitudes, suggesting more cortical effort is recruited during inhibitory control in the presence of negative emotion.

Nevertheless, regulatory processes induced when viewing negative images may be far from the cognitive control required to regulate emotions in the real world. Inducing a negative emotional state in the participant which they must then manage in order to perform well on a task (i.e. ER in pursuit of goal achievement) may be a more accurate reflection of ER in a real world context. Lewis and colleagues designed a paradigm which achieved this, by embedding a negative emotion induction into a go/no-go task (Lewis & Stieben, 2004). Results show some promising findings in its use as a more direct measure of ER in both adults and children.

7.1.3 Emotion-induction adaptation of the go/no-go paradigm

In Lewis and colleagues' adaptation of the go/no-go paradigm, the task is split into three blocks (Lewis & Stieben, 2004). Participants are informed that they will earn points for correct responses, and lose points for incorrect responses, and that the accumulation of points will result in a prize. Points are gained readily in block A and the accumulation of points is displayed to participants. However, in block B the task is made more difficult by increasing the speed at which the stimuli are presented and participants see their points drop. This block is designed to induce a negative emotional state, such as frustration, anger, or anxiety, as progress towards goal achievement is challenged. In block C, task difficulty is returned to match that of block A, and points are regained so that all participants receive the prize.

Lewis and colleagues piloted this task in two studies with 5- to 16-year-olds (Lewis & Stieben, 2004, *N*=53; Lewis, Lamm, et al., 2006, *N*=58). As in traditional go/no-go tasks, a distinct N2 waveform was observed on correct no-go trials. In both samples, greater N2 amplitudes (more negative) were observed following the negative emotion induction, suggestive of more effortful activation of inhibitory control mechanisms while experiencing negative emotion. A self-report emotion-induction check in which participants rated emotion words (including excited, satisfied, sad, and mad) following the task confirmed that negative emotion had been induced.

While these results suggest this ERP paradigm could be a useful tool for measuring ER in children and adolescents, inconsistencies in the effect the emotion-induction has on performance and N2 amplitudes have been reported. For example, using the same task with a sample of 49 children and adolescents (aged 7-16), Lamm and Lewis (2010) found no effect of block on N2 amplitudes. In a sample of 58 children (aged 5-6), Farbiash and Berger (2015) found that behavioural performance on the go/no-go task improved following the negative emotion-induction and therefore conclude that negative emotion enhanced inhibitory control. Based on findings of the influence of emotion on cognitive tasks (e.g. Sarter, Gehring, & Kozak, 2006; Van Steenbergen, Band, & Hommel, 2011), Farbiash and Berger (2015) speculate that the threat of losing the prize may have increased motivation to succeed and increased on-task attention. The discrepancy with

Lewis and colleagues' findings then may be accounted for by task design. Previous evidence has suggested that for highly demanding and resource-intensive tasks, negative emotions have a negative impact on EF (Eysenck et al., 2007; Mitchell & Phillips, 2007). Children in Farbiash and Berger's study were shown a stimulus (e.g. picture of an animal or food) designated as a Go or No-go stimulus, while Lewis and colleague's used repetition of a letter as the no-go stimulus. It could be argued then that Lewis' task has a greater cognitive load, involving shifting and working memory in addition to inhibition, as the same stimulus sometimes required a response and other times required inhibition of response depending on the sequence in which it was presented. In addition, it should be noted that these results were conducted at the group level, and while on average children performed better during the negative induction, some children performed more poorly.

Of particular relevance to this thesis, Lewis and colleagues have detected individual differences in the N2 response of children with behavioural difficulties during this task, and have tested this paradigm as an intervention evaluation tool for children with CP. Lamm, Granic, Zelazo and Lewis (2011) recruited 27 aggressive boys and girls either with or without co-morbid anxiety, and 14 healthy children (aged 8-12). Co-morbid children had greater N2 amplitudes across all blocks compared to healthy children and children with externalising problems alone. In a sample of 37 boys (aged 8-12), Stieben et al. (2007) found that following the emotion-induction in particular, N2 amplitudes were greater for boys with co-morbid internalising and externalising difficulties compared to children with externalising difficulties alone, suggestive that co-morbid children recruited more cortical resources for inhibitory control and ER compared to children without anxiety. Using this paradigm as an intervention evaluation tool, Woltering et al. (2011) found that school-aged children (*N*=71) with clinical externalising behaviour whose behaviour improved following a combined programme of CBT and PMT, had a greater overall decrease in the magnitude of the N2 compared to non-improvers. Source analysis, during the time-window of the N2, estimated activation decreases in the medial and ventral PFC and in the anterior medial temporal lobe for improvers only. While not an RCT, results from a healthy comparison group suggest that practice effects were not accountable for the change in neural activation. This evidence provides support for the idea that PFC activation associated with ER can change with successful treatment for children with behaviour difficulties and that more effective regulatory mechanisms might help explain the beneficial effects of treatment for these children. However, in a sample of twenty-seven 8- to 12-year-olds with externalising problems, Lewis et al. (2008) found reduced vmPFC activation in improvers compared to non-improvers, but post-intervention N2 amplitudes were no different between improvers, non-improvers, and a healthy comparison group, suggesting behavioural improvement was not reflected in the N2 response. This may be due to the low power of the smaller sample size in this study, but further replication of this method is needed.

Taken together, these findings provide evidence for the use of this tool as a measure of inhibitory control and ER in children, as well as measuring distinct patterns of neural activity suggestive of ER in children with subtypes of behaviour difficulties. However, a number of discrepancies and limitations to this research need to be addressed. Firstly, the magnitude of the N2 was found to differ between blocks in some studies but not in others using this paradigm (e.g. Lamm & Lewis, 2010; Lamm et al., 2011; Stieben et al., 2007). Secondly, the direction of the magnitude of the N2 between blocks has recently been put into question (e.g. Faribash & Berger, 2015). There is also some ambiguity between studies in regards to the function of the final part of the task (block C). While structurally the same as the first part of the task (block A), and therefore considered to be an emotionally neutral block, the negative induction in the middle of the task (block B) may have lasting effects into this final block. As a result, some studies have considered both block B and C to be under a negative emotion and therefore analysed both blocks as such (Lewis & Stieben, 2004; Lewis et al., 2006), or where there were too few trial counts in block B (the emotion-induction) for analyses, block C has been analysed alone as the negative emotional state block (e.g. Lewis et al., 2008; Woltering et al., 2011). These assumptions have been made for block C despite self-reported emotions reported as more positive in block C than B across studies (e.g. Lamm et al., 2011; Lewis et al., 2006; Lewis et al., 2008; Stieben et al., 2007). It could be argued that self-reports rate block C as less negative than actually experienced, because these are collected post-task when all points have already been won back and therefore may be recalled as a positive end to the game. However, this cannot be determined; therefore more trial counts in block B would allow for a comparison of block A and block B to avoid the use of the ambiguous block C.

Finally, there is a lack of evidence of how neural activity measured by this ERP tool relate to behavioural measures of ER. While Lamm et al. (2011) did include a behavioural measure of self-regulation (Early Adolescent Temperament Questionnaire; Ellis & Rothbart, 2001), which verified that youths with externalising difficulties had poorer self-regulation than healthy controls, most of this work has relied on a score of externalising and internalising behaviour only, with no behavioural measure of ER or EF.

7.1.4 Current study: Aims and hypotheses

The primary aim of the current study was to pilot an adaptation of Lewis and colleagues' emotion-induction go/no-go paradigm and to consider the utility of this measure as an evaluation tool in future CP intervention research. Within this pilot work, the aim was to provide further support for the use of an emotion-induction go/no-go paradigm to index ER, to address some of the discrepancies present in the literature with regards to this measure, and to extend this literature by assessing whether this proposed neural marker of ER is associated with behavioural measures of ER.

No hypotheses were made regarding accuracy and reaction times on the go/no-go task, as the task was designed to dynamically adjust presentation times to maintain the same level of difficulty across participants. However, response times may differ between blocks in response to the loss of points (i.e. faster reaction time due to an increased effort to gain back points, or a slower reaction time if participants resign to the idea that they are unable to win the prize).

As documented in previous literature (e.g. Folstein & van Petten, 2008), it is predicted that a distinct N2 deflection will be seen at 200-350ms post-stimulus on trials requiring participants to withhold a pre-potent response (i.e. no-go trials). In line with previous findings that N2 amplitudes are greater (more negative) in the presence of negative emotions (e.g. Lewis, et al., 2007; Lewis & Stieben, 2004), it is predicted that a significantly greater N2 deflection will be found for no-go trials during the emotion induction (block B) compared to pre-emotion-induction (block A).

The final aim is to find out whether this neural measure of ER is associated with self-reported behavioural measures. Based on findings of greater N2 amplitudes for children with co-morbid externalising and internalising difficulties (Lamm et al., 2011; Stieben et al., 2007), it is predicted that higher self-reported emotional difficulties will be associated with greater N2 (more negative) amplitudes during the negative emotion-induction. While theoretically an association between the

N2 and behavioural reports of inhibitory control and ER would be expected, previous research using these behavioural measures in conjunction with this ERP paradigm are limited. Therefore this work will extend the previous literature by examining associations between neural activity measured using this ERP tool and a series of behavioural self-report measures.

7.2 Method

7.2.1 Participants

While using child participants for this study would have been desirable in the context of this thesis, difficulties with school recruitment and the loss of one of the recruited schools mentioned previously, made this impossible within the testing time-frame. As a result, it was decided that for the purpose of this small pilot study, namely to test the adaptations made to Lewis and colleagues' paradigm and to examine the associations between this neural measure and behavioural measures of EF and ER, a preliminary investigation with young adults would be carried out. Therefore, fourteen undergraduate students were recruited from Goldsmiths College through the psychology course credit scheme. Usable data were available for 10 (3 male) participants (aged 18-27; M= 21.40, SD=3.53). Ethical approval was granted from Goldsmiths, University of London Research Ethics Committee.

