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Factors associated with reward and punishment responsivity in children and young people
with callous unemotional traits

Jayde Sayers¹

Research Supervisors:

Dr Luna Centifanti¹ and Dr Steven Gillespie¹

¹Department of Clinical Psychology, University of Liverpool, UK

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Introductory Chapter: Thesis Overview

The overall aim of the current thesis was to improve the understanding of reward and punishment sensitivity or responsivity in CYP (CYP) who display persistent patterns of violent and antisocial behaviour. It is estimated that one in twenty (5.6%) of 5 to 19 year old's have conduct problems, with these rates higher for boys than girls (NHS digital, 2018). These behaviours are a serious concern for public policy and are associated with a host of social, emotional and academic problems for the child or young person (Kimonis & Frick, 2011).

Research has found that there is considerable heterogeneity within this group of CYP which creates challenges for developing effective evidence-based interventions (Frick, Ray, Thornton, & Kahn et al, 2014). One approach to delineate this group of CYP is by their affective and interpersonal style, and not the conduct problems themselves. Specifically, research has focused on identifying CYP on the basis of a callous unemotional (CU) interpersonal style or '*trait*' which derives from the adult literature of psychopathy (Frick et al., 2014; Hare & Neumann, 2008). CYP with CU traits are characterised by affective and interpersonal problems such as lack of remorse or empathy, callous use of others and shallow or deficient emotions (Fanti, 2013; Frick & Viding, 2009). These CYP represent a group with the most persistent and severe problem behaviours (Burke, Loeber, & Lahey, 2007; Lynam, Caspi, Moffitt, Loeber, & Stouthamer-Loeber, 2007) and it is estimated that between 36% and 55% of CYP accessing the youth justice system have elevated CU traits (Teplin, Abram, McClelland, Dulcan, & Mericle, 2002).

CYP with CU traits have been found to show more risk taking behaviours and the mechanism behind this is thought to be due to their responsiveness to reward (Barry et al., 2000; O'Brien & Frick, 1996) and reduced sensitivity to punishment cues (Allen, Morris, &

1 Chhoa, 2016; Fisher & Blair, 1998; Pardini, Lochman, & Frick, 2003). The experience of
2 punishment is usually perceived as negative or discomforting by a child or young person
3 (Kochanska, 1994). However, for CYP with CU traits, they have been found to have a
4 reduced responsivity, level of arousal, and memory for negative stimuli (Anastassiou-
5 Hadjicharalambous & Warden, 2008; Kimonis, Frick, Fazekas, & Loney, 2006; Sharp, van
6 Goozen, & Goodyer, 2006). This lack of arousal and emotional memory for negative
7 information in relation to reward and punishment responsivity was investigated in Chapter 2.

8 To the author's best knowledge, there has not been a systematic review examining
9 responsiveness to reward and insensitivity to punishment. In order to address this, Chapter 1 of
10 the current thesis outlines a systemic review of studies investigating responsiveness to reward
11 and insensitivity to punishment in CYP with CU traits. The findings demonstrated that CYP
12 with CU traits are less responsive (or insensitive) to punishment. However the literature
13 pertaining to reward responsivity was inconsistent. There was a lack of consistency within
14 which reward and punishment responsivity was measured and conceptualised. Furthermore,
15 given the heterogeneity associated with CU traits it was surprising that many studies failed to
16 include or acknowledge subgroups of CU traits. Finally, the review found that CYP with CU
17 traits were insensitive to punishment however there remains little explanation of the
18 mechanism of this relationship.

19 In order to address the limitations documented within the review, Chapter 2 details an
20 empirical study that examined the mechanism behind the relationship between CU traits and
21 responsivity to reward, when there is a possibility of being punished. Specifically the study
22 explored whether emotional memory could explain this relationship. The study used
23 validated measures of CU traits, anxiety and conduct problems. Task based measures were
24 used to assess reward responsivity (when there is a possibility of being punished) and an
25 ecologically valid measure was used to assess emotional memory in a life like setting (The

1 Scenic False Memory Paradigm; Hauschildt, Peters, Jelinek, & Moritz, 2012). Correlation
2 and regression analysis were conducted and no associations were found between CU traits,
3 reward sensitivity or emotional memory. As predicted, high CU traits were related to higher
4 conduct problems. It is believed that with a sample size and greater power, significance
5 would have been reached. Clinical implications regarding the focus of assessment, support
6 and interventions for CYP with CU traits are presented.

7 It is planned that both chapters will be submitted to the Journal of Development and
8 Psychopathology (See Appendix A for guidelines).

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Chapter 1: Literature Review

What is the association of callous unemotional traits with responsiveness to reward and punishment in children and young people? A Systematic Review¹

Jayde Sayers

Author Note

Correspondence concerning this review should be addressed to Jayde Sayers, Doctorate in Clinical Psychology Programme, Institute of Health, Psychology and Society, University of Liverpool, The Whelan Building, Brownlow Hill, Liverpool, L69 3GB, UK. Email: Jayde.Sayers@liverpool.ac.uk

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Abstract

1
2 **Objectives** To review the literature on reward and punishment responsivity in
3 children and young people with callous unemotional traits (CU). **Methods** Electronic
4 searches of four online databases were conducted using predefined search terms. Fourteen
5 articles were selected for review according to predetermined criteria to identify quantitative
6 studies investigating reward and punishment responsivity in children and young people with
7 CU traits. The Quality Assessment Tool for reviewing Studies with Diverse Designs
8 (QUATSDD) was used to evaluate risk of bias. The results were synthesised narratively.
9 **Results** Over half of the studies reported significant findings, in that, children and young
10 people with CU traits were less responsive to punishment. The findings for reward
11 responsivity were inconsistent with many studies finding no statistically significant
12 relationships. Studies varied in what method was used to measure reward and punishment
13 responsivity, from using self-report questionnaires to using risky decision making tasks. Only
14 two studies measured young people's level of anxiety alongside responsiveness to reward or
15 punishment. **Conclusions** Children and young people with CU traits are less responsive to
16 punishment; however, the literature pertaining to reward responsivity is inconsistent. These
17 findings have implications for interventions such that traditional approaches to treatment use
18 behaviour modification methods based on social learning theory and operant conditioning.
19 Methods involving punishment or harsh discipline have poorer outcomes for children with
20 CU traits. The heterogeneity associated with CU traits makes accounting for anxiety
21 necessary and we urge future research to consider this. Finally, future research should
22 investigate the underlying processes behind responsiveness to punishment to aid intervention.
23 **Keywords** systematic review; callous unemotional traits; children; young people;
24 reward; punishment
25

Introduction

1 All children disobey adults and break the rules during their development (Thompson,
2 Centifanti, & Lemerise, 2017) however a subset of children and young people seem to
3 persistently engage in norm-breaking behaviours and show significant externalising problem
4 behaviours. Prevention of these externalising behaviours in children and young people (i.e.
5 aggression and violence) reduces costs to the economy, education and the employment
6 system (Scott, Knapp, Henderson, & Maughan, 2001). Externalising behaviours, or conduct
7 problems, are a major problem in schools and society, and have a considerable negative
8 impact on both the individual and the systems around them. Conduct problems are often
9 predictive of school dropout, truancy, peer rejection and poor academic outcomes (Parker,
10 Rubin, Price & Derosier, 1995). This places a burden on health, social and criminal justice
11 systems (i.e. secure care, court proceedings and incarceration), withstanding the greatest cost
12 (Green et al., 2005; Herlitz, 2016; Snell et al., 2013).

14 The traditional criminal justice system has been shown to be inadequate for children
15 and young people; 64 percent of children given a Youth Rehabilitation Order and 69 percent
16 of those sentenced to custody, go on to reoffend within a year (Ministry of Justice & National
17 Statistics, 2016). The youth justice system relies on punitive methods and a ‘tough on crime’
18 approach (Bottoms, 1995) for rehabilitation of offenders and primarily uses punishment as a
19 deterrent of future anti-social behaviour (Ministry of Justice, 2010 pp. 14). One potential
20 explanation of this inefficiency within the youth justice system is that a subset of children
21 displaying severe antisocial behaviours and a callous unemotional (CU) interpersonal style,
22 have been found to have a reduced sensitivity to punishment and heightened sensitivity to
23 reward (Ezpeleta, Granero, de la Osa, & Domènech, 2017; Frick et al., 2003; O’Brien &
24 Frick, 1996; Pardini, Lochman, & Frick, 2003). That is, these children and young people with
25 CU traits prefer, and appear to respond better to, praise and token economies over and above

1 discipline and punishment methods like time out or response cost (i.e. removal or withdrawal
2 of items as a consequence of behaviour). This insensitivity to punishment is thought to
3 increase the persistence of future antisocial behaviour and risky decision making (Byrd,
4 Hawes, Burke, Loeber, & Pardini, 2018). Given that children and young people with the most
5 severe antisocial behaviour exert a cost on society, there is a strong emphasis on investigating
6 and understanding the mechanism behind antisocial behaviours.

7

8 **Externalising Behaviours and Interpersonal Difficulties**

9 **Conduct problems.** Conduct problems are common in children and young people
10 (National Institute for Care and Excellence, 2017). If there is a severe, repetitive and
11 persistent pattern of violent and antisocial behaviour, children with conduct problems may be
12 diagnosed with conduct disorder (American Psychiatric Association; APA, 2013). Conduct
13 problems are exhibited by children and young people diagnosed with conduct disorder and
14 oppositional defiance disorder. The DSM-5 (APA, 2013) characterises conduct disorder as
15 behaviour that violates the rights of others or major societal norms. Oppositional defiance
16 disorder has comparable characteristics but is common in children under the age of 10
17 (Bufferd, Dougherty, Carlson, Rose, & Klein, 2012; Ezpeleta et al., 2017) . Oppositional
18 defiance disorder tends to co-occur with conduct disorder during development, although
19 some children “graduate” from having oppositional defiance disorder to conduct disorder
20 (Rowe, Maughan, Pickles, Costello, & Angold, 2002). For the purpose of this review, the
21 focus is on conduct problems in general and not solely on disorders that have conduct
22 problems as part of their diagnostic features.

23 **Callous-unemotional traits.** In recent years, there has been an interest in the
24 heterogeneity of groups of children and young people with conduct problems, with particular
25 attention paid to the presence or absence of callous-unemotional (CU) traits. Children and

1 young people with CU traits are characterised by affective and interpersonal problems such
2 as a lack of remorse or empathy, callous use of others and shallow or deficient emotions
3 (Frick & Viding, 2009). CU traits in children and young people are associated with a greater
4 severity, variety and stability of antisocial behaviour (Burke, Loeber, & Lahey, 2007; Lynam,
5 Caspi, Moffitt, Loeber, & Stouthamer-Loeber, 2007; Salekin, 2008; Viding, Blair, Moffitt, &
6 Plomin, 2005).

7 The importance of considering the presence or absence of CU traits, for children and
8 young people with conduct problems, has led to the inclusion of the specifier ‘with limited
9 prosocial emotion’ for conduct disorder within the DSM-5 (APA, 2013). It is thought that 12
10 to 40 percent of young people with conduct disorder show significant CU traits (Fanti, 2013;
11 Kahn, Frick, Youngstrom, Findling, & Youngstrom, 2012; Pardini, Stepp, Hipwell,
12 Stouthamer-Loeber, & Loeber, 2012). The limited prosocial emotions specifier permits the
13 identification of a more homogeneous subgroup of children and young people who share a
14 CU pattern of interpersonal and emotional functioning, and is used when a child or young
15 person meets the criteria for conduct disorder. That is, children and young people may be
16 diagnosed with conduct disorder with limited prosocial emotions when they persistently
17 (more than 12 months) show two or more of the following characteristics: (i) lack of remorse
18 or guilt; (ii) callous-lack of empathy; (iii) unconcerned about performance; or (iiii) shallow or
19 deficient affect. Yet, there is evidence to suggest that CU traits can be present in children and
20 young people independently of conduct problems. For example, children and young people
21 who have experienced early trauma and deprivation may present with similar characteristics
22 to those with CU traits but in the absence of conduct problems (Kumsta, Sonuga-Barke, &
23 Rutter, 2012). However, this is relatively rare in community populations (Fontaine,
24 McCrory, Boivin, Moffitt, & Viding, 2011). For the purpose of this review, the term CU

1 traits will be used regardless of the presence of conduct problems because the focus is on
2 reward and punishment sensitivity related to CU traits.

3 The presence of CU traits, along with a deceitful and manipulative interpersonal style,
4 and disinhibited or antisocial behaviour, refers to a constellation of personality traits that
5 have been termed psychopathy (Byrd, Loeber, & Pardini, 2014). The CU specifier for
6 ‘limited pro-social emotions’ is most closely linked to the affective component of
7 psychopathy, which has been considered a core feature of the psychopathy construct within
8 the adult population (Hare & Neumann, 2008). Given that CU traits are closely linked with
9 psychopathy constructs, considerable care should be taken when applying this construct to
10 children and young people. There is potential harm related to the diagnosis and social stigma
11 of diagnostic labelling such as conduct disorder, delinquent and psychopath (Edens & Cox,
12 2012; Rockett, Murrie, & Boccaccini, 2007). The author has critically reflected on the use of
13 this problematic terminology in Appendix C.

14

15 **Theoretical Underpinnings of Reward and Punishment**

16 Children and young people with CU traits make riskier decisions than those
17 without CU traits (Centifanti & Modeki, 2013); one explanation for this is these children and
18 young people have a higher sensitivity to rewards (O’Brien & Frick, 1996). A focus on
19 rewards could explain their increased risky decision making (Centifanti & Modecki, 2013).
20 Gray’s reinforcement sensitivity theory (1981, 1987) is the most cited framework for
21 understanding reward and punishment sensitivity in humans. The theory proposes two
22 systems: the behavioural approach system (BAS) which increases activity and initiates goal-
23 directed behaviour in response to a reward, and the behavioural inhibition system (BIS)
24 which inhibits action and avoids aversive stimuli or punishment. Quay (1993) was one of the

1 first to extend Gray's model suggesting that children and young people with conduct
2 problems have an over active BAS (or reward system) and a reduced BIS.

3 In the literature investigating adults with psychopathy, people with psychopathy have
4 been found to have little negative arousal in response to punishment. Therefore, people with
5 psychopathy have difficulties learning from punishment cues (Fowles, 1980; Lykken, 1995).
6 Similar findings have been suggested for children and young people with CU traits (Marsh et
7 al., 2011; Sharp, van Goozen, & Goodyer, 2006). That is, children and young people have
8 deficits in the BIS system as they have less sensitivity to punishment cues.

9 The presence or absence of anxiety in children and young people with CU traits can
10 add further heterogeneity in reward and punishment sensitivity. For example, low levels of
11 anxiety and CU traits have been termed primary psychopathy, and high levels of anxiety and
12 CU traits termed secondary psychopathy (Kimonis & Armstrong, 2012; Kimonis, Skeem,
13 Cauffman, & Dmitrieva, 2011). In the literature, adults with psychopathy show a lack of
14 anxiety (termed 'primary psychopathy') and an underactive BIS system; that is, they show a
15 reduced sensitivity to punishment that drives further antisocial behaviour (Newman,
16 MacCoon, Vaughn, & Sadeh, 2005). There is a dearth of research looking at BIS or BAS
17 sensitivity in relation to primary and secondary variants of psychopathy in children and
18 young people. However, one study by Kahn and colleagues (Kahn et al., 2012) found that
19 children with high levels of CU traits and low anxiety (primary psychopathy) had lower
20 behavioural inhibition (BIS) when compared with those with high levels of CU traits and
21 high anxiety (secondary psychopathy). Moreover, this low level of anxiety is believed to
22 hinder the internalisation of moral beliefs in the development of empathy and guilt in
23 children and young people (Kochanska, 1994).

24

1 **Developmental Considerations**

2 Classical conditioning theories (Pavlov, 1927) emphasise the importance of
3 developing emotional responses to punishment. Emotional discomfort (or anxiety) in
4 response to punishment is an essential part of moral development (Burton, Maccoby, &
5 Allinsmith, 1961) and may facilitate the internalisation of social norms (Kochanska, 1994).
6 Thus, if a child remembers the feelings and emotions of being punished, then this, in turn,
7 informs their decision to engage (or not) in further harmful or problematic behaviour.
8 Research suggests that children and young people with conduct problems, particularly those
9 with CU traits, fail to encode the emotional components of reward and punishment and
10 therefore are unable to acquire conditioned associations (Blair et al., 2004). Social learning
11 theory - in its explanation of conduct problems - relies heavily on operant conditioning
12 (Skinner 1938) and suggests that parents unintentionally reinforce conduct problems whilst
13 failing to reinforce (or reward) prosocial behaviour (Patterson et al. 1992). Parents who use
14 harsh, punitive and inconsistent parenting techniques with children and young people with
15 conduct problems may exacerbate the problematic behaviour (Dadds & Salmon, 2003;
16 Matthys, Vanderschuren, Schutter, & Lochman, 2012). Children and young people with
17 conduct problems, and CU traits, respond well to reward-based components of parent training
18 (Hawes & Dadds, 2005) suggesting rewards are important. Yet punishment techniques appear
19 to be less effective for children with CU traits (Hawes & Dadds, 2005).

20

21 **Measuring Reward and Punishment**

22 There has been extensive research to disentangle the concept of reward and
23 punishment in children and young people with conduct problems. To this end, there exists a
24 variety of measures to assess responsiveness to reward and punishment including

1 questionnaires, risk-taking tasks, passive-avoidance tasks, response-reversal tasks and
2 neuroimaging.

3 **Risk taking and decision making tasks.** Risk-taking behaviours are those that
4 involve a potential for danger or harm whilst also providing an opportunity to obtain a form
5 of reward (Leigh, 1999). Adolescence is a marked time for risky behaviours, and adolescents
6 are disproportionately involved in dangerous risk taking relative to other age groups
7 (Blakemore & Robbins, 2012; Centifanti & Modecki, 2013; Figner & Weber, 2011; Van
8 Leijenhorst et al., 2010). One study found that adolescent offenders engage in more risk
9 taking than healthy controls which is driven by a strong tendency to make risky decisions
10 following small rewards (Syngelaki, Moore, Savage, Fairchild, & Van Goozen, 2009).
11 Existing assessments of risk-taking and risky decision making rely heavily on self-report
12 measurements (Lejuez et al., 2002). Given the overall shortcomings of self-report measures,
13 researchers have also developed behavioural measures of risk taking. These simple
14 behavioural tasks can be used to examine the likelihood and causes of risky behaviours
15 (Lejuez, 2010). Risk-taking tasks like the Iowa Gambling Task (IGT; Bechara, Damasio,
16 Damasio, & Anderson, 1994), the Risky Choice Task (RCT; Rogers et al., 2003) the Balloon
17 Analogue Risk Task (BART; Lejuez et al., 2002) measure behavioural responses to
18 immediate reward despite potential punishment.

19 **Passive-avoidance tasks.** Passive avoidance learning involves learning from aversive
20 experiences (or punishment); this idea stems from Pavlovian behavioural theory (Pavlov,
21 1902). In passive avoidance paradigms (or tasks) the individual must learn to avoid
22 responding to specific stimuli that give rise to punishment (Newman & Kosson, 1986;
23 Newman & Schmitt, 1998; Thornquist & Zuckerman, 1995). Performance is assessed by
24 measuring rates of passive avoidance errors (i.e., responses to stimuli paired with negative
25 reinforcement) and omission errors (i.e., failures to respond to stimuli paired with positive

1 reinforcement). The avoidance loss of reward paradigm (PALR; Newman, Widom, &
2 Nathan, 1985) is a common example where people must learn to respond to cues of reward
3 (i.e. touch a card) and inhibit cues of punishment (i.e., refrain from touching a card).
4 Compared with typically developing children, children and young people with CU traits have
5 more pronounced difficulties when required to inhibit a rewarded response in the face
6 potential punishment (Byrd et al., 2014). It is this balance of reward with punishment that is
7 difficult for children with CU traits.

8 **Response reversal tasks.** Similar to passive avoidance tasks, response reversal tasks
9 include reward and punishment and learning by trial and error (Daugherty & Quay, 1991;
10 Newman, Patterson, & Kosson, 1987). However, these tasks vary in probability of reward
11 and punishment throughout the task and require participants to adjust their performance
12 accordingly. Response reversal learning, therefore, requires flexibility of responding and
13 response reversal tasks are thought to measure cognitive flexibility, inhibitory control, and
14 response inhibition (Izquierdo & Jentsch, 2012). Compared with children with conduct
15 problems only, children and young people with conduct problems and co-occurring CU traits
16 have more pronounced deficits in response to these reversal tasks (Budhani & Blair, 2005;
17 O'Brien & Frick, 1996).

18 **Aims of the Current Review**

19 There has been considerable research drawing on the above theories to understand
20 differences in responses to reward and punishment in children and young people with
21 conduct problems. More recent studies have also investigated the relationship of CU traits
22 with responses to reward and punishment. To the author's knowledge, there are no systematic
23 reviews to date exploring responses to reward and punishment in children and young people
24 with CU traits. Therefore, the aims of this current review are threefold: a) to systematically
25 review and synthesize available literature surrounding responses to reward and punishment

1 sensitivity in children and young people with CU traits; b) review the ways in which
2 responses to reward and punishment are operationalised and measured in this area,
3 considering the implications for future research; c) review the findings and consider the
4 implications for intervention in this small but significant population of children and young
5 people.

6 Neuroimaging studies have also attempted to investigate reward with animals and
7 humans; however, this is beyond the scope of this review. The current review will focus on
8 behavioural responses to reward and punishment.

9 **Method**

10
11 Before the review was undertaken, a protocol was submitted to the Prospero register
12 (www.crd.york.ac.uk/PROSPERO) [CRD42019119747]. This protocol was updated to
13 accurately reflect review undertakings.

14

15 **Eligibility Criteria**

16 Studies were included if the following criteria were met: a) participants were children
17 and young people aged 0-18 years old; b) a validated measure was used for the assessment of
18 either callous unemotional traits or the affective component of psychopathy; c) a measure of
19 reward and/or punishment was used (questionnaire or behavioural tasks); d) a quantitative
20 design was employed, including cross sectional, correlational, case control or prospective
21 study design; e) full text was written in English; f) published in a peer reviewed journal.

22 Studies were excluded if they did not meet the above criteria. Functional magnetic resonance
23 imaging (fMRI) studies were included if they also used behavioural measures of reward
24 and/or punishment and reported these outcomes. Studies published before 1990 were

1 excluded because the current definition of CU traits was conceptualised in the early 1990's
2 (see Frick et al., 2014).

3

4 **Information Sources**

5 The electronic publication databases PsychINFO, Medline, Scopus and Pubmed were
6 searched from their date of inception by the first author (JS) for peer reviewed journals,
7 publications written in English and human participants. The EBSCOhost interface was used
8 where appropriate. An initial search was conducted on 1st February 2019. Attempts to
9 identify additional eligible publications included hand searching of reference lists, journals
10 and correspondence with authors.

11 The following search terms combined with Boolean operators were used to search the
12 title, abstract and key word list of articles: (callous* **OR** unemotional **OR** CU trait*
13 **OR** callous-unemotional **OR** psychopath* **OR** CU) **AND** (reward **OR** incentiv* **OR** reward
14 sensitiv* **OR** reward respons* **OR** punish* **OR** disciplin* **OR** punishment sensitiv*).

