UNIVERSITY OF SOUTHAMPTON

FACULTY OF SOCIAL, MATHEMATICAL,

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Psychology

Investigating emotion recognition and empathy deficits in Conduct Disorder using behavioural and eye-tracking methods

by

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ABSTRACT

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INVESTIGATING EMOTION RECOGNITION AND EMPATHY DEFICITS IN CONDUCT DISORDER USING BEHAVIOURAL AND EYE-TRACKING METHODS

Nayra Anna Martin-Key

The aim of this thesis was to characterise the nature of the emotion recognition and empathy deficits observed in male and female adolescents with Conduct Disorder (CD) and varying levels of callous-unemotional (CU) traits. The first two experiments employed behavioural tasks with concurrent eye-tracking methods to explore the mechanisms underlying facial and body expression recognition deficits. Having CD and being male independently predicted poorer facial expression recognition across all emotions, which held across both static and dynamic faces. Eye-tracking data indicated that males showed reduced attention to the eye region of the face across all emotions, relative to females, with CD predicting lower levels of attention to the eyes for fearful, sad, and surprised faces. Critically, the deficits observed in facial emotion recognition were not explained by atypical eye movements in the CD group. Contrary to expectations, high levels of CU traits within the CD group were not associated with impaired recognition of fear or a reduced tendency to fixate the eye region of the face.

Males with CD exhibited global deficits in body expression recognition relative to male and female controls. These deficits held for both dynamic and static bodies and were not modulated by CU traits. Eye-tracking data demonstrated that having CD and being male were both related to a reduced tendency to fixate the arms of fearful and neutral bodies. Once again, deficits in body expression recognition were not explained by atypical eye movements in the CD group. Contrary to predictions, CU traits in the CD group were associated with an increased preference to fixate the arms. Taken together, these two eye-tracking studies indicate that adolescents with CD, and particularly males, show impairments in facial and body expression recognition that are not solely related to overt attentional mechanisms.

The final two experiments employed an empathic accuracy (EA) task that involved watching video clips of actors recounting emotionally-charged autobiographical experiences. Relative to control males, CD males showed deficits in sadness, fear, and disgust recognition, as well as reduced affective empathy for the same three emotions. In the second experiment, we found that CD females did not show significant deficits in emotion recognition but they did exhibit reduced affective empathy for fear and happiness. Contrary to predictions, CD adolescents showed an intact ability to track changes in emotional intensity (measure of EA). Although CU traits in males with CD were negatively correlated with EA for sadness, no other significant correlations with CU traits or differences between high and low CU traits subgroups were found in either study. The findings from this thesis have important implications for interventions aiming to remediate the emotion recognition and empathy deficits observed in CD, as well as approaches to subtyping CD.

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DECLARATION OF AUTHORSHIP

I, Nayra A. Martin-Key, declare that this thesis and the work presented in it are my own and has been generated by me as the result of my own original research.

[Investigating emotion recognition and empathy in Conduct Disorder using behavioural and eye-tracking methods] .....

I confirm that:

1. This work was done wholly or mainly while in candidature for a research degree at this University;
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3. Where I have consulted the published work of others, this is always clearly attributed;
4. Where I have quoted from the work of others, the source is always given. With the exception of such quotations, this thesis is entirely my own work;
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Signed: N. A. Martin-Key .....

Date: 06/01/17 .....

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Definitions and Abbreviations

ADFES	Amsterdam Dynamic Facial Expression Set
ADHD	Attention-Deficit/Hyperactivity Disorder
AD	Anxiety disorder
AL	Adolescence-limited
ANOVA	Analysis of Variance
AO-CD	Adolescence-onset Conduct Disorder
APSD	Antisocial Process Screening Device
APD	Antisocial Personality Disorder
ASDs	Autism-Spectrum Disorders
ASI	Adolescent Symptom Inventory
BLA	Basolateral amygdala
CBCL	Child Behaviour Checklist
CD	Conduct Disorder
CD+AD	Conduct Disorder with comorbid Anxiety disorder
CD+ADHD	Conduct Disorder with comorbid Attention-Deficit/Hyperactivity Disorder
CD/CU+	Conduct Disorder with higher levels of callous-unemotional traits
CD/CU-	Conduct Disorder with lower levels of callous-unemotional traits
CD/PT+	Conduct Disorder with higher levels of Psychopathic Traits
CD/PT-	Conduct Disorder with lower levels of Psychopathic Traits
CeN	Central nucleus
CO-CD	Childhood-onset Conduct Disorder
CPs	Conduct Problems
CPs/CU+	Conduct Problems with higher levels of callous-unemotional traits
CPs/CU-	Conduct Problems with lower levels of callous-unemotional traits
CSI	Child Symptom Inventory
CU	Callous-Unemotional
DISC	Diagnostic Interview Schedule for Children
DISCAP	Diagnostic Interview Schedule for Children, Adolescents, and Parents
DBDs	Disruptive Behaviour Disorders
DBD/CU+	Disruptive Behaviour Disorder with higher levels of callous-unemotional traits
DBD/CU-	Disruptive Behaviour Disorder with lower levels of callous-unemotional traits
DSM-IV	Diagnostic and Statistical Manual of Mental Disorders, fourth edition
DSM-IV-TR	Diagnostic and Statistical Manual of Mental Disorders, fourth edition, text revision

DSM-5	Diagnostic and Statistical Manual of Mental Disorders, fifth edition
EA	Empathic Accuracy
EC	Empathic Concern
EI	Emotional Intelligence
FET	Fisher's Exact Test
GAD	Generalised Anxiety Disorder
GEM	Griffith Empathy Measure
Hz	Hertz
ICU	Inventory of Callous-Unemotional Traits
IES	Integrated Emotion Systems
IQ	Intelligence Quotient
IRI	Interpersonal Reactivity Index
K-SADS-PL	Kiddie-Schedule for Affective Disorders and Schizophrenia – Present & Lifetime
LCP	Life-course persistent
LMM	Liner Mixed Model
MDD	Major Depressive Disorder
OCD	Obsessive Compulsive Disorder
ODD	Oppositional Defiant Disorder
OFC	Orbitofrontal cortex
ONS	National Statistics
PAM	Perception-Action Model
PCL	Psychopathy Checklist
PCL-R	Psychopathy Checklist-Revised
PCL:YV	Psychopathy Checklist Youth Version
PD	Personal Distress
PTs	Psychopathic Traits
PT+	Higher Psychopathic Traits
PT-	Lower Psychopathic Traits
PTSD	Post-traumatic Stress Disorder
QMEE	Questionnaire Measure of Emotional Empathy
ROI	Region of Interest
SD	Standard Deviation
SDQ	Strengths and Difficulties Questionnaire
SE	Standard Error
SEAL	Social and Emotional Aspects of Learning
SES	Socio-economic status

TD	Typically-developing
ToM	Theory of Mind
UR	Unconditioned Response
US	Unconditioned Stimuli
VIM	Violence Inhibition Mechanism
vlPFC	Ventrolateral frontal prefrontal cortex
vmPFC	Ventromedial prefrontal cortex
WASI	Wechsler Abbreviated Scale of Intelligence
YO/CD+	Young Offender with Conduct Disorder
YO/CD-	Young Offender without Conduct Disorder
YO/PT+	Young Offender with Psychopathic Traits
YO/PT-	Young Offender without Psychopathic Traits
YOSs	Youth Offending Services
YPI	Youth Psychopathic Traits Inventory
YSR	Youth Self-Report

Chapter 1: Conduct Disorder: Key Terms and Concepts

1.1 What is Conduct Disorder?

Conduct disorder (CD) is a pervasive and persistent form of disruptive behaviour resulting in the violation of other people's rights or of age-appropriate societal norms (American Psychiatric Association, 2013). It is evidenced by the presence of at least three symptoms out of a total of 15 (American Psychiatric Association, 2013). These symptoms fall into four distinct categories: 'aggression to people and animals' (e.g., often initiates physical fights, and has been cruel to animals), 'destruction of property' (e.g., breaking other people's things on purpose, and deliberately setting other people's things on fire), 'deceitfulness or theft' (e.g., lying with the purpose of obtaining goods or avoiding obligations, and non-aggressive stealing), and 'serious violations of rules' (e.g., truancy beginning before the age of 13, and staying out late regardless of parental constraints before the age of 13).

It is important to note that in order for an individual to be diagnosed with CD, these symptoms must result in significant impairment in at least one of the following domains: social, academic, or occupational functioning (American Psychiatric Association, 2013). An individual can receive a diagnosis of current CD if he or she has displayed any three of the 15 symptoms in the past 12 months, with at least one of these symptoms being present in the last six months. If this is not the case but the individual appears to have exhibited three symptoms concurrently prior to the last 12 months, he or she would be regarded as having lifetime or past, but not current, CD.

Individuals who display at least one symptom before the age of 10 years and then go on to develop full CD are classified as having childhood-onset CD, whilst those who only develop symptoms in adolescence are categorised as having adolescence-onset CD (American Psychiatric Association, 2013). When there is no information for the clinician or researcher to determine the age of onset, it is good practice to classify the disorder as having an unspecified age of onset. It is also important to establish the severity of the disorder, this can either be 'mild' (few, if any, conduct symptoms in addition to the three required to meet the criteria, resulting in minor harm to others), 'moderate' (the number of CD symptoms and its consequences on others lie in between the specifications for 'mild' CD and 'severe' CD), or 'severe' (numerous conduct symptoms in addition to the three required to meet the criteria, resulting in substantial harm to others and typically involving aggression) (American Psychiatric Association, 2013).

Apart from the age of onset and the severity of the disorder, the DSM-5 has introduced an additional specifier: the existence of 'limited prosocial emotions (LPE)', with the aim of understanding a distinct developmental pathway to CD that is driven by the presence of personality traits (Frick & Nigg, 2012). In order to meet the criteria for this specifier, individuals with a diagnosis of CD must display at least two of the following characteristics: 'lack of remorse

or guilt' (i.e., does not feel bad or guilty when he or she has done something wrong), 'callous lack of empathy' (i.e., is unconcerned about others' feelings), 'unconcerned about performance' (i.e., does not appear to care about his or her problematic performance at school or work), or 'shallow or deficient affect' (i.e., does not express his or her feelings to others). These symptoms must have occurred persistently over a minimum of 12 months and in numerous settings and relationships (American Psychiatric Association, 2013).

It has been estimated that approximately 1.5% of children and adolescents in the UK meet criteria for CD (Ford, Goodman, & Meltzer, 2003), while prevalence rates between 2 and 3.32% have been found in recent US studies (Canino et al., 2004; Roberts, Roberts, & Xing, 2007). CD has been associated with current and future aggressive behaviour, as well as Antisocial Personality Disorder (APD), poor physical health, a higher prevalence of sexually transmitted diseases, poor academic and occupational achievement, and comorbid disorders (Fazel, Doll, & Langstrom, 2008; Forrest, Tambor, Riley, Ensminger, & Starfield, 2000; Teichner & Golden, 2000; Teplin et al., 2005; Teplin, Abram, McClelland, Dulcan, & Mericle, 2002).

Regarding the latter, Oppositional Defiant Disorder (ODD) is often diagnosed when a child does not meet the criteria for CD but shows difficult or challenging behaviour, in particular, if the child exhibits a pattern of hostile and defiant behaviour for a period of at least six months (Davidson, O'Connell, Tondora, Lawless, & Evans, 2005). The diagnostic criteria for ODD involve frequently losing one's temper, purposely annoying others, declining to obey adults' requests, as well as arguing with caregivers and authority figures (American Psychiatric Association, 2013). ODD has often been regarded as an early form of CD and is frequently seen as its developmental precursor (Cappadocia, Desrocher, Pepler, & Schroeder, 2009).

Other disorders that are common amongst individuals with CD are Attention-Deficit/ Hyperactivity Disorder (ADHD), substance use disorder, and internalising disorders such as Major Depressive Disorder (MDD) and anxiety disorders (Drabick, Gadow, & Sprafkin, 2006; Levy, Hay, Bennett, & McStephen, 2005; Milin, Halikas, Meller, & Morse, 1991). Interestingly, it has been suggested that most of the internalising problems in children and adolescents with CD may be due to interpersonal difficulties and other stressors, such as school failure (Capaldi, 1992; Frick, Lilienfeld, Ellis, Loney, & Silverthorn, 1999).

CD not only affects the individual, but also impacts on society as a whole, particularly financially (Berkout, Young, & Gross, 2011). In fact, the costs incurred by children diagnosed with CD at the age of 10 equate to a total of £70,000 over an 18-year period, which is 10 times more than a young person without CD (Scott, Knapp, Henderson, & Maughan, 2001). Another UK study revealed that raising a child with CD costs approximately £6000 per year – this figure excluded

criminal justice costs, with expenses to the family accounting for around 80% of the total costs (Romeo, Knapp, & Scott, 2006). It has been estimated that approximately 80% of all crimes in England and Wales are attributable to young people who had conduct problems (CPs), with lifetime costs of crime approaching £1.5 million per offender, and the costs incurred by all crimes approximating £60 billion a year (Sainsbury Centre for Mental Health, 2009).

It is evident, therefore, that CD is a key public health issue (Garland et al., 2001). In spite of its prevalence and negative prognosis, however, there currently exists a lack of treatment-based interventions. Evidently, more research is needed in order to ascertain which treatment methods and interventions would be most advantageous when trying to reduce the prevalence of CD within society. Additionally, further research is necessary in order to explore the underlying causes of CD, as this could aid in our understanding of which treatment methods and interventions would be most beneficial.

1.2 Sex Differences in Conduct Disorder

Most of the research on CD has been conducted on male samples due to the fact that this disorder is more common amongst this gender, with a typically-cited ratio being that of two to four males for every female (Fontaine et al., 2009; Moffitt et al., 2001; Nock et al., 2006). Indeed, substantial sex differences in aggression are evident from as early as the ages of two to three (Archer, 2004), and it is widely accepted that males are much more likely than females to engage in antisocial behaviour, including, but not limited to, violent crimes (Moffitt et al., 2001). Furthermore, males are reported to display more physical forms of antisocial behaviour, including physical cruelty and weapon use (Gorman-Smith & Loeber, 2005), while females tend to exhibit relational aggression, such as non-physical bullying, rumour spreading, and manipulation (Crick & Grotpeter, 1995).

Although comparable genetic and environmental risk factors have been postulated for males and females (Moffitt et al., 2001), some researchers have proposed that females may necessitate a higher loading of these risk factors in order to develop CD (Cloninger, 1978), suggesting that females who receive a diagnosis of CD may be more impaired in their social, academic, and/or occupational functioning than their male counterparts. Interestingly, while childhood-onset CD may be more prevalent amongst males (Fontaine et al., 2009), adolescence-onset CD may be more common amongst females, leading to suggestions that females typically show a ‘delayed onset’ to their antisocial behaviour, even if they are exposed to the same environmental or individual-level risk factors (Silverthorn & Frick, 1999). This increase in aggressiveness and

antisocial behaviour has often been associated with the start of puberty (Silverthorn & Frick, 1999).

On the other hand, several researchers have identified risk factors that may operate differently in males and females. For example, it has been shown that males experience more punitive parental discipline relative to females (Meier, Slutske, Heath, & Martin, 2009). Critically, this difference accounted for 45% of the sex differences found in childhood CPs (Meier et al., 2009). Similarly, harsh disciplinary practices have been seen to predict later antisocial behaviour in males but not in females (Leve, Kim, & Pears, 2005). Females, however, may be more vulnerable to the detrimental effects of parental antisocial behaviour, particularly when the antisocial parent is the mother (Pajer et al., 2008). Indeed, it has been reported that females whose mother exhibited aggressive or antisocial behaviour were four times more likely to receive a diagnosis of CD in comparison to those whose mothers were free of antisocial behaviour (Herndon & Iacono, 2005). It appears that females with CD may be more susceptible to the effects of problematic interpersonal relationships with parental figures than males with CD (Ehrensaft, 2005). These findings highlight some important differences in terms of the risk factors contributing towards the development of CD in males and females.

Indeed, while multiple risk factors are involved in all psychiatric disorders, this is particularly likely to be the case for the development of CD (e.g., genetic, temperamental, peer, family, and neurocognitive factors have all been implicated). The Developmental Taxonomic Theory, first proposed in a seminal and inspirational article by Moffitt (1993), has posited the existence of multiple developmental pathways via which children and adolescents may develop a predisposition to exhibit antisocial behaviour related to the diagnosis of CD (Pardini & Frick, 2013). The following section aims to provide an overview of this theory. Throughout this section, it is important to bear in mind the potential sex differences in CD (discussed above), particularly as the development of CD in females may have a 'delayed onset'. As such, it is likely that the theory put forward by Moffitt (1993) only applies to males.

1.3 The Developmental Taxonomic Theory

One of the most informative methods of subtyping CD is according to the age of onset of antisocial behaviour. Research has indicated that children who develop CD before the age of 10 (i.e., childhood-onset CD) are at a higher risk for demonstrating persistent patterns of antisocial behaviour that continue into adulthood as APD or criminality (Pardini & Frick, 2013). These individuals are said to have life-course persistent (LCP) CD (Moffitt, 1993). It has been suggested that those with LCP CD are at greater risk of having long-lasting difficulties (Moffitt, 2006).

Individuals who transition between ADHD or ODD to CD are more likely to show neurological deficits, such as having poor inhibitory control and poor verbal abilities, which then result in problems such as negotiating conflicts with peers, regulating emotions, and controlling impulses (Moffitt, 2006). These youths also demonstrate impairments in a range of cognitive (e.g., verbal) and neuropsychological domains (e.g., memory, executive functioning, spatial abilities) in childhood and adolescence (e.g., Raine, Yaralian, Reynolds, Venables, & Mednick, 2002).

These LCP CD youths also tend to have more personality and temperamental risk factors, including an avoidant attachment style (Aguilar, Sroufe, Egeland, & Carlson, 2000), impulsivity (McCabe, Hough, Wood, & Yeh, 2001; Silverthorn, Frick, & Reynolds, 2001), difficulties sustaining attention (Woodward, Fergusson, & Horwood, 2002), and difficulties regulating their emotions (Frick & Morris, 2004; Moffitt, Caspi, Dickson, Silva, & Stanton, 1996). Research also emphasises the fact that youth with LCP CD usually come from families with a history of aggressive and antisocial behaviour (Odgers et al., 2008), which, in turn, means that these children are less likely to develop age-suitable social skills necessary for appropriate behaviour (Pardini & Frick, 2013). Additionally, it has been demonstrated that these youth also tend to experience cascading academic and peer-related difficulties as they grow up (Moffitt, 2006; Odgers et al., 2008). Taken together, these risk factors often interfere with typical life transitions (e.g., graduating from high school), thus further ensnaring these individuals into a criminal way of life (Moffitt, 2006; Odgers et al., 2008).

In contrast, individuals who develop CD during adolescence, or adolescence-limited (AL) CD, do not typically display ADHD or ODD in childhood and are less likely to exhibit neurocognitive impairments (e.g., low verbal IQ), as well as being less likely to come from a so-called 'broken' home (Moffitt, 2006; Odgers et al., 2008). In fact, Moffitt (2006) has argued that this form of CD may be merely characterised by an increase in rebelliousness due to poor parental monitoring and an association with antisocial peers. It has been suggested that these adolescents are less likely to continue engaging in antisocial behaviour by the time they reach adulthood, often as a result of the adoption of prosocial roles, such as employment and spending less time with delinquent friends (Pardini & Frick, 2013).

Further evidence suggesting a distinction between LCP and AL antisocial behaviour comes from longitudinal studies. For example, Piquero, Farrington, Nagin, and Moffitt (2010) studied the following groups: non-offenders, very low-rate chronic offenders, low-adolescence peak offenders, high-adolescence peak offenders, and high-rate chronic offenders. They found that those with the highest levels of life failure (i.e., being unable to secure a job or form long-lasting, meaningful relationships) at the age of 48, belonged to the low- and high-rate chronic offenders

group. The offenders belonging to these groups had displayed antisocial behaviour throughout their childhoods, whereas the other groups began engaging in antisocial behaviour during adolescence.

Consistent with these findings, Odgers et al. (2007) surveyed a cohort of 539 males from age three to age 26 and discovered that those exhibiting LCP antisocial behaviour (approximately 10% of the sample) had committed more serious offences, such as assault, exhibited greater violence against women, demonstrated greater psychopathic traits, and were seen to have more severe psychiatric and behavioural difficulties. Moreover, these men were more likely to have a criminal record, accounting for 53% of the cohort's violent and drug-related offences. On the other hand, those who had exhibited antisocial behaviour only during adolescence (approximately 26% of the sample) reported having better life outcomes, including a greater chance of having a good, high-status job, and better relationships with women. Interestingly, although less severe than the LCP group, this group also exhibited high rates of criminal convictions and psychiatric symptoms, suggesting that the distinction between the two subgroups may not be as clear-cut as originally proposed.

In fact, longitudinal research has also suggested that, despite there being a distinction between the two groups in terms of verbal ability during middle childhood, with LCP individuals being associated with poorer verbal skills in comparison to AL individuals, measures of neuropsychological functioning in the first four years of age did not predict later differences between the two groups (Aguilar et al., 2000). The authors also demonstrated that although LCP CD was related to decreased verbal and language functioning in both childhood and adolescence, this was not the case before the age of 64 months. These findings somewhat oppose Moffitt's (1993) proposition of a distinction between LCP and AL CD. Another aspect of neuropsychological functioning is emotion processing, which has been studied most frequently using facial expression recognition tasks. Indeed, if Moffitt's (1993) suggestions were correct, one might presume facial expression recognition impairments to be characteristic of youth with LCP CD only. This does not appear to be the case, however, with researchers demonstrating that both childhood-onset and adolescence-onset groups show emotion recognition impairments (Fairchild, Van Goozen, Calder, Stollery, & Goodyer, 2009).

Researchers have thus suggested that an extended model may be necessary in order to further subtype youths with CD. In particular, psychologists have emphasised the need to develop a model that defines youth antisocial behaviour in terms of its time-course and severity, the particular vulnerabilities that may make socialisation more challenging, and the developmental pathways that may be interrupted by the interaction between these vulnerabilities and their

social environment (Foster & Jones, 2005; Frick & Ellis, 1999; Frick, 2004; Jones, Laurens, Herba, Barker, & Viding, 2009; Viding, Blair, Moffitt, & Plomin, 2005). As a result, researchers have noted that the concept of psychopathy might be useful in understanding heterogeneity within CD (Frick & Ellis, 1999; Lynam, 1996).

1.4 Psychopathy and Callous-Unemotional Traits

The construct of psychopathy was originally proposed by Cleckley (1941), who suggested an array of potential criteria determined by a series of case studies in his influential work, 'The Mask of Sanity'. These included: superficial charm, lack of guilt and remorse, lack of anxiety and neuroticism, undependability, dishonesty, egocentricity, failure to form long-lasting relationships, reduced reactivity to punishment, and shallow affect, amongst others (Cleckley, 1941). Following this, Hare (1980) introduced Cleckley's (1941) notion of psychopathy into mainstream psychological practice via the development of the Psychopathy Checklist (PCL; Hare, 1980) and the subsequent Psychopathy Checklist-Revised (PCL-R; Hare, 1991, 2003) for use with adult forensic samples. It should be acknowledged that these assessment tools were developed with incarcerated criminals and are primarily suited to assessing such individuals, rather than members of the general population, although subsequent instruments have been developed for research with community samples, such as the PCL Screening Version (Hare, 2003).

A variety of measures have been developed with the aim of assessing psychopathic traits in child and adolescent samples. The majority of these questionnaires focus on callous-unemotional (CU) traits. These are argued to capture the affective/interpersonal features of psychopathy (e.g., emotional detachment and deficits in empathy or guilt), with the presence of these traits designating a subgroup of antisocial individuals who are at greater risk for showing severe and chronic CPs and violence (Rowe et al., 2010).

In accordance with models of adult psychopathy, CU traits have been characterised as encompassing a lack of concern for other people's feelings, superficial affect, and a deficient sense of culpability or regret (Pardini & Frick, 2013). It has been posited that high levels of CU traits are present in between 10 and 46% of children and adolescents with CD in community samples, and from 21 to 59% of those with CD in clinical samples (Kahn, Frick, Youngstrom, Findling, & Youngstrom, 2011; Kolko & Pardini, 2010; Rowe, Costello, Angold, Copeland, & Maughan, 2010). CU traits have been shown to be particularly stable throughout childhood, adolescence, and adulthood, suggesting that it might be difficult to modify them using psychological interventions (Andershed, 2010; Edens, Skeem, Cruise, & Cauffman, 2001).

For example, Frick, Kimonis, Dandreaux, and Farell (2003) demonstrated that in a community sample of high-risk children, parent-rated CU traits remained fairly stable over a four-year period. Similarly, in a sample of adolescent offenders, psychopathic traits appeared to remain stable over a six-month period (Lee, Klaver, Hart, Moretti, & Douglas, 2009). Despite these findings, one study found that levels of CU traits declined with age, implicating that these traits may be malleable (Lynam, Caspi, Moffitt, Loeber, & Stouthamer-Loeber, 2007). Similarly, a twin study by Fontaine, Rijsdijk, McCrory, and Viding (2010) revealed that over a quarter of the sample exhibited unstable levels of teacher-rated CU traits over a four-year time-span, whilst only 3.4% of the sample demonstrated stable, high CU traits. Thus, given the fact that levels of CU traits may change throughout development, these may not be 'perfect' predictors of severe adult psychopathology.

Irrespective of their potential stability, CU traits have often been associated with fearlessness and thrill-seeking behaviours (Essau, Sasagawa, & Frick, 2006; Frick et al., 2003; Pardini, 2006), with youth with high levels of these traits showing an inclination towards novel and dangerous activities (Frick et al., 2003; Frick et al., 1999). These youth also demonstrate reduced levels of neuroticism and trait anxiety in comparison to youth with low CU traits, suggesting that they may be less prone to anxiety or worry (Andershed, Gustafson, Kerr, & Stattin, 2002; Frick et al., 1999; Lynam et al., 2007; Pardini et al., 2007, although see Short, Sonuga-Barke, Adams, & Fairchild, 2016). In fact, youth with high CU traits may be less sensitive to stress. Indeed, in comparison to typically-developing (TD) youth and those with low CU traits, boys with elevated levels of CU traits demonstrate lower resting cortisol levels (O'Leary, Taylor, & Eckel, 2010; Stadler et al., 2011; von Polier et al., 2013), which is a stress hormone that reflects the level of activity in the hypothalamic-pituitary adrenal axis (Takai et al., 2004). Additionally, youth with high CU traits are reported to show reduced electrodermal responses to both threatening stimuli and distress cues (i.e., fear), suggesting that they are less physiologically responsive than those with low CU traits (Blair, 1999; Isen et al., 2010).

In addition, accumulating evidence has demonstrated that children with high CU traits often display impairments when processing fearful cues in others (Marsh & Blair, 2008). This may be due to deficits in their ability to attend to emotionally-salient features, such as the eye region of the face (Dadds et al., 2006). Indeed, research has suggested that youth with elevated CU traits appear to look less at the eye region of other people's faces than those with low levels of CU traits, irrespective of the particular emotion being portrayed (Dadds et al., 2008). Remarkably, this pattern of attention only affected high CU children's ability to accurately recognise others' fear, thus showing similarities with patients with amygdala lesions, who also demonstrate specific fear-recognition impairments (Adolphs et al., 2005). This may be due to the fact that the amygdala is crucial for registering and directing attention to emotionally-salient stimuli, such as the eye region

(Whalen et al., 2004). Whilst the recognition of some emotions may be principally dependent on the lower half of the face (e.g., disgust), the recognition of fear is specifically dependent on the shape of the eyes (Ekman, Friesen, & Tomkins, 1971).

Interestingly, Dadds, Cauchi, Wimalaweera, Hawes, and Brennan (2012) found that individuals with high levels of CU traits also make less eye contact with their caregivers when they are involved in emotional discussions with them. Skuse (2003) has claimed that eye contact with attachment figures may not only be crucial for emotional development, but also for the development of social cognition, including Theory of Mind (ToM), which concerns the ability to represent and understand others' mental states (Baron-Cohen, Leslie, & Frith, 1985). Reduced eye contact has also been associated with Autism Spectrum Disorders (ASDs) (Klin, Jones, Schultz, Volkmar, & Cohen, 2002), which have been associated with deficits in ToM (Baron-Cohen, Wheelwright, Skinner, Martin, & Clubley, 2001). Interestingly, adults with psychopathy and children with CU traits have been found to show *intact* performance on ToM tasks (Jones, Happé, Gilbert, Burnett, & Viding, 2010; Richell et al., 2003).

Furthermore, when comparing boys with psychopathic traits to those with ASDs, research has demonstrated that the former exhibited specific difficulties in feeling others' emotions (affective empathy), whilst those with ASDs demonstrated impairments understanding others' emotions (cognitive empathy) (Jones et al., 2010). Similarly, Dadds et al. (2009) found that higher levels of parent-reported psychopathic traits appeared to be associated with impairments in affective empathy in a community sample of boys aged between three and 13 years. Interestingly, Dadds et al. (2009) found that younger children with CU traits show cognitive empathy deficits, but that these were no longer present in adolescents with CU traits. These findings suggest that individuals high in CU traits may learn to 'talk the talk', or in other words, to demonstrate a cognitive understanding of others' emotions despite failing to experience how others feel (Dadds et al., 2012).

Indeed, while research has generally demonstrated that antisocial youth with CU traits appear to demonstrate deficits in subjective emotional experience, those without CU traits exhibit difficulties in emotion regulation and impulsivity (Frick & Morris, 2004). Additionally, youth with CPs but without CU traits appear to be less aggressive than those with high CU traits. When the former group is aggressive, however, they tend to exhibit reactive aggression, often responding impulsively and with aggressive emotions in response to actual or perceived threat, whereas the latter show reduced levels of reactive aggression (Blair, 2010; Frick et al., 2003; Pardini, Lochman, & Frick, 2003). Indeed, differences in aggression styles, including the inability to control one's

anger, has been deemed as a crucial feature underlying the aetiology of CD, and particularly childhood-onset CD (Pardini & Frick, 2013).

In fact, high temperamental anger in both infants and children has been associated with CPs and later aggression (Arsenio, Cooperman, & Lover, 2000; Lengua & Kovacs, 2005; Rothbart, Ahadi, & Hershey, 1994). Interestingly, difficulties in regulating one's anger are a major (and diagnostic) feature of ODD (the developmental precursor of CD) (Stringaris, 2011). Furthermore, researchers have posited that children with elevated levels of trait anger perceive ambiguous social stimuli as intimidating or threatening (Schultz, Izard, & Bear, 2004), which, in turn, may lead them to exhibit self-protective forms of hostility in response to trivial forms of provocation (de Castro, Veerman, Koops, Bosch, & Monshouwer, 2002).

These self-protective forms of aggression may be moderately influenced by exposure to abuse and punitive parental discipline (Pardini & Frick, 2013). Thus, one might predict higher levels of dysregulated anger amongst individuals with LCP CD, as research has proposed that these individuals often come from families with a long history of antisocial behaviour that are more likely to use harsh and inconsistent disciplinary practices (Odgers et al., 2008). Indeed, severe and unpredictable discipline may lead these children to exhibit augmented levels of hypervigilance in reaction to potential threats (Dodge, Pettit, Bates, & Valente, 1995; Pollak & Sinha, 2002) which, in turn, may result in difficulties developing suitable emotion regulation skills (Shields & Cicchetti, 1998).

Other than age-of-onset, the presence of CU traits, and the presence of anger regulation difficulties, researchers have also attempted to subtype individuals on the basis of their antisocial behaviour by utilising a neurocognitive approach (e.g., Blair, 2005). It has been suggested that in order to comprehensively evaluate a particular psychiatric disorder, one must not only identify the global behavioural profile and its functional deficiencies, but also the neural substrates underlying these, the hormones and neurotransmitters that play a role in these impairments, and the underlying genetic bases that lead to the development of the disorder. This notion has been explored within the Integrated Emotion Systems model (Blair, 2005), which will be considered in the next section.

1.5 The Integrated Emotion Systems (IES) Model

The IES model (Blair, 2005) proposes that the key cause of the development of antisocial behaviour and psychopathy is a genetic susceptibility to amygdala dysfunction (Blair, 2006; Blair, Mitchell, & Blair, 2005b; Blair, Peschardt, Budhani, Mitchell, & Pine, 2006). As mentioned previously, there appear to be behavioural similarities between patients with amygdala

dysfunction and antisocial youth with high psychopathic traits, as both groups seem to show deficits in the recognition of facial expressions of fear (Adolphs et al., 2005). See Box 1.1 for a brief overview of the neuroanatomy of the amygdala.

Box 1.1 The Neuroanatomy of the Amygdala

The amygdala resides in the centre of numerous neurological circuits. It plays a key role in the processing of social and emotional information and it is said to be the central part of the limbic system (Adolphs, 1999). Via its connections to other brain areas, such as the frontal cortices, the basal ganglia, the hypothalamus, and the hippocampus (Adolphs, 1999), it is heavily involved in the recognition of emotions and their regulation, memory for emotional information (particularly, regarding negative affect), and conditioning processes that require emotion (e.g., learning from punishment; Davidson, Fox, & Kalin, 2007; DeLisi, Umphress, & Vaughn, 2009; LeDoux, 2000).

The amygdala is typically viewed as being comprised of two distinct sections, the central nucleus (CeN), including the cortical, medial, and central nuclei, and the basolateral amygdala (BLA), encompassing the lateral, basal, and accessory basal nuclei (LeDoux, 2007). Despite the fact that these subregions are highly connected to each other, they also appear to have partly distinct functions (Blair, Budhani, Colledge, & Scott, 2005; Blair, 2005a; Everitt, Cardinal, Parkinson, & Robbins, 2003). In turn, these parts are also connected to other brain regions, and it has been posited that there are three key systems that connect the CeN and the BLA to these (Price, 2003).

Firstly, the forebrain structure sends sensory information to both the CeN and the BLA (Price, 2003). Secondly, the CeN appears to be connected to the hypothalamus, midbrain, and the lower brainstem. These networks are said to play a vital role in the control of vegetative functions, including perspiration, digestion, respiration, and heart rate. Finally, the third system encompasses the connections between the BLA and the orbital and medial prefrontal cortex, the medial thalamus, and the ventromedial basal ganglia. It is proposed that these regions are involved in mood, reward, and goal-directed behaviours (Price, 2003).

The interchange of information between these systems is said to be partly regulated by neurotransmitters such as noradrenaline, serotonin, dopamine, and acetylcholine, which appear

to play a role in the firing of particular neuronal circuits within and surrounding the amygdala (LeDoux, 2007). For example, the interplay between the BLA and the dopamine system has been deemed to play a crucial role in reward-seeking behaviours (Ambroggi, Ishikawa, Fields, & Nicola, 2008). Additionally, although it is uncertain whether a dysfunction in the amygdala disrupts the noradrenergic system or vice-versa, researchers have established the importance of the noradrenergic system for its contribution to the processing of punishment cues (Rogers, Lancaster, Wakeley, & Bhagwagar, 2004) and its influence in memorising negative emotional experiences (McGaugh, 2004). For this reason, the noradrenergic system has been implicated in the development of psychopathy (Blair, 2006).

The IES model suggests that individuals who exhibit antisocial behaviour and/or psychopathic traits have difficulties processing punishment cues and memorising negative emotional experiences, implying that the connections between the noradrenergic system and the amygdala may be dysfunctional (Blair, 2003, 2004, 2005, 2006; Blair et al., 2005c). In turn, these deficits are said to impede the development of 'moral socialisation' (socialisation via emotional learning), whereby a typical individual would learn to desist from behaviours that would cause damage to others (e.g., observing someone in pain evokes an empathic reaction that teaches the individual to avoid performing the hurtful behaviour again). It may be the case that individuals who are aggressive or psychopathic do not learn to make these associations due to a dysfunction in the amygdala, resulting not only in impairments in developing stimulus-punishment associations, but also, in processing distress cues (i.e., fear, sadness) appropriately.

Neuroimaging research is broadly supportive of Blair's (2005) proposition of a dysfunction in the amygdala in youths with aggressive and psychopathic tendencies. The study by Marsh et al. (2008) demonstrated that youths with Disruptive Behaviour Disorders (DBDs; e.g., CD) *and* CU traits exhibit reduced amygdala activation when viewing fearful faces, relative to TD youth and individuals with ADHD. Moreover, the former group demonstrated reduced functional connectivity between ventromedial prefrontal cortex and the amygdala in contrast to the TD and ADHD groups, with those with the highest levels of CU traits exhibiting the lowest levels of connectivity, implying a reduced flow of information between these two areas during the viewing of fearful faces.

Similarly, a study by Jones et al. (2009) examined blood-oxygen-level-dependent responses (brain activity quantified on the basis of blood flow) in individuals with elevated CPs and psychopathic traits and age- and IQ-matched controls when viewing fearful and neutral faces. Although both groups demonstrated heightened amygdala activation when viewing fearful faces, relative to

neutral faces, youth with CU traits demonstrated less activity in the right amygdala in comparison to TD controls, further supporting Blair's (2005) IES Model. Critically, the individuals in this study could have also had a diagnosis of CD or ODD, meaning that the findings may have been driven by the presence of these disorders, rather than individuals' CU traits alone.

Counter to the IES model, some researchers have found no association between parent- or self-reported CU traits and amygdala activation in females with CD (Fairchild et al., 2014). Although this could be a function of the task employed, where the authors presented sad (rather than fearful) facial expressions of emotion, one would expect to find reduced amygdala responses in those with elevated CU traits, given that sadness is also a distress cue. Critically, the findings may highlight differences in the association between psychopathic traits and amygdala reactivity to distress cues in males and females, given that most studies finding reduced amygdala activation have been conducted on male samples.

Apart from the aforementioned amygdala abnormalities, the IES model also predicts that individuals with CU traits will show dysfunction in the following areas: the orbitofrontal cortex (OFC), ventrolateral frontal (vlPFC), and ventromedial (vmPFC) areas of the prefrontal cortex (PFC) (Blair, 2005; Blair, 2010). The OFC is found at the bottom of the frontal lobe, located right above the eyes, and is connected to the amygdala, hippocampus, entorhinal cortex, and the inferior temporal cortex (Kringelbach, 2004). It has been argued that the OFC has a crucial role in the processing of reward and punishment and in the formation of stimulus-reinforcement associations (Rolls, 2000). Closely located in the lateral and medial sections of the OFC are the vlPFC and vmPFC. Injury and lesions to the OFC have been demonstrated to lead to changes in personality, behaviour, and emotion (Kiehl, 2006). Damasio, Grabowski, Frank, Galaburda, and Damasio (1994) proposed that these lesions could also lead to 'acquired psychopathy', whereby individuals may exhibit impairments regarding empathy, motivation, insight, planning, organisation, responsibility, and behavioural inhibition (Malloy, 1993), all of which are comparable to 'developmental psychopathy' (Blair & Cipolotti, 2000).

Furthermore, damage to the OFC has been associated with heightened levels of reactive aggression (Blair et al., 2005c; Grafman et al., 1996), suggesting that the OFC may play a crucial role in the monitoring and regulating of threat responses (Blair, 2004; Gregg & Siegel, 2001). Damage to the vmPFC has been associated with deficient emotion processing skills, whereby individuals appear unable to use emotions to guide their decisions in everyday life and demonstrate impairments in using positive and negative feedback in order to modify their behaviour (Bechara, Damasio, & Damasio, 2000).

Taken together, the IES model suggests that the amygdala and the PFC may play a key role in the development of antisocial behaviour and psychopathy. Specifically, the affective components of psychopathy are related to amygdala dysfunction, whereas the behavioural/disinhibition components of psychopathy are related to PFC deficits. Furthermore, Blair (2005) posits that impairments in these brain areas lead to difficulties in processing distress cues (i.e., fear), thus affecting the development of empathic skills and leading to impairments in using emotional information to modulate behaviour.

Indeed, emotion processing and empathic deficiencies have been observed in a myriad of studies on CD and psychopathy (see Bons et al., 2012; Dawel, O'Kearney, McKone, & Palermo, 2012 for reviews). It is evident that these impairments are associated with antisocial behaviour in children and adolescents with childhood-onset or adolescent-onset CD (Fairchild, Stobbe, van Goozen, Calder, & Goodyer, 2010; Fairchild, Van Goozen, Stollery, & Goodyer, 2008), youth with psychopathic traits (Blair, Colledge, Murray, & Mitchell, 2001), and children with DBDs (van Goozen, Snoek, Matthys, van Rossum, & van Engeland, 2004).

Nevertheless, it is currently uncertain whether these impairments are solely related to fear (e.g., Dadds et al., 2006; Jones et al., 2009; Marsh et al., 2008), sadness (e.g., Blair, 1999; Fairchild et al., 2010), or represent a global deficit in emotion processing (e.g., Sully, Sonuga-Barke, & Fairchild, 2015). This uncertainty may have contributed to the lack of successful interventions aiming to improve empathy and emotion processing in these youth. Furthermore, no studies have employed longitudinal designs to investigate whether there are causal relationships between difficulties in emotion recognition and empathy and the development of CD. The following section will provide a summary of the emotion recognition and empathy deficits exhibited by children and adolescents with CD and varying levels of CU traits. Before doing this, the concept of empathy will be discussed, including its developmental trajectory and importance for successful social functioning.

1.6 Empathy and Emotion Processing

The ability to understand and share the emotional states of others, a process typically referred to as empathy, is essential for the development of social competence, including the maintenance of interpersonal relationships and the facilitation of prosocial behaviours (Barnett & Thompson, 1985; Eisenberg & Miller, 1987). Empathy has often been described as a multidimensional phenomenon comprised of both affective and cognitive components (Hoffman, 2000). Although definitions of these constructs have not yet been agreed upon within the literature, affective empathy is typically viewed as an emotional response that is evoked by, and matches, another

person's emotions (Blair, 2005; Decety & Jackson, 2004), while cognitive empathy has often been described as the identification and understanding of others' emotional states (Reniers, Corcoran, Drake, Shryane, & Völlm, 2011).

Despite the highly overlapping nature of affective and cognitive empathy, it has been suggested that these components of empathy can be dissociated and that they depend on distinct cognitive and neurobiological mechanisms (Shamay-Tsoory, 2011). Lesion studies have shown notable anatomical differences between these two empathy systems. For example, patients with lesions in the inferior frontal gyrus have been seen to display impairments in affective empathy (Shamay-Tsoory, Aharon-Peretz, & Perry, 2009), while those with lesions in the vmPFC exhibit difficulties in cognitive empathy.

From an evolutionary perspective, it has been postulated that different forms of empathy-related constructs developed over time, from more basic forms, including mimicry and emotional contagion, to more complex forms, such as sympathy and compassion (Gonzalez-Liencres, Shamay-Tsoory, & Brüne, 2013; see *Figure 1.1* for a hierarchical representation of empathy-related contructs). Both sympathy and compassion have often been identified in the literature as building upon our skills for empathising with others (Goetz, Keltner, & Simon-Thomas, 2010). These empathy-related constructs entail the capacity to form a representation of another's emotional state but, as opposed to affective empathy, do not require emotion-sharing (Goetz et al., 2010). Smith (2006) proposed that the affective and cognitive forms of empathy developed as a result of distinct evolutionary-relevant selection forces, where affective empathy may have developed as a consequence of sexual and kin selection (Hamilton, 1964). On the other hand, cognitive empathy may have arisen as a result of the greater social complexity of early hominin groups (i.e., reciprocity and cooperation; Trivers, 1971).

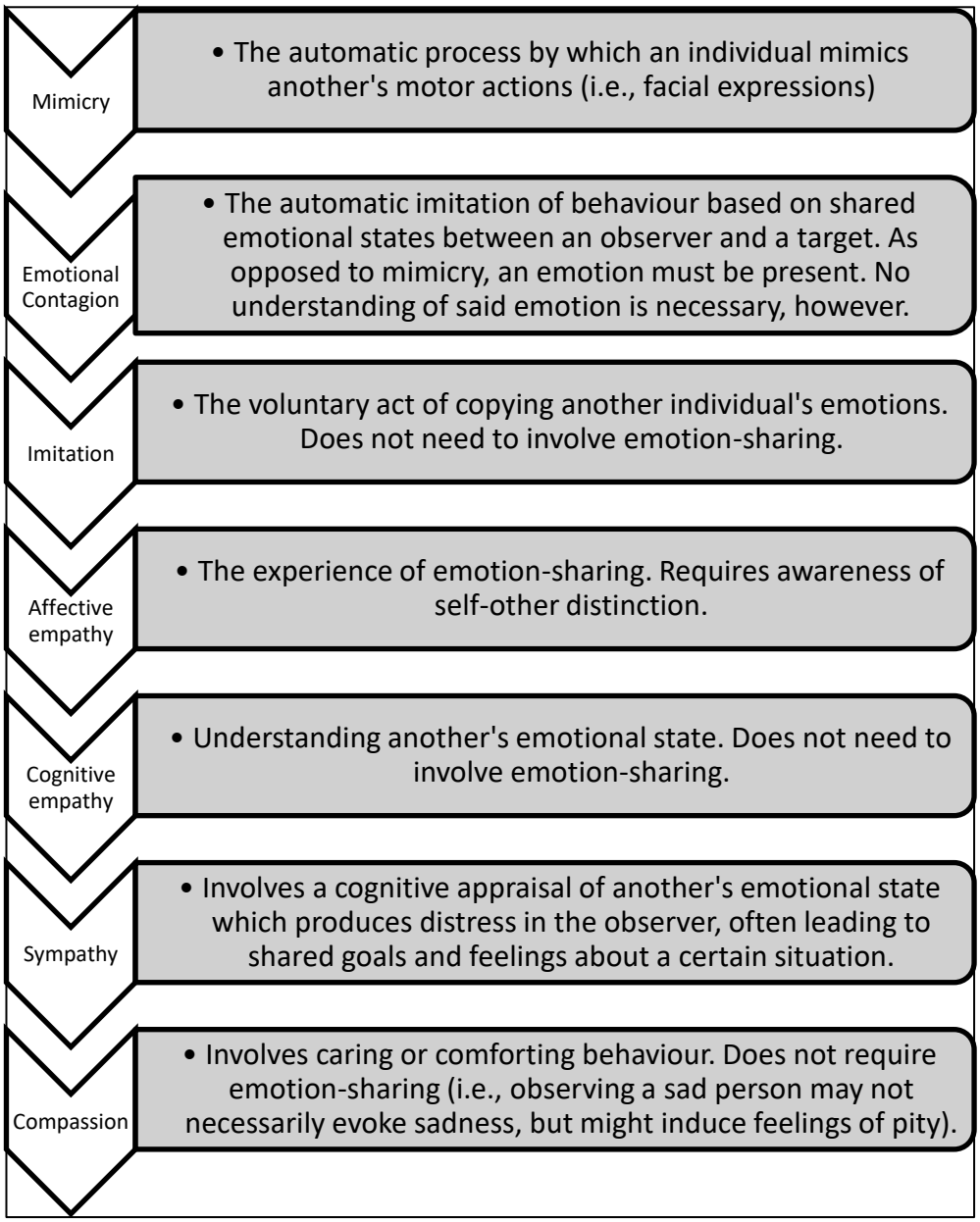


Figure 1.1 Hierarchical representation of the evolutionary aspects of empathy. Adapted from "Towards a neuroscience of empathy: Ontology, phylogeny, brain mechanisms, context and psychopathology", by C. Gonzalez-Liencres et al., 2013, *Neuroscience and Behavioural Reviews*, 37, p. 1539. Copyright 2013 Elsevier Ltd. Adapted with permission.