7.2.2 Measures

7.2.2.1 The Difficulties in Emotion Regulation Scale (DERS)

The DERS (Gratz & Roemer, 2004) is a 36-item self-report measure designed to assess multiple aspects of difficulties in emotion regulation in 18- to 60-year-olds. The DERS includes six subscales: Non-acceptance (non-acceptance of emotional responses), Goals (difficulties engaging in goal-directed behaviours when experiencing negative emotions), Impulsivity (difficulties controlling impulses when experiencing negative emotions), Awareness (lack of awareness of emotional responses), Strategies (limited access to effective emotion regulation strategies), and Clarity (lack of clarity of emotional responses). The DERS uses a Likert-type scale ranging from 1 ('almost never') to 5 ('almost always'). Higher scores indicate greater difficulty with emotion regulation. The authors report internal consistency reliabilities of α=.80 to .93, and test-retest reliabilities of .57 to .89 (Gratz & Roemer, 2004). In the current sample, Cronbach alphas ranged from .66 to .94 across subscales.

7.2.2.2 Behavior Rating Inventory for Executive Function: Adult version (BRIEF-A)

The BRIEF-A (Roth, Isquith, & Gioia, 2005) is a 75-item self-report questionnaire developed to assess everyday executive function behaviours in adults aged 18 to 90 years. Item scores can be summed to form eight subscales: Inhibition (ability to control impulses and stop own behaviour at the appropriate time), Shifting (ability to move easily from one situation, activity or aspect of a problem to another when necessary, and to solve problems flexibly), Emotional Control (ability to appropriately modulate emotional responses), Initiation (ability to begin a task and independently generate ideas), Working Memory (ability to hold information in mind to complete a task), Planning/Organising (ability to anticipate future events, set goals, and develop appropriate steps to carry out tasks), Organisation of Materials (ability to keep work space and materials orderly), and Monitoring (ability to check work, assess performance of a task to ensure goal achievement, and keep track of the effect of own behaviour on others). The BRIEF-A has evidence of good reliability and validity across a wide age range (Roth et al., 2005). In the current sample, Cronbach alphas ranged from .72 to .86 across scales.

7.2.2.3 Emotion-induction go/no-go task

The go/no-go paradigm involves a continuously presented series of stimuli composed of frequent Go cues to which participants respond as rapidly as possible and infrequent No-go cues to which subjects are instructed to withhold a response. The high frequency of Go cues creates a tendency to respond that must then be inhibited for no-go cues, providing a measure of the ability to inhibit a prepotent response. In the current study, the emotion-induction go/no-go task was adapted from Lewis and colleagues' studies (e.g. Lewis et al., 2008; Lamm et al., 2011). Participants are instructed to press a key when a letter is presented on a computer screen, but to withhold their response when the same letter is presented in succession. This version of the go/no-go task is made up of three blocks. Block A and C are structurally identical, while in block B the presentation time of the stimuli is decreased, resulting in a more difficult task. Block B is designed to induce a negative emotional state in the participant. Stimulus duration returns to normal in block C to allow participants to regain their points and win a prize.

7.2.2.4 Self-report emotion-induction check

To assess whether participants' emotional state did change throughout the go/no-go task, participants were asked to rate how they felt during each of the three blocks. To aid recall, the letters presented during each block were displayed. Participants rated five written emotion words ('upset', 'angry', 'nervous', 'satisfied', and 'excited') on a Likert-type scale ranging from 1 ('Not at all') to 10 ('Very much') (see Appendix D. Emotion-induction check). This method has been used in a number of studies by Lewis and colleagues (e.g. Lamm et al., 2011; Lewis et al., 2006; Lewis et al., 2008; Stieben et al., 2007).

7.2.3 Procedure

Participants were given a brief introduction to the testing environment, electrode sensor nets, and recording system at the EEG lab. Following written consent, participants completed the BRIEF-A and DERS.

Participants were fitted with an electrode cap and the electrodes were placed in the headcap using electrolyte gel to make good connections. Participants were then seated in a sound-attenuated electrically shielded room, in front of a computer monitor and a keyboard. Participants were instructed to press the space bar as quickly as possible for each letter presented on the screen ('go' trials), but to avoid pressing anything when a letter was repeated a second time in succession ('no-go' trials) (see task schematic in Figure 7.1). They were informed that they would win a prize (and were shown a £5 note) with successful performance (accumulation of points).

The computerised task ran on E-Prime software (Psychological Software Tools). A practice block of 30 trials was given to ensure proficiency with the task and allow for any questions. Participants then completed three blocks of trials (A, B, and C) with the option to take a short rest between blocks. In each block, no-go trials were presented in pseudorandom sequence. Points were added for correct no-go responses and deducted for response errors on go and no-go trials, with accumulated points displayed at random intervals in the centre of the screen. Stimulus duration began at 500msec and was then dynamically adjusted to provide the same level of challenge across participants. The algorithm was set to maintain the no-go error rate at approximately 50 ± 10%. Following each incorrect response on no-go trials (i.e. incorrectly pressing the space bar), stimulus duration was increased. Decreases in stimulus duration only occurred when the no-go trial followed a correct go trial to account for chronic non-responding.

Changes in the algorithm caused all participants to lose their points in Block B to induce a negative emotional state (frustration, anger, and/or anxiety) at the possible loss of the prize. Block C returned to the algorithm of block A, so that all participants regained their points to win the prize. Different pairs of letters were used for each block to enhance novelty (block A: x, y; block B: o, p; block C: u, d). Stimuli letters, dimensions, and timings in each block were identical to those used previously (e.g. Lewis et al., 2008). However, trial counts from Lewis and colleagues task were doubled to avoid previously reported difficulties with insufficient data in block B for analyses (e.g. Lewis et al., 2008). Therefore, in the current adaptation, blocks A and C were made up of 400 trials each (132 no-go trials) while Block B was shorter (300 trials, including 80 no-go trials) to limit the duration of negative emotion. Due to the non-clinical adult sample, this increase in trial counts, including a longer emotion-induction block, was considered appropriate for this study.

Following the task, all participants were verbally praised for their successful accumulation of points and given the £5 note. Participants then completed the self-report emotion induction check and were given a debrief information sheet and the opportunity to ask any questions.

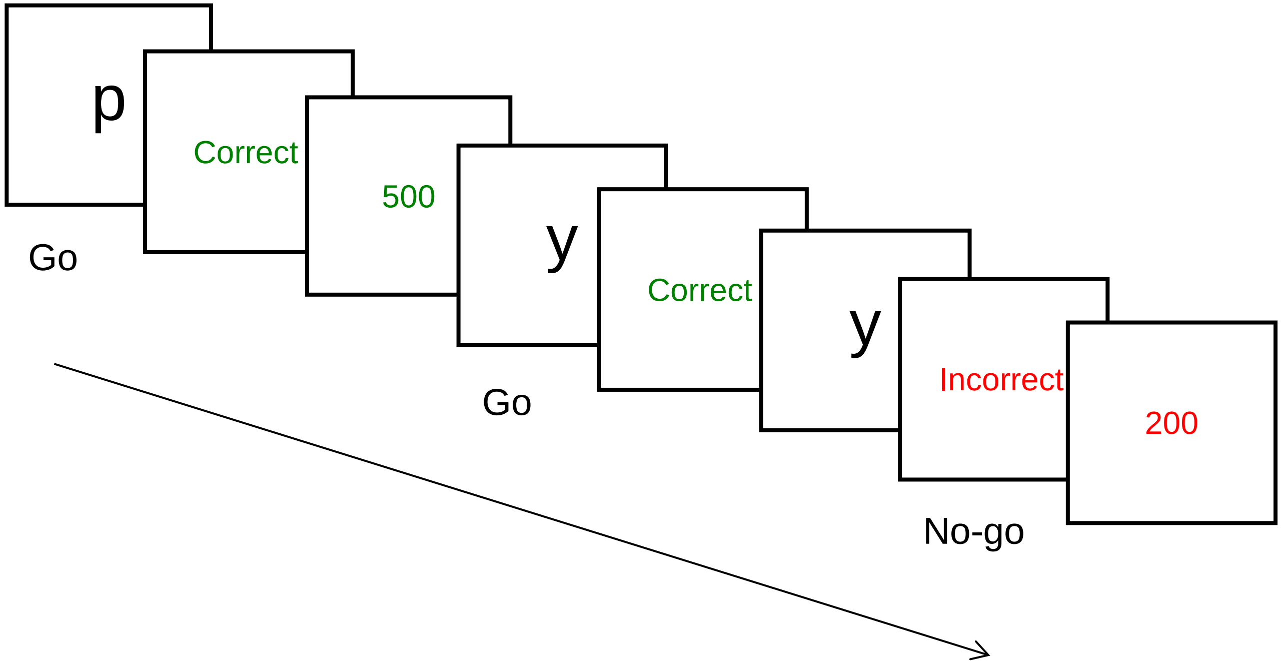

Figure 7.1: *Go/no-go task schematic.*

Schematic presents an example of three trials (two Go trials followed by one No-go trial) with written feedback following each trial and the accumulation of points presented at random feedback intervals throughout the task. In this example, the space bar was pressed following presentation of the stimuli in all three trials, i.e. a correct response for both Go tasks, but an incorrect response (i.e. failure to inhibit the key press) on the No-go trial (repeated letter).

7.2.4 EEG data recording and analyses

EEG was recorded using a 64 channel active electrode cap and sampled at 512 Hz using BioSemi software (BioSemi, 2011). The BioSemi software also checks that good connections between electrodes and the scalp have been made. All channels were referenced to electrodes on both earlobes during recording. Eye movement artefacts (70μV threshold), signals exceeding 200μV, and fast transits exceeding 100μV were removed before averaging. Data were filtered using a Butterworth filter with low-pass frequency of 30Hz and high pass frequency of 1Hz.

Correct no-go data were segmented into epochs from 200ms before to 1000ms after stimulus-onset and baseline corrected for the 200ms preceding the stimulus. The no-go N2 was scored as the average ERP amplitude between 225 and 325ms post-stimulus, as waveforms showed peak N2 activation throughout this time period. As the N2 is usually detected in the frontal-central electrodes (e.g. Farbiash & Berger, 2015), all analyses were conducted on stimulus-locked waveforms averaged across electrodes Fz and FCz. Of the 14 participants recruited, one was excluded because the EEG recording failed. Data from three further participants were rejected due to excessive artefacts in at least one of the blocks (fewer than 50% of artefact-free trials), leaving 10 participants with usable data for analyses. The mean number of rejected trials for all blocks was 68.8 (6.3%); ranging from 6 (0.5%) to 202 (18.4%) across these 10 participants.