15 On each database the following limiters were set: written in English language, human
16 and journal articles.

17

18 **Study Selection**

19 The original database searches were undertaken on 1st February 2019. First, any
20 duplicate records were identified and excluded. Second, titles, abstracts and keyword lists of
21 all papers generated from the database search were screened by the first author to determine
22 whether they met the inclusion criteria. Third, the full text of papers that met the inclusion
23 criteria were read by the first author and reviewed for eligibility. A second rater screened 10
24 percent of the eligible papers to ensure consistency and eligibility. If eligibility was unclear, a
25 discussion was held between the first author (JS), second rater and second author (LC).

1 Authors of the eligible papers were contacted regarding any other relevant published
2 or soon to be published research which could be included in the review. This contact resulted
3 in four additional papers that met the inclusion criteria. References in eligible papers and key
4 review articles were also hand searched to ensure a thorough review of the literature. This
5 provided one additional article that met the inclusion criteria. To ensure up-to-date results,
6 the database search and process described above was undertaken again on 15th May 2019.
7 This identified 19 new articles; all of which were excluded either as duplicates or failing to
8 meet eligibility criteria at initial screening. Finally, the systematic study selection led to
9 fourteen articles deemed eligible for review (see Figure 1). Figure 1 illustrates a flow diagram
10 of the search and screening strategy used, based on PRISMA guidelines (Moher, Liberati,
11 Tetzlaff, & Altman, 2009).

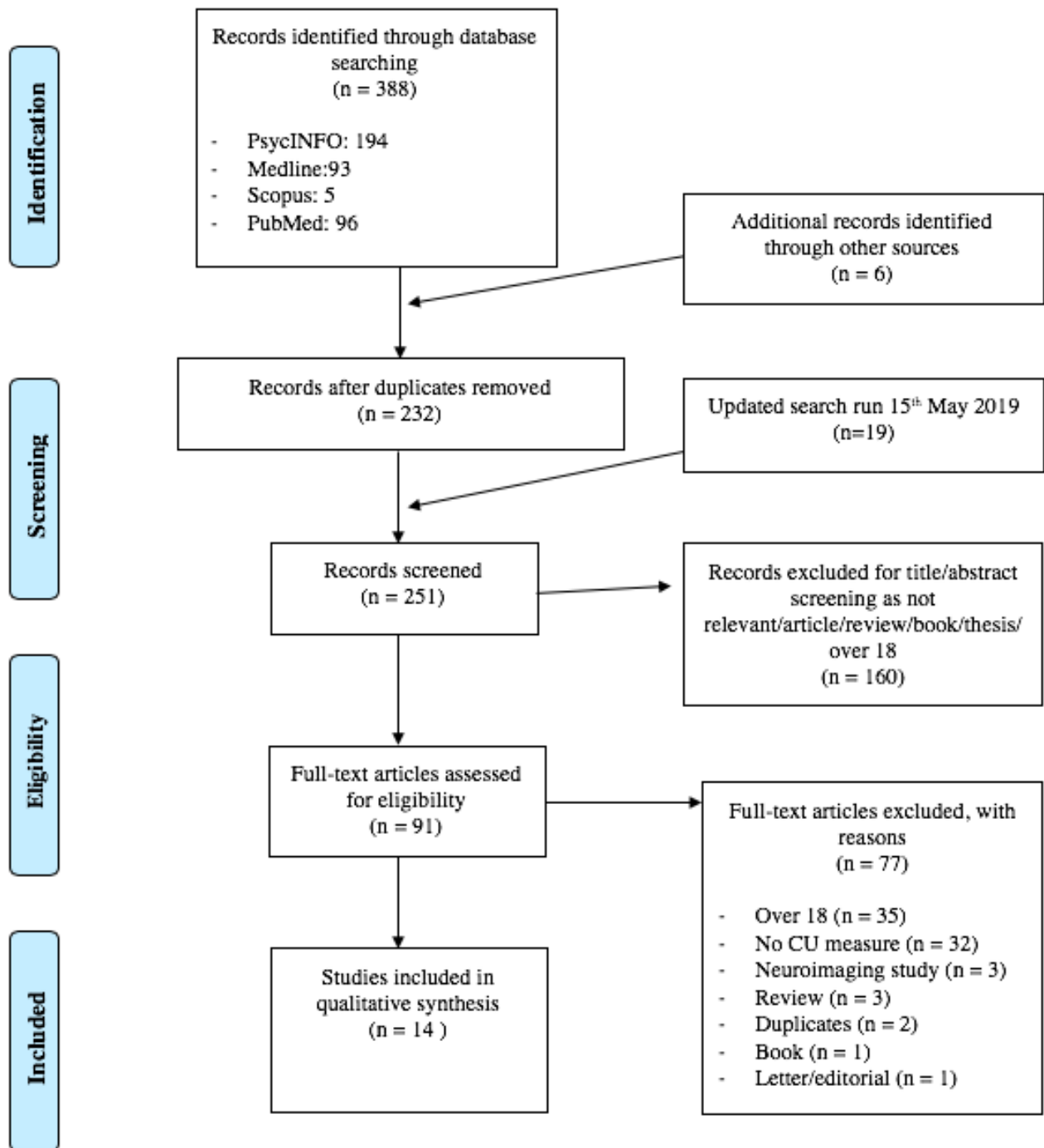
12 **Data Extraction**

13 Extraction of study details, participant characteristics and main research findings was
14 undertaken by the first author (JS) using a purposely developed data collection form (see
15 Table 1 and 2). Any discrepancies in the information recorded were discussed and a
16 consensus was reached. Only aims and findings relevant to the current review were extracted.
17

18 **Assessment of Quality and Risk of Bias**

19 Systematic review guidance stipulates that risk of bias should be assessed as part of a
20 systematic review (Moher et al., 2009). The PRISMA guidelines do not provide specific
21 recommendations with regards to completing a quality assessment but a widely implemented
22 tool was used. To evaluate the quality and risk of bias, the Quality Assessment Tool for
23 reviewing Studies with Diverse Design (QATSDD; Sirriyeh, Lawton, Gardner, & Armitage,
24 2012) was used. The QATSDD is a 16-item quality assessment tool which reflects aspects of
25 clarity in descriptions of aims and setting, data quality, method of analysis and self-

1 evaluation which are rated between zero and three (with three being the best practice). The
 2 tool can be used to assess quantitative and qualitative studies but for the purpose of this
 3 review the two qualitative questions specific to qualitative methods were removed (see
 4 Appendix B).



5 *Figure 1.* Flow diagram of study selection, based on PRISMA guidelines (Moher et al., 2009)

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Data Synthesis

Due to the heterogeneity of outcome measures used across the studies and the small number of papers included in the review, meta-analysis was not deemed to be appropriate. A narrative synthesis was therefore conducted.

Results

Characteristics of Included Studies

The participant and study characteristics of the included studies are displayed in table 1. The fourteen studies were published between 1996 and 2018. The studies were conducted primarily in the United States of America (USA) with two studies from the United Kingdom (UK) and single studies from Spain, Cyprus and The Netherlands. The selected studies used cross sectional and longitudinal designs. Boys were significantly oversampled which is consistent with the findings that boys consistently rate themselves, and are rated by others, as higher on levels of conduct problems and CU traits (see Frick et al., 2014 for review). Eleven studies included girls.

The sample population varied between studies: five studies recruited from treatment programs, two included clinic-referred children and young people; five studies were recruited from the community (i.e., education settings), and four studies included offender samples (one community, one detention centre and two residential). The sample sizes studied varied widely from 39 to 1341. The longitudinal studies were larger (2 studies with $n > 1000$) while sample sizes tended to be smaller (5 studies with $n < 132$) in cross sectional studies. All studies measured levels of CU traits, however the ways in which these were measured, categorised and grouped varied widely. That is, Fanti and colleagues used dichotomous categories based on the presence of absence of a behaviour (Fanti et al., 2015), two studies

Table 1

Main characteristics of included studies

Author	Location	Study design	Population	N	% male	Age range (or mean)	Ethnicity (n / %)	Measure of CU	Measure (s) of reward/punishment
Allen, Morris & Chhoa (2016)	UK	Cross Sectional ¹	Community (school)	39	100	12-13 ($M=13.10$, $SD=3.68$)	Black British (22), Asian (5), White (4), Other (8)	ICU (TR, SR)	SPSRQ-C (SR) 'punishment insensitivity scale' MAP-DB (SR,TR)
Briggs-Gowan et al. (2014)	USA	Cross Sectional	Clinic-referred	157	52.2	3-5 ($M=4.7$, $SD=0.08$)	Caucasian/white (33), African American/black (80), Hispanic (42), other (2)	MAP-DB (PR) 'low concern items'	Passive Avoidance Task (Stars in Jars task)
Ezpeleta et al. (2017)	Spain	Longitudinal	Community (School)	2283 (screening) 622 (baseline) 496 (follow-up)	49.8	$M=3.77$, $SD=0.33$ (baseline)	Non-Hispanic white (89.1%) Hispanic American (6.4%) other (4.5%)	ICU (TR)	SPSRQ-C (PR)
Fanti et al. (2015)	Cyprus	Longitudinal	Community (School)	1311 families (screening) 73 children (experimental)	54.5	$M=11.21$ $SD=1.06$	Not reported	ICU (PR, SR) (scored dichotomously as per DSM-IV)	BIS/BAS Scale for Children (SR) SPSRQ-C (modified) (PR)
Frick et al. (2003)	USA	Cross sectional	Community (school)	4000 parents (screening), 100 children (experimental)	53	$M=12.36$ $SD=1.73$	White (89%) African American (21%)	APSD CU scale (PR, TR)	Reward Dominance Task (response reversal)
Marini & Stickle (2010)	USA	Cross sectional	Offender (detention centre)	150	59	11-17 ($M=15.1$, $SD=1.4$)	White (89%), Hispanic (7%), African American (2%), Other (5%)	ICU (SR, PR, TR)	BART-Y (risk taking measure)
Morgan et al. (2014)	UK	Cross sectional	Offender (Community)	85	100	12-18 ($M=15.95$, $SD=1.12$)	Caucasian (70.60%) Non-white (29.40%)	YPI Callousness scale (SR)	BIS/BAS scales-adult (SR)
O'Brien & Frick (1996)	USA	Cross sectional	Clinic-referred	132	Clinic referred (79%) Control (80%)	6-13 ($M=8.77$, $SD=1.89$)	Clinic referred (White = 78%) Control (White=68%)	SPD CU subscale (PR, TR)	Reward Dominant Task (response reversal)

Pardini (2006)	USA	Cross sectional	Offender (residential)	169	57	11-18 ($M=15.81$, $SD=1.26$)	African-American (69%), Caucasian (30%), Asian (0.5%), Latino (0.5%).	APSD CU subscale (SR)	Outcomes Values Questionnaire - Revised (SR)
Pardini et al. (2003)	USA	Cross Sectional	Offender (residential)	169	57	11-18 ($M=15.81$, $SD=1.26$)	African-American (69%), Caucasian (30%), Asian (0.5%), Latino (0.5%).	APSD CU subscale (SR)	Outcomes Values Questionnaire - Revised (SR) Outcomes Expectation Questionnaire (SR)
Platje et al. (2018)	Netherlands	Cross sectional	Community (School)	346	100	12-17 ($M=14.01$, $SD=1.19$)	Not reported	ICU (SR)	SPSRQ-C (PR)
Rau et al. (2008)	USA	Cross sectional	Treatment program	91	60.44	BD ($M=14.2$, $SD=2.60$), SMD ($M=12.5$, $SD=2.35$), Control ($M=13.5$, $SD=2.59$)	Not reported	APSD (PR)	DRPLT (passive avoidance task)
Roose et al. (2013)	USA	Cross sectional	Treatment program	79	92	14-18 ($M=16.15$, $SD=1.17$)	Not reported	YPI-S (SR), ICU (SR)	The Revised PSRTT-C task (passive avoidance task)
White et al. (2016)	USA	Cross Sectional	Treatment program	72	72.22	$M=13.81$, $SD=2.19$	Not reported	ICU (PR)	Passive Avoidance task

Note: APSD=Antisocial Process Screening Device, BART-Y= Balloon Analogue Risk Task Youth version, BD= Bipolar Disorder, BIS/BAS = Behavioural Inhibition

System/Behavioural Activation System, DRPLT= differential reward/ punishment learning task, DSM-IV= Diagnostic Statistical Manual of mental disorders – 5th edition, ICU= Inventory of Callous Unemotional Traits, M=mean, MAP-DB= The Multidimensional Assessment of Preschool Disruptive Behavior, PR= Parent report, PSRTT-C= Performance on the Point Scoring Reaction Time Task for Children, SPD= Psychopathy Screening Device, SMD= Severe Mood Dysregulation, SPSRQ-C= Sensitivity to Punishment and Sensitivity to Reward Questionnaire for children, SR= Self Report, TR= Teacher Report, UK=United Kingdom, USA=United States of America, YPI= Youth Psychopathic traits Inventory, YPI-S= Youth Psychopathic traits Inventory short version. ¹ Mixed method study, only quantitative information was used for review.

1 rated young people as high in CU traits if their scores were persistently above the mean
2 (Frick et al., 2003; Ezpeleta et al., 2017; Platje et al., 2018) and other studies rated CU traits
3 as a continuous variable, based on correlational analyses (White et al., 2016; Roose et al.,
4 2013; Pardini et al., 2003). Once categorised, the number of young people within the groups
5 varied. One study, a longitudinal study, categorised 176 children and young people as high in
6 CU traits (Ezpeleta et al., 2017) however a number of studies had less than 25 children and
7 young people with CU traits only and less than 25 children and young people categorised
8 with CU traits, with or without co-occurring conduct problems (Allen, Morris, & Chhoa,
9 2016; Fanti, Panayiotou, Lazarou, Michael, & Georgiou, 2015; Frick et al., 2003). There was
10 a wide age range of the children and young people; from 3 years (Briggs-Gowan et al., 2014)
11 to 18 years (Morgan, Bowen, Moore, & van Goozen, 2014; Pardini, 2006; Roose, Bijttebier,
12 Van Der Oord, Claes, & Lilienfeld, 2013). Ethnicity information was only reported in nine
13 out of the fourteen studies with a majority of research conducted with white children and
14 young people.

15

16 **Results of Assessment of Risk of Bias Assessment**

17 The results from the risk of bias assessment are presented in Table 2. Common
18 methodological issues related to whether an explicit theoretical framework was discussed, the
19 sample (sample size and representativeness), whether there was detailed procedure for data
20 collection and recruitment, and whether service users were involved in the design of the
21 study.

22 First, twelve out of fourteen studies were cross sectional which meant that causality
23 could not be inferred. Second, many studies did not explicitly state a clear theoretical
24 framework and therefore it was unclear where the theory behind CU traits, punishment and
25 reward sensitivity had derived. All studies included a discussion of background research to

1 provide a rationale for their study; however, only six studies included an explicit theoretical
2 framework. One of the common theoretical frameworks which were referred to in the studies
3 was the BAS and BIS, initially theorised by Gray (1981, 1987).

4 Third, all studies failed to show a priori calculations to justify their sample sizes;
5 however two studies commented on their justifications of sample sizes based on sizes used in
6 previous literature (Frick et al., 2003; Marini & Stickle, 2010). Modest sample sizes were
7 evident in a number of studies (Allen et al., 2016; A Roose et al., 2013; White et al., 2016).
8 Some studies compared different groups based on a child or young persons categorised level
9 of CU traits, conduct problems or anxiety, but the sample sizes of these groups were small
10 (Ezpeleta et al., 2017; Fanti et al., 2015; Pardini, 2006). Fanti and colleagues included only
11 16 children with high CU traits and high conduct problems (Fanti et al., 2015). Moreover,
12 due to the small samples in the experimental groups it did not allow for analysing with other
13 variables, for example gender or ethnicity (Fanti et al., 2015; Ezpeleta et al., 2017; Pardini,
14 2006). Although most studies included girls, boys formed the majority of participants and
15 most children and young people were white.

16 Fourth, many of the studies also had sampling bias in that they were recruited from
17 only one institution therefore the sample may not be representative or generalisable to other
18 settings. Furthermore, of those that were recruited from treatment programs or clinics, there
19 was little information about the type of treatment or clinical intervention they may have
20 received (Briggs-McGowan et al., 2014; Rau et al., 2008). Finally, many studies used
21 multiple informants and multiple methods of data gathering combining reports of CU traits
22 from multiple reporters. However, a number of studies relied solely on one informant (i.e.
23 self-report, teacher report or parent report).

Table 2
Risk of bias assessment of included studies

Criteria	Allen et al. (2016)	Briggs-Gowan et al. (2014)	Ezpeleta et al. (2017)	Fanti et al. (2015)	Frick et al. (2003)	Marini & Stickle (2010)	Morgan et al. (2014)	O'Brien & Frick. (1996)	Pardini (2006)	Pardini et al. (2003)	Platje et al. (2018)	Rau et al. (2008)	Roose et al. (2013)	White et al. (2016)
Explicit theoretical framework	0	1	0	3	3	2	3	3	3	1	1	0	3	0
Statement of aims/objectives in main body of report	3	2	3	3	3	3	3	3	3	3	3	1	3	1
Clear description of research setting	3	3	3	3	3	3	3	2	3	3	3	1	2	2
Evidence of sample size considered in terms of analysis	0	1	1	0	3	2	3	0	0	0	0	0	0	0
Representative Sample of target group of a reasonable size	0	2	2	3	3	1	3	1	2	2	3	1	2	1
Description of procedure for data collection	2	2	3	3	2	2	1	2	2	2	1	1	2	2
Rationale for choice of data collection tool(s)	3	2	3	3	3	3	2	0	3	3	1	1	3	3

Detailed recruitment data	2	3	3	3	2	2	2	2	1	2	1	1	3	2
Statistical assessment of reliability and validity of measurement tool(s)	3	2	3	3	3	3	3	3	3	3	3	2	3	1
Fit between stated research question and method of data collection	2	3	3	3	3	3	2	2	2	2	2	3	3	2
Fit between research question and method of analysis	3	3	3	3	3	3	3	3	3	3	3	3	3	3
Good justification for analytical method selected	3	3	3	3	3	3	2	2	2	2	3	3	2	1
Evidence of user involvement in design	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Strengths and limitations critically discussed	3	2	2	3	3	3	2	1	3	3	3	2	3	2
Quality Score	64.10%	69.10%	76.20%	85.70%	88.10%	78.60%	76.20%	57.20%	71.40%	69.10%	64.30%	45.20%	76.20%	42.90%

1 **Summary of Measures**

2 **Measures of CU.** A range of quantitative tools were used to measure CU
3 traits across the studies. Firstly, six studies solely used the Inventory of Callous Unemotional
4 traits (ICU; Frick, 2004), and one study (Roose et al., 2013) used both the ICU together with
5 the Youth Psychopathic Traits Inventory-Short Version (YPI-S; van Baardewijk et al., 2010).
6 The ICU is a 24-item measure, where items are coded on a 4-point Likert scale. Items are
7 distributed across three subscales that assess callousness (lack of empathy, guilt, and
8 remorse), uncaring (lack of caring about one’s performance or feelings of others), and
9 unemotional (absence of emotional expression) features (Kimonis et al., 2008). The ICU has
10 shown good reliability and validity and provides a continuous measure of CU traits (Essau,
11 Sasagawa, & Frick, 2006; Kimonis et al., 2008; Ray, Frick, Thornton, Steinberg, &
12 Cauffman, 2016; Annelore Roose, Bijttebier, Decoene, Claes, & Frick, 2010). One study
13 (Fanti et al., 2015) used the ICU and four items from the DSM-5 limited prosocial emotions
14 specifier ‘Is concerned about the feelings of others’ (reverse scored), ‘Feels bad or guilty
15 when he/she has done something wrong’ (reverse scored), ‘Is concerned about schoolwork’
16 (reverse scored), and ‘Does not show emotions’ to further measure CU traits. These were
17 dichotomously coded to be indicative of the limited prosocial emotions specifier (coded as
18 absent if rated 0 or 1 and present if rated either 2 or 3). Scores were calculated by summing
19 the four dichotomous items to obtain a total score for CU traits.

20 Five studies measured CU traits using the CU subscale of the Antisocial Process
21 Screening Device (APSD; Frick & Hare, 2001). Its predecessor, the Psychopathy Screening
22 Device, was used for one study (O’Brien & Frick, 1996). The APSD is a 20-item measure,
23 which includes a 6-item CU subscale. It has been validated across different formats including
24 parent, teacher and self-report. Despite a number of the studies using the APSD, there are
25 well-documented limitations associated with the CU subscale, including the small number of

1 items (n=6), poor internal consistency of subscales and limited range of response options
2 (Waller, Gardner, & Hyde, 2013).

3 One study (Morgan et al., 2014) used the YPI (Andershed, Kerr, Stattin, & Levander,
4 2002) to measure CU traits and one used the short version of the YPI (YPI-S). The YPI is a
5 50-item self-report measure for the assessment of psychopathic traits in young people. The
6 scale contains three core dimensions: (1) Grandiose-Manipulative (2) Callous-Unemotional
7 and (3) Impulsive-Irresponsibility. Each item is answered on a 4-point Likert scale. The YPI
8 has previously shown good reliability and validity (Morgan et al., 2014). The YPI-S is an 18-
9 item measure with six items for each of the three factors. Van Baardewijk et al. (2010)
10 demonstrated adequate internal consistencies of the YPI-S subscales and a high convergence
11 between both the YPI and the YPI-S. Yet, the YPI includes a broader constellation of
12 psychopathic-like traits that goes beyond callous-unemotional traits.

13 Finally, one study used the Multidimensional Assessment of Pre-School Disruptive
14 Behaviour (MAP-DB; Wakschlag, Tolan, & Leventhal, 2010). The MAP-DB is a
15 developmentally sensitive tool to measure disruptive behaviours in very young children
16 (Wakschlag et al., 2014). The 'low concern' items from the questionnaire were used as a
17 measure of CU traits as it reflects a child's tendency toward insensitivity to others' feelings
18 and is akin to the CU component of psychopathy (Nichols et al., 2015). The low concern
19 items are rated on a 6-point scale based on how often a particular behaviour occurred over the
20 previous month. There are 16 items in the low concern subscale of the MAP-BD, however;
21 only 9 were retained for use in the Briggs-Gowan et al., (2014) study. The low concern scale
22 was reported to have acceptable internal consistency ($\alpha=.81$) and test-retest reliability
23 (ICC=.83).

24 A range of informants was used to report on CU traits across the 14 studies. Of these,
25 one study relied on teacher report, five self-report, three parent report and the remaining five

1 combined parent ratings, teacher ratings or self-report ratings. Commonly, this approach
2 involves summing ratings at an item level, or creating a best estimate score, which combines
3 ratings by summing the highest score given by any reporter on each item.

4 In a number of studies, conduct problems (including oppositional defiance disorders)
5 were also assessed in addition to CU traits. This is understandable given the DSM-5 specifier
6 of ‘with limited pro-social emotions’ where CU traits denote a particular subgroup of
7 children and young people with conduct problems. A number of studies used ratings of
8 conduct problems and CU traits to specify distinct subgroups of children. For example,
9 Ezpeleta et al., (2017) included CU traits and oppositional defiance disorder within one of the
10 trajectories of measurement, and Fanti et al., (2015) included groups of children categorised
11 as having CU traits only or as having CU traits plus conduct problems (as per the specifier
12 ‘with limited prosocial emotions’).