It has been demonstrated that by 18 months of age, toddlers are capable of consoling another person in distress (Dunn, 1988), while by 24-months of age they can understand the causes of the suffering of others (Dunn & Munn, 1985). Shortly after the second year of age, children start describing other people's behaviour by referring to physiological states (Wellman, 2002). Indeed, affective empathy is thought to be an older phylogenetic trait than cognitive empathy, where the

former is said to allow an individual to form a mental representation of another person's emotional state by feeling it in the first place (Gallese & Sinigaglia, 2011). The perception-action model (PAM; Preston & de Waal, 2000) supports this two-stage hypothesis by postulating that in order for an individual to recognise and understand the emotional state of another, the viewer must represent a similar state in his/her brain by activating a similar neural network. In order for this to happen, an individual must automatically mimic the emotion being displayed (Singer et al., 2006). For example, facial expressions have been seen to evoke facial mimicry in the observer (which may not be done consciously; Dimberg, Thunberg, & Elmehed, 2000). In turn, facial mimicry may elicit alterations in the autonomic nervous system that result in the observer feeling the emotion that was displayed in the first place (Levenson, Ekman, & Friesen, 1990). This then allows the individual to recognise the emotion (van Baaren, Janssen, Chartrand, & Dijksterhuis, 2009).

Cognitive empathy has occasionally been operationalised as emotion recognition (Bons et al., 2012), while some researchers have made a distinction between understanding and simply recognising emotions (e.g., Besel & Yuille, 2010). The ability to recognise the six basic emotions in faces has been deemed universal across cultures (Ekman et al., 1987), and is crucial for social interaction and interpersonal communication. Facial expression identification is reported to develop throughout childhood and adolescence (Mondloch, Geldart, Maurer, & Le Grand, 2003; Montirosso, Peverelli, Frigerio, Crespi, & Borgatti, 2010). Research has demonstrated that children first learn to categorise expressions into happy and non-happy categories, while gradually distinguishing between the negative facial expressions, with anger being recognised first in the developmental sequence (Adolphs, 2002; Herba & Phillips, 2004).

Empathy-related deficits, including impairments in facial expression recognition, have been associated with a variety of psychiatric disorders, including eating disorders (e.g., Ridout, Wallis, Autwal, & Sellis, 2012), schizophrenia (see Chan, Li, Cheung, & Gong, 2010 for a meta-analysis), MDD (e.g., O'Connor, Berry, Weiss, & Gilbert, 2002; Schreiter, Pijnenborg, & Aan Het Rot, 2013), and ASDs (e.g., Hobson, Ouston, & Lee, 1988; Philip et al., 2010). Furthermore, empathy has been related to aggression (Feshbach & Feshbach, 1982), with researchers positing that the ability to recognise and understand another person's distress (i.e., fear, sadness) may inhibit or attenuate behaviours that harm others such as aggression – this idea is encapsulated in the Violence Inhibition Mechanism model (VIM; Blair, 1995; see Box 1.2 for a brief overview).

Box 1.2 The Violence Inhibition Mechanism Model

The VIM is a cognitive model proposed by Blair (1995) in which non-verbal distress cues (e.g., fearful facial expressions) evoke a withdrawal response. It is important to note that there exist other cognitive mechanisms that may override the VIM, thereby, the final response may not necessarily be to withdraw from the situation. If, however, the resulting behaviour involves withdrawal, the strength of this behaviour will depend on the degree of activation of the VIM. For example, seeing a sad facial expression may result in limited withdrawal relative to watching a screaming or sobbing individual. Distress-related social cues can be seen as aversive unconditioned stimuli (US), where the unconditioned response (UR) reflects the activation of the VIM. It is argued that, via empathy-related mechanisms involving forming a mental representation of another's distress, and pairing this with the US, one's mental representations also become conditioned stimuli, resulting in a conditioned VIM activation (e.g., thoughts of harming another individual are also linked to VIM activation).

Thus, during development, the typically-developing child's behaviours will be negatively reinforced by distress-related cues whenever he or she employs aggressive behaviour and harms another individual. It is argued that, via classical conditioning, even the thought of engaging in aggression will be negatively reinforced via the activation of VIM. Therefore, it is likely that the individual who responds appropriately to distress cues will desist from engaging in aggressive behaviour over time. On the other hand, if an individual is rewarded for his/her antisocial behaviour (e.g., praise from peers), this may override the VIM and therefore no withdrawal response will take place. In turn, it is likely that the individual will not experience an aversive response and will be more likely to engage in future aggression. Similarly, if an individual is less sensitive to, or even incapable of processing, another's distress cues in the first place, no aversive response will take place, and therefore, their aggressive behaviours will not be negatively reinforced (conditioned). This leads to a failure to stop using aggression in an instrumental way to obtain rewards or resolve conflicts with peers.

In accordance with this notion, children and adolescents with psychopathic tendencies have been found to exhibit impairments in the identification of fearful and sad facial and vocal expressions (e.g., Stevens, Charman, & Blair, 2001). Elevated CU traits in children and adolescents have also been negatively associated with verbal reports of victim concern (a measure of affective empathy) in response to vignettes describing aggressive acts (Pardini et al., 2003). Similarly, a study by

Anastassiou-Hadjicharalambous and Warden (2008) assessed affective empathy in children with CD and high versus low levels of CU traits, and healthy controls. Healthy control children verbally reported the presence of an affective response to another's fear to a greater extent than children in both of the CD subgroups, while the high CU participants exhibited reduced heart rate deceleration relative to both the low CU and control groups. Critically, Anastassiou-Hadjicharalambous and Warden (2008) only focused on congruence (asking the participant whether he/she felt the same emotion/similar valence, irrespective of what the emotion was), so it is uncertain whether the participants felt the same emotion as the target or not. Furthermore, this study only explored affective responses to a single video clip, so it is unclear whether group differences would have been found for other fearful stimuli or additional emotions.

Although these findings support the notion of a relationship between CU traits or psychopathy and a reduced ability to recognise or show affective matching to another individual's distress cues, not all studies have found this inverse association (e.g., Kosson, Suchy, Mayer, & Libby, 2002). In fact, a study by Woodworth and Waschbusch (2008) found that children high in CU traits were more accurate than TD youth at identifying others' facial expressions of fear, whilst those with high levels of CPs but low CU traits appeared least accurate. These findings are not consistent with most of the extant literature regarding emotional processing in youth with CU traits, but are in accordance with the finding that children with CD and low levels of CU traits are more likely to exhibit deficient social cognitive skills than those with CD and high levels of CU traits (e.g., Waschbusch, Carrey, Willoughby, King, & Andrade, 2007).

Critically, some studies have demonstrated that antisocial and aggressive behaviour may be associated with relatively global emotion recognition and empathic deficits (i.e., not just fear and sadness). For example, Fairchild et al. (2009) found that, in comparison to controls, individuals with childhood-onset CD were worse at identifying facial expressions depicting anger, disgust, and happiness, while the recognition of fear was impaired in participants with adolescence-onset CD. Furthermore, the authors found that CD subjects who were high in psychopathic traits demonstrated more pronounced deficits in fear, sadness, and surprise recognition, relative to those low in psychopathic traits. Comparably, there are a range of studies reporting pervasive impairments across facial recognition tasks, revealing global emotion recognition deficits in children and adolescents with CD or CPs *and* CU traits, as well as in adults with psychopathy (see Dawel et al., 2012 for a review).

Taken together, research with young people with CD and/or CU traits largely supports the notion that these individuals have difficulties identifying, understanding, and feeling negative emotions. Nevertheless, the specific deficits associated with CD and CU traits may be different – i.e., CD may

be associated with relatively global impairments in emotion recognition and empathy (e.g., Fairchild et al., 2009; 2008), while high CU traits may be related to specific difficulties processing fearful (e.g., Dadds et al., 2006; Jones et al., 2009; Marsh et al., 2008) and sad cues (e.g., Blair, 1999; Fairchild et al., 2010). As such, it may not be appropriate to treat these as synonymous to each other, or to collapse across constructs.

Furthermore, the majority of these studies have employed high-intensity, static, facial stimuli that do not resemble the kinds of stimuli that we have to recognise in everyday social contexts. Thus, it is unclear whether these findings would still hold if more naturalistic and ecologically-valid stimuli were employed, or whether these findings are simply a result of the artificial nature of the stimuli and experimental paradigms employed. Additionally, facial expressions are rarely seen in isolation, and although they play a crucial role in social communication, there are good reasons to extend emotion recognition and empathy research by studying body expressions of emotion. In fact, it has been posited that body expressions are the most evolutionary preserved and direct means of transmitting emotional information (de Gelder, 2006). Furthermore, there are a number of situations in which body expressions are more accessible than facial affect, such as when observing an individual from a distance or in poor illumination, or when their face is averted.

Research has demonstrated that our perception of facial expressions is affected by the accompanying body expression (Meeren, van Heijnsbergen, & de Gelder, 2005; Van den Stock, Righart, & de Gelder, 2007), and individuals appear to place greater emphasis on body expressions over facial expressions when these are incongruent (de Gelder, 2006). Moreover, some emotions may be communicated more effectively via the body than the face – e.g., aggressiveness can be perceived as more of a direct risk when portrayed via the body (i.e., an aggressive stance), relative to the face (angry expression; de Gelder et al., 2010), and research has demonstrated that body expressions of emotion are as informative and readily recognised as facial expressions (Reed, Stone, Bozova, & Tanaka, 2003; Reed, Stone, Grubb, & McGoldrick, 2006).

To date, however, only two studies have examined emotion recognition from body expressions in youths with CU traits (Muñoz, 2009; Wolf & Centifanti, 2014). The findings from the first study revealed that children and adolescents with higher levels of CU traits exhibited difficulties interpreting emotions from static body expressions displaying fear (Muñoz, 2009). On the other hand, the more recent study failed to replicate these findings, with the results revealing that the recognition of dynamic fearful body expressions was unrelated to levels of CU traits (Wolf & Centifanti, 2014). It could be claimed that when using more naturalistic stimuli (dynamic body expressions), individuals with higher CU traits are able to overcome their difficulties identifying

emotions from static body expressions. Thus, the results from the earlier study could simply be due to the artificial nature of the stimuli employed. Furthermore, it is important to note that both of these studies were conducted on community samples of male children and adolescents with varying levels of CU traits. It is therefore uncertain whether any of the participants would have met diagnostic criteria for CD.

Taken together, it is uncertain whether the findings previously observed for facial emotion recognition extend to body expressions of emotion. Given the fact that studies that have used clinical diagnoses of CD have tended to report global impairments in facial emotion recognition, rather than specific difficulties with fear (Fairchild et al., 2010, 2009; Short, Sonuga-Barke, Adams, & Fairchild, 2016; Sully et al., 2015), it may be the case that individuals with diagnosable levels of CPs (i.e., CD) would also exhibit global difficulties in identifying body expressions of emotion. On the other hand, if this is not the case, one may assume that children and adolescents with CD may focus their attention on others' body expressions in order to identify their emotional states, thereby compensating for their facial expression recognition difficulties. In fact, impairments in emotion recognition may arise from the fact that these individuals may process emotional stimuli in a different way from healthy individuals, such as by fixating less on emotionally-salient information (i.e., the eye region of the face). The following section will explore this notion, placing a particular emphasis on the potential use of eye-tracking measurements to explore the extent to which attentional mechanisms may underlie emotion recognition deficits.

1.7 Attention and Emotion Recognition

It has been argued that eye movements and spatial attention are intricately related (Engbert & Kliegl, 2003), with a key aspect of attention being that of directing our gaze to important stimuli in the environment for detailed processing (Lavie, Hirst, de Fockert, & Viding, 2004). Research has demonstrated that humans direct a substantial proportion of their fixations to emotionally-significant stimuli (Findlay & Gilchrist, 2003), and eye movements have been found to play a critical role in facial affect identification and facial memory (Henderson, Williams, & Falk, 2005). The eye region of the face appears to capture our attention the most (Yarbus, 1967) – indeed, this region conveys a vast amount of information, including information related to a person's mental or emotional states, the focus of their attention, and their social intentions (Emery, 2000). Furthermore, looking at another individual's eyes serves a dual purpose as it allows us to identify another person's mental or emotional state, while revealing our own emotional states or thoughts to them. This twofold nature of information-sharing via attention to the eyes has been seen to arise early in development, with infants in their first month of age showing a preference

for the eye region of the face, relative to other regions, such as the mouth (Haith, Bergman, & Moore, 1977).

Healthy adults also appear to show a strong preference for the eye region of the face (e.g., Birmingham, Bischof, & Kingstone, 2008), with individuals (particularly women) exhibiting longer fixation times on the eyes, relative to the mouth, during facial affect identification (Hall, Hutton, & Morgan, 2010). Critically, fixation time has been positively associated with facial expression recognition accuracy, supporting the notion that emotion recognition can be directly improved by attending to the eye region of the face (Smith, Cottrell, Gosselin, & Schyns, 2005). Further support for this idea comes from studies that have asked healthy individuals to deliberately look away from the eye region, with findings revealing that this manipulation leads to a reduced ability to recognise others' facial expressions (e.g., Peterson & Eckstein, 2013). Indeed, it has been demonstrated that the eye region conveys important cues for emotion processing (Ekman & Friesen, 1969), with researchers finding that attending to this region is important across *all* emotional categories (Spezio, Adolphs, Hurley, & Piven, 2007).

On the other hand, it has also been argued that observers tend to alter their attentional strategy in accordance with the particular emotion being presented. For example, research has demonstrated that the eyes are the most emotionally-informative regions for the successful identification of expressions such as fear and anger, while the recognition of happiness, disgust, and surprise is improved by focusing on the mouth region of the face (Smith et al., 2005; Tanaka, Kaiser, Butler, & Le Grand, 2012). In accordance with these findings, it has been shown that healthy adults are better at identifying emotions from isolated features when the feature is the optimal one (Calder, Young, Keane, & Dean, 2000; Wallace, Coleman, & Bailey, 2008), highlighting the importance of both the eyes and mouth for successful emotion identification.

Indeed, while healthy subjects focus on the eyes and mouth, studies of clinical populations have often revealed atypical attentional strategies when processing facial affect. For example, abnormal scanpaths with no preference for these emotionally-informative regions, and particularly the eye region of the face, have been observed across a range of disorders, such as ASDs, schizophrenia, bipolar disorder, and severe mood dysregulation (e.g., Dalton et al., 2005; Kim et al., 2013; Loughland, Williams, & Gordon, 2002; Pelphrey et al., 2002; Speer, Cook, McMahon, & Clark, 2007). Critically, these disorders have been associated with poorer facial expression recognition abilities (Boraston, Blakemore, Chilvers, & Skuse, 2007; Edwards, Jackson, & Pattison, 2002; Rich et al., 2008), suggesting that abnormal visual attention may underlie these difficulties. As such, these findings suggest that the emotion recognition deficits exhibited by

children and adolescents with CD and/or CU traits may be explained by a lower preference to attend to emotionally-informative areas of the face, such as the eyes.

To date, only one study has examined eye movements in antisocial adolescents. Dadds et al. (2008) assessed eye movements in adolescents with high and low CU traits when viewing facial expressions. Under free-viewing conditions, adolescents with high levels of CU traits fixated less on the eye region of the face, relative to low CU adolescents. This attentional impairment only affected their ability to recognise others' fear, whilst the recognition of other prototypical facial expressions remained intact. Interestingly, when they were instructed to look at the eye region, high CU adolescents' fear-recognition performance improved. These findings have important implications, especially in terms of intervention practices.

Despite this demonstration that fear recognition deficits in those with CU traits may be related to atypical fixation patterns to informative regions of the face, Dadds et al. (2008) recruited a community sample of children who may have lacked clinically-significant levels of antisocial behaviour. It would therefore be informative to examine the effects of CU traits *within* a sample of adolescents with diagnosable levels of CPs, rather than evaluating the effects of CU traits alone. Additionally, Dadds et al.'s (2008) sample was comprised solely of males, so it is currently uncertain whether females with CU traits would exhibit comparable emotion recognition deficits and problems in attending to the eye region of the face.

Furthermore, given that adolescents with clinically-diagnosed CD have generally been reported to have relatively global impairments in emotion recognition (Fairchild et al., 2009, 2008), rather than specific difficulties with fear, it is unclear whether these broader difficulties in emotion recognition are also explained by attentional deficits. Additionally, psychopathic traits have also been associated with impaired recognition of fear from body expressions (e.g., Dawel et al., 2012; Muñoz, 2009), meaning that mechanisms other than reduced attention to the eye region of the face must underlie these deficits.

1.8 The Gaps in the Literature

The study of emotion recognition in antisocial populations has mainly relied on visually presented static images depicting high-intensity prototypical facial expressions that do not resemble the stimuli that we have to recognise in everyday situations. Restricting the stimuli used in emotion recognition paradigms to high intensity facial expressions could result in ceiling effects being seen and may not provide a sensitive enough measure for detecting individuals' emotion recognition deficits. Therefore, incorporating low intensity stimuli (e.g., blending happy expressions with

neutral expressions to produce 50% happy morphs) in such tasks may help reveal more subtle differences between groups or individuals.

A further methodological issue relates to the number of emotions studied – some studies have included all six of the 'basic' or primary emotions (Blair et al., 2001; Blair & Coles, 2000; Fairchild et al., 2009), while other studies have been limited to two (Adolphs & Tranel, 2003), three (Leist & Dadds, 2009), four (Stevens et al., 2001), or five emotions (Dadds et al., 2006; Hastings, Tangney, & Stuewig, 2008). It could be argued that the use of fewer emotion categories does not allow for a sufficiently comprehensive measure of facial expression recognition deficits, and limits researchers' ability to show selective or disproportionate impairments in certain emotions (e.g., fear or disgust). Furthermore, given the importance of body expressions for emotion recognition, the current dependence on using facial expression stimuli to examine emotion recognition abilities may not capture the true scope of individuals' emotion understanding.

An additional methodological issue regards the lack of studies presenting dynamic stimuli. Relative to static stimuli, dynamic portrayals of emotional expressions are higher in ecological validity as both facial expressions and body expressions of emotion are accompanied by movement during real-life social interactions. For example, expressive information can be portrayed via changes in features such as the shape of the eyes and mouth, as well as the position of the jaw (Calder, Burton, Miller, Young, & Akamatsu, 2001). Moreover, dynamic properties of emotional expressions, including movement and time-course, have been seen to directly impact emotion recognition accuracy (Kamachi et al., 2001; Pollick, Hill, Calder, & Paterson, 2003). Therefore, there is a need for emotion recognition paradigms to include dynamic stimuli as this will help improve the ecological validity of these studies and refine our understanding of how individuals process emotional information in everyday social contexts. It is possible that the previous findings in the literature are due to the use of artificial stimuli, and adolescents with CD or high levels of CU traits may show intact recognition of dynamic emotional expressions.

The existence of atypical eye movements (i.e., reduced number of fixations to the eyes) in clinical populations, as well as the association between attending to emotionally-salient regions and emotion recognition accuracy (Birmingham et al., 2008; Peterson & Eckstein, 2013; Smith et al., 2005), imply a key link between eye movements and emotion recognition performance. Despite this association, only one study to date has examined eye movements in antisocial youth (Dadds et al., 2008). Therefore, there is a need for studies to integrate emotion recognition paradigms with highly-sensitive eye-tracking measures as this has the potential to shed light on the underlying causes of these well-documented (albeit inconsistent) emotion recognition deficits.

For example, CD-related deficits in emotion recognition may be explained by a failure to attend the most salient and informative regions of emotional stimuli (i.e., eyes).

Furthermore, Dadds et al.'s (2008) eye-tracking study recruited a community sample of children who may have lacked clinically-significant levels of antisocial behaviour. It would therefore be advisable to study emotion recognition and empathy in a sample of adolescents with diagnosable levels of CPs, particularly as this population has been shown to exhibit relatively global difficulties in emotion recognition (Fairchild et al., 2009, 2008), rather than specific problems recognising distress cues alone (e.g., Blair et al., 1999; Dadds et al., 2006; Jones et al., 2009; Marsh et al., 2008). Additionally, given the distinction made in the DSM-5 between CD with LPE and CD without LPE, it is important, from a clinical perspective, to assess whether individuals with CD and high levels of CU traits differ from those with CD and low CU traits on a range of emotion recognition and empathy tasks.

In addition, although emotion recognition represents an aspect of cognitive empathy, the use of static, greyscale stimuli depicting facial expressions may not be sufficient to capture whether individuals actually understand what the other person is feeling. Similarly, selecting excerpts from television shows or scenarios portrayed by actors means that the emotion displayed in the clip is inevitably artificial, and further, that it is not possible to determine whether the targets were genuinely feeling the emotion they were portraying. Moreover, the dependence on requiring participants to make an overall judgement of emotion, often through forced-choice procedures, means that it has not been possible to examine whether individuals are capable of tracking changes in emotional intensity, which is a key skill in real-life situations (Zaki, Bolger, & Ochsner, 2009). It would be therefore interesting to study the performance of CD individuals on new empathy paradigms that involve tracking changes in the target's affective states on a continuous basis, as well as directly measuring cognitive empathy/emotion recognition and experience sharing/affective empathy as dependent measures.

Zaki et al. (2009) have recently developed an Empathic Accuracy (EA) task that they believe overcomes many of the above-mentioned methodological issues. EA, defined as the capacity to correctly deduce the intensity and valence of the feelings being experienced by a target (Zaki et al., 2009; Zaki & Ochsner, 2012), involves both mental state attribution (cognitive empathy/emotion recognition) and experience sharing (affective empathy; Zaki & Ochsner, 2012). Critically, the participant's continuous ratings of changes in emotional intensity during the clip are compared with the target's own ratings of the emotions they experienced to provide an index of EA. Indeed, during real-life social encounters, sources of emotional information are also the targets of empathic reactions experienced by the perceivers in response to the emotional

information. As a result, the target's own feelings play a key role in cognitive empathy during social interactions. Despite this, there are a lack of studies that have incorporated how targets actually feel during interpersonal encounters (Gadassi, Mor, & Rafaeli, 2011; Zaki, Bolger, & Ochsner, 2008) and, to date, no studies have investigated EA in CD populations.

Finally, given that the prevalence of CD has increased significantly amongst females in the UK over the last two decades (Collishaw, Maughan, Goodman, & Pickles, 2004), and the lack of research including females with CD, it is critical that females are incorporated into studies of CD. Indeed, studies including both male and female individuals with CD, as well as appropriate sex-matched control groups, would allow us to test whether females with CD show similar or distinct problems in emotion recognition and empathy relative to their male counterparts. Furthermore, these studies have the potential to aid in the development of sex-specific treatments, as males and females with CD may benefit from different intervention strategies and training methods.

1.9 Thesis Aims and Objectives

The principal aim of this thesis is to characterise and understand the mechanisms underlying emotion recognition and empathy deficits in male and female adolescents with CD and varying levels of CU traits.

In the first study described in this thesis (Chapter 2), our objective was to assess facial emotion recognition in male and female adolescents with CD and varying levels of CU traits. We also included age-matched male and female healthy controls as a comparison group. Facial stimuli with varying levels of emotion intensity (both positive and negative expressions) were created by morphing prototypical expression images (e.g., 100% happy) with neutral faces. Dynamic facial expressions presented at full intensity were also included to investigate whether previously reported impairments in emotion recognition in CD are explained by the artificial (static) nature of the stimuli used in those studies. Critically, the emotion recognition task was paired with eye-tracking measurements to assess the relationship between observers' emotion recognition performance and their propensity to fixate on informative face regions. We were specifically interested in testing whether CD-related deficits in emotion recognition were explained by a failure to attend to the most salient and informative regions of the face, and whether this was more pronounced for emotions that are principally communicated via the eyes, such as fear. We also examined the impact of CU traits on facial emotion recognition performance and eye movements within our CD sample, to see whether we could replicate the findings of Dadds et al. (2008) showing poorer fear recognition as a result of reduced orienting to the eye region of the face in those with high CU traits.

Given the importance of recognition of emotions from body expressions for adaptive social behaviour and non-verbal communication, as well as the relative lack of research examining body expression recognition in antisocial youths, our second study (Chapter 3) aimed to examine recognition of, and attention to, body expressions of emotion in male and female CD subjects with varying levels of CU traits. We employed an emotion recognition task that involved presenting both static and dynamic body expression stimuli. As in our previous study, we included age-matched male and female healthy controls as a comparison group. Furthermore, the behavioural task was paired with eye-tracking measurements to explore the relationship between observers' emotion recognition performance and their propensity to fixate on emotionally-salient regions of the body (i.e., arms). We were interested in investigating whether individuals with CD exhibit impairments in body expression recognition, and if so, whether these deficits were explained by atypical eye movements to emotionally-salient regions of the body. We also examined the impact of CU traits on body expression recognition and eye movements.

Although there is increasing evidence that individuals with CD exhibit deficits in cognitive empathy/emotion recognition and affective empathy, findings have been inconsistent across studies of empathy and highly simplified stimuli or tasks have frequently been employed. Therefore, it is uncertain whether adolescents with CD would still present difficulties in empathy if more naturalistic stimuli and paradigms were used. To this end, we employed a modified version of the EA task developed by by Zaki et al. (2009). This task allowed us to assess individuals' ability to correctly track the intensity of the feelings being expressed by another person, as well as measuring complex emotion recognition and affective empathy. Rather than using just positively- and negatively-valenced stimuli, we employed video clips depicting each of the six primary emotions. We investigated whether male adolescents with CD, as well as male TD controls, were able to track changes in emotional intensity, as well as measuring recognition of dynamic stimuli and affective empathy responses to the stimuli (Chapter 4). Given the proposed association between CU traits and more pronounced deficits in empathy (e.g., Blair, 1995, 2003), we also compared adolescents with CD and high levels of CU traits with those with CD and low levels of CU traits in terms of EA task performance.

Following this, we attempted to replicate the EA study in an independent sample of females with CD and TD controls (Chapter 5). In contrast with the studies presented in Chapters 2 and 3, we felt that it would not be appropriate to include both males and females in the same study because of the disparity between the male and female sample sizes. This is because we encountered more difficulties recruiting females with CD than males, with the result that almost twice as many males were recruited as females. Furthermore, it is important to note that all clips in the EA task involved a male target talking about his experiences, meaning that females may have found it

more difficult to empathise with the targets than if they had been female. As such, we felt that it might not be appropriate to combine males and females in the same study because the task may have been inherently more difficult for females. As with our study of males, we explored whether female adolescents, as well as TD controls, were able to track changes in emotional intensity, and explored recognition of dynamic stimuli and affective empathy responses to the video clips. A secondary objective involved assessing the influence of variation in CU traits on empathy in females with CD – to achieve this objective, we contrasted adolescents with CD and high CU traits with those with CD and low CU traits in terms of EA performance.

Finally, the general discussion chapter (Chapter 6) begins by summarising the key findings from the studies in this thesis. Following this, potential implications of the findings for our understanding of CD and CU traits, as well as theoretical models of these disorders such as the IES model, are considered. The implications of the present results for intervention strategies aiming to remediate the emotion recognition and empathy difficulties shown by those with CD and CU traits are discussed. Finally, the strengths and limitations of the current studies are described, as well as ideas for future research.

Chapter 2: Investigating Facial Emotion Recognition in Conduct Disorder using Eye-tracking[1]

[1] Publication note: this chapter is based on Martin-Key, N. A., Graf, E. W., Adams, W. J., & Fairchild, G. (2016). Investigating facial emotion recognition in Conduct Disorder using eye-tracking. *Journal of Child Psychology and Psychiatry*, under review.

Contributions: experimental design, data collection, analyses, and write up were completed by N. A. Martin-Key. Dr. Graf helped with the pre-processing of the eye-tracking data, as well as the preparation of the manuscript. Dr. Adams helped analyse and interpret the findings, and helped prepare the manuscript for submission. Dr. Fairchild helped interpret the findings and helped with the preparation of the manuscript.

2.1 Abstract

Conduct Disorder (CD) is associated with impairments in facial emotion recognition. However, it is unclear whether such deficits are explained by a failure to attend to emotionally-informative regions of the face, such as the eyes, or by problems in stimulus appraisal. Male and female adolescents with CD and varying levels of callous-unemotional (CU) traits and age- and sex-matched typically-developing controls (aged 13-18) categorised the emotion of dynamic and morphed static facial expressions. Concurrent eye-tracking allowed us to relate recognition performance to participants' allocation of overt attention. Adolescents with CD were worse at recognising emotions than typically-developing controls, and such deficits were present across all emotions and for both static and dynamic expressions. Overall, males were worse at recognising emotions than females and were less likely to fixate the eye region of the face. The effects of CD status and gender were additive, such that males with CD were the most impaired. Adolescents with CD fixated less on the eye region of the face when viewing fearful, sad, and surprised expressions, but abnormal fixation patterns did not explain the emotion recognition deficits observed in this group. Across the whole sample, CU traits were negatively correlated with fear recognition performance. Participants with CD, and particularly males, displayed emotion recognition deficits and atypical fixation patterns when processing faces, but our data did not support the hypothesis that emotion recognition deficits in CD are *mediated* by abnormal patterns of fixation. These findings have implications for emotion-training interventions for CD.

2.2 Introduction

Conduct disorder (CD) is a pervasive and persistent form of disruptive behaviour that is characterised by the violation of other people's rights or age-appropriate societal norms (American Psychiatric Association, 2013). CD is more common in males than in females (Moffitt, Caspi, Rutter, & Silva, 2001), and reflecting this, most research on this disorder has been conducted using male-only or predominantly male samples. However, CD is associated with similar neuropsychological impairments in males and females, including lower verbal IQ (Lynam, Moffitt, & Stouthamer-Loeber, 1993; Moffitt & Silva, 1988; Pajer et al., 2008), deficits in autonomic fear conditioning (Fairchild, Stobbe, van Goozen, Calder, & Goodyer, 2010; Fairchild, Van Goozen, Stollery, & Goodyer, 2008), and reduced eye-blink startle responses (Fairchild et al., 2010, 2008). Whilst research has demonstrated that CD is associated with impairments in facial emotion recognition in males and females (Fairchild et al., 2010; Fairchild, Van Goozen, Calder, Stollery, & Goodyer, 2009; Schwenck et al., 2012, 2014; Short, Sonuga-Barke, Adams, & Fairchild, 2016; Sully, Sonuga-Barke, & Fairchild, 2015), the underlying cause(s) of these deficits are not well

understood. They could reflect difficulties with attention (e.g., impaired orienting to the eye region of the face) and/or appraisal (interpretation of stimuli that have been successfully encoded).

There is accumulating evidence that children high in callous-unemotional (CU) traits, i.e., a lack of concern for other people's feelings, superficial affect, and a reduced ability to feel guilt (Pardini & Frick, 2013), are impaired in recognising fearful facial expressions (Marsh & Blair, 2008). This impairment has been associated with a failure to attend to emotionally-relevant regions of the face, such as the eyes (Dadds et al., 2006; Dadds, El Masry, Wimalaweera, & Guastella, 2008). Healthy individuals, and particularly females, show a preference for the eye region when viewing faces (Hall, Hutton, & Morgan, 2010). Moreover, this preference is positively associated with facial expression recognition accuracy (Hall et al., 2010); attending to the eye region appears to be important for recognition of all emotions (Spezio, Adolphs, Hurley, & Piven, 2007).

To date, only one study has examined eye movements in male adolescents with elevated CU traits. The authors found selective deficits in fear recognition in adolescents with elevated CU traits compared to those with low CU traits (Dadds et al., 2008). Notably, the former group fixated less on the eyes than the latter. Interestingly, when they were instructed to look at the eye region, the deficit in fear recognition in the high CU traits group was ameliorated (Dadds et al., 2008), suggesting that their emotion recognition deficits were due to problems with *attentional allocation*, rather than appraisal.

The existing literature raises a number of important questions. First, given that adolescents with clinically-diagnosed CD have generally been reported to show global impairments in facial emotion recognition (Fairchild et al., 2010, 2009; Short et al., 2016; Sully et al., 2015), rather than specific difficulties with fear, it is unclear whether these broader difficulties are also explained by attentional deficits. It is therefore of interest to examine whether adolescents with CD show atypical eye movements across a wider range of emotional expressions, and whether atypical fixation patterns explain the more global deficits observed in CD populations, relative to those with elevated CU traits. Second, while research has demonstrated similar emotion recognition impairments in males and females with CD (although see Pajer, Leininger, & Gardner, 2010), no studies have included males and females in the same experiment to examine whether the relationship between CD and emotion recognition differs by sex, and whether comparable deficits in attention and/or appraisal are present in both sexes. Finally, most studies in this area have used high intensity static facial stimuli that do not resemble the full range of expressions that we encounter in everyday life (although see Bowen, Morgan, Moore, & van Goozen, 2013; Schwenck et al., 2012, 2014). By presenting static stimuli at differing intensities, as well as *dynamic* facial

expressions of emotion, we can examine whether individuals with CD still show recognition impairments when processing more naturalistic stimuli.

Accordingly, the present study investigated facial emotion recognition in male and female adolescents with CD and varying levels of CU traits, and typically-developing (TD) controls. Facial expressions at varying levels of emotional intensity and dynamic, full-intensity facial expressions were included. Importantly, the emotion categorisation task was paired with eye-tracking methods to assess whether CD-related deficits in emotion categorisation could be explained by atypical patterns of fixation (e.g., fixating less on the eyes). A secondary aim was to investigate whether CU traits modulated emotion recognition and attention to the eyes, in line with the work of Dadds and colleagues (2008).

We predicted that adolescents with CD would show deficits in emotion recognition, particularly for negative emotions such as anger, sadness, and fear, and lower intensity static expressions. In addition, we hypothesised that elevated CU traits would be associated with impaired fear recognition. We predicted that adolescents with CD would fixate less on the eyes and that those with CD and elevated CU traits would show the greatest deficits in attending to the eyes. Lastly, we hypothesised that emotion recognition deficits in the CD group would be mediated by a failure to fixate the eyes, and this relationship would be strongest for expressions that are principally communicated via the eyes, such as fear.

2.3 Method

2.3.1 Participants

Adolescents aged 13-18 years were recruited through Youth Offending Services and pupil referral units across Southampton and Hampshire, via referrals from caseworkers, and through mainstream schools and colleges in Southampton via mail-shots. 26 male and 24 female participants met diagnostic criteria for CD. The TD control group included 26 males and 25 females. All participants and the parents of those aged below 16 provided written informed consent to participate in the study. In the latter case, the young people were also asked to indicate their assent. This study was approved by the University Ethics Committee and the Southampton County Council Children's Services Research Governance Committee.

Inclusion criteria for the study were: (i) fluency in English; (ii) no hard contact lenses or bi/tri-focal glasses; (iii) an Intelligence Quotient (IQ) ≥ 70 (assessed via the Wechsler Abbreviated Scale of Intelligence (WASI; Wechsler, 1999)); and (iv) no diagnosis of psychosis or Autism Spectrum Disorder (ASD). All participants were assessed for CD, Oppositional Defiant Disorder (ODD),

Attention-Deficit/Hyperactivity Disorder (ADHD), Major Depressive Disorder (MDD), Generalised Anxiety Disorder (GAD), Obsessive Compulsive Disorder (OCD), Psychosis, Post-Traumatic Stress Disorder (PTSD), and Alcohol and Substance Use Disorders using the Schedule of Affective Disorders and Schizophrenia for School-Age Children-Present and Lifetime version (K-SADS-PL; Kaufman et al., 1997), a semi-structured diagnostic interview based on DSM-IV criteria. ASDs were assessed using the ASD module of the unpublished DSM-5 version of the K-SADS-PL. Diagnostic interviews were carried out separately with participants and caregivers, and data were combined across informants such that a symptom was considered present if endorsed by either informant, as suggested by Kaufman and colleagues (1997). The inter-rater reliability of CD diagnoses was excellent (Cohen's kappa = 1.00). CU traits were assessed using the self-report Inventory of Callous-Unemotional traits (ICU; Frick, 2003; Cronbach's alpha = .81).

2.3.2 Procedure

2.3.2.1 Emotional face categorisation

We assessed the participants' ability to categorise dynamic and static facial expressions of anger, sadness, fear, happiness, surprise, disgust, and neutral taken from the Amsterdam Dynamic Facial Expression Set (ADFES; van der Schalk, Hawk, Fischer, & Doosje, 2011), which were validated in two studies demonstrating very high emotion recognition rates (van der Schalk et al., 2011). The current study used 56 video stimuli (8 models (4 females, 4 males) × 7 facial expressions) at full (100%) emotional intensity. For the dynamic version of each stimulus, the ADFES videos were shortened to 1000ms clips in which actors transitioned from neutral to emotional expressions.

Static stimuli were created by morphing each emotional face with the neutral face from the same model, using a bespoke morphing algorithm (Adams, Gray, Garner, & Graf, 2010) implemented in Matlab 7.14.0 (The MathWorksInc. Natick, MA, USA); see *Figure 2.1*A. In total, 100 static stimuli were used (4 models (2 males, 2 females) × 6 facial expressions (plus neutral) × 4 emotion intensities (30%, 50%, 70%, 100%)). These were spatially scaled, aligned, masked (to hide external features, i.e., hair), and matched for mean luminance and root-mean-square contrast. Stimuli were displayed on a 1024 × 768 monitor and subtended 10.48 degrees of visual angle at a viewing distance of 60cm.

Participants completed two practice trials followed by four experimental blocks of 39 randomly presented dynamic and static trials, taking breaks between blocks as necessary. Each trial began with a 500ms fixation cross. Following a 1000ms stimulus presentation, participants were presented with seven emotion labels (anger, sadness, happiness, fear, surprise, disgust, and neutral) and used a mouse to select the emotion that best described the displayed expression

(see *Figure 2.1*B). Response time was unlimited, but participants were instructed to be as quick and accurate as possible.

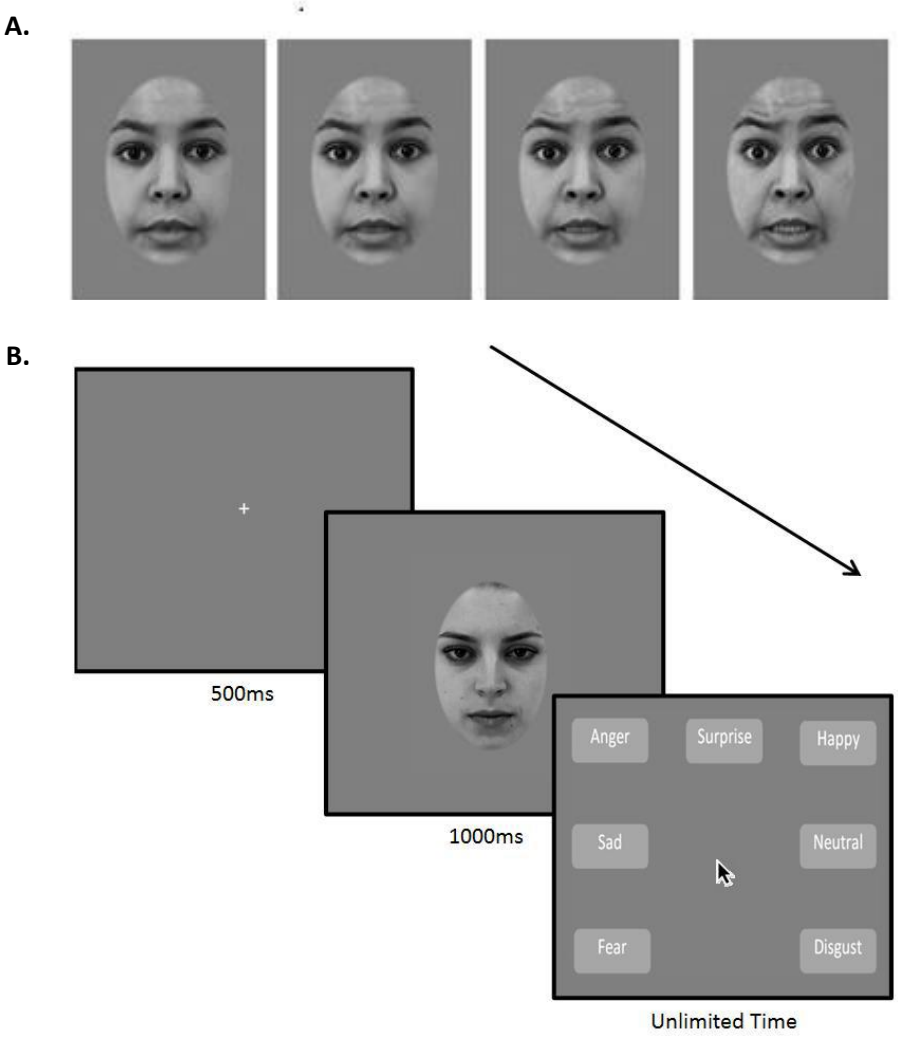


Figure 2.1 Task design examples of facial expression stimuli used in the study. Panel A shows examples of static fearful stimuli, with intensities of 30%, 50%, 70%, and 100%, respectively. Panel B depicts a trial sequence. Participants viewed facial expressions for 1000ms and were then asked to label the emotion.

2.3.2.2 Eye-tracking

Participants' eye movements were recorded using an EyeLink 1000 eye-tracker (SR Research Ltd, Canada) with a monocular sampling rate of 1000Hz. A chin and forehead rest stabilised the head to maximise measurement accuracy. Eye-tracker calibration occurred before each block; this required participants to sequentially fixate targets presented at nine different locations on the screen.

2.4 Data Analyses

2.4.1 Demographic characteristics

Socioeconomic status (SES) was calculated according to the profession of the parent(s) using the UK Office for National Statistics (ONS) guidelines (Office of National Statistics, 2010). Participants whose parents' professions fell under 'high or intermediate' ONS categories were classified as high SES, whilst those categorised as 'routine, manual, or unemployed' were classified as low SES. Due to the limited variation in ethnicity in the sample, participants were categorised as Caucasian or non-Caucasian. Group differences in continuous variables were explored using one-factor ANOVAs, with effect sizes reported as partial eta-squared (η_p^2; small ≥ .01, medium ≥ .06, large ≥ .14; Cohen, 1988). Comparisons on binary variables were conducted using Chi-Square tests (χ^2), with effect sizes reported as 'r equivalent' (Rosenthal & Rubin, 2003), referred hereafter as 'r' (small effects, r ≥ .10; medium, r ≥ .30; large, r ≥ .50; Cohen, 1988).

2.4.2 Behavioural data

We employed linear mixed model (LMM) analyses in Matlab 8.5.0 (The MathWorksInc. Natick, MA, USA) using the '*fitlme'* function to examine the effects of CD status, gender, CU traits, IQ, SES, and the interactions between these variables, on: (i) overall categorisation accuracy, and (ii) categorisation accuracy for each emotion. Initial LMM analyses revealed that dynamic stimuli were categorised more accurately than static stimuli (B = -4.64, p < .001). As expected, accuracy improved significantly with increasing emotional intensity (B = .67, p < .001). Critically, these variables did not significantly interact with any other predictor variables (CD status, gender, CU traits, IQ, SES). Therefore, to account for their effects, while reducing model complexity, stimulus type (dynamic *vs.* static) and intensity were included as random factors in all LMMs. Because rates of psychiatric comorbidity did not significantly differ across the four groups (see Table 2.1), and did not improve the best model predicting overall categorisation accuracy, these variables were excluded from further analyses.

When assessing categorisation accuracy across all emotions, emotional expression was included as a random factor (random intercepts). This provided the maximum power to explore the effects of our predictor variables (CD status, gender, CU traits, IQ, SES), while accounting for variance introduced by emotional expression (i.e., differences in categorisation accuracy across emotions). This was followed by separate analyses of categorisation performance for each emotion. The significance of each predictor (and hence its inclusion in the final model) was defined by likelihood ratio tests comparing the models with and without each predictor.

2.4.3 Eye-tracking data

Bespoke software was used to manually select three regions of interest (ROIs) for each of our face stimuli: two around the eyes and one around the mouth. These are the regions previously found to maximally convey information about emotional content (Adolphs et al., 2005). At each 1ms time-point, the participant's eye position was compared to the ROIs to create two eye region preference scores: (i) *initial eye preference*: the proportion of trials in which the participant fixated on the eyes first, minus the proportion of trials in which they fixated on the mouth first; and (ii) *total eye preference*: the proportion of trial time spent fixating the eye region minus the proportion of time spent fixating the mouth. Eye region preference scores were considered for all trials, regardless of categorisation accuracy. LMMs were used to assess whether: (i) initial eye preference, or (ii) total eye preference were predicted by CD status, gender, CU traits, IQ, SES, or their interactions.

2.4.4 Relating eye-tracking data to behavioural data

Finally, we examined whether differences in fixation behaviour could explain (i.e., mediate) the relationship between participant characteristics (e.g., CD status, gender, CU traits) and categorisation performance. First, we determined whether initial and/or total eye preference significantly predicted emotion categorisation accuracy. Second, we asked whether adding initial and/or total eye preference to the best-fitting models of emotion categorisation resulted in significant improvements in the models' predictive power.

2.5 Results

2.5.1 Participant characteristics

Table 2.1 reports demographic and clinical characteristics for the four groups, with statistical comparisons. The groups did not differ significantly in age or ethnicity. However, the CD groups had significantly lower IQs than the TD groups. In addition, CD males were more likely to come from low SES backgrounds than the TD groups. Finally, both CD groups had higher levels of CU traits than their sex-matched control groups.

Table 2.1 *Demographic and clinical characteristics of the sample*

	TD Males[1] (*n* = 26)	CD Males[2] (*n* = 26)	TD Females[3] (*n* = 25)	CD Females[4] (*n* = 24)		Post-hocs
	M (SD)				*F*	
Age (years)	16.22 (1.45)	15.94 (1.98)	16.40 (1.53)	16.21 (1.69)	.33	-
IQ	104.65 (11.39)	87.12 (7.33)	100.40 (12.64)	91.42 (16.70)	10.87***	1, 3 > 2, 4
ICU	22.88 (6.08)	30.38 (7.56)	17.96 (6.45)	26.83 (8.95)	12.78***	1, 3 < 2; 3 < 4
	n (%)				χ^2	
High SES	17 (65)	5 (19)	14 (56)	10 (42)	10.77*	1, 3 > 2
Low SES	4 (15)	12 (46)	8 (32)	9 (38)		
Caucasian	21 (81)	24 (92)	24 (96)	23 (96)	4.87	-
ADHD	-	11 (42)	-	6 (25)	1.67	-
MDD	-	5 (19)	-	4 (17)	.06	-
Anxiety	-	1 (4)	-	4 (17)	2.28	-
Substance abuse	-	0 (0)	-	1 (4)	-	
Alcohol abuse	-	0 (0)	-	1 (4)	-	
PTSD	-	0 (0)	-	1 (4)	-	

Note: The presence of a current psychiatric disorder was an exclusion criterion for the TD group. Key: ADHD, attention-deficit/hyperactivity disorder; CD, Conduct Disorder; ICU; Inventory of Callous-Unemotional traits; IQ, intelligence quotient; MDD, major depressive disorder; PTSD, Post-Traumatic Stress Disorder; SD, standard deviation; SES, socioeconomic status; TD, typically-developing. *p < .05, ***p < .001.