As the task was dynamically adjusted based on each participant's performance to ensure difficulty across participants was consistent, performance accuracy was not analysed. Mean response times were analysed using correct Go trials in each block. A series of repeated-measures ANOVAS were conducted to compare behavioural (response times and self-report emotion-induction scores) and ERP data (N2 amplitudes) across blocks A, B and C. Pearson's correlations were used to examine associations between subscale and total scores of self-reported emotional difficulties (DASS-21), ER (DERS), and EF (BRIEF-A), and correct no-go N2 amplitudes.

7.3 Results

7.3.1 Go/no-go behavioural analyses

Mean and standard deviations of task response times are presented in Table 7.1. Correct go trials were averaged to calculate mean response time scores for each block. In a repeated measures ANOVA, a significant effect of block was found for response time, $F(2,8)=56.76$, $p<.001$, Pillai's Trace=.942, partial $\eta^2=.94$. Pairwise comparisons (Bonferroni corrected) show response times were significantly slower in block A than in block B and C (both $p<.001$). Response times for block B and block C were not significantly different, $p=1.00$.

Table 7.1: *Means and standard deviations (in parentheses) for go/no-go task response times, self-reported negative emotion, and N2 amplitudes by block and trial type*

	Response time[a]	Negative emotion[b]	N2 amplitude[c]	
			Go trials	No-go trials
	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)
Block A	357.39 (41.05)	11.50 (4.95)	-.14 (2.66)	-.58 (2.85)
Block B	289.97 (33.47)	17.20 (5.05)	.89 (2.38)	-2.87 (3.39)
Block C	296.56 (36.60)	10.10 (4.53)	.33 (2.50)	-2.29 (2.09)

[a]Go/no-go task, correct go trials. [b]Self-reported emotion-induction check; sum of Upset, Frustrated/Angry, and Nervous. [c]N2 amplitudes averaged across channels Fz and FCz

7.3.2 ERP analyses

All analyses were conducted on stimulus-locked waveforms averaged across electrodes Fz and FCz as in previous analyses of this task (e.g Lewis et al., 2008; Lamm et al., 2011). Means and standard deviations of N2 amplitudes by block and trial type are presented in Table 7.1. Figure 7.3 presents the stimulus locked grand-averaged waveforms for no-go trials for block A, B, and C, showing a distinct and well-formed N2 component peaking at between 225 and 325ms after the no-go stimulus.

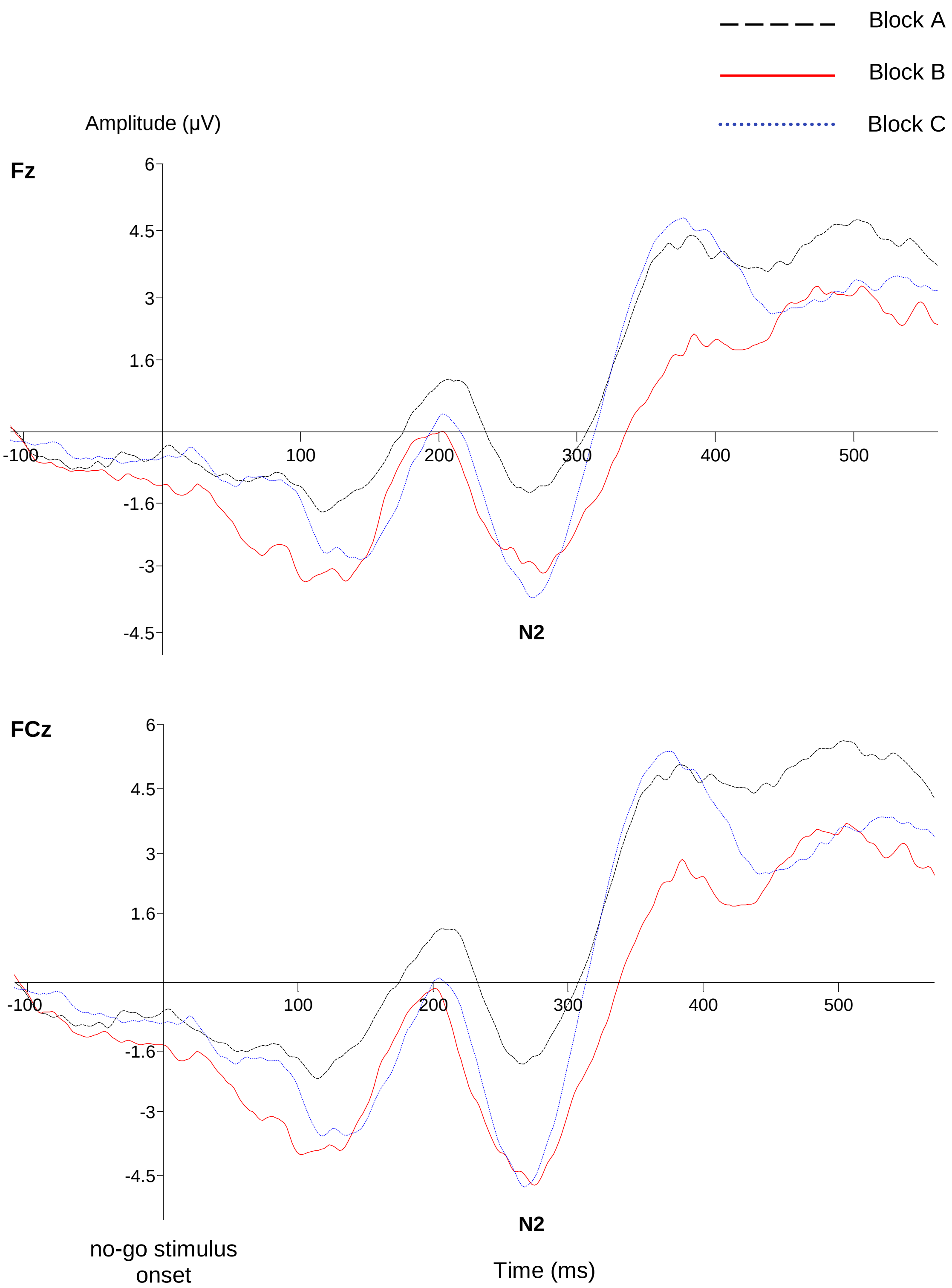

Figure 7.3: *Block differences in grand-averaged waveforms for the N2 at site channels Fz (top panel) and FCz (bottom panel) on no-go trials*

A 3 (block) by 2 (trial type) repeated measures ANOVA demonstrated a main effect of trial type $F(2,8)=19.61$, $p<.01$, Pillai's Trace =.685, partial $\eta^2=.69$, but no significant effect of block, $F(2,8)=$, $p=.32$, Pillai's Trace =.246, partial $\eta^2=.25$. However, a significant block*trial type interaction was found for N2 amplitudes, $F(2,8)=$, $p<.05$, Pillai's Trace =.599, partial $\eta^2=.60$. Simple effects demonstrate significantly greater N2 amplitudes (more negative) for no-go trials compared to go trials for block B ($p<.01$) and block C ($p<.001$). Go and no-go trials did not significantly differ for block A ($p=.39$). For go trials, significantly greater N2 amplitudes (more negative) were found for blocks A and C compared to block B (both $p<.05$). Go trial amplitudes did not differ significantly between block A and block C. For no-go trials, significantly greater N2 amplitudes (more negative) were found for block B compared to block A ($p<.05$), but amplitudes did not differ significantly between block C and block A ($p=.06$) or block B ($p=.61$).

7.3.3 Emotion induction check

The self-report emotion induction data were used to assess whether the negative emotion induction was effective. Means and standard deviations of self-reported negative emotion (sum of upset, frustrated/angry, and nervous scores) in each block are presented in Table 7.1. Results from a repeated measures ANOVA demonstrated that self-reported negative emotion differed significantly between blocks, $F(2,18)=13.80$, $p<.001$, partial $\eta^2=.61$. Pairwise comparisons demonstrate that block B was perceived as more negative than block A ($p<.05$) and block C ($p<.01$). Ratings of negative emotion did not significantly differ between Blocks A and C ($p=.82$).

7.3.4 Individual differences in the N2 response

Scores from behavioural measures of EF and ER were analysed to assess whether these behavioural self-reports were associated with the neural N2. Pearson's correlations between ERP amplitudes for correct No-Go trials and scores on behavioural measures of EF (BRIEF-A) and ER (DERS) are presented in Table 7.2. No significant correlations were found between no-go N2 amplitudes on any block and any total score or subscale of the behavioural self-reports.

Table 7.2: Means and standard deviations (in parentheses) *of behavioural self-reports, and test statistics of bivariate correlations with N2 amplitudes.*

	Mean (SD)		Pearson's *r* [a]	*p*-value
BRIEF [b]				
Inhibit	14.33	(3.32)	-0.20	.61
Shift	11.20	(3.08)	0.14	.70
Emotional control	19.00	(6.22)	0.07	.85
Self-monitor	9.50	(2.59)	0.25	.48
Initiate	12.70	(2.45)	-0.33	.36
Working Memory	15.33	(4.58)	-0.02	.96
Plan/Organise	15.60	(3.69)	-0.14	.70
Monitor	12.30	(2.91)	-0.34	.34
Organisation of materials	16.50	(2.76)	0.08	.83
DERS [c]				
Emotion Regulation	99.50	(30.37)	-0.46	.18

[a]Pearson's correlation coefficient between mean self-report score and N2 amplitudes on correct no-go trials. [b]Behaviour Rating Inventory for Executive Function-Adult version. [c]Difficulties in Emotion Regulation Scale.

7.4 Discussion

7.4.1 Behavioural performance on the go/no-go task

Accuracy scores were not analysed as the task was dynamically adjusted to maintain the same level of difficulty across participants. However, participants' response times were found to be faster during and after the emotion-induction, which is in line with the increased presentation of stimuli in block B and a response which may have continued into block C.