13

14 **Measures of reward and punishment sensitivity.** A range of tools were used to
15 assess reward and punishment sensitivity across the studies, including questionnaires, passive
16 avoidance tasks, decision making tasks and response reversal tasks. Seven studies used
17 questionnaire-based measures to measure reward and punishment sensitivity. Four studies
18 used the Revised Sensitivity to Punishment And Sensitivity to Reward Questionnaire for
19 Children (SPSRQ-C; Colder & O’Connor, 2004). The SPSRQ-C is a 33-item measure used to
20 assess sensitivity to reinforcement according to Gray’s model. It contains four scales
21 (sensitivity to punishment, impulsivity/fun-seeking, drive and reward responsivity) but this
22 review focused on the sensitivity to punishment and the reward responsivity scales. The
23 SPSRQ-C has been found to have good validity and reliability (Luman, van Meel,
24 Oosterlaan, & Geurts, 2012). In Ezpeleta et al. (2012), the two subscales showed A

1 Cronbach's alpha of .87 for punishment sensitivity and .67 for reward responsivity. One
2 study (Allen et al., 2016) used only the reward responsivity scale of the SPSRQ-C.

3 Two studies used the BIS/BAS scales; however, one (Morgan et al., 2014) study used
4 the original version by Carver & White, 1994) within an adolescent population and the other
5 used the BIS/BAS for children (Fanti et al., 2015) alongside the SPSRQ-C (as described
6 above). The former is a 24-item self-report measure and the version for children is a 20-item
7 self-report measure. Both versions use a 4-point scale and measure four subscales: BAS
8 drive, BAS fun seeking, BAS reward responsiveness and BIS. The current review only
9 focuses on the BAS reward responsiveness (the positive response to reward and the
10 anticipation of reward) and BIS (reactions to anticipation of punishment). One further study
11 (Morgan et al., 2014) also used the BIS/BAS scales. Two studies (Pardini, 2006; Pardini et
12 al., 2003) used the Outcomes Values Questionnaire –Revised (OVQ-R; Boldizar, Perry, &
13 Perry, 1989; Pardini et al., 2003) and the Outcome Expectations Questionnaire - Revised
14 (OEQ-R; Pardini et al., 2003; Perry, Perry, & Rasmussen, 1986). The OVQ-R is a measure
15 consisting of eight brief vignettes designed to assess the values children place on the
16 outcomes of verbal and physical aggression against a same sex peer. In four of these
17 vignettes were children were asked to imagine using aggression to obtain tangible rewards.
18 They were then asked how much they would care if they got into trouble or punished for their
19 behaviour on a 4-point scale. Higher scores indicate increased concern for being punished. In
20 Pardini et al. (2003) the OEQ-R was used as a measure of children and young people's
21 expectations that aggressive behaviour would produce various outcomes. Like the OVQ-R
22 half of the vignettes depicted aggression to obtain tangible rewards. They were then asked the
23 likelihood of various outcomes occurring; successfully gaining desired object and being
24 punished for their behaviour (amongst two others not pertinent to this review). Again this was
25 rated on a 4-point scale with higher scores indicating increased expectations that an outcome

1 would occur. Scales on the OEQ-R have been found to have a modest internal consistency
2 (Cronbach's alpha = .52; Pardini et al., 2003) and the OVQ-R subscales have been found to
3 have a high internal consistency (Cronbach's alpha = .82 to .85; Pardini, 2006). Finally, one
4 study (Allen et al., 2016) used the punishment insensitivity scale of the MAP-DB (Wakschlag
5 et al., 2012) which is a 7-item scale rated on a 6-point Likert scale. It has been found to have
6 good reliability and validity for child and teacher report, respectively (Nichols et al., 2015).

7 Four studies used passive avoidance learning tasks. These assess the extent to which
8 an individual approaches a stimulus that is accompanied by reward and the extent to which
9 they passively avoid stimuli that results in punishment. Passive avoidance tasks incorporate
10 aspects of both reward and punishment and participants are required to learn by trial and
11 error. The Briggs-McGowen et al. (2014) study used a developmental modification of a
12 passive avoidance task used with older individuals (Blair et al., 2004) termed 'the Stars in
13 Jars (SIJ) task'. In this task, two stimuli are rewarded and two are punished; children are
14 required to press on the rewarded stimuli and withhold pressing on the punished stimuli.
15 Dependent measures were passive avoidance or commission errors (i.e. responses to cues of
16 punishment) or omission errors (lack of responses to reward). Similarly, in the Rau et al.
17 (2013) study, children were presented with different images, some that resulted in winning
18 and some that resulted in losing points. The goal was to choose an image that would gain
19 them the most points or lose them the least points.

20 One study used the The Point Scoring Reaction Time Task for Children (PSRTT-C;
21 Roose, Bijttebier, Van Der Oord, Claes, & Lilienfeld, 2013) developed by Colder and
22 O'Connor (2004) to assess children's BIS and BAS and was based on an existing task
23 developed for adults (Avila, 2001). The task required participants to discriminate between
24 odd and even numbers, and included three blocks presented in a fixed order: reward,
25 punishment, and post-punishment. In the reward block, points are earned for correct

1 discriminations and the number of points earned was dependent on reaction time. Fast
2 reaction times yielded more points. During the punishment block, participants were told not
3 to respond when the number was accompanied by a red circle. Responding to red circle trials
4 would result in a loss of half of the points accumulated. Accordingly, red circles become a
5 cue for potential punishment. The post-punishment block was the same as the reward block.
6 That is, subjects were told to respond to all trials, even red circle trials. Thus, the red circle
7 shifts from being a punishment cue to a reward cue in the last block. The reaction time on
8 punishment and pre-punishment blocks are associated with the BIS scale (i.e. sensitivity to
9 punishment). One final study (White et al., 2014) used a passive avoidance task; however,
10 there was no reference to who had developed this task or if it had been used in previous
11 studies. Children either respond to an object or chose not to respond. If they chose to respond,
12 participants received one of four outcomes: Win \$5, win \$1, lose \$1 or lose \$5. If the
13 participant did not respond, the result was no outcome (or feedback).

14 Two studies used response reversal tasks. Like passive avoidance tasks, response
15 reversal tasks involve reward and punishment and learning by trial and error. However, in
16 both studies, the task varies the probability of receiving reward or punishment. Participants
17 start with a high probability of reward but after each trial, this probability decreases. Poorer
18 performance reflects continuing to play trials despite the probability of punishment increasing
19 and the probability of reward decreasing.

20

21 **Study Outcomes**

22 The main findings from the fourteen studies included in this review can be found in
23 Table 3. Studies implemented a range of designs to analyse the strength of the association
24 between CU traits and responsiveness to reward and/or punishment based on the task used to
25 measure these constructs.

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CU traits and responsiveness to reward using questionnaires. Five studies used questionnaires to measure reward responsiveness; three of the studies found no significant relationship between CU traits and reward responsiveness. However, two studies (Ezpeleta et al., 2017; Pardini et al., 2003) did not show this pattern and found that CU traits were related to reward responsiveness, such that children and young people with CU traits showed greater reward responsiveness.

The two studies that found a significant result with reward and CU traits differed in their measurement of CU traits and the samples surveyed. First, Pardini and colleagues, uses a cross sectional design and recruited adolescent offenders, using self-report measures of reward and CU traits (Pardini et al., 2003). Pardini and colleagues used vignettes and found that young people with CU traits were more likely to expect aggression to result in tangible rewards (as measured by the OEQ) and also placed more value on gaining tangible rewards (as measured by the OVQ). Pardini et al., (2003) did not measure or categorise children and young people on their level of conduct problems or anxiety. However, given that they used a sample of adolescent offenders it is likely that they presented with conduct problems. It may be that other variables like conduct problems and anxiety moderate the relationship between CU traits and reward sensitivity.

Ezpeleta and colleagues used a longitudinal design and recruited and assessed children from the age of 3 to 7 (Ezpeleta et al., 2017). These children were recruited from a community sample, using parental reports of reward responsiveness and teacher reports of CU traits. Ezpeleta and colleagues also categorised young people based on trajectories of the child's level of anxiety, conduct problems (oppositional defiance disorder) and CU traits (Ezpeleta et al., 2017). Ezpeleta and colleagues found that it was young children with CU traits and co-occurring conduct problems and anxiety that were most reward orientated when

1 compared with those with CU traits and co-occurring conduct problems. However, Ezpeleta
2 et al., (2017) only had a small sample of 17 children with CU traits and co-occurring conduct
3 problems and anxiety and they were also significantly younger than those measured in
4 Pardini et al., (2003). Furthermore, reliability of the questionnaire used to measure anxiety
5 was with the moderate to low range when measured at ages 3, 4 and 5. One explanation could
6 be that anxiety, only moderates the relationship between CU traits and reward responsivity in
7 younger aged children, as found by Ezpeleta et al., (2017). Pardini and colleagues did not
8 categorise children and young people based on their level of CU traits and co-occurring
9 conduct problems and anxiety, but they did use a more ecologically valid tool measuring
10 reward using vignettes (Pardini et al., 2003) than Ezpeleta et al., (2017). They used a
11 questionnaire rated by parents, to assess reward responsivity which was only reported when
12 the child was six years old, despite the longitudinal design, and was only reported on by
13 parents. Moreover, relying on one particular informant, whether self-report or parent report
14 can lead to different conclusions regarding the mechanisms behind reward sensitivity (De los
15 Reyes & Kazdin, 2005).

16 Three studies found no significant relationship between CU traits and reward
17 responsivity. All of these studies were community samples; however one study (Morgan et
18 al., 2014) was with a sample of young offenders in the community. Two studies (Allen et al.,
19 2016; Platje et al., 2018) further delineated this heterogeneous group by categorising young
20 people into those with high and low CU traits as well as high and low conduct problems.
21 Allen and colleagues found no relationship between CU traits and reward responsivity using
22 self-reported levels of CU traits and teacher reported CU traits (Allen et al., 2016). Platje and
23 colleagues found that conduct problems were the main predictor of reward responsivity, over
24 and above CU traits (Platje et al., 2018). For these studies, as above, self-report was used
25 most often. For example, two studies measured CU traits via self-report (Morgan et al., 2014;

1 Platje et al., 2018) and one study used a combination of self-report and teacher report (Allen
2 et al., 2016). Two studies used self-reported measures of reward of reward responsivity
3 (Allen et al., 2016; Morgan et al., 2014) and one was reported by parents (Platje et al., 2018).
4 Thus there were no patterns for reporters and the significance of findings. Therefore, it may
5 be that the children and young people with conduct problems *and* CU traits are more
6 responsive to reward than those with CU traits without conduct problems.

7
8 **CU traits and punishment insensitivity using questionnaires.** All of the studies
9 using questionnaires to assess punishment sensitivity found significant results; children and
10 young people with CU traits were less sensitive to punishment. Five studies (Allen et al.,
11 2016; Ezpeleta et al., 2017; Fanti et al., 2015; Morgan et al., 2014; Platje et al., 2018)
12 recruited children and young people from community samples, and one of these studies was a
13 community sample of young offenders (Morgan et al., 2014). Two studies (Pardini, 2006;
14 Pardini et al., 2003) recruited from a sample of adjudicated young people who had a history
15 of committing several criminal offences; the same sample was used in both of the studies.
16 Ezpeleta et al., (2017) used teacher reported of levels of CU traits, measured by the ICU.
17 Three further studies (Allen et al., 2016; Fanti et al., 2015; Platje et al., 2018) also used the
18 ICU to measure CU traits in children and young people. Two studies used a combination of
19 teacher report and self-report (Allen et al., 2016) and parent report and self-report (Fanti et
20 al., 2015), one was self-reported only (Platje et al., 2018) CU traits.
21 Interestingly, studies used various means of measurement for reporting of CU traits and
22 punishment sensitivity. Six of seven of these studies used self-report methods of assessing
23 punishment sensitivity, with two studies using both self-report and either teacher report
24 (Allen et al., 2016) or parent report (Fanti et al., 2015). One study relied solely on parent
25 report for punishment sensitivity (Ezpeleta et al., 2017). The very young age of the

Table 3
Main findings of included studies

Author	Aim	Groups (n)	Group classification	Variables investigating reward or punishment	Variables measuring CU	Analyses	Summary of main findings	Insensitive to punishment Y/N	Sensitive to reward Y/N
Allen, Morris & Chhoa (2016)	To examine the relationship between CU traits and responses to rewards and discipline in adolescent boys	SR Low CU (18), SR High CU (21), TR low CU (21), TR High CU (18)	Score on ICU (median split)	Punishment insensitivity, reward sensitivity	ICU total score	Pearson's correlations ANOVA	Positive correlation between ICU score and punishment insensitivity on both teacher report ($r=.81, p<.001$) and child report ($r=.58, p<.001$). High CU traits less sensitive to punishment than low CU traits $F(1,37)=10.39, p=.003, \eta_p^2=.22$ No significant relationship between ICU score and reward sensitivity on both teacher report ($r=.16 p>0.05$) and child report ($r=.09 p>0.05$). No significant effect of high CU vs low CU on reward sensitivity $F(1,37) = 1.81, p=.184, \eta_p^2=0.05$.	Yes	Non-significant
Briggs-Gowan et al. (2014)	To test the hypothesis that children, reported by their mothers as being high in low concern for others on the MAP-DB, have impaired passive avoidance learning	Normative Low Concern (94), Moderately High Low Concern (32), High Low Concern (31)	Sum of Low Concern items on MAP-DB	Task performance (omission/commission errors)	Low Concern	ANCOVA	No significant associations between Low Concern and commission errors $F(2,146) = 1.06 p>0.05$. No significant association between Low Concern and omission errors.	Non-significant	Non-significant
Ezpeleta et al. (2017)	To investigate whether it is possible to identify the heterogeneity of behaviour problems based on CU traits, anxiety and ODD levels from preschool age	T1 null (337), T2 ANX increasing (42), T3 CU+ANX+ODD (17), T4 CU+ODD increasing (54), T5 CU+ODD decreasing (105), T6 ANX decreasing (65)	ICU scores consistently above the mean + scores on oppositionality subscale of SDQ + scores on anxiety scale of CBCL	Sensitivity to punishment scale, reward responsivity scale	T3 (secondary variant), T4 (primary variant), T5 (primary variant) trajectories	Pairwise comparisons	T3 more sensitive to punishment $d=0.97$ and more responsive to reward $d=1.27 p<0.003$ than T1. T3 more sensitive to punishment than T4 $d=1.47 p<0.003$ and T5 $d=1.07 p<0.003$, T3 more sensitive to reward than T5 $d=0.96 p<0.003$)	Yes	Yes

Fanti et al. (2015)	To identify heterogeneous groups of children who vary with respect to CP and CU traits (2) To evaluate the role of the fearfulness-fearlessness continuum as a developmental mechanism than can differentiate heterogeneous groups	High CP + low CU (15), High CP + high CU (16) High CU + low CP (20), Low CP + low CU (22)	ICU Checkmate Plus Child Symptom Inventory for Parents	Sensitivity to punishment (BIS), Sensitivity to punishment (SPSRQ-C)	ICU score	ANCOVA	No main effects on sensitivity to punishment between CP and CU. CP only children higher sensitivity to punishment than CP and CU traits. High-CU youth scored lower on BIS compared to low-CU youth. Youth high on both CP and CU traits reported the lowest levels of BIS $F(1,69) = 9.21, p < .001, \eta^2 = 0.20$.	Yes	Not measured
Frick et al. (2003)	To test the hypothesis that CP, irrespective of CU traits would be associated with measures of emotional and behavioural dysregulation	Control (25), CP only (23), CU only (25), CP&CU (25)	CU present if at or above the upper quartile on ASPD measure	Behavioural Inhibition	ASPD CU subscale	MANOVA's	Significant main effect for CU traits, $F(2, 85) = 4.24, p < .05$. Children high on CU traits played more trials on the reward dominance computer task ($M = 145.76, SD = 33.69$) than children low on CU traits ($M = 145.76, SD = 76$). No significant interaction between CU traits and CP.	Yes	Yes
Marini & Stickle (2010)	To investigate if CU traits will explain the unique variance in approach motivation (operationalized as the pursuit of reward) above and beyond impulsivity and sensation seeking	150 offenders	Composite (highest) scores from youth, teacher & staff ratings.	Reward responsivity (number of pumps) Punishment Sensitivity (number of pumps)	ICU score	Hierarchical Multiple Regression Analysis. Partial Correlations	CU traits negatively predicted reward responsivity $\beta = -.17, p < 0.05$. CU traits was not a predictor of punishment responsivity.	Non-significant	No
Morgan et al. (2014)	To examine the association between reward and punishment and antisocial behaviour in adolescent males	Offenders, Healthy controls	Total number of offences	BAS (reward) BIS (punishment)	YPI CU subscale	Pearson's correlation Hierarchical Multiple Regression	CU traits significantly correlated with BIS $r = -.363, p < 0.01$. BIS negative predictor of CU traits ($\beta = -.34, p < 0.001$). No significance between BAS and CU traits ($\beta = -.09, p > 0.05$).	Yes	Non-significant

O'Brien & Frick (1996)	To understand the association between psychopathology and a child's response style on a task of competing rewards and punishment.	CU+ANX (37) CU ONLY (29), CONTROL (46) Non anxious CU+CP (8) Non anxious CU ONLY (22)	PSD (summing the ratings on each item from the parent and teacher forms)	Reward dominance - number of trials played on task	PSD (CU subscale)	Mixed ANOVA's - within subject conditions	CU ONLY played significantly more trials than the other two groups $F(2,109) = 6.77, p < .001$. CU+ANX did not differ from control group on number of trials played. Non anxious CU+CP (310.63) and non-anxious CU ONLY (292.77) played more trials than control group (243.07) but not significantly. No significant difference between non anxious CU traits with or without CP.	Yes	Yes
Pardini (2006)	To test the basic tenants of the callousness pathway to antisocial behaviour in a structural equation modelling framework	Offenders	ASPD	Punishment concern-rewards (OVQ)	ASPD CU traits	Pearson's correlations	Punishment concern was negatively correlated with callousness $r = -.55, p < 0.05$	Yes	Not measured
Pardini et al. (2003)	(1) To replicate previous findings regarding the association between each of the factors of psychopathy and various emotional and behavioral variables. (2) To examine the relation between CU traits and various social-cognitive processes.	Offenders	ASPD	Tangible reward, punishment (OEQ) Tangible Reward, Punishment (OVQ)	ASPD CU traits	Regression	CU traits was positively related with the outcome expectation measures of tangible rewards ($\beta = .37, p < .001$) and negatively related to expectations that aggression would result in punishment ($\beta = -.28, p < 0.01$) CU traits were positively related to the outcome values subscales of tangible rewards ($\beta = .30, p < 0.001$) and negatively related to values pertaining to punishment as a consequence of aggression ($\beta = -.36, p < 0.001$)	Yes	Yes

Platje et al. (2018)	To investigate differences in cognitive factors between four groups of boys with and without CU-traits and/or CPs	Low CU/Low CP (169) High CU/low CP (69) Low CU/high CP (65), High CU/high CP (57)	ICU total and SDQ total be low or above the mean in upper or lower quartiles	Reward responsivity Punishment sensitivity	ICU	ANCOVA	Reward responsivity differed overall $F(3,338)=17.51, p<.001, n^2=.14$. High CU/high CP score higher on reward sensitivity than high CU/low CP and low CU/low CP ($p<0.001$) but did not differ in reward responsivity from low CU/Low CP ($p=.158$). The high CU/low CP group did not differ in reward responsivity when compared with low CU/low CP ($P=1.000$). Punishment sensitivity differed overall $F(3,331)=4.60, p=.004, n^2=.04$. High CU/high CP scored higher compared with high CU/low CP ($p=0.001$) and low CU/Low CP ($p=.003$) but did not differ in low CU/high CP ($p=.205$).	No	Non-significant
Rau et al. (2008)	To investigate whether BD subjects will perform similarly to controls on the DRPLT, in comparison with SMD subjects who will exhibit deficits similar to those of individuals with psychopathy	Bipolar disorder (BD; 23), Severe Mood Dysregulated (SMD; 37) Healthy controls (31)	DSM-IV (TR)	Reward/ Reward, Reward/Punishment, Punishment/Punishment	ASPD CU traits	Post hoc tests: Pearson correlations	A comparison of task performance between SMD and BD youths with and without psychopathy could not be performed due to the very limited number of BD ($n= 2$) and SMD subjects ($n= 6$) meeting APSD criteria for psychopathy (i.e., APSD = 25). For healthy controls, performance on the punishment/punishment trial was significantly correlated with CU traits ($r=-0.45, p<0.05$)	Yes	Could not be performed
Roose et al. (2013)	To disentangle potentially different pathways to psychopathic traits using a performance-based measure of reward/punishment and cognitive control.	None	YPI CU (total score), ICU (total score)	Fear Sensitivity Index (BIS),	ICU (total score), YPI CU subscale	Correlations Bivariate and Partial Correlations	No significant correlations between total CU score or YPI CU and fear sensitivity index (BIS)	Non-significant	not measured

White et al. (2016)	To investigate the level of CP and/or CU traits would be inversely associated with (a) expected value representation within the anterior insula cortex/inferior frontal gyrus, dorsal anterior cingulate, and striatum during choice; and (b) prediction error representation within ventromedial frontal cortex and striatum.	None	ICU (total score)	Task performance (commission and omission errors)	ICU (total score)	ANCOVA (CU traits as covariate)	No significant differences of performance by CU traits either as a main effect $F(1,70) = 1.302, p=.258$ or in interaction with run or error type $F(1,70) <.794, p >.376$	Non-significant	Non-significant
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Note: ANCOVA=Analysis of Covariance, ANOVA= analysis of variance, ANX= anxiety, APSD= Antisocial Process Screening Device, BAS= behavioural activation system, BIS=behavioral inhibition system, CBCL= Child Behavior Checklist, CP=conduct problems, CU= callous unemotional, DSM-IV= Diagnostic Statistical Manual of mental disorders – 5th edition, ICU= Inventory of Callous Unemotional traits, MAP-DB= The Multidimensional Assessment of Preschool Disruptive Behavior, ODD= oppositional defiance disorder, OVQ= Outcome Values Questionnaire, OEQ=

1 children ($M=3.77$) during the early phases of the longitudinal study explains the use of other
2 reporters.

3 A significant relationship was found between CU traits and self-reported insensitivity
4 to punishment using the MAP-DB (Allen et al., 2016), the BIS/BAS scales (Fanti et al., 2015;
5 Morgan et al., 2014), the OVQ (Pardini, 2006; Pardini et al., 2003), the OEQ (Pardini, 2006)
6 and the SPSRQ-C (Platje et al., 2018). Fanti and colleagues used two measures of
7 punishment sensitivity, the BIS/BAS scales and the SPSRQ-C. Interestingly, when using the
8 SPSRQ-C for measuring punishment sensitivity, as informed by parents, there was no
9 relationship between CU traits and punishment sensitivity. In contrast, Platje and colleagues
10 found that young people with high CU traits with co-occurring high levels of conduct
11 problems were more sensitive to punishment than those with CU traits only. This was based
12 on using the SPSRQ-C, like Fanti et al., (2015). However, whereas Fanti and colleagues used
13 parent reported punishment sensitivity (Fanti et al., 2015), Platje and colleagues used self-
14 report (Platje et al., 2018), a larger sample and adolescents who were slightly older ($M=14$).