2.5.2 Overall categorisation accuracy[2]

Figure 2.2 shows emotion categorisation as a function of CD status, gender, emotional intensity (morph strength), and stimulus type (static *vs.* dynamic). As noted above, categorisation accuracy was significantly higher for dynamic than static stimuli and also improved with increasing emotional intensity.

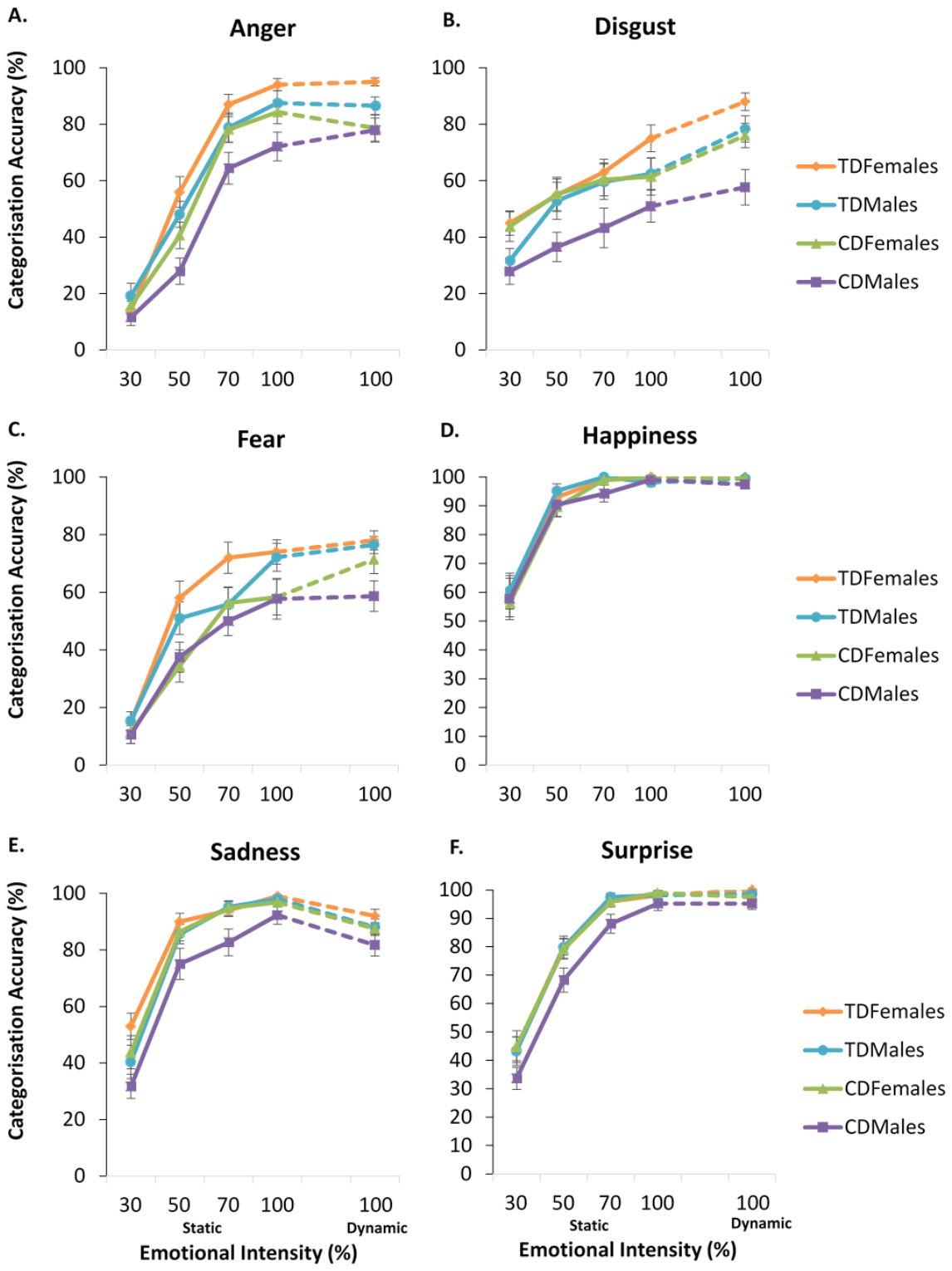


Figure 2.2 Emotion categorisation accuracy data for each group, as a function of emotion, intensity, and stimulus type. Categorisation accuracy scores for static stimuli, split by emotion intensity (30%, 50%, 70%, 100%), and dynamic stimuli (full intensity: 100%) per emotion are shown in panels A-F. *Note:* error bars show +/-standard error. CD, conduct disorder; TD, typically-developing.

We used LMMs to investigate the effects of CD status, gender, CU traits, IQ, SES, as well as interactions between these variables, on categorisation accuracy across all emotions (Table 2.2). Having CD and being male were both independently associated with reduced categorisation accuracy across all emotions, and these effects remained significant after accounting for IQ and SES by including them as additional predictors in the model. Low SES was another significant predictor of poorer categorisation accuracy.

Table 2.2 *Final models for facial emotion categorisation and eye movement behaviour, across all emotions and for individual emotions.*

		Significant Predictors (*B*)					
		CD	Gender	CU	IQ	SES	CD*CU
Categorisation Accuracy	All	-6.41***	6.80***	-	-	-4.36*	-
	Anger	-7.65*	6.92*	-	.29**	-	-
	Fear	-36.03***	-	-.97**	-	-	1.11**
	Disgust	-	16.17***	-	-1.39*	-110.04**	-
	Happiness	-	-	-	-	-	-
	Sadness	-	6.90**	-	-	-8.59**	-
	Surprise	-	-	-	-	-36.96*	-
Initial Eye Preference	All	-	22.36**	-	-	-	-
	Anger	-	29.66*	-	-	-	-
	Fear	-	35.10*	-	-	-	-
	Disgust	-	-	-	-	-	-
	Happiness	-	24.20**	-	-	-	-
	Sadness	-41.38*	14.05***	-	-	-	-
	Surprise	-10.99**	9.40**	-	-	-	-
Total Eye Preference	All	-	9.37**	-	-	-	-
	Anger	-	9.09*	-	-	-	-
	Fear	-8.09*	9.48*	-	-	-	-
	Disgust	-	6.93*	-	-	-	-
	Happiness	-	8.78*	-	-	-	-
	Sadness	-	12.48***	-	-	-	-
	Surprise	-	9.28*	-	-	-	-

Note: Emotion intensity (30%, 50%, 70%, 100%) and stimulus type (dynamic *vs.* static) were included as random effects in all models, while emotion was included as a random factor in the overall model. Key: *B,* unstandardised beta; CD, Conduct Disorder; CU, callous-unemotional traits; IQ, intelligence quotient; SE, standard error; SES, socioeconomic status. *p < .05, **p < .01, ***p < .001.

2.5.3 Categorisation accuracy for individual emotions[2]

Next, we explored categorisation accuracy for each emotion separately (Table 2.2). Participants with CD showed poorer fear recognition relative to controls. In addition, CU traits were negatively correlated with fear recognition performance across the whole sample. However, there was also a significant interaction between CD status and CU traits such that within the CD groups, those with higher CU traits showed *better* fear recognition (*Figure 2.3*). These effects remained significant when controlling for IQ and SES and the inclusion of these variables did not improve the final model fit (Table 2.2).

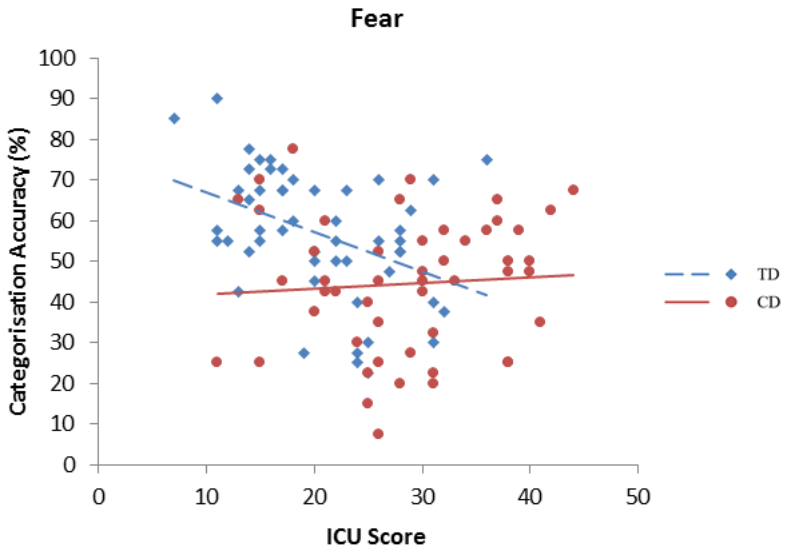


Figure 2.3 Fear categorisation accuracy as a function of Inventory of Callous-Unemotional traits (ICU) score, averaged across stimulus type. Each symbol represents a single participant and lines show the linear best fits to the data from participants with CD and TD controls. *Note:* CD, conduct disorder; TD, typically-developing.

Having CD and being male were both independently associated with reduced categorisation accuracy for anger, disgust, and sadness. The effects for anger remained significant when controlling for IQ and SES. However, CD status was no longer a significant predictor of categorisation accuracy for disgust and sadness after including these covariates: low IQ and low SES were both associated with reduced recognition of disgust, while low SES predicted poorer sadness recognition. Finally, having CD was associated with poorer recognition of surprise, and CD status interacted with gender such that CD was associated with poorer surprise recognition in

males but not females. However, the effects of CD status and gender were no longer significant when controlling for IQ and SES.

2.5.4 Eye movements: initial and total eye preference

Figure 2.4 shows eye movement behaviour when viewing static and dynamic facial expressions, as a function of CD status and gender. For simplicity, and because emotional intensity did not interact with any of the predictor variables, the eye movement data for static stimuli have been collapsed across the four emotional intensities.

We first considered whether eye movement behaviour was modulated by CD status, gender, CU traits, IQ, and SES, across *all* emotional expressions (Table 2). Females were more likely than males to fixate the eyes, and this was true for both the initial and total eye preference measures. These effects remained significant after controlling for IQ and SES. Neither CD status nor CU traits significantly modulated eye movement behaviour across all emotional expressions.

[2] Categorisation accuracy data across all emotions and for individual emotions were reanalysed using bias-corrected scores (see Wagner, 1993 for details). All categorisation accuracy models remained the same, except for categorisation accuracy for '*surprise*', with CD status and gender being significant predictors of accuracy, even after including IQ and SES into the model. Having CD and being male were associated with decreased categorisation accuracy for surprised facial expressions of emotion (all *Bs* > -6.25, *ps* < .05).

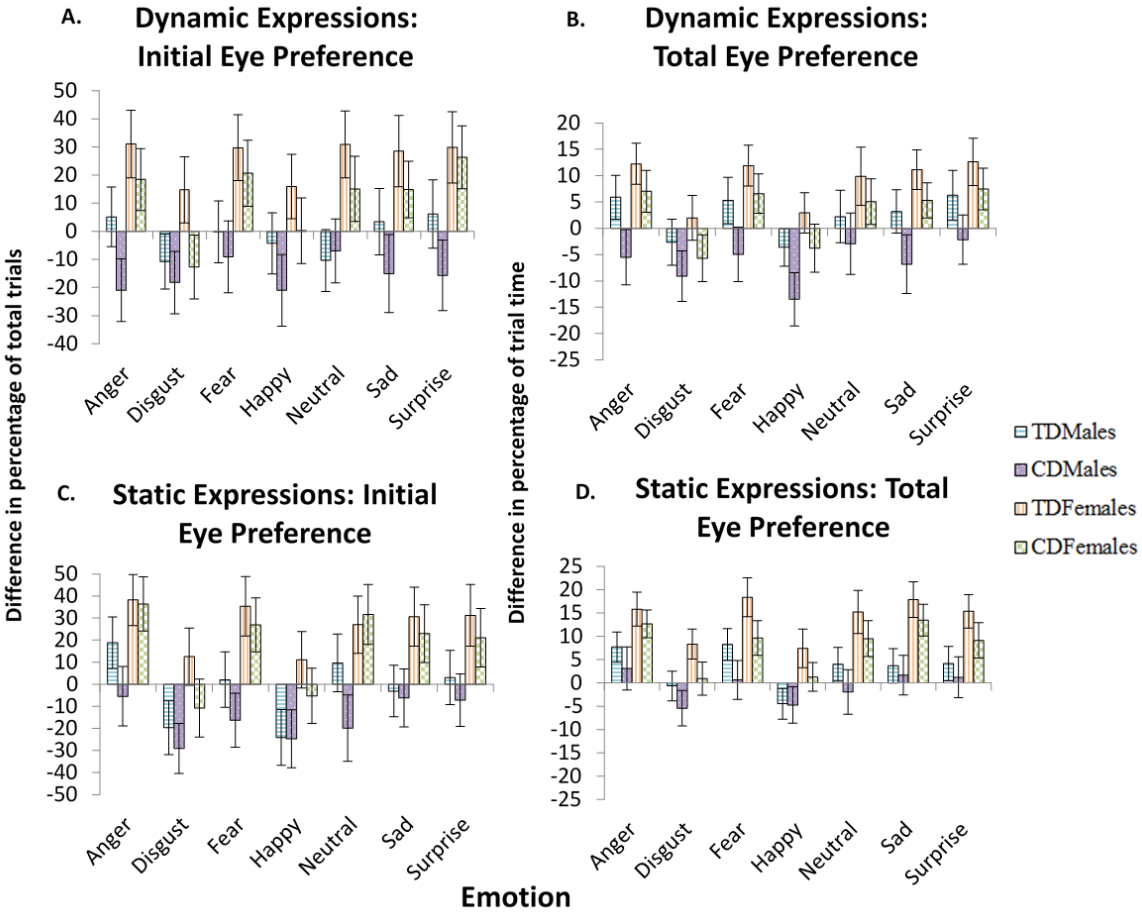


Figure 2.4 Eye movement data for each group, split by emotion and stimulus type. Initial and total eye preference scores for dynamic stimuli are shown in panels A-B, whereas eye preference scores for static stimuli (collapsed across emotional intensity) are presented in panels C-D. *Note:* error bars show +/-standard error. CD, conduct disorder; TD, typically-developing.

Next, we performed separate eye movement analyses for each of the emotional expressions. Having CD and being male were both independently related to a reduced tendency to fixate the eyes first when viewing sad and surprised expressions. These associations remained significant after controlling for IQ and SES. Having CD and being male were also associated with reduced *total* eye preference when viewing fearful expressions. Although the inclusion of IQ and SES reduced the effects of CD below formal levels of significance, these covariates were not significant predictors of eye movement behaviour, thus the best-fitting model included CD status and gender.

Finally, females displayed a stronger tendency to fixate the eyes first for anger, fear, and happiness, and showed greater total eye preferences when viewing all six emotional expressions,

relative to males. These gender effects remained significant after controlling for the effects of IQ and SES, and these covariates were not significant predictors of eye movement behaviour.

Notably, CU traits did not significantly predict initial or total eye preferences across all expressions. Although CU traits (when considered alone) were associated with a reduced tendency to fixate the eyes of sad and surprised faces, these effects were better explained by CD status and gender (as described above).

2.5.5 Eye movements behaviour as a predictor of categorisation accuracy

The preceding analyses revealed: (i) that CD status, gender and CU traits (for fearful faces only) predicted emotion categorisation performance, and (ii) that CD status and gender independently modulated patterns of eye fixation. The question is – does reduced attention to the eyes *predict* deficits in emotion recognition?

To address this, we first tested whether eye movement behaviours alone accounted for categorisation accuracy by including initial and total eye preference as predictors, but excluding CD status, CU traits, and gender. However, neither initial, nor total eye preference significantly predicted overall categorisation accuracy. When considering each emotion separately, initial eye preference was positively related to anger categorisation ($B = .05$, $p < .01$). Total eye preference was a marginally significant predictor of categorisation accuracy for happy ($B = .07$, $p = .07$) and sad ($B = .09$, $p = .06$) expressions. If eye movement behaviour mediated the relationships between CD status, gender, and categorisation, we would expect fixation behaviour to strongly predict categorisation performance, and to remain significant after including CD status and gender as predictors. In contrast, however, initial and total eye preference measures did not improve the best model of overall emotion categorisation (CD status, gender, and SES), nor did they add any predictive power to the models of categorisation for individual emotions.

2.6 Discussion

The present study explored Conduct Disorder (CD) and typically-developing (TD) adolescents' ability to recognise dynamic and morphed static facial expressions. We also assessed the effects of callous-unemotional (CU) traits on emotion recognition. Overall, having a diagnosis of CD, being male, and coming from a low socioeconomic status (SES) background each had independent and detrimental effects on our participants' ability to recognise facial expressions. This pattern of findings held regardless of whether the stimuli were static or dynamic and across different emotional intensities.

When considering each emotion separately, having CD and being male were independently related to poorer anger recognition. CD was also associated with impaired fear recognition. Analyses using bias-corrected scores also revealed associations between having CD and being male and poorer surprise recognition. These findings are consistent with previous research demonstrating impaired recognition of anger, fear, and surprise in adolescents with CD (Bowen et al., 2013; Fairchild et al., 2010, 2009; Short et al., 2016; Sully et al., 2015). Critically, our work extends previous findings by demonstrating that these deficits are still present when the stimuli are presented in a dynamic format or at a lower emotional intensity.

Furthermore, CU traits were negatively correlated with fear recognition when considering the *entire* sample. Contrary to expectations, however, in those with CD, elevated CU traits were related to *enhanced* recognition of fearful expressions. Although the former finding is consistent with past research demonstrating an association between psychopathic traits and difficulties identifying fearful expressions (Blair, Colledge, Murray, & Mitchell, 2001; Dadds et al., 2006; Stevens, Charman, & Blair, 2001), we note that the latter finding may be considered surprising given previous findings that impaired fear recognition is more pronounced in those with CD and elevated CU traits relative to those with low CU traits (Fairchild et al., 2009; Marsh & Blair, 2008), and theories proposing that psychopathy is linked to deficits in processing distress cues (Blair, 1995, 2003). However, not all studies have found an association between elevated CU traits in CD populations and fear recognition impairments. In fact, some researchers found no effect of CU traits in individuals with CD on emotion recognition performance (Sully et al., 2015) and others have reported superior fear recognition in children with conduct problems and elevated CU traits (Woodworth & Waschbusch, 2008).

Considering the eye-tracking data, males were less likely to fixate the eye region of the face, relative to females, across all emotions. This extends previous findings showing sex differences in orienting towards the eyes (Hall et al., 2010). When considering each emotion separately, having CD and being male were both related to a reduced tendency to fixate the eyes, for sad, surprised, and fearful expressions. Contrary to expectations, CU traits did not predict variance in eye movement behaviours beyond that explained by CD status and gender. Dadds and colleagues (2008) reported that adolescents high in CU traits showed reduced attention to the eyes of fearful faces. In contrast, we found weak relationships between elevated CU traits and reduced attentional orienting to the eyes for two emotional expressions (sadness and surprise). Moreover, the CD and TD groups differed significantly in CU traits, and the association between CU traits and attention to the eyes was better explained by CD status and gender.

Contrary to expectations, eye movement behaviour was not, in general, a strong predictor of emotional categorisation performance. Initial eye preference was positively associated with categorisation accuracy for angry faces, while total eye preference was marginally positively related to happiness and sadness categorisation. Critically, however, our analyses did not support the hypothesis that reduced orienting towards the eyes mediates the relationship between CD and emotion recognition impairments. Rather, CD status and gender were stronger predictors of categorisation behaviour across the different emotions than eye movement behaviour, and eye movement behaviour did not explain any additional variance in categorisation accuracy beyond that explained by CD status, gender, and SES. It is important to note, however, that eye movement behaviour was considered across all trials, irrespective of categorisation accuracy. It is possible that the exploration of eye movement behaviour in regards to correct trials only may have revealed alternative associations between our predictor variables and facial expression recognition.

To our knowledge, this is the first study to examine recognition of, and attention to, static and dynamic emotional faces in both male and female adolescents with and without CD. The use of dynamic and lower-intensity static stimuli increased the study's ecological validity, and the fact that adolescents with CD showed impaired recognition of facial expressions across both stimulus types suggests that previously reported deficits were not merely artefacts of using static stimuli.

The study also had several potential limitations. First, the sample size was only moderate, reflecting the difficulties in recruiting adolescents, and particularly females, with CD. Additionally, because the experimental design was cross-sectional, we cannot infer that CD is causally related to deficits in emotion recognition. Finally, it is worth noting that information concerning CU traits was obtained solely using the self-report version of the ICU, which may be influenced by social desirability effects. Nevertheless, it seems unlikely that this factor accounts for the difference between the present and previous findings; studies using self-report measures of CU or psychopathic traits have observed significant effects of these variables (Frick, Ray, Thornton, & Kahn, 2014).

2.7 Conclusion

Our findings suggest that CD-related deficits in facial emotion recognition might be better conceptualised as resulting from problems in stimulus interpretation, rather than abnormal fixation patterns. Adolescents with CD showed impairments in emotion recognition, and a reduced tendency to fixate the eye region across fearful, sad, and surprised expressions. We speculate that a deficit in the detection of salient emotional information could lead to both

impaired emotion recognition and abnormal patterns of fixation. Finally, we found that having CD and being male had additive, detrimental effects on emotion recognition and attention to the eyes. Interventions seeking to improve emotion recognition in CD may, therefore, differ by gender, with males being likely to require more comprehensive training programmes than females.

Chapter 3: Investigating the Perception of Emotion in Body Expression in Conduct Disorder using Eye-tracking[3]

[3] Publication note: this chapter is based on Martin-Key, N. A., Graf, E. W., Adams, W. J., & Fairchild, G. (2016). Investigating the perception of emotion in body expression in Conduct Disorder using eye-tracking. *Psychological Medicine*, manuscript submitted.

Contributions: experimental design, data collection, analyses, and write up were completed by N. A. Martin-Key. Dr. Graf helped with the pre-processing of the eye-tracking data, as well as the preparation of the manuscript. Dr. Adams helped analyse and interpret the findings, and helped prepare the manuscript for submission. Dr. Fairchild helped interpret the findings and helped with the preparation of the manuscript.

3.1 Abstract

Adolescents with Conduct Disorder (CD) show impairments in recognising facial expressions of emotion, but it is not known whether these difficulties extend to other emotional cues, such as body expressions of emotion. If such deficits are present, it is important to ascertain whether they are due to a failure to attend to informative regions of the body (i.e., arms) or problems in the appraisal of emotional content. Adolescent males and females with CD and varying levels of callous-unemotional (CU) traits and typically-developing males and females categorised dynamic and static body expressions of emotion. The emotion categorisation task was paired with eye-tracking methods to relate fixation behaviour to observers' ability to recognise body expressions of emotion. Participants with CD showed deficits in body expression recognition relative to typically-developing controls. These effects were primarily driven by poor performance in males with CD and were independent of CU traits. Adolescents with CD fixated less on the informative arm region during task performance than controls, and males, overall, were less likely than females to fixate the arms. CU traits were positively correlated with fixation on the arms in the CD group but negatively correlated with arm fixation in the typically-developing group. Critically, our findings suggest that CD subjects' impaired recognition of body expressions of emotion is not mediated by attentional issues (i.e., atypical fixation patterns), but is likely explained by appraisal difficulties. Training programmes designed to ameliorate the emotion recognition difficulties observed in adolescents with CD may need to incorporate a body expression component.

3.2 Introduction

Conduct disorder (CD) is characterised by a pervasive form of antisocial behaviour (American Psychiatric Association, 2013), and is one of the most common child and adolescent psychiatric disorders (Maughan, Rowe, Messer, Goodman, & Meltzer, 2004; Nock, Kazdin, Hiripi, & Kessler, 2006). A key personality factor when considering the aetiology of CD regards callous-unemotional (CU) traits – i.e., a reduced sense of guilt or regret, a lack of concern for other individuals' feelings, and superficial affect (Pardini & Frick, 2013).

Children and adolescents with CD and/or elevated CU traits are reported to show deficits in facial expression recognition. Nevertheless, the relative contributions of CD and CU traits to these emotion recognition deficits and the mechanisms underlying such deficits are not well understood. While adolescents with clinically-diagnosed CD may exhibit global impairments in facial expression recognition (Fairchild, Van Goozen, Calder, Stollery, & Goodyer, 2009; Fairchild, Van Goozen, Stollery, & Goodyer, 2008; Short, Sonuga-Barke, Adams, & Fairchild, 2016; Sully, Sonuga-Barke, & Fairchild, 2015), high levels of CU traits may be specifically associated with

difficulties in recognising distress cues in others, such as sad (Blair, 1999; Fairchild, Stobbe, van Goozen, Calder, & Goodyer, 2010) and fearful facial expressions (Dadds et al., 2006; Marsh & Blair, 2008).

The latter deficit in fear recognition has been associated with a failure to attend to emotionally relevant regions of the face, such as the eyes (Dadds et al., 2006; Dadds, El Masry, Wimalaweera, & Guastella, 2008). Indeed, Dadds et al. (2008) found selective deficits in fear recognition in male adolescents who were high in CU traits. Importantly, the high CU traits group fixated less on the eyes than those who were low in CU traits. When instructed to look at the eye region, the deficit in fear recognition in adolescents with high levels of CU traits was ameliorated, suggesting that their emotion recognition deficits were driven by attentional issues, rather than deficits in appraisal (i.e., interpretation of stimuli that have been successfully encoded).

In contrast, our previous study examining recognition of, and attention to, static and dynamic facial expressions in male and female adolescents with CD and varying levels of CU traits revealed that while CD was related to poorer fear recognition, CU traits within the CD group were *positively* correlated with the recognition of fearful expressions (Chapter 2). Although there was a negative association between CU traits (when considered alone) and attention to the eye region of sad and surprised faces, these effects were better explained by CD status and gender. Indeed, irrespective of the level of CU traits, having CD and being male were independent predictors of a lower preference to attend the eyes, particularly when viewing sad, surprised, and fearful expressions. Critically, however, impaired orienting to the eye region of the face (i.e., attentional issues) did not appear to drive the facial expression recognition deficits exhibited by adolescents with CD. Instead, these difficulties appeared to reflect problems in the appraisal of emotional stimuli.

It is important to note that we do not rely solely on facial expressions when identifying others' emotional states. Other social cues, such as body expressions of emotion, are also important (de Gelder, 2006). To date, however, only two studies have examined body expression recognition in male youth with CU traits (Muñoz, 2009; Wolf & Centifanti, 2014). The first study showed that youth with higher levels of CU traits (when controlling for levels of violence and antisocial behaviour) *and* youth with higher levels of violence (when controlling for CU traits) had difficulties recognising fearful static body expressions (Muñoz, 2009). Notably, individuals who were poor at identifying fearful facial expressions *and* body expressions, collectively, had the highest levels of CU traits and the highest levels of violence.

The more recent study (Wolf & Centifanti, 2014) employed both dynamic and static body expressions and facial stimuli and found that CU traits were not significantly related to fear recognition difficulties. However, high levels of CU traits were associated with impaired

recognition of dynamic angry body expressions and facial expressions of pain. Despite the discrepancies between the two studies, collectively they suggest that while CU traits may be associated with deficits in recognition of facial and body expressions of emotion, these impairments may not be specific to fear.

The existing literature raises a number of questions. First, the two previous studies on body expression recognition (Muñoz, 2009; Wolf & Centifanti, 2014) assessed levels of violence and antisocial behaviour in community samples. Although it is likely that many of the participants would have met criteria for CD, the authors did not investigate this. It remains unclear, therefore, whether diagnosable levels of conduct problems (i.e., CD) drive the body expression recognition deficits observed in those high in CU traits (Muñoz, 2009; Wolf & Centifanti, 2014). By examining the effects of CU traits *within* a sample of adolescents with CD, we can assess: i) whether the relatively global facial expression recognition impairments reported in adolescents with CD (e.g., Sully et al., 2015) extend to *body* expressions of emotion, and ii) the extent to which CU traits influence the emotion recognition difficulties observed in adolescents with CD. The latter issue is of potential clinical significance given the introduction of the 'limited prosocial emotions' specifier to CD in the DSM-5 (American Psychiatric Association, 2013), which maps closely onto the concept of CU traits.

Second, the previous studies on body expression recognition recruited male-only samples. Therefore, while research has shown similar facial expression recognition impairments in males and females with CD (e.g., Fairchild, Stobbe, van Goozen, Calder, & Goodyer, 2010; Fairchild, Van Goozen, Calder, Stollery, & Goodyer, 2009; although see Pajer, Leininger, & Gardner, 2010), it is unclear whether comparable impairments in fear and anger body expression recognition would be observed in females with elevated CU traits (or CD). As with our facial expression recognition study (Chapter 2), where CD status and gender operated additively (i.e., having CD and being male were independently associated with poorer recognition accuracy), we might expect similar effects for body expression recognition.

Third, if such deficits are present, it is important to ascertain whether they are due to attentional- or appraisal-based issues. Indeed, one possibility is that difficulties in body expression recognition may arise as a result of a failure to fixate on emotionally-salient regions of the body (e.g., the clenched fist which indicates the target is angry). Alternatively, in line with the findings from our previous study on facial expression recognition, where reduced orienting to the emotionally-salient regions of the face (i.e., eyes) did not mediate the relationship between CD and emotion recognition impairments (Chapter 2), they may instead reflect difficulties in stimulus appraisal.

To this end, the current study assessed the recognition of static and dynamic body expressions of emotion in males and females with CD and sex-matched typically-developing (TD) controls. We also measured eye movements during task performance to investigate whether individuals with CD show atypical patterns of fixation when processing body expressions of emotion, and if so, whether abnormal eye movement behaviours mediate deficits in body expression recognition. A secondary aim was to examine the relationships between CU traits, emotion recognition, and eye movement behaviour. Here, we tested whether CU traits predicted poorer body expression recognition performance and/or atypical patterns of fixation when processing body expressions, akin to the findings of Dadds and colleagues (2008) on *facial* expression processing.

We hypothesised that individuals with CD, and particularly males, would exhibit global difficulties in body expression recognition, and that these deficits would be present for both static and dynamic stimuli. In terms of eye movement behaviour, we predicted that individuals with CD, and particularly males with CD, would show a weaker tendency to fixate the emotionally-informative arm regions of the body stimuli. In addition, we expected that these deficits in emotion recognition and attention to the arms would be greater in those with CD and elevated CU traits. Finally, we hypothesised that atypical patterns of fixation on the arms would mediate the relationships between CD and CU traits and body expression recognition deficits.

3.3 Method

3.3.1 Participants

Twenty-two male and 23 female participants met criteria for CD, while the control group comprised 26 TD males and 25 TD females. All participants had taken part in our previous study on facial expression recognition (Chapter 2) and completed the two tasks during the same session. Participants were aged 13-18 and were recruited via Youth Offending Services, pupil referral units, and mainstream schools and colleges across Hampshire. Participants above the age of 16, as well as the parents/carers of those below the age of 16, provided written informed consent. Participants below the age of 16 were asked to indicate their assent. The study was approved by the University Ethics Committee and the Southampton County Council Children's Services Research Governance Committee.

All participants were required to: (i) be fluent in English; (ii) not wear bi/tri-focal glasses or hard contact lenses; (iii) have an estimated Intelligence Quotient (IQ) ≥ 70 (determined using the Wechsler Abbreviated Scale of Intelligence (WASI; Wechsler, 1999)); and (iv) not have an Autism Spectrum Disorder (ASD) or Psychosis. The Schedule of Affective Disorders and Schizophrenia for

School-Age Children-Present and Lifetime version (K-SADS-PL; Kaufman et al., 1997), a semi-structured diagnostic interview based on DSM-IV criteria (American Psychiatric Association, 1994), was employed to assess for a range of disorders including CD, Attention Deficit/Hyperactivity Disorder (ADHD), Major Depressive Disorder (MDD), Generalized Anxiety Disorder (GAD), Psychosis, Post-Traumatic Stress Disorder (PTSD), and Alcohol and Substance Use Disorders. ASDs were evaluated using the ASD component of the unpublished DSM-5 version of the K-SADS-PL. As suggested by Kaufman et al. (1997), a symptom was deemed present if reported by either the participant or the parent/carer. The inter-rater reliability of CD diagnoses in the current study was very high (Cohen's kappa = 1.00). The self-report version of the Inventory of Callous-Unemotional traits (ICU; Frick, 2003; Cronbach's alpha in the present sample = .82) was used to measure CU traits.

3.3.2 Procedure

3.3.2.1 Body expression categorisation task

This task assessed participants' ability to categorise dynamic and static body expressions depicting angry, fearful, and neutral emotional states. The dynamic stimuli were developed by Jessen, Obleser, and Kotz (2012), and validated in a pilot study which reported an average recognition accuracy of 96.2% in a sample of healthy adults. In this stimulus set, the actors' faces have been blurred to eliminate emotional information portrayed via facial expressions. We created static stimuli by taking one highly identifiable frame from each video clip using Matlab 7.1.9 (TheMathWorks Inc. Natwick, MA, USA). The current study used 42 dynamic stimuli and 42 static stimuli (with 2 actors (1 female, 1 male) × 3 emotions × 7 repetitions).

Participants completed two practice trials followed by 84 trials in two blocks of 42 randomly ordered dynamic and static trials, taking a break between blocks as needed. Each trial began with a 500ms fixation cross. Following a 3000ms stimulus presentation, participants were presented with three emotion labels (anger, fear, and neutral) and were required to select (via a mouse click) the label that best described the emotion presented in the video or static image (see *Figure 3.1*). Participants had an unlimited time to respond, but were asked to be as quick and accurate as possible.

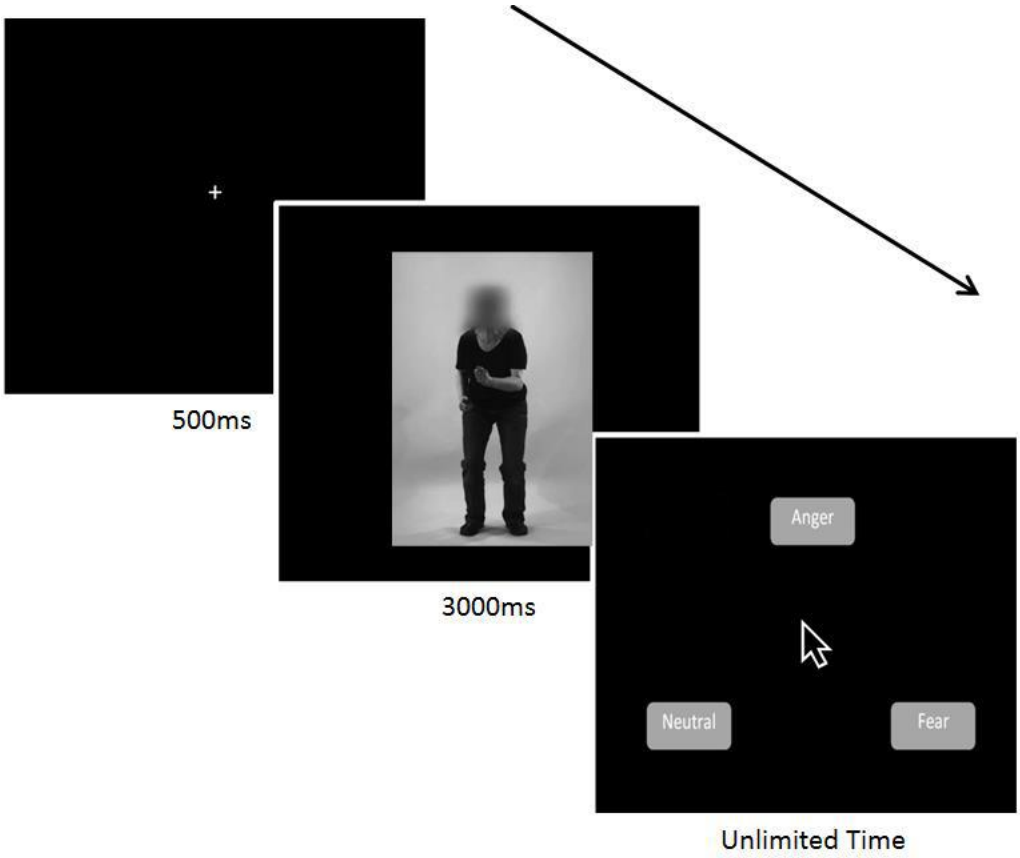


Figure 3.1 Task design and example of the body expression stimuli used in the study. Participants viewed body expressions of emotion for 3000ms and were then asked to label the emotion.

3.3.2.2 Eye-tracking

An EyeLink 1000 eye-tracker (SR Research Ltd., Canada) was used to measure participants' eye movements at a monocular sampling rate of 1000Hz. A chin and forehead rest stabilised the head to increase measurement accuracy. The tracker was calibrated before each block: participants were required to fixate a target as it appeared at nine different locations on the screen.

3.4 Data Analyses

3.4.1 Demographic characteristics

In accordance with the UK Office for National Statistics guidelines (Office for National Statistics, 2010), participants whose parents' or carers' professions were classed as 'high or intermediate' (e.g., lawyer) were categorised as high socioeconomic status (SES), while those classified as falling in the 'routine, manual, or unemployment' category (e.g., mechanic), were classified as low SES. Given the limited range of ethnicities in the current sample, participants were classified as either

Caucasian or non-Caucasian. One-factor ANOVAs were employed to assess group differences in continuous variables (i.e., ICU scores). Effect sizes for these analyses are reported as partial eta-squared (η_p^2; small ≥ .01, medium ≥ .06, large ≥ .14; Cohen, 1988). Chi-Square tests (χ^2) were used to compare group differences in binary variables (i.e., SES), with 'r equivalent' (Rosenthal & Rubin, 2003) (r; small ≥ .10, medium ≥ .30, large ≥ .50; Cohen, 1988) used to express effect sizes in this case.

3.4.2 Behavioural data

Linear mixed models (LMMs) analyses were conducted in Matlab 8.5.0 (The MathWorksInc. Natick, MA, USA), using the *'fitlme'* function to evaluate models. We examined the effects of CD status, gender, CU traits, IQ, SES, and the interactions between these predictor variables, on: (i) overall categorisation accuracy, and (ii) categorisation accuracy per emotion.

Our initial analyses revealed that dynamic stimuli were categorised with significantly higher accuracy than static stimuli (B = -9.60, p < .001), but this effect of stimulus type did not interact with any of our predictor variables. Thus, stimulus type was included as a random effect in all models. We also found that the inclusion of psychiatric comorbidities did not improve the model fit for overall emotion categorisation. In addition, there were no significant group differences in these variables (see Table 3.1), therefore we excluded these variables from further analyses.

When examining overall categorisation accuracy, body expression (angry, fearful, and neutral) was included as a random effect. This accounted for the variance introduced by baseline differences in categorisation accuracy across emotions, whilst maximising statistical power to examine the effects of group status and other individual differences on emotion categorisation. Subsequently, we assessed categorisation accuracy for each individual emotion. The significance of each predictor (and hence its inclusion in the final model) was defined by likelihood ratio tests comparing the models with and without each predictor.

3.4.3 Eye-tracking data

To our knowledge, there is no consensus regarding which region(s) of the body need to be attended in order to recognise different emotions successfully. Therefore, given the characteristics of the stimuli used in the current study (i.e., anger was depicted by raising the *arms*, fear was presented by moving the *arms* towards the body, and neutral body expressions included grooming movements, such as moving the *arms* towards the head or scratching; see Jessen & Kotz, 2011), we classified the arm regions of the body as the most emotionally-relevant regions of interest (ROIs) for each of the three emotions. These regions were manually selected

using bespoke software and compared the participant's eye position at each 1ms time point to the coordinates of the ROIs. This allowed us to calculate two measures of interest: (i) *initial arm preference*: the percentage of total trials in which the participant fixated the arms first; and (ii) *total arm preference*: the percentage of time spent fixating the arms per trial. Arm preference scores were considered for all trials, irrespective of categorisation accuracy. The extent to which CD status, gender, CU traits, IQ, SES, and the interactions between these variables, modulated (i) initial and (ii) total arm preference was determined using LMMs.

3.4.4 Relating eye-tracking to behavioural data

Lastly, we assessed whether initial and/or total arm preference were significant predictors of emotion categorisation accuracy. We also determined whether differences in fixation behaviour mediated the relationship between participant characteristics (e.g., CD status, gender, CU traits) and emotion categorisation performance. To do this, we examined whether adding initial and/or total arm preference as predictors improved the fit of the best-fitting models of emotion categorisation performance.

3.5 Results

3.5.1 Participant characteristics

The demographic and clinical characteristics of the sample are reported in Table 3.1. The four groups did not significantly differ in age or ethnicity, but there were significant group differences in IQ, SES, and levels of CU traits. Firstly, males and females with CD had significantly lower IQs than both of our TD groups. Secondly, relative to the TD males, males with CD were more likely to come from low SES backgrounds. Finally, CD males had significantly higher levels of CU traits than both TD groups, while females with CD had higher levels of CU traits than TD females.

Table 3.1 *Demographic and clinical characteristics of the sample*

	TD Males[1] (*n* = 26)	CD Males[2] (*n* = 22)	TD Females[3] (*n* = 25)	CD Females[4] (*n* = 23)		Post-hocs
	M (SD)				*F*	
Age (years)	16.22 (1.40)	15.80 (1.92)	16.40 (1.80)	16.36 (1.52)	.60	-
IQ	104.65 (11.63)	85.64 (6.95)	100.40 (12.64)	91.91 (16.90)	11.05***	1, 3 > 2, 4
ICU	22.88 (6.08)	30.23 (7.97)	17.96 (6.47)	26.65 (9.11)	11.72***	1, 3 < 2; 3 < 4
	n (%)				χ^2	
High SES	17 (65)	5 (23)	14 (56)	10 (43)	9.60*	1 > 2
Low SES	4 (15)	11 (50)	8 (32)	8 (35)		
Caucasian	21 (81)	21 (95)	24 (96)	22 (96)	5.55	-
ADHD	-	10 (36)	-	5 (22)	2.85	-
MDD	-	5 (20)	-	4 (17)	.20	-
Anxiety	-	1 (5)	-	4 (35)	1.88	-
Substance abuse	-	0 (0)	-	1 (4)	-	
Alcohol abuse	-	0 (0)	-	1 (4)	-	
PTSD	-	0 (0)	-	1 (4)	-	

Note: The presence of a current psychiatric disorder was an exclusion criterion for the TD group. Key: ADHD, attention-deficit/hyperactivity disorder; CD, Conduct Disorder; ICU; Inventory of Callous-Unemotional traits; IQ, intelligence quotient; MDD, major depressive disorder; PTSD, Post-Traumatic Stress Disorder; SD, standard deviation; SES, socioeconomic status; TD, typically-developing. *p < .05; ***p < .001.

3.5.2 Overall categorisation accuracy[4]

Emotion categorisation performance separated by group, gender, and stimulus type (static *vs.* dynamic) is shown in *Figure 3.2*. The extent to which CD status, gender, CU traits, IQ, SES, and the interactions between these variables, could predict overall categorisation accuracy was assessed using LMMs. These analyses revealed that the CD group showed impaired recognition of body expressions (Table 3.2). This effect remained significant when including IQ and SES in the model. In this case, there was also a significant interaction between CD and gender, such that males with CD performed significantly worse than TD males, whereas females with CD did not differ from TD

females. This implies that the effects of CD observed in the main analyses were driven by poorer emotion recognition in males with CD. This is also evident in *Figure 3.2*, which shows similar performance levels in females with CD and TD females.

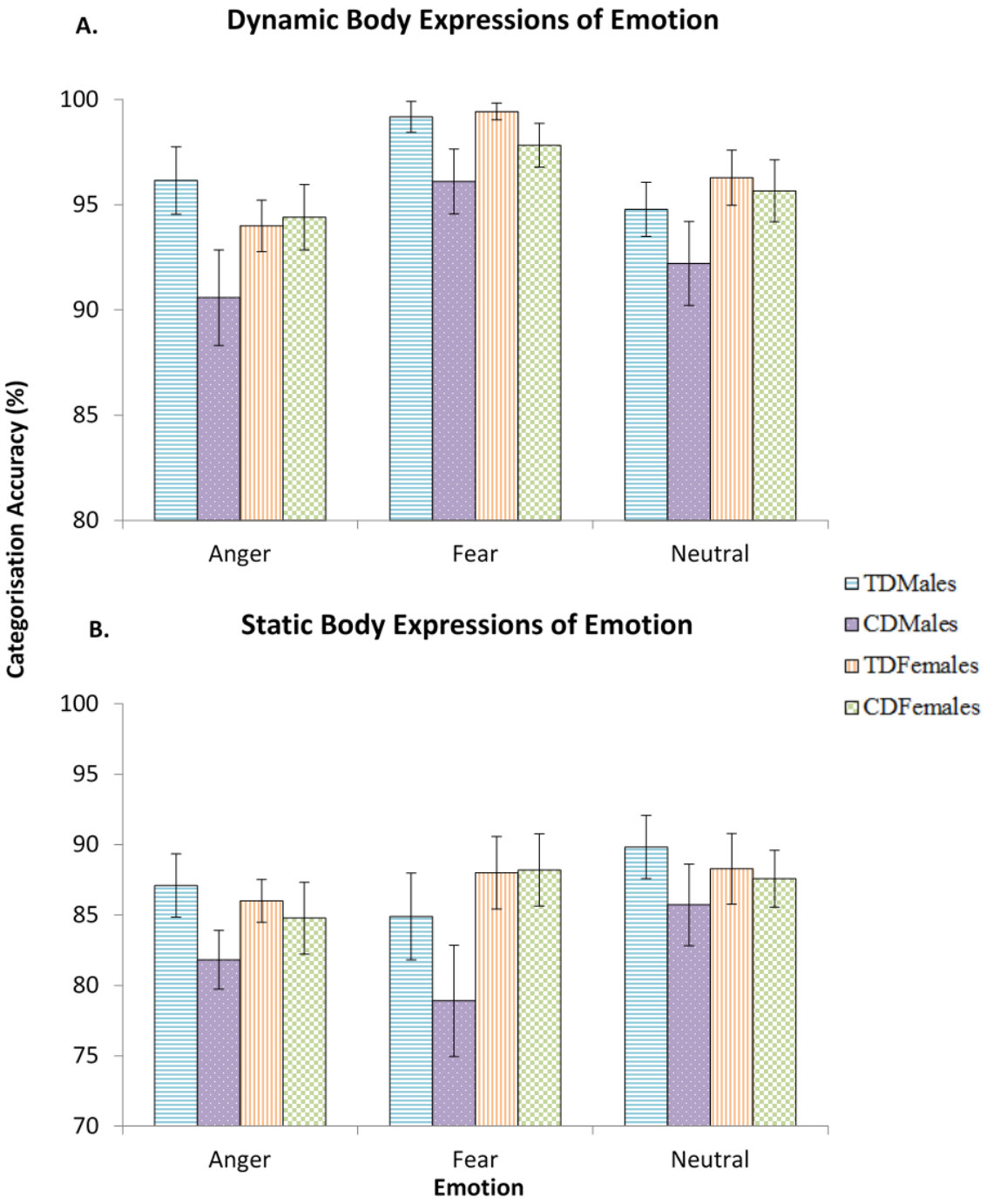


Figure 3.2 Emotion categorisation accuracy data for each group, as a function of emotion and stimulus type. The findings obtained when using dynamic stimuli are shown in panel A, whereas those obtained with static stimuli are presented in panel B. *Note:* error bars show +/-standard error. CD, Conduct Disorder; TD, typically-developing.