7.4.2 Effect of the emotion-induction on the N2 response

As predicted, a distinct N2 deflection was seen at 225-325 ms post-stimulus on trials requiring participants to withhold a pre-potent response (i.e. no-go trials). This study also addressed some of the discrepancies in the N2 response found in previous studies using this task. While a greater N2 response has generally been found following the emotion-induction (Lewis, et al., 2007; Lewis & Stieben, 2004; Lewis et al., 2006), Lamm and Lewis (2010) found no effect of emotion on N2 amplitudes using the same task. However, the current finding that N2 amplitudes were greater (more negative) in the presence of negative emotions provide support for the original findings and conclusions of Lewis and colleagues, that more effortful activation of response inhibition mechanisms are needed in the presence of a negative emotion. Self-reports of experiencing significantly more negative emotions (nervous; frustrated/angry; upset) in the emotion-induction block compared to the other blocks confirms that the negative emotion was experienced most prominently in this middle block.

The current study also found that N2 amplitudes did not significantly differ between the initial phase of the task (before the emotion-induction) and the final phase (after the emotion-induction). While the task before and after the emotion-induction were designed to be structurally identical, previous studies have taken the view that the effect of the negative emotion-induction in the middle of the task would still be in place in the final phase of the task and have therefore interpreted data analysed from this final phase (block C) in this way (Lewis & Stieben, 2004; Lewis et al., 2006; Lewis et al., 2008; Woltering et al., 2011). However, as in previous studies, ratings of negative emotions did not significantly differ between the initial phase of the task (before the emotion-induction) and the final phase (after the emotion-induction) in the current study. This puts into question findings from the studies which have used data from the final phase of the task (block C) to represent inhibitory control under negative emotion.

However, it may be that adults recover more quickly from the negative-induction of block B than children do, resulting in the current finding that N2 amplitudes returned to pre-emotion induction levels in block C. Age differences in terms of N2 amplitudes have been reported previously, with reduced N2 amplitudes thought to reflect improved cortical efficiency as children mature (Lamm & Lewis, 2010), but individual differences in the speed at which participants recover from the emotion-induction need to be examined further to again determine how to interpret block C in this task. Furthermore, it could be argued that some negative emotion was experienced in block C, but as scores had increased by the end of the block, participants may have rated block C as positive. The current study avoided this ambiguity by increasing trial counts to allow enough data in block B for it to be used as a measure of inhibitory control under negative emotion in comparison to block A. However, it is worth noting that the current study used a non-clinical adult sample as a pilot for future work with children. This longer task, in particular the frustrating and potentially distressing emotion-induction block, may be less appropriate for children, especially those with behaviour difficulties.

7.4.3 Association between behavioural measures and the N2 response

The final aim of this study was to extend the literature by examining the association between this neural marker of ER and self-reported behavioural measures of EF and ER. In the current sample, no significant associations were found between the N2 response and self-reported EF (including inhibitory control) or ER. The finding that self-reports of inhibition were not associated with the N2, which has been well-documented to index inhibitory control (e.g. Folstein & van Petten, 2008; Espinet, et al., 2012), was surprising. However, the BRIEF-A is designed to measure everyday inhibition, while the artificial task and lab conditions may have influenced the neural response. Furthermore, while behavioural measures such as self-reports, adult-reports, and observational methods are criticised for bias and a lack of ability to measure internal processes, the function of an ERP component is arguably not as clear as the function of an overt behavioural response (Luck, 2005). As ERPs represent the sum of all cortical generators at the recorded time point, the N2 may not be directly related to response inhibition. Indeed, N2 activity has been reported in tasks which do not require inhibition (Stieben et al., 2007).

Similarly, this proposed neural marker of ER in the emotion-induction go/no-go task may be measuring something different to the everyday ER assessed in the DERS. As discussed, ER is difficult to measure, largely because there is no consensus on a definition and different measures likely tap different constructs of ER (Gross, 2013). This is not to say that one measure is a more accurate marker of ER, rather the behavioural and ERP measures used in the current study are measuring something different. This has important implications for research because, as has been noted in other areas of cognitive psychology, the method chosen can have a profound impact on conclusions drawn (McDermott, Szpunar, & Christ, 2009). An integrative approach which uses multimethods across behavioural and neural measures may give a more holistic approach to the individual's ER.

7.4.4 Limitations

While the current study addresses some inconsistencies and methodological issues with previous research using this ERP paradigm, limitations should be noted. Since child participants were unable to be recruited in the timeframe of this study (discussed in section 7.3), a small adult sample was used instead. This was felt appropriate for the purpose of a preliminary examination of this adaptation to Lewis and colleagues' methods, however direct comparisons between the current adult sample and the child samples used in previous studies cannot be made. Indeed, a series of studies measuring ERPs during go/no-go tasks, including those by Lewis and colleagues (Lewis et al., 2006; Lamm & Lewis, 2010), have found differences in the latency and amplitude of the N2 response across the life span. For example, in a study of 6–7year olds, 9–10 year olds, and young adults (19–23 year olds), Junkman (2006) found that the N2 response during No-go trials was largest in 6–7 year olds and decreased linearly with age. Similarly in Johnstone, Pleffer. Barry, Clarke, and Smith's (2005) EEG study, children (mean age 10.8 years), young adults (mean age 20.7 years), and older adults (mean age 36.4 years) performed an auditory go/no-go task. Johnstone et al. (2005) found a reduction in the latency and amplitude of the N2 component with increasing age and this coincided with improvements in task performance, suggesting improved neural efficiency with age. While this research shows the N2 response may differ with age, the current detection in adults of a distinct N2 response during an emotion induction, suggests that this could also be detected in children since evidence suggest they have an even greater N2 response.

7.4.5 Implications and conclusions

As discussed throughout this thesis, there is now a large body of evidence which demonstrates neuropsychological and neurobiological abnormalities in adults and children with antisocial behaviour (for reviews, see Hyde, Shaw, & Hariri, 2013; Ogilvie et al., 2011; Wilson & Scarpa, 2012). This suggests that taking a neurobiological approach can enhance our understanding of the biological underpinnings of antisocial behaviour. Despite this evidence, evaluations of interventions for children with CP remains largely limited to behavioural outcome measures (Cornet, Kogel, Nijman, Raine, & Laan, 2015). With the development of interventions informed by evidence from cognitive neuroscience (e.g. Frederickson et al., 2013), it seems appropriate to also consider neuroscience methods when evaluating these interventions. Moreover, the success of interventions, especially in respect to long-term improvements, may depend on the effect of the intervention on neural mechanisms (Lewis et al., 2008). Psychological interventions for a range of clinical and non-clinical populations have shown changes on neurobiological measures (e.g. Hammerfald et al., 2006; Hum, Manassis, & Lewis, 2013; Karlsson, 2011). It is feasible then to suggest then that changes in neurobiology of individuals with antisocial behaviour may be found after intervention. In a review of studies which have examined neurobiological changes following intervention for youths and adults with antisocial behaviour, Cornet et al. (2015) found that brain activity, hormone levels, and heart rate variability, have all been shown to change from pre- to post-intervention. This includes evidence from Lewis and colleagues using the EEG emotion-induction go/no-go task (Lewis et al., 2008; Woltering et al., 2011). However, conclusions regarding the utility of this tool in Lewis and colleague's intervention evaluation studies rely heavily on their findings from source analyses. These findings should be interpreted with caution, since localisation based on ERPs can only create models which estimate the location of neural activity and therefore significant assumptions need to be made (Albares et al., 2015; Luck, 2005).

Nevertheless, using EEG to its advantages, this ERP paradigm offers an additional tool for studying ER, as the high temporal resolution and ability to provide a covert and continuous measure of processing is ideal for the study of ER (Luck, 2005). Moreover, EEG methods are suitable for children with behavioural difficulties, as they are non-invasive and flexible to take outside of the lab. As demonstrated in the current study, more work is needed which combines behavioural and neurobiological measures rather than relying on a single method. This highlights a promising area for future research in which this adapted version of the emotion-induction go/no-go task, alongside behavioural measures (self- and teacher-reported behaviour, ER and EF) are used at pre- and post- intervention with a sample of children with CP.

Chapter 8 General Discussion

8.1 Introduction

The high prevalence of CP amongst school-aged children (Department for Education, 2016) and the associated concurrent and long-term difficulties for these youths, their families, and society (e.g. D'Amico et al., 2014; Frick, 2016; Knapp et al., 2011) suggest that effective interventions for pupils with CP are of great importance. The primary aim of this thesis was to develop and evaluate an intervention which targets the neuropsychological deficits found in youths with CP (). To achieve this, the first aim was to extend the current literature by providing a detailed neuropsychological profile of primary school pupils with CP and to examine associated difficulties in the classroom, including self-perceived behavioural, scholastic, and social competence, and the quality of student-teacher relationships. Importantly, this thesis aimed to account for the heterogeneous nature of CP in the development and evaluation of interventions for CP, by investigating the neuropsychological and classroom difficulties in pupils with both CP/CU- and CP/CU+ and through an examination of intervention outcomes for CU traits. The final aim of this thesis was to consider the use of neuroscience methods to evaluate interventions for CP. Therefore an EEG paradigm (e.g. Lewis et al., 2008) was piloted as a direct measure of cognitive control and ER.

8.2 Summary of Results

8.2.1 Neuropsychological profiling of primary school pupils with CP

The first two experimental studies in this thesis provide a detailed neuropsychological profile of primary school pupils with CP and their associated difficulties in the classroom. In a sample of 73 pupils (aged 6-10) recruited from a mainstream primary school and a special SEMH provision, the first study in this thesis compared EF, ER, academic achievement, and self-perceived behavioural, scholastic and social competence, in pupils with and without CP, and between CP/CU- and CP/CU+ groups. The second study investigated the association between CP and the STR in 108 pupils (aged 6-11) from six mainstream primary schools. Mediation and moderation analyses were employed to examine potential mechanisms involved in this association. A summary of results from both studies follows.

8.2.1.1 Executive functions

In line with previous research (e.g. Pinsonneault et al., 2015; Schoemaker et al., 2012; Séguin et al., 2015), pupils with high CP symptoms were found to have a significantly greater teacher-reported EDF than pupils with low CP, even when controlling for IQ. Deficits were found across a full range of everyday EF skills in pupils with CP/CU- and CP/CU+ at both school provisions. Differences within the CP group were also found. Controlling for CP symptoms, pupils attending the special provision had greater deficits in cognitive flexibility and organisation skills than mainstream pupils with CP, possibly due to co-morbid difficulties present in this group. Pupils with CP/CU+ had significantly poorer inhibitory control on the performance-based assessment, supporting previous findings of a particular inhibition deficit in adults and juvenile offenders with psychopathic traits (Lapierre et al., 1995; Roussy & Toupin, 2000). However, discrepancies were found between teacher-reported EF and performance-based assessments, possibly due to shared-reporter variance or bias in teacher-reports. Alternatively, it may be that these tools measure different conceptualisations of EF.