15 Fanti et al., (2015) also included the BIS/BAS scales to measure punishment
16 sensitivity. Using self-report, those with high CU traits scored lower on BIS (i.e. less
17 sensitive to punishment) than those with low CU traits. Furthermore, it was youths with high
18 CU traits and co-occurring high levels of conduct problems that reported the lowest levels on
19 the BIS (i.e. sensitivity to punishment). Similar to Fanti et al., (2015) Ezpeleta and colleagues
20 found children with occurring conduct problems (i.e. oppositional defiance disorder) were
21 less sensitive to punishment (Ezpeleta et al., 2017). Ezpeleta et al., (2017) used the SPSRQ-
22 C, reported by parents, alongside parent reported levels of child anxiety and child conduct
23 problems.

24 For Ezpeleta and colleagues, the addition of anxiety (with conduct problems and CU
25 traits) meant that children were more sensitive to punishment than healthy controls, children

1 with anxiety only, and children with CU traits and conduct problems. This was the only study
2 using questionnaires to take into account level of anxiety and conduct problems when
3 measuring punishment sensitivity, which may explain higher sensitivity when anxiety is also
4 present with CU traits. Given that Ezpeleta et al., (2017) and Fanti et al., (2015) used
5 longitudinal data for both younger children (mean age of 3) and older children (mean age of
6 11) you could suggest that children and young people with high CU traits *and* co-occurring
7 conduct problems have the highest insensitivity to punishment over time.

8

9 **CU traits, reward and punishment using task-based measures.** The studies that
10 used task based measures to measure reward and punishment responsiveness showed a mixed
11 picture. Findings were generally weaker than the results with questionnaire measures of
12 reward and punishment. There was no clear pattern of insensitivity to punishment in
13 relationship to punishment as there was when using questionnaires. Three of seven studies
14 (Frick et al., 2003; O'Brien & Frick, 1996; Rau et al., 2008) found a significant relationship
15 between CU traits and insensitivity to punishment. Further, two of (Frick et al., 2003;
16 O'Brien & Frick, 1996) five studies measuring reward responsivity found that CU traits to be
17 related to reward responsivity.

18 Interestingly, two studies that used the same task, a response reversal task, found that
19 children with CU traits played more trials (despite increasing levels of punishment) on the
20 reward dominance computer task. That is, children and young people with CU traits may be
21 more insensitive to punishment and more reward orientated than those low in CU traits – as
22 suggested by playing many more trials. Both used the APSD (Frick & Hare, 2001) to
23 measure CU traits, reported by both parents and teachers. Both of these studies grouped
24 children with CU traits based on whether they had co-occurring conduct problems. For both
25 of these studies, those children and young people with CU traits and conduct problems played

1 more trials on the response reversal task than children with CU traits only. This indicates that
2 children with CU traits *and* co-occurring conduct problems are the most reward dominant
3 when compared to those with CU traits only. The task does not separate reward and
4 punishment sensitivity so the response reversal behaviour could indicate greater reward
5 responsivity and/or lesser punishment sensitivity, or indeed greater reward responsivity when
6 in competition with punishments. Yet, the studies found that CU traits in general were
7 associated with a more reward dominant response style. Frick and colleagues and O'Brien &
8 Frick (1996) were the only two studies using task based measures that measured levels of co-
9 occurring conduct problems. Furthermore, the study by O'Brien & Frick (1996) was the only
10 study that included co-occurring anxiety using task based measures.

11 The presence, or absence, of anxiety and conduct problems has been found to have an
12 impact on responsiveness to punishment and reward with CU traits. O'Brien & Frick (1996)
13 found children with CU traits without anxiety, (i.e., primary psychopathy) were more reward
14 orientated and less responsive to punishment than those with high anxiety (i.e., secondary
15 psychopathy). The presence or absence of anxiety or the presence of emotional discomfort
16 may impact our interpretations, as this discomfort enables children and young people's moral
17 development. That is, if children do not show this level of discomfort or anxiety (i.e., primary
18 psychopathy), they may be reward driven, without any care for increasing levels of
19 punishment (i.e., in the response reversal task). However, this study does not investigate the
20 mechanism behind this finding.

21 Only one study (Rau et al., 2008) of five, using an alternative task to response
22 reversal, found a relationship between CU traits and punishment insensitivity using a passive
23 avoidance task. In a trial where both options resulted in high or low levels of punishment
24 (i.e., loss of points), CU traits were negatively related to performance for the healthy control
25 group only (but not with bipolar disorder or severe mood dysregulation). That is, young

1 people with higher levels of CU traits had impaired decision making in the
2 punishment/punishment trial of the task. This is consistent with other studies (Blair et al.,
3 2004; Finger et al., 2011). The sample sizes for this study (Rau et al., 2008) were very small
4 and therefore there is an increased margin of error. Furthermore, the authors did not report
5 where the sample of healthy controls were recruited from, their ethnicity, or if they had any
6 comorbidities (such as anxiety or conduct problems). Three studies (Briggs-Gowan et al.,
7 2014; Roose et al., 2013; White et al., 2016) also used passive avoidance tasks and found no
8 relationship between CU traits and insensitivity to punishment; of these three studies, two
9 (Briggs-Gowan et al., 2014; White et al., 2016) also found that CU traits were unrelated to
10 reward responsiveness.

11 Of note, all of the studies using passive avoidance tasks, which found no significance
12 with CU traits, were from clinic referred samples (Briggs-Gowan et al., 2014) or from a
13 treatment program (Rau et al., 2008; Roose et al., 2013; White et al., 2016). There were no
14 studies with children recruited from the community. It may be that those in treatment
15 programs, or referred for treatment in a clinic, have a different set of characteristics. That is,
16 clinic referred or those in a treatment program whom have CU traits do not show any deficits
17 in relation to reward and punishment responsivity. In all of the four studies using passive
18 avoidance tests there was very little information about the treatment program, the clinic they
19 were referred to, or the treatment they may have been receiving. It may be that the treatment
20 received moderated the relationship between CU traits and reward and punishment
21 responsivity. One further observation is that three out of four studies relied solely on parent
22 report, using a single informant and only a single measure of CU traits. It was only Roose and
23 colleagues who used two measures of CU traits, but again, only used self-report (single
24 informant) to measure CU (Roose et al., 2013). Moreover, three of the four studies using
25 passive avoidance tasks did not report ethnicity and in one study (Briggs-Gowan et al., 2014)

1 children and young people who were African American or black were over represented.
2 There is a significant shortage of research investigating ethnicity and CU traits (Moffitt et al.,
3 2008). However, in the adult literature, in prison samples, cognitive-affective deficits (such
4 as failure to inhibit reward responses) are not as strong in African American than in
5 Caucasian samples (Kosson et al., 1990; Lorenz & Newman, 2002a, 2002b).

6 Only one study in this review (Marini & Stickle, 2010) measured reward and
7 punishment responsivity using a risk taking task. Similarly, to using passive avoidance tasks,
8 the BART risk taking task showed that CU traits were unrelated to insensitivity to
9 punishment. However, Marini & Stickle (2014) found that those with higher CU traits were
10 less responsive to reward. This study had several strengths; the authors used multiple
11 informants to measure CU traits, measured data on ethnicity, included females and had a
12 large sample size compared to the studies that used passive avoidance tasks.

13 Finally, all of the studies that measured CU traits and reward or punishment
14 responsivity using task- based measures used cross sectional designs. Thus, we do not know
15 about longitudinal progressions.

16 **Discussion**

17 The present systematic review investigated the association between CU traits and
18 responsiveness to reward and punishment in children and young people and enables several
19 conclusions to be drawn from the evidence. First, the ways in which reward and punishment
20 responsivity or sensitivity varies significantly across studies. Second, very few studies
21 measured co-occurring levels of anxiety of conduct problems. Of the ones that did, children
22 and young people with CU traits *and* conduct problems were the most insensitive to
23 punishment and more reward orientated when compared to children with CU traits only.
24 Furthermore, few studies measured levels of anxiety in relationship to reward and
25 punishment responsivity. Third, the evidence suggests that children and young people with

1 CU traits are insensitive to punishment however the relationship with CU traits and reward
2 responsivity is a more of a mixed picture.

3 Ten of the fourteen studies found that children and young people with CU have
4 reduced responsivity to punishment. Only four studies from the review supported the notion
5 that children and young people with CU were more responsive to reward. The findings in this
6 review were consistent with a previous narrative synthesis (Byrd et al., 2014) which found
7 that children with CU traits were insensitive to punishment, however those with increased
8 levels of anti-social behaviour had a more marked insensitivity. Given this finding it was
9 interesting that few studies accounted for co-occurring conduct problems and even fewer
10 accounted for levels of anxiety.

11 Only six of thirteen studies in this review used categories based on a child or
12 young person's level of co-occurring conduct problems and CU traits. This is a surprising
13 finding given that CU traits are related to increased levels of conduct problems and severe
14 anti-social behaviours (Byrd et al., 2012; Frick & White, 2008; Pardini & Loeber, 2008).
15 Across the studies, CU traits in general were associated with punishment insensitivity;
16 however it was those with high levels of conduct problems that showed the most
17 insensitivities to punishment. Surprisingly, one study found that children and young people
18 with CU traits and co-occurring conduct problems were more sensitive to punishment than
19 those with CU traits only (Platje 2018). One explanation for this may be that insensitivity to
20 punishment is mainly present in the face of reward (Barry et al., 2000; Frick et al., 2003). For
21 example, when using task based measures like response reversal tasks children with CU traits
22 and conduct problems continue to seek rewards despite punishments increasing (Frick et al.,
23 2003). The sample sizes of children within these subgroups also varied and in some studies,
24 there were only sixteen children and young people with CU traits and conduct problems;

1 therefore, larger sample sizes are required to further evaluate these groups and the
2 mechanisms behind those with CU traits and co-occurring conduct problems.

3 Two studies further sub-grouped children on the basis of a child or young person's
4 CU traits and co-occurring anxiety (Ezpeleta et al., 2017; O'Brien & Frick, 1996). Research
5 proposes that primary psychopathy (an absence of anxiety) and secondary psychopathy
6 (presence of anxiety) in children and young people show further heterogeneity (Kimonis,
7 Frick, Cauffman, Goldweber, & Skeem, 2012). Of the two studies that measured level of
8 anxiety Ezpeleta and colleagues found that the secondary variant (presence of anxiety) were
9 more sensitive to punishment than the primary variant who were more reward dominant
10 (Ezpeleta et al., 2017). This is consistent with Gray's Reinforcement Sensitivity Theory
11 (RST) in that adults with psychopathy, with an absence of anxiety (primary variant) are
12 characterised by an underactive BIS system that drives further anti-social behaviour due to
13 insensitivity to cues of punishment (Lykken, 2013; Newman et al., 2005). The BAS however,
14 is relatively intact (Leentje Vervoort et al., 2010). This is true for the findings of this review,
15 that is, the 'core' interpersonal and affective features of psychopathy (i.e. CU traits) in
16 children and young people are related to deficits in the BIS (Allen et al., 2016; Fanti, 2013;
17 Morgan et al., 2014). Interestingly, in two studies the presence of anxiety in children with CU
18 traits found that they were more sensitive to punishment, using a response reversal task
19 (O'Brien & Frick, 1996) and questionnaires (Ezpeleta et al., 2017). This is consistent with
20 research in adult psychopathy in that they are more sensitive to punishment cues and have an
21 overactive BIS system (Lykken, 2013; Newman et al., 2005). These findings however need
22 to be treated cautiously, due to the small number of studies that included anxiety, the small
23 sample sizes, and the way in which reward or punishment responsivity was measured (i.e.
24 task based or questionnaire).

1 **Measurement of punishment and reward.** Despite the widespread use of RST, there
2 is no agreement on the instrument to assess its concepts. Several questionnaires have been
3 used to assess punishment sensitivity and reward sensitivity in child and adolescent samples
4 (Vervoort et al., 2015) however the measures used to report these concepts are not without
5 their limitations. The most popular questionnaires, the BIS/BAS scales and the SPSRQ-C
6 were used in this review, and it has been found that the reward responsiveness scales are
7 more individually determined than punishments. That is, what is rewarding for one individual
8 may be aversive to another (Van den Berg, Franken, & Muris, 2010). For punishment
9 responsiveness, individual variation seems less prominent, as most people seem wary for the
10 same types of threatening social and physical events (Lovibond & Rapee, 1993). The more
11 subjective nature of responsiveness to reward is also reflected in the overall lower reliability
12 levels of scales measuring this construct as compared to scales measuring punishment
13 responsiveness (e.g. Franken & Muris, 2005). This is consistent with this review in that most
14 studies using the BIS/BAS scales and the SPSRQ-C found significant relationships between
15 CU traits and punishment insensitivity but non-significant findings for reward
16 responsiveness. This may suggest that these questionnaires may be more sensitive to
17 detecting responsiveness to punishment than reward.

18 Behavioural tasks, such as passive avoidance tasks and response reversal tasks
19 use paradigms that typically include both rewards and punishments and require children and
20 young people to learn by trial or error over repeated trials. The findings across the studies in
21 this review are limited and inconsistent which links in with a recent narrative review (Byrd et
22 al., 2014). Almost all studies that utilised passive avoidance tasks were found to be non-
23 significant. Only one study found a relationship between CU traits and punishment sensitivity
24 and this was with a very small sample of healthy controls (Rau et al., 2008). Other studies
25 that included young people over the mean age of 18 found that young people with CU traits

1 (measured as psychopathy) failed to avoid punished stimuli in the context of competing
2 rewards (Newman & Kosson, 1986; Vitale et al., 2005) and showed increased responsiveness
3 to reward. Interestingly, one of these studies grouped young people with CU traits by their
4 level of anxiety and found that deficits in passive avoidance learning (i.e. making more
5 errors) were only associated with CU traits but without co-occurring anxiety (Vitale et al.,
6 2005). None of the studies in this review using passive avoidance tasks or risk taking tasks
7 took into account the level of anxiety. Given that CU traits may be heterogeneous to anxiety;
8 the results could differ based on anxiety. Results appeared more reliable with regard to
9 response reversal learning. Both studies (Frick et al., 2003; O'Brien & Frick, 1996) noted
10 that children and young people with CU have difficulties inhibiting a dominant response to
11 reward when in the face of increasing punishments.

12 One study used a measure of risk taking (Marini & Stickle, 2010) - the BART. The
13 BART has no fixed probability of reward or punishment, therefore almost all responses are
14 rewarded. This is different to the paradigms described above. The BART activates the BAS
15 (approach system) and the punishments are considered relatively weak (Marini & Stickle,
16 2010). Despite this, the BART has been proven to have strong ecological validity as it is a
17 strong predictor of real-life risk taking behaviours, at least with regard to drug use which may
18 or may not be rewarding to people with CU traits (Aklin, Lejuez, Zvolensky, Kahler, &
19 Gwadz, 2005; Bornovalova et al., 2009; Hopko et al., 2006).

20 Intricate tasks assessing reward and punishment responsiveness using passive
21 avoidance tasks, response reversal and risk taking, have provided fairly consistent
22 behavioural results, however, most have failed to include or acknowledge different subgroups
23 of children with CU traits. Furthermore, whilst these behavioural tasks have allowed
24 inferences to be made about reward and punishment responsivity, rarely have they

1 acknowledged the mechanisms behind these phases of learning (Ernst, Pine, & Hardin,
2 2006).

3 **Strengths and Limitations of the Current Review**

4 Overall, the quality of studies varied. All of the studies included in this review were
5 behavioural studies, however it is acknowledged that there is a significant field of research
6 using fMRI that could add to the understanding in this area. Most of the studies reviewed
7 were cross sectional studies so it is difficult to determine causal factors. Furthermore,
8 although most studies included girls, boys formed the majority of participants. Of the studies
9 that did include girls, they had small sample sizes and could not look at gender differences
10 (Ezpeleta et al., 2017; Fanti et al., 2015; Pardini, 2006). Many of the studies also had
11 sampling bias in that they were recruited from only one institution. Many studies used
12 multiple informants and multiple methods of data gathering combining reports of CU traits
13 from multiple reporters. However, a number of studies relied solely on one informant (i.e.
14 self-report, teacher report or parent report). Differences in informants responses can easily be
15 ascribed to well-known differences in child behaviour across situations (Achenbach,
16 McConaughy, & Howell, 1987; Stanger & Lewis, 1993). That is, perhaps conduct problems,
17 or even CU traits may be more apparent in the home or in the school environment.
18 Furthermore, parent and child reports of behaviour problems have been found to show
19 discrepancies (Van Roy, Groholt, Heyerdahl, Clench-Aas, 2010). However, a number of
20 studies relied on teacher, parent or staff report via questionnaires. Few studies took into
21 account confounding variables which may impact on responsiveness to reward or punishment
22 such as ADHD, medication, parenting, experience of trauma.

23 It is acknowledged that this review has a number of limitations. The review only
24 included peer-reviewed publications, meaning that findings could be subject to publication
25 bias. That is, studies that found a negative result may not have been published. Furthermore,

1 when there are many study variables, as may be in the larger longitudinal studies, for
2 example Ezpeleta et al., (2017) there remains the risk of selective reporting, that is, only
3 reporting findings that may be interesting to the reviewer. Finally, the heterogeneity of
4 identified studies did not allow for meta-analysis of results.

5 To the author's knowledge, this is the first systematic review to explore the
6 association of CU traits and responsiveness to reward and punishment in children and young
7 people. It utilised a range of databases and the author completed additional searching and
8 correspondence with authors to ensure relevant and newer studies were included.

9 **Clinical Implications and Future Research**

10 Most of the studies exploring responsiveness to punishment in this review suggested
11 that children and young people with CU traits have an insensitivity to punishment cues; this
12 is likely to impact on interventions used to support this small but significant subset of young
13 people. Often parenting programmes and behavioural interventions, based on social learning
14 theory are used to support children with conduct problems. However, research shows that
15 even the most successful interventions are not effective for one third of children with conduct
16 problems (Kolko et al., 2009; Ollendick et al., 2016; Reid, Webster-Stratton, & Hammond,
17 2003). High levels of CU traits in the child are a robust predictor of poorer response to
18 parenting programmes to reduce conduct problems (Hawes, Price, & Dadds, 2014).
19 Consistent with the findings in this review, the parents of children with CU traits, found the
20 disciplinary (or punishment) component of treatment more effective for those with conduct
21 problems but without CU traits (Hawes & Dadds, 2005). Furthermore, evidence based and
22 formulation driven interventions, such as Multisystemic Therapy (MST) have been found
23 ineffective for young people with CU traits (Manders, Deković, Asscher, van der Laan, &
24 Prins, 2013). Interventions for children and young people with CU traits predict poor
25 treatment outcomes and higher rates of recidivism after release from treatment programs for

1 adjudicated adolescents (Frick & Dickens, 2006). This finding is important given the
2 financial burden of recidivism (Herlitz, 2016; Snell et al., 2013). Given the findings presented
3 in the systematic review, one could suggest that traditional punishment or discipline
4 strategies are ineffective for children with CU traits and therefore more reward-based
5 strategies need to be developed and evidenced. Moreover, it is thought that children with CU
6 traits are more reward orientated (Frick et al., 2003; O'Brien & Frick, 1996) therefore
7 treatment or parenting programs should focus on reward-based strategies (e.g. descriptive
8 praise; Hawes & Dadds, 2005). However, this review found inconsistent evidence to support
9 that children with CU are more reward orientated, therefore it may be that parenting or
10 treatment programs need to take a more individual and holistic approach.

11 Future research should attempt to address the inconsistencies in the
12 measurement of reward responsivity in developing effective interventions for this group of
13 young people. Furthermore, there needs to be a clear definition and conceptualization of what
14 the tools to measure reward and punishment are measuring. Therefore, ecologically valid
15 measures need to be developed instead of lab based tasks or questionnaires which are not
16 relevant to real-world responsiveness to punishment and reward. Perhaps observational
17 methods could be utilized instead of relying on parent or self-report. Future research should
18 also focus on further delineating this heterogenic group of young people by looking at those
19 with and without conduct problems and those with and without anxiety. Moreover, there
20 needs to be adequate sample sizes from different sites using a longitudinal methodology to
21 help establish causal pathways and explore the changes of responsivity to reward and
22 punishment over time. Finally, further research should investigate the mechanisms behind
23 why children and young people with CU are less responsive to punishment or discipline.

Conclusions

The present systematic review reports on the responsiveness to reward and punishment in children and young people with CU traits. It has revealed that children and young people with CU traits are less responsiveness to punishment. These studies have implications for intervention; in that, traditional approaches to treatment are using behavioural or parenting programmes or incarceration for those young people who display the most significant conduct problems or antisocial behaviour. The studies have shown inconsistent findings with regards to whether children and young people with CU traits are more responsive to reward or more reward dominant.

There is a lack of consistency within how reward and punishment responsivity is measured and conceptualized which limits the conclusions that can be drawn. There is also considerable heterogeneity within this subset of children and young people based on level of anxiety and externalizing behaviours which means there is considerable ambiguity within the literature. It is recommended that future research explores the mechanisms behind responsiveness to reward and punishment in children and CU traits but also including level of anxiety and conduct problems. Finally, it is apparent that the clinical needs of children with conduct problems and CU traits warrant intervention strategies which meet their needs beyond the current interventions and treatments which appear ineffective.

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Chapter 2: Empirical Paper

The role of emotional memory and anxiety in children and young people with callous unemotional traits in their responsiveness to reward¹

Jayde Sayers

Author Note

Correspondence concerning this review should be addressed to Jayde Sayers, Doctorate in Clinical Psychology Programme, Institute of Health, Psychology and Society, University of Liverpool, The Whelan Building, Brownlow Hill, Liverpool, L69 3GB, UK. Email: Jayde.Sayers@liverpool.ac.uk

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Abstract

Background Research suggests that young people (YP) with a callous-unemotional (CU) interpersonal style take more risks, are less responsive to punishment or discipline, and are more reward orientated. YP with CU traits have been found to have poor emotional memory for negative events or stimuli; this could explain why they often show reduced responsivity to punishment. The presence of anxiety adds further heterogeneity in that YP with CU traits and high anxiety are more sensitive to punishment and show differences in emotional processing.

Objectives To examine whether emotional memory mediates the relationship between CU traits and responsiveness to punishment (and reward) and whether anxiety moderates the relationship between CU traits and emotional memory. **Methods** 31 boys from alternative provision schools, aged 11-16 years, were assessed using questionnaires and task-based methods. Conduct problems, CU traits and anxiety were assessed using questionnaires. Emotional memory and reward responsivity were assessed using task-based measures; videos based on the Deese-Roediger-Mcdermott (DRM) paradigm and a risky choice task. **Results** Correlational and hierarchical regression analysis indicated no association between CU traits and reward sensitivity or emotional memory. High CU traits were associated with higher conduct problems. High anxiety and low CU traits were related to more false memories in neutral videos. Anxiety did not impact emotional memory for those with high CU traits.