Table 3.2 *Final models for body expression categorisation and eye movement behaviour, across all emotions and for individual emotions.*

		Significant Predictors (*B*)							
		CD	Gender	CU	IQ	SES	CD*Gender	CD*CU	Gender*CU
Categorisation Accuracy	All	-4.80**	-	-	-	-	4.87*	-	-
	Anger	-	-	-	-	-	-	-	-
	Fear	-	-	-	-	-	-	-	-
	Neutral	-	-	-	-	-	-	-	-
Initial Arm Preference	All	-	24.89*	-	-	-	-	-	-.81*
	Anger	-	-	-	-	-	-	-	-
	Fear	-32.53**	-	-	-	-	-	1.16*	-
	Neutral	-	31.31**	-	-	-66.03*	-	-	-1.08*
Total Arm Preference	All	-	9.44**	-	-	-	-	.28*	-.35**
	Anger	-	-	-	-	-	-	-	-.43**
	Fear	-20.76***	10.66*	-1.58*	-.40*	-	-	.66***	-.40*
	Neutral	-11.57**	9.31**	-1.13**	-.32**	-	-	.39*	-.37**

Note: Stimulus type (dynamic *vs.* static) was included as a random effect in all models, while emotion was included as a random factor in the overall model. Key: *B,* unstandardised beta; CD, Conduct Disorder; CU, callous-unemotional traits; IQ, intelligence quotient; SE, standard error; SES, socioeconomic status. ***$p < .001$; **$p < .01$; *$p < .05$

3.5.3 Categorisation accuracy for individual emotions[4]

We also assessed predictors of categorisation accuracy for each of the individual emotions (including neutral). However, categorisation accuracy for the individual emotions was not significantly predicted by CD status, gender, CU traits, or any of the other variables.

3.5.4 Overall eye movement behaviour

Initial and total arm preference values, as a function of CD status, gender, and stimulus type (static *vs.* dynamic) are shown in *Figure 3.3*. When considering eye movement behaviour across all emotions (with emotion included as a random factor), we found that being female predicted higher initial and total arm preferences (see Table 3.2). Gender interacted with CU traits, such that *lower* levels of CU traits predicted *higher* initial and total arm preference scores among females, while *higher* levels of CU traits in males were associated with *higher* initial and total arm preference scores (*Figure S3.1*, see section 3.7).

Overall, individuals with CD displayed lower total arm preference scores relative to controls. In addition, there was an interaction between CD status and CU traits, such that *higher* levels of CU traits predicted *higher* total arm preference within the CD group, while *lower* levels of CU traits predicted *higher* total arm preference scores within the TD group (*Figure S3.2*, see section 3.7). In other words, those with CD and *lower levels of CU traits* showed the most abnormal arm fixation patterns.

The effect of CD status was reduced below significance when including IQ and SES in the model, but all other effects remained significant.

[4] Categorisation accuracy data across all emotions and for individual emotions were reanalysed using bias-corrected scores (see Wagner, 1993 for details). All categorisation accuracy models remained the same.

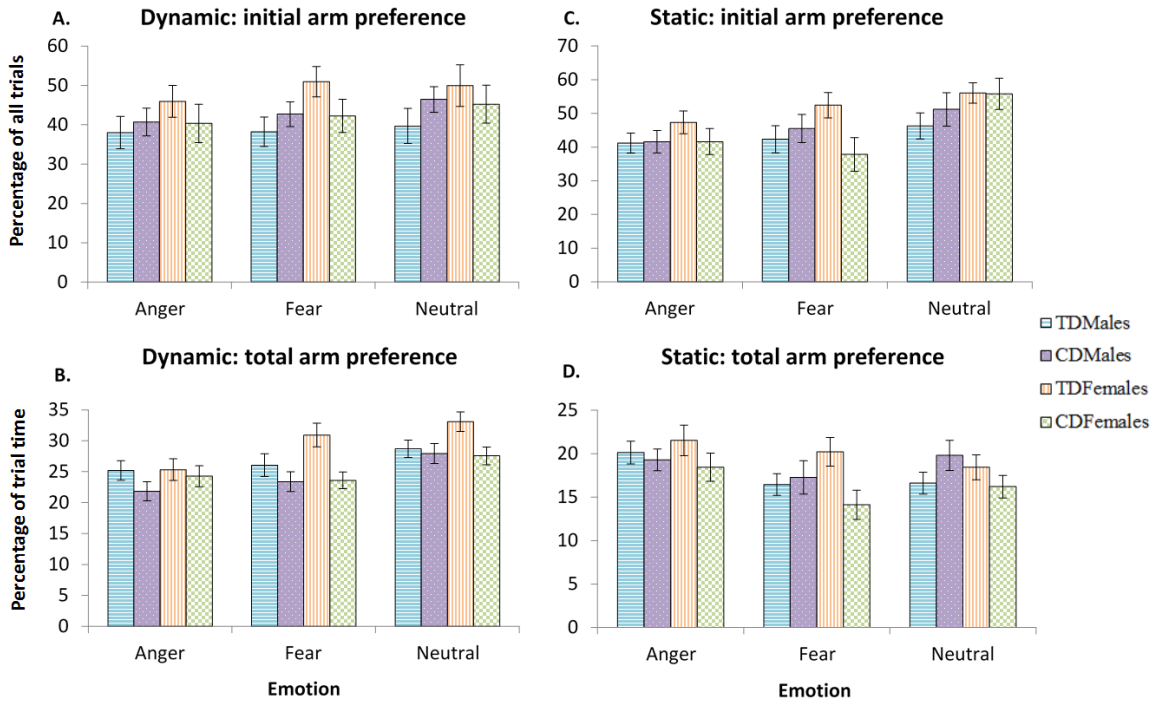


Figure 3.3 Eye movement data for each group, split by emotion and stimulus type. Initial and total arm preference scores for dynamic stimuli are shown in panels A-B, whereas those obtained with static stimuli are presented in panels C-D. *Note:* error bars show +/-standard error. CD, Conduct Disorder; TD, typically-developing.

3.5.5 Eye movement analyses for individual emotions

Anger: There was an interaction between CU traits and gender, such that *lower* levels of CU traits predicted *higher* total arm preference in females, but *lower* total arm preference in males.

Fear: Relative to controls, individuals with CD showed lower initial and total arm preference scores when viewing fearful body expressions. In addition, CD status interacted with CU traits, such that *within* the CD group, *higher* levels of CU traits were associated with *higher* initial and total arm preference scores, while the opposite relationship was found amongst TD individuals (*Figure S3.3*, see section 3.7). Gender was also a significant predictor, with males, overall, showing lower total arm preference scores, relative to females. Furthermore, *higher* levels of CU traits in males were *positively* associated with total arm preference scores, while being *negatively* related to total arm preference scores in females. These effects remained significant when including IQ and SES in the model. In this case, *lower* CU traits (across the entire sample) also predicted *higher* total arm preference scores for fearful body expressions.

Neutral: Relative to males, females showed higher initial and total arm preference scores when viewing neutral body expressions. In addition, gender interacted with CU traits: *lower* CU traits

predicted *higher* initial and total arm preference scores in males, while the opposite pattern was found for females. These effects remained significant when including IQ and SES in the models. In this case, individuals with CD showed significantly lower total arm preference scores compared with controls. We also found an interaction between CD and CU traits, such that *higher* levels of CU traits predicted *higher* total arm preference scores within the CD group but lower total arm preference scores in the TD group.

3.5.6 Eye movement behaviour as a predictor of categorisation accuracy

We investigated whether individual differences in eye movement behaviour were associated with, or could potentially mediate, individual differences in categorisation accuracy. First, we tested whether initial and/or total arm preference scores were significant predictors of categorisation ability, whilst leaving out CD status, gender, CU traits, IQ, and SES. Our analyses revealed that arm preference scores did not significantly predict categorisation accuracy, either across all emotions, or for any of the individual emotions.

Next, we explored whether eye movement behaviour had any effect on emotion recognition performance, when considered alongside other predictors of categorisation accuracy. Because *overall* categorisation of body expressions (across emotions) was modulated by individual differences in CD, gender and IQ, we assessed whether adding initial and/or total arm preference to the best-fitting overall categorisation model (which included CD status, CD*Gender, and Gender*IQ) resulted in a significant improvement in the model's predictive power. However, initial and total arm preference measures did not improve the model fit for overall emotion categorisation, suggesting that eye movement behaviours did not mediate the associations between CD status, gender and IQ, and emotion categorisation performance.

3.6 Discussion

The current study assessed recognition of body expressions of emotion in male and female adolescents with Conduct Disorder (CD) and varying levels of callous-unemotional (CU) traits and a group of sex- and age-matched typically-developing (TD) adolescents. We also measured eye movement behaviour during task performance to examine whether body expression recognition difficulties were explained by attentional or appraisal-based issues. As predicted, we found that adolescents with CD exhibited global deficits in the recognition of body expressions of emotion, across both static and dynamic stimuli, relative to controls. Interestingly, when controlling for group differences in IQ and SES, CD status interacted with gender, such that males with CD, but not females, showed significant impairments in body expression recognition, compared to their

sex-matched control groups. Thus, the association between CD and deficits in emotion recognition appeared to be specific to males with CD.

Given that the previous studies on body expression recognition were conducted using all-male samples (Muñoz, 2009; Wolf & Centifanti, 2014), our findings have significantly extended the literature in this area by showing that females with CD do not show significant impairments in body expression recognition. Furthermore, this pattern of findings differs to our previous study on facial expression recognition (Chapter 2), where having a diagnosis of CD and being male were *independently* associated with poorer emotion recognition performance (i.e., CD status and gender did not interact, but operated additively). Collectively, these findings suggest that emotion-training interventions may need to be tailored according to gender, with males with CD being likely to require more comprehensive training programmes than females.

When analysing each emotion separately, however, males with CD did not show *significant* impairments in body expression recognition performance for individual emotions. This may have been due to the fact that we did not have enough statistical power to detect group differences when considering individual emotions. Related to this point, we note that most of the control participants performed at ceiling, particularly for dynamic fearful expressions - this raises concerns in relation to our analyses and suggests that our categorisation task may have been too easy. Future studies may wish to employ a more sensitive task by including shorter presentation times, adding noise/masking, and/or dropping frames, in addition to including both positive and negative body expression stimuli.

Contrary to expectations, CU traits did not influence body expression recognition performance. This finding does not accord with theories relating psychopathic traits with difficulties identifying and processing distress cues, such as fearful and sad facial expressions (e.g., Blair, 1995; Blair, 2003), as well as studies demonstrating reduced fear identification from *facial* expressions in individuals high in CU traits, relative to those with lower levels of CU traits (e.g., Dadds et al., 2008; Marsh & Blair, 2008). Despite this, not all studies have found significant associations between elevated CU traits or psychopathic traits and impaired fear recognition. Indeed, some researchers have found no influence of CU traits on *facial* expression recognition performance within CD samples (e.g., Schwenck et al., 2012, 2014; Sully et al., 2015).

Although our study does not directly replicate the findings by Muñoz (2009) and Wolf and Centifanti (2014) showing associations between CU traits and poorer fear and anger body expression recognition, respectively, we found that CD (in males) was associated with global deficits in body expression recognition, irrespective of CU traits. Importantly, the current study extends our previous work in which we revealed that CU traits have a limited impact on facial

expression recognition in those with a CD diagnosis (Chapter 2). Here, we demonstrate a similar pattern of results when considering body expressions of emotion. However, it should be noted that the samples used in these two studies were overlapping, and that further studies testing the impact of CU traits on body expression recognition in CD populations are needed.

When considering the eye movement data, we found that a diagnosis of CD and being male were both related to lower arm preferences when viewing fearful and neutral body expressions. Contrary to expectations, higher levels of CU traits within our CD sample were associated with *higher* initial and total preferences for the arm region, particularly when viewing fearful and neutral body expressions. The reverse pattern was found amongst TD individuals: lower levels of CU traits predicted higher initial and total arm preference scores. CU traits also interacted with gender: there was a positive correlation between CU traits and initial and total arm preference scores amongst males, whereas the opposite relationship was found in females. Taken together, these findings suggest that the effects of CU traits on attention to emotionally-salient information vary according to CD status and gender: interestingly, CU traits only modulated fixation patterns in the expected manner in TD and female subjects.

These findings represent a challenge to the limited prosocial emotions specifier for CD in the DSM-5, because the most atypical fixation patterns were observed in the CD males with *lower* levels of CU traits. However, it is important to note that we designated the arms as representing the most emotionally-informative regions on the basis of the stimuli presented. As such, these findings must be interpreted with caution. Indeed, further research is needed in order to disentangle the extent to which CD status, gender, and CU traits interact with each other and what this means in terms of attention to emotionally-relevant information.

Furthermore, and irrespective of CU traits, females showed a stronger tendency to fixate the arms first and for longer durations, indicating that there may be female-specific protective effects on attention to emotionally-salient information. This extends previous normative findings showing that males are less likely to orient towards emotionally-informative regions, such as the eye region of the face (Chapter 2; Hall, Hutton, & Morgan, 2010), by showing similar gender effects during *body expression* processing.

Critically, eye movement behaviour was not a significant predictor of categorisation accuracy. Contrary to our hypothesis, our analyses did not support the idea that atypical eye movement behaviours (i.e., lower arm preferences) mediate the relationship between CD and body expression recognition impairments. Instead, our findings suggest that the body expression recognition impairments exhibited by males with CD are explained by difficulties in interpreting emotional cues, rather than deficits in attending to emotionally-informative regions of the body,

such as the arms. These findings are broadly consistent with our earlier study examining recognition of, and attention to, facial expressions (Chapter 2). In that study, we found that CD-related deficits in facial expression recognition were not mediated by problems in orienting towards informative regions of the face, such as the eyes. It is worth mentioning, however, that eye movement behaviour was considered across all trials in both studies (Chapters 2 and 3), regardless of categorisation accuracy. It is therefore foreseeable that the examination of eye movement behaviour in correct trials only may have revealed distinct associations between our predictor variables and emotion recognition.

Taken together, our two eye-tracking studies suggest that adolescents with CD, and particularly males, show deficits in recognising facial expressions of emotion, while impaired recognition of body expressions appears to be specific to males with CD. Furthermore, adolescents with CD show *independent* problems in attending to emotionally-informative regions of the face and body when processing emotional cues – which were most pronounced amongst males. We therefore propose that a failure to detect emotionally-salient information, irrespective of whether this is conveyed via facial or body expressions, may result in impaired recognition of others' emotional states *and* atypical eye movement behaviours, particularly in males with CD.

To our knowledge, this is the first study to examine recognition of, and attention to, static and dynamic body expressions of emotion in male and females with CD and their TD counterparts. The use of dynamic and whole-body stimuli helped to improve the ecological validity of this study. Furthermore, the CD and TD groups were also well-characterised from a clinical perspective, using a highly reliable diagnostic measure.

Despite these strengths, this study had several limitations. First, due to ceiling effects and our moderate sample size, we only had adequate statistical power to detect medium and large effects, and were under-powered to detect small effects (i.e., group differences for individual emotions). Second, we were only able to examine recognition of angry, fearful, and neutral body expressions, as the stimulus set did not include additional emotions. It would be interesting to examine whether adolescents with CD show deficits in recognising body expressions depicting other emotions. In addition, we were unable to manipulate the emotional intensity of the stimuli, which might have increased the sensitivity of the task (although see Chapter 2; Short et al., 2016).

Although research on facial expression recognition has been able to identify facial regions most responsible for conveying emotional content (i.e., eyes, mouth; Adolphs et al., 2005), to our knowledge, emotionally-salient regions have not been identified for body expressions of emotion. Therefore, emotionally-salient regions were selected on the basis of the stimuli presented – for this reason, it may be advisable to use ratings obtained from independent samples when

determining emotionally-informative regions in future studies. Finally, CU traits were measured using the self-report version of the Inventory of Callous-Unemotional traits, which may be influenced by social desirability effects. Future studies should obtain data on CU traits from independent informants, such as parents or teachers, as well as the adolescents themselves.

3.7 Supplementary Figures

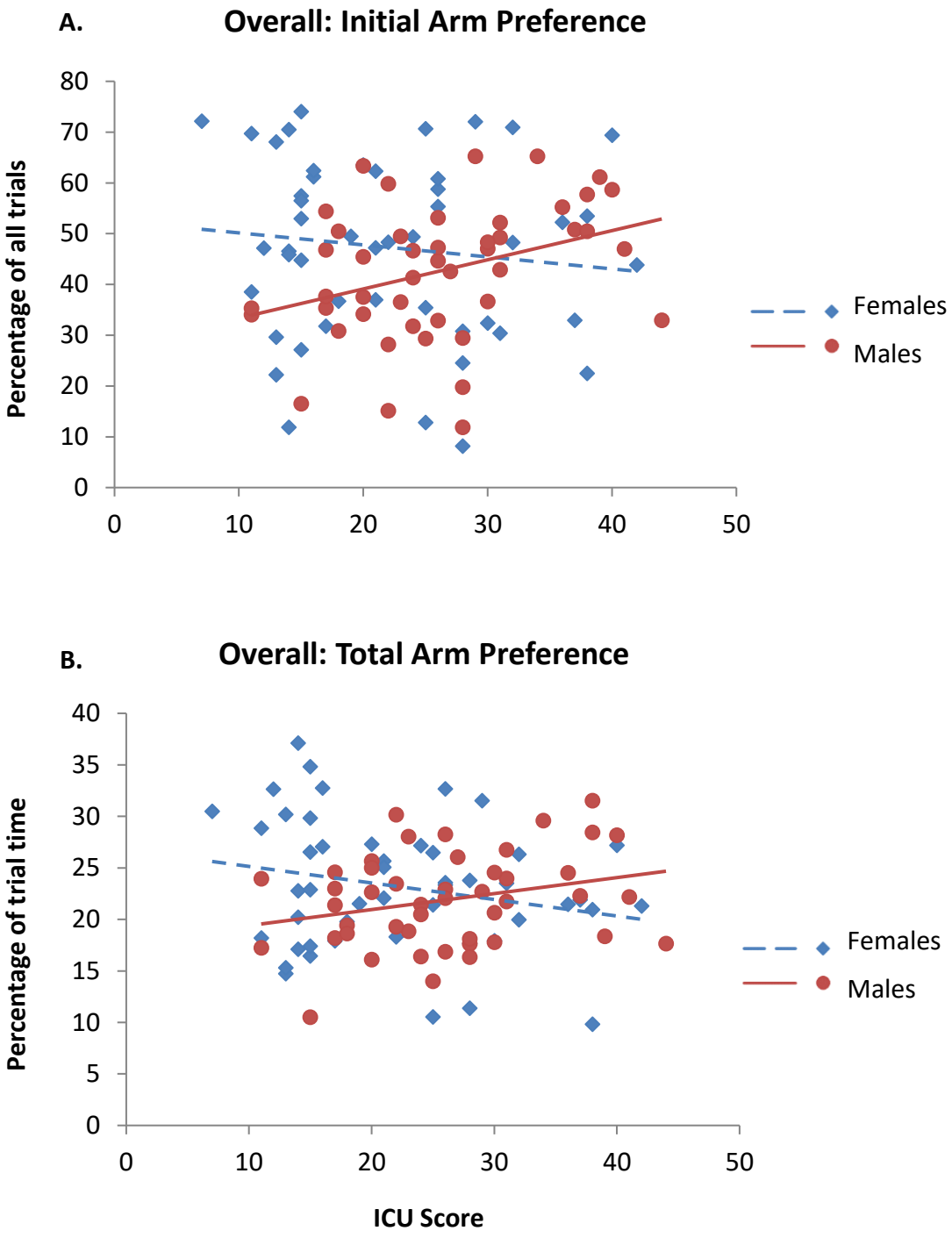


Figure S3.1 Eye movement behaviour across all emotions as a function of Inventory of Callous Unemotional traits (ICU) score, averaged across stimulus type. Initial arm preference scores are shown in panel A, while total arm preference scores are presented in panel B. Each symbol represents a single participant and lines show the linear best fits to the data from female and male participants.

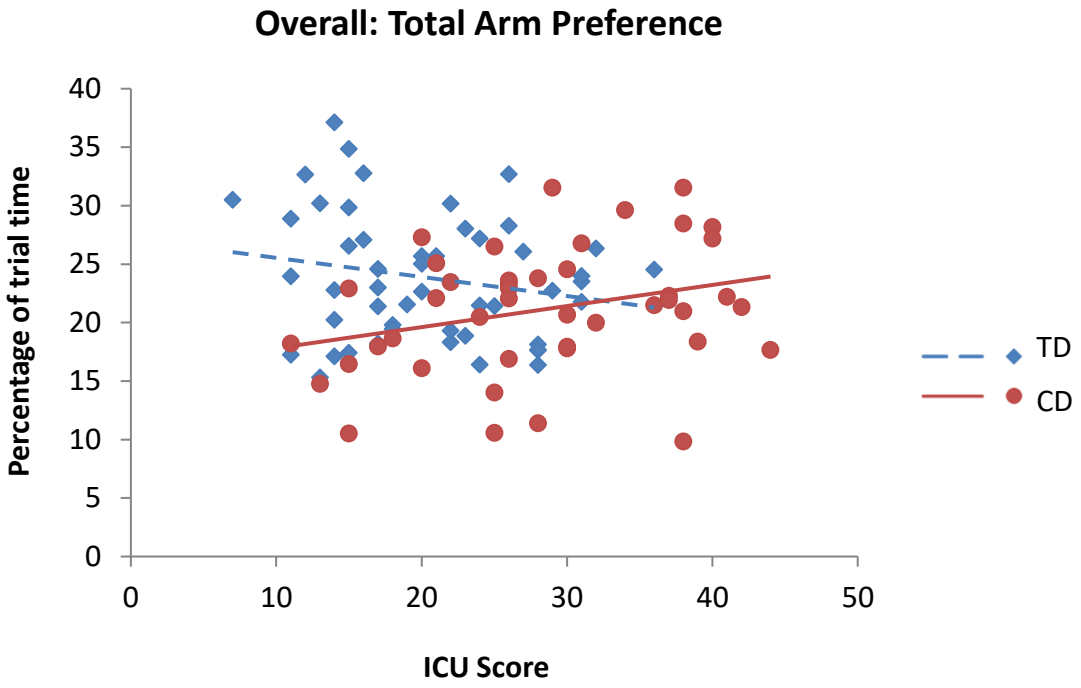


Figure S3.2. Total arm preference scores across all emotions as a function of Inventory of Callous-Unemotional traits (ICU) score, averaged across stimulus type. Each symbol represents a single participant and lines show the linear best fits to the data from participants with CD and typically-developing controls. *Note:* CD, conduct disorder; TD, typically-developing.

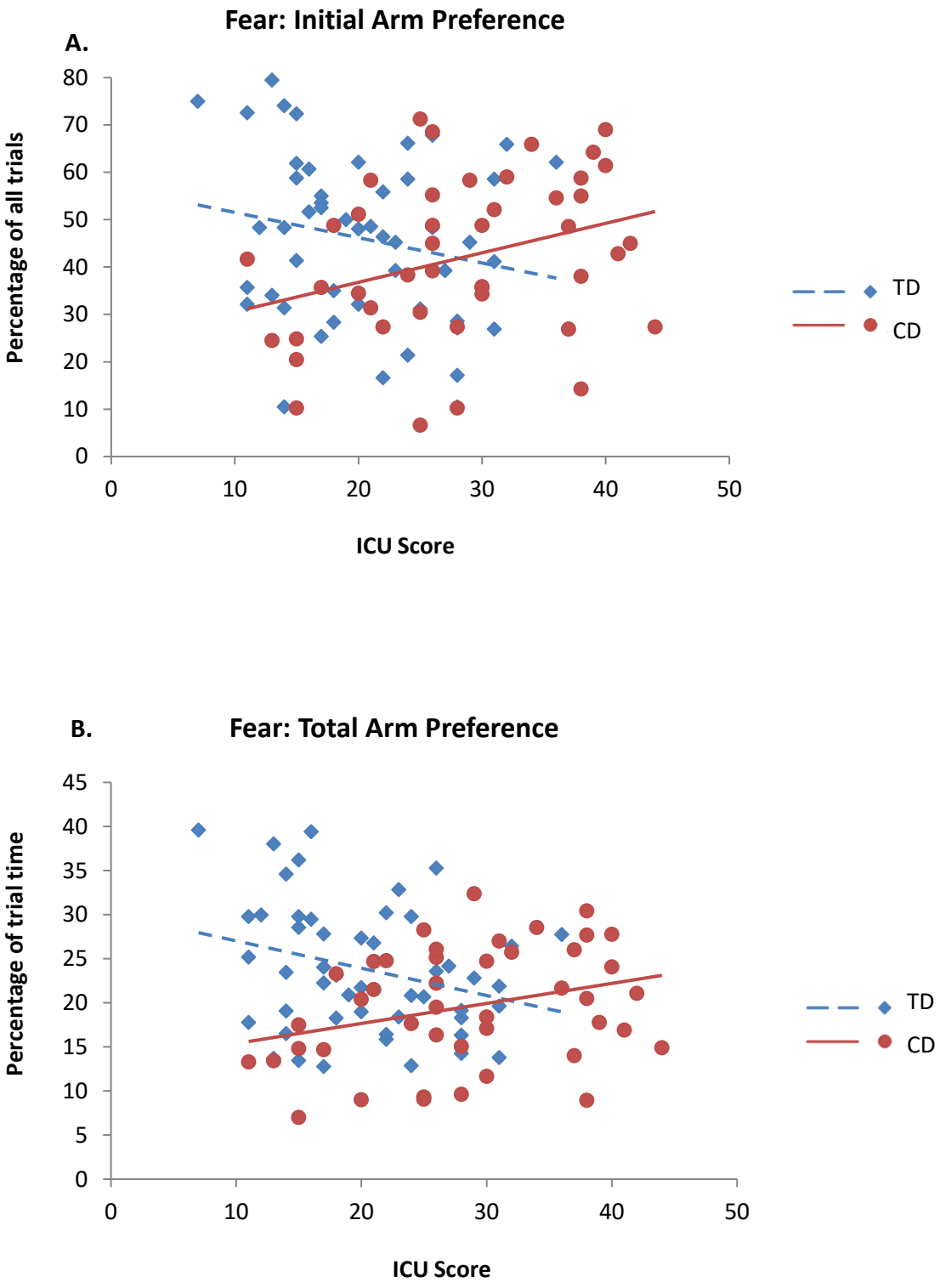


Figure S3.3. Eye movement behaviour when viewing fearful body expressions as a function of Inventory of Callous-Unemotional traits (ICU) score, averaged across stimulus type. Initial arm preference scores are shown in panel A, while total arm preference scores are presented in panel B. Each symbol represents a single participant and lines show the linear best fits to the data from participants with CD and typically-developing controls. Note: CD, conduct disorder; TD, typically-developing.

Chapter 4: Empathic Accuracy in Male Adolescents with Conduct Disorder and Higher versus Lower Levels of Callous-Unemotional Traits[5]

[5] Publication note: this chapter is based on Martin-Key, N. A., Brown, T., & Fairchild, G. (2016). Empathic accuracy in male adolescents with Conduct Disorder and higher versus lower levels of callous-unemotional traits. *Journal of Abnormal Child Psychology*. doi:10.1007/s10802-016-0243-8

Contributions: Approx. 50% of the data collection, all analyses, and write-up were completed by N. A. Martin-Key. The development and validation of stimuli for the empathic accuracy task, as well as 50% of the data collection were completed by T. Brown. Dr. Fairchild assisted with the interpretation of the findings, as well as the preparation of the manuscript.

4.1 Abstract

Adolescents with disruptive behavior disorders are reported to show deficits in empathy and emotion recognition. However, prior studies have mainly used questionnaires to measure empathy or experimental paradigms that lack ecological validity. We used an empathic accuracy (EA) task to study EA, emotion recognition, and affective empathy in 77 male adolescents aged 13-18 years (37 with Conduct Disorder (CD) and 40 typically-developing (TD) controls). The CD sample was subdivided into higher callous-emotional (CU) traits (CD/CU+) and lower callous-unemotional traits (CD/CU) subgroups using a median split procedure. Participants watched films of actors recalling happy, sad, surprised, angry, disgusted or fearful autobiographical experiences and provided continuous ratings of emotional intensity (assessing EA), as well as naming the emotion (recognition) and reporting the emotion they experienced themselves (affective empathy). The CD and TD groups did not differ significantly in EA and there were also no differences between the CD/CU+ and CD/CU- subgroups. Participants with CD were significantly less accurate than controls in recognising sadness, fear, and disgust (all *ps* < .05, *rs* ≥ .30), whilst the CD/CU- and CD/CU+ subgroups did not differ in emotion recognition. CD participants also showed reduced affective empathy for sadness, fear, and disgust relative to controls (all *ps* < .01, *rs* ≥ .33). No significant differences in affective empathy were found between the CD/CU+ and CD/CU- subgroups. These results extend prior research by demonstrating affective empathy and emotion recognition deficits in adolescents with CD using a more ecologically-valid task, and challenge the view that affective empathy deficits are specific to CD/CU+.

4.2 Introduction

Empathy has been defined as the capacity to share the emotions displayed by others (Eisenberg & Miller, 1987). For many years, researchers have sought to study the relationship between empathy and aggressive and antisocial behaviour, working under the view that deficits in empathy may promote aggression, and particularly instrumental aggression (Blair, 2005). It has been proposed that empathy is a multi-faceted phenomenon that can be fractionated into at least three forms: cognitive empathy (understanding others' mental states/emotion recognition), affective empathy (feeling the same emotion as another person), and motor empathy (mirroring others' body movements and facial expressions) (Blair, 2005). There is increasing evidence that individuals with Disruptive Behaviour Disorders (DBDs), such as Conduct Disorder (CD) and Oppositional Defiant Disorder (ODD), show deficits in emotion recognition (Fairchild et al., 2009; Short et al., 2016) and affective empathy (de Wied, Goudena, & Matthys, 2005; de Wied, Van

Boxtel, Matthys, & Meeus, 2012). Nevertheless, findings are inconsistent across studies and highly simplified stimuli or tasks have been used in many of these studies.

Studies employing questionnaire measures have consistently demonstrated lower levels of both cognitive and affective empathy in children and adolescents with DBDs relative to healthy controls (e.g., Anastassiou-Hadjicharalambous & Warden, 2008; Cheng, Hung, & Decety, 2012; Jolliffe & Farrington, 2004). Contrary to models positing reduced deficits in affective empathy in those higher in callous-unemotional (CU) traits (an index of the affective and interpersonal aspects of psychopathy that can be assessed in children; Blair, 2013), affective empathy does not appear to be modulated by these traits (e.g., Anastassiou-Hadjicharalambous & Warden, 2008; Cheng et al., 2012).

Other commonly used measures of empathy include tasks assessing the recognition of facial expressions of emotion (considered critical for cognitive empathy). Relative to healthy controls, children and adolescents with CD have been found to exhibit emotion recognition impairments, although it is currently unclear which emotions are affected. For example, when presenting morphed facial expressions, studies have found impairments in anger and disgust recognition in both males and females with CD, with additional impairments in happiness and fear recognition in males with CD (Fairchild et al., 2010; Fairchild et al., 2009). When exploring CD subjects' ability to identify emotions from both faces and voices, impairments in the recognition of happiness, fear, and sadness (but not anger) have been found (Cadesky, Mota, & Schachar, 2000).

The influence of CU traits on facial emotion recognition also remains unclear, with some studies suggesting that CU traits are associated with deficits in recognising facial expressions signalling distress (i.e., fear and sadness; Dadds et al., 2008; Fairchild et al., 2010), whilst other studies have reported superior fear recognition in those higher in CU traits compared to those lower in CU traits (e.g., Woodworth & Waschbusch, 2008). Emotion recognition has also been measured with the use of video clips (often excerpts from films or documentaries). Here, findings have been even more mixed. Some studies have found no impairments in recognition of emotions in dynamic stimuli or video clips in those with DBDs (e.g., de Wied et al., 2005, Schwenck et al., 2012), while one study found significant impairments in overall emotion recognition in adolescents with CD (Cohen & Strayer, 1996), although data for individual emotions were not reported and it is therefore unclear whether specific emotions were more affected than others.

Emotionally-laden video clips have also been employed to measure affective empathy responses, although there have been inconsistencies between studies in the operationalisation of affective empathy. When affect matches (i.e., feeling the same emotion as another person) have been assessed, studies have found significantly fewer affect matches in children with DBDs relative to

controls (e.g., de Wied et al., 2005). Other studies have focused solely on emotional intensity (e.g., Schwenck et al., 2012) or congruence (asking the participant whether he/she felt the same emotion or similar valence as the target, irrespective of what the emotion was; e.g., Anastassiou-Hadjicharalambous & Warden, 2008), finding that the DBD groups reported less intense emotions than controls. It has also been suggested that individuals higher in CU traits exhibit greater impairments in affective empathy than those with low levels of CU traits, particularly for sadness (e.g., de Wied et al., 2012; Schwenck et al., 2012). Again, however, these findings have not been consistent, with some studies finding no effects of CU traits on affective empathy for sadness (e.g., Anastassiou-Hadjicharalambous & Warden, 2008).

Taken together, it is evident that findings related to both cognitive empathy/ emotion recognition and affective empathy in youth with DBDs are inconsistent across studies. This is likely due to the wide range of materials and tasks used in these studies. The kinds of static, grayscale stimuli depicting facial expressions used in most studies of facial emotion recognition do not resemble the facial stimuli we see in everyday life, whilst studies employing vignettes or films have often required participants to label an overall emotion and occasionally rate its strength and explain the reason for it. This dependence on requiring participants to make an overall judgement of the emotion, often through forced-choice procedures, means that it has not been possible to examine whether participants are able to continuously track changes in emotional intensity, which is a key skill in real-life situations. Furthermore, selecting excerpts from television shows or scenarios portrayed by actors means that the emotion displayed in the clip is inevitably artificial and, further, that it is not possible to determine whether the targets were genuinely feeling the emotion they were portraying. Zaki et al. (2009) recently developed an Empathic Accuracy (EA) task that they believe overcomes many of these methodological issues. EA, defined as the capacity to correctly deduce the intensity and valence of the feelings being experienced by a target (Zaki et al., 2008; Zaki & Ochsner, 2012), involves both mental state attribution (cognitive empathy/emotion recognition) and experience-sharing (affective empathy; Zaki & Ochsner, 2012). Critically, the participant's continuous ratings of changes in emotional intensity during the clip are compared with the target's own ratings of the emotions they experienced to provide an index of EA.

In order to investigate whether participants are able to track changes in emotional intensity and address the issue of low ecological validity in previous work, as well as exploring recognition of dynamic stimuli and affective empathy, the current study employed a modified version of the EA task developed by Zaki et al. (2009). Rather than using just positively- and negatively-valenced stimuli, we created video clips depicting each of the primary emotions, and we also asked participants to rate their own feelings after watching the video clips. Our primary objective was to

compare male adolescents with CD and TD controls across these different measures of empathy. We also contrasted adolescents with CD and higher levels of CU traits (CD/CU+) with those with CD and lower levels of CU traits (CD/CU-) in terms of EA task performance. We predicted that participants with CD would be impaired in EA and would show emotion recognition and affective empathy deficits relative to typically-developing (TD) controls. We also hypothesised that participants with CD/CU+ would show reduced EA, emotion recognition, and affective empathy relative to CD/CU- participants. We predicted that such deficits would be particularly marked for sadness and fear, given previous research showing that the processing of distress cues is disproportionately impaired in those with elevated CU traits (Dadds et al., 2006; Marsh & Blair, 2008; Short et al., 2016).

4.3 Method

4.3.1 Participants

Male adolescents (37 with CD and 40 typically-developing (TD) controls) aged 13-18 years were recruited through Youth Offending Services (YOSs) and pupil referral units across Southampton and Hampshire via poster advertisements and referrals from case workers, and by sending out information packs to students at mainstream schools and colleges in the local area. All participants and the parents of those aged below 16 provided written informed consent to participate in the study. In the latter case, the young people were asked to indicate their assent. The study was approved by the University Ethics Committee and the Southampton County Council Children's Services Research Governance Committee.

Exclusion criteria included the following: Intelligence Quotient (IQ) < 70, as estimated using the two subtest version of the Wechsler Abbreviated Scale of Intelligence (WASI; Wechsler, 1999), and the presence of Autism Spectrum Disorders (ASDs), psychosis, bipolar disorder or severe affective illness. All participants were assessed for CD, ODD, Attention-Deficit/Hyperactivity Disorder (ADHD), Major Depressive Disorder (MDD), Generalised Anxiety Disorder (GAD), Obsessive-Compulsive Disorder (ODC), Post-Traumatic Stress Disorder (PTSD), Psychosis, and Alcohol and Substance Use Disorders using the Schedule of Affective Disorders and Schizophrenia for School-Age Children-Present and Lifetime version (K-SADS-PL; Kaufman et al., 1997). The presence of ASDs was assessed using the ASD module of the unpublished DSM-5 version of the K-SADS-PL. Diagnostic interviews were carried out separately with participants and caregivers, and data were combined across informants such that a symptom was considered present if it was endorsed by either informant, as suggested by Kaufman et al. (1997). The inter-rater reliability of the CD diagnoses in this study was excellent (kappa = 1.00).

CU traits were assessed using the self-report version of the Inventory of Callous-Unemotional traits (ICU; Frick, 2003; Cronbach's alpha in present sample = .78). Within the CD group, participants were categorised as CD/CU+ (*n* = 20) or CD/CU- (*n* = 17) using a median split procedure based on total ICU scores. Participants scoring ≥ 30 were classified as CD/CU+ while those scoring < 30 were classified as CD/CU- (SD = 8.81) This ICU score to perform the median split, as well as the SD value, are comparable to the mean scores and SD values reported in previous studies using the self-report version of the ICU (ranging from 23.2 to 29.5, with SD values between 6.38 and 9.41 (Feilhauer, Cima, & Arntz, 2012; Kimonis, Frick, Munoz, & Aucoin, 2008a; Kimonis, Kennealy, & Goulter, 2016; Kimonis et al., 2008b; Wolf & Centifanti, 2014). Although this approach is common in the literature (Jones et al., 2010; de Wied et al., 2012; Schwenck et al., 2012), and there are no agreed cut-offs or norms on the ICU, there are limitations to using a median split procedure to dichotomise a continuous variable (i.e., reducing statistical power; MacCallum, Zhang, Preacher, & Rucker, 2002). In an attempt to address this issue, we also treated CU traits as a dimensional measure by testing for correlations between CU traits and EA, emotion recognition, and affective empathy within the CD and TD groups and across the entire sample.

To provide continuity with the previous literature on empathy in adolescents with DBDs, we also included a measure of dispositional empathy: the self-report Interpersonal Reactivity Index (IRI; Davis, 1983; Cronbach's alpha in present sample = .82). Participants' ethnicity was categorised as either Caucasian or non-Caucasian, and socioeconomic status (SES) was categorised according to the parents' occupations using the UK Office for National Statistics guidelines (ONS, 2010).

4.3.2 Empathic accuracy task

This task was designed to assess whether participants could: a) track changes in the intensity of the target's emotion (empathic accuracy; EA); and b) recognise the emotion displayed by the target after watching the full video clip (emotion recognition). We also investigated whether they reported experiencing the same emotion as the target (affective empathy). The task was adapted from a paradigm developed by Zaki et al. (2009). Actors (targets) were filmed talking about autobiographical experiences in which they had felt discrete primary emotions, rather than undifferentiated positive or negative emotions, and the continuous rating scale was used to rate changes in emotional intensity, rather than conflating intensity and emotional valence. The actors provided continuous ratings of the intensity of the emotions they experienced when filming the clips.

Participants were asked to watch two practice clips to familiarise themselves with the task and rating scale, and then watched 12 test clips involving two instances of each of the following

emotions: anger, happiness, sadness, disgust, fear, and surprise. These clips lasted between 61 and 158 seconds, with a mean length of 144 seconds. During the presentation of each video clip, participants were required to rate, on a continuous basis, the intensity of the emotions being experienced by the target on a nine-point rating scale (from 0 = no emotion to 9 = very strong emotion). We examined the correlations between the targets' continuous ratings of the intensity of their emotions and the participants' ratings of emotional intensity on the same scale (*Figure 4.1*A). The correlation between the target's and the participant's continuous ratings formed the dependent measure of EA (see *Figure 4.1*B for examples of low and high correlations).

Following each clip, participants were asked to name the predominant emotion displayed in the video clip from a list of the six primary emotions. There was also an option of 'no emotion'. Participants also named the predominant emotion that they had experienced whilst watching the clip (again, with options of the six primary emotions and 'no emotion').

A.

1) Empathic Accuracy (61-158s)

2) Emotion Recognition (unlimited time)

3) Affective Empathy (unlimited time)

B.

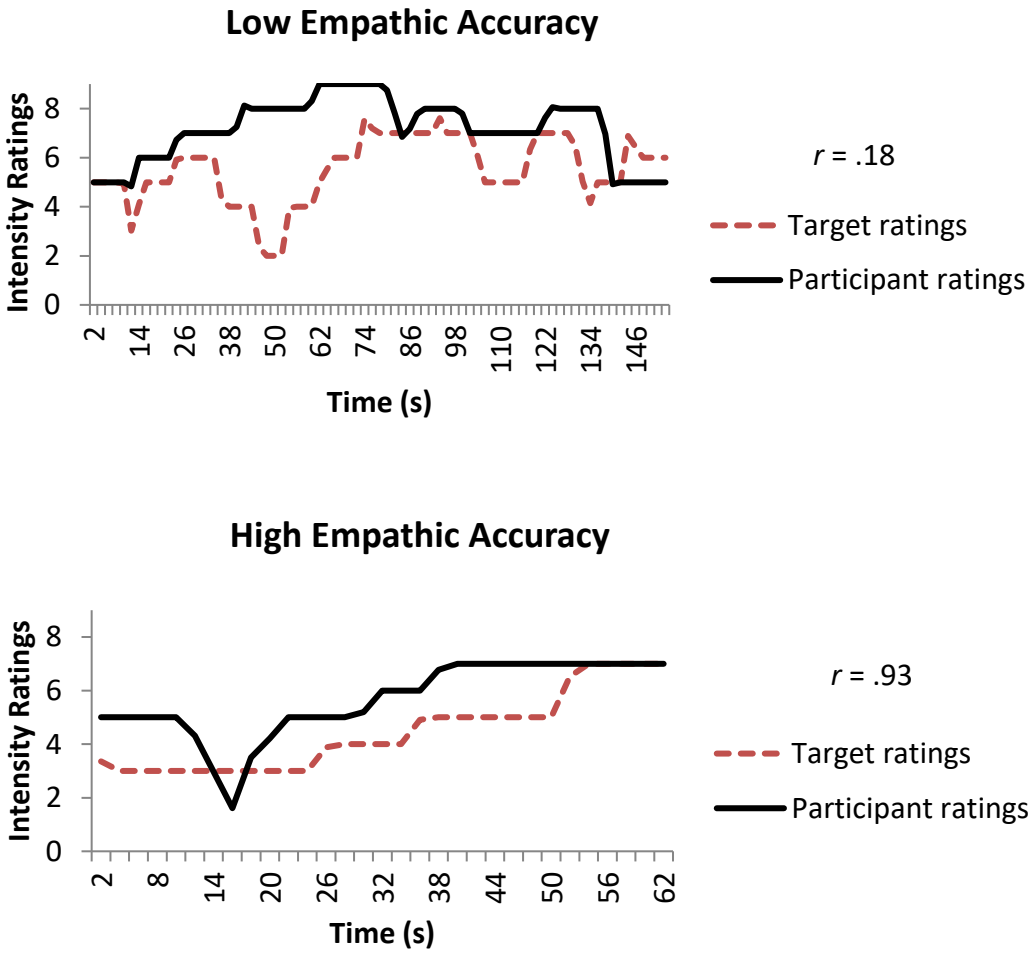


Figure 4.1 Schematic representation of a trial sequence of the empathic accuracy task (panel A) and examples of low and high correlations between the perceiver's and the target's continuous ratings of emotional intensity, i.e., low and high empathic accuracy (panel B).

4.4 Data Analytic Strategy

Continuous EA data were separated by clip. Mean ratings for each two-second period served as one data point (bin) in subsequent analyses. Participants' ratings across all bins were correlated with the target's own ratings. Correlations were then transformed using Fisher's Z for all subsequent analyses, as recommended when averaging correlation coefficients (Silver, Clayton, Tulane, & Dunlap, 1987). Average correlations for each participant per emotion were then calculated. EA correlations were compared between groups using 2 (CD *vs.* control; CD/CU+ *vs.* CD/CU-) x 6 (sadness, happiness, fear, surprise, anger, disgust) mixed-design ANOVAs. For emotion recognition, participants' performance accuracy was compared for each emotion separately using non-parametric statistical tests because the data were not normally distributed and could not be transformed to a normal distribution. Participants could receive scores of 0 (0/2 correct), 50 (1/2 correct) or 100% (2/2 correct) for each emotion. Emotion recognition scores for each emotion were compared between groups (CD *vs.* control; CD/CU+ *vs.* CD/CU-) using Mann-Whitney U tests, subject to the Holm-Bonferroni correction to correct for multiple comparisons (Holm, 1979).

Similar procedures were used to compare the groups in terms of affective empathy as the data were not normally distributed; participants could receive scores of 0, 50, or 100% for affect matches for each emotion (i.e., same emotion as target in 0/2, 1/2, or 2/2 clips, respectively). Affective empathy scores for specific emotions were compared between groups (CD *vs.* control; CD/CU+ vs. CD/CU-) using Mann-Whitney U tests, subject to the Holm-Bonferroni correction method. We also examined for effects of CU traits using a dimensional approach by testing for correlations between CU traits and EA, emotion recognition, and affective empathy (using either parametric or non-parametric bivariate correlations, as appropriate). Effect sizes are reported either as 'r equivalent' for the direct group comparisons (Rosenthal & Rubin, 2003) (hereafter 'r'; small ≥ .10, medium ≥ .30, large ≥ .50; Cohen, 1988) or partial eta-squared (η_p^2) for the ANOVA analyses (small ≥ .01, medium ≥ .06, large ≥ .14; Cohen, 1988). We also assessed the effects of potential confounds (i.e., IQ, SES, and psychiatric comorbidity). We first ran bivariate and point-biserial correlations between the variables that showed significant group effects and IQ, SES, and psychiatric comorbidity. Significant correlations were followed up by running multiple regression analyses to examine whether CD status or the potentially confounding variables were more important in explaining the observed group effects.