8.2.1.2 Emotion regulation and lability

In both studies, pupils with high CP symptoms had greater teacher-reported emotion lability and/or negativity than pupils with low CP, and the first study demonstrated this for pupils with CP/CU- and CP/CU+. In line with evidence from behavioural reports, laboratory tasks, and physiological measures (e.g. Graziano, et al., 2007; Röll et al., 2012; Woltering et al., 2016), pupils with high CP reported greater use of non-adaptive ER strategies compared to pupils with low CP. In particular, pupils with high CP reported a specific dysfunctional coping style of high acceptance with low use of refocusing strategies. This supports evidence that youths with CP have a tendency to think that they cannot change their emotions (Tergwot, 1990; Tergwot et al., 1990).

Examining subtypes of CP also demonstrated some interesting differences in emotion-related abilities. Pupils with CP/CU+, but not those with CP/CU-, were found to have difficulties on a teacher-reported scale of emotion understanding, expression, and empathy. Pupils with CP/CU- reported blaming others as an ER strategy more than the CP/CU+ or no-CP groups, supporting evidence that antisocial individuals, in particular those with CP/CU-, hold self-serving and hostile attribution biases (Dodge et al., 1990; Frick et al., 2014; Iselin et al., 2016). However, there is also contrasting evidence which suggests that youths with CU traits have more deviant values, including blaming others for their problems (Chabrol et al., 2011; Frick, 2016), therefore further research is needed to examine these subtype differences.

8.2.1.3 Academic achievement

While mathematical reasoning was significantly associated with CP in the profiling work of this thesis, reading comprehension was not, and there were no significant group differences for achievement. Therefore, the well-documented association between CP and poor academic achievement (e.g. Masten et al., 2005; Risi et al., 2003) was not fully supported. Co-morbid ADHD, rather than antisocial behaviour, may be responsible for the association with achievement in previous research, as there are suggestions that ADHD is particularly implicated in the link between behaviour problems and achievement (Clark et al., 2002; Willcutt & Pennington, 2000). Nevertheless, since ADHD co-morbidity is high in youths with CP (Harrington & McGuffin, 2001; Thapar et al., 2001), ADHD symptoms were likely present in the current samples too, which would refute this explanation. It is worth considering that achievement data were not available for all pupils in the current samples, therefore the lack of significant group differences may have been due to low statistical power, especially for mathematical reasoning which was significantly correlated with CP.

8.2.1.4 Self-perceptions

There are mixed findings in the literature on the self-perceptions of antisocial individuals (e.g. Ostrowsky, 2010; Walker & Bright, 2009), and there is a lack of research which investigates how school pupils with CP perceive their own competencies, such as their behavioural and scholastic abilities. In the first study presented in this thesis, pupils with CP/CU- and CP/CU+ in both school provisions, were found to have lower perceptions of their behavioural conduct and scholastic competence compared to pupils with low CP, but low self-perceptions of athletic and social competence were not evident. These findings of low self-perceptions in specific areas of functioning may explain the previous mixed findings, as different conceptualisations and facets of self-perception have been inconsistently used across studies.

The finding that there were no differences between groups on self-perceptions of social acceptance is surprising, considering youths with CP are typically rejected by peers (Miller-Johnson, et al., 2002). The current finding supports suggestions that pupils with CP have a distorted view of their own social acceptance, are not sensitive to negative social feedback, or report higher social competence to buffer against developing a negative self-image (Barry et al., 2008; Warren et al., 2014). Additional sociometric data would be needed to examine the relationship between social competence, peer rejection, and self-perceptions in these pupils.

8.2.1.5 Student-teacher relationship

An important, but understudied, examination of CP in the context of the classroom is the relationship these pupils have with their teacher. In the second study, CP was found to predict greater S-T conflict, but not S-T closeness. While this pattern has been reported previously (e.g. O'Connor et al., 2012; Zhang & Sun, 2011), little is known about the mechanisms involved in this association. Based on previous literature and results from the first study in this thesis, the role of emotion regulation and lability deficits and the influence of CU traits were examined as potential mediating and moderating influences in this relationship. Using Preacher and Hayes' (2004; 2008) bootstrapping method, emotion lability/negativity was found to fully mediate the relationship between CP and S-T conflict. This relationship has not been investigated previously, but suggests that the way in which pupils manage and express their emotions in the classroom is a mechanism through which pupils with CP have a conflicting STR. CU traits were not found to moderate S-T closeness or conflict, suggesting the relationship between a teacher and a pupil with CP does not vary depending on level of CU traits. Nevertheless, CU traits did predict lower S-T closeness, which is in line with research showing that psychopathic traits are associated with poor interpersonal relationships (e.g. Crum et al., 2016; Horan et al., 2016; Kimonis, et al., 2013; Pasalich, et al., 2012) and that adults have a tendency to withdraw from callous and severe antisocial behaviour (Kimonis, et al., 2013; Munoz, et al., 2011).

While there is some previous evidence to suggest that achievement plays a role in the association between CP and the STR (Gallagher, 2013), achievement, or IQ, did not significantly predict the STR when included in a model with CP, and CP remained a significant predictor of S-T conflict. However, these analyses could only be carried out with a subsample with available achievement data, reducing statistical power to detect an association. Therefore, as noted previously, the role of academic achievement needs replicating in a larger sample.

8.2.1.6 Summary

In summary, these experimental studies demonstrate deficits in cognitive and emotional control and additional classroom difficulties in terms of low behavioural and scholastic self-perceptions and S-T conflict for pupils with CP[6]. This body of work offers replication and clarification of findings from previous studies in terms of an EDF and EDR account of CP, which proposes that the antisocial and disruptive behaviour reflect abnormalities in the neurobiological systems involved in cognitive and emotional control (Cappadocia et al., 2009; Johnson et al., 2015; Noordermeer et al., 2016). By providing a detailed neuropsychological profile of pupils with CP, this work extends the literature by identifying specific areas of difficulties within these broader concepts, including the use of specific ER strategies and particular areas of low self-perception. In addition, evidence was found for such deficits across school provisions and for pupils with CP/CU- and CP/CU+. Importantly, individual differences between these subgroups, including lower empathy, emotion understanding, and S-T closeness for youths with CP/CU+ only, were also identified. Moreover, this is the first study to examine the role of emotion deficits in the relationship between CP and the STR, demonstrating that emotion lability and/or negativity may be one way in which CP is related to S-T conflict. Implications of this work for the development of interventions for CP will be discussed later in this chapter.

8.2.2 Intervention outcomes for children and adolescents with subtypes of CP

In Chapter Five, a systematic review of intervention outcomes for CU traits was carried out to address concerns that this group of antisocial youths are not responsive to treatment, and to examine whether any particular intervention approach is more suitable for these youths. This was followed in Chapter Six by an evaluation of a cognitive-neuroscience informed classroom-based intervention, which was designed to address the neuropsychological deficits found in pupils with CP and to account for the individual characteristics of children with and without CU traits.

8.2.2.1 Systematic review of intervention outcomes for CU traits

A systematic search of PubMed and PsychInfo databases for publications reporting intervention outcomes for children or adolescents with CU traits or reporting changes in CU trait symptoms

[6] The use of 'with CP', 'high CP', or 'with CU traits' throughout the experimental work in this thesis are relative terms used to describe children with the highest CP (BASC-II) and CU trait (ICU) teacher-reported scores within these samples and therefore may not reflect clinical levels of antisocial behaviour.

following intervention was conducted. Inclusion criteria in previous reviews was broadened to conduct an extensive review which did not exclude studies based on intervention type, measures of CU traits, or research design, resulting in 45 studies published between 1964 and early 2016.

The review demonstrated that poorer intervention outcomes, including greater recidivism and antisocial behaviour, have been reported for youths with psychopathic or CU traits compared to youths with CP without CU traits (e.g. Manders et al., 2013; Masi et al., 2013; Spain et al., 2004). Attrition from treatment was also documented to be greater for youths with high psychopathic traits (e.g. Högström et al., 2013; Hornsveld & Kraaimaat, 2011; O'Neill et al., 2003). Nevertheless, a similar body of evidence was found which suggests that CU traits do not predict intervention outcomes (e.g. Caldwell et al., 2007; Dadds et al., 2012; Waschbusch et al., 2007) and some studies report continued long-term improvements for these youths (e.g. Hawes & Dadds, 2005; 2007, Hawes et al., 2012; Lochman et al., 2014). However, most studies did not include a long-term follow-up and one study found that improvements disappeared after the intervention (Datyner et al., 2016). Individual differences with this group of youths with CU traits, including ethnicity, developmental delay, and stability of CU traits, were found to influence outcomes (Hawes & Dadds, 2007; Kimonis et al., 2014; McCord & Sanchez, 1985). However, each of these findings need replicating. Common methodological limitations included the reliance on a single-informant of youth behaviour, lack of control group, and no long-term follow-up.

While no *best* treatment could be identified, partly due to the fact that each intervention programme varied greatly without replication of their findings, one intervention component showed promising results across several studies. Consistent with the theory of a reward-dominance (Blair, 2013; Frick et al., 2014), reward strategies were found to be effective at reducing behaviour problems and CU symptoms for youths with CP/CU- and CP/CU+, while punishment was ineffective at reducing behaviour problems and CU symptoms, with a particularly poor response to sanctions for youths with CU traits (Hawes & Dadds, 2005; Kimonis & Armstrong, 2012; Miller, 2014). Studies by Caldwell and colleagues (Caldwell et al., 2006; Caldwell et al., 2007; Caldwell, 2011), as well as a novel intervention evaluated by Frederickson et al. (2013), demonstrated that improvements in CU traits can be seen following a residential or school-based intervention which takes a reward-focused approach. Frederickson et al.’s (2013) study is of particular note, as promising results were found following a classroom-based intervention which, alongside a reward-focused approach, targets the neuropsychological deficits of these pupils. These findings lead to the development and evaluation of the classroom-based intervention discussed next.