Conclusions Although findings provide tentative support for the heterogeneity and subtyping of children with conduct problems, this preliminary study was underpowered and replications with a larger numbers of participants would be beneficial.

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Introduction

1 All children disobey adults at times, however a subset of children and young people
2 exhibit conduct problems resulting in a diagnosis of conduct disorder. These children and
3 young people, although a small proportion of all children, persistently break the rules, engage
4 in norm-breaking behaviours and repeatedly and seriously violate the rights of others
5 (American Psychiatric Association; APA, 2013). Conduct problems and associated antisocial
6 behaviour remain one of the most common mental health and behavioural problems in
7 children and young people in the United Kingdom (National Institute for Health and Care
8 Excellence, 2013). It is estimated that one in twenty (4.6%) 5 to 19 year olds have conduct
9 problems, with rates higher for boys than girls (NHS digital, 2018).

11 Serious conduct problems that are characterised as persistent patterns of disruptive
12 and violent behaviour that violate the rights of others and societal norms are highly related to
13 criminal behaviour (Frick, Stickle, Dandreaux, Farrell, & Kimonis, 2005). These behaviours
14 are a serious concern for public policy and are associated with a host of social, emotional and
15 academic problems for the child or young person (Kimonis & Frick, 2011). Serious conduct
16 problems in childhood have been shown to be predictive of poor educational outcomes, peer
17 rejection, increased risk of comorbid mental health problems, substance misuse and increased
18 risk of arrest (Frick, Ray, Thornton, & Kahn, 2014). Consequently, severe conduct problems
19 in children and young people have been considered one of the most challenging set of
20 behaviours to treat (Dadds & Salmon, 2003), and these children often enter the criminal
21 justice system. However, in the UK, the criminal justice system has also been shown to be
22 inadequate and ineffective, with 38 percent of juvenile offenders going on to reoffend within
23 a year (Puffet, 2017).

24 There is a long and extensive history of research on the causes of serious conduct
25 problems, their developmental trajectory and the ways in which children with conduct

1 problems respond to treatment. A better understanding of the mechanisms underlying
2 conduct problems has significant implications for prevention and intervention efforts (Byrd,
3 Loeber, & Pardini, 2014). One of the challenges in developing interventions for this group is
4 that there is considerable heterogeneity within this group of children who display persistent
5 patterns of violent and antisocial behaviour (Frick et al., 2014). To develop effective
6 interventions, researchers have found ways of classifying children into different subgroups
7 (Frick et al., 2014). One approach that has been developed to delineate this group of children
8 and young people is by their affective and interpersonal style, and not the conduct problems
9 themselves. Specifically, research has focused on identifying children and young people on
10 the basis of a callous unemotional (CU) interpersonal style or '*trait*' which derives from the
11 adult literature of psychopathy (Frick et al., 2014; Hare & Neumann, 2008).

12 The presence of psychopathic tendencies in children with conduct problems
13 has been termed CU traits. Children and young people with CU traits are characterised by
14 affective and interpersonal problems such as lack of remorse or empathy, callous use of
15 others and shallow or deficient emotions (Fanti, 2013; Frick & Viding, 2009). Based on the
16 extensive research investigating CU traits, the most recent DSM-5 (APA, 2013) added the
17 specifier "with Limited Prosocial Emotions" (LPE) to designate those with conduct disorder
18 and show two or more of the following characteristics in two or more settings: (i) lack of
19 remorse or guilt; (ii) callous-lack of empathy; (iii) unconcerned about performance; or (iv)
20 shallow or deficient affect (Blair, Leibenluft, & Pine, 2014). There have been many
21 definitional problems in looking at 'psychopathic traits' in children and young people (see
22 Frick et al., 2014 for comprehensive review), with many highlighting the pejorative nature of
23 the term 'psychopath' or 'psychopathy'. There is a need to be sensitive in applying
24 psychopathy constructs to children and young people as there is potential harm related to the
25 diagnosis of these traits in children and young people, particularly in relation to the social

1 stigma of diagnostic labelling such as “conduct disorder” “delinquent” and “psychopath”
2 (Edens & Cox, 2012; Rockett, Murrie, & Boccaccini, 2007). The author has critically
3 reflected on the use of this problematic terminology in Appendix C.

4 Children and young people with CU traits are thought to represent a group
5 with the most persistent and severe problem behaviours (Burke, Loeber, & Lahey, 2007;
6 Lynam, Caspi, Moffitt, Loeber, & Stouthamer-Loeber, 2007). High CU traits in children and
7 young people has been linked with increased violence and aggression alongside significant
8 risk taking behaviour and decision making when compared to those low in CU traits
9 (Centifanti & Modecki, 2013; Frick & White, 2008). It is estimated that between 36 and 55
10 percent of children accessing the youth justice system have elevated CU traits (Teplin,
11 Abram, McClelland, Dulcan, & Mericle, 2002). A well-established explanation of the risk
12 taking behaviours of children with CU traits is their responsiveness to reward (Barry et al.,
13 2000; O’Brien & Frick, 1996) and reduced sensitivity to punishment cues (Allen, Morris, &
14 Chhoa, 2016; Fisher & Blair, 1998; Pardini, Lochman, & Frick, 2003).

15

16 **Callous unemotional traits and reward/punishment sensitivity**

17 The most cited framework for understanding reward and punishment sensitivity in
18 humans is Gray's reinforcement sensitivity theory (1981, 1987). The theory proposes two
19 systems: the behavioural approach system (BAS) which increases activity and initiates goal
20 directed behaviour in response to a reward, and the behavioural inhibition system (BIS)
21 which inhibits action and avoids aversive stimuli or punishment. Children and young people
22 with CU traits have been found to have deficits in one or both of the BAS and BIS systems.
23 Quay (1993) suggested that a heightened BAS (reward system) in children and young people
24 with conduct problems leads to a reward dominant response style that overrides the BIS and
25 leads to persistent reward seeking behaviours. Another theory, developed in the adult

1 literature of psychopathy, is that adults with psychopathic traits have little negative arousal in
2 response to punishment and therefore have difficulties in learning from cues indicative of
3 punishment or discipline (Fowles, 1980; Lykken, 1995). There has been limited research in
4 this area within the child and adolescent population but one suggestion is that conduct
5 problems, including CU traits, can be attributed to the functioning of both the BAS and BIS
6 (Patterson & Newman, 1993; Wallace & Newman, 2008). Alternative theories and research
7 to support the understanding of CU traits and reward and punishment responsivity have been
8 developed; for example, how attachment and parenting style influences children's responses.

9 Considering that most, if not all children are more sensitive to rewards than
10 punishment, mothers who demonstrate higher levels of warmth and a secure attachment to
11 their child may be able to shape and reinforce socially adaptive behaviours (Kim & Chang,
12 2019; Waller, Gardner & Hyde, 2013). If children with CU traits are even more resistant to
13 punitive discipline, then it stands to reason they will receive the most benefit from warm and
14 responsive parenting early in life (Centifanti, Meins, & Fernyhough, 2016). Furthermore,
15 there is evidence that parental harshness and low parental warmth are related to problem
16 behaviours in children with CU traits (Frick et al., 2003; Pardini, Lochman & Powell, 2007).
17 Harsh punishment is thought to elicit high levels of arousal in children, making it difficult for
18 children to internalise parental messages about pro-social behaviours (Pardini et al., 2007).
19 Therefore, a child's responsivity or influence of rewards could be related to attachment style
20 between the child and caregiver.

21 Evidence based interventions that rely on punitive discipline methods such as time
22 out, exclusions, or incarceration, often used with children and young people with conduct
23 problems, have been found to be less effective for children with elevated CU traits (Haas et
24 al., 2011; Hawes, Dadds, Frost, & Hasking, 2011; Pardini et al., 2003). Furthermore, reward-
25 based approaches such as targeting the self-interests of the child and rewarding the length of

1 time a child performs a desired behaviour (Pardini et al., 2003; Skinner, 1938) have been
2 found to be more effective for children and young people with CU traits than more punitive
3 disciplinary methods. These findings suggest that among children with elevated CU traits, the
4 BAS and BIS (i.e. reward and punishment responsivity) function differently compared with
5 typically developing children with whom discipline methods are more effective (Hawes &
6 Dadds, 2005).

7 Although this association has been heavily researched, there remains a dearth of
8 research of the mechanism behind why children and young people with CU traits are less
9 responsive to punishment cues and more reward-orientated. Emerging research has attempted
10 to explain this mechanism by focusing on level of arousal and emotional memory in children
11 and young people with CU traits (Dolan & Fullam, 2010; Kimonis, Frick, Cauffman,
12 Goldweber, & Skeem, 2012; Loney, Frick, Clements, Ellis, & Kerlin, 2003). Healthy
13 functioning individuals generally have an enhanced emotional memory for distressing or
14 negative material (Christianson et al., 1996; Dolan & Fullam, 2010; Dolan & Fullam, 2004).
15 However, children and young people with CU traits have been found to have a reduced
16 responsivity, level of arousal, and memory for negative stimuli (Anastassiou-
17 Hadjicharalambous & Warden, 2008; Kimonis, Frick, Fazekas, & Loney, 2006; Sharp, van
18 Goozen, & Goodyer, 2006). Furthermore, children and young people with CU traits have
19 been found to have problems with their affective theory of mind (Gillespie, Kongerslev,
20 Sharp, Bo & Abu-Akel, 2018). That is, children and young people have difficulties
21 understanding the emotional states of others. This may be particularly pertinent in that young
22 people with CU traits may have difficulties understanding the person giving discipline or
23 punishment therefore not generating negative or discomforting arousal in themselves.

24 The experience of punishment is usually perceived as negative or discomforting by a
25 child or young person (Kochanska, 1994). Given that CU traits is associated with a

1 diminished memory for negative material (Dolan & Fullam, 2010), the assumption is that
2 children and young people are less likely to remember the experience of being punished
3 (negative emotional memory). This then makes a child or young person less likely to inhibit
4 further conduct problems to avoid future punishment.

5

6 **Emotional Memory and Callous Unemotional Traits**

7 Emotional memory is a term used to denote the memory of experiences that evoke
8 emotional reactivity or arousal. Research on normal conscience development suggests that
9 emotional arousal and discomfort in response to punishment are essential components of
10 conscience development and the resulting moral socialization (Burton, Maccoby, &
11 Allinsmith, 1961; Kochanska, 1994). The use of emotion allows people to guide prosocial or
12 antisocial actions (Reisberg & Hertel, 2003). If the child remembers the feelings and emotion
13 of punishment, then this will inform their decision as to whether or not to engage in future
14 harmful or problematic behaviour. Caregivers play an important role in the development of
15 conscience and a child's social competence. Research has found that parental warmth
16 predicts higher levels of empathy, social competence and compliance in parental requests in
17 children (Kochanska and Askan, 1995; Choe et al., 2003; Zhou et al., 2010). In addition,
18 Centifanti et al. (2016) found that enhanced and attuned parental responsiveness to infants'
19 mental and emotional states results in better emotion understanding for the child when they
20 enter school and less CU traits in later childhood. Thus, it may be that CU traits, and in
21 particular there reduced responsiveness to punishment develops based on parental warmth
22 and being attuned to their child's emotions.

23 Children with CU traits have been found to have reduced responsiveness to emotional
24 stimuli (Marsh et al., 2008), have difficulties remembering emotive or negative material
25 (Dolan & Fullam, 2010), and show reduced psychophysiological responses to distressing and

1 threatening pictures, films and words, indicative of reduced affective arousal (Anastassiou-
2 Hadjicharalambous & Warden, 2008; Blair, Colledge, & Mitchell, 1999; Kimonis et al.,
3 2006; Loney et al., 2003). Collectively, these studies show that children with CU traits have a
4 specific deficit in processing negative emotional stimuli. Being punished is generally
5 described as something that is negative, emotive and produces high arousal (Byrd et al.,
6 2014). As such, if a child with high CU traits is unable to remember the negative emotional
7 arousal (or memory) of previous punishment, then this may increase their risk of engaging in
8 future harmful behaviour (Kochanska, 1994).

9 In addition to CU traits, Dadds and Salmon, (2003) also suggested that levels of
10 anxiety may be associated with the extent to which discomforting arousal is experienced
11 following wrong-doing and punishment. It is suggested by these authors that the degree to
12 which anxiety is experienced is related to the development of an internal system that
13 functions to inhibit misbehaviour.

14

15 **The impact of co-occurring anxiety and CU traits**

16 Anxiety plays a part in emotional arousal (or memory) in relation to punishment;
17 however the presence or absence (of anxiety) adds further heterogeneity to children with CU
18 traits (Kimonis et al., 2012). Several studies support the existence of at least two distinct
19 groups of children and young people who show elevated CU traits. Specifically, research
20 using various clustering techniques has consistently found one group of children with
21 elevated CU traits and normative or low levels of anxiety, and a second group with elevated
22 levels of both CU traits and anxiety (Kahn, Frick, Youngstrom, Findling, & Youngstrom,
23 2012). These variants, in the adult and adolescent literature, have often been referred to as
24 primary and secondary psychopathy, respectively (Kimonis & Frick, 2011; Kimonis et al.,

1 2012; Skeem, Johansson, Andershed, Kerr, & Louden, 2007). However, this distinction is
2 somewhat controversial.

3 Studies have shown that the absence of anxiety (or low anxiety) and high levels of CU
4 traits (the primary variant), in children and young people, are characterized as being more
5 insensitive to punishment (i.e. low BIS; Kimonis et al., 2012). This low level of anxiety and
6 insensitivity to punishment drives further antisocial behaviour (Byrd et al., 2014).
7 Furthermore, the primary variant (i.e. low anxiety, high CU traits) has been found to have
8 significant deficits in emotional memory for negative stimuli or events when compared to
9 those with the secondary variant (i.e. high anxiety, high CU traits; Kimonis et al; 2012). It
10 may be that the emotional arousal of anxiety, supports or scaffolds emotional memory for
11 negative stimuli or events, thus preventing further antisocial behaviour.

12 There have been very few studies that have accounted for the level of anxiety when
13 investigating reward and punishment sensitivity in children and young people with CU traits.
14 Two studies (Ezpeleta, Granero, de la Osa, & Domènech, 2017; O'Brien & Frick, 1996) have
15 found that children and young people with CU traits, conduct problems and high levels of
16 anxiety (secondary variant) are more responsive to punishment than children with CU traits
17 without anxiety (primary variant). The primary and secondary variant of psychopathy (i.e.
18 high or low CU traits with or without high anxiety) clearly have very different patterns of
19 responses to emotional stimuli, and different responsiveness to punishment (and reward) which
20 could contribute to their problems in conscience development and further antisocial
21 behaviour (Ezpeleta et al., 2017; Kimonis et al., 2012; O'Brien, Frick, & Lyman, 1994). To
22 date, there is very little research that have tested these constructs together.

23 The present study examines the relationship of emotional memory on responsiveness
24 to reward, when there is a possibility of being punished, in children with conduct problems
25 and varying levels of CU traits. We hypothesised that children with conduct problems and

1 higher CU traits would be more reward dominant and have a poorer memory for emotionally
2 negative stimuli. In addition, we hypothesised that level of anxiety would explain the
3 relationship between CU traits and emotional memory. Specifically, we predicted that
4 children and young people with high CU traits and low anxiety (primary variant) would have
5 a better memory for positive stimuli and a poorer memory for negative stimuli. In addition,
6 those with high CU traits and high anxiety (secondary variant) would have a better memory
7 for negative stimuli.

8 **Method**

9 **Participants**

10 Thirty-one boys aged 11-16 years ($M=13.32$, $SD=1.51$) were recruited from three
11 schools within the North West of England. A child or young person's neurodevelopmental
12 diagnosis (or diagnoses) was collected from the child's school case file, in most cases from
13 their Education Health Care Plan (EHCP). The children and young people had a range of
14 neurodevelopmental diagnoses including; Attention Deficit Hyperactivity Disorder (ADHD;
15 48.4%), Autistic Spectrum Condition (ASC; 3.2%), Oppositional Defiance Disorder (ODD;
16 3.2%) and multiple diagnoses (16.1%), which included children and young people with more
17 than 1 neurodevelopmental condition. From the young people recruited, 29% had no reported
18 neurodevelopmental diagnoses (see Table 1 for demographic information). The schools were
19 two special schools for social emotional and mental health needs (SEMH) and one school for
20 alternative provision. The rationale for sampling from these schools was that children and
21 young people who attend alternative provision schools and SEMH schools show a wide range
22 of social and emotional difficulties that manifest in different ways and may be associated
23 with an overrepresentation of high CU traits. Children and young people who attend special
24 schools often display behaviour that may be challenging and disruptive, and often present
25 with attention deficit hyperactive disorder (ADHD; Cooper, 2008; McCarthy et al., 2012).

1 We noted participants' Education Health Care Plans (EHCP) for ADHD, Autistic Spectrum
 2 Conditions (ASC), Oppositional Defiance Disorder (ODD) and other relevant diagnoses.
 3 Young people were eligible to participate if they met the following criteria: i) were 11-16
 4 years old at the time of taking part in the study (in line with the age recommendations for the
 5 questionnaires), ii) were attending one of the three recruited schools and iii) could understand
 6 written or verbal English. Fifteen of the thirty-one participants had a diagnosis of ADHD.
 7 The Head Teachers acted in loco parentis, and verbal consent was obtained from parents. The
 8 children and young people gave written assent. This method of gaining consent was
 9 approved by the University of Liverpool Central Research Ethics Committee.

10 Table 1.

11 *Demographic and neurodevelopmental diagnoses of the sample (n=31)*

Demographic and diagnoses	N (%)
Age	
11	4 (12.9)
12	8 (25.8)
13	2 (6.5)
14	10 (32.3)
15	5 (16.1)
16	2 (6.5)
Neurodevelopmental Diagnoses	
None	9 (29.0)
ADHD	15 (48.4)
ASD	1 (3.2)
ODD	1 (3.2)
Multiple*	5 (16.1)
Gender	
Male	31 (100)

12 *these were a combination of ADHD, ODD, ASD, PDA, anxiety disorder, attachment
 13 disorder, Tourette's syndrome and CU.

14

1 **Design**

2 The study adopted a cross-sectional design using questionnaires and task-based
3 measures.

4 **Measures**

5 Participants completed self-report questionnaires (see Appendix D) and task based
6 measures. The delivery of the questionnaires and tasks were randomised to prevent order
7 effects (see Appendix E for the 12 different combinations in which the task and
8 questionnaires were presented). The risk taking task was always the first or final task and the
9 final video shown to the children and young people was always the positive video to
10 minimise any potential distress from the negative videos. The responses within the
11 questionnaires (i.e. each individual question) was presented in the same order each time. The
12 individual responses on the questionnaires were presented in the same order were captured
13 using an electronic form creator (Google Forms) that saved the non-identifiable data online.

14 *Callous-unemotional traits/limited prosocial emotions.* The Youth Psychopathic
15 Traits Inventory (Andershed, Kerr, Stattin, & Levander, 2002) is a 50 item self-report
16 measure designed to assess the core personality traits of the psychopathic personality
17 constellation in children and young people. The YPI includes three subscales: the grandiose-
18 manipulative or interpersonal dimension, the callous-unemotional or affective dimension and
19 the impulsive-irresponsible or behavioural dimension. All items are rated on a 4-point Likert
20 scale (1 = Does not apply at all, to 4 = Applies very well). In this study, the callous-
21 unemotional dimension (15 items) was used to assess callousness, remorselessness and
22 unemotionality. The questionnaire was designed for use in community samples and has been
23 shown to have good to excellent internal consistency for each subscale ($\alpha=.66-82$;
24 Andershed, Kerr, Stattin & Levander, 2002). In the current study, the Cronbach alpha
25 coefficient for the callous-unemotional subscale used was .76.

1 **Conduct problems.** The Me & My Feelings (M&MF) questionnaire (Deighton et al.,
2 2013) is a brief school-based measure of child mental health. It covers two broad domains:
3 emotional difficulties and behavioural difficulties. The 7 item self-report behavioural
4 difficulties scale was used in the current study. It demonstrates good internal consistency ($\alpha=$
5 0.80) and good construct validity in community samples ($r=.7$ Deighton et al., 2013). In the
6 current study the Cronbach alpha coefficient was .725.

7 **Anxiety.** The Behaviour Assessment System for Children, Third Edition (BASC-3;
8 Reynolds & Kamphaus, 2015) is a well-validated measure of child emotion and behaviour
9 problems and was used to measure generalized anxiety (Reynolds & Kamphaus, 2015). The
10 anxiety scale comprised of 11 questions for children aged 6-11 years, and 13 questions for
11 children and young people aged 12 -21 years. In the current study, the Cronbach's alpha for
12 the 6-11 age group was not determinable due to too few participants 11 and under. The
13 Cronbach alpha coefficient for the 6-21 age group was .76.

14 **Emotional memory.** The Scenic False Memory Paradigm (Hauschildt, Peters, Jelinek,
15 & Moritz, 2012) is a set of five videos, based on the Deese-Roediger-McDermott (DRM)
16 paradigm, used to assess emotional (and false) memory in a life like setting. Videos, rather
17 than static stimuli, were used as previous studies have used faces, pictures or word lists that
18 lack ecological validity (Hauschildt et al. 2012). Five video scenes were presented to the
19 participants. The video scenes were comparable regarding duration (approximately 1.5 min)
20 and complexity, but they varied in emotional content. Video scenes were: neutral (electrician
21 at work), positive (children's birthday party), negative (car accident, surveillance or
22 interpersonal violence [trauma related]). All of the videos included typical items that one
23 would expect to find in such a scene, for example, a balloon or present in the birthday party
24 scene.

1 The videos were presented to children and young people on a HP Probook 14-inch
2 screen laptop. They were sat approximately 20 inches from the screen in a quiet classroom
3 within the school. Prior to the presentation of each video, each participant was instructed to
4 watch the video carefully as they would be asked to remember certain details from the scene.
5 On the same computer, using a questionnaire, the children and young people were asked
6 whether they had seen any of the 24 objects or actions in the video that had just watched.
7 This was the recognition test and the answers were captured using a 3-point scale; yes, unsure
8 or no.

9 The recognition test consisted of the following items: (a) objects or actions present in
10 the video (12 ‘old’ items), (b) objects or actions not in the video but related to the scene (9
11 ‘new’ items) and (c) items not present in the video and completely unrelated to the scene (3
12 ‘new unrelated’ items). The ‘old’ (items that were present in the video) and ‘new’ (items not
13 present in the video) were split into objects or actions that were ‘central ‘in video (i.e.
14 blowing out candles in the birthday video), peripheral (i.e. a paper cup in the birthday video)
15 and unrelated (i.e. a sheep in the birthday party video). Appendix F contains a list of all
16 objects and actions.

17 Incorrect responses were coded as 0 and correct responses were coded as 1. For each
18 video (positive, neutral and negative) a total number of correct responses were calculated for
19 old central, new central, old peripheral, new peripheral and new unrelated items. The ‘new
20 unrelated’ variables in the video were highly skewed towards higher values. That is, almost
21 all children and young people stated that the ‘new unrelated’ objects or actions were not
22 present in each of the videos. Participant scores on ‘central’ and ‘peripheral’ items on each
23 video (positive, negative and neutral) were skewed towards higher values therefore Z scores
24 were created.