4.5 Results

4.5.1 Participant characteristics

Demographic characteristics and rates of psychiatric comorbidity by group and between-group comparisons are presented in Table 4.1. The CD and control groups did not differ in age or ethnicity. However, the CD group had lower IQs than the control group (t (75) = -6.71, p < 0.001, r = .61), and members of the CD group were more likely to come from lower SES backgrounds than the control group (χ^2 (1) = 13.89, p < .001, r = .85). Participants with CD had significantly higher levels of CU traits (t (75) = 3.47, p < .001, r = .40), and scored significantly lower than controls on all subscales of the empathy questionnaire (the IRI), except for personal distress. Approximately half (46%) of the CD participants had co-occurring ADHD diagnoses, and several CD participants had multiple comorbid disorders. However, 46% of the CD group had no current comorbid psychiatric disorders.

Table 4.1 *Demographic characteristics and comorbidity: CD vs. TD comparisons*

	TD (n = 40)	CD (n = 37)	p value
	M (SD)	M (SD)	
Age (years)	16.20 (1.42)	16.03 (1.70)	.63
Estimated IQ	104.18 (10.25)	89.27 (9.14)	<.001
Callous-unemotional traits (ICU)	23.85 (6.84)	30.05 (8.81)	<.001
Empathy questionnaire (IRI)			
Perspective-taking	15.55 (4.43)	12.19 (5.38)	.01
Fantasy	14.38 (6.18)	10.95 (5.32)	.01
Empathic concern	18.00 (3.97)	13.81 (4.94)	<.001
Personal distress	11.28 (3.79)	11.27 (5.75)	.54
	n (%)	n (%)	
Socioeconomic status ≠			
Higher	26 (65)	9 (24)	<.001
Lower	8 (20)	21 (57)	
Missing	6 (15)	7 (19)	

Table 4.1 *Demographic characteristics and comorbidity: CD vs. TD comparisons*

	TD (*n* = 40)	CD (*n* = 37)	*p* value
Ethnicity			
Caucasian	34 (85)	33 (89)	.59
Non-Caucasian	6 (15)	4 (11)	
Psychiatric comorbidity			
ADHD	0 (0)	17 (46)	-
Mood disorder	0 (0)	4 (11)	-
Anxiety disorder	0 (0)	5 (14)	-
Substance use disorder	0 (0)	5 (14)	-
Alcohol use disorder	0 (0)	2 (5)	-

Note: ≠ Estimated on the basis of parental occupation using the Office for National Statistics guidelines. Key: ADHD, attention-deficit/hyperactivity disorder; CD, Conduct Disorder; ICU, Inventory of Callous-Unemotional traits (self-report version); IQ, intelligence quotient; IRI, Interpersonal Reactivity Index; SD, standard deviation; TD, typically-developing.

There was a significant difference between the CD/CU+ and CD/CU- groups in age (t (35) = 2.14, $p < .05$, $r = .34$), with the latter group being slightly younger than the former (see Table 4.2). There was also a difference in ethnicity (χ^2 (1) = 5.28, $p < .05$, $r = .70$), with the CD/CU+ subgroup containing only Caucasian individuals, whereas the CD/CU- subgroup contained four non-Caucasian participants (out of 17). However, these subgroups were matched in IQ and SES. Confirming the effectiveness of the median split, the CD/CU+ group had higher levels of CU traits than the CD/CU- group (t (35) = 8.39, $p < .001$, $r = .82$). The CD/CU+ participants scored significantly lower on the perspective-taking subscale of the IRI than the CD/CU- participants (t (35) = -2.03, $p < .05$, $r = .32$), but there were no other group differences. Rates of ADHD, mood, and anxiety disorders were similar in the CD/CU- and CD/CU+ subgroups. Due to the relative absence of substance use disorder comorbidity in the CD/CU- group, it was not possible to use statistical procedures to test for differences between subgroups in rates of these conditions.

Table 4.2 *Demographic characteristics and comorbidity: CD/CU+ vs. CD/CU- group comparisons*

	CD/CU- (*n* = 17)	CD/CU+ (*n* = 20)	*p* value
	M (SD)	*M* (SD)	
Age (years)	15.41 (1.84)	16.56 (1.41)	.04
Estimated IQ	87.88 (8.03)	90.45 (10.05)	.40
Callous-unemotional traits (ICU)	22.35 (4.29)	36.60 (5.77)	<.001
Empathy questionnaire (IRI)			
Perspective-taking	14.06 (4.93)	10.60 (5.35)	.05
Fantasy	10.65 (4.68)	11.20 (5.92)	.76
Empathic concern	14.82 (3.71)	12.95 (5.74)	.36
Personal distress	11.29 (5.05)	11.25 (6.14)	.26
	n (%)	*n* (%)	
Socioeconomic status ≠			
Higher	7 (41)	2 (10)	.94
Lower	7 (41)	13 (65)	
Missing	3 (18)	5 (25)	
Ethnicity			
Caucasian	13 (76)	20 (100)	.02
Non-Caucasian	4 (24)	0 (0)	
Psychiatric comorbidity*			
ADHD	6 (29)	11 (60)	.19
Mood disorder	1 (24)	3 (30)	.70
Anxiety disorder	1 (6)	4 (20)	.35
Substance use disorder	0 (0)	5 (25)	-
Alcohol use disorder	0 (0)	2 (10)	-

Note: ≠ Estimated on the basis of parental occupation using the Office for National Statistics guidelines. *Percentage values sum to more than 100% due to multiple comorbid disorders in some participants. Key: ADHD, attention-deficit/hyperactivity disorder; CD/CU-, Conduct Disorder with lower levels of callous-unemotional traits; CD/CU+, Conduct Disorder with higher levels of callous-unemotional traits; ICU, Inventory of Callous Unemotional traits (self-report version); IQ, intelligence quotient; IRI, Interpersonal Reactivity Index; SD, standard deviation.

4.5.2 Correlations between dispositional empathy (measured using the IRI) and empathic accuracy, emotion recognition, and affective empathy

In order to establish the validity of the empathic accuracy (EA) task, we tested for associations between the measures of interest (EA, emotion recognition, and affective empathy) and total IRI scores, as well as the perspective-taking, fantasy, empathic concern, and personal distress subscales of the IRI. There were significant positive correlations between total IRI score and both overall EA (r = .23, p < .05) and overall affective empathy (r = .54, p < .001). We also found significant positive correlations between the perspective-taking, fantasy, and empathic concern subscales of the IRI and overall affective empathy (all rs > .35, ps < .01). No significant correlations were found between emotion recognition and total IRI score or the individual subscales, however.

4.5.3 Empathic accuracy: CD vs. TD comparisons

We assessed the participants' ability to track changes in emotional intensity when viewing targets describing emotional autobiographical experiences, i.e., empathic accuracy. There was no main effect of Group; F (1, 60) = .19, p = .66, η_p^2 = .01, or interaction between Group and Emotion; F (4.26, 255.49) = 1.20, p = .36, η_p^2 = .02, although the CD group achieved numerically lower scores for all emotions (see Table 4.3).

Table 4.3 *Empathic accuracy descriptive statistics: CD vs. TD comparisons*

	TD (n = 40)	CD (n = 37)
Emotion	Mean correlation (r) (SE)	Mean correlation (r) (SE)
Sadness	.52 (.03)	.41 (.03)
Happiness	.51 (.04)	.50 (.03)
Fear	.51 (.04)	.44 (.05)
Surprise	.54 (.05)	.34 (.06)
Anger	.41 (.04)	.31 (.05)
Disgust	.49 (.06)	.37 (.08)

Note: Mean scores were transformed back to correlation coefficient scores (r) from Fisher's Z for ease of interpretation. Key: CD, Conduct Disorder; SE, standard error; TD, typically-developing.

4.5.4 Empathic accuracy: CD/CU+ vs. CD/CU- comparisons

We also compared the CD/CU+ and CD/CU- subgroups in EA. Again, there was no main effect of Group, F (1, 25) = 1.47, p = .24, η_p^2 = .06, nor was there an interaction between Group and Emotion, F (5, 125) = .90, p = .49, η_p^2 = .04, although the CD/CU+ group achieved numerically lower scores than the CD/CU- group for all emotions (see Table 4.4).

4.5.5 Empathic accuracy: CU traits

When treating CU traits as a dimensional measure, a significant correlation was found between CU traits *within* the CD group and EA for sad clips (r = -.35, p < .05), with elevated CU traits associated with a reduced ability to track changes in the intensity of sadness. However, no other correlations between CU traits and EA were found in the CD and TD groups, nor across the entire sample.

Table 4.4 *Empathic accuracy descriptive statistics: CD/CU- vs. CD/CU+ group comparisons*

	CD/CU- (n = 17)	CD/CU+ (n = 20)
Emotion	Mean correlation (r) (SE)	Mean correlation (r) (SE)
Sadness	.47 (.05)	.37 (.04)
Happiness	.50 (.05)	.49 (.04)
Fear	.51 (.09)	.39 (.05)
Surprise	.39 (.10)	.30 (.07)
Anger	.33 (.09)	.30 (.05)
Disgust	.39 (.14)	.34 (.07)

Note: Mean scores were transformed back to correlation coefficient scores (r) from Fisher's Z for ease of interpretation. CD/CU-, Conduct Disorder with lower callous-unemotional traits; CD/CU+, Conduct Disorder with higher callous-unemotional traits; SE, standard error.

4.5.6 Emotion recognition: CD vs. TD comparisons

We compared the TD and CD groups in terms of emotion recognition using Mann-Whitney U tests, subject to the Holm-Bonferroni correction for multiple comparisons. Participants in the CD group were significantly less accurate than controls in recognition of sadness (U = 572.50, z = -2.55, p < .05, r = .30), fear (U = 512, z = -2.86, p < .05, r = .30), and disgust (U = 478.50, z = -3.36, p < .01, r = .40; see *Figure 4.2*A). All of these group differences had medium effect sizes. Neither IQ, nor SES or psychiatric comorbidity were significantly associated with the recognition

of these emotions, suggesting that these findings were not influenced by group differences in these variables.

4.5.7 Emotion recognition: CD/CU+ vs. CD/CU- comparisons

We ran a similar analysis as described above for emotion recognition, but in this case comparing the CD/CU+ and CD/CU- subgroups. No significant group differences were found for any emotion (see *Figure 4.2*B).

4.5.8 Emotion recognition: CU traits

When treating CU traits as a dimensional measure, no significant correlations were found between CU traits and recognition of any of the emotions in the CD and TD groups, nor across the entire sample.

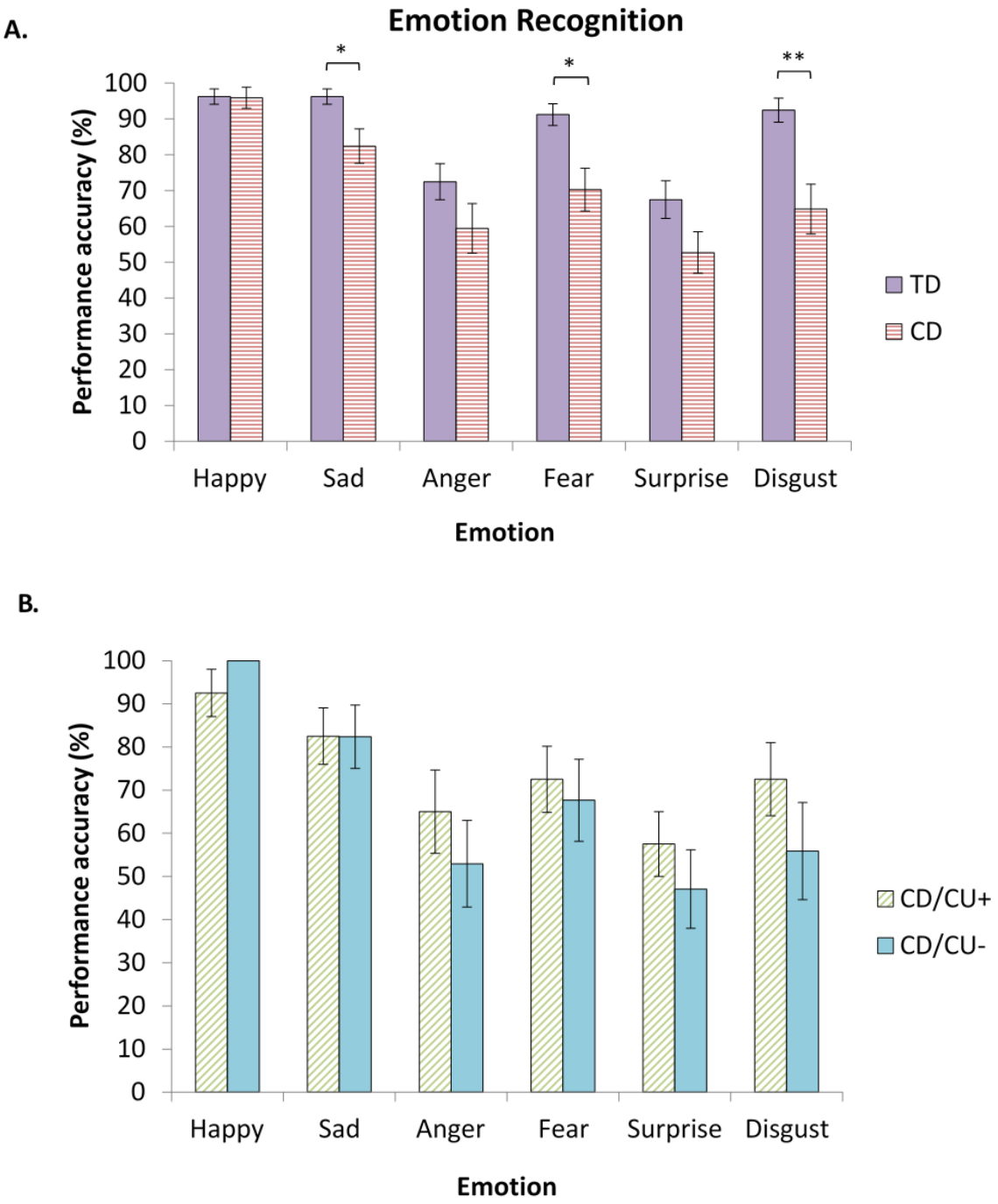


Figure 4.2 Emotion recognition scores for the typically-developing (TD) and Conduct Disorder (CD) groups (panel A), and the higher (CD/CU+) and lower (CD/CU-) callous-unemotional traits subgroups (panel B) (error bars show +/-Standard Error). *Note:* The *p*-values are those obtained after applying the Holm-Bonferroni correction for multiple comparisons*;* $*p < 0.05$. $**p < 0.01$.

4.5.9 Affective empathy: CD vs. TD comparisons

We analysed the data for affective matches to the emotions displayed by targets. Mann-Whitney U tests were again used to test for group differences, applying the Holm-Bonferroni correction.

Participants with CD reported significantly fewer affect matches than control participants when watching clips depicting sadness (U = 394, z = -3.89, p < .001, r = .41), fear (U = 476.5, z = -3.06, p < .01, r = .33), and disgust (U = 390, z = -3.79, p < .001, r = .40; see *Figure 4.3*A). Again, all of these group differences had medium effect sizes.

When assessing for potential confounds, affective empathy for sadness (r = .40, p < .001), fear, (r = .35, p < .01), and disgust (r = .36, p < .01) were positively correlated with IQ. Thus, separate multiple regression analyses were conducted for these emotions, with IQ and CD status as predictors of affective empathy. IQ was not a significant predictor of affective empathy for all emotions (all standardised βs < .23, ps > .10), indicating that the findings were not influenced by group differences in IQ. CD status was uniquely associated with reduced affective empathy for all emotions (all standardised βs > -.24, ps < .05), with CD status accounting for ≥ 41.40% of the variance in affective empathy (all $R^2 s$ > .41, Fs > 15.51, ps < .05).

4.5.10 Affective empathy: CD/CU+ vs. CD/CU- comparisons

We ran a similar non-parametric analysis as was described above to compare the CD/CU+ and CD/CU- subgroups in affective empathy. No between-group differences were found for any emotion (see *Figure 4.3*B).

4.5.11 Affective empathy: CU traits

When treating CU traits as a dimensional measure, no significant correlations were found between CU traits and affective empathy for any of the emotions in the CD and TD groups, nor across the entire sample.

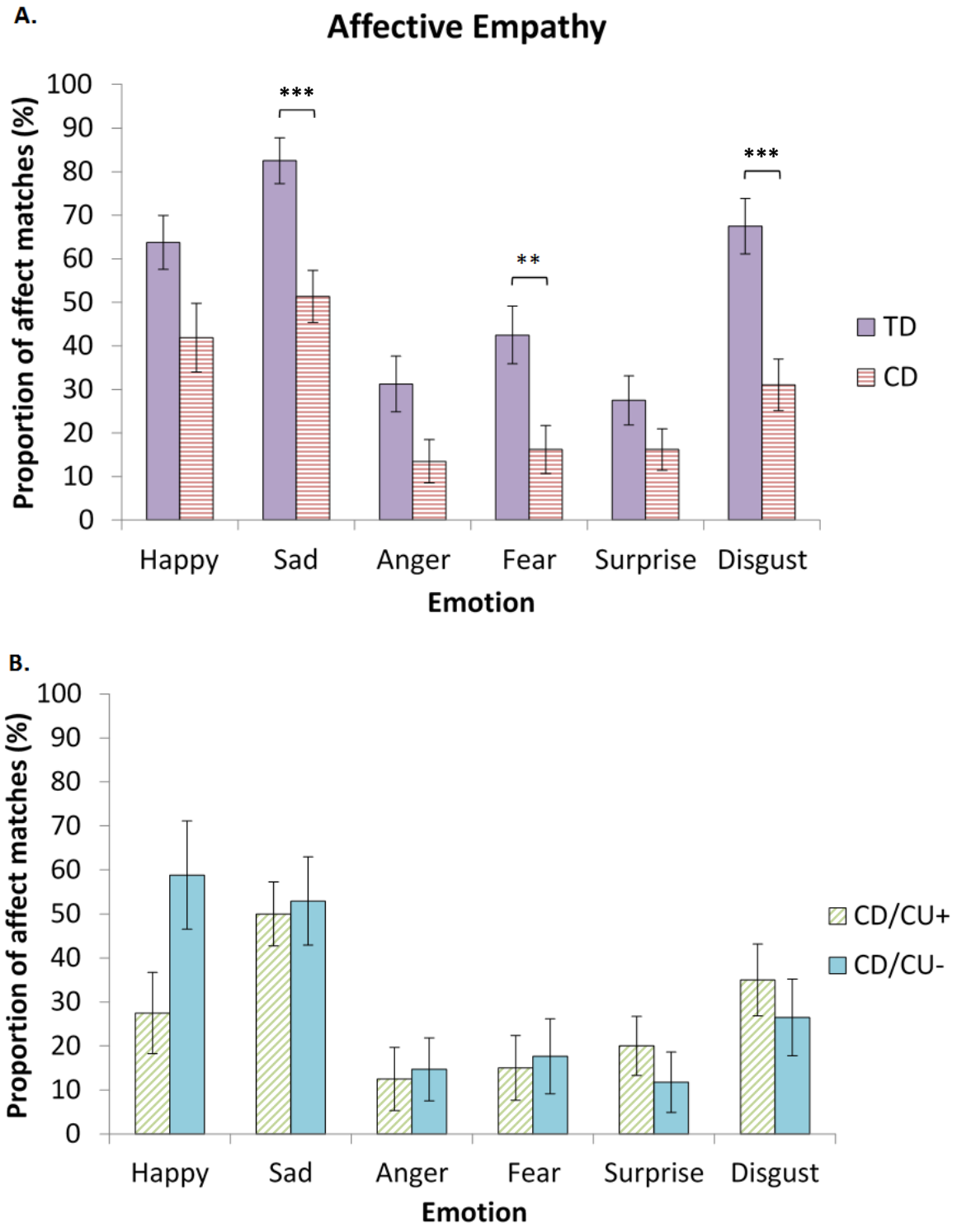


Figure 4.3 Affect matches to emotions displayed by targets in the typically-developing (TD) and Conduct Disorder (CD) groups (panel A) and the higher (CD/CU+) and lower (CD/CU-) callous-unemotional traits subgroups (panel B) (error bars show +/-Standard Error). *Note:* The *p*-values are those obtained after applying the Holm-Bonferroni correction for multiple comparisons; $^{**}p < 0.01$. $^{***}p < 0.001$.

4.6 Discussion

The present study aimed to assess empathic accuracy (EA), emotion recognition, and affective empathy in adolescents with Conduct Disorder (CD) and higher versus lower levels of callous-unemotional (CU) traits, using a more ecologically-valid task than has been used previously. We note that issues with small sample sizes and limited statistical power must be taken into consideration when interpreting these findings. Relative to typically-developing (TD) adolescents, participants with CD exhibited impairments in emotion recognition and affective empathy when viewing intense and emotionally-evocative video clips depicting targets talking about real autobiographical experiences, and such difficulties were particularly marked for disgust, sadness, and fear. Contrary to our hypothesis, however, participants with CD were not significantly impaired in their ability to continuously track changes in emotional intensity (i.e., empathic accuracy) relative to TD adolescents.

The present findings for emotion recognition of dynamic stimuli are broadly consistent with those obtained in studies using static images of facial expressions to investigate facial emotion recognition in adolescents with CD, as well as our effect sizes being similar (medium) in size to those in previous studies (Fairchild et al., 2009, 2010; Sully et al., 2015). In particular, adolescents with CD have been reported to show deficits in fear and disgust recognition using tasks involving morphed facial expressions. The present study shows that such deficits are present even when the emotional stimuli contain visual, auditory, and linguistic information, and the stimulus duration extends to multiple seconds or even minutes. Consequently, it seems likely that male adolescents with CD experience difficulties in recognising or understanding others' emotions in real-life situations – thus previous findings in this area were probably not explained by the use of highly artificial stimuli in the experimental paradigms.

The findings obtained for affective empathy were also very interesting. Adolescents with CD were found to show reduced affective empathy for sadness, fear, and disgust compared with TD controls. Again, all of these group differences had medium effect sizes. These results suggest that emotion recognition and affective empathy are related, consistent with a two-stage model in which cognitive empathy/emotion labelling precedes or provides a foundation for affective empathy (e.g., Batson, 2009; Feshbach, 1987) as impairments were seen for the same emotions as were identified in the emotion recognition analyses. Additionally, these findings are in accordance with the notion that empathy is a multi-faceted phenomenon, which not only requires one to identify and understand others' emotions/mental states, but also involves feeling the same emotion as the target. It seems intuitive that difficulties identifying emotions such as sadness, fear, and disgust might lead to deficits in affective empathy for these emotions. It could also be

argued that the link between emotion recognition and affective empathy, where difficulties in the former affect the latter, influences the development of 'moral socialisation' (socialisation via emotional learning). Indeed, Blair (1995) has proposed that TD children learn to desist from engaging in behaviours that cause harm to others partly as a result of empathic processes (e.g., observing someone in pain or displaying fear evokes an empathic reaction which is experienced as aversive and teaches the child not to perform the harmful/frightening action again). On the other hand, an individual who is not capable of identifying or sharing someone else's feelings may not learn to desist from engaging in behaviours that cause harm to others (Blair, 1995).

To address the second aim of the study, we directly compared the CD/CU+ and CD/CU- subgroups in terms of EA, emotion recognition, and affective empathy, to examine whether empathy deficits were more pronounced, or only present, in the CD/CU+ subgroup. The median split analyses revealed no significant differences between the two subgroups on any of the aforementioned measures. When treating CU traits as a dimensional measure, which is arguably a more powerful approach than using a median split, we found an inverse relationship between CU traits *within* the CD group and EA for sadness, with higher levels of CU traits being associated with a reduced ability to track changes in the intensity of sadness. This is broadly consistent with previous studies showing impairments in the processing of distress cues in children and adolescents with higher levels of CU traits (Dadds et al., 2006; Short et al., 2016), although it should be noted that no other significant correlations were found within the CD and TD groups, nor across the entire sample.

Nevertheless, small sample sizes and accompanying issues with limited statistical power to detect differences between groups must be borne in mind when interpreting these null findings for the CD/CU+ vs. CD/CU- subgroup comparisons. Indeed, we acknowledge that the present findings may be considered surprising given previous work showing that empathy deficits are more pronounced in those with CD and elevated CU traits than those with lower levels of CU traits (Jones et al., 2010; Schwenck et al., 2012) and theories predicting that affective empathy deficits are uniquely related to CU traits (Blair, 2005, 2013). On the other hand, these findings are consistent with previous research showing that the antisocial/lifestyle facet of psychopathy is more strongly related to deficits in empathy than the affective facet (Brook & Kosson, 2013) and prior work with children with DBDs showing impaired empathy in both CU+ and CU- subgroups relative to TD children (de Wied et al., 2012). It is possible that previous studies have conflated the effects of CU traits and conduct problems, i.e., those with higher levels of CU traits have tended to be higher in conduct problems as well, whereas in the present study we specifically examined the effects of CU traits within a sample of adolescents with diagnosable levels of conduct problems.

Therefore, it is difficult to ascertain whether our null findings reflect the fact that CU traits have a limited impact on emotion recognition and affective empathy within CD populations, whether they are due to the fact that we had limited statistical power to detect differences between groups, or whether they are explained by the restricted range of CU traits in our sample (as few of our CD participants had extremely high levels of CU traits). Nevertheless, we note that the ICU score used to perform the median split in the present study (30, SD = 8.81) is comparable to or higher than the mean scores reported in previous studies of juvenile offenders that have used the self-report version of the ICU, which have ranged from 23.2 to 29.5, with SD values ranging from 6.4 to 9.4 (Feilhauer et al., 2012; Kimonis et al., 2008a, 2008b, 2016; Wolf & Centifanti, 2014) so the latter explanation seems unlikely.

4.6.1 Strengths and limitations

A major strength of this study was the use of a more ecologically-valid paradigm to simultaneously assess different forms of empathy and the use of video clips depicting discrete primary emotions, rather than just positive or negative emotions as in earlier studies using the EA task (e.g., Lee, Zaki, Harvey, Ochsner, & Green, 2011). The use of relatively naturalistic stimuli containing visual, auditory, and linguistic information means that our findings should be more applicable to real-life social situations than those obtained previously using artificial, highly-simplified stimuli. In addition, the fact that we obtained emotional intensity ratings from the targets themselves means that we were able to study EA for the first time in a CD population – this factor critically differentiates the present EA paradigm from other tasks of its type, such as the Multifaceted Empathy Test (Dziobek et al., 2008). In addition, the CD and control groups were well-characterised from a clinical perspective, psychiatric comorbidity was carefully assessed, and diagnostic information was obtained from multiple informants using standardised, semi-structured interviews.

However, this study also had a number of limitations. Firstly, problems regarding false positives should be acknowledged when examining these findings as we had limited statistical power to detect small effects. Alternatively, it could be claimed that the Holm-Bonferroni correction method may have been too conservative, thereby resulting in false negatives. Either way, issues with limited statistical power should be borne in mind when interpreting these findings. Another important limitation relates to the EA task design. The movable scale used to provide emotion intensity ratings started at a default value of 5 (‘moderate emotion’). This may have discouraged participants from adjusting the scale upwards or downwards until pronounced changes in emotional intensity were detected. This design feature may have reduced the sensitivity of the task and restricted our ability to detect group differences in EA. Although this is the first study to

obtain emotional intensity ratings from the targets themselves, the EA task relies on the target's initial ratings of emotional intensity being accurate. For this reason, it may be advisable to use EA ratings collected from independent healthy samples as the reference point for calculating EA values in future studies.

Furthermore, it is important to note that some emotions were more difficult to empathise with than others. This was particularly true for clips depicting anger, fear, and surprise, where the majority of our participants did not report matched-affect. Although this could be a result of the clips used, it could be argued that some emotions are more likely to evoke the same emotion in the perceiver, whereas anger, for example might evoke alternative emotions in the perceiver, such as fear or sadness. Indeed, previous research has shown that the presentation of happy facial expressions induced happiness in the observer, whilst presenting angry facial expressions evoked fear (Dimberg, 1988). Along similar lines, the affective empathy component of our EA task could, in fact, be measuring sympathy (i.e., feeling *for* another person, without affect matching). Thus, it may be the case that while CD subjects may exhibit deficits in affect matching, they may, however, experience sympathy – future studies may wish to explore this notion.

Another potential limitation of the study is the use of a median split procedure to define the CD/CU+ and CD/CU- subgroups. Although this approach is common in the literature (Jones et al., 2010; de Wied et al., 2012; Schwenck et al., 2012), and there are no agreed cut-offs or norms on the Inventory of Callous-Unemotional traits (ICU), there are limitations to using a median split procedure to dichotomise a continuous variable, including losing or misrepresenting information about individual differences and reducing statistical power (MacCallum et al., 2002). Indeed, we only had adequate statistical power to detect medium and large effects, and were under-powered to detect small effects. In an attempt to address this issue, we also tested for correlations between CU traits and the different measures of empathy. Critically, the findings were largely consistent with those obtained using the median split approach.

It could be argued that using the self-report version of the ICU is problematic as it relies on the ability or motivation of young people to introspect and report on their own empathic capabilities. Although most studies revealing differences between CD/CU+ and CD/CU- individuals in empathic abilities have used parent- or teacher-report measures of CU traits, it is important to note that over 130 published studies have used self-report measures of CU traits or psychopathic traits in children and adolescents (see Frick et al., 2014). Many of these studies observed significant effects of self-reported CU traits. To our knowledge, there is no evidence to suggest that self-report measures of CU traits are less valid than parent-report or teacher-report measures, although we acknowledge that collecting data from multiple informants would have strengthened

the study. Finally, this study was restricted to male participants, so the findings may not generalise to female samples. Consequently, future studies should investigate empathy in females with CD using similar paradigms.

4.7 Conclusion

This study extends previous research on empathy by demonstrating that, even when using rich and multi-sensory stimulus materials that are more ecologically-valid than those used in previous studies, male adolescents with CD still display significant impairments in emotion recognition and affective empathy – these deficits were particularly evident for sadness, fear, and disgust. To our knowledge, this is the first time that an empathic accuracy (EA) task has been used with a population of this kind, and although we did not find any significant differences in EA between the CD and typically-developing groups or between those with CD and higher versus lower levels of CU traits, further investigation of these issues with larger samples is needed. Experimental paradigms such as the EA task could potentially be used to assess empathy in clinical and forensic or judicial settings and to evaluate the effectiveness of interventions designed to enhance empathy in children and adolescents with disruptive behaviour disorders.

Chapter 5: Empathic Accuracy in Female Adolescents with Conduct Disorder and Higher versus Lower Levels of Callous-Unemotional Traits[6]

[6] Publication note: this chapter is based on Martin-Key N. A., Allison, G., & Fairchild, G. (2016). Empathic accuracy in female adolescents with Conduct Disorder and higher versus lower levels of callous-unemotional traits. *European Child and Adolescent Psychiatry*, under review.

Contributions: 70% of the data collection, all analyses, and write up were completed by N. A. Martin-Key. G. Allison assisted with 30% of the data collection and helped compile the supplementary Table S5.1 (see Appendix A). The development and validation of stimuli for the empathic accuracy task were completed by T. Brown. Dr. Fairchild assisted with the interpretation of the findings, as well as the preparation of the manuscript.

5.1 Abstract

Most of the extant research on empathy in young people with Conduct Disorder (CD) has been conducted on males. Although studies with female subjects have primarily found that females with CD exhibit similar difficulties in emotion recognition and affective empathy to CD males, the majority of these studies have employed self-report measures and tasks designed to assess static facial expression recognition. It is therefore uncertain whether or not deficits in empathy would be found if more ecologically-valid stimuli and tasks were employed. The current study used an empathic accuracy (EA) task to examine EA, emotion recognition, and affective empathy in adolescent females aged 13-18 years (23 CD and 29 typically-developing controls). We used a median split procedure to divide the CD sample into two groups: CD with higher (CD/CU+) or lower (CD/CU-) levels of callous-unemotional traits. Participants watched video clips of targets talking about real-life experiences in which they had felt sadness, surprise, disgust, anger, happiness, or fear, and were required to rate the intensity of the emotions experienced by the target on a moment-to-moment basis (measure of EA). Participants also named the primary emotion expressed in each video clip (emotion recognition), and reported the emotion they experienced themselves while watching the clip (affective empathy). CD females exhibited reduced affective empathy for happiness and fear, relative to controls (*ps* < .01, *rs* ≥ .39). Nevertheless, there were no significant group differences in EA or emotion recognition. Furthermore, the CD/CU+ and CD/CU- subgroups performed equally on EA, emotion recognition, and affective empathy. This study significantly extends the literature by revealing impaired affective empathy in adolescent females with CD when employing a more ecologically-valid paradigm.

5.2 Introduction

Empathy has been defined as an individual's emotional response to the affective states of others (Blair, 2005), and it can be fractionated into at least two distinct forms: cognitive empathy or emotion recognition (recognising and understanding others' emotions) and affective empathy (experiencing the same emotion as another person) (Blair, 2013). Despite this distinction, it has been proposed that these two forms of empathy are strongly related (Gonzalez-Liencres et al., 2013). Empathy has been studied extensively in antisocial populations, given that there are several influential theories positing that empathy inhibits aggressive or antisocial behaviour (Blair, 2013; Blair, 1995). Consistent with these theories, prior research has found that adolescents with Conduct Disorder (CD) exhibit emotion recognition and empathic deficits (e.g., Bowen et al., 2013;

Fairchild et al., 2009). Findings in this area have been inconsistent, however, and many of these studies have employed highly simplified stimuli or tasks.

A further limitation of the empathy literature in antisocial populations and CD in particular, is that it has focused primarily on males. Of the previous 28 studies of empathy in children and adolescents with CD or related constructs, such as psychopathic or callous-unemotional (CU) traits, 15 have been solely restricted to males, and 10 have recruited mixed-sex samples, while just three studies have used female-only samples (Table S5.1, see Appendix A). Five of these 28 studies employed self-report questionnaire measures of empathy only, with 1521 of the 3150 participants studied being female. However, it is important to note that just one of these five studies (Dadds et al., 2009) included 1367 females. The remaining 23 studies used a mix of questionnaires and behavioural measures of emotion recognition and empathy. Of the 1823 participants across these latter studies, just 311 were female – thus females with CD or related constructs such as psychopathic traits have been dramatically under-represented in these studies.

Despite this issue, research with female participants has largely found reduced cognitive and affective empathy in females with CD, suggesting similar empathic deficits as have been observed in males with CD (although see Pajer et al., 2010). For instance, Pasalich et al. (2011) examined relationships between callous-unemotional (CU) traits - an index of the affective and interpersonal aspects of psychopathy - and Autism Spectrum Disorders (ASDs) and self-reported cognitive and affective empathy in males and females with conduct problems (CPs). While ASD symptoms were negatively associated with cognitive empathy, CPs in males and females were negatively correlated with cognitive *and* affective empathy. Within the CPs sample, CU traits were found to be inversely related to cognitive and affective empathy in both males and females. Similarly, Brouns et al. (2013) found that female adolescents with moderate levels of psychopathic traits (PTs) scored lower on measures of cognitive and affective empathy than females who were low in PTs.

Empathic deficits in CD have also been assessed via tasks assessing facial expression recognition. For example, Fairchild et al. (2010) investigated facial emotion recognition in females with CD, who were either high (CD/PT+) or low (CD/PT-) in PTs, and typically-developing (TD) controls. Relative to controls, females with CD showed impaired recognition of disgust and anger. Within the CD group, CD/PT+ girls were worse at recognising sad expressions than CD/PT- girls. A similar study found that PTs were negatively correlated with recognition of angry, sad, and fearful facial expressions in both females and males (Blair & Coles, 2000).

Individuals high in PTs have not always been found to show more pronounced deficits in emotion recognition than those with low levels of PTs, however. A study by Schwenck et al. (2014)

employed video clips depicting a neutral face changing to display either angry, happy, sad, fearful or disgusted expressions. The authors assessed emotion recognition performance accuracy and reaction times in girls with CPs and higher (CPs/CU+) versus lower levels (CPs/CU-) of CU traits. Compared to healthy controls, girls with CPs/CU- were slower to identify sad, fearful and happy expressions, as well as being worse than controls at recognising sadness. On the other hand, girls with CPs/CU+ were significantly better than both of the other groups at identifying fearful facial expressions, thereby challenging the notion that impairments in fear recognition are more pronounced in, or specific to, those with high levels of CU traits.

Taken together, these findings largely indicate similar empathic deficits in males and females with CD when using self-report measures and emotion recognition paradigms involving either static or dynamic facial expressions of emotion. Although the latter more closely resemble the stimuli that we are exposed to in everyday social interactions, dynamic stimuli are still relatively low in ecological validity, so it is unclear whether these findings would hold if more naturalistic stimuli were used. Interestingly, our previous study of empathy in males with CD showed that such deficits are present even when the emotional stimuli contain visual, auditory, and linguistic information and the stimulus duration extends to multiple seconds or even minutes (Chapter 4). Our study involved the use of an empathic accuracy (EA) paradigm, where EA is defined as the ability to accurately infer the specific thoughts and feelings of another person, including changes in the intensity of their emotions on a moment-to-moment basis (Ickes, Stinson, Bissonnette, & Garcia, 1990).

The participants in that study, who were all male, watched video clips of targets talking about sad, angry, happy, fearful, surprised, or disgusted real-life experiences and were required to provide ratings of the target's emotional intensity on a moment-to-moment basis (the key measure of EA). They also identified the emotion that the target was experiencing (emotion recognition) and reported the emotion that they felt themselves while watching the film (i.e., affective empathy). There were no significant differences between the CD and TD groups in EA, and also no EA differences between CD participants with higher versus lower levels of CU traits. Regardless of the level of CU traits, however, the CD group showed deficits in sadness, fear, and disgust recognition, relative to the control group. The CD group also exhibited reduced affective empathy for sadness, fear, and disgust. These findings demonstrated deficits in both emotion recognition and affective empathy in males with CD, and challenge the view that empathy deficits are specific to those with elevated CU traits. Furthermore, these findings fit with the notion that cognitive empathy/emotion recognition is strongly related to affective empathy, as the same emotions were impaired in each case. However, this earlier study was restricted to males, so it is currently unclear whether similar deficits would be observed in females with CD.

To address this gap in the evidence base on empathy in females with CD and examine whether empathic deficits would be observed in this group, the present study intended to assess EA, emotion recognition, and affective empathy in female subjects with CD using the same task that was used in our earlier study on males (Chapter 4). In addition, we examined whether CU traits influenced EA task performance within the CD group. We predicted that group differences would be most evident for emotion recognition and affective empathy, with females with CD exhibiting deficits that would be particularly marked for negative emotions such as sadness or disgust. Although we did not find group differences in EA in our study on males, we tested for EA deficits in females with CD, predicting that, if present, these would be most evident for negative emotions. Lastly, we predicted that the female CD/CU+ and CD/CU- subgroups would not differ in terms of empathy, given our previous findings in males.

5.3 Method

5.3.1 Participants

We recruited 52 female adolescents (23 CD, 29 TD) between the ages of 13-18 years through mainstream schools and colleges, pupil referral units, and Youth Offending Services across Hampshire. Informed consent was obtained from all participants above the age of 16, as well as the parents of those aged below 16. Participants under the age of 16 were asked to indicate their assent. This study was approved by the University Ethics Committee and the Southampton County Council Research and Evaluation Unit

Exclusion criteria comprised the following: Intelligence Quotient (IQ) < 70 (calculated using the Wechsler Abbreviated Scale of Intelligence (WASI; Wechsler, 1999)), the presence of ASDs and/or Psychosis. We employed the Schedule of Affective Disorders and Schizophrenia for School-Age Children-Present and Lifetime version (K-SADS-PL; Kaufman et al., 1997) in order to assess for CD, Oppositional Defiant Disorder (ODD), Attention-Deficit/Hyperactivity Disorder (ADHD), Major Depressive Disorder (MDD), Generalised Anxiety Disorder (GAD), Obsessive-Compulsive Disorder, Post-Traumatic Stress Disorder (PTSD), Psychosis, and Alcohol and Substance Use Disorders. The presence of ASDs was evaluated using the ASD module of the unpublished version of the K-SADS-PL based on the DSM-5 criteria. Participants and parents/carers were interviewed separately, and data were combined such that a symptom was considered present if it was reported by either informant, as suggested by Kaufman et al. (1997). The inter-rater reliability of the K-SADS-PL in this study was kappa = .87, which indicates high agreement between raters.

We employed the self-report version of the Inventory of Callous-Unemotional traits (ICU; Frick, 2003; Cronbach's alpha = .78) to assess for levels of CU traits. Within the CD group, participants were classified as being higher (CD/CU+) or lower (CD/CU-) in CU traits using a median split procedure based on total ICU scores. Participants scoring > 28 were categorised as CD/CU+ whereas those scoring ≤ 28 were categorised as CD/CU-. We used the median split procedure in order for our findings to be comparable with earlier work in this area (e.g., de Wied et al., 2012; Jones et al., 2010). Nevertheless, there are limitations to using this procedure (e.g., loss of power). For this reason, we also treated CU traits as a dimensional measure, assessing for correlations between CU traits and EA, cognitive empathy, and affective empathy within the CD and TD groups and across the entire sample. To provide continuity with the previous literature on empathy in adolescents with disruptive behaviour disorders (DBDs), we also included a measure of dispositional empathy: the self-report Interpersonal Reactivity Index (IRI; Davis, 1983; Cronbach's alpha = .66). Participants' ethnicity was characterised as either Caucasian or non-Caucasian and socioeconomic status (SES) was assessed on the basis of parental occupation using the UK Office for National Statistics guidelines (ONS, 2010).

5.3.2 Empathic accuracy task

This task measured whether participants could: a) track changes in the intensity of the target's emotion (EA); b) recognise the target's emotion, and c) experience the same emotion as the target (affective empathy). The current task was adapted from a paradigm originally created by Zaki et al. (2009). In brief, male actors (targets) were filmed talking about real-life experiences in which they had felt discrete primary emotions and rated changes in emotional intensity during the clips using a continuous rating scale (from 0 = no emotion to 9 = very strong emotion) immediately after filming them.

In order to familiarise themselves with the task and the rating scale, participants watched two practice clips. Following this, participants were required to watch 12 test clips comprising two examples of each of the following emotions: anger, happiness, sadness, disgust, fear, and surprise. The lengths of these clips were between 61 and 158 seconds, with a mean duration of 144 seconds. During the presentation of each video clip, participants were asked to rate, on a moment-to-moment basis, the intensity of the emotions being experienced by the target using the same rating scale that was used by the targets themselves during the filming process (*Figure 5.1*A). We calculated the correlation between the targets' continuous ratings of the intensity of their emotions and the perceivers' ratings of emotional intensity on the same scale. The correlation between the target's and the perceiver's continuous ratings formed the dependent measure of EA (see *Figure 5.1*B for examples of low and high correlations). Immediately after each

clip, participants were required to select the emotion-label that best described the target's main emotion during the clip from a list of the six basic emotions. There was also an option of 'no emotion'. Participants also selected the main emotion that *they* had experienced whilst watching the clip (again, with options of the six emotions and 'no emotion').

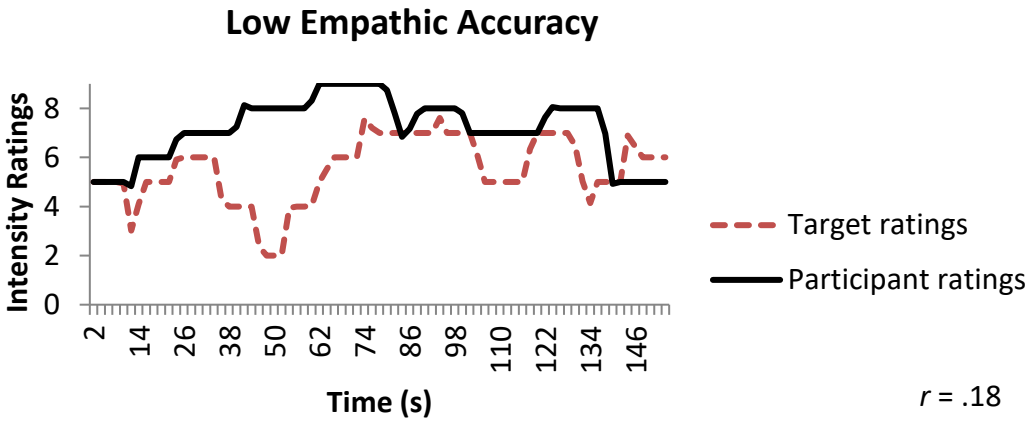
A.

1) Empathic Accuracy (61-158s)

2) Emotion Recognition (unlimited time)

3) Affective Empathy (unlimited time)

B.



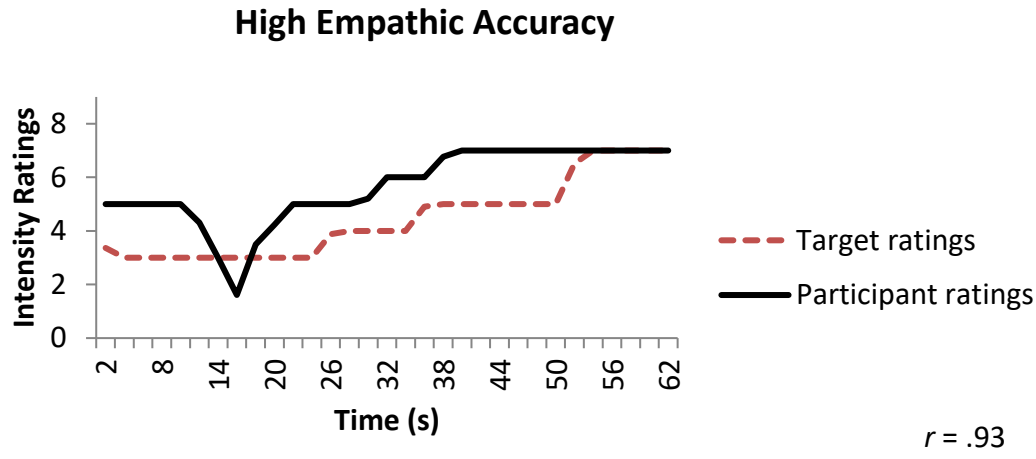


Figure 5.1 Schematic representation of a trial sequence of the empathic accuracy task (panel A) and examples of low and high correlations between the perceiver's and the target's continuous ratings of emotional intensity, i.e., low and high empathic accuracy (panel B).