8.2.2.2 Experimental evaluation of a cognitive-neuroscience-informed classroom-based intervention for pupils with CP

A sample of 25 pupils (aged 7 to 9) from the mainstream school in the first study presented in this thesis participated in the intervention. Due to changes in teaching staff at the comparison school and insufficient time to recruit a suitable alternative school, there was no TAU group. Teachers and LSAs took part in an intervention workshop which aimed to 1) educate staff in the role of EF and ER in learning, and the association between these skills and classroom behaviour; 2) train staff to identify EF and ER deficits and identify EF demands in their classroom; 3) provide staff with a flexible toolbox of strategies, and support staff in the development of their own strategies, to break down barriers to learning and improve classroom behaviour. This included an emphasis on the use of immediate rewards and a reduction in sanctions. Teaching staff were asked to implement their intervention strategies in the classroom on a daily basis for one school term. Self-report and teacher-report questionnaires were collected before and after the intervention and a weekly log of strategy-use in the classroom was collected from LSAs to assess intervention fidelity and the use of this approach in a mainstream classroom.

Findings from strategy-use logs suggested the LSAs were successfully able to use and adapt strategies to meet the individual needs of pupils, and that the intervention was effective in improving pupils' behaviour, self-regulation, and self-awareness of their learning and behaviour. However, self-reports and teacher questionnaires suggested no improvements in EF, ER, self-perceptions, or the STR following the intervention. This is in contrast to Frederickson et al.'s (2013) study which found improvements in EF and behaviour following a similar intervention. It is proposed that the way in which the interventions were delivered may be the cause of this discrepancy. Frederickson and colleagues' intervention ran for a full academic year and had a greater teacher-to-pupil ratio due to the special provision setting. Moreover, unlike the mainstream school, staff in Frederickson and colleague's study had requested the intervention and therefore likely had greater investment in the approach. An examination of fidelity in the mainstream study further supports the idea that intervention delivery may have been responsible for poor outcomes. While the strategy logs do suggest improvements, there was a poor response rate and key components of the intervention, including the use of novel tools used in Frederickson and colleagues' intervention (e.g. stop button or emotion thermometers), pupils' independent use of strategies, and the use of tangible rewards and reduction in sanctions, were not mentioned in these reports. Alternatively, an improved awareness of EF deficits by teaching staff following the workshop may have resulted in an increase in teacher-reported EDF scores at post-intervention due to successfully improving teacher's awareness and ability to identify these difficulties.

CU traits did not influence intervention outcomes on EF, ER, academic achievement or self-perceptions. However, CU trait symptoms significantly increased for the CP/CU- group, but significant decreased for CP/CU+. This is in contrast to findings from previous interventions studies which have shown CU traits do not improve with intervention and that children with CP/CU+ have the poorest intervention outcomes. These findings therefore provide support for the argument that youths with CU traits are amenable to change when the intervention is designed with their characteristics in mind (Frick et al., 2014). However, it is more difficult to account for the apparent iatrogenic effect for pupils with CP/CU-. There was also a significant reduction in S-T closeness at post-intervention for children with CP/CU-. It may be that CU trait symptoms and S-T closeness would have worsened with time if left untreated anyway, and therefore these results reflect lack of effectiveness of the intervention, rather than an iatrogenic effect. Again, a TAU group would be needed to test this hypothesis. Importantly, this work is one of the first to address CU traits in the context of the classroom, especially in terms of the STR, and it has highlighted the need for more research in this area, especially in terms of the complexities of antisocial behaviour and the STR.

8.2.2.3 Summary

In summary, both the systematic review and the mainstream intervention evaluation suggest that CU traits are amenable to change, especially if interventions are designed to account for characteristics of CU traits. However, the overall poor outcomes for pupils in the neurocognitive-informed intervention study, suggest that this approach may not be effective on its own, or that mainstream schools need additional engagement or support to make these changes. Contributions to the literature and further implications for the development and evaluation of interventions for CP will be discussed later in this chapter.

8.2.3 Use of neuroscience methods to study EF and ER

Research has increasingly turned to neuroscience methods to improve our understanding of the aetiology of antisocial behaviour (Beauchaine & McNulty, 2013; Snyder et al., 2015) and findings from neuroscience are now being considered in the development of interventions for CP (e.g. Frederickson et al., 2013). Nevertheless, evaluations of interventions for CP still predominantly rely on behavioural methods (Cornet et al., 2015). The final study presented in this thesis piloted an adaptation of a novel EEG approach in the study of inhibitory control and ER. This approach may offer a direct measure of change in the evaluation of interventions for CP (Lewis et al., 2008; Woltering et al., 2011).

In this EEG study, ERP waveforms in 10 undergraduate students (aged 18-27) were measured during a computerised go/no-go inhibitory control task. Manipulation of the level of difficulty during the middle block of the task (block B), causing participants to lose points towards a prize, was used to induce a negative emotional state. Consistent with previous research (e.g. Lewis et al., 2006; Stieben & Lewis, 2004), a distinct N2 deflection was seen at 200-400ms post-stimulus on trials requiring inhibitory control. Moreover, N2 amplitudes more pronounced during the negative emotion induction, providing support for the findings and conclusions of Lewis and colleagues, that more effortful activation of response inhibition mechanisms are needed under emotionally challenging conditions. In addition, participants reported experiencing significantly more negative emotions (nervous; frustrated/angry; upset) in block B compared to block A or C, confirming a negative emotion had been induced. Self-reported negative emotion did not significantly differ between blocks A and C, suggesting the influence of the emotion-induction was no longer present in block C and therefore demonstrating that only block B should be used to index ER. This puts into question findings from studies which have interpreted ERPs in block C to represent ER (Lewis et al., 2006; Lewis et al., 2008; Lewis & Stieben, 2004; Woltering et al., 2011).

This study extended previous research by including behavioural self-reports of EF and ER, which are missing from Lewis and colleagues' studies. No significant associations were found between the N2 response and self-reported EF, ER, or emotional difficulties. This has important implications for the design and interpretation of ER research, since the method used may influence conclusions drawn (McDermott, et al., 2009). An integrative approach which uses multimethods across behavioural and neural measures may give a more holistic view of the individual’s cognitive and emotion control processes. Furthermore, as this study used a non-clinical adult sample, generalisability of these findings to youths with CP are tentative. Despite these limitations, this study addressed discrepancies between previous studies using this paradigm, and was the first to combine this tool with self-reports of ER and EF. Implications for the measurement of ER and the evaluation of interventions are discussed below.

8.3 Implications and Contribution to the literature

8.3.1 Contribution to the CP/CU+ literature

Findings presented in this thesis suggest that pupils with CP/CU+ have problems with a full range of everyday EF skills, emotion lability/negativity, and poor self-perceptions of their scholastic competence and behavioural conduct. However, while children and adolescents with CU traits are considered to be a particularly problematic group in terms of severity and chronicity of antisocial behaviour (Frick et al., 2014), these findings suggests that pupils with CU traits are no more likely than those with CP/CU- to have these deficits. Nevertheless, pupils with CP/CU+ may be at greater risk for deficits in performance-based inhibition and have additional difficulties with empathy and understanding their own emotions, while pupils with CP/CU- are more likely to blame others for their negative experiences. In addition, while both subtypes experience relationships with their teachers that are characterised by conflict, it may only be those with additional CU traits that have low closeness with their teacher. These differences support behavioural evidence and findings from neuroscience that youths with CP/CU+ and CP/CU- differ in their emotional and social functioning (e.g. Finger et al., 2011; Frick, et al., 2014; Frick & Viding, 2009). This body of work extends previous research in the investigation of EF and ER in youths with CP, which has not considered the CU traits subtype. Moreover, this is one of the few studies to investigate the role of CU traits in an educational context.

While applying psychopathy to childhood has received criticism (Edens, Skeem, Cruise, & Cauffman, 2001; Hart et al., 2002), the current research suggests that a distinct subgroup of children do exist at least in terms of emotion-related abilities and interpersonal relationships. These differences provide support for the utility of the limited prosocial emotions specifier in the DSM-5 (APA, 2013) for researchers and clinicians. Identification of these problematic traits in childhood could improve the individual's chances of being appropriately treated at a time when opportunities to intervene, such as in the classroom, are available, and before negative consequences have accumulated (Lynam & Gudonis, 2005). Indeed, this thesis has also presented evidence to suggest that CU traits are amenable to change with treatment. Contributions of this work to the development and evaluation of interventions will be discussed below.

8.3.2 Implications for the development and evaluation of interventions for pupils with CP and CU traits

The detailed profile of CP difficulties presented in this thesis can be used to identify targets for interventions for these pupils. Furthermore, the intervention pilot was the first to develop and evaluate a mainstream classroom-based intervention informed by cognitive neuroscience for pupils with CP and CU traits. This work also extends and updates our understanding of intervention outcomes for CU traits, which is a valuable contribution in light of the increase in research and clinical interest in CU traits in recent years and the inclusion of the limited prosocial specifier in the DSM-5 (APA, 2013).

8.3.2.1 A classroom-based neurocognitive-informed intervention approach

Findings of EF and ER deficits in these pupils suggest that interventions for CP need to address these difficulties. For example, while some interventions for CP have aimed to improve emotion recognition and understanding (e.g. Dadds et al., 2012; Datyner et al., 2016), there is currently little in the way of an intervention which aims to build a better ER strategy repertoire. In particular, based on the findings in this thesis, making children aware that negative situations can be modified and training pupils to make more use of refocusing strategies, could improve their emotional liability. Furthermore, teachers and parents need to be made aware that disruptive behaviour stemming from these deficits, such as impulsivity, inattention, or disengagement from school (Loukas, Cance, & Batanova, 2016), may not be behaviours that these children can control in the current classroom environment. Teachers may need to adapt the demands placed on these children and offer additional support in tasks requiring EF skills. In turn, this may benefit the child's poor self-perceptions and school success. The difficult STR identified in this work provides further support for the idea of intervening at the level of the teacher is needed. If these dysfunctional relationships are not addressed, negative knock-on effects detrimental to the child, the teacher, and other pupils in the class may occur. An intervention which aims to increase awareness of EF and ER deficits in pupils with CP was not found to improve the STR in the current work. While this may be due to limitations within the study, it may be that an intervention component which addresses these interpersonal relationships more directly, for example by training teachers in ways to interact with these pupils, may be beneficial. In summary, interventions for CP need to move beyond the problem child approach to consider relations in the classroom and the perceptions, expectations, and behaviour of teachers working with these pupils.