1 The Z scores for ‘old central’ and ‘old peripheral’ were combined to create a new
2 variable for each video (i.e. ‘old negative’, ‘old positive’ and ‘old neutral’). The prefix ‘old’
3 measures accuracy of recall (i.e. emotional memory) for objects or actions that were present
4 in the video. Z scores for ‘new central’ and ‘new peripheral’ were also combined to create a
5 new variable for each video (i.e. ‘new negative’, ‘new positive’ and ‘new neutral’). The
6 prefix ‘new’ measures accurately reporting that an object or action *was not* present in the
7 video. Lower scores indicate poorer accuracy therefore higher false memories (i.e. saying that
8 objects or actions were in the video when they were not). DRM paradigms have been used
9 previously to assess emotional memory in community samples of children and young people
10 with CU traits (Thijssen, Otgaar, Howe, & de Ruiter, 2013).

11 **Reward sensitivity.** The Risky Choice Task (RCT; Fairchild et al., 2009) was used to
12 measure reward sensitivity and is a modified version of the Risky Choice Task by Rogers et
13 al., (2003). This was a computer based task to assess risk-taking behaviour (i.e. reward
14 sensitivity) with the aim of the task to win as many points as possible. Participants were told
15 that they would see two wheels of fortune on the computer screen, one on the left and one on
16 the right, and were asked to choose the wheel that will give them the best chance of winning
17 as many points as possible. Each wheel consisted of eight segments that had different
18 amounts that could be won or lost on each trial. Participants chose between the control and
19 experimental wheels. The control wheel had a 50-50% change of either winning or losing 10
20 points. The experimental wheel varied in terms of probability of losing (75% or 25%), the
21 magnitude of gain (20 or 80 points), and the magnitude of loss (20 or 80 points). Different
22 combinations of these wheels yielded eight trial types.

23 The task consisted of four blocks with 20 trials in each block, giving 80 trials in total.
24 All trial types were presented in a pseudo random order and the experimental wheel appeared
25 on either the left or the right of the display. The outcome variable (or dependent measure)

1 was the number of times the experimental or 'risky' wheel was chosen over the control
2 wheel. The number of times the participant made a 'risky' choice (i.e. chose the experimental
3 wheel) was summed and served as a measure of reward sensitivity. The reward sensitivity
4 total scores were flat (kurtosis) and the scores on blocks 2-4 were skewed therefore each of
5 the blocks were analysed separately (i.e. blocks 1-4). An example trial of the task can be
6 found in Appendix G. This task has previously been used in a community sample of males
7 with early-onset of adolescent conduct problems (Fairchild et al., 2009) and samples of male
8 offenders aged 12-18 (Syngelaki, Moore, Savage, Fairchild, & Van Goozen, 2009).

9

10 **Procedure**

11 The Liverpool Central University Research Ethics Committee granted ethical
12 approval for the research; approval documents can be found in Appendix H. An information
13 sheet (Appendix I) was sent to all parents via the school administrative department, inviting
14 their child to take part in the research. After one week, the researcher, with the aid of a
15 member of the school administrative staff, contacted each parent via telephone. The
16 information sheet was read verbatim over the phone and the parents were given an
17 opportunity to ask any questions. The consent form (see appendix J) was then read verbatim
18 and the parents/carers responded yes or no. Parents/carers consent was recorded verbally
19 during the telephone call. Verbal consent was used due to low response rates for returning of
20 consent forms in school populations, particularly from disadvantaged backgrounds (Fletcher
21 & Hunter, 2003). The information sheet provided details of the research and confirmed
22 confidentiality, consent/assent, and the right to withdraw. The children and young people
23 were provided with an age-appropriate information sheet (see Appendix K) before providing
24 written assent (Appendix L) if they wished to take part.

1 The delivery of questionnaires and tasks was counterbalanced and took approximately
2 45 minutes to one hour to complete. All tasks and questionnaires were presented on a HP
3 Probook 14-inch screen. The data was captured on an electronic form creator (Google Forms)
4 that saved the non-identifiable data online. All questionnaires were read aloud to account for
5 any reading difficulties. At the end of the questionnaires and tasks, the young people were
6 given a debrief sheet that contained contact details for the researcher, and a list of third-party
7 organisations should they have felt any level of discomfort.

8

9 **Expert by Experience Consultation**

10 Liverpool Expert by Experience (EbE) Group members and four members of
11 CAMHelions, a young person's local service user group, was consulted early in the research
12 planning. Feedback from these consultations led to modifications in data collection
13 procedures that would be more amenable and accessible for younger participants of the study.
14 Consultation with experts by experience (EbE) also supported the process of ethical approval
15 for the research study. Consultation with EbE's at the latter stage of the analysis provided
16 opportunities to disseminate the findings to parents of the children who took part in the
17 research, and to gain their thoughts on further dissemination of the research.

18

19 **Data Analyses**

20 Based on Soper (2017), sample size was estimated at a minimum number of 67
21 participants. This number was required to detect a medium effect size with .90 power at a
22 critical alpha level of 0.05 for a multiple regression. Although the requirements of the power
23 calculation were not met, the number of participants recruited was comparable with other,
24 similar studies (Allen et al., 2016; Budhani & Blair, 2005; Frick et al., 2003; Scerbo et al.,
25 1990). The total number of participants enrolled in the schools was 200. There were a number

1 of reasons why this number of children and young people did not participate. A significant
2 proportion of parents and carers were not able to be reached by telephone to give consent. Of
3 the parents who consented, the young people were either absent from school, receiving
4 education off-site, or declined to take part.

5 Data were screened and bivariate correlations were calculated using IBM Statistical
6 Packages for the Social Science (SPSS version 22.0) for Windows (IBM_Corp, 2010). Prior
7 to analyses, data were screened for missing values, normality, linearity, and
8 homoscedasticity. Less than 5% of values were missing therefore multiple imputation was
9 not required (Schafer, 1999). A mean substitution was generated for 2 missing items for one
10 participant whom did not fully complete the YPI. In order to assess the distribution of
11 continuous data, inspection of histograms and normality plots were undertaken in addition to
12 looking at skewness and kurtosis and the z-scores of the skewness value divided by the
13 standard error.

14 Descriptive statistics were used to summarise scores on the measures of conduct
15 problems, CU traits, anxiety and reward responsivity for the total sample. Hierarchical
16 multiple linear regression was conducted to establish the impact of CU traits, anxiety, and
17 their two-way interaction on emotional memory. At step 1, CU traits and anxiety were added
18 as the null model. At step 2, an interaction term between CU traits and anxiety was added as
19 a predictor variable. R^2 change was tested to investigate the difference between step 1 and
20 step 2. The multiple hierarchical regression analysis was carried out using JASP (version
21 0.9.2) computer software (JASP Team, 2019). For all analyses, p-values less than or equal to
22 .05 were considered significant.

23 Results

24 Descriptive Statistics

1 Table 1 presents means and standard deviations for levels of conduct
 2 problems, CU traits, anxiety, and number of risky decisions (reward responsivity). To test for
 3 violations of normality, we looked at the z-score of the standard error to estimate ratio of
 4 skewness and kurtosis. All variables were normally distributed apart from conduct problems.
 5 As shown in Table 2, scores on the conduct problem measure were skewed towards lower
 6 values to the right. Thus, a square root transformation was conducted. After transformation,
 7 the scores were then normally distributed (skewness= 0.493, SE= 0.441) and the transformed
 8 variable was used for parametric analysis.

9 Table 2.

10
 11 *Descriptive statistics of all study variables*

Variable	M (SD)	Median	Range	Cronbach's Alpha	Skewness	Skewness z-score*	Kurtosis	Kurtosis z-score*
Age	13.32 (1.51)	14.0	11-16					
Conduct Problems (M&MF)	5.79 (2.15)	5.00	2-12	0.725	1.046	2.372	1.404	1.636
Callous unemotional traits (YPI)	37.47 (7.64)	37.0	24-54	0.787	0.595	1.323	0.393	0.472
Anxiety (BASC)	10.41 (3.62)	10.0	5-17	0.776	0.064	0.143	-1.134	-1.300
Reward responsivity block 1 (RCT)	11.37 (2.173)	11.0	7-16		-0.011	-0.026	-0.054	-0.065
Reward responsivity block 2 (RCT)	12.38 (3.55)	12.0	6-18		-0.182	-0.419	-1.112	-1.316
Reward responsivity block 3 (RCT)	11.93 (3.339)	12.0	6-18		-0.044	-0.098	-1.025	-1.175
Reward responsivity block 4 (RCT)	12.08 (3.285)	12.0	4-18		-0.411	-0.901	0.304	0.343
Reward responsivity total (RCT)	48.15 (9.41)	12.0	34-64		-0.125	-0.274	-1.14	-1.285
New positive (emotional memory)					0.472	1.070	-0.66	-0.769
Old positive (emotional memory)					-0.488	-1.107	0.141	0.441
New negative (emotional memory)					-0.174	-0.395	1.481	1.726
Old negative (emotional memory)					0.395	0.896	0.196	0.228
New neutral (emotional memory)					-0.289	-0.645	-0.306	-0.351
Old neutral (emotional memory)					-0.592	-1.321	0.924	1.060

Note:*Z-scores > 1.96 and < -1.96 indicate significant skewness or kurtosis at $p < 0.05$ (Ghasemi & Zahediasl, 2012)
 BASC = Behavioural Assessment System for Children M&MF= Me and My Feelings Questionnaire, 'new' (emotional memory) = accurately reporting that an object or action *was not* present in the video, Old (emotional memory) = accuracy of recall for objects or actions that were present in the video RCT = Risky Choice Task, YPI= Youth Psychopathic Inventory

1 Bivariate Correlations

2 *Are children and young people with conduct problems and CU traits more responsive to*
 3 *reward?*

4 Correlations were used to test whether CU traits were positively associated with reward
 5 responsivity (when there is a possibility of being punished). The results of the Spearman's
 6 correlational analyses are presented in Table 3. Conduct problems and callous unemotional
 7 traits were unrelated to reward responsivity on each block of the wheel of fortune task. As
 8 expected, there was a significant association between conduct problems and callous
 9 unemotional traits ($r_s = .418$ $p < 0.05$).

10

11 Table 3.

12 *Spearman correlations of study variables*

13

Variable	Conduct Problems	Callous Unemotional (CU) Traits	Anxiety
Conduct Problems (M&MF)***	—		
Callous Unemotional (CU) Traits (YPI)	0.418*	—	
Anxiety (BASC)	0.331	0.049	—
Reward responsivity block 1 (RCT)	-0.157	-0.047	-0.235
Reward responsivity block 2 (RCT)	-0.108	-0.27	-0.127
Reward responsivity block 3 (RCT)	0.141	-0.100	0.115
Reward responsivity block 4 (RCT)	-0.035	-0.175	0.236
Reward responsivity total (RCT)	-0.087	-0.207	-0.006
New positive (emotional memory)	0.045	0.048	-0.030
Old positive (emotional memory)	-0.043	0.135	0.087
New negative (emotional memory)	-0.016	-0.071	0.020
Old negative (emotional memory)	0.382*	0.039	0.269
New neutral (emotional memory)	-0.269	-0.043	-0.404*
Old neutral (emotional memory)	0.032	-0.250	-0.096

BASC = Behavioural Assessment System for Children, CU= callous unemotional traits, M&MF= Me and My Feelings Questionnaire, 'new' (emotional memory) = accurately reporting that an object or action *was not* present in the video, Old (emotional memory) = accuracy of recall for objects or actions that were present in the video RCT = Risky Choice Task, YPI= Youth Psychopathic Inventory

* $p < 0.05$, ** $p < 0.001$

*** square root of conduct problems transformed variable

14

15

1 *Are conduct problems and CU traits related to emotional memory?*

2 The relationship between CU traits and emotional memory, as measured by the
3 different affective videos was non-significant. There was a significant relationship between
4 conduct problems and accurate recall of previously seen information in videos with negative
5 emotional content ($r_s = .382, p < 0.05$), such that higher conduct problems related to higher
6 accurate recall in videos with negative emotional content.

7

8 *The role of anxiety in emotional memory and reward responsiveness*

9 Associations between anxiety and the other main study variables were also tested.
10 Anxiety was unrelated to conduct problems, CU traits and reward responsivity on all trials on
11 the risky choice task (see table 3). Anxiety was negatively correlated with scores on the
12 videos with neutral (or no) emotional content. That is, accuracy was poorer for young people
13 with high anxiety; they recalled more items not present in the video (i.e., they showed greater
14 false memories).

15

16 **Multiple Linear Regression**

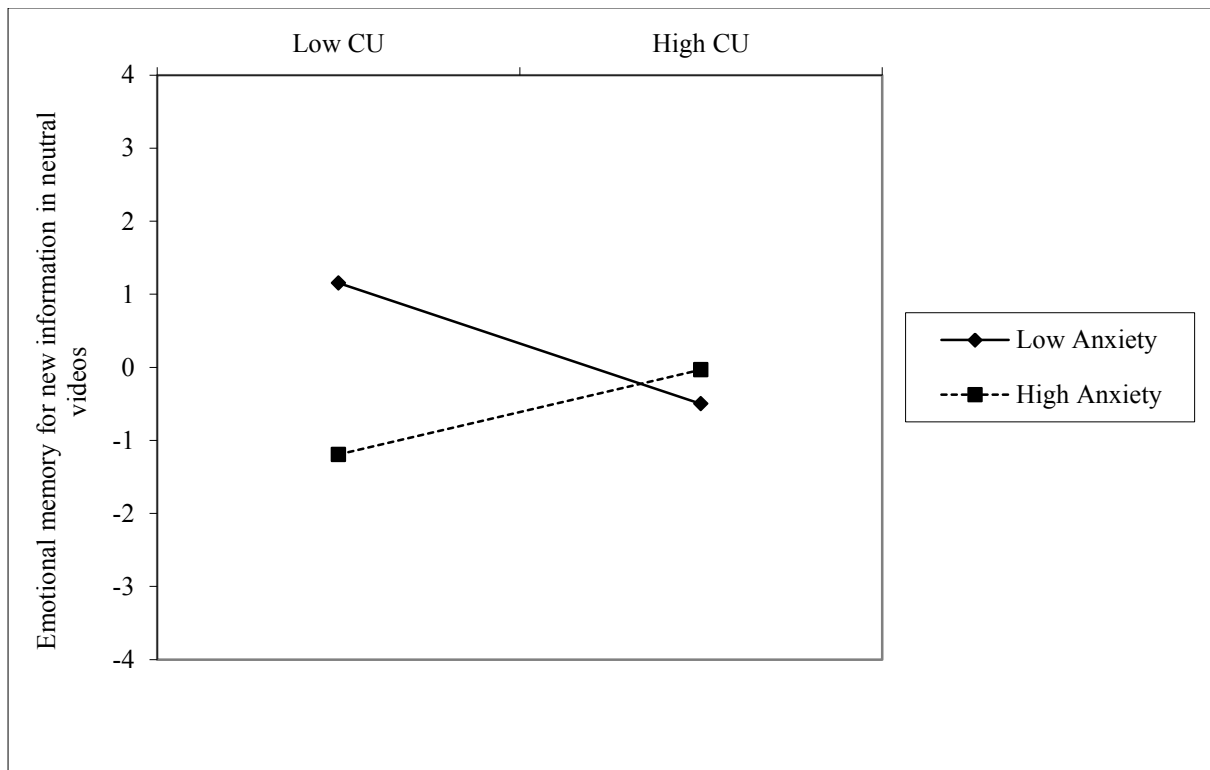
17 *The moderating effect of anxiety on CU traits and emotional memory*

18 A hierarchical linear regression including anxiety, CU traits and their interaction, was
19 used to test the moderating effect of anxiety on the relationship of CU traits with emotional
20 memory. On step 2 $F(1,22)=6.469, p < 0.019$, the interaction of CU traits and anxiety was
21 positively associated ($\beta = 2.587$) with reporting of information not-present in the video in
22 neutral videos. The interaction of anxiety and CU traits explained 18.3% of the variance in
23 reporting of information not-present in the neutral videos, with an R^2 change of 0.183. At low
24 levels of CU traits, anxiety was positively associated with higher accuracy of reporting of
25 information not present in videos with no emotional content (neutral videos). However, at

1 high levels of CU, there was a negative relationship of anxiety with accurate reporting of
 2 information not present in the videos with no emotional content (neutral video). That is,
 3 anxiety was associated with a higher number of false memories for neutral videos among
 4 children with low CU, but not high CU (see figure 1).

5 There was a borderline negative significant ($\beta = -2.261$) interaction of the moderating
 6 effect of CU traits by anxiety and recall of information in the videos with negative emotional
 7 content ($F(1,22) = 3.643, p = 0.066$). There was a further borderline significance ($\beta = 2.135$) for
 8 young people high CU traits and high anxiety (secondary variant) in recalling new
 9 information in videos with positive content ($F(1,22) = 3.235, p = 0.086$). 12.4% of the variance
 10 in recall of new information in videos with positive content can be explained by anxiety and
 11 CU traits with an R^2 change of 0.124. Further linear regression models were completed for
 12 each affective video however each had non-significant results (see table 4 and 5).

13



14

Figure 1. Accuracy for reporting items not present in the video. Higher numbers = greater accuracy of reporting items as not present in the video. Lower numbers = more false memories.

Table 4.
Multiple hierarchical regression: emotional memory for new information (false memory)

Model	Positive						Negative						Neutral						
	R ²	B	SE	β	t	sig	R ²	B	SE	β	t	sig	R ²	B	SE	β	t	sig	
Step 1	0.03						0.015						0.196						
CU		-0.036	0.043	0.174	0.835	0.412		-0.031	0.079	-0.084	-0.4	0.693		0.009	0.041		0.041	0.213	0.833
Anxiety		-0.021	0.093	-0.047	-0.225	0.824		0.091	0.179	0.107	0.508	0.616		-0.211	0.089		-0.448	-1.361	0.027
Step 2	0.154						0.096						0.379						
CU		-0.191	0.133	-0.939	-1.444	1.163		-0.374	0.256	-1.001	-1.46	0.158		-0.281	0.119		-1.308	-2.348	0.028
Anxiety		-0.739	0.409	-1.65	-1.807	0.085		-0.992	0.792	-1.163	-1.252	0.224		-1.126	0.369		-2.391	-3.055	0.006
CU * Anxiety		0.02	0.011	-2.135	1.798	0.086		0.031	0.022	1.716	1.402	0.175		0.026	0.01		2.587	2.544	0.019*

Multiple hierarchical regression R², beta values (β), standardised coefficient (B), unstandardized coefficient (SE), t values (*t*), *p* values (*p*). Note: CU= callous unemotional traits

Table 5.
Multiple hierarchical regression: emotional memory for accurate recall of information

Model	Positive						Negative						Neutral						
	R ²	B	SE	β	t	sig	R ²	B	SE	β	t	sig	R ²	B	SE	β	t	sig	
Step 1	0.002						0.036						0.066						
CU		0.006	0.044	0.029	0.139	0.89		0.015	0.08	0.04	0.191	0.85		-0.049	0.039		-0.254	-1.243	0.226
Anxiety		0.012	0.097	0.026	0.123	0.903		0.155	0.182	0.177	0.852	0.403		-0.005	0.087		-0.012	-0.059	0.954
Step 2	0.099						0.176						0.159						
CU		0.212	0.14	1.015	1.513	0.145		0.479	0.251	1.248	1.906	0.07		0.137	0.125		0.71	1.096	0.285
Anxiety		0.662	0.432	1.446	1.533	0.139		1.619	0.776	1.85	2.086	0.049		0.583	0.385		1.378	1.513	0.144
CU * Anxiety		-0.018	0.012	-1.89	-1.543	0.137		-0.041	0.021	-2.261	-1.935	0.066		-0.017	0.011		-1.851	-1.564	0.132

Multiple hierarchical regression R², beta values (β), standardised coefficient (B), unstandardized coefficient (SE), t values (*t*), *p* values (*p*). Note: CU= callous unemotional traits

Discussion

This cross sectional study aimed to examine the relationship between emotional memory and responsiveness to reward when there is a possibility of being punished, in children and young people with CU traits. To the authors' knowledge, this was the first study to quantitatively and systematically explore the moderating effects of anxiety on relationship of CU traits with reward sensitivity and emotional memory.

In bivariate analyses and as expected, there was a positive correlation between CU traits and conduct problems. This is consistent with literature that CU traits are highly related to conduct problems (Frick et al., 2003, 2014; Frick & Dickens, 2006). This study adds further evidence for the subtype 'with limited prosocial emotions' (LPE; APA, 2013) in that children and young people with CU traits have higher and more significant levels of conduct problems and antisocial behaviour (Burke et al., 2007; Lynam et al., 2007). There was a further significant finding in that, conduct problems was positively correlated to recall of negative information. In contrast to our hypotheses, there were no statistically significant associations of CU traits, conduct problems or anxiety with reward responsivity. For emotional memory, accuracy was poorer for young people with high anxiety as they recalled more items that were not present in the neutral emotion videos (i.e. had more false memories).

In multivariate analyses, anxiety moderated the relationship between CU traits and emotional memory in reporting of new information in neutral videos. Anxiety appeared to have a bigger moderating effect for children and young people with low CU traits; that is, anxiety was associated with a higher number of false memories for neutral videos among children with low CU traits, but not high CU traits. The other interactions in the multivariate analysis were non-significant, suggesting that anxiety did not moderate the effect of CU traits on recall or false memory. As such these findings do not support the hypothesis.

1 A surprising finding, and contrary to the hypothesis, was that children and young
2 people with CU traits were not reward orientated and did not make ‘riskier’ decisions based
3 on the wheel of fortunes task. This is surprising given that the sample were all in adolescence
4 which has been found to be a marked time for engaging in risky or dangerous behaviours
5 (Fairchild, 2011; Steinberg, 2010). Despite this, research into children and young people with
6 CU traits and reward responsivity is mixed. The literature for CU traits and a reduced
7 sensitivity to punishment is well founded (see Byrd, Loeber, & Pardini, 2014, for review)
8 however for reward responsivity this is more of a mixed picture. One study (Marini &
9 Stickle, 2010), which used a similar task, the Balloon Analogue Risk Task (BART-Y; Lejuez
10 et al., 2007) found that higher levels of CU traits predicted less reward responsivity. Other
11 studies measuring reward responsivity using passive avoidance tasks (Briggs-Gowan et al.,
12 2014; White et al., 2016) and questionnaires (Allen et al., 2016; Morgan, Bowen, Moore, &
13 van Goozen, 2014; Pardini, 2006; Platje et al., 2018) have also found non-significant results
14 for reward responsivity. It may be that significant (or non-significant) findings are associated
15 with the way reward responsivity is measured as studies that have used response reversal
16 tasks have found that children with CU traits are more responsive to reward (Frick et al.,
17 2003; O’Brien & Frick, 1996). The differences and variety of ways of measurement in the
18 tasks themselves may be responsible for the variability of findings. For example, in response
19 reversal tasks children are required to learn by trial and error where reward dominance is
20 measured based on continuing to play despite increased ratio of punishment (Frick et al.,
21 2003). In contrast, risky decision making tasks (like the one used in this study) looks at the
22 choices young people make between stimuli based on rewards and losses (punishment; Byrd
23 et al., 2014). Therefore, it may be useful to further delineate between learning and decision
24 making in children and young people with CU traits.