5.4 Data Analytic Strategy

5.4.1 Empathic accuracy data

EA data were separated by participant and by clip. Mean intensity ratings per two-second period equated to one data point (bin) in our analyses. Correlations between the participants' emotional intensity ratings across all bins and the target's own ratings were calculated. We then employed 2 (Group; CD *vs.* control; CD/CU+ *vs.* CD/CU-) x 6 (Emotion; sadness, happiness, fear, surprise, anger, disgust) mixed-design ANOVAs to compare correlations between groups. In terms of emotion recognition, categorisation accuracy was measured per emotion as the data were non-normal and could not be converted to a normal distribution. Participants could obtain emotion recognition scores of 0, 50, or 100% per emotion (the correct emotion was identified in 0/2, 1/2, or 2/2 clips, respectively). Emotion recognition scores per emotion were compared between groups (CD *vs.* control; CD/CU+ *vs.* CD/CU-) using Mann-Whitney U tests, subject to the Holm-Bonferroni correction method (Holm, 1979). We employed similar statistical procedures to measure affective empathy as the data were non-normal. Participants obtained scores of 0, 50, or 100% for affect matches per emotion (the participant felt the same emotion as the target in 0/2, 1/2, or 2/2 clips, respectively). Affective empathy scores were then compared between groups (CD *vs.* control; CD/CU+ *vs.* CD/CU-) using Mann-Whitney U tests, subject to the Holm-Bonferroni correction method. Effect sizes are reported either as '*r* equivalent' for the direct group comparisons (Rosenthal & Rubin, 2003) (hereafter '*r*'; small ≥ .10, medium ≥ .30, large ≥ .50; Cohen, 1988) or partial eta squared (η_p^2) for the ANOVAs (small ≥ .01, medium ≥ .06, large ≥ .14; Cohen, 1988).

5.5 Results

5.5.1 Demographic and clinical characteristics: CD vs. TD group comparisons

Demographic and clinical characteristics by group and between-group comparisons are shown in Table 5.1. The CD and control groups did not differ in age, IQ, SES, or ethnicity. However, relative to TD controls, CD subjects reported significantly higher levels of CU traits (t (49) = 3.96, $p < .001$, r = .49). Eight of the CD participants had comorbid psychiatric disorders. However, 65% of the CD

group did not have a current comorbid disorder. The TD and CD groups did not differ in rates of mood disorders ($p > .20$; Fisher's Exact Test, FET), but CD females had higher rates of anxiety disorders ($p < .05$; FET). As none of the controls had ADHD, it was not possible to use statistical procedures to test for differences between the CD and control groups for this disorder. There were no significant group differences in empathy on the Personal Distress and Empathic Concern subscales of the IRI, but the CD group obtained significantly lower scores on the Perspective Taking (t (47) = 2.41, $p < .05$, $r = .33$) and the Fantasy subscales (t (47) = 2.14, $p < .05$, $r = .30$), as well as having lower total IRI scores (t (47) = 2.84, $p < .01$, $r = .38$).

Table 5.1 *Demographic characteristics and comorbidity: CD vs.TD comparisons*

	TD (n = 29)	CD (n = 23)	p value
	M (SD)	M (SD)	
Age (years)	16.22 (1.94)	16.06 (1.63)	.77
Estimated IQ	100.17 (12.66)	93.52 (16.11)	.10
Callous-unemotional traits (ICU)	19.39 (6.95)	28.00 (8.59)	<.001
Empathy questionnaire (IRI)			
Perspective-taking	15.79 (5.04)	12.55 (3.98)	.02
Fantasy	14.72 (5.07)	11.45 (5.56)	.04
Empathic concern	17.48 (3.61)	16.30 (2.90)	.23
Personal distress	11.24 (2.92)	11.55 (4.43)	.77
	n (%)	n (%)	
Socioeconomic status ≠			
Higher	15 (52)	8 (35)	.24
Lower	10 (34)	11 (48)	
Missing	4 (14)	4 (17)	
Ethnicity			
Caucasian	26 (90)	22 (96)	.42
Non-Caucasian	3 (10)	1 (4)	

Table 5.1 *Demographic characteristics and comorbidity: CD vs.TD comparisons*

	TD (*n* = 29)	CD (*n* = 23)	*p* value
Psychiatric comorbidity			
ADHD	0 (0)	3 (13)	-
Mood disorder	1 (3)	3 (13)	.20
Anxiety disorder	1 (3)	5 (22)	.04

Note: ≠ Estimated on the basis of parental occupation using Office for National Statistics guidelines; Key: ADHD, attention-deficit/hyperactivity disorder; CD, Conduct Disorder; ICU, Inventory of Callous-Unemotional traits; IQ, intelligence quotient; IRI, Interpersonal Reactivity Index; SD, standard deviation; TD, typically-developing.

5.5.2 Demographic and clinical characteristics: CD/CU+ vs. CD/CU- group comparisons

The CD/CU+ and CD/CU- subgroups were matched in age, ethnicity, SES, and IQ (see Table 5.2). Confirming the effectiveness of the median split, the CD/CU+ group had higher levels of CU traits than the CD/CU- group (t (21) = 5.78, $p < .001$, $r = .78$). CD/CU+ participants scored significantly lower than CD/CU- participants on both total IRI score (t (18) = 2.18, $p < .05$, $r = .46$) and the Empathic Concern subscale (t (18) = 4.15, $p < .01$, $r = .70$). Rates of ADHD and anxiety disorders were similar in the CD/CU- and CD/CU+ subgroups. Due to the absence of mood disorders in the CD/CU+ group, it was not possible to use statistical procedures to test for differences between these subgroups in this variable.

Table 5.2 *Demographic characteristics and comorbidity: CD/CU- vs. CD/CU+ group comparisons*

	CD/CU- (*n* = 13)	CD/CU+ (*n* = 10)	*p* value
	M (SD)	*M* (SD)	
Age (years)	16.29 (1.21)	15.77 (2.09)	.49
Estimated IQ	90.31 (13.74)	97.70 (18.66)	.29
Callous-unemotional traits (ICU)	22.23 (6.25)	35.50 (4.22)	<.001
Empathy questionnaire (IRI)			
Perspective-taking	13.67 (4.05)	10.88 (3.44)	.13
Fantasy	11.42 (5.66)	11.50 (5.78)	.98
Empathic concern	17.92 (2.43)	13.88 (1.55)	<.001
Personal distress	12.25 (4.79)	10.50 (3.89)	.40

Table 5.2 *Demographic characteristics and comorbidity: CD/CU- vs. CD/CU+ group comparisons*

		CD/CU- (*n* = 13)	CD/CU+ (*n* = 10)	*p* value
		n (%)	*n* (%)	
Socioeconomic status ≠				
	Higher	4 (31)	4 (40)	.85
	Lower	6 (46)	5 (50)	
	Missing	3 (23)	1 (10)	
Ethnicity				
	Caucasian	13 (100)	9 (90)	.24
	Non-Caucasian	0 (0)	1 (10)	
Psychiatric comorbidity				
	ADHD	1 (8)	2 (20)	.39
	Mood disorder	3 (23)	0 (0)	-
	Anxiety disorder	3 (23)	2 (20)	.86

Note: ≠ Estimated on the basis of parental occupation using the Office for National Statistics guidelines; Key: ADHD, attention-deficit/hyperactivity disorder; CD/CU+ and CD/CU-, Conduct Disorder with high and low levels of callous-unemotional traits; ICU, Inventory of Callous-Unemotional traits; IQ, intelligence quotient; IRI, Interpersonal Reactivity Index; SD, standard deviation

5.5.3 Correlations between dispositional empathy (measured using the IRI) and empathic accuracy, emotion recognition, and affective empathy

The validity of the current EA task was assessed by testing for correlations between the dependent measures (EA, emotion recognition, and affective empathy) and total IRI score, as well as the Perspective Taking, Fantasy, Empathic Concern, and Personal Distress subscales. We found positive correlations between Empathic Concern scores and overall EA performance ($r = .33$, $p < .05$), and between Fantasy scores and overall affective empathy ($r = .32$, $p < .05$). However, IRI scores and emotion recognition were not significantly correlated.

5.5.4 Empathic accuracy: CD vs. TD group comparisons

We tested for group differences in EA – i.e., participants' ability to identify changes in emotional intensity when viewing targets describing emotionally-charged real-life experiences. Due to

technical error, data from two subjects were lost, leaving 22 CD and 28 TD participants' data available for analysis. No significant main effect of Group was found (F (1, 48) = 2.03, p = .16, η_p^2 = .04), with the CD and TD groups not differing in EA (see Table 5.3). Additionally, there was no interaction between Group and Emotion (F (4.02, 192.85) = .89, p = .47, η_p^2 = .02).

Table 5.3 *Empathic accuracy descriptive statistics: CD vs. TD comparisons*

	TD (n = 28[a])	CD (n = 22[a])
Emotion	Mean correlation (r) (SE)	Mean correlation (r) (SE)
Sadness	.36 (.04)	.27 (.07)
Happiness	.42 (.06)	.33 (.07)
Fear	.34 (.07)	.35 (.08)
Surprise	.38 (.06)	.36 (.08)
Anger	.29 (.05)	.18 (.07)
Disgust	.33 (.09)	.10 (.11)

Note: Mean scores have been transformed back to correlation coefficient scores (r) from Fisher's Z for ease of interpretation. Key: CD, Conduct Disorder; SE, standard error; TD, typically-developing. [a]Empathic accuracy data were unavailable for one TD and one CD subject due to technical difficulties.

5.5.5 Empathic accuracy: CD/CU+ vs. CD/CU- group comparisons

There was no main effect of Group (F (1, 20) = 1.01, p = .33, η_p^2 = .05), with the CD/CU+ and CD/CU- subgroups not differing in EA. Furthermore, there was no significant Group-by-Emotion interaction (F (5, 100) = .58, p = .72, η_p^2 = .03; see Table 5.4).

5.5.6 Empathic accuracy: CU traits

When treating CU traits as a dimensional measure, there were no significant correlations between CU traits and EA for any of the six primary emotions within the CD and TD groups, nor across the entire sample (all r values < -.26, ps > .24).

Table 5.4 *Empathic accuracy descriptive statistics: CD/CU- vs. CD/CU+ group comparisons*

	CD/CU- (*n* = 13)	CD/CU+ (*n* = 9[a])
Emotion	Mean correlation (*r*) (SE)	Mean correlation (*r*) (SE)
Sadness	.32 (.09)	.20 (.12)
Happiness	.42 (.10)	.19 (.10)
Fear	.42 (.12)	.26 (.12)
Surprise	.36 (.12)	.37 (.13)
Anger	.21 (.08)	.15 (.13)
Disgust	.22 (.14)	-.06 (.15)

Note: Mean scores have been transformed back to correlation coefficient scores (*r*) from Fisher's Z for ease of interpretation. CD/CU- = Conduct Disorder with low levels of callous-unemotional traits; CD/CU+ = Conduct Disorder with high levels of callous-unemotional traits; SE, standard error. [a]Data were unavailable for one CD/CU+ subject due to technical difficulties.

5.5.7 Emotion recognition: CD vs. TD group comparisons

There were no significant differences between the CD and TD groups for any of the six emotions (all *ps* > .54; see *Figure 5.2*A).

5.5.8 Emotion recognition: CD/CU+ vs. CD/CU- group comparisons

No significant differences were found between the CU traits subgroups for any of the emotions (all *ps* > .23; see *Figure 5.2*B).

5.5.9 Emotion recognition: CU traits

When treating CU traits as a dimensional measure, no significant correlations emerged between CU traits and emotion recognition within the CD and TD groups, nor across the entire sample (all *ps* > .18).

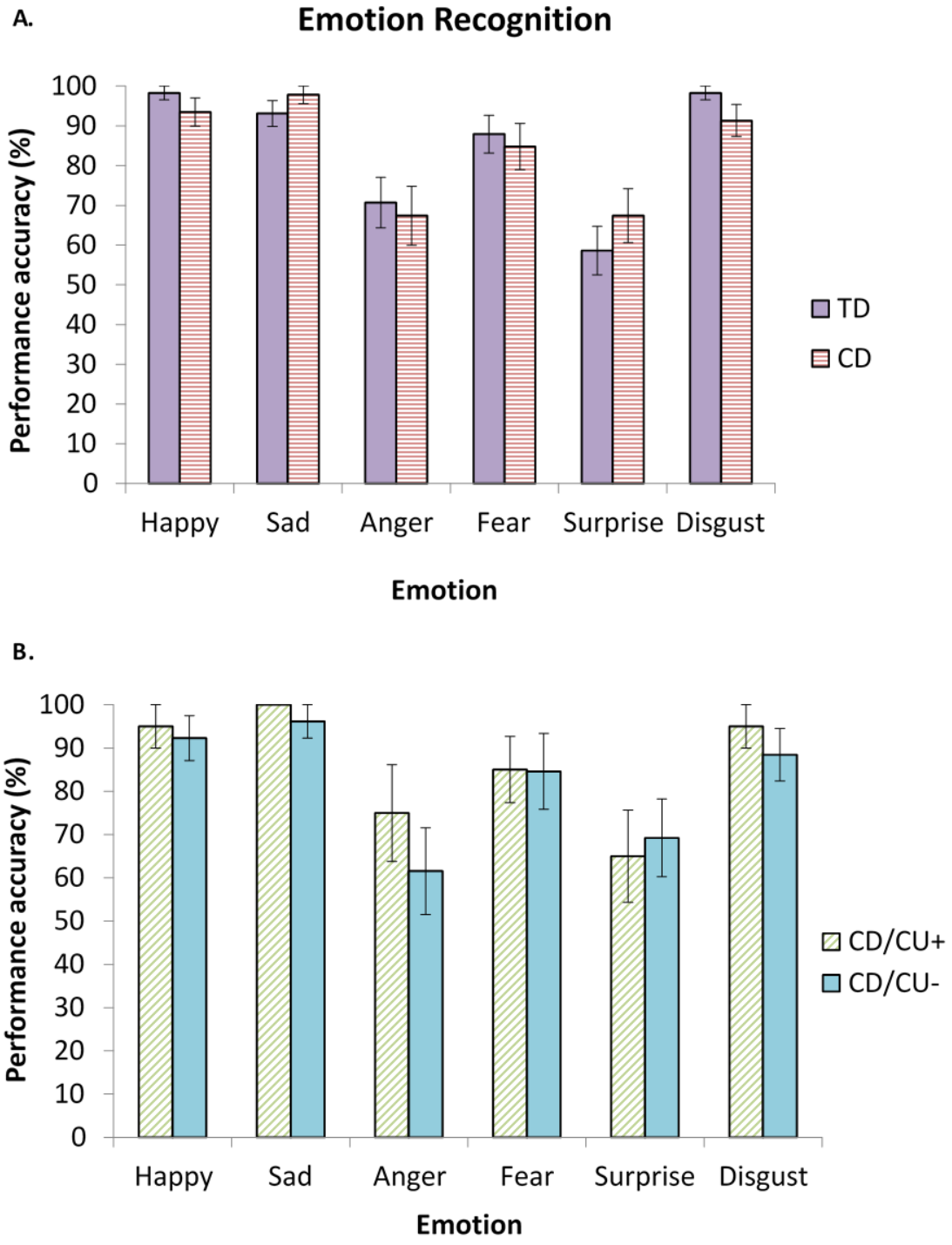


Figure 5.2 Mean emotion recognition scores for the typically-developing (TD) and Conduct Disorder (CD) groups (panel A), and the higher (CD/CU+) and lower (CD/CU-) callous-unemotional traits subgroups (panel B) (error bars show +/-Standard Error).

5.5.10 Affective empathy: CD vs. TD group comparisons

Relative to controls, participants with CD reported fewer affect matches when watching clips portraying happiness (U = 170.50, z = -3.21, p < .01, r = .45) and fear (U = 199, z = -2.79, p < .05, r = .39), while there were trends towards the CD group reporting fewer affect matches for sadness (p = .07, r = .33) and disgust (p = .07, r = .32; see *Figure 5.3*A). All of these group differences and trends had medium effect sizes.

5.5.11 Affective empathy: CD/CU+ vs. CD/CU- group comparisons

No significant differences were found between the CU traits groups for any of the emotions (all *ps* > .41; *Figure 5.3*B).

5.5.12 Affective empathy: CU traits

When treating CU traits as a dimensional measure, no correlations were found between CU traits and affective empathy within the CD and TD groups, nor across the entire sample (all *ps* > .17).

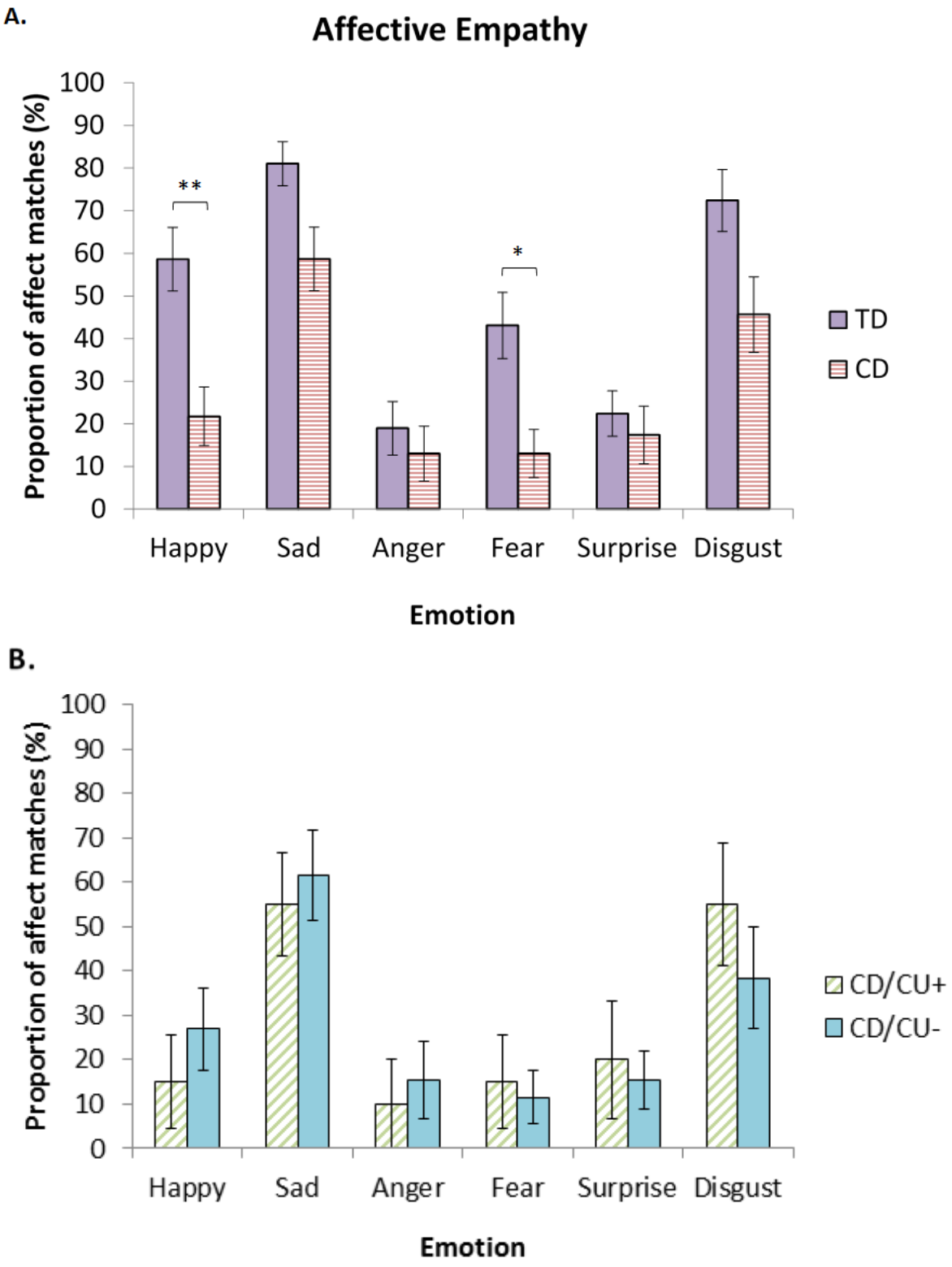


Figure 5.3 Mean affect matches to emotions displayed by targets in the typically-developing (TD) and Conduct Disorder (CD) groups (panel A) and in the higher (CD/CU+) and lower (CD/CU-) callous-unemotional traits subgroups (panel B) (error bars show +/-Standard Error). *Note.* The *p*-values shown are those obtained after applying the Holm-Bonferroni correction for multiple comparisons; *$p < 0.05$. **$p < 0.01$.

5.5.13 Potential confounds

Here we assessed whether the significant group differences in affective empathy were attributable to group differences in psychiatric comorbidity (i.e., ADHD, anxiety disorders). We ran multiple regression analyses to test whether CD or other psychiatric disorders were more important in explaining the observed group effects. Neither ADHD nor anxiety disorders were significant predictors of affective empathy for happiness or fear (all standardised *βs* < .16, *ps* > .23), suggesting that the main findings were not driven by group differences in psychiatric comorbidity. Having a diagnosis of CD was uniquely associated with reduced affective empathy for these emotions (standardised *βs* > -.36, *ps* < .05), with CD accounting for ≥ 18% of the variance in affective empathy (all R^2s > .18, *Fs* > 2.61, *ps* < .05).

5.6 Discussion

To date, research investigating empathy in young people with Conduct Disorder (CD) has focused primarily on males. Nonetheless, existing research with females with CD has provided some evidence for emotion recognition and affective empathy deficits in this group, suggesting that females and males show comparable impairments in these domains. Findings in this area have been inconsistent, however, and many of these studies have employed highly simplified stimuli or tasks. To address some of these methodological limitations and investigate which aspects of empathy are impaired, the present study assessed empathic accuracy (EA), emotion recognition, and affective empathy in female adolescents with CD and higher versus lower levels of CU traits using a more ecologically-valid task than has been used previously, which involved watching video clips of actors recalling emotional experiences from their own lives. We caution that issues with small sample sizes and limited statistical power must be taken into consideration when interpreting these findings. Relative to typically-developing (TD) females, females with CD exhibited reduced affective empathic responses to the emotions displayed by others – these difficulties were particularly marked for fear and happiness. It should be noted, however, that the groups did not significantly differ in their ability to continuously track changes in emotional intensity (EA) or identify the targets' emotions (emotion recognition).

While the latter finding of intact emotion recognition goes against our hypothesis and earlier studies showing impaired emotion recognition in females with CD (e.g., Fairchild et al., 2010), not all studies have reported impairments in emotion recognition in females with CD (Pajer et al., 2010), while another report found only weak evidence for emotion recognition impairments in females with conduct problems (Schwenck et al., 2014). Furthermore, our findings are perhaps not surprising given that the stimuli used in the present task contain visual, auditory, and linguistic

information and last for multiple seconds or even minutes. It seems that under these more naturalistic conditions, female adolescents with CD are capable of overcoming the emotion recognition impairments that they display when viewing briefly-presented static facial expressions in standard alternative-forced choice tasks (e.g., Blair & Coles, 2000; Fairchild et al., 2010). Interestingly, we recently demonstrated that males with CD have difficulties recognising others' disgust, sadness, and fear, even when using the same stimuli as were used in the present experiment, which are more ecologically-valid than the stimuli used in the majority of previous research (Chapter 4) . Considered together, the results of these two studies using the EA task imply that males with CD are more likely to show emotion recognition impairments in real-life social situations than females with CD. It should be noted, however, that we may have been able to demonstrate emotion recognition deficits in females with CD in the present study if our sample size had been larger. Indeed, we only had adequate statistical power to detect medium and large effects, and were under-powered to detect small effects. Nevertheless, we note that it is challenging to recruit females with CD and this is still one of the largest experimental studies to investigate empathy in females with CD (Table S5.1, see Appendix A).

When considering affective empathy, we found that females with CD showed reduced affective empathy for fear and happiness, relative to TD controls. In line with our study on males, the group differences in affective empathy had medium effect sizes. These findings are interesting, given that females with CD did not exhibit deficits in fear or happiness *recognition* – the impairments were specific to affective empathy. In line with our study of males, we note that the overall pattern of affective matching to different emotions was similar in the TD and CD groups, but simply shifted downwards in the latter. These findings suggest that empathy deficits in females with CD may be more pronounced or specific to affective empathy, which has potential implications for intervention practices. Consequently, enhancing affective empathy in females with CD may prove more beneficial than targeting cognitive empathy or facial emotion recognition.

We also investigated the impact of variation in CU traits on empathy in females with CD by comparing the CD/CU+ and CD/CU- subgroups in terms of empathic accuracy, emotion recognition, and affective empathy. This was done to explore whether empathy deficits were more pronounced, or only present, in the CD/CU+ subgroup. As predicted, we found no differences between the two subgroups for any of the dependent measures. When treating CU traits as a dimensional measure, which is arguably a more powerful approach than using a median split, the findings were consistent with those obtained using the median split approach – i.e., CU traits were not associated with any of our empathic measures. These results suggest that CD in females is associated with impairments in affective empathy that are largely independent from

co-occurring CU traits. These findings are consistent with the results of our previous study, in which males with CD/CU+ did not differ from CD/CU- males (Chapter 4), and are in accordance with studies demonstrating that both high and low levels of CU traits in children with DBDs are associated with impaired empathy (e.g., de Wied et al., 2012).

5.6.1 Strengths and limitations

Our study has a number of strengths - as opposed to previous EA studies that have simply employed positively- and negatively-valenced stimuli (e.g., Lee et al., 2011), the current study used video clips portraying discrete primary emotions. The use of a more ecologically-valid paradigm, including visual, auditory, and linguistic content, suggests that our findings may be more applicable to real social encounters than those obtained using artificial stimuli and/or paradigms. Further strengths regard the fact that the CD and control groups were well-characterised from a clinical perspective, psychiatric comorbidity was measured carefully, and diagnostic information was obtained from both the participants and their caregivers using semi-structured interviews.

Nonetheless, this study also had a number of limitations. Given the difficulty of recruiting females with CD, our sample size was relatively small (n = 52), meaning that some of the present findings could reflect false positives. On the other hand, it is likely that the Holm-Bonferroni method of correcting for multiple comparisons may have been too conservative, leading to false negatives. Therefore, the findings from the current study should be interpreted with caution. A further limitation regards the EA task design, whereby the scale provided for rating changes in emotional intensity started at a default value of 5 ('moderate emotion'). This may have discouraged participants from moving the scale upwards or downwards until substantial changes in emotional intensity were perceived. Furthermore, the EA task depends on the target's initial emotional intensity ratings being accurate. Indeed, targets may have been swayed by their own feelings concerning the autobiographical episode rather than rating the emotions displayed during the clip itself.

It is also important to note that all clips in the EA task involved a male target talking about his life experiences. It would be interesting to investigate the effect of the target's sex on different aspects of empathy, and particularly affective empathy. Furthermore, some of the clips, such as those depicting anger and surprise, were more difficult to empathise with than others – irrespective of group status. Previous research has shown that some classes of emotional stimuli are more likely to trigger congruent emotions in the observer than others – e.g., happy expressions induced happiness in the observer, whilst angry expressions evoked fear (Dimberg,

1988). On a related note, we did not explore whether our CD subjects experienced sympathy (i.e., feeling *for* another person, without affect matching). Indeed, while some clips may have been particularly difficult to empathise with, our subjects may have still experienced sympathy – future EA studies may wish to explore this.

Finally, the use of the self-report version of the Inventory of Callous-Unemotional traits may be regarded as problematic, particularly as it relies on adolescents' ability to introspect and report on their own empathic skills. On the other hand, while most of the research revealing differences in empathy between those with higher and lower CU traits has used parent or teacher ratings, over 130 published studies have used self-report measures of CU traits or psychopathic traits in children and adolescents (see Frick et al., 2014). Many of these studies observed significant effects of self-reported CU traits. To our understanding, there is no evidence to suggest that self-report measures of CU traits are less valid than parent- or teacher-report measures, although we recognise that obtaining data from multiple informants would have strengthened this study.

5.7 Conclusion

Relative to typically-developing females, female adolescents with Conduct Disorder (CD) exhibited reduced affective empathy for happiness and fear. However, there were no significant group differences for empathic accuracy or emotion recognition, indicating that females with CD are capable of tracking changes in emotional intensity and labelling others' emotions when more ecologically-valid stimuli containing visual, auditory, and linguistic information are used. Furthermore, our findings challenge the view that empathy deficits are specific to individuals with CD who are high in callous-unemotional traits. Although further studies with larger sample sizes and improved stimuli depicting male and female targets are needed to replicate and extend these results, the present findings have potential implications for intervention practices. For example, they suggest that enhancing affective empathy in females with CD may be more beneficial than trying to improve facial emotion recognition or cognitive empathy skills in this group.

Chapter 6: General Discussion

The key objective of this thesis was to characterise the nature of the emotion recognition and empathy deficits observed in male and female adolescents with Conduct Disorder (CD) and varying levels of callous-unemotional (CU) traits. Another important aim was to explore the mechanisms underlying such emotion recognition deficits using concurrent behavioural and eye-tracking methods. This chapter will begin by summarising the key findings from each of the studies described in this thesis (see Table 6.1 for an overview). Where possible, it will consider the potential implications of the results for our understanding of CD and CU traits, as well as theoretical models such as the Violence Inhibition Mechanism (VIM; Blair 1995) and the Integrated Emotion Systems (IES; Blair, 2005) models. Following this, the chapter will consider the implications of the present findings for interventions aiming to remediate the emotion recognition and empathy difficulties shown by those with CD and CU traits. The general strengths and limitations of the studies will be discussed, as well as ideas for future research. Finally, this chapter will end with a general conclusion.

6.1 Summary of Key Findings

Many studies have shown an association between empathy-related deficits, including impairments in facial expression recognition, and antisocial behaviour. Nonetheless, findings to date have been inconsistent across studies and most of the studies in this area have employed static, high-intensity facial expressions of emotion, which do not resemble the stimuli that we see in everyday social interactions. In the first study described in this thesis (Chapter 2), we aimed to characterise facial emotion recognition in male and female adolescents with CD using more naturalistic stimuli. We generated a set of facial stimuli with varying levels of emotion intensity (30-100%) by morphing facial expressions showing strong emotions with neutral faces. A set of dynamic stimuli was also included, with both manipulations designed to improve the ecological validity of this study and test whether the deficits reported in previous studies may have been related to the use of artificial stimuli. We also combined the behavioural task with highly-sensitive eye-tracking measurements in order to examine whether CD-related deficits in emotion recognition could be explained by atypical patterns of fixation (e.g., fixating less on the eyes).

The results revealed that CD status and gender were significant independent predictors of emotion recognition, such that having a diagnosis of CD and being male were associated with the lowest levels of overall emotion recognition performance. These findings fit with research demonstrating a global deficit in emotion processing in CD (e.g., Fairchild et al., 2009, 2008; Sully et al., 2015), as well as studies revealing a female superiority in emotion recognition (Mcclure, 2000). Importantly, this pattern of findings was seen for both dynamic and static stimuli, and held

across different emotion intensities, suggesting that previous findings in this area were not explained by the use of highly artificial stimuli in the earlier experimental paradigms.

Similarly, when considering each emotion separately, having a diagnosis of CD and being male were both related to poorer recognition of angry faces. This finding contradicts theories positing that antisocial individuals are hypersensitive to threat signals (i.e., anger) (Crick & Dodge, 1994), while being highly consistent with studies finding deficits in anger recognition in adolescents with CD (Fairchild et al., 2009; 2010), as well as in adults with impulsive aggression (Best, Williams, & Coccaro, 2002). We also found an association between CD status and fear recognition, such that having a diagnosis of CD predicted reduced fear identification. Once again, this finding is highly consistent with previous research finding impaired fear identification in males with adolescent-onset CD (Bowen et al., 2013; Fairchild et al., 2009; Short et al., 2016; Sully et al., 2015), girls with conduct problems (CPs) (Schwenck et al., 2014), and mixed-samples of antisocial children (Bowen & Dixon, 2010). When reanalysing the data using bias-corrected scores (see Wagner, 1993 for details), all categorisation accuracy models remained the same, except for categorisation accuracy for surprise, where the detrimental effect of having CD on recognition accuracy for this emotion remained a significant predictor. This finding accords with previous research demonstrating reduced surprise recognition in individuals with CD (e.g., Sully et al., 2015), and further suggests that CD subjects' poor facial expression identification skills may not be limited to negative emotions.

In terms of the eye movement data, we found that being female was associated with an increased tendency to fixate the eye region of the face across all emotion categories. This pattern of findings accords with previous research demonstrating that females fixate more on the eye region of faces, relative to males (e.g., Birmingham, Bischof, & Kingstone, 2008; Hall et al., 2010). Critically, to our knowledge, this is the first study to replicate this finding in a sample of adolescents. Indeed, further research is needed to ascertain when this sex difference in fixation patterns emerges. In principle, this female-specific advantage in terms of emotion recognition and attention to the eyes suggests an association between successful emotion recognition performance and higher levels of attention to the eye region. Indeed, attending the eye region was positively associated with emotion recognition performance for angry, happy, and sad faces. However, our findings do not support the notion of eye movement behaviour being a mediating factor between gender and emotion recognition, signifying that the appraisal and attentional systems underlying emotion recognition may run in parallel to each other.

Importantly, when considering each emotion separately, having a diagnosis of CD and being male were independently related to reduced attention to the eyes when viewing sad, surprised, and

fearful expressions. Given that our CD samples had higher levels of CU traits relative to our typically-developing (TD) groups, our findings are somewhat in line with Dadds and colleagues' (2008) demonstration of reduced attention to the eyes in males with high CU traits. Critically, our findings suggest that this pattern of atypical eye movements is present in adolescents with diagnosable levels of CPs, irrespective of the level of CU traits. Given that a diagnosis of CD was associated with a reduced ability to recognise fear, and having CD and being male were both related to reduced attention to the eyes of fearful faces, it could be argued that the latter may explain such difficulties in fear identification. Once again, however, our findings did not support this hypothesis. In fact, while CD and gender were the strongest predictors of emotion recognition impairments and eye movement behaviour, attention to the eyes did not explain any additional variability in emotion recognition performance. Therefore, appraisal mechanisms may play a more important role than attentional issues in the emotion recognition deficits exhibited by adolescents with CD.

In our second study (Chapter 3), we employed an emotion recognition task with concurrent eye-tracking to explore whether male and female adolescents with CD exhibit impaired recognition and attention to dynamic and static *body expressions* of emotion. Our results demonstrated that males with CD exhibited a reduced ability to recognise body expressions of emotion, whereas females with CD performed similarly to female controls. This pattern of findings was observed across all emotion categories and held for both static and dynamic stimuli. These findings accord with previous research revealing a global deficit in *facial* expression processing in CD (e.g., Fairchild et al., 2009; 2008; Short et al., 2016; Sully et al., 2015), as well as with the findings from our first study (Chapter 2), where we found a global deficit in facial expression recognition, which was more pronounced for males with CD. Critically, however, this pattern of findings differs to our first study (Chapter 2), where CD and gender operated additively – having CD and being male were *independent* predictors of poorer facial expression recognition. In this case (Chapter 3), CD and gender interacted with each other, such that males with CD, but not females, exhibited significant impairments in body expression recognition, relative to their sex-matched control groups. Given that studies on body expression recognition have been conducted using all-male samples (Muñoz, 2009; Wolf & Centifanti, 2014), these findings have extended the literature by revealing that adolescent females with CD do not show difficulties recognising body expressions of emotion.

When considering each emotion separately, however, we did not find impaired emotion recognition performance in males with CD for individual emotions. Although these findings may seem surprising, and contradict our previous finding of reduced emotion recognition performance at a global level, it is important to note that we only had adequate statistical power to detect

medium to large effects, and were underpowered to detect small effects (i.e., deficits for individual emotions. It is evident that replication with larger sample sizes is needed in order to ascertain whether males with CD demonstrate impairments for specific emotions. Furthermore, future studies should include all six primary emotions.

In terms of the eye movement data, being female was related to an increased tendency to fixate the arms first and for more of the trial time across all emotions. This finding suggests that there may be female-specific protective effects on attention to emotionally-salient information, and are in accordance with our eye movement findings for our facial expression study (Chapter 2), where we found that being female was associated with an increased tendency to fixate the eye region of the face across all emotion categories. Furthermore, this finding extends previous research demonstrating that males are less likely to orient towards emotionally-informative regions, such as the eye region of the face (Hall et al., 2010), by showing that similar gender effects are observed during body expression processing. To our knowledge, this is the first study that has shown this gender-specific effect on attention to emotionally-salient information when processing body expressions of emotion.

When considering each emotion separately, we found that having a diagnosis of CD and being male were both independently related to a reduced tendency to fixate the arms of fearful and neutral body expressions. As with our study on facial expression recognition (Chapter 2), our findings do not support the notion that abnormal fixation patterns (i.e., a reduced preference for the arm region) mediate the relationship between CD and body expression recognition impairments. Once again, our data suggest that the difficulties in emotion recognition shown by males with CD appear to be explained by problems in the interpretation of stimuli that have been encoded (i.e., appraisal mechanisms), rather than issues orienting towards informative regions of the body (i.e., the arms).

Taken together, the findings from our first two studies (Chapters 2 and 3) highlight that individuals with CD, and particularly males, demonstrate pervasive emotion recognition deficits. Chapter 2 revealed that young people with CD exhibit global deficits in facial expression recognition, which are more pronounced for males with CD and for negative emotions like anger. Importantly, the recognition of fear appears to be equally impaired for males and females with CD. Chapter 3 demonstrated global deficits in body expression recognition in males, but not females, with CD. Importantly, we demonstrated that difficulties in facial and body expression recognition were still present when the stimuli were presented in a dynamic format, suggesting that individuals with CD, and particularly males with CD, may not be able to recognise others' emotional expressions in everyday social encounters. Additionally, our studies suggest that

appraisal mechanisms may play a more important role than attentional issues in the emotion recognition deficits exhibited by adolescents with CD.

Given that previous findings for facial expression recognition have been inconsistent across studies, and the lack of research examining the identification of body expressions of emotion, we felt that it was necessary to study emotion recognition from faces and bodies separately in the first instance. We acknowledge, however, that stimuli that combine facial and body expressions, as well as vocal and linguistic information, would aid in our understanding of how these adolescents may process emotions in everyday social contexts. Furthermore, recognising others' emotions, despite being a key component of empathy, does not encapsulate the full concept of empathy, which also includes sharing the emotions of others. It is unlikely, for example, that briefly presented fearful or angry facial or body expressions elicit similar emotions in the observer during the emotion recognition tasks.

Therefore, the final two studies described in this thesis (Chapters 4 and 5) employed a more ecologically-valid paradigm to study emotion recognition, as well as further aspects of empathy, namely empathic accuracy (EA) and affective empathy. EA is defined as the ability to track changes in another individual's emotional states on a moment-to-moment basis, whereas affective empathy regards the sharing of another person's emotional states, even though such emotions might be more appropriate to the target than the observer's current situation. Chapter 4 described a study using the EA task in males with CD and TD male controls, whereas Chapter 5 described a companion study using the same task in females with CD and female comparison subjects.

In the study on males (Chapter 4), we found that adolescents with CD were as good as TD adolescents at identifying changes in emotional intensity – there were no group differences in EA. However, we found that the CD group exhibited impairments in emotion recognition for disgust, sadness, and fear. This suggests that it might not be necessary for an individual to identify another person's emotion in order to correctly judge changes in intensity. These findings largely support studies that have found an association between impaired negative emotion recognition and antisocial behaviour in children, adolescents, and adults (e.g., disgust; Fairchild et al., 2009; Kosson, Suchy, Mayer, & Libby, 2002, sadness; Blair et al., 2001, Fairchild et al., 2009, fear; see Marsh & Blair, 2008 for a meta-analysis).

In line with the first study in this thesis (Chapter 2), our findings suggest that CD in males may be related to pervasive impairments in emotion recognition. Critically, the findings from the present study go a step further by demonstrating that, even when the emotional stimuli include visual, auditory, and linguistic information, and the stimulus duration extends to multiple seconds or

even minutes, adolescent males with CD still exhibit marked difficulties in recognising others' emotions. In terms of affective empathy, we found that CD males showed reduced empathy for sadness, fear, and disgust compared with TD controls. Given that the same emotions were impaired for both the emotion recognition and affective empathy components of the task, these findings support the idea that empathy is a multi-faceted phenomenon, which requires both the identification/understanding of another's emotional states and affect-sharing.

Our study of females (Chapter 5) demonstrated that females with CD did not differ from TD females in terms of the ability to continuously track changes in emotional intensity (i.e., EA) and recognise others' emotions. While the latter finding goes against our initial predictions, it seems that, when using more naturalistic stimuli, females with CD are capable of overcoming the emotion recognition impairments that they typically show when viewing static facial expressions in standard alternative-forced choice tasks (e.g., Blair & Coles, 2000; Fairchild et al., 2010). As with the first two studies in the thesis (Chapters 2 and 3), our findings suggest that there may be female-specific protective effects on emotion recognition in CD. Compared to males with CD, females with CD may use auditory and linguistic information to a greater extent when trying to identify others' emotions, thereby compensating for their poorer facial expression recognition skills. Alternatively, relative to males with the same disorder, females may exhibit less of an impairment in emotion recognition, suggesting that when using a more naturalistic task, their performance levels become normalised.

Importantly, females with CD exhibited reduced affective empathy for fear and happiness – i.e., they were less likely to feel happy or fearful when others were feelings these emotions, relative to TD females – despite showing intact EA and emotion recognition. These findings suggest that empathic deficits in females with CD may be more discernible (or only present) for affective empathy, in contrast to the more global deficits that were observed in males with CD on the same task. It is important to bear in mind, however, that all clips involved a male target talking about his experiences. It may be the case that female subjects would have reported higher levels of affective empathy if we had used clips involving female targets. In fact, research has demonstrated that while adolescent females tend to report higher levels of affective empathy towards male and female targets, relative to adolescent males, they report even higher levels of affective empathy towards a target of the same sex (Stuijfzand et al., 2016). The authors only examined affective empathy for sadness, so it is unclear whether the same pattern of findings would be found for other emotions. Consequently, future studies should include both male and female targets across a range of different emotions. An overview of the key findings from this thesis is provided in Table 6.1

Table 6.1 *Summary of key findings for each study described in this thesis, as a function of group status, gender, and CU traits*

	Key findings			
	Task	Group effects	Gender and Gender × Group interactions	CU traits
Chapter 2	Facial expression recognition task with concurrent eye-tracking	CD < TD: emotion recognition: overall, anger, fear, surprise; initial eye preference: sadness and surprise; total eye preference: fear.	Males < females: emotion recognition: overall, anger, disgust, sadness, surprise; initial eye preference: overall, anger, fear, happiness, sadness, and surprise; total eye preference: overall and per emotion.	CU traits ↓ fear recognition across whole sample; CU traits *within* CD group ↑ fear recognition.
Chapter 3	Body expression recognition task with concurrent eye-tracking	CD < TD: emotion recognition: overall; initial arm preference: fear; total arm preference: fear and neutral.	Gender x Group: overall emotion recognition: CD males < TD males; CD females = TD females. Males < females: initial arm preference: overall and neutral; total arm preference: overall, fear, and neutral.	CU traits across whole sample ↓ total arm preference for fear. CU traits *within* CD group ↑ initial arm preference for fear, and total arm preference for overall, fear and neutral. The opposite was found for TD controls. CU traits in males ↑ initial arm preference for overall and neutral, and total arm preference for overall, anger, fear, and neutral. The opposite was found for females.

Table 6.1 *Summary of key findings for each study described in this thesis, as a function of group status, gender, and CU traits*

	Key findings			
	Task	Group effects	Gender and Gender × Group interactions	CU traits
Chapter 4	EA task (males)	CD < TD: emotion recognition for fear, disgust, and sadness; affective empathy for fear, disgust, and sadness.	-	CU traits *within* CD group ↓ EA for sadness. CD/CU+ = CD/CU-: EA for all other emotions; emotion recognition and affective empathy for *all* emotions
Chapter 5	EA task (females)	CD < TD: affective empathy for fear and happiness.	-	CD/CU+ = CD/CU-: EA, emotion recognition, and affective empathy for all emotions.

Note: ↓ negative association; ↑ positive association. Key: CD, Conduct Disorder; CU, CD/CU+, Conduct Disorder with higher levels of callous-unemotional traits; CD/CU-, Conduct Disorder with lower levels of callous-unemotional traits; CU, callous-unemotional traits; EA, empathic accuracy; SES, socioeconomic status; TD, typically-developing.

6.2 Callous-Unemotional Traits

Callous-emotional (CU) traits have been characterised as designating an important personality factor contributing towards the aetiology of CD (Frick et al., 2014). These traits have become increasingly emphasised in theoretical models and empirical studies, and the DSM-5 has included an additional specifier to the diagnosis of CD, referred to as the 'with Limited Prosocial Emotions' (LPE) specifier (American Psychiatric Association, 2013). This specifier is proposed to provide additional information about the current and future impairments related to the diagnosis of CD, including serving as a clinical indicator of greater psychosocial disturbance and psychiatric vulnerability (Frick & Nigg, 2012). Therefore, a secondary aim of the studies in this thesis was to examine the effects of CU traits on emotion recognition, attention to emotionally-salient stimuli, and empathy. An overview of the key findings from this thesis is provided in Table 6.1.

In the first study described in this thesis (Chapter 2), we found that CU traits (across the whole sample) were associated with a reduced ability to recognise fear. In those with CD, however, CU traits were associated with a small effect in the opposite direction, such that elevated CU traits were related to a slight increase in performance accuracy for fearful expressions. The former finding is consistent with previous work finding impairments in fear recognition in children with higher levels of psychopathic traits (e.g., Blair et al., 2001), and support Blair's (1995) VIM model, as well as the extended IES model (Blair, 2005). The latter finding, however, contradicts previous research demonstrating poorer fear recognition in individuals with CD and high CU traits, relative to CD subjects with low CU traits (e.g., Fairchild et al., 2009; Marsh & Blair, 2008) as well as the VIM and IES models (Blair, 1995; 2005). This finding suggests that that CD may be a better predictor of impaired fear identification than CU traits.

In fact, prior work has demonstrated that while individuals with the highest number of CPs exhibit poor fear recognition, those with elevated CU traits demonstrate enhanced recognition of fear (Woodworth & Waschbush, 2008). This slight advantage in the recognition of others' fear may make it easier for these individuals to con, manipulate, and prey on others. In fact, it may be the case that these individuals can recognise others' fear but do not experience it empathically and thus fail to desist from engaging in aggression (i.e., hurting others). Although Blair's (1995) VIM model does not specify whether psychopathic individuals demonstrate difficulties at the appraisal or emotional/empathic response level, it may be the case that these individuals may not actually exhibit difficulties in the recognition of fear per se, but rather, an inability to inhibit their aggressive behaviour following the observation of others' distress.

In terms of the eye movement data, CU traits was not a significant predictor when added to the best-fitting models, i.e., it did not predict any additional variability in eye movement behaviour beyond that explained by CD status and gender. Therefore, our study does not replicate the findings of Dadds et al.'s (2008) eye-tracking study, which showed reduced attention to the eyes in adolescents high in CU traits. It is important to note, however, that there are key differences between the studies. In addition to the fact that Dadds et al.'s (2008) study employed a correlational design, rather than a case-control comparison design, their sample was recruited from the community and it is unclear whether or not any of the participants met criteria for CD, as the primary aim of their study was to evaluate the effects of CU traits. Additionally, their sample comprised solely of males, and differed from our sample in terms of age (8-15 years *vs.* 13-18 years) and SES (middle to upper-middle class *vs.* (primarily) low working-class). Therefore, these differences between the studies make it hard to compare them directly. Critically, our findings suggest that CD was associated with reduced attentional orienting to the eye region of the face across multiple emotions (irrespective of the level of CU traits).