8.3.2.2 Mainstream classroom intervention and fidelity

The poor overall outcomes found in the mainstream intervention study do not provide support for the use of a classroom-based intervention which targets EF and ER deficits through teacher training. While these findings are in contrast to Frederickson et al.'s (2013) evaluation, the study did not have a TAU group and therefore reported improvements may not have been a result of this intervention approach, but rather the one-to-one staff contact these pupils in the special provision received. While the current study hoped to address this limitation, the TAU school recruited for the current work withdrew from the study. Further work is needed then which takes Frederickson et al.'s approach with a TAU comparison group.

It is possible that this approach can be effective at reducing disruptive classroom behaviour, but that intervention delivery resulted in the lack of improvement found in the current work (Horner et al., 2006). Indeed, problems with intervention fidelity were evident in the mainstream school. While the research team made an effort not to disrupt lessons in the current intervention, as suggested in the literature, it may be that more input is needed to provide additional support and training to the teaching staff (Leflot et al., 2010; Stormont, 2002). Despite the strong rationale for a classroom-based intervention, the withdrawal of the second school and the missing data in the intervention school further highlights difficulties of carrying out an intervention evaluation in a mainstream school. The suitability of the setting for the evaluation of the intervention, in addition to the delivery of the intervention, needs to be considered when designing future work.

8.3.2.3 CU traits and intervention motivation

Findings from this thesis also have important implications for interventions for youths with CU traits. Firstly, the finding that youths with CP/CU+ have difficulties with emotion understanding and /or empathy supports Ciucci et al.'s (2015) argument that interventions which may require these qualities, such as Restorative Justice, are not suitable for youths with CP/CU+. Moreover, a number of findings from the current work point to issues relating to intervention motivation for children with CU traits. Current recommendations of group-based interventions based on the Social Learning Theory model for youths with CP (Pilling, Gould, Whittington, Taylor, & Scott, 2013) assume that all children are motivated by social approval and connectedness. However, as discussed previously, not all children are inherently social or share these social motivations (Warren, 2010). The lack of S-T closeness for pupils with CP/CU+, but not those with CP/CU-, found in the current work supports this view. The high attrition found for youths with psychopathic or CU traits in the current systematic review also supports previous evidence which suggests these individuals have low motivation to engage in traditional intervention programmes (Rice & Harris, 2006; Richards et al., 2003). In addition, the finding in the first study, that pupils with CP have a tendency to accept negative situations and resign to the idea that nothing can be done to change the situation also has important implications for treatment motivation. Taken together, this evidence suggests that issues of treatment motivation and engagement are of paramount importance for youths with CU traits.

Taking advantage of the reward-dominance in youths with CU traits, reported in behavioural and neuroscience studies (Blair, 2013; Fanti et al., 2016; Morgan et al., 2014), is proposed as a way of addressing these treatment motivation issues.

This suggestion is supported by evidence found in the systematic review that youths with high CU traits were less sensitive to sanctions, but reward strategies were effective for both CP/CU- and CP/CU+. Indeed, while youths with CP/CU+ have generally shown poorer intervention outcomes compared to youths with CP/CU-, evidence was found to suggest that CU traits are amenable to change following interventions which take a reward-focused approach (e.g. Caldwell et al., 2006; Caldwell et al., 2007; Caldwell, 2011; Datyner et al., 2016; Frederickson et al., 2013). Some studies have found youths with CU triats actually have a diminished sensitivity to reward (Centifanti & Modecki, 2013; Marini & Stickle, 2010) and it should be noted that differences in assessment methods and the conceptualisation of reward dominance make these findings diffiuclt to interpret (Byrd, Loeber, & Pardini, 2014; Aleen et al, 2016). Findings of a reduced sensitivity to punishment in youths with CU triats, does not mean these children have a heightened sensitivty to reward. Rather, most of the research (e.g. Allen et al, 2016; Morgan et al. 2014), including ‘real world’ intervention evaluations (Hawes & Dadds, 2005; Kimonis & Armstrong, 2012; Miller, 2014; Kimonis et al., 2014), suggests that CP/CU+ have reduced sensitivity to punishment compared to CP/CU-, but both CP/CU+ and CP/CU- respond equally to reward. Nevertheless, more research is needed which clearly defines and distinguishes punishment sensitivity and reward-dominance, and which disentangles these intervention components from a larger intervention approach.

8.3.2.4 Using neuroscience methods to evaluate interventions for CP

Finally, the EEG study in Chapter Seven has implications for the evaluation of interventions for youths with CP. As Snyder (2015) suggests, interventions for CP may be effective because they work around the deficits identified in the brain, or because the neurobiology actually changes following treatment. It may be that physical changes in the brain are needed to ensure long-term benefits from treatment. This cannot be determined without researchers moving beyond behavioural methods and incorporating neuroscience methods in the evaluation of interventions. Advances in the measurement of neurobiological processes have made it possible to do this, and the EEG work by Lewis and colleagues (Lewis et al., 2008; Woltering et al., 2011) which was further validated in this thesis, provides promise for one possible tool to achieve this with youths with CP.

8.3.3 Implications for the measurement of EF and ER

The prevailing issue of inconsistencies in the operationalisation and measurement of EF and ER in the literature (Baggetta & Alexander, 2016; Blair, 2016; Toplak, et al., 2013) was also addressed in this thesis. Firstly, the lack of association between teacher-reports and performance-based measures of EF may support the idea that EF tasks measure something quite different from reports of everyday EF. The one-to-one structured format of the child assessments may have enabled children who struggle with everyday EF demands to keep on-task during the assessment (Gioia et al., 2008). This superior performance could even be interpreted as an indicator of how well these pupils may perform in EF tasks if additional structure and support were provided in the classroom (Toplak et al., 2013). Alternatively, teacher bias or shared reporter variance may have resulted in the significant associations found between CP and EF. Similarly, few associations were found between teacher- and child-reports on measures of ER. On closer inspection of the scales, the two measures labelled emotion regulation, appeared to assess quite different conceptualisations of ER. In this thesis, Thompson's (1994) commonly used definition of ER as the *'processes responsible for monitoring, evaluating, and modifying emotional reactions…to accomplish one's goals'* (pp. 27–28) was adopted. However, as discussed at the start of this thesis, ER encompasses a broad range of processes and there is currently no universal definition (Cole et al., 2004). In addition, while the emotion-induction go/no-go paradigm was found to demonstrate a distinct neural response for inhibitory control under emotionally challenging situation, providing support for this EEG tools as a measure of ER (Lewis et al., 2006; Lewis et al., 2007), this neural response was not associated with behavioural reports.

Inconsistencies in the measurement of EF and ER were demonstrated throughout this thesis, providing a further demonstration of measurement issues inherent in the study of complex and multi-dimensional concepts such as EF and ER (Blair, 2016). Despite using multimethods in this body of work, this approach cannot guide us towards the *best* tool to measure EF or ER, but it highlights the need to interpret previous findings with caution and consider measurement tools carefully in the design of future research.

8.4 Directions for future research

Limitations in the current body of work could be addressed in future research. Using larger sample sizes may be needed to increase statistical power for more complex analyses which can disentangle the relationship between CP, EF and ER, and academic achievement. Moreover, due to the cross-sectional nature of this research, the direction of associations cannot be determined, therefore longitudinal designs would also be valuable when examining these associations. While multiple methods were used throughout this thesis, only teacher-reports of child CP and CU traits were used. As discussed, shared reporter variance may therefore account for the significant associations between behaviour and some of the other teacher-reported measures, such as EF, emotion regulation and lability, and the STR. While the current work was classroom-based, parent-reports may provide an account of the child's behaviour and functioning outside the classroom which is also important to consider, especially in the development of interventions which aim to improve children's behaviour beyond the classroom.

Other avenues for research generated by the work in this thesis include further investigation into the understudied self-perceptions of children with CP and the STR for these pupils. The current work contributed to the CP literature by providing evidence of low behavioural conduct and scholastic competence specifically, rather than low or high global self-esteem. This finding needs replicating in future research and could be extended further to address which specific areas of scholastic competence and behavioural conduct these children view as problematic. Similarly, while the current work was the first to identify ER difficulties as a mechanism through which CP is associated with S-T conflict, additional characteristics of children with CP, such as physical aggression, bullying behaviour, or school attendance, may mediate or moderate the association between CP and the STR and need exploring in future research.

The intervention study could also be replicated with some methodological changes, to assess whether this approach can be beneficial to mainstream pupils. Firstly, additional schools including a TAU comparison group as planned would increase generalisability beyond the single school and allow us to assess whether any pre- to post-intervention changes are due to the intervention. An additional assessment time point immediately after the workshop would also us to explore the suggestion that EDF scores increased due to an improved awareness and ability to identify these deficits in children with disruptive behaviour. More frequent visits to the school would allow fidelity checks to be carried out during the implementation, allowing additional support or teacher training to be provided if and when it is needed.

The systematic review demonstrated great variability in the intervention programmes being evaluated and the methodological designs used, limiting the comparisons and conclusions that could be drawn. Therefore replications of these are needed, which examine the same intervention across multiple samples or compare different interventions using the same research design. Methodological limitations of previous intervention studies found in the review also suggests that more studies with well-controlled TAU comparison groups and follow-up assessments to examine long-term outcomes are needed. In addition, larger sample sizes would improve the scope for comparisons within the CU traits subtype, such as the influence of gender, age, and co-morbidity on intervention outcomes. As discussed in relation to the profiling work, these studies should also use multiple measures to evaluate intervention outcomes.

Finally, cognitive neuroscience methods, such as the ERP tool tested in this work, could be used as an evaluation tool for these interventions. This method could help address whether changes in behaviour following intervention coincide with physical changes in the brain, and whether any physical changes are associated with long-term improvements (Lewis et al., 2010). As the current work found the neural marker of ER was not associated with behavioural reports, it would be helpful to extend Lewis and colleagues' work by incorporating behavioural measures of children's EF and ER into these intervention evaluations, to take a more holistic approach.