1 This study hypothesized that for those with high CU traits, anxiety would have an
2 impact on their emotional memory. Based on previous research, children with CU traits and
3 high anxiety (secondary variant) have been shown to be more engaged with, and have a better
4 memory for distressing or negative emotional stimuli (Kimonis et al., 2012) when compared
5 with those with CU traits and low anxiety (primary variant). However, this study does not
6 provide support for this. That is, anxiety only impacted emotional memory in young people
7 with low CU traits on neutral videos. Young people with high anxiety and low CU traits had
8 more false memories. This is consistent with the research in that high anxiety is generally
9 related to less accuracy and more suggestibility (Gudjonsson, 1988; Siegel & Loftus, 1978).

10 One unexpected finding in this study is that there was a positive relationship between
11 conduct problems and accurate recall of information in negatively valenced videos. One
12 explanation for this is that children with conduct problems often have often experienced
13 harsh parenting (Shaw et al. 2005). This lack of positive interaction or parental warmth could
14 foster hypervigilance in children with conduct problems to negative information and a loss of
15 sensitivity to positive cues (Kuhne et al. 1997). Furthermore, a significant proportion of the
16 sample in this study had ADHD; studies have found that young people with ADHD
17 remember negative contents better than positive information (d'Acremont & Van Der
18 Linden, 2007). In differentiating CU traits and conduct problems in emotional memory,
19 studies have found that, children with CU traits show low anxiety and fear and reduced
20 reactions to distress pictures. Children with conduct problems have been found to have
21 normative or even high arousal to negative stimuli (Rydell & Brocki, 2019).

22 Interestingly, this study found no significant differences in CU traits and emotional
23 memory on both false memory and recall in positive, negative and neutral videos. This
24 finding is consistent with the work of Thijssen and colleagues, who found that children high
25 or low in CU traits did not differ in their emotional memory for neutral and negative stimuli

1 (Thijssen, Otgaar, Howe, & de Ruiter, 2013). Furthermore, we did not find that children with
2 CU traits and low anxiety (primary variant) had poorer memory for negative stimuli than
3 those with high CU traits and high anxiety (secondary variant), low CU traits and low anxiety
4 or low CU traits and high anxiety. Again, these findings are consistent with the results of a
5 further study by Thijssen and colleagues who found that children with high CU traits did not
6 differ in their true recall of negative word lists than those with low CU traits (Thijssen et al.,
7 2013). Like this study, Thijssen and colleagues also noted difficulties in replicating previous
8 findings regarding the emotional memory of adults and children and young people with
9 psychopathic or CU traits (Christianson et al., 1996; M. C. Dolan & Fullam, 2010; Dolan &
10 Fullam, 2004).

11

12 **Strengths and Limitations**

13 The results of this study must be considered within the context of several
14 study limitations. First, the study used a small sample size of thirty one boys therefore the
15 results should be interpreted with caution. Past studies with larger sample sizes, with young
16 people who have been clinically referred for treatment or incarcerated, have found links
17 between CU traits and reward dominance (Barry et al., 2000; O'Brien & Frick, 1996; Pardini
18 et al., 2003). Therefore, a larger sample is required as this study lacked optimal power for a
19 regression analysis which therefore increases the probability of a type-II error. Second, this
20 study was cross sectional and correlational therefore causality and the directional nature of
21 the variables relative to CU traits, reward responsivity, emotional memory and anxiety cannot
22 be inferred. Despite the cross sectional design, one strength is that children and young people
23 were recruited from three different sites; two special schools for children and young people
24 with social, emotional, behavioural and mental health difficulties and an alternative provision
25 school. These settings often have children and young people attending whom have the most

1 severe conduct problems (Warren, Jones, Fredrickson, 2015) therefore it is likely that the
2 study captured those with significant conduct problems and CU traits. However, it may be
3 that other confounding factors may have impacted the results such as, neurodevelopmental
4 problems, mental health problems or the teaching ethos of the school (i.e. the schools had
5 different cultures related to reward and punishment). Although neurodevelopmental
6 diagnoses were collected there were too few children and young people to control for these
7 variables.

8 Second, the study measured CU traits, anxiety and conduct problems from the
9 perspective of the young person. Studies have found that informants are more likely to under
10 report their socially undesirable behaviour (Frick et al., 2003) than over report, therefore a
11 multiple information method of collecting data is likely to be the most reliable. Studies that
12 have used multiple informant approaches, using teachers or parents with self-report, are
13 thought to have more of an objective view of a young person's level of CU traits (Fanti,
14 Panayiotou, Lazarou, Michael, & Georgiou, 2015; Platje et al., 2018). Teacher report was not
15 used in this study due to the significant and increased pressure on school teachers within the
16 UK at present (Weale, 2019). Given that teaching staff are responsible for many children and
17 young people within a classroom, it was thought that assessing these children and young
18 people (in addition to their teaching roles) would have been an additional burden.

19 Furthermore, the internal consistency of the YPI, CU traits and conduct problem
20 questionnaires were suboptimal. This is consistent with other research which has found that
21 YPI subscales related to callousness and unemotionality tend to show consistently low alphas
22 for adolescent offenders and young people with behavioural problems (Andershed et al.,
23 2002; Dolan & Rennie, 2006; Poythress, Dembo, Wareham, & Greenbaum, 2006). Other
24 scales such as the Inventory of Callous Unemotional traits (ICU; Frick, 2004) using multiple
25 informants have yielded more optimal internal consistencies.

1 Third, although the emotional memory videos were high in ecological validity,
2 it may be that the different affective components of each video were not personally relevant
3 for the children and young people in the study. That is, children and young people with
4 conduct problems and CU traits have been found to have higher prevalence of traumatic
5 experiences (Krischer & Sevecke, 2008; Poythress, Skeem, & Lilienfeld, 2006) in childhood,
6 therefore it may be that a scene depicting a children's birthday is perceived as a negative
7 emotional memory rather than positive (due to memories of familial abuse or neglect).
8 Although the stimuli varied across emotional content (positive/negative/neutral) it is possible
9 that certain types of details are more or less memorable (as well as contextual factors, such as
10 trauma which alter recall; Van Damme & Smets, 2014). In this study, central and peripheral
11 components of emotional memory were combined (due to high kurtosis). As with previous
12 studies in the adult literature (Cooper, Hervé, & Yuille, 2007) psychopathy is related to
13 increased focus on central (more arousing) aspects of events or stimuli instead of peripheral
14 (non-arousing) information.

15 One further strength in relation to using task based measures was that the children and
16 young people were more engaged in the research. Questionnaire measures of emotional
17 memory and reward and punishment responsivity could have been used, however, the
18 children and young people that were recruited were from alternative education provisions and
19 are likely to have had low verbal ability. This group often find paper-and-pencil tasks
20 intimidating, non-engaging or no 'fun' (David, 1992, Smith and Barker, 1999). Using this
21 guidance, task based measures on a computer have been found to be more engaging and
22 therefore likely to be more enjoyable and appealing for young people; this is especially true
23 given that there is an increased use of technology within the classroom environment (Kirby,
24 2004).

1 **Clinical Implications**

2 To the authors' knowledge, this is the first study to systematically explore the role of
3 emotional memory on reward responsivity and looking at the moderating role of anxiety in
4 children and young people with CU traits. In doing so it has enhanced the understanding of
5 what factors may be important for this population, thus indicating area in which to focus
6 assessment, support and intervention. Although, the findings from the current study do not
7 support the hypothesis that was tested, it is believed that with a larger sample and greater
8 power, significance would be reached.

9 Firstly, based on these results, children and young people with a callous unemotional
10 interpersonal style have high levels of conduct problems. That is, children and young people
11 who have a lack of empathy and guilt, show a callous use of others, and show little emotion
12 show higher levels of conduct and anti-social behaviour. It may be important for community,
13 child and adolescent mental health services (CAMHS) and in particular forensic or youth
14 justice settings to understand that children and young people with conduct problems and
15 severe antisocial behaviour may differ from one another. For children with conduct problems
16 the most effective treatment currently used is parenting programs often based on social
17 learning theory such as Triple P and Webster-Stratton (Sanders & Turner, 2005; Webster-
18 Stratton, 1998) which are often based on positive reinforcement and discipline focused
19 components. These programs are commonly delivered in CAMHS and other public services
20 for supporting parents to manage their child's problem behaviour. However, these have been
21 found to have poor outcomes for children and young people with CU traits (Hawes, Price, &
22 Dadds, 2014). Studies have found that the discipline (or punishment) strategies for targeting
23 conduct problems are not as effective as positive reinforcement (or reward) and the
24 promotion of warmth in the parent-child relationship, for children with CU traits (Hawes &
25 Dadds, 2005).

1 Secondly, this study highlights the importance of assessing anxiety in children and
2 young people with callous unemotional traits given that high and low levels of anxiety show
3 different mechanisms. Young people with callous unemotional traits and high anxiety have
4 been found to have the most severe clinical picture and present with poorer outcomes
5 (Ezpeleta et al., 2017). Interventions such as cognitive behavioural therapy have been found
6 to be effective in treating internalising symptoms (e.g. anxiety and depression) and related
7 trauma histories (Chaffin & Friedrich, 2004; Kaslow & Thompson, 1998; Ollendick & King,
8 1998) alongside parenting programs for externalizing problems (e.g. conduct problems;
9 (Webster-Stratton & Hammond, 1997).

10 Finally, this study highlights the complexity of this group of children and young
11 people. These findings show that children with CU traits do not have impairments in
12 emotional memory therefore this may not be an explanation for why children with CU traits
13 are less responsive to discipline or punishment. These findings suggest that children with CU
14 traits are not more responsive to reward despite other research explaining to the contrary.

15

16 **Future Research**

17 First, prospective research with larger samples and greater power is required. Future
18 research could continue to develop and strengthen the potential relationships between CU
19 traits, emotional memory, anxiety and reward responsiveness. Studies with larger sample
20 sizes have found significant effects relating to these variables. This would allow future
21 research to control for and investigate other variables such as gender, neurodevelopmental
22 diagnoses, and intelligence quotient (IQ).

23 Second, it would be beneficial to collect data of a clinically referred sample or youth
24 offending population given that children in these settings or services are likely to display a

1 more severe pattern of conduct problems which are associated with callous unemotional traits
2 (Frick et al., 2014). This would allow comparison of the current data for level of CU traits.

3 Thirdly, measuring CU traits using multiple informants would be an advantage.
4 Furthermore, the validation of the scenic false memory paradigm (Hauschildt et al., 2012) for
5 its use with children and young people would be beneficial given its high ecological validity
6 for measuring emotional memory using real life scenarios.

7

8 **Conclusions**

9 In summary, the present study did not find that children and young people with high
10 CU traits were more responsive to reward. However, it did show that children with high CU
11 traits have co-occurring conduct problems. The results indicate that anxiety may impact
12 emotional memory for those with CU traits, however future research is required to clarify
13 this.

14 There is a myriad of etiological pathways to conduct problems, including those
15 highlighted in this study. However, the mechanism underlying the associations are still yet to
16 be fully explored despite the impact of these behaviours on the young person themselves and
17 the wider society. Future research needs to take a bottom-up approach paying particular
18 attention to the strengths and limitations of other studies. Future studies need larger sample
19 sizes, multiple informant methods and further investigation of the heterogeneity of this
20 subgroup (i.e. those with high and low anxiety and CU traits).

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Appendix A: Author guidelines for the Journal of Development and Psychopathology

Development and Psychopathology strongly encourages contributions from a wide array of disciplines because an effective developmental approach to psychopathology necessitates a broad synthesis of knowledge. Manuscripts will be considered that address, for example, the causes and effects of genetic, neurobiological, biochemical, cognitive, or socioemotional factors in developmental processes with relevance to various risk or psychopathological conditions. The journal also seeks articles on the processes underlying the adaptive and maladaptive outcomes in populations at risk for psychopathology.

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General. All manuscripts must be provided in MSWord format in 12-point type with 1-in. margins on all sides. The entire manuscript must be double-spaced and numbered consecutively. The language of publication is English.

Style and Manuscript Order. Follow the general style guidelines set forth in the *Publication Manual of the American Psychological Association* (6th ed.). The Editor may find it necessary to return manuscripts for reworking or retyping that do not conform to requirements. Do not use embedded references, end notes, or bookmarks. Manuscripts must be arranged in the following order:

Title Page. To facilitate blind review, all indication of authorship must be limited to this page, which should be submitted as a separate file. Other pages must only show the short title plus page number at the top right. The title page should include the (a) full article title; (b) name and affiliations of all authors; (c) acknowledgments; (d) mailing address and telephone number of the corresponding author; (e) address of where to send offprints, if different from the corresponding author; and (f) a short title of less than 50 characters.

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Abstract Page. Include (a) a full article title, (b) an abstract of no more than 200 words, and (c) up to five keywords for indexing and information retrieval.

Text. Use a standard paragraph indent. Do not hyphenate words at the ends of lines or justify right margins.

References. Bibliographic citations in the text must include the author's last name and date of publication and may include page references. Examples of in-text citation style are Cicchetti (2002), Durston (2008, pp. 1133–1135), Hunt and Thomas (2008), (Hunt & Thomas, 2008), (Posner, Rothbart, Sheese, & Tang, 2007), and subsequently (Posner et al., 2007). If more than one, citations must be in *alphabetical* order. Every in-text citation must be included in the reference section; every reference must be cited in the text. Examples of reference styles:

Journal Article

Haltigan, J. D., Roisman, G. I., & Fraley, R. C. (2013). The predictive significance of early caregiving experiences for symptoms of psychopathology through midadolescence: Enduring or transient effects? *Development and Psychopathology*, 25, 209–221.

Book

Buss, A., & Plomin, R. (1984). *Temperament: Early developing personality traits*. Hillsdale, NJ: Erlbaum.

Chapter in an Edited Book

Gottlieb, G., & Willoughby, M. T. (2006). Probabilistic epigenesis of psychopathology. In D. Cicchetti & D. Cohen (Eds.), *Developmental psychopathology* (Vol. 1, 2nd ed., pp. 673–700). Hoboken, NJ: Wiley.

An Endnote style that reflects the *Publication Manual of the American Psychological Association* (6th ed.) is available for download [here](#).

Appendix (optional). Use only if needed.

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Last updated: 9th June 2016

Appendix B: Quality Assessment Tool for Reviewing Studies with Diverse Designs (QATSDD)

Table 1 Quality assessment tool and scoring guidance notes

Criteria	0 = Not at all	1 = Very slightly	2 = Moderately	3 = Completely
Explicit theoretical framework	No mention at all.	Reference to broad theoretical basis.	Reference to a specific theoretical basis.	Explicit statement of theoretical framework and/or constructs applied to the research.
Statement of aims/objectives in main body of report	No mention at all.	General reference to aim/objective at some point in the report including abstract.	Reference to broad aims/objectives in main body of report.	Explicit statement of aims/objectives in main body of report.
Clear description of research setting	No mention at all.	General description of research area and background, e.g. 'in primary care'.	General description of research problem in the target population, e.g. 'among GPs in primary care'.	Specific description of the research problem and target population in the context of the study, e.g. nurses and doctors from GP practices in the east midlands.
Evidence of sample size considered in terms of analysis	No mention at all.	Basic explanation for choice of sample size. Evidence that size of the sample has been considered in study design.	Evidence of consideration of sample size in terms of saturation/information redundancy or to fit generic analytical requirements.	Explicit statement of data being gathered until information redundancy/saturation was reached or to fit exact calculations for analytical requirements.
Representative sample of target group of a reasonable size	No statement of target group.	Sample is limited but represents some of the target group or representative but very small.	Sample is somewhat diverse but not entirely representative, e.g. inclusive of all age groups, experience but only one workplace. Requires discussion of target population to determine what sample is required to be representative.	Sample includes individuals to represent a cross section of the target population, considering factors such as experience, age and workplace.
Description of procedure for data collection	No mention at all.	Very basic and brief outline of data collection procedure, e.g. 'using a questionnaire distributed to staff'.	States each stage of data collection procedure but with limited detail, or states some stages in details but omits others.	Detailed description of each stage of the data collection procedure, including when, where and how data were gathered.
Rationale for choice of data collection tool(s)	No mention at all.	Very limited explanation for choice of data collection tool(s).	Basic explanation of rationale for choice of data collection tool(s), e.g. based on use in a prior similar study.	Detailed explanation of rationale for choice of data collection tool(s), e.g. relevance to the study aims and assessments of tool quality either statistically, e.g. for reliability & validity, or relevant qualitative assessment.
Detailed recruitment data	No mention at all.	Minimal recruitment data, e.g. no. of questionnaire sent and no. returned.	Some recruitment information but not complete account of the recruitment process, e.g. recruitment figures but no information on strategy used.	Complete data regarding no. approached, no. recruited, attrition data where relevant, method of recruitment.
Statistical assessment of reliability and validity of measurement tool(s) (Quantitative only)	No mention at all.	Reliability and validity of measurement tool(s) discussed, but not statistically assessed.	Some attempt to assess reliability and validity of measurement tool(s) but insufficient, e.g. attempt to establish test-retest reliability is unsuccessful but no action is taken.	Suitable and thorough statistical assessment of reliability and validity of measurement tool(s) with reference to the quality of evidence as a result of the measures used.
Fit between stated research question and method of data collection (Quantitative)	No research question stated.	Method of data collection can only address some aspects of the research question.	Method of data collection can address the research question but there is a more suitable alternative that could have been used or used in addition.	Method of data collection selected is the most suitable approach to attempt answer the research question.
Fit between stated research question and format and content of data collection tool e.g. interview schedule (Qualitative)	No research question stated.	Structure and/or content only suitable to address the research question in some aspects or superficially.	Structure & content allows for data to be gathered broadly addressing the stated research question(s) but could benefit from greater detail.	Structure & content allows for detailed data to be gathered around all relevant issues required to address the stated research question(s).
Fit between research question and method of analysis	No mention at all.	Method of analysis can only address the research question basically or broadly.	Method of analysis can address the research question but there is a more suitable alternative that could have been used or used in addition to offer greater detail.	Method of analysis selected is the most suitable approach to attempt answer the research question in detail, e.g. for qualitative IPA preferable for experiences vs. content analysis to elicit frequency of occurrence of events, etc.
Good justification for analytical method selected	No mention at all.	Basic explanation for choice of analytical method.	Fairly detailed explanation of choice of analytical method.	Detailed explanation for choice of analytical method based on nature of research question(s).
Assessment of reliability of analytical process (Qualitative only)	No mention at all.	More than one researcher involved in the analytical process but no further reliability assessment.	Limited attempt to assess reliability, e.g. reliance on one method.	Use of a range of methods to assess reliability, e.g. triangulation, multiple researchers, varying research backgrounds.
Evidence of user involvement in design	No mention at all.	Use of pilot study but no involvement in planning stages of study design.	Pilot study with feedback from users informing changes to the design.	Explicit consultation with steering group or statement or formal consultation with users in planning of study design.
Strengths and limitations critically discussed	No mention at all.	Very limited mention of strengths and limitations with omissions of many key issues.	Discussion of some of the key strengths and weaknesses of the study but not complete.	Discussion of strengths and limitations of all aspects of study including design, measures, procedure, sample & analysis.

Appendix C: personal reflection on the use of terms related to callous unemotional traits and psychopathy, and the problems with labelling

As a researcher *and* a Trainee Clinical Psychologist I take a critical standpoint on diagnosis and accept that there are many shortcomings within it. In addition, psychiatric labelling can create stigma and discrimination. The last three years of this project has been a personal journey in which my thoughts, opinions and critical standpoint has been tested, challenged and ultimately changed over time. Clinically, I have worked with children and young people for many years, who people may describe as having conduct or behavioural problems. These children and young people, are often stigmatized or labelled as ‘bad’. In my view they are under researched, under supported and there is lack of understanding in developing good evidence-based interventions for this diverse group of children and young people.

Personally, I find using the labels callous unemotional traits and psychopathy challenging. In starting this project, I thought a lot about my foster brother one would think might fit the criteria for conduct or behavioural problems. He can also show characteristics that might fit with a label or diagnosis of limited prosocial emotions or callous unemotional traits. He can often show a lack of remorse or guilt for his behaviour, he can show limited emotion and can show a lack of care for others. However, given his history, I can formulate and hypothesize as to why this might be; neglect, abuse, victimization, the peers he relates to, his intellectual ability. As a sister, not a Trainee Clinical Psychologist or Researcher, I would not like my brother to be labelled with callous unemotional traits, limited prosocial emotions or (when he is an adult) a ‘psychopath’. This was the perspective that I started with and still remains. However, after numerous discussions with research supervisors, other Clinical Psychologists and family and friends, and additional understanding I have come to view the importance of investigating and researching callous unemotional traits.

Callous unemotional traits or limited prosocial emotions are labels to describe a set of characteristics or behaviours. Characteristics that include, lack of remorse, lack of empathy, lack of concern about performance or achievement and shallow or deficient affect. As a Researcher and a Trainee Clinical Psychologist I am interested in looking at *why* these behaviours develop and how people can be supported. These behaviours may stem from something that’s happened to them, like neglect or abuse, or dynamic factors like associations with peers who also have conduct or antisocial behaviours, social rejection or an impoverished community. Whatever the mechanism behind these behaviours or characteristics, they are present in small but significant group of children and young people and should not be ignored. What I wholeheartedly disagree with, is the huge implications these labels can have for children and young people such as accessing education, healthcare, employment, and can lead to discrimination and stigma.

In conclusion, I remain critical of diagnostic labelling, this is because diagnosis, in particular labels like ‘psychopathy’, create discrimination, stigma and prevent access to services. I understand that callous unemotional traits links with the construct of psychopathy, but I take a developmental approach, in that children and young people are still developing into adulthood. Therefore, the diagnostic label of ‘psychopathy’ should not be used when describing children and young people. I believe that using a ‘grouping term’ or descriptive summary to describe a set of behaviours or characteristics like callous unemotional traits or limited prosocial emotions, is important and necessary. It is especially important when

reviewing the literature and developing evidence based interventions for children and young people with these distinct characteristics. On reflection, I still feel uncomfortable about the terminology used in this area of research. However, there are children and young people in society that display these behaviours and we need to understand them better in order to help them live full, meaningful and happy lives.

Appendix D: Self report questionnaires that are freely available and may be reproduced for inclusion in a thesis.

The Youth Psychopathic Traits Inventory (Andershed, Kerr, Stattin & Levander, 2002). Callous-unemotional scale only.

YPI

Version 3.0

Instructions

This sheet consists of a number of statements that deal with what you think and feel about different things. Read each statement carefully and decide how well the particular statement applies to you. You can choose between four different alternatives on each statement.

Answer each statement as you most often feel and think, not only how you feel right now.

Example:

I like reading books.

Does not apply at all Does not apply well Applies fairly well Applies very well

Put a mark in the box that corresponds to how you feel.

Do not think too long on each statement.

REMEMBER:

Answer ALL statements.

Do not put a mark between the alternatives.

Only one answer per statement.