In our second study (Chapter 3) we found no influence of CU traits on body expression recognition performance. This finding does not support the studies conducted by Muñoz (2009) and Wolf and Centifanti (2014), which demonstrated associations between elevated CU traits and impaired fear and anger body expression recognition. Similarly, this finding does not accord with most of the extant literature on *facial* expression recognition, where those with elevated CU traits have been seen to show more pronounced deficits in fear recognition, relative to those with lower levels of CU traits (e.g., Dadds et al., 2008; Marsh & Blair, 2008). Additionally, our findings challenge theories linking psychopathic traits with a reduced ability to identify others' distress cues (i.e., fear), such as the VIM and IES models (Blair, 1995; Blair, 2003). Critically, our study demonstrates that CD in males is associated with global deficits in body expression recognition, irrespective of the level of CU traits, indicating that CD may be a stronger predictor of emotion recognition deficits than CU traits.

In terms of the eye movement data, we found that elevated levels of CU traits within our CD group were related to an increased tendency to fixate the arms of fearful and neutral body expressions. These findings go against our predictions and the findings of Dadds et al.'s (2008) study showing reduced attention to emotionally-salient information (i.e., the eye region of the face) in children high in CU traits, relative to those with lower levels of CU traits. Interestingly, we found that CU traits in TD individuals were *negatively* associated with attention to the arms, such that those with higher levels of CU traits fixated on the arms less than those with lower levels of CU traits. It could be argued that CU traits may have a negative impact on attention to emotionally-relevant information (i.e., eyes, arms) in individuals who lack significant levels of

antisocial behaviour (i.e., TD subjects). Similarly, we found that CU traits in females, but not males, were negatively associated with attention to the arms.

Taken together, our findings indicate that CU traits may operate differently according to both group status (i.e., having/not having CD) and gender, such that CD males with lower levels of CU traits showed the most atypical eye movements. Nevertheless, it is important to note that we selected the arms as representing the most emotionally-informative regions on the basis of the stimuli presented. As such, these findings must be interpreted with caution. Indeed, further research is needed in order to disentangle the extent to which CD status, gender, and CU traits interact with each other and what this means in terms of attention to emotionally-relevant information.

The findings from our EA study on males (Chapter 4) revealed an association between elevated CU traits (within the CD group) and a reduced ability to track changes in emotional intensity for sadness. However, no other effects of CU traits were found. Similarly, we did not find any effects of CU traits on EA, emotion recognition, and affective empathy in our EA study on females (Chapter 5). Overall, our findings are consistent with previous studies demonstrating deficits in emotion recognition and empathy in those with high *and* low levels of CU traits (e.g., de Wied et al., 2012; Sully et al., 2015), and indicate that having a diagnosis of CD may be a more informative predictor of neuropsychological impairment than CU traits. In fact, our findings suggest that there may not be a disproportionate problem in the processing of others' distress cues in those high in psychopathic traits, as proposed by both the VIM and IES models (Blair, 1995; 2005), but rather, these difficulties may be associated with CD in general.

Therefore, these models, as well as the LPE specifier in the DSM-5, may need to be modified or extended to characterise emotion recognition and empathy problems in CD, rather than in a subset of children and adolescents with CD and high CU traits. Critically, individuals with CD, and particularly males with CD, demonstrate impairments in emotion recognition that go beyond *distress-specific* difficulties. As such, more comprehensive models delineating these more pervasive impairments may need to be proposed. Overall, the findings from this thesis have important implications for intervention strategies aiming to alleviate the emotion recognition and empathy deficits shown by adolescents with CD and CU traits. The following section will discuss targeted training methods, placing a particular emphasis on the importance of CD, gender differences, the use of dynamic and other more naturalistic stimuli, and the adoption of a global emotion and empathy training approach.

6.3 Implications

The findings from the studies described in this thesis have important implications for interventions seeking to remediate the emotion recognition and empathy deficits observed in children and adolescents with CD and CU traits. Firstly, our studies suggest that impairments in emotion recognition and affective empathy in CD are largely independent from co-occurring CU traits. Therefore, tailored emotion and empathy training approaches may not be needed for individuals who are high versus those who are low in CU traits, for example. Although past research has found that children and adolescents with high levels of CU traits appear to be less responsive to parenting-based treatments, in comparison to youth without elevated CU traits (Haas et al., 2010; Hawes & Dadds, 2005), we believe that focusing on whether the individual meets criteria for CD or not may be more informative in terms of developing targeted emotion and empathy training strategies. Additionally, interventions may need to be tailored according to the deficits of the particular child.

In terms of the particular emotions that would need to be targeted, the findings from our first two studies (Chapters 2 and 3) indicate that these young people are likely to benefit from training methods that incorporate all emotion categories. While our EA study of males (Chapter 4) showed that males with CD had difficulties identifying and sharing the negative emotions of others (i.e., sadness, fear, disgust), it is evident that, although the comparisons did not reach formal levels of significance, males with CD had difficulties in affective empathy across most of the emotion categories. Further, in line with our study of males, we note that the overall pattern of affective matching to different emotions was shifted downwards across most emotion categories in females with CD (Chapter 5). Thus, although interventions may need to place a particular emphasis on the training of negative emotions, individuals with CD are likely to benefit more from global emotion training methods. Furthermore, the studies included in this thesis highlight that interventions should not only employ static stimuli, but should also incorporate dynamic and more naturalistic stimuli, including visual, auditory, and linguistic information, as well as whole-body stimuli. In fact, the inclusion of these more ecologically-valid stimuli are likely to aid in the training of empathy and emotion recognition.

Although further research is needed in order to examine the relative contributions of attentional and appraisal mechanisms to the facial and body expression recognition deficits exhibited by males and females with CD, the findings from our first two studies (Chapters 2 and 3) suggest that interventions aiming to improve emotion recognition in CD may benefit from incorporating both attentional and appraisal components. It is clear that the latter component is key to the successful training of emotions in these young people, while the teaching of attentional strategies might

provide additional skills that help improve emotion recognition performance. Given that males with CD showed the greatest emotion recognition problems and the most abnormal patterns of eye movements when viewing both facial and body expressions, it is likely that these individuals would benefit from more comprehensive training methods than their female counterparts. Indeed, our findings highlight the fact that optimal intervention strategies are likely to differ by gender – a 'lighter touch' intervention may be sufficient for females, as they are likely to have less severe difficulties to start with.

In fact, further support for the idea that males and females may benefit from distinct training techniques comes from our EA studies (Chapters 4 and 5). While males with CD are likely to benefit from intervention studies that aim to improve both emotion recognition/cognitive empathy and affective empathy, enhancing affective empathy in females with CD may prove more beneficial than targeting facial emotion recognition or cognitive empathy. One way of enhancing affective empathy could be via the administration of intranasal oxytocin, which is a hormone and neuropeptide involved in a series of affiliative behaviours, such as attachment and sexuality (Donaldson & Young, 2008; Strathearn, 2011). Although research involving the administration of oxytocin as an affective empathy enhancer has been inconsistent across studies, there is evidence to suggest that it can improve affective empathy for both positive and negative emotions (e.g., Hurlemann et al., 2010). Similarly, and of relevance to the findings described in this thesis, oxytocin has also been reported to enhance both emotion recognition (e.g., Fischer-Shofty, Shamay-Tsoory, Harari, & Levkovitz, 2010; Marsh, Yu, Pine, & Blair, 2010) and attention to the eyes (Gamer, Zurowski, & Büchel, 2010; Guastella, Mitchell, & Dadds, 2008).Therefore, intervention strategies involving the administration of oxytocin may help address a range of impairments exhibited by adolescents with CD.

Although our current EA task could be extended and improved in a number of ways, we believe that experimental paradigms like this could potentially be used to evaluate the effectiveness of interventions designed to enhance emotion recognition and empathy in males and females with DBDs, as well as assessing empathy in clinical and forensic or judicial settings. Moreover, although improvements in emotion recognition and empathy should be the primary outcome measures in any intervention aiming to remediate emotion recognition and empathy deficits in CD, generalised treatment effects should also be explored (i.e., improvements in prosodic affect recognition and a reduction in the number of CD symptoms or remission from CD).

6.4 Strengths and Limitations

The studies included in this thesis had a number of methodological advantages over previous studies of emotion recognition and empathy in CD. Firstly, to our knowledge, the studies presented in Chapters 2 and 3 are the first to combine emotion recognition paradigms with non-invasive video-based eye-tracking measurements to study emotion recognition of, and attention to others' emotions, in a sample of males and females with diagnosable levels of CPs, i.e., CD. These experimental paradigms allow for an unobtrusive measure of attentional mechanisms during emotion processing, thereby refining our understanding of how these individuals may process emotional information in situations that more closely resemble everyday social contexts. Indeed, although further research is needed to disentangle the extent to which attentional and appraisal mechanisms underlie the emotion recognition deficits exhibited by adolescents with CD, these tasks have clear advantages over standard accuracy or reaction time measures, such as by providing us with a rich source of information regarding real-time allocation of attention.

Commonly used measures of empathy have included tasks measuring the identification of facial expressions of emotion (considered critical for cognitive empathy) – but these paradigms often include high-intensity, static, greyscale stimuli that do not resemble the stimuli that we encounter in everyday life. In an attempt to improve the sensitivity and ecological validity of these tasks, our studies included facial expressions morphed with neutral faces at varying intensities, as well as dynamic facial expressions (Chapter 2), and both static and dynamic body expressions of emotion (Chapter 3). Although group differences in facial expression recognition did not seem to be modulated by emotional intensity, such that they were more pronounced or only present at low or medium intensities, our face task could be used to explore subtle differences in facial recognition performance in community samples with CPs or other psychiatric disorders.

Although previous studies have employed extracts from television shows or scenarios depicted by actors, which are arguably higher in ecological validity than static (and dynamic) stimuli, the fact that they have used actors means not only that the emotions shown in these clips are artificial, but also, that we cannot conclude whether the targets were actually feeling the emotion they were exhibiting. Our final two studies (Chapters 4 and 5) overcome these limitations by using a more ecologically-valid paradigm to simultaneously evaluate individuals' ability to track changes in emotional intensity (a key skill in everyday social interactions), emotion recognition, and affective empathy. The use of relatively naturalistic stimuli containing visual, auditory and linguistic information means that our findings should be more relevant to real-life social situations than those acquired using artificial, highly-simplified stimuli and tasks. This task also differs from previous paradigms in that we obtained emotional intensity ratings from the targets themselves,

thereby allowing us to examine empathic accuracy – the ability to continuously track changes in emotional intensity - for the first time in a CD population.

A further strength of all of our studies is the fact that both the CD and TD groups were well-characterised from a clinical perspective. In most cases, diagnostic information regarding a range of disorders was obtained from multiple informants using semi-structured diagnostic interviews. Our inter-rater reliability assessments also indicate excellent agreement between raters. This is an improvement over studies that have recruited groups from the community on the basis of questionnaire measures as these individuals may have lacked clinically-significant levels of antisocial behaviour or the range of scores on antisocial behaviour or CU traits measures might have been relatively restricted. Furthermore, we have controlled for group differences in IQ, SES, and psychiatric comorbidity in our analyses, meaning that our findings are not confounded by these variables. Finally, given that there appears to be positive correlation between CU traits and CPs, it is likely that previous studies may have conflated these factors. The present studies have improved upon this limitation of previous work by specifically examining the effects of CU traits within a sample of adolescents with diagnosable levels of CPs. We also treated CU traits as a dimensional measure in our studies, which is arguably a more powerful approach than the commonly adopted median split procedure.

Regardless of the substantial strengths of the present studies, a number of limitations should be noted. Firstly, the studies in this thesis are cross-sectional, and therefore it is not possible to determine when and why these impairments in emotion recognition and empathy emerge in development. Given that there are a myriad of factors that are likely to contribute towards these difficulties, it is unlikely that, for example, deficits in emotion recognition are simply due to problems in appraisal. Indeed, longitudinal studies are needed to determine the potential causes underlying these deficits, and the importance of these throughout development for males and females at risk of developing a Disruptive Behaviour Disorder.

A further weakness that applies across all of our studies relates to the information we collected regarding CU traits – which was obtained using the self-report version of the ICU, which is likely to be influenced by social desirability effects, under-reporting or even, over-reporting (i.e., bragging). Furthermore, it could be claimed that the use of self-report measures of CU traits may be problematic as it relies on the capability of youth who are characterised by a lack of empathy to introspect and report on their own empathic and emotional skills. The majority of studies suggesting differences between high and low CU traits individuals have employed parent- or teacher-report (or a combination) measures of CU traits, suggesting that parents and teachers may be better at recognising these traits than the adolescents themselves. Indeed, we

acknowledge that obtaining data from multiple informants would have strengthened our studies, although we may have had to face further challenges in the process of combining data across informants who disagree.

An issue that is specific to our eye-tracking studies of emotion (Chapters 2 and 3) relates to the fact that where an individual fixates may not necessarily relate to where they are attending (Posner, 1980; Remington, 1980). In fact, an individual may fixate the nose region while employing parafoveal vision to attend to the eye or mouth regions. Indeed, covert orienting (orienting without moving the eyes or head) could have taken place in our studies. This is particularly likely as our stimuli were small and thus overt orienting (orienting accompanied by eye or head movements) may not have been necessary. Another issue that is worth mentioning is the fact that emotion recognition may require only one or two fixations. Indeed, research with healthy adults has revealed that identifying others' expressions typically takes less than one second (De Sonneville et al., 2002).

As such, although our facial expression stimuli were only presented for one second, it is very likely that our participants may have recognised the emotion before the end of the stimulus presentation. Thereby, the eye movement data recorded after this identification stage may have confounded our findings. This is particularly likely to be the case for our body expressions of emotion task, where the stimuli were presented for three seconds. Consequently, future studies should employ shorter or subliminal stimulus presentation times, as well masking, and larger stimuli that will require participants to engage in overt attentional strategies. This may help capture more subtle differences between the CD and TD groups in attention to emotionally-relevant stimuli.

Other issues that are worth mentioning include the use of just three emotion categories in our body expressions of emotion task (Chapter 3). We acknowledge that the addition of other prototypical emotions and the inclusion of body expressions presented at varying emotional intensities would have allowed for a more sensitive task. Additionally, future studies should use ratings collected from independent samples as a reference point for determining emotionally-salient regions of the body. Similarly, our EA task design (Chapters 4 and 5) relied on the target's initial ratings of emotional intensity being accurate, which may have not been the case. Further issues with this task include the fact that, given that our participants were passive observers, our findings may not be generalised to situations where they are active participants. In other words, individuals with CD may exhibit higher levels of empathy in situations that concern them or when interacting with individuals who are known to them such as friends and family members. Despite

these limitations, the studies in this thesis provide an important foundation for future work in this field of research.

6.5 Future Directions

There are a number of ways in which future research can build upon our findings. Apart from addressing the issues outlined above, we believe that there is a need for longitudinal studies of emotion recognition and empathy in children and adolescents with CD and varying levels of CU traits. By examining the potential mechanisms underlying the difficulties in emotion recognition and empathy observed in these individuals, as well as the developmental trajectories of these abilities and underlying mechanisms, we may be able to develop preventative strategies that may help reduce future impairment and escalation of antisocial behaviour and violence.

In addition to longitudinal studies, we should be designing interventions to help promote the development of empathy in young children who exhibit or are at risk of showing challenging behaviour, even before CPs are severe enough to be diagnosable. In fact, our research could help inform schemes designed to teach empathy in schools, such as the Social and Emotional Aspects of Learning (SEAL) programme in the UK. We believe that teaching empathy at school has the potential to reduce bullying and its consequences on others (e.g., self-harm and suicide), as well as antisocial behaviours that may lead to the development of DBDs, and reduce financial costs for society. In fact, research examining a similar programme in the US revealed that, for every $1 invested, between $2.50 and $10 of tax-payers' money was saved in the long-run (Allen, 2011).

Another avenue via which our research can be expanded upon regards the treatment of young offenders. Currently, the criminal justice system principally relies on the use of restorative justice, where victims are encouraged to describe how the offence has made them feel (Ministry of Justice, 2014). Critically, given that both males and females with CD demonstrate difficulties empathising with others' distress (as well as a range of other emotions), it is unlikely that all of these young people are capable of reacting appropriately to the victims' distress. We believe that there is a need for tailored emotion recognition and empathy training strategies, such as the ones discussed earlier in this chapter (see section 6.3), prior to the commencement of any restorative justice programme. These interventions have the potential to enhance empathy towards victims, which in turn, would increase the chances of the restorative justice scheme being completed successfully, as well as helping to reduce reoffending behaviour.

6.6 General Conclusion

We found global impairments in facial expression recognition in adolescents with CD, and particularly in males with CD. These impairments were seen for both static and dynamic stimuli, and across a range of emotion intensities. Additionally, males, but not females, with CD, exhibited global deficits in body expression recognition. Although further research is needed, our eye-tracking data suggest that these difficulties result from impairments in the appraisal of facial and body expression stimuli rather than fundamental issues with attention. Furthermore, even when using more ecologically-valid and multisensory stimuli, males with CD show emotion recognition deficits, whereas in this case, females with CD show problems in affective empathy only.

Overall, our findings indicate that CU traits have a relatively limited impact on emotion recognition and empathy within CD samples. Thus, previous studies showing differences between high and low CU traits subgroups or correlations with CU traits and performance may have been confounded by co-occurring CPs and/or differences in severity of such problems.

Taken together, the findings in this thesis have important implications, especially in terms of intervention practices aiming to remediate the emotion recognition and empathy deficits observed in individuals with CD. Indeed, our findings highlight the fact that optimal intervention strategies may need to be sex-specific, with males with CD being likely to benefit from more comprehensive training methods, including facial and body expression components, as well as emotion recognition and affective empathy training. Females with CD, on the other hand, may require a 'lighter touch' intervention that places a particular focus on enhancing recognition of facial expressions and affective empathy.

Appendix A Supplementary Table S5.1

Table S5.1. *Overview of studies on cognitive and affective empathy and emotion recognition in children and adolescents with disruptive behaviour disorders and related constructs*

Citation	Sample			DBD measure(s)	Measure(s) of empathy	CU/PT measure	Main findings
	DBD (*n*)	TD (*n*)	Proportion of females (*n* and *%*)				
Studies using Self-Report Questionnaires							
Brouns et al. (2013)	0	Moderate PT = 62 Low PT = 171.	Total = 126; Moderate PT = 23 (59%); Low PT = 103 (53%).	Not applicable	IRI	APSD	Moderate PT < Low PT: cognitive & affective empathy.
Cheng et al. (2012)	Total = 28; CD/CU+ = 13;	17	0 (0%)	DSM-IV criteria for CD	IRI	PCL:YV	CD/CU+ & CD/CU- < TD;

Table S5.1. *Overview of studies on cognitive and affective empathy and emotion recognition in children and adolescents with disruptive behaviour disorders and related constructs*

Citation	Sample			DBD measure(s)	Measure(s) of empathy	CU/PT measure	Main findings
	DBD (*n*)	TD (*n*)	Proportion of females (*n* and *%*)				
	CD/CU- = 15.						CD/CU+ = CD/CU- : cogntive emapthy subscales. CD/CU+ = CD/CU- = TD : affective empathy subscales.
Dadds et al. (2009)	0	2760	Total = 1367 (50%)	APSD & SDQ	GEM	APSD; SDQ	CU traits in males negatively correlated with cognitive and affective empathy; CU traits in females negatively correlated with cognitive empathy.
Pasalich, Dadds, & Hawes (2014)	ODD/CD = 134	0	28 (21%)	DISCAP	GEM	APSD; SDQ	CPs in both males & females negatively associated with cognitive and affective empathy.

Table S5.1. *Overview of studies on cognitive and affective empathy and emotion recognition in children and adolescents with disruptive behaviour disorders and related constructs*

Citation	Sample			DBD measure(s)	Measure(s) of empathy	CU/PT measure	Main findings
	DBD (*n*)	TD (*n*)	Proportion of females (*n* and *%*)				
Schonert-Reichl (1993)	DBD = 39	39	0 (0%)	Clinician- diagnosed DBD	QMEE	Not applicable	DBD < TD: overall empathy.
Studies using Behavioural Tasks							
Anastassiou-Hadjicharalambous & Warden (2008)	Total = 72; CD/CU+ = 30; CD/CU- = 42.	50	Total = 6; CD/CU+ = 1 (3.3%); CD/CU- = 2 (4.8%); TD = 3 (6%).	DSM-IV-TR criteria for CD	Second-Order False-Belief Paradigm	APSD	CD/CU+ & CD/CU- < TD; CD/CU+ = CD/CU-: affective empathy; no data on females.
Blair & Coles (2000)	0	TD = 44; PT+ = 11.	Total = 24; PT+ = 2 (18%);	Not applicable	Emotion Hexagon Task	PSD	PT+ < TD: fear & sadness identification; CPs negatively

Table S5.1. *Overview of studies on cognitive and affective empathy and emotion recognition in children and adolescents with disruptive behaviour disorders and related constructs*

Citation	Sample			DBD measure(s)	Measure(s) of empathy	CU/PT measure	Main findings
	DBD (*n*)	TD (*n*)	Proportion of females (*n* and *%*)				
			TD = 22 (50%).				associated with anger, fear & sadness identification.
Blair, Colledge, Murray, & Mitchell (2001)	0	PT+ = 20; PT- = 31.	0 (0%)	Not applicable	Facial recognition with Ekman & Friesen stimuli	PSD	PT+ < PT-: sadness and fear identification (accuracy); PT+ > PT-: RTs for sadness.
Bowen et al. (2013)	Total = 67; YO/CD+ = 33; YO/CD- = 24. YO/PT+ = 20; YO/PT- = 40.	37	0 (0%)	YSR; assesses range of behavioural problems based on DSM-IV criteria	Facial Emotion Recognition Task	YPI	YOs overall < TD: sadness, 100% fear, 25% anger recognition; YO/CD+ < YO/CD-: 50% sadness; YO/PT+ > YO/PT-: sadness; YO/PT+ < YO/PT-: 50 & 75% disgust.
Cadesky et al. (2000)	Total = 87;	27	Total = 23; CD = 4 (17%);	Parent Interview for Child Symptoms and	Diagnostic Analysis of Nonverbal Accuracy	Not applicable	CD < TD: overall recognition accuracy and for all individual emotions, except anger.

Table S5.1. *Overview of studies on cognitive and affective empathy and emotion recognition in children and adolescents with disruptive behaviour disorders and related constructs*

Citation	Sample			DBD measure(s)	Measure(s) of empathy	CU/PT measure	Main findings
	DBD (*n*)	TD (*n*)	Proportion of females (*n* and *%*)				
	CD = 24; CD+ADHD = 63.		CD+ADHD = 8 (13%); TD = 11 (41%).	Teacher Telephone Interview			
Cohen & Strayer (1996)	CD = 30	32	0 (0%)	Clinician- diagnosed CD	Empathy-inducing vignettes	Not applicable	CD < TD: emotion recognition & affective empathy.
Dadds et al. (2006)	0	PT+ = 25; PT- = 73.	0 (0%)	SDQ; APSD	New South Wales Facial Emotion Task	APSD	PT+ < PT-: neutral & fear identification.
Dadds et al. (2008)	0	PT+ = 25; PT- = 75.	0 (0%)	SDQ; APSD	New South Wales Facial Emotion Task	APSD	PT+ < PT-: fear identification, number and duration of eye fixations.

Appendix A

Table S5.1. *Overview of studies on cognitive and affective empathy and emotion recognition in children and adolescents with disruptive behaviour disorders and related constructs*

Citation	Sample			DBD measure(s)	Measure(s) of empathy	CU/PT measure	Main findings
	DBD (*n*)	TD (*n*)	Proportion of females (*n* and *%*)				
de Wied et al. (2005)	DBD = 25;	22	0 (0%)	DISC; CBCL parent and teacher	Empathy-inducing Vignettes	Not applicable	DBD < TD: Empathy Index; DBD < TD: cognitive & affective empathy.
de Wied, Van Boxtel, Zaalberg, Goudena, & Matthys (2006)	DBD = 22.	22	0 (0%)	DISC; CBCL - parent and teacher	Emotional Film Clips	APSD	DBD < TD: emotional empathy.
de Wied et al. (2012)	Total = 31; DBD/CU+ = 14; DBD/CU- = 17.	32	0 (0%)	DISC; CBCL parent and teacher	Emotional Film Clips	APSD	DBD/CU+ < TD: empathic sadness and happiness; DBD/CU- < TD: empathic happiness.
Fairchild et al. (2010)	Total = 25; CD/PT+ = 11;	30	55 (100%)	K-SADS-PL child and parent	Emotion Hexagon Task	YPI	CD < TD: anger & disgust identification;

Table S5.1. *Overview of studies on cognitive and affective empathy and emotion recognition in children and adolescents with disruptive behaviour disorders and related constructs*

Citation	Sample			DBD measure(s)	Measure(s) of empathy	CU/PT measure	Main findings
	DBD (*n*)	TD (*n*)	Proportion of females (*n* and *%*)				
	CD/PT- = 14.						CD/PT+ < CD/PT-: sadness identification.
Fairchild et al. (2009)	Total = 82; CO-CD = 43; AO-CD = 39.	40	0 (0%)	K-SADS-PL child and parent	Emotion Hexagon Task	YPI	AO-CD < TD: fear; CO-CD < TD: fear, anger, disgust & happiness identification; CD/PT+ < CD/PT- fear, sadness, surprise identification.
Jones et al. (2010)	Total = 65; PT = 21; CP = 23; ASD = 21.	31	0 (0%)	CSI; ASI	Emotion Attribution to Self; First- & Second-Order ToM Task; ToM Animation Task	ICU	PT < TD: self-attributed fear; PT, CP, & TD < ASD: ToM.

Appendix A

Table S5.1. *Overview of studies on cognitive and affective empathy and emotion recognition in children and adolescents with disruptive behaviour disorders and related constructs*

Citation	Sample			DBD measure(s)	Measure(s) of empathy	CU/PT measure	Main findings
	DBD (*n*)	TD (*n*)	Proportion of females (*n* and *%*)				
Leist & Dadds (2009)	Psychopathology + CU traits = 23	22	Psychopathology + CU traits† = 6 (26%)	SDQ	Facial Emotion Task	APSD; SDQ	Antisocial behaviour & CU traits negatively associated with fear recognition; Antisocial behaviour negatively associated with anger and neutral recognition.
Martin-Key et al. (2016) – presented in Chapter 4	Total = 37; CD/CU+ = 20; CD/CU- = 17.	40	0 (0%)	K-SADS-PL	Empathic Accuracy Task	ICU	CD < TD: disgust, fear, & sadness identification; CD < TD: affective empathy for disgust, fear, & sadness.
Pajer et al. (2010)	CD = 35	30	65 (100%)	DISC	Pictures of Facial Affect	Not applicable	CD = TD: overall & by emotion.
Schwenck et al. (2012)	Total = 70;	67	0 (0%)	DSM-IV criteria for CD	Morphing Task; Animated Shapes	ICU	CD/CU+ = CD/CU- = TD: recognition of all emotions;

Table S5.1. *Overview of studies on cognitive and affective empathy and emotion recognition in children and adolescents with disruptive behaviour disorders and related constructs*

Citation	Sample			DBD measure(s)	Measure(s) of empathy	CU/PT measure	Main findings
	DBD (*n*)	TD (*n*)	Proportion of females (*n* and *%*)				
	CD/CU+ = 36; CD/CU- = 34.				Task; Video Sequences Task		CD/CU+ < TD: affective empathy on video task.
Schwenck et al. (2014)	Total = 32; CP/CU+ = 16; CP/CU- = 16.	32	64 (100%)	DSM-IV criteria for CD	Morphing Task	ICU	CP/CU- < TD: RTs sadness, fear & happiness; CP/CU- < TD: sadness identification.
Short et al. (2016)	Total = 71; CD = 28; CD+AD = 20; AD = 23.	28	Total = 37; CD = 5 (18%); CD+AD = 8 (40%); AD = 18 (78%); TD = 6 (21%).	K-SADS-PL child and parent	NimStim Face Stimuli Set	ICU	CD < TD: recognition of all emotions; CU+ < CU-: disgust, fear, & happiness identification.

Table S5.1. *Overview of studies on cognitive and affective empathy and emotion recognition in children and adolescents with disruptive behaviour disorders and related constructs*

Citation	Sample			DBD measure(s)	Measure(s) of empathy	CU/PT measure	Main findings
	DBD (*n*)	TD (*n*)	Proportion of females (*n* and *%*)				
Stevens et al. (2001)	0	PT+ = 9; PT- = 9.	0 (0%)	Not applicable	Diagnostic Analysis of Nonverbal Accuracy	PSD	PT+ < PT-: fear & sadness identification; PT+ < PT-: sad vocal expression identification.
Sully et al. (2015)	Total = 64; CD = 43; Unaffected relatives = 21.	38	Total = 17 (17%); CD = 5 (12%); Unaffected relatives = 7 (33%); TD = 5 (13%).	K-SADS-PL child and parent	Emotion Hexagon Task	YPI; ICU	CD < TD: anger, happiness, sadness, & surprise identification; Unaffected relatives < TD: anger & happiness identification.
Woodworth & Waschbusch (2008)	Total = 56; CP/CU- = 32; CP/CU+ = 24.	17	Whole sample† = 14 (19%)	Clinician- diagnosed DBD	Ekman & Friesen stimuli	APSD	CP/CU + < CP/CU-: sadness identification; CP/CU+ > CP/CU-: fear identification.

Table S5.1. *Overview of studies on cognitive and affective empathy and emotion recognition in children and adolescents with disruptive behaviour disorders and related constructs*

Citation	Sample			DBD measure(s)	Measure(s) of empathy	CU/PT measure	Main findings
	DBD (*n*)	TD (*n*)	Proportion of females (*n* and *%*)				

Key: AD, Anxiety Disorder; ADHD, Attention-Deficit/Hyperactivity Disorder; APSD, Antisocial Process Screening Device; ASI, Adolescent Symptom Inventory; CBCL, Child Behaviour Checklist; CD, Conduct Disorder; CD+AD, Conduct Disorder with comorbid Anxiety Disorder; CD+ADHD, Conduct Disorder with comorbid Attention-Deficit/Hyperactivity Disorder; AO-CD and CO-CD, Adolescence-onset Conduct Disorder and Childhood-onset Conduct Disorder; CD/CU+ and CD/CU-, Conduct Disorder with high and low levels of Callous-Unemotional traits; CP, Conduct Problems; CP/CU+ and CP/CU-, Conduct Problems with high and low levels of Callous-Unemotional traits; CU, Callous-Unemotional traits; CD/PT+ and CD/PT-, Conduct Disorder with high and low levels of psychopathic traits; CSI, Child Symptom Inventory; DBD, Disruptive Behaviour Disorder; DBD/CU+ and DBD/CU-, Disruptive Behaviour Disorder with high and low levels of Callous-Unemotional traits; DISCAP, Diagnostic Interview Schedule for Children, Adolescents and Parents; DISC, Diagnostic Interview Schedule for Children; DSM-IV, Diagnostic and Statistical Manual of Mental Disorders, fourth edition; DSM-IV-TR, Diagnostic and Statistical Manual of Mental Disorders, fourth edition, text revision; EC, Empathic Concern; EI, Emotional Intelligence; GEM, Griffith Empathy Measure; ICU, Inventory of Callous-Unemotional traits; IRI, Interpersonal Reactivity Index; K-SADS-PL, Schedule of Affective Disorders and Schizophrenia for School-Age Children-Present and Lifetime version; ODD, Oppositional Defiant Disorder; PCL:YV, Psychopathy Checklist: Youth Version; PSD, Psychopathy Screening Device; PD, Personal Distress; PT, Psychopathic Traits; PT+ and PT-, high and low levels of psychopathic traits; QMEE, Questionnaire Measure of Emotional Empathy; RT, Reaction Time; SDQ, Strengths and Difficulties Questionnaire; TD, Typically-developing; ToM, Theory of Mind; YO/CD+ and YO/CD-, Young Offenders with and without Conduct Disorder; YO/PT+ and YO/PT-, Young Offenders with and without Psychopathic Traits; YPI, Youth Psychopathic traits Inventory; YSR, Youth Self-Report.

Appendix B Materials used in the Studies

B.1 Invitation Letter (Parent Version)

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Project Title: ***Understanding Emotion Recognition and Empathy in Adolescents with and without Disruptive Behaviour*** (Version 1.1, 09/12/2013)

Dear Parent or Carer,

We are writing to invite your teenage son or daughter to take part in a research project at the University of Southampton. We are interested in studying how young people without disruptive behaviour, as well as those who have been in trouble a lot at school or with the police, recognise emotions in others and how they understand how others are feeling (empathy). To do this, we are studying where teenagers look when viewing others' facial expressions and body language on a computer screen. We are also interested in seeing how teenagers recognise the positive and negative feelings of others, and whether being aware of someone else's feelings makes people feel the same way themselves. To do this, we are inviting your son or daughter to take part in a study that involves measuring their eye movements while they are looking at pictures of faces and video clips of people showing different emotions. We can measure eye movements by pointing a little camera at their eye – nothing will actually touch their eyes or their face, and it won't hurt at all.

We would first like to come to your house to meet up with you and your son or daughter to explain what the study involves and find out whether they fit the criteria for inclusion in the study. If you would prefer not to meet at home, we could meet up at the University instead. We will ask you and your son or daughter some questions about their lifestyle, life experiences, and typical moods and behaviours. Some of the questions we will ask you and your son or daughter are potentially of a sensitive nature (e.g., we will be asking your son or daughter whether anything traumatic has happened to them in the last year, like being in a car accident or being

attacked). We will also ask you about topics such as bullying, or other possible sources of psychological or physical harm. Please note that you and your son or daughter can always leave out questions if necessary. Additionally, everything you and your son or daughter say in the interview will be treated as confidential. The interview will take around 1.5 hours and you and your son or daughter will be paid £10 each for your time. You will be paid an additional £5 for filling in a few questionnaires. This may mean that you may spend up to 2 hours in total completing the interview and the questionnaires. If your son/daughter fits the inclusion criteria for the study, we will ask them to come to the University to complete computer tasks measuring recognition of others' emotions. However, they don't have to take part in the study and they will still be paid **£10** for the interview.

If they decide that they want to take part in the study, we will ask them to complete a series of short and simple eye-tracking tasks in order to study their eye movements. Following these tasks, we will ask them to complete eye-tracking tasks that will look at how they recognise other people's emotions from faces and body postures. The last task will involve watching video clips of people talking about their life events. We will ask them to rate the emotions that they think the person in the video is feeling. Finally, we will ask them to complete a few questionnaires. In total, these tasks are expected to take around 3 hours and we will give them **£20** for this part of the study. We are hoping to use our findings to develop an emotion training programme that will take place in London, therefore their contribution will be extremely valuable in terms of helping other young people.

To summarise, if you and your son or daughter decide to take part:

- You and your son or daughter will be interviewed for about 1.5 hours either at home or at the University. You will also be asked to complete a few questionnaires. Please note that it may take an extra 30 minutes for you to do the questionnaires.
- If your son or daughter fits the inclusion criteria and they wish to continue with the study, we will invite them to the University to complete some computer tasks and fill in a few questionnaires (around 3 hours).

This means the whole study should take around 4 and a half hours. We can work around their schedule if they are attending school or college, or working (e.g., testing in the evenings or at weekends). We will also pay for all their travel expenses to and from the University.

If your son or daughter is interested in taking part, please fill in the contact details form and send it back to us in the Freepost envelope (no stamp is needed). You or your son or daughter are also welcome to send us your contact details by e-mail (**namk1e13@soton.ac.uk**). If you have any questions, please e-mail us or give us a call at 02380 596652.
Thanks for reading this!
Nayra Martin-Key, Graeme Fairchild, Wendy Adams, & Erich Graf

B.2 Invitation Letter (Child Version: Control)

Nayra Martin-Key, Graeme Fairchild, Wendy Adams & Erich Graf
Academic Unit of Psychology
Shackleton Building (Building 44)
Highfield Campus, University of Southampton
e-mail: namk1e13@soton.ac.uk

Telephone: 02380 596652

Project Title: ***Understanding Emotion Recognition and Empathy in Adolescents with and without Disruptive Behaviour*** (Version 1.1, 09/12/2013)

Dear Teenager,

We are writing to you to invite you to take part in a research project at the University of Southampton. Your Headteacher has given us permission to send out letters to all pupils in Years 9-13. We are interested in studying how young people recognise emotions in others and how they understand how others are feeling (empathy). To do this, we are studying where teenagers look when viewing others' facial expressions and body language. We are also interested in seeing how teenagers recognise the positive and negative feelings of others, and whether being aware of someone else's feelings makes people feel the same way themselves. To do this, we are inviting you to take part in a study that involves measuring your eye movements while you are looking at pictures and video clips of people showing different emotions.

We would first like to come to your house to meet up with you and your parent/carer to explain what the study involves and find out whether you fit the criteria for inclusion in the study. If you don't want to meet at home, we could meet up at the University instead. We will ask you some questions about your lifestyle, life experiences, typical moods and behaviours; we would also like to ask your parent or carer the same questions. Some of the questions we will ask you and your parent/carer are of a potentially sensitive nature (e.g., we will be asking you whether anything traumatic has happened to you in the last year, like being in a car accident or being attacked). We will also ask your parent/carer about topics such as bullying, or other possible sources of psychological or physical harm. Please note that you and your parent/carer can always leave out questions if necessary. Additionally, everything you and your parent/carer say in the interview will be treated as confidential. The interview will take around 1.5 hours and you and your parent/carer will be paid **£10 each** for your time. Your parent/carer will be paid an additional **£5**

for filling in a few questionnaires. This may mean that your parent/carer may spend up to 2 hours in total completing the interview and the questionnaires. If you fit the inclusion criteria for the study, we will ask you to come to the University to complete computer tasks measuring recognition of others' emotions. However, you do not have to take part in the study if you don't want to and you will still be paid **£10** for the interview.

If you decide that you want to take part in the study, we will ask you to complete a series of short and simple eye-tracking tasks in order to see how your eyes move in everyday life. Following these tasks, we will ask you to complete two eye-tracking tasks that will require you to recognise others' emotions from faces and body postures. We can measure your eye movements by pointing a little camera at your eye – nothing will actually touch your eyes or your face. The last task will involve watching video clips of people talking about their life events. We will ask you to rate the emotions that you think the person in the video is feeling. We will show you some pictures of the equipment and explain in detail what you will be doing at the interview. Finally, we will ask you to complete a few questionnaires. In total, these tasks are expected to take approximately 3 hours and we will give you **£20** for taking part. We are hoping to use our findings to develop an emotion training programme that will take place in London, therefore, your contribution will be extremely valuable.

To summarise, if you decide to take part:

- You and your parent/carer will be interviewed for about 1.5 hours either at home or at the University if you prefer. Your parent/carer will be asked to complete a few questionnaires. Please note that it may take your parent/carer up to 2 hours to do everything.
- If you fit the criteria and you wish to continue with the study, we will invite you to the University to complete some computer tasks and fill in a few questionnaires (around 3 hours).

This means the whole study should take around 4 and a half hours, and we can work around your schedule if you are attending school or college, or working (e.g., testing in the evenings or at weekends). We will also pay for all your travel expenses to and from the University.

If you're interested in taking part, please fill in the contact details form for teenagers and send it back to us in the Freepost envelope (no stamp is needed). You or your parent/carer can also e-mail us to give us your contact details, by e-mailing Nayra at **namk1e13@soton.ac.uk** Lastly, you are welcome to ring Nayra on 02380 596652 to ask questions or give us your contact details.

Thanks!

Nayra Martin-Key, Graeme Fairchild, Wendy Adams & Erich Graf

B.3 Invitation Letter (Child Version: Youth Offending Services)

Nayra Martin-Key, Graeme Fairchild, Wendy Adams & Erich Graf
Academic Unit of Psychology
Shackleton Building (Building 44)
Highfield Campus, University of Southampton
e-mail: namk1e13@soton.ac.uk

Telephone: 02380 596652

Project Title: ***Understanding Emotion Recognition and Empathy in Adolescents with and without Disruptive Behaviour*** (Version 1.1, 09/12/2013)

Dear Teenager,

We are writing to you to invite you to take part in a research project at the University of Southampton. You may have been told about this study by your caseworker. We are interested in studying how young people recognise emotions in others and how they understand how others are feeling (empathy). To do this, we are studying where teenagers look when viewing others' facial expressions and body language. We are also interested in seeing how teenagers recognise the positive and negative feelings of others, and whether being aware of someone else's feelings makes people feel the same way themselves. To do this, we are inviting you to take part in a study that involves measuring your eye movements while you are looking at pictures and video clips of people showing different emotions. This will involve pointing a small camera at your eyes while you are looking at pictures of faces or bodies.

We would first like to come to your house to meet up with you and your parent or carer to explain what the study involves and find out whether you fit the criteria for inclusion in the study. If you don't want to meet at home, we could meet up at the University instead. We will ask you some questions about your lifestyle, life experiences, typical moods and behaviours; we would also like to ask your parent or carer the same questions. Some of the questions we will ask you and your parent/carer could be of a sensitive nature (e.g., we will be asking you whether anything traumatic has happened to you in the last year, like being in a car accident or being attacked). We will also ask your parent/carer about your typical moods and behaviours, and topics such as bullying or other possible sources of psychological or physical harm. Please note

that you and your parent/carer can always leave out questions if you want. Additionally, everything you and your parent/carer say in the interview will be treated as confidential.

The interview will take around 1.5 hours and you and your parent/carer will be paid **£10 each** for your time. Your parent/carer will be paid an additional **£5** for filling in a few questionnaires. This may mean that your parent/carer may spend up to 2 hours in total completing the interview and the questionnaires. If you fit the inclusion criteria for the study, we will ask you to come to the University to complete computer tasks measuring recognition of others' emotions. However, you don't have to take part in the study if you don't want to and you will still be paid **£10** for the interview.

If you decide that you want to take part in the study, we will ask you to complete a series of short and simple eye-tracking tasks in order to see how your eyes move in everyday life. Following these tasks, we will ask you to complete two eye-tracking tasks that will require you to recognise others' emotions from faces and body postures. The last task will involve watching video clips of people talking about their life events. We will ask you to rate the emotions that you think the person in the video is feeling. Finally, we will ask you to complete a few questionnaires. In total, these tasks are expected to take around 3 hours and we will give you **£20** for taking part. We are hoping to use our findings to develop an emotion training programme that will take place in London, therefore your contribution will be extremely valuable.

To summarise, if you decide to take part:

- You and your parent/carer will be interviewed for about 1.5 hours either at home or at the University if you prefer. Your parent/carer will be asked to complete a few questionnaires. Please note that it may take your parent/carer up to 2 hours to do everything.
- If you fit the inclusion criteria and you want to do the study, we will invite you to the University to complete some computer tasks and fill in a few questionnaires (3 hours).

This means the whole study should take around 4 and a half hours of your time, and we can work around your schedule if you are attending school or college, or working (e.g., testing in the evenings or at weekends). We will also pay for all your travel expenses to and from the University.

If you're interested in taking part, please fill in the contact details form for teenagers and send it back to us in the Freepost envelope (no stamp is needed). You or your parent/carer are welcome to e-mail Nayra with your contact details at **namk1e13@soton.ac.uk** or give her a call: 02380 596652

Thanks!

Nayra Martin-Key, Graeme Fairchild, Wendy Adams & Erich Graf

B.4 Participant Information Sheet (Short Version)

Nayra Martin-Key, Graeme Fairchild, Wendy Adams & Erich Graf

Academic Unit of Psychology
Shackleton Building (Building 44)
Highfield Campus, University of Southampton
namk1e13@soton.ac.uk

02380 596652

Project Title: ***Understanding Emotion Recognition and Empathy in Adolescents with and without Disruptive Behaviour*** (Version 1.0, 28/10/2013)

Dear Teenager,

We are interested in finding out where teenagers look when viewing others' facial expressions and body language in order to recognise their emotions. We are also interested in seeing how teenagers recognise the positive and negative feelings of others, and whether being aware of someone else's feelings makes people feel the same way themselves. We would first like to come to your house to meet up with you and your parent/carer to explain what the study involves and find out whether you fit the criteria for inclusion in the study. If you don't want to meet at home, we could meet up at the University instead. We will ask you some questions about your lifestyle, life experiences, typical moods and behaviours; we would also like to ask your parent or carer the same questions. Everything you and your parent/carer say in the interview will be treated as confidential. However, if you give us information that makes us concerned about your safety or the safety of another person in your family we may have to refer you onto someone who can help, e.g., your GP, but we will always talk to you about this first. The interview will take around 1.5 hours and you and your parent/carer will be paid **£10 each** for your time. Your parent/carer will be paid an additional **£5** for filling in a few questionnaires. This may mean that your parent/carer may spend up to 2 hours in total completing the interview and the questionnaires. If you fit the inclusion criteria for the study, we will ask you to come to the Academic Unit of Psychology at the University to complete computer tasks measuring recognition of others' emotions. However, you do not have to take part in the study if you do not wish to and you will still be paid **£10** for the interview.

If, however, you decide that you want to take part in the study, we will ask you to complete a series of short and simple eye-tracking tasks in order to see how your eyes move in everyday life. Following these tasks, we will ask you to complete two eye-tracking tasks that will require you to recognise others' emotions from faces and body postures. We can measure your eye movements by pointing a little camera at your eye – nothing will actually touch your eyes or your face. The last task will involve watching video clips of people talking about their life events. We will ask you to rate the emotions that you think the person in the video is feeling. We will show you some pictures of the equipment and explain in detail what you will be doing at the interview. Finally, we will ask you to complete a few questionnaires. In total, these tasks are expected to take approximately 3 hours and we will give you **£20** for taking part. We are hoping to use our findings in an emotion training intervention that will take place in London, therefore, your contribution will be extremely valuable.

To summarise, if you decide to take part:

- You and your parent/carer will be interviewed for about 1.5 hours either at home or at the University if you prefer. Your parent/carer will be asked to complete a few questionnaires. Please note that it may take your parent/carer up to 2 hours to complete the interview and the questionnaires.
- If you fit the criteria and you wish to continue with the study, we will invite you to the Academic Unit of Psychology to complete some computer tasks and fill in a few questionnaires. This will take around 3 hours.

This means the whole study should take around 4 hours of your time, and we can work around your schedule if you are working or attending college (e.g., testing in the evenings or at weekends). We will also pay for all your travel expenses to and from the University.

If you're interested in taking part, please fill in the consent form for teenagers and send it back to us in the stamp-addressed envelope. If you prefer, you or your parent/carer could give us a ring on 02380 596652 or e-mail us at namk1e13@soton.ac.uk.

Thanks!

Nayra Martin-Key, Graeme Fairchild, Wendy Adams & Erich Graf

B.5 Participant Information Sheet (Long Version)

UNIVERSITY OF Southampton

Participant Information Sheet: (Version 1.0, 28/10/2013)

Study Title: *Understanding Emotion Recognition and Empathy in Adolescents with and without Disruptive Behaviour*

Researchers: Nayra Martin-Key, Graeme Fairchild, Wendy Adams and Erich Graf

ERGO Study ID number: 9796

Please read this information carefully before deciding to take part in this research. If you are happy to participate you will be asked to sign a consent form.

What is the research about?