8.5 General Conclusion

The literature review in Chapter One highlighted the high prevalence of CP and the associated long-term difficulties for these youths and society. It was demonstrated that the aetiology of CP is not fully understood and there is heterogeneity within antisocial behaviour. Chapter Two reviewed behavioural studies and evidence from neuroscience which suggest that youths with CP have neuropsychological deficits, in particular in cognitive control and emotion regulation abilities. Considering the important role of these skills in the classroom, EF and ER deficits may account for the disruptive classroom behaviour and poor academic achievement found in pupils with CP. Taking the evidence presented in these reviews together, it was proposed that effective interventions for school pupils with CP are of paramount importance, and that taking a cognitive neuroscience informed approach to the development and evaluation of interventions may be effective for these youths.

The experimental studies in Chapters Three and Four found support for this neuropsychological profile of CP and extended previous research by demonstrating that some of these deficits are present across pupils with CP, while others are specific to those with or without CU traits. Additional problematic areas for these pupils in terms of low behavioural and scholastic self-perceptions and poor student-teacher relations were also identified, with emotion lability/negativity found to be a mechanism through which CP is associated with S-T conflict. In a brief review of interventions for CP, it was concluded that traditional approaches are often limited in terms of generalisability and long-term effectiveness, and interventions based on the Social Leaning Theory model (Bandura, 1978) do not account for the motivations of youths with CU traits (Frick, 2001; Warren, 2010). Therefore an extensive systematic review of interventions outcomes for CU traits followed, demonstrating that CU traits do show poorer intervention outcomes, but importantly, these traits are amenable to change.

Taking findings from the literature reviews, experimental studies, and systematic review in this thesis, a cognitive neuroscience-informed intervention for pupils with CP was developed. Chapter Six presents the evaluation of this intervention in a mainstream school. However, overall intervention outcomes were poor, with issues of fidelity from teaching staff most likely accountable. Furthermore, as Frick (2001) previously concluded, there may not be a *best* treatment for CP, since research suggests that CP involves a complex interaction of cognitive, social, and parenting factors (Frick, 2006). Therefore, while Social Learning Theory-based interventions do not account for these neurocognitive deficits, interventions which target EF and ER may also need to consider the role of the social environment outside of the classroom to be effective (Snyder, 2015).

Finally, measurement issues documented in the literature and found throughout the studies in this thesis were considered and the need for a direct measure of ER was addressed through an experimental EEG study using an emotion-induction go/no-go paradigm developed by Lewis and colleagues (Lewis et al., 2008). Findings from this study may be used to build on previous work using this paradigm as an evaluation tool for interventions for CP, allowing behavioural and neural changes following intervention to be assessed.

Taken together, the results presented in this thesis have contributed to the literature by advancing the understanding of CP in the context of the classroom, the distinction between CP/CU- and CP/CU+, intervention development and evaluation, as well as the measurement of EF and ER. Dissemination of this work to researchers and practitioners is needed to inform them that children with CP have a range of neuropsychological deficits which may make their behaviour difficult to self-regulate. Furthermore, there is a distinct CU traits subtype of CP which needs to be considered when developing and evaluating interventions.

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Appendix A. NESPY-II subtest descriptions and scoring

Subtest	Task Procedure	Scoring	Interpretation of low Scores
Design Fluency	Draws as many designs as he/she can in one minute by connecting five dots presented in two arrays (structured and random)	Combined Scaled Score (structured array total correct and random array total correct)[a]	Poor initiation, cognitive flexibility, monitoring, problem-solving, and comprehension of and/or adherence to rules. May also reflect poor psychomotor speed and visuoperceptual skills.
Comprehension of Instructions	Points to one or more items in an array of coloured shapes in response to verbal instruction, e.g. '*point to all the red circles'*	Correct Scaled Score	Poor comprehension of and/or adherence to instructions, poor attention, poor working memory.
Inhibition (IN)	IN-Naming: Names a shape or direction of arrows in a visual series	IN-Naming Combined Scaled Score (total completion time and total errors)[a]	(Used as a comparison for IN-Inhibition)
	IN-Inhibition: Names the alternate response of the shape or direction of the arrow	IN-Inhibition Combined Scaled Score (total completion time and total errors)[a]	Poor inhibitory control
	IN-Switching: Names the correct or alternate shape or direction of an arrow depending on the colour of the shape/arrow	IN-Switching Combined Scaled Score (total completion time and total errors)[a]	Poor inhibitory control and cognitive flexibility
		IN-Naming vs. IN-Inhibition Contrast Scaled Score[b]	Poor inhibitory control which is not due to slow naming speed
		IN-Inhibition vs. IN-Switching Contrast Scaled Score[b]	Poor switching ability relative to inhibitory control, indicating problems with cognitive flexibility or cognitive overload
Word List Interference	Repetition: Repeats a verbal sequence of 1-5 words.	Repetition Total Correct Scaled Score	Limited verbal memory span
	Recall: Recalls each sequence in order of presentation after every two word lists have been presented.	Recall Total Correct Scaled Score	Poor verbal working memory
		Repetition vs. Recall Contrast Scaled Score[b]	Poor management of competing information in working memory for his/her level of memory span

[a]Total scores made by combining two measures within the subtest, e.g. completion time and errors; [b]Contrast scores compare the higher- to lower-level cognitive scores within the same subtest

Appendix B. Strategy-Use Weekly Log

1. How often have you used, suggested, or taught learning or behaviour strategies in the classroom <u>this week</u>?	Not at all	On one or two occasions	Multiple times, some days	Multiple times, most days	Multiple times, every day
2. Have you seen or heard any pupils using the strategies or EDF strategies of their own <u>this week</u>?	Not at all	Rarely (1 or 2 pupils, once or twice)	Often (a few pupils, most days)	Quite a lot (multiple pupils, most days)	A lot (All pupils, every day)
3. How easy or difficult have you found using strategies in the classroom <u>this week</u>?	Very easy	Quite easy	Sometimes easy, sometimes difficult	Quite difficult	Very difficult

Please briefly tell us about any **positive or negative experiences** of identifying barriers to learning and/or use of strategies in the classroom <u>this week</u>.

Please include examples from the classroom and any thoughts or feelings you have about these experiences (please use a separate sheet if needed).

Please write any **other comments** about the Behaviours for Learning programme and your experiences here:

Appendix C. 'Behaviours for Learning' Workshop Activities

Activity 1

Think of a pupil who you consider to have ‘challenging behaviour’ in your classroom

1) Does this child show any warning signs of an EDF?
2) Do these warning signs suggest a specific EDF or multiple EFs? What are they?
3) Think of an instance in your classroom where this child has struggled (behaviourally, emotionally, socially, or academically) – can you use any of the above signs of an EDF to explain some of this behaviour?

Activity 2

Scenario A

It is coming to the end of the lesson, and many of the pupils still have not completed the maths worksheet in which they have to manipulate coloured counters. The materials have to be collected together and put away, and the worksheets must be returned to each child’s maths folder in their drawer.

Scenario B

The purpose of today’s literacy lesson is to develop the skills of pupils writing about their own family.

Scenario C

Some shared art materials are currently held by another teacher in an adjoining building. The materials are needed urgently in your classroom for pupils to complete their art project. A pupil must be sent to collect the items.

1) Which executive functions might a pupil need to complete this task?
2) What warning signs might suggest a weak executive function during this task?
3) How could you organise the class (or your small group of pupils) to achieve this efficiently? Use the principles of the EDF intervention to suggest ways of breaking down the barrier to learning in this situation.

Things to consider:

- ✓ Have all the strategy principles been considered? (EF; self-regulation; motivation & reinforcement; individual differences; flexibility)
- ✓ Could this strategy be used in your classroom, i.e. is it practical?
- ✓ Are additional resources or time needed to prepare and implement this strategy? If yes, are there any ways to reduce this?
- ✓ Will use of this strategy have any effect on other pupils in the class? How can this be addressed?
- ✓ Could this strategy be handed over to the pupil to use themselves?

Appendix D. Emotion-induction check

The computerised task that you just completed was split into three parts ('blocks'). During each block you were presented with a different set of 2 letters (e.g. **X** and **Y)**.

Please rate the intensity of each emotion that you experienced during each block. The letters presented during the computer task are shown to help remind you of each block.

Please circle the intensity of each emotion on a scale of 1 (Not at all) to 10 (Very much) below.

Block 1: **x y**

	Not at all				Somewhat					Very much
Upset	1	2	3	4	5	6	7	8	9	10
Frustrated/Angry	1	2	3	4	5	6	7	8	9	10
Nervous	1	2	3	4	5	6	7	8	9	10
Satisfied	1	2	3	4	5	6	7	8	9	10
Excited	1	2	3	4	5	6	7	8	9	10

If you experienced any other emotion during this block, please write the word that best describes it in the box:

	Not at all				Somewhat					Very much
Please rate the intensity of this emotion.	1	2	3	4	5	6	7	8	9	10

Block 2: **u d**

	Not at all				Somewhat					Very much
Upset	1	2	3	4	5	6	7	8	9	10
Frustrated/Angry	1	2	3	4	5	6	7	8	9	10
Nervous	1	2	3	4	5	6	7	8	9	10
Satisfied	1	2	3	4	5	6	7	8	9	10
Excited	1	2	3	4	5	6	7	8	9	10

If you experienced any other emotion during this block,
please write the word that best describes it in the box:

	Not at all				Somewhat					Very much
Please rate the intensity of this emotion.	1	2	3	4	5	6	7	8	9	10

Block 3: **o p**

	Not at all				Somewhat					Very much
Upset	1	2	3	4	5	6	7	8	9	10
Frustrated/Angry	1	2	3	4	5	6	7	8	9	10
Nervous	1	2	3	4	5	6	7	8	9	10
Satisfied	1	2	3	4	5	6	7	8	9	10
Excited	1	2	3	4	5	6	7	8	9	10

If you experienced any other emotion during this block,
please write the word that best describes it in the box:

	Not at all				Somewhat					Very much
Please rate the intensity of this emotion.	1	2	3	4	5	6	7	8	9	10