IMPORTANT!!! There are no answers that are “Right” or “Wrong”. You cannot score worse or better than anyone else. We are interested in what you think and feel, not in what is “Right” or “Wrong”.

	Does not apply at all	Does not apply well	Applies fairly well	Applies very well
1. To feel guilty and remorseful about things you have done that have hurt other people is a sign of weakness.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2. I have the ability not to feel guilt and regret about things that I think other people would feel guilty about.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3. When someone finds out about something that I've done wrong, I feel more angry than guilty.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4. To feel guilt and regret when you have done something wrong is a waste of time.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
5. I seldom regret things I do, even if other people feel that they are wrong.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
6. I usually feel calm when other people are scared.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
7. What scares others usually doesn't scare me.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
8. To be nervous and worried is a sign of weakness.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
9. I don't let my feelings affect me as much as other people's feelings seem to affect them.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
10. I don't understand how people can be touched enough to cry by looking at things on TV or movie.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
11. I think that crying is a sign of weakness, even if no one sees you.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
12. When other people have problems, it is often their own fault, therefore, one should not help them.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
13. I often become sad or moved by watching sad things on TV or	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

film.				
14. I usually become sad when I see other people crying or being sad.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
15. It's important to me not to hurt other people's feelings.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

The Me and My Feelings Questionnaire (Deighton et al., 2013)



How are things?

Date: / / 20

Time: h m

Below is a questionnaire which is going to ask you how you feel. There are no right or wrong answers. You should just pick the answer which is best for you. For example, we might ask "I feel happy", and then you will have to mark one of the options that say "Never", "Sometimes" or "Always"

		0	1	2
1	I get very angry	Never	Sometimes	Always
2	I lose my temper	Never	Sometimes	Always
3	I hit out when I am angry	Never	Sometimes	Always
4	I do things to hurt people	Never	Sometimes	Always
5	I am calm*	Always	Sometimes	Never
6	I break things on purpose	Never	Sometimes	Always
7	I bully others	Never	Sometimes	Always

*This item needs to be scored in reverse, i.e. Always =2, Sometimes=1, Never=0
Clinical banding is based on scoring of first 6 items only.

NHS ID: _____

Service allocated
case ID _____

SUM:



Appendix F: Objects or actions from each video scene

1. TRAUMA VIDEO (FIGHT SCENE)	
Word	Category (from Excel sheet)
1. Punch ✓	Old-central
2. Pushing ✓	Old-central
3. Stretcher ✓	Old-central
4. Police Car ✓	Old-central
5. Paramedic ✓	Old-central
6. Ambulance ✓	Old-central
7. Disposable Gloves ✓	Old-peripheral
8. Red-yellow sweater-vest ✓	Old-peripheral
9. Metal Box ✓	Old-peripheral
10. Van ✓	Old-peripheral
11. Luminous vest ✓	Old-peripheral
12. Baseball cap ✓	Old-peripheral
13. Arrest ✓	New-central
14. Resuscitation (CPR) ✓	New-central
15. Bloody nose ✓	New-central
16. Policemen on motorcycles ✓	New-central
17. Handheld radio	New-central
18. Knife ✓	New-central
19. Zebra crossing	New-peripheral
20. Women ✓	New-peripheral
21. Bus ✓	New-peripheral
22. Fish ✓	New-unrelated
23. Vacuum cleaner ✓	New-unrelated
24. Piano ✓	New-unrelated

2. NEUTRAL VIDEO (Electrician at work)	
Word	Category (from Excel sheet)
1. Man repairing lamp ✓	Old-central
2. Man kneeling down ✓	Old-central
3. Notes. ✓	Old-central
4. Oven ✓	Old-central
5. Screwdriver ✓	Old-central
6. Work van	Old-central
7. Knife block ✓	Old-peripheral
8. Mirror ✓	Old-peripheral
9. Flower(s) ✓	Old-peripheral
10. Doormat ✓	Old-peripheral
11. TV ✓	Old-peripheral
12. Microwave ✓	Old-peripheral
13. Man opening tool box ✓	New-central
14. Man wiping sweat ✓	New-central

15. Hammer ✓	New-central
16. Cable ✓	New-central
17. Boiler suit ✓	New-central
18. Goggles ✓	New-central
19. Carpet ✓	New-peripheral
20. Mailbox ✓	New-peripheral
21. Clock ✓	New-peripheral
22. Hamster ✓	New-unrelated
23. Paddling pool ✓	New-unrelated
24. Guitar ✓	New-unrelated

3. POSITIVE VIDEO (Birthday party)	
Word	Category (from Excel sheet)
1. Blowing candles ✓	Old-central
2. Clapping hands ✓	Old-central
3. Paper decorations (changed from garland)	Old-central
4. Balloons ✓	Old-central
5. Presents ✓	Old-central
6. Adult female (mother) ✓	Old-central
7. Paper Cup ✓	Old-peripheral
8. Floor lamp ✓	Old-peripheral
9. Wooden cabinet ✓	Old-peripheral
10. Swivel chair ✓	Old-peripheral
11. Red carpet ✓	Old-peripheral
12. Plate ✓	Old-peripheral
13 Children eating cake ✓	New-central
14. Child unwrapping presents ✓	New-central
15. Ribbon ✓	New-central
16. Confetti ✓	New-central
17. Party hats (changed from Birthday crown) ✓	New-central
18. Stereo ✓	New-central
19. Tablecloth ✓	New-peripheral
20. Napkins ✓	New-peripheral
21. Cutlery ✓	New-peripheral
22. Sheep ✓	New-unrelated
23. Sandcastle ✓	New-unrelated
24. Garden hose ✓	New-unrelated

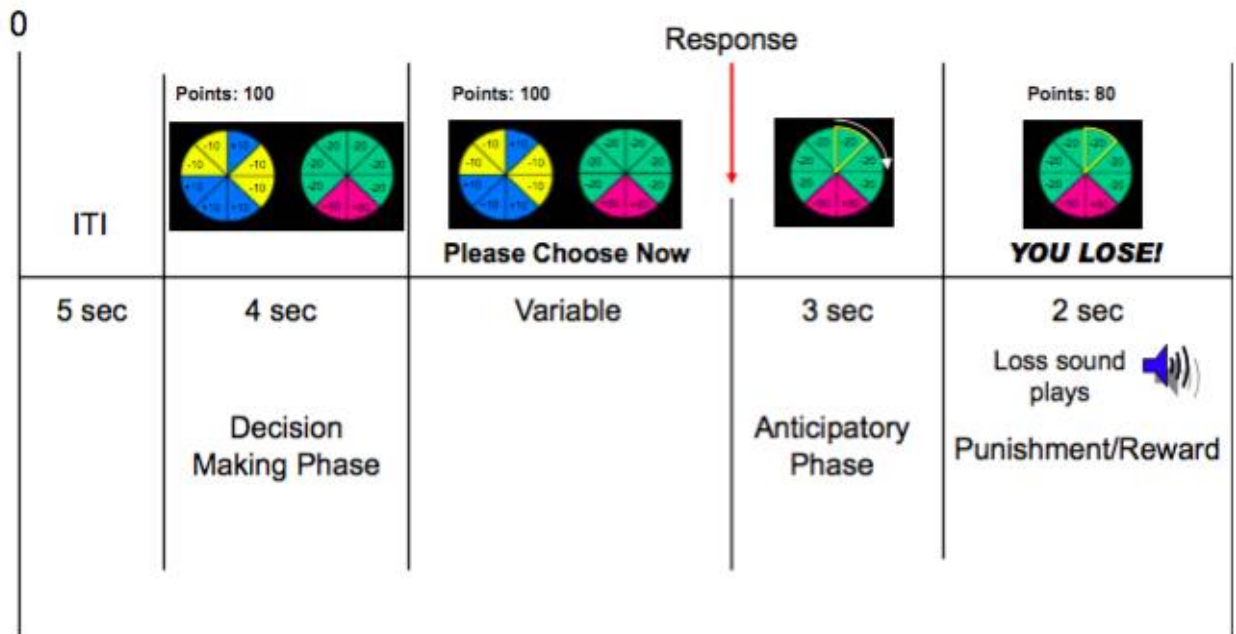
4. DELUSIONAL VIDEO (Surveillance)	
Word	Category (from Excel sheet)
1. Spying on a man ✓	Old-central
2. Car ramming ✓	Old-central

3. Digital camera ✓	Old-central
4. Arabic characters ✓	Old-central
5. Leather case ✓	Old-central
6. Earpiece (changed from earplugs/earphone) ✓	Old-central
7. Newspaper ✓	Old-peripheral
8. Parasols ✓	Old-peripheral
9. Street stalls (changed from kiosk) ✓	Old-peripheral
10. Pushchair (changed from Stroller) ✓	Old-peripheral
11. Dark van (changed from dark minibus, assuming it's the one during the 'car ramming' section).	Old-peripheral
12. Parked cars ✓	Old-peripheral
13. Circling helicopter ✓	New-central
14. Man putting on sunglasses ✓	New-central
15. Guns ✓	New-central
16. Microphone ✓	New-central
17. Notepad ✓	New-central
18. Police car ✓	New-central
19. Cyclist ✓	New-peripheral
20. Kebab shop ✓	New-peripheral
21. Binoculars ✓	New-peripheral
22. Deer ✓	New-unrelated
23. Rubber boat ✓	New-unrelated
24. Lawnmower ✓	New-unrelated

5. NEGATIVE VIDEO (Car accident)	
Word	Category (from Excel sheet)
1. Flashing warning lights	Old-central
2. Passing manoeuvre ✓	Old-central
3. Cloud of dust and smoke ✓	Old-central
4. Torn exhaust ✓	Old-central
5. Onlookers ✓	Old-central
6. Accident victims ✓	Old-central
7. Torn grass tufts ✓	Old-peripheral
8. Motorcyclist ✓	Old-peripheral
9. Marker posts ✓	Old-peripheral
10. Clouds ✓	Old-peripheral
11. Truck	Old-peripheral
12. Grass between lanes ✓	Old-peripheral
13. Two cars colliding ✓	New-central

14. Cordoning of accident site ✓	New-central
15. Blood ✓	New-central
16. Central barrier	New-central
17. First Aid kit ✓	New-central
18. Warning triangle ✓	New-central
19. SOS telephone ✓	New-peripheral
20. Fire brigade ✓	New-peripheral
21. Single shoe ✓	New-peripheral
22. Table ✓	New-unrelated
23. Hot-air balloon ✓	New-unrelated
24. Drums ✓	New-unrelated

Appendix G: Example trial of The Risky Choice Task (Fairchild et al., 2009)



Appendix H: Liverpool Central University Ethics Committee Approval



Central University Research Ethics Committee A

9 April 2018

Dear Dr Centifanti

I am pleased to inform you that your application for research ethics approval has been approved. Application details and conditions of approval can be found below. Appendix A contains a list of documents approved by the Committee.

Application Details

Reference:	2571
Project Title:	Children and young people's memory and emotion in a game of winning and losing
Principal Investigator/Supervisor:	Dr Luna Centifanti
Co-Investigator(s):	Miss Jayde Sayers, Dr Praveetha Patalay
Lead Student Investigator:	-
Department:	Psychological Sciences
Approval Date:	09/04/2018
Approval Expiry Date:	Five years from the approval date listed above

The application was **APPROVED** subject to the following conditions:

Conditions of approval

- All serious adverse events must be reported via the Research Integrity and Ethics Team (ethics@liverpool.ac.uk) within 24 hours of their occurrence.
- If you wish to extend the duration of the study beyond the research ethics approval expiry date listed above, a new application should be submitted.
- If you wish to make an amendment to the research, please create and submit an amendment form using the research ethics system.
- If the named Principal Investigator or Supervisor leaves the employment of the University during the course of this approval, the approval will lapse. Therefore it will be necessary to create and submit an amendment form using the research ethics system.
- It is the responsibility of the Principal Investigator/Supervisor to inform all the investigators of the terms of the approval.

Kind regards,

Central University Research Ethics Committee A

ethics@liverpool.ac.uk

CURECA

Appendix - Approved Documents

(Relevant only to amendments involving changes to the study documentation)

Appendix I: Parent information sheet

Title of study: Children and young people's memory and emotion in a game of winning and losing

Dear Parent(s)/Carer(s)/person with parental responsibility

Your child (or the child that you have parental responsibility) is being invited to take part in a research study which is part of my Doctorate in Clinical Psychology thesis. Please take the time to read the information and feel free to ask any further questions if you do not understand.

1. What is the purpose of the study?

The purpose of the study is to see how young people differ in how much they care about things or show empathy. The study will also look at young people's memory and decision-making in a range of tasks. For example, young people who make better decisions may have a better memory (resulting in more wins and less losses). Also, it could be that young people who how less care about things may remember some events, positive or negative, better than others, which could affect the way they learn. Other young people may care a lot about things therefore may remember differently, affecting learning in an alternative way. The aim is to see how young people who differ in the way they care about things (and people) learn in a game of wins and losses, depending on their memory.

2. Why has my child been chosen to take part?

All young people who attend a non-mainstream school for young people with social, emotional and mental health needs (SEMH) or a residential school, have been asked to take part. These types of schools or residential placement often have young people who may show problem behaviour and young people may present with different levels of care and emotion that range from very little to a great deal. We are interested in the full range of behaviours.

3. Does my child have to take part?

Your child's participation in the project is voluntary. Along with your consent, young people will also be asked if they would like to take part. They can also stop at any time.

4. What will happen if I take part?

The researcher will ask your child to complete three short questionnaires about anxiety, problem behaviour and emotions. Then your child will watch five short video clips and will be asked what they remember from each video. These video clips range from videos about birthday parties, an electrician at work and a car chase. If you wish to receive a detailed description of each video, please let the researcher know during the telephone call or by phoning the researcher on the details included in this sheet. Finally, your child will take part in a decision making task, based on a wheel of fortune game.

The whole study takes approximately 40 minutes and this will be completed within a convenient time in the school day. The researcher would also like to access your child's school/case file to note any information that would be relevant to how they perform in the memory task, such as special needs statements and assessment information.

5. Are there any risks in taking part?

There are no risks of harm associated with this study. The procedures involve standard rating scales and tasks that have been used before with young people. However, your child may experience discomfort in sharing personal information, boredom or fatigue. Where possible breaks will be offered in between procedures to prevent fatigue. If at any time your child feels uncomfortable watching the films, or tired, and wishes to discontinue with the study he or she may do so. In addition, the researcher involved in this research has a current DBS clearance and has worked extensively with young people before.

6. Are there any benefits in taking part?

There are no direct benefits for you or your child to taking part in the research, however, it will help develop strategies for schools, residential settings, parents and society in supporting young people and young people with problem behaviour.

7. What if I am unhappy or if there is a problem?

All complaints should be handled through the Committee on Research Ethics complaints procedure. If you are unhappy, or if there is a problem, please feel free to let us know by contacting the principle investigator (and supervisor) Dr Luna Centifanti (0)151 794 5658 and we will try to help. If you remain unhappy or have a complaint which you feel you cannot come to us with then you should contact the Research Ethics and Integrity Office at ethics@liv.ac.uk. When contacting the Research Ethics and Integrity Office, please provide details of the name or description of the study (so that it can be identified), the researcher(s) involved, and the details of the complaint you wish to make.

8. Will my participation be kept confidential?

All of the information your child shares in this study will be kept completely private. During collection of information your child will have a unique ID number attached to their name so that you are can withdraw your child from the study if you wish. After the collection of information is complete, the list of names of young people will be destroyed as per guidelines set out by the University of Liverpool. All information will then be anonymous. All completed consent forms will be stored in a secure filing cabinet and will not be connected with your child's information. The information will be used in research; however, your child's anonymity will be maintained in any research reports. Only the research team will have access to the information that is collected.

9. What will happen to the results of the study?

The results of the study will be written up in a report for completion of the doctorate in clinical psychology. We will also look to publish the findings in an international psychology journal. All schools will be provided with a summary of the research findings. Young people who have taken part in the research will not be identifiable from the results.

10. What will happen if I want my child want to stop taking part?

Your child can stop the tasks at any time and thus withdrawing their information. After all of the data has been collected (approximate end date December 2018) we will make all information non-identifiable therefore your child cannot be identified from the data. Withdrawal from the study is not possible after this happens.

Who can I contact if I have further questions?

Jayde Sayers (Primary Investigator)	Dr Luna Centifanti (Principal Investigator & Primary Supervisor)	Dr Steven Gillespie (Secondary Supervisor)
Doctorate in Clinical Psychology, University of Liverpool, Whelan Building, Liverpool, L69 3GB. j.sayers@liverpool.ac.uk 0151 794 5658	Doctorate in Clinical Psychology, University of Liverpool, Whelan Building, Liverpool, L69 3GB. Luna.Centifanti@liverpool.ac.uk 0151 794 5658	Doctorate in Clinical Psychology, University of Liverpool, Whelan Building, Liverpool, L69 3GB Steven.Gillespie@liverpool.ac.uk 0151 794 4140

Video descriptions

All videos are between 30 seconds to 90 seconds in length

Electrician at work – this is a video of an electrician at working; fixing an oven, some plug sockets and a light fitting. This video has no sound. This video is considered to have no emotional content.


A birthday party – This video is of a group of children sat around a table singing happy birthday. There is a cake with candles which are blown out. There is sound in this video of children singing happy birthday in German language (as it is a German video). This video is considered to have positive emotional content.

A surveillance scene – This video is from the perspective of a person following someone. The video shows a man being followed by another man with a video camera. The person sees that someone is following them and runs away. He pushes people out of the way and they fall onto the ground. He runs into the road and runs into a van which causes him to fall to the ground. There is no sound on this video and is considered to have negative emotional content

A fight scene - This video shows two people arguing in the street. A group of people all become involved and start pushing one and other. People punch and kick each other and fall to the ground. Two people try to help someone who appears injured on the ground. A man is put on a stretcher by the emergency services and goes into an ambulance. This video has sound and is considered to have negative emotional content.

A car accident – This video shows two cars on a dual carriage way, one car tries to overtake on the road. When the car tried to pull back into the lane it hits the other car which causes the car to lose control, drive into the central reservation and crash. This video shows parts of the car going into the air and people running over to help. It shows a car that is smashed and parts of the car scattered all over the road. It shows people helping a person who is on the floor. There is sound on the video and is considered to have a negative emotional content.

Appendix J: Parental Consent Form

Participant/carer/social worker information sheet & consent Parent/Carer Version 9 24/9/18	 UNIVERSITY OF LIVERPOOL
Parent consent form	
<p>Title of the research project: Children and young people's memory and emotion in a game of winning and losing</p> <p>Researcher(s): Jayde Sayers, Dr Luna Centifanti, Dr Steven Gillespie</p> <p style="text-align: right;">Please initial box</p> <p>1. I confirm that I have read and have understood the information sheet dated 24/9/18 for the above study. I have had the opportunity to consider the information, ask questions and have had these answered satisfactorily <input style="float: right;" type="checkbox"/></p> <p>2. I understand that my child's participation is voluntary and that I am free to withdraw their information before the data collection phase has ended (approximately December 2018). I can withdraw without giving any reason, without my rights being affected. <input style="float: right;" type="checkbox"/></p> <p>3. I understand that, under the Data Protection Act 1998 you can ask for access to the information your child provides before anonymisation, and you can also request for the destruction of that information should I wish. <input style="float: right;" type="checkbox"/></p> <p>4. I agree for the data my child provides to be anonymously archived at the end of the study. I understand that other authorised researchers will have access to this anonymised data only if they agree to preserve the confidentiality of the information as requested in this form. <input style="float: right;" type="checkbox"/></p> <p>5. I agree for the researcher to have access to my child's school file for any information that would be relevant to how they perform in the memory task, such as special needs statement and assessment information <input style="float: right;" type="checkbox"/></p> <p>6. I agree for my child to take part in the study. <input style="float: right;" type="checkbox"/></p> <p>7. <i>I do not wish my child to take part</i> <input style="float: right;" type="checkbox"/></p>	

Childs name

Date

Signature

Name of person giving consent

Date

Signature

Researcher

Date

Signature

PLEASE RETURN THIS FORM TO THE SCHOOL

Appendix K: Information sheet for children and young people

Study title: Children and young people's memory and emotion in a game of winning and losing

We would like you to help us with our research study. Please read this information carefully and talk to your parent, carer or teacher about the study. Ask us if there is anything that is not clear or if you want to know more. Take time to decide if you want to take part. It is up to you if you want to do this. If you don't then that's fine, it won't affect school or the support you get.

1. Why are we doing this research?

We want to find out why some children care about things (and people) more than others. We know people are different in the things (and people) they care about. We think people who care more might be able to read other people's feelings more than others. Also, people who care a lot about things might remember things better. We want to know whether these two things (better memory and more caring) might help young people make better decisions.



2. What do you have to do?

- You will fill out surveys about how much you care about different things, and about your feelings and behaviour.
- You will watch 5 short videos and we will ask you to tell us what you remember from them.
- We will then ask you to play a game where you can win or lose depending on your choices.
- We will also have a look at your school file to gather your age and your school needs.



3. Why have you been chosen to take part?

You have been chosen as go to a non-mainstream school (i.e. a social, emotional, mental health need school – SEMH, or a residential school). These types of schools have been chosen as children who go to these schools can show different behaviours, emotions and level of care.

4. Do you have to take part?

No! it's entirely up to you. If you decide to take part:



You will be asked to sign a form to say that you agree to take part

You are free to stop taking part at any time during the research without giving a reason. When the study is finished, we will use all the information we've gathered in our research.

5. Is there anything to be worried about if you take part?

The questions that we will ask you have been asked of other children your age many times. You might feel uncomfortable answering the survey questions, because they ask about personal feelings. But you can leave any blank that you don't want to answer. If you do feel worried at any time you can tell the researcher or you can ask to stop. You can ask the researcher for a break at any time.

6. Will the study help you?

No, not in a direct way. We expect the research will help schools, parents other people understand children and young people better.

7. What if you are unhappy or if there is a problem?

If you are unhappy about something you can speak to one of your teachers, parent or carer who can contact the research team or the University of Liverpool.

8. Will my information be kept private?

All the information you share will be kept private, including things like your name. After we have all the information from all the children and young people, your name will not be used – only a number.

Jayde Sayers (Primary Investigator)	Dr Luna Centifanti (Primary Supervisor)	Dr Steven Gillespie (Secondary Supervisor)
Doctorate in Clinical Psychology, University of Liverpool, Whelan Building, Liverpool, L69 3GB. j.sayers@liverpool.ac.uk	Doctorate in Clinical Psychology, University of Liverpool, Whelan Building, Liverpool, L69 3GB. Luna.Centifanti@liverpool.ac.uk 0151 794 5658	Doctorate in Clinical Psychology, University of Liverpool, Whelan Building, Liverpool, L69 3GB Steven.Gillespie@liverpool.ac.uk 0151 794 4140

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Thank you for reading this. Please ask any questions if you need to.

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Appendix L: Assent form

Study Title: Children and young people's memory and emotion in a game of winning and losing

Have you read the information sheet? YES or NO

Do you understand what the study is about? YES or NO

Have you asked all the questions you wanted to? YES or NO

Have you had your questions answered in a way you understand? YES or NO

Are you happy to take part? YES or NO

If any answers are 'no' or you don't want to take part, don't sign your name

If you do want to take part, you can write your name below

Your name:

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Date:

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