We are interested in finding out where teenagers look when viewing others' facial expressions and body language in order to recognise their emotions. We are also interested in seeing how teenagers recognise the positive and negative feelings of others, and whether being aware of someone else's feelings makes people feel the same way themselves. To do this, we are inviting you to take part in a study. Firstly, we will meet up with you (normally at your home) to ask you questions about your typical moods and behaviours. We will ask your parent or carer the same questions (if they agree to take part) and we will also ask them to fill in some questionnaires. If you fit the inclusion criteria for the study, we will invite you to come to the Psychology Department at the University.

At the University, we will ask you to complete a series of short and simple eye-tracking tasks in order to see how your eyes move in everyday life. Following these tasks, we will ask you to complete two eye-tracking tasks that will require you to recognise others' emotions from faces and body postures. We can measure your eye movements by pointing a little camera at your eye – nothing will actually touch your eyes or your face. The last task will involve watching video clips of people talking about their life events. We will ask you to rate the emotions that you think the person in the video is feeling. Finally, we will ask you to complete a few questionnaires.

Why have I been chosen?

Appendix B

We are recruiting teenagers aged between 13 and 18 years through schools, colleges, pupil referral units, education centres, and the Southampton Youth Offending Service. Our sample is what is called an 'opportunity' sample - anyone who chooses to take part can do so, providing that they are not affected by the study's exclusion criteria (e.g., neurodevelopmental disorders, vision or hearing problems, etc.). It is up to you to decide whether or not to take part. If you do, you will be given this information sheet to keep and be asked to sign a consent form. If you are aged below 16 your parent/carer will also have to give consent. You are still free to withdraw at any time and without giving a reason. You can also choose to opt out of any part of the study.

How will you measure my eye movements?

This is a non-invasive technique which is completely safe and painless. Eye-tracking has been used a lot with children and adolescents. We will be asking you to place your chin on a chin-rest and will record your eye movements with a camera which will be located on the table in front of you. The camera will pick up the movements of your pupil as it tracks the dark areas of your eye. Therefore, we will ask you not to wear heavy make-up, as this may interfere with the tracking of your pupil. Below is a picture of what the eye-tracker looks like.

What will happen to me if I take part?

We would first like to meet up with you and your parent /carer to explain what the study involves and find out whether you fit the inclusion criteria for the study. We will also like to ask you some questions about your typical moods and behaviours and your life experiences and we would like to ask your parent or carer the same questions in a separate room. This part of the study should take about 1 hour and you and your parent/carer would be paid for your time (£10 each). We will also like to ask your parent/carer to fill in a few questionnaires (they will be paid an additional £5). Please note that in total, your parent/carer may spend up to 2 hours completing the interview and the questionnaires. If you fit the inclusion criteria and you wish to continue with the study,

we will invite you to come to the Academic Unit of Psychology at the University.

The laboratory study will take place on another day. All tasks will be explained to you and we will be happy to answer any other questions you may have. The first four tasks will involve tracking your eye movements while you perform very simple tasks, such as following a dot that will move across the screen and looking at photographs and video clips of faces and body postures. These tasks will give us an indication as to how your eyes move in everyday life. Following these tasks, we will ask you to take part in two emotion recognition tasks, where you will be required to look at photographs and video clips of faces and body postures and decide which emotion they are showing. Once again, we will be measuring your eye movements during these tasks. The last task will require you to watch some video clips of people talking about emotional situations they have been in. We will be asking you some questions, such as what you think the person in the video clip is feeling, how you are feeling and what you would do to help the person in the video clip (if anything). Finally, we will be asking you to fill in a few questionnaires. You will be given a full description of the purposes of the tasks and the goals of the research at the end of the study. We will reimburse you for your time and travel.

Are there any benefits in my taking part?

We will reimburse you for your time and travel (£10 for the interview, £20 for the laboratory tasks and we will pay for your transport to and from the University) and you will have made a contribution to our understanding of how teenagers tell how others are feeling. Although there is no intended clinical benefit to you from taking part in this research, we are hoping to use these results to develop an emotion training intervention which we will use at a children's charity in London.

Are there any risks involved?

All techniques used in this research are safe and non-invasive – they will not hurt. There are no known risks or side effects. However, if you feel uncomfortable or upset, you may stop taking part in the study at any time without explaining why.

Additionally, there is a small possibility that you or your parent/carer may become upset during the home interview or when filling in questionnaires about highly sensitive topics. Please note that you and your parent/carer can always leave out questions if necessary. Additionally, we can put you in touch with suitable sources of support, including contact details of counselling agencies

in the local area, such as 'No Limits', a local charity that offers information, counselling and support for young people.

Will information about me be kept confidential?

Yes. If you decide to take part in the study, we will take the following steps to ensure confidentiality. Your identity will be protected by changing your name to a subject code during data collection and data analysis. Records of your personal details will only be kept if you agree. We can assure you that any information given will be strictly confidential, not shown to your parent/carer, and you can leave questions out you are not comfortable with. All questionnaires will be number coded and if the study is written up for publication, the paper(s) will not include names or any other identifying information.

The only time when we might have to talk to people outside of the research team is: if you tell us information that makes us concerned that your safety or the safety of another person in your family is at risk. In this instance, we may be duty bound to refer you onto someone who may be able to help, e.g., your GP. We will not pass on this information to anyone else without talking to you first.

What happens if I change my mind?

You are free to stop taking part in the study at any time, without explaining why. If you don't object, we may use data collected up to the point of withdrawal.

What happens is something goes wrong?

If you have a concern or complaint regarding any aspect of this study, you can contact the Head of Research Governance, Dr Martina Prude (02380 595058, mad4@soton.ac.uk) who will be happy to help.

Where can I get more information?

Thank you for taking the time to read this letter. If you would like to talk to an independent person regarding your involvement in this research we would recommend you speak with your family, friends or a teacher at school.

If you would like more information or if you have any questions, please feel free to contact us by e-mail or telephone (Nayra Martin-Key: namk1e13@soton.ac.uk; 02380 596652; Graeme Fairchild: g.f.fairchild@soton.ac.uk; Wendy Adams: W.Adams@soton.ac.uk).

Yours sincerely,

Nayra Martin-Key, Graeme Fairchild, Wendy Adams and Erich Graf

B.6 Consent Form

UNIVERSITY OF Southampton

CONSENT FORM (Version 1.0: 28/10/2013)

Study title: *Understanding Emotion Recognition and Empathy in Adolescents with and without Disruptive Behaviour*

Researchers: Nayra Martin-Key, Graeme Fairchild, Wendy Adams and Erich Graf
ERGO Study ID number: 9796

The aim of this study is to look at similarities and differences between teenagers with behavioural difficulties and a control group of typically-developing teenagers. A short interview at your home will be conducted with your parent/carer in order to introduce the study and its aims, and explain what will be involved if you decide to take part. In total, the interview is expected to take approximately 1.5 hours and we will be paying you and your parent/carer £10 each. We will also be paying your parent/carer an additional £5 for the completion of a few questionnaires. If you meet the eligibility criteria, we will invite you to the Academic Unit of Psychology.

At the University, we will ask you to complete a series of short and simple eye-tracking tasks in order to see how your eyes move in everyday life. Following these tasks, we will ask you to complete two eye-tracking tasks that will require you to recognise others' emotions from faces and body postures. We can measure your eye movements by pointing a little camera at your eye – nothing will actually touch your eyes or your face. The last task will involve watching video clips of people talking about their life events. We will ask you to rate the emotions that you think the person in the video is feeling. Finally, we will ask you to complete a few questionnaires. In total, these tasks are expected to last approximately 3 hours and we will be paying you £20 for your participation. To give consent to participate in the study, please initial the boxes below to show that you agree with each of the statemenents, and sign and date this form.

I have read and understood the information sheet **(28/10/2013 /Version no 1.0)** and have had the opportunity to ask questions about the study. ☐

I agree to take part in this research project and agree for my data to be used for the purpose of this study. ☐

I understand my participation is voluntary and I may withdraw at any time without my legal rights being affected. ☐

I am happy to be contacted regarding other research projects in the Developmental Brain-Behaviour Laboratory. I therefore consent to the research team retaining my personal details on a database, kept separately from the research data detailed above. The 'validity' of my consent is conditional upon the researchers complying with the Data Protection Act and I understand that I can request my details be removed at any time. ☐

Data Protection

I understand that information collected about me during my participation in this study will be stored on a password protected computer and that this information will only be used for the purpose of this study. All files containing any personal data will be encrypted or stored in a locked filing cabinet.

- If participant is age 16 or over, please could they sign below to give consent:

Name of participant (print name)……

Signature of participant……..

Date……

- If participant is under the age of 16, consent is required from their parent/carer, please could they sign below:

Name of parent/carer (print name)…….

Signature of parent……..

Date…….

- The teenage participant should sign below to indicate their willingness to take part:

Appendix B

Name of participant (print name)……

Signature of participant……..

Date……

B.7 K-SADS Screen – Preliminary Interview

ID: ☐☐☐☐☐☐

K-SADS SCREEN - Preliminary interview YOUTH

*I would like to ask you a few questions about how you've been feeling and behaving **over the last 12 months**, but also when you were younger. It isn't a test of any kind. There are no right or wrong answers – all I'd like you to do is to answer my questions as honestly as you possibly can. The information you give me today is **confidential** and will go no further, so I won't tell your parents or teachers (or any other authority). However, if I think that you are having problems at the moment, which could benefit from help, we will discuss the possible options with you, e.g. referring you to a doctor. If you provide information that makes me concerned about your well-being or safety or the safety of another person in your family, I may be duty bound to refer you or them on to someone who can help, e.g., your GP. However, we will not pass on this information to anyone outside the research team without telling you first.*

The first thing I'd like to ask is whether you have ever seen a healthcare professional (e.g., a counsellor, Educational Psychologist, a Psychiatrist or a GP) for any other reason apart from routine illness, such as to do with your mood or behaviour?

Have you ever been prescribed medication for anything to do with your mood or behaviour or any other serious illness?

1) MAJOR DEPRESSIVE EPISODE

At least 1 from the following 3 symptoms present for more than half the time for a period of at least 2 weeks:

(I) Depressed Mood

Everyone has good days and bad days, but in the past 6 months has there been a time when you've felt down, miserable or depressed for days on end? How long did this feeling last? Do you feel like this at the moment? Have you ever gone through a time in your life when you felt like this?

Did you feel (___) all the time, some of the time?

Did it come and go?
How often? Every day?
How long did it last?
What do you think brought it on?

C	P	
0	0	No information.
1	1	Not at all or less than once a week.
2	2	Subthreshold: Depressed mood at least 2-3 days/week, for much of the day.
3	3	Threshold: Depressed mood, more days than not (4-7 days/week), most of the day (at least 50% of awake time).

(II) Irritability and anger

Has there been a time when you've felt irritable or angry for most, or all of the time, for days on end? How long did this last? What about recently? Is there a reason why you felt angry more than before?
What kinds of things made you feel angry?
Did you sometimes feel angry and/or irritable and didn't know why?
Did this happen often?
Did you lose your temper?
With your family? Your friends? Who else? At school?
What did you do? Did anybody say anything about it?
How much of the time did you feel angry or irritable?
All of the time? Lots of the time? Or just now and then?

C	P	
0	0	No information.
1	1	Not present. Not at all or less than once a week.
2	2	Subthreshold: Feels definitely more angry or irritable than called for by the situation, at least 2-3 times a week, for much of the day.

3	3	Threshold: Feels irritable/angry more days than not, (4-7 days/week), most of the day (at least 50% of awake time).

(III) Anhedonia, Lack of interest, Apathy, Boredom

Boredom:

Do you do any activities after school or at weekends? What kind of things do you do for fun?
(Give examples: Sports, friends, favourite games, school subjects, family activities, TV, music, dancing, playing alone, reading, going out, etc.).

Has there ever been a time that you felt bored a lot of the time? When? Do you feel bored a lot now? Did you feel bored when you thought about doing the things you usually like to do for fun? (Give examples mentioned above). Did this stop you from doing those things? Did you (also) feel bored while you were doing things you used to enjoy?

Anhedonia:

Did you look forward to doing the things you used to enjoy? (Give examples) Did you try to get into them?
Did you have to push yourself to do your favourite activities? Did they interest you? Did you get excited or enthusiastic about doing them? Why not? Did you have as much fun doing them as you used to before you began feeling (sad, etc.)?
If less fun, did you enjoy them a little less? Much less? Not at all?

Did you have as much fun as your friends?
How many things are much less fun now than they used to be (use concrete examples provided earlier by child)?
How many were as much fun? More fun?
Did you do____ less than you used to? How much less?

C	P	
0	0	No information.
1	1	Not present.
2	2	Subthreshold: Several activities definitely less pleasurable or interesting. Or bored or apathetic at least 3 times a week during activities.
3	3	Threshold: Most activities much less pleasurable or interesting. Or bored or apathetic daily, or almost daily, at least 50% of the time.

(IV) Recurrent thoughts of death

Sometimes when children get upset or feel bad, they think about death, or even feel that they'd be better off dead. Have you ever had these types of thoughts? When? Do you feel that way now? Was there ever another time you felt that way?

C	P	
0	0	No information
1	1	Not present
2	2	Subthreshold: Infrequent thoughts of death (e.g. less than once per month, vague, non-specific).
3	3	Threshold: Recurrent thoughts of death, "I would be better of dead" or "I wish I was dead".

(V) Suicidal Ideation

Sometimes children who get upset or feel bad think about dying or even killing themselves. Have you ever had such thoughts?
How would you do it?
Do you or did you have a plan?

C	P	
0	0	No information.
1	1	Not present.
2	2	Subthreshold: Infrequent or vague thoughts of suicide (e.g. less than once a month).

3	3	Threshold: Recurrent thoughts of suicide.

(VI) Suicidal Acts- Seriousness

Have you actually tried to kill yourself?
When? What did you do?
Any other things?
Did you really want to die
How close did you come to doing it Was anybody in the room?
In the apartment?
Did you tell them in advance? How were you found?
Did you really want to die?
Did you ask for any help after you did it?

C	P	
0	0	No information
1	1	No attempt.
2	2	Subthreshold: Preparations with no actual intent to die (e.g., help pills in hand) or planned attempt but did not follow through or engage in self harm.
3	3	Threshold: Definite suicidal intent.

(VII) Suicidal Acts- Medical Lethality

How close were you to dying after your (most serious suicidal act)?
What did you do when you tried to kill yourself?
What happened to you after you tried to kill yourself? Did you have to go to hospital or get medical attention?

C	P	
0	0	No information.
1	1	No attempt or gesture with no intent to die (e.g., held pills in hand).
2	2	Subthreshold: e.g., took 10 aspirins, mild gastritis, superficial cuts.
3	3	Threshold: Medical intervention occurred or was indicated; or significant cut with bleeding, or took more than a couple of pills.

(VIII) Non-Suicidal Physical Self-Damaging Acts

Did you ever try to hurt yourself?
Have you ever burned yourself with matches/candles? Or scratched yourself with needles/ a knife? Your nails? Or put hot pennies or cigarettes on your skin?
Anything else? Why did you do it? How often?
Do you have many accidents? What kind? How often?

C	P	
0	0	No information
1	1	Not present
2	2	Subthreshold: Infrequent (1-3 times). Has never caused serious injury to self.
3	3	Threshold: Frequent (4 or more times a year) or has caused serious injury to self (e.g. burn with scarring; cut required stitches, broken bone).

2) PSYCHOSIS

(I) Hallucinations

Has there ever been a time you heard, saw or smelled something that other people couldn't hear, see or smell? For example, have you ever heard someone call your name when there was no one around, or seen shadows or objects move? What kind of things did you hear? Did you ever hear music which other people could not (i.e. it wasn't really there)?

Did this only happen at night while you were trying to sleep, or did it happen in the daytime too? Could it have been a dream? What did you see?

Note: If hallucinations possibly present, prior to scoring this item, assess the subject's conviction of the reality of the hallucinations with the probes below.

What did you think it was?
Did you think it was your imagination or was it real?
What did you do when you (heard, saw, etc.) it?
Were you sick with fever (e.g. 'flu) when they occurred?
Were you drinking alcohol or taking any drugs when it happened? Was this the only time it happened?

C	P	
0	0	No information
1	1	Not present
2	2	Subthreshold: Suspected or likely
3	3	Threshold: Definitely present

(II) Delusions

Has there ever been a time your imagination played tricks on you? Did you believe in things that other people didn't believe in? Like what?
Have you ever thought that someone was following you, or listening to your conversations, when you couldn't see anyone? Or thought that someone was out to hurt you? Who? Why? Do you think you really were in danger (from a specific person)?

Have you ever felt that something bad was happening to your body? Did you believe it was rotting from the inside, or that something was very wrong with it?
Did you ever feel convinced that the world was coming to an end? How often did you think about ___?

C	P	
0	0	No information
1	1	Not present
2	2	Subthreshold: Suspected or likely delusional
3	3	Threshold: Definite delusions

3) GENERALISED ANXIETY DISORER

(I) Excessive worries

Would you describe yourself as a worrier? Do you worry a lot about things that might have happened in the past or that might happen in the future?
What kind of things do you worry about?
Do you think you worry or worried more than other kids your age? Has anyone ever said you were a worrier? Do you know why they said that? Can you control your worries, maybe by doing something to take your mind off them (e.g. going out)?

Note: If the only worries the child brings up relates to the attachment figure or a simple phobia, do not score here. Only rate positively if the child worries about multiple things.

C	P	
0	0	No information
1	1	Not present
2	2	Subthreshold: Frequently worries somewhat excessively (at least 3 times per week) about anticipated events or current behavior.
3	3	Threshold: Most days of the week is excessively worried about at least two different life circumstances or anticipated events or current behavior.

(II) Somatic Complaints

Do you worry a lot about your health?
Do you get a lot of headaches? Stomachaches?
Have a lot of aches and pains?
Do you worry that you might have a serious illness? Is there any clear reason for this (e.g. a medical diagnosis)?

C	P	
0	0	No information
1	1	Not present
2	2	Subthreshold: Occational worries/complaints that are more severe and more often than experienced by a typical child his/her age.
3	3	Threshold: Frequent worries/complaints. Worries about health preoccupy child and cause distress.

4) OBSESSIVE-COMPULSIVE DISORDER

(I) Obsessions

Has there ever been a time when you were bothered by thoughts, "pictures" or words which kept coming into your head for no reason and that you couldn't stop or get rid of?

Like did you ever worry a lot about having germs on your hands, or worry that you might get ill from germs? Did you ever worry about doing things perfectly or about making things even or arranging things in a certain way? What about thoughts that something bad might happen, or that you did something terrible, even though you knew it wasn't true?

What about numbers that wouldn't go away?
Do these thoughts get in your way or stop you from doing things?

Any other types of thoughts that kept running around your mind? What about numbers that wouldn't go away? Do these thoughts get in the way of your life or stop you from doing things?

Note: Do not score obsessions item positively if ideas/thoughts are delusional, or relate to another Axis I disorder.

C	P	
0	0	No information
1	1	Not present
2	2	Subthreshold: Suspected or likely.
3	3	Threshold: Definite obsessions, causes some effect on functioning or distress.

(I) Compulsions

Has there ever been a time when you found yourself having to do things over and over, or things which you could not resist repeating like touching things, or counting or washing your hands over and over again, or checking doors/locks or other things?

Were there things you always felt you had to do exactly the same way or in a special way?

Did you ever have trouble making it to school on time because it took too long to get ready in the morning?
Have other people ever commented about these habits?

Has there ever been a time when you were bothered by thoughts, "pictures" or words which kept coming into your head for no reason and that you couldn't stop or get rid of?

C	P	
0	0	No information
1	1	Not present
2	2	Subthreshold: Suspected or likely.
3	3	Threshold: Definite compulsions, causes some effect on functioning or distress.

5) ATTENTION DEFICIT HYPERACTIVITY DISORDER

(I) Difficulty Sustaining Attention on Tasks or Play Activities

Has there ever been a time when you had a lot of trouble paying attention in school? Did it affect your school work? Did you get into trouble because of this? When you were working on your homework, did your mind wander a lot of the time? What about when you were playing games? Did you forget to go when it was your turn?

C	P	
0	0	No information
1	1	Not present
2	2	Subthreshold: Occasionally has difficulty sustaining attention on tasks or play activities. Problems have only minimum effect on functioning.
3	3	Threshold: Often (4-7 days/week) has difficulty sustaining attention. Problem has significant effect on functioning.

(II) Easily Distracted

Was there ever a time when little distractions would make it very hard for you to keep your mind on what you were doing? Like if another kid asked the teacher a question while the class was working quietly, was it ever hard for you to keep your mind on your work? When there was an interruption, like when the phone rang, was it very hard to get back to what you were doing before the interruption? Were there times when you could keep your mind on what you are doing, and little noises and things didn't bother you? How often were they a problem?

C	P	
0	0	No information
1	1	Not present
2	2	Subthreshold: Occasionally distractable. Problem has only minimal effect on functioning.
3	3	Threshold: Attention often disrupted by minor distractions other kids would be able to ignore. Problems has moderate to severe effect on functioning.

(III) Difficulty Remaining Seated

Was there ever a time when you got out of your seat a lot at school? Did this happen a lot or only once or twice? Did you get into trouble for this? Was it hard to stay in your seat at school? What about at dinnertime or at home?

C	P	
0	0	No information
1	1	Not present
2	2	Subthreshold: Occasionally has difficulty remaining seated when required to do so. Problem has only minimal effect on functioning.
3	3	Threshold: Often (4-7 days/week) has difficulty remaining seated when required to do so. Problem has significant effect on functioning.

(IV) Impulsivity

Do you act before you think, or think before you act?
Has there ever been a time when these kinds of behaviours got you into trouble? Give some examples.

C	P	
0	0	No information
1	1	Not present
2	2	Subthreshold: Occasionally impulsive. Problem has only minimal effect on functioning.
3	3	Threshold: Often (4-7 days/week) impulsive. Problem has significant effect on functioning.

6) OPPOSITIONAL DEFIANT DISORDER

(I) Loses Temper

Has there ever been a time when you would get upset easily and lose your temper? Did it take much to make you mad, or did it happen even to little things? How often did you get really mad or annoyed and lose your temper? What were you like when you had a temper tantrum? What did you do? Shout and scream?

C	P	
0	0	No information
1	1	Not present
2	2	Subthreshold: Occasional temper outbursts (less than 1 time weekly).
3	3	Threshold: Severe outbursts at least once a week. Outbursts more severe and more often than a typical child his/her age; causes impairment.

(II) Argues a Lot With Adults/ Authority Figures

Was there ever a time when you would argue a lot with adults? Your parents or teachers? What kinds of things did you argue with them about? Did you argue with them a lot? How bad did the fights get? Did you ever swear at them or hit them?

C	P	
0	0	No information
1	1	Not present
2	2	Subthreshold: Occasionally argues with parents and/or teachers; less than once a week.
3	3	Threshold: Often argues with parents and/or teachers (at least once a week). Arguments more severe and more often than a typical child his/her age.

(III) Disobeys Rules a Lot/ Defies or Refuses to Comply with Adult Requests

Do you ever deliberately break the rules or disobey your parents at home? How about at school? How often does this happen – a lot of the time or hardly ever?
Do you think that your parents/teachers ask you to do things that you shouldn't have to do? Like what? Does this get you into trouble?
In addition ask the following for adolescents:
How often do you get away with things without getting into trouble or without getting caught?

C	P	
0	0	No information
1	1	Not present
2	2	Subthreshold: Occasionally actively defies or refuses adult requests or rules (less than once a week).
3	3	Threshold: Often actively defies or refuses adult requests or rules (at least once a week). Disobedient more often than a typical child his/her age.

7) AUTISM SPECTRUM DISORDER

(I) Stereotyped or repetitive speech, motor movements, or use of objects

Do you like to watch your hands while you wiggle your fingers? Does rocking back and forth calm you down when you're upset? Do people ever tell you to stay still and stop spinning? Do you ever 'flap' your hands when you're excited?

C	P	
0	0	No information
1	1	Not present
2	2	Subthreshold: A few isolated incidents, rarely observed.
3	3	Threshold: Occasional or more frequent occurrences.

(II) Insistence on sameness, Inflexible adherence to routines, Ritualized patterns of verbal or nonverbal behaviour

Do you get really upset when there is an unexpected change in your plans or the way you usually do things, like if there is a delay in the start of school, if dinner is a little earlier than usual, or if you have to drive home a different way than usual? What do you do if something like this happens and how long would you be upset?

C	P	
0	0	No information
1	1	Not present
2	2	Subthreshold: Only mildly inflexible, or inflexibility not evident in early childhood.
3	3	Threshold: Significant and persistent rigid adherence to routines and rituals that elicit distress when interrupted. Pattern of behavior evident since early childhood.

(III) Highly restricted, fixated interests that are abnormal in intensity or focus

Is there something special you are interested in that you really like to talk about, read about, or do? Maybe something like engines or the inside of computers? Tell me about it.

NOTE: RATE THIS AS POSITIVE IF IT IS INAPPROPRIATE FOR THE AGE AND CULTURE OF THE CHILD, AND IT IS EXAGGERATED. DO NOT SCORE PREOCCUPATION WITH VIDEOGAMES OR COMPUTER GAMES HERE.

C	P	
0	0	No information
1	1	Not present
2	2	Subthreshold: Unusual preoccupations that do not cause significant impairment or take excessive amounts of time.
3	3	Threshold: Definitely preoccupied with one or more stereotyped and restricted patterns of interest that is abnormal either in intensity or focus. Causes significant impairment in social functioning or limits participation in other activities.

(IV) Deficits in nonverbal communicative behaviours used for social interaction

No question for the child? SCORE OBSERVATIONALLY.

Eye to Eye Gaze: Do you frequently have to remind your child to look at you or the person s/he is talking to?
Facial Expressions: Does your child show the typical range of facial expressions?
Can you see joy on his/her face when /she is happy?
Does s/he pout or look upset when s/he is sad?
Does s/he show less common facial expressions like surprise, interest, and guilt?
Gestures: As a toddler or preschooler, did your child use common gestures like pointing to show interest, clapping when happy, and nodding to indicate 'yes'?
Does he /she use gestures to help show how something works or while they are explaining something?
Indicate problematic areas of non-verbal behavior:
Gaze Expressions Gestures

C	P	
0	0	No information
1	1	Not present
2	2	Subthreshold: Subtle problems in one or more area, which is evident to family members and professionals but not to teachers or classmates.
3	3	Threshold: Problems with one or more aspects of non-verbal behaviours cause functional impairment.

8) ALCOHOL USE (0= No Information; 1= No; 2= Yes)

Do you drink alcohol or did you drink in the past? How much alcohol do you drink in a typical week? What do you drink – beer, wine or spirits? How often? Do you get drunk? Do you have a group of friends you usually drink with or do you usually drink alone? Where do you usually drink? At home? Parties? A friend's house? The street? Pubs?

(I). Use

a. Drank two drinks in one week four or more times	0 1 2
b. Age of first regular use: _____	
c. Current frequency of use (days per month): _____	
d. Have you ever had 3 or more drinks in a single day?	0 1 2
(II). Problems related to alcohol	
Has drinking ever caused you any problems at home? With your parents? With your schoolwork? With your teachers? With your friends? With a job? *Have you ever gotten in trouble (with the law) while drinking?*	0 1 2
(III). Received treatment for alcohol problems?	0 1 2

9) ALCOHOL USE DISORDER

1. Quantity	C	P	
a. How many drinks do you usually have when you sit down to drink?	0	0	No information
	1	1	1 - 2 drinks
	2	2	3 or more drinks
b. What's the most you ever drank in a single day? When was that? How about in the last six months, what's the most you drank in a single day?	**C**	**P**	
	0	0	No information
	1	1	1 - 2 drinks
	2	2	3 or more drinks
2. Frequency	**C**	**P**	
What's the most number of days in a given week that you had something to drink? Do you usually drink on Friday and Saturday night? In the week as well (e.g. after school)?	0	0	No information
	1	1	1 - 2 days
	2	2	3 or more days
3. Concern from Others about Drinking	**C**	**P**	
Has anyone ever complained about your drinking? Friends? Parents? Teachers? Have you ever been worried about it at all? Have you ever tried to stop or cut down?	0	0	No information
	1	1	No
	2	2	Yes

10) SUBSTANCE USE (0= No Information; 1= No; 2= Yes)

Prior to beginning this section, give the subject the list of drugs included on the next page. Remind child about the confidential nature of the interview prior to beginning probes (if appropriate).

(I). Drug Use

Let me know if you have used any of the drugs on this list before, even if you have only tried them once. Which ones have you ever used?

	C	P
a. Cannabis (Marijuana, pot, hash, THC)	0 1 2	0 1 2
b. Stimulants (Speed, uppers, amphetamines, dexedrine, diet pills, crystal meth)	0 1 2	0 1 2
c. Sedatives/Hypnotics/Anxiolytics (Barbiturates (sedatives, downers), Benzodiazepine, Quaalude (ludes), valium, librium, Xanax)	0 1 2	0 1 2
d. Cocaine (Coke, crack)	0 1 2	0 1 2
e. Opioids (Heroin, morphine, codeine, methadone, Demerol, percodam)	0 1 2	0 1 2
f. PCP (Angel dust)	0 1 2	0 1 2
g. Hallucinogens (LSD, acid, trips, other psychedelic drugs)	0 1 2	0 1 2
h. Solvents/Inhalants (Glue, tippex, petrol, chloroform, ether, paint thinner)	0 1 2	0 1 2
i. Other (Prescription drugs, nitrous oxide, ecstasy, MDMA, etc.)	0 1 2	0 1 2

11) SUBSTANCE USE DISORDER

(II) Frequency

In the past 6 months, what is the most you have ever used___? Everyday or almost every day for at least 1 week? Less? More? Was there a time when you used___ more than you do now?

Code:

0 = No information

1 = Not present

2 = Less than once a month

3 = More than once a month

	C	P
a. Cannabis	0 1 2 3	0 1 2 3
b. Stimulants	0 1 2 3	0 1 2 3
c. Sedatives/Hypnotics/Anxiolytics	0 1 2 3	0 1 2 3
d. Cocaine	0 1 2 3	0 1 2 3
e. Opioids	0 1 2 3	0 1 2 3
f. PCP	0 1 2 3	0 1 2 3
g. Hallucinogens (e.g. acid or LSD)	0 1 2 3	0 1 2 3
h. Solvents/Inhalants	0 1 2 3	0 1 2 3
i. Other	0 1 2 3	0 1 2 3
j. Polysubstance (multiple drugs at once)	0 1 2 3	0 1 2 3

(III) Problems related to substance abuse

Has your use of ___ ever caused you any problems at home? With your parents? With your schoolwork? With teachers (e.g. exclusion)? With friends? With the police?	0 1 2

12) POST-TRAUMATIC STRESS DISORDER

(I) Traumatic Event

Probe: *I am going to ask you about a number of bad things that often happen to children your age, and I want you to tell me if any of these things have ever happened to you. Be sure to tell me if any of these things have ever happened, even if they only happened one time.*

a. Car Accident		0 1 2	h. Terrorism Related Trauma		0 1 2
Have you ever been in a bad car accident? What happened? Were you hurt? Was anyone else in the car hurt?			*Have you been involved in a terrorist attack? When and where?*		
Significant car accident in which child or other individual required medical intervention.			**Loved one missing for extended period of time or seriously injured or killed by terrorist attack.**		

b. Other Accident 0 1 2

Have you ever been in any other type of bad accidents? Like a bike accident? Other? What happened?
Were you hurt?

Significant accident in which child was injured and required medical intervention.

c. Fire 0 1 2

Have you ever been in a serious fire?
Your house or school? Did you ever start a fire that got out of control?
Did anyone get hurt?

Child witness to fire that caused significant damage or moderate to severe physical injuries.

d. Witness of a Disaster 0 1 2

Have you ever been in a really bad storm, like a tornado or a hurricane?
Have you ever been caught in floods with waters that were deep enough to swim in?

Child witness to natural disaster that caused significant devastation.

e. Witness of a Violent Crime 0 1 2

Have you ever witnessed a violent crime, like seeing somebody get robbed or shot?
Seen someone taken hostage?
Was anyone seriously hurt?

Child witness to threatening or violent crime.

f. Victim of Violent Crime 0 1 2

Did anyone ever mug or attack you in another way? What happened? Were you badly hurt?

Child victim of seriously threatening or violent crime.

g. Confronted with Traumatic News 0 1 2

Have you ever gotten some really bad news unexpectedly? Like finding out someone you loved died suddenly or was seriously ill (e.g. cancer) and would never get better?

Learned about sudden, unexpected death of a loved one, or that loved one has life-threatening disease.

i. War Zone Trauma 0 1 2

Have you ever lived in a war zone?
Had your home attacked?
Witnessed the killing or sexual assault of others?
Seen everything around you set on fire?

Lived in war zone. Witnessed death and mass destruction.

j. Witness to Domestic Violence 0 1 2

Did your parents ever get in really bad fights? Tell me about the worst fight you remember your parents having. What happened?

Child witness to explosive arguments involving threatened or actual harm to parent.

k. Physical Abuse 0 1 2

When your parents got mad, did they hit you?
Have you ever been hit so that you had bruises or marks on your body, or were hurt in some way? What happened?

Bruises sustained on more than one occasion, or more serious injury sustained.

l. Sexual Abuse 0 1 2

Did anyone ever touch your private parts when they shouldn't have? Made you undress, touch you between the legs, make you get in bed with them, or play with their private parts?

Isolated or repeated incidents of genital fondling, oral sex, or vaginal or anal intercourse.

m. Other 0 1 2

Is there anything else that happened that was really bad or scary, that you want to tell me about?

Please Specify_____

Appendix B

(II) Screen Items

1. Recurrent Thoughts or images of the Event *Has there ever been a time when you kept seeing again and again? How often did this happen? Did what happened keep coming into your mind? Did you think about it a lot?*	0 1 2
2. Feelings of Detachment *Is it harder for you to trust other people or interact with people? Do you feel like being alone more often than before? Like you just don't feel like being around people now that you used to like being around before? Do you feel alone even when you are with other people?*	0 1 2
3. Efforts to Avoid Thoughts or Feelings Associated with the Trauma *Are there places or things that remind you of ____? Do you try to avoid them? You said before that ___ sometimes reminds you of what happened. Do you try to avoid ___?*	0 1 2
4. Nightmares *Has there ever been a time when you had a lot of nightmares about ____? Did you ever dream about ___? How often? How did you feel when you woke up from one of your nightmares?*	0 1 2
5. Hypervigilance *Since ___ happened, are you a lot more careful? Do you feel like you always have to watch what's going on around you? Do you double check the doors or windows to make sure they are locked?*	0 1 2
5. Irritability or Outbursts of Anger? *After___ happened, did you feel angry or irritable a lot more than usual? Were you having a lot of temper tantrums?*	0 1 2

B.8 Conduct Disorder Supplement

(1) Vandalism

Do you ever break other people's things on purpose? Like breaking windows? Smashing cars? Anything else? What's the most expensive thing you ever broke, damaged, or destroyed on purpose? How about when you are feeling really angry? About how often do you break or destroy other people's things on purpose?

C	P	
0	0	No information.
1	1	Not present.
2	2	Subthreshold: Minor acts of vandalism on 1 or 2 occasions (e.g., breaks another's toy on purpose).
3	3	Threshold: Three or more instances of moderate to severe vandalism

(2) Breaking and entering

In the past six months, have you or any of your friends broken into any cars? Houses? Any stores? Warehouses? Other buildings? About how many times have you broken into a house, car, store, or other building?

C	P	
0	0	No information.
1	1	Not present.
2	2	Subthreshold: Has been with friends who broke into a house, car, store, or building, but did not actively participate.
3	3	Threshold: Has broken into a house, car, store, or building 1 or more times.

(3) Aggressive Stealing

In the past six months, have you or any of your friends held anyone up to try and get their money or something else? Snatched their purse or mobile? Threatened them? How often?

C	P	
0	0	No information.
1	1	Not present.
2	2	Subthreshold: Has been with friends who aggressively stole, but did not actively participate.
3	3	Threshold: Mugging, purse-snatching, extortion, armed robbery, etc. on 1 or more occasions

(4) Fire Setting

Have you ever set anything on fire?

C	P	
0	0	No information.

Why did you start the fire? Were you playing with matches and did you start the fire by accident, or did you start it on purpose? Were you angry? Were you trying to cause a lot of damage or to get back at someone? What's the most damage you ever caused by starting a fire? About how many fires have you set?

C	P	
1	1	Not present.
2	2	Subthreshold: Match play. No intent to cause damage, and fire(s) not started out of anger.
3	3	Threshold: Set 1 or more fires with the intent to cause damage, or out of anger.

(5) Often Stays out at Night

What time are you supposed to come home at night? Do you often stay out past your curfew?

What is the latest you ever stayed out? Have you ever stayed out all night? How many times have you done that?

C	P	
0	0	No information.
1	1	Not present.
2	2	Subthreshold: Stayed out all night, or almost all night, on one isolated occasion.
3	3	Threshold: Stayed out all night, or almost all nights, on several occasions (2 or more times)

(6) Run Away Overnight

Over the past six months, have you run away from home? Why? Was there something going on at home that you were trying to get away from?

How long did you stay away? How many times did you do this?

Note: Do not score positively if child ran away to avoid physical or sexual abuse.

C	P	
0	0	No information.
1	1	Not present.
2	2	Subthreshold: Ran away overnight only one time, or ran away for shorter periods of time on several occasions.
3	3	Threshold: Ran away for at least two nights or more on one or more occasions, or ran away overnight 2 or more times.

(7) Use of a Weapon

Do you carry a knife or a gun? A numb-chuck? Have you ever used a weapon against someone else, including using bricks, broken bottles, or other things you might pick up from the street? What about in self-defense?

Have you ever threatened to use a weapon to get someone to back off?

C	P	
0	0	No information.
1	1	Not present.
2	2	Subthreshold: Has threatened to use a weapon, but has never used one.
3	3	Threshold: Used a weapon that can cause serious harm on 1 or more occasions (e.g., knife, brick, broken

bottle, gun).

(8) Physical Cruelty to Persons

What is the worst you ever laid into someone in a fight? Have you ever beat someone up really badly for no real reason, or just because you don't like them? What happened? Did they get hurt? Have you ever put someone in hospital?

C	P	
0	0	No information.
1	1	Not present.
2	2	Subthreshold: Bullies others (e.g., pushes, intimidates others), but has never bruised anyone, or caused a more serious injury.
3	3	Threshold: Bullying or physical cruelty to others has led to moderate to severe injury (e.g., Bruises, laceration).

(9) Forced Sexual Activity

Are you sexually active (if 'No' stop here)? Have you ever forced anyone to have sex with you, or go further than they wanted? Has someone ever said you did? What did they say happened? How many times has this happened?

C	P	
0	0	No information.
1	1	Not present.
2	2	Subthreshold: Forced someone to participate in non-genital fondling on one or more occasions.
3	3	Threshold: Forced someone to participate in

(10) Cruelty to Animals

Some kids like to hurt or torture animals. In the past six months have you hurt or tried to hurt an animal on purpose? Shot at one with an air rifle or BB gun? Fed an animal poison? Other things? What did you do? About how many times have you hurt an animal on purpose in the last six months?

Note: Do not score traditional hunting outings.

C	P	
0	0	No information.
1	1	Not present.
2	2	Subthreshold: Has killed or tortured an animal on only one occasion.
3	3	Threshold: Has killed or tortured an animal on 2 or more occasions

(11) Impairment

a. Socially (With peers)	0 1 2
b. With family:	0 1 2
c. In school	0 1 2
(12) Duration of Disturbance *For how long did you (list positively endorsed conduct symptoms)?* **6 months or more**	0 1 2
(13) Group type *Did you normally do (positively endorsed conduct symptoms) with your friends or in a group with other kids?*	0 1 2
(14) Solitary aggressive type *Did you normally do (positively endorsed conduct symptoms) alone or by yourself?*	0 1 2
(15) Undifferentiated type *Did you do some of the things we talked about with your friends and others on your own?*	0 1 2
Evidence of Conduct Disorder **DSM-IV Criteria** A. Meets criteria for at least three of the following 15 conduct symptoms in the past 12 months, with at least one criterion present in the past 6 months: *Lies, truant, physical fights, bullies, often stays out at night, nonaggressive stealing, vandalism, breaking and entering, aggressive stealing, fire-setting, ran away overnight, use of a weapon, physical cruelty to persons, forced sexual activity, cruelty to animals.*	0 1 2
B. Behavior causes clinically significant impairment;	0 1 2

0 1 2

and, C. If 18 or older, does not meet criteria for antisocial personality disorder. <u>Childhood-Onset Type</u> Onset of at least one criterion prior to the age of 10 years. <u>Adolescent-Onset Type</u> Absence of any criteria prior to age 10 years.	0 1 2

B.9 Inventory of Callous-Unemotional Traits (Youth Version)

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ICU
(YV)

ID:

Date Completed:

Instructions: *Please read each statement and decide how well it describes you. Mark your answer by circling the appropriate number (0-3) for each statement. Do not leave any statement unrated.*

	Not at all true	Somewhat true	Very true	Definitely True
1. I express my feelings openly.	0	1	2	3
2. What I think is "right" and "wrong" is different from what other people think.	0	1	2	3
3. I care about how well I do at school or work.	0	1	2	3
4. I do not care who I hurt to get what I want.	0	1	2	3
5. I feel bad or guilty when I do something wrong.	0	1	2	3
6. I do not show my emotions to others.	0	1	2	3
7. I do not care about being on time.	0	1	2	3
8. I am concerned about the feelings of others.	0	1	2	3
9. I do not care if I get into trouble.	0	1	2	3
10. I do not let my feelings control me.	0	1	2	3
11. I do not care about doing things well.	0	1	2	3
12. I seem very cold and uncaring to others.	0	1	2	3
13. I easily admit to being wrong.	0	1	2	3
14. It is easy for others to tell how I am feeling.	0	1	2	3
15. I always try my best.	0	1	2	3
16. I apologize ("say I am sorry") to persons I hurt.	0	1	2	3
17. I try not to hurt others' feelings.	0	1	2	3
18. I do not feel remorseful when I do something	0	1	2	3
19. I am very expressive and emotional.	0	1	2	3
20. I do not like to put the time into doing things well.	0	1	2	3

	Not at all true	Somewhat true	Very true	Definitely True
21. The feelings of others are unimportant to me.	0	1	2	3
22. I hide my feelings from others.	0	1	2	3
23. I work hard on everything I do.	0	1	2	3
24. I do things to make others feel good.	0	1	2	3

B.10 Interpersonal Reactivity Index

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IRI

ID: _____ **Date completed** _____

The following statements inquire about your thoughts and feelings in a variety of situations. For each item, indicate how well it describes you by choosing the appropriate letter on the scale at the top of the page: 0, 1, 2, 3, or 4. When you have decided on your answer, fill in the letter on the answer sheet next to the item number. READ EACH ITEM CAREFULLY BEFORE RESPONDING. Answer as honestly as you can. Thank you.

		Does not describe me very well				Describes me very well
1	I daydream and fantasise, fairly often, about things that might happen to me.	0	1	2	3	4
2	I often have tender, concerned feelings for people less fortunate than me.	0	1	2	3	4
3	I sometimes find it difficult to see things from the "other guy's" point of view	0	1	2	3	4
4	Sometimes I don't feel very sorry for other people when they are having problems	0	1	2	3	4
5	I really get involved with the feelings of the characters in a novel	0	1	2	3	4
6	In emergency situations, I feel apprehensive and ill-at-ease	0	1	2	3	4
7	I am usually objective when I watch a movie or play, and I don't often get completely caught up in it	0	1	2	3	4

		Does not describe me very well				Describes me very well
8	I try to look at everybody's side of a disagreement before I make a decision	0	1	2	3	4
9	When I see someone being taken advantage of, I feel kind of protective towards them	0	1	2	3	4
10	I sometimes feel helpless when I am in the middle of a very emotional situation	0	1	2	3	4
11	I sometimes try to understand my friends better by imagining how things look from their perspective	0	1	2	3	4
12	Becoming extremely involved in a good book or movie is somewhat rare for me	0	1	2	3	4
13	When I see someone get hurt, I tend to remain calm	0	1	2	3	4
14	Other people's misfortunes (bad luck) do not usually disturb me a great deal	0	1	2	3	4
15	If I'm sure I'm right about something, I don't waste much time listening to other people's arguments	0	1	2	3	4
16	After seeing a play or movie, I have felt as though I were one of the characters	0	1	2	3	4
17	Being in a tense emotional situation scares me	0	1	2	3	4
18	When I see someone being treated unfairly, I sometimes don't feel very much pity for them	0	1	2	3	4

		Does not describe me very well				Describes me very well
19	I am usually pretty effective in dealing with emergencies	0	1	2	3	4
20	I am often quite touched by things that I see happen	0	1	2	3	4
21	I believe that there are two sides to every question and try to look at them both	0	1	2	3	4
22	I would describe myself as a pretty soft-hearted person	0	1	2	3	4
23	When I watch a good movie, I can very easily put myself in the place of a leading character	0	1	2	3	4
24	I tend to lose control during emergencies	0	1	2	3	4
25	When I'm upset at someone, I usually try to "put myself in his shoes" for a while	0	1	2	3	4
26	When I am reading an interesting story or novel, I imagine how I would feel if the events in the story were happening to me	0	1	2	3	4
27	When I see someone who badly needs help in an emergency, I go to pieces	0	1	2	3	4
28	Before criticising somebody, I try to imagine how I would feel if I were in their place	0	1	2	3	4

B.11 Debriefing Statement

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Debriefing Statement *(written):* (Version 1.0, 28/10/2013)

Study Title: *Understanding Emotion Recognition and Empathy in Adolescents with and without Disruptive Behaviour*

The aim of this research is to look at similarities and differences between teenagers with behavioural difficulties (with or without a history of negative early experiences) and a control group of teenagers.

You were asked to come to the Academic Unit of Psychology to take part in a series of computerised tasks measuring your eye movements when tracking dots and when perceiving others' emotions from faces and body postures. We are interested in finding out where teenagers look when viewing others' facial expressions and body language in order to recognise their emotions, and whether there are any differences between teenagers with and without behavioural difficulties. Additionally, we are aiming to explore whether having a history of early negative experiences affects how teenagers recognise others' emotions.

We are also interested in seeing how teenagers process emotional situations, including what they think others are feeling, and what they, themselves, are feeling. We are studying whether there are differences between teenagers with and without behavioural difficulties. Additionally, we aim to explore whether having a history of negative early experiences affects teenagers' empathic skills.

Once again, let us remind you that the results of this study will not include any identifying details and that your data will be number coded and treated as confidential. If you have any further questions regarding the study, please contact me, Nayra Martin-Key, at namk1e13@soton.ac.uk

Thank you for taking part in this research.

If you have any questions about your rights as a participant in this research, or you feel that you have been placed at risk, you may contact the Head of Research Governance, Dr Martina Prude (02380 595058, mad4@soton.ac.uk) who will be happy to help.

If you require further advice and support after taking part in the study you can contact 'No Limits',

a charity that offers information, counselling and support for young people living in Southampton and Hampshire. Their contact details are: 02380 224224 and http://www.nolimitshelp.org.uk/home.

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