# Psychopathic traits and social reward


## Lucy Foulkes

Prepared under the supervision of

Prof Essi Viding and Prof Eamon McCrory




Division of Psychology and Language Sciences

University College London


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I, Lucy Foulkes, confirm that the work presented in this thesis is my own. Where information has been derived from other sources, I confirm that this has been indicated in the thesis.

# Abstract

Psychopathy is a personality disorder defined by atypical affective and interpersonal functioning, and impulsive and antisocial behaviour. This thesis explored associations between psychopathic traits and social reward processing in adults, and callous-unemotional (CU) traits and social reward processing in adolescents. The goal was to investigate what could potentially explain the atypical social behaviour seen in these individuals.

In this thesis, five research questions were proposed. Firstly, in Chapter 2: *What types of social interactions and relationships are valued by individuals with high levels of psychopathic traits?* Secondly, in Chapter 3: *What is the structure of social reward?* Thirdly, in Chapter 4: *In what way are psychopathic traits in adults associated with self-report and experimental measures of social reward?* Finally, in Chapter 5: *What is socially rewarding for adolescents, and in what way is this associated with callous-unemotional traits?*

The principal findings were as follows. In Chapter 2, I found that individuals with high levels of psychopathic traits were not motivated to have affiliative, long-term relationships. In Chapter 3, I developed and validated the Social Reward Questionnaire, a measure of individual differences in social reward value. In Chapter 4, I found that adults with high levels of psychopathic traits showed a pattern of 'inverted' social reward, in which being cruel was enjoyable and being kind was not. Additionally, social approval may have reward value for individuals with high levels of interpersonal psychopathic traits. In Chapter 5, I validated the Social Reward Questionnaire – Adolescent Version for use with 11-16 year olds. Like adults with high levels of psychopathic traits, adolescents with high levels of CU traits displayed a pattern of 'inverted' social reward. Together, these studies are an important initial exploration of the role that atypical social reward processing may play in explaining the problematic social behaviour seen in psychopathy.

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# Contents

# List of Tables

# List of Figures

# Chapter 1: General Introduction

## 1.1. Psychopathic traits in adults

### *1.1.1. Psychopathy*

Psychopathy is a personality disorder that affects approximately 0.75% of the population (Blair, Mitchell, & Blair, 2005). Individuals with psychopathy lack empathy for others, do not feel guilt, manipulate others, and engage in impulsive and antisocial behaviour. The most commonly used instrument to assess psychopathy in forensic samples is the Psychopathy Checklist-Revised (PCL-R; Hare, 2003), which uses information from a semi-structured interview and file records to formally evaluate whether an individual has psychopathic traits. Extensive factor analytic work on large samples of incarcerated individuals indicates that the PCL-R reliably measures four clusters of problematic traits characteristic of psychopathy (Neumann, Hare, & Newman, 2007). The first of these, *affective* traits, include a lack of empathy or guilt and a generally cold or flat affect. The *interpersonal* facet includes traits such as superficial charm, pathological lying and a tendency to manipulate others. *Lifestyle* traits describe a proneness to boredom and increased impulsivity and risk taking. Finally, *antisocial* traits include a range of behaviours that are harmful or inconsiderate towards others, which are often criminal acts (Hare & Neumann, 2010). The *affective* and *interpersonal* traits group together on a higher order factor referred to as Factor 1 of psychopathy, and *lifestyle* and *antisocial* traits group together to form so-called Factor 2 (Hare, 2003). Together, these factors load onto one superordinate psychopathy factor (Hare, 2003).

### *1.1.2. Psychopathic traits delineate a distinct subgroup of antisocial individuals*

Of all the individuals who present with chronic and persistent levels of antisocial behaviour (Factor 2 traits), only a subgroup will also present with the cold affective interpersonal traits (Factor 1 traits) characteristic of psychopathy. For example, in US forensic samples, 50% to 75% of individuals meet criteria for Antisocial Personality Disorder (ASPD), a disorder characterised by a persistent pattern of

behaviour that violates and disregards the rights of others (American Psychiatric Association, 2013; Hare, 1996). In contrast, only 15% to 25% of US prisoners meet diagnostic criteria for psychopathy (Hare, 1996, 1999). As such, psychopathy delineates only a proportion of individuals who are highly antisocial: those who are also affectively cold, lack empathy and guilt, and have a manipulative interpersonal style (Blair, 2001; Decuyper, De Pauw, De Fruyt, De Bolle, & De Clercq, 2009; Hare, 1996, 2003; Hare & Neumann, 2006).

It is clinically and empirically important to distinguish antisocial individuals with psychopathy from other antisocial individuals, for several reasons. Firstly, antisocial behaviour is thought to have at least partially different aetiology in each group, with those who have high levels of psychopathic traits potentially being more genetically vulnerable to developing antisocial behaviour compared to those with low levels (Viding, Seara-Cardoso, & McCrory, 2014). Secondly, the pattern of offending is different between the two groups. Criminals with high levels of psychopathic traits commit a disproportionately high number of violent crimes: 78% of prisoners who meet diagnosis for psychopathy have committed a violent offence, compared with 62% of the general prison population (Kiehl & Hoffman, 2011). Incarcerated individuals with psychopathy also show more criminal versatility, committing a wider range of different offences (Hare, 2003). Thirdly, criminals with high levels of psychopathic traits are more likely to commit further offences once released from prison. For example, one study found that higher scores on the PCL-R predicted higher levels of recidivism (Hemphill, Hare, & Wong, 1998). A second study assessed recidivism in offenders released from a maximum security psychiatric hospital and found that, over 10 years, 77% of individuals defined as psychopaths had committed a violent offence, compared to 40% across the group (Harris, Rice, & Cormier, 1991).

Evidence from structural and functional brain imaging studies indicates that the neurocognitive profile of individuals with high levels of psychopathic traits is distinct from other antisocial individuals. One study analysed structural brain differences between a group of healthy controls and two groups of violent offenders with Antisocial Personality Disorder (ASPD): those with psychopathy and those without (Gregory et al., 2012). They found that, compared to both the

non-offenders and the offenders with ASPD only, those with ASPD and psychopathy displayed significantly reduced grey matter volumes in several brain regions, including the bilateral anterior rostral prefrontal cortex and temporal poles. These areas have previously been implicated in processes relevant to psychopathy, such as moral cognition and emotion processing (Gregory et al., 2012). A review of functional brain imaging studies concluded that in both forensic and community samples, individuals with high levels of psychopathy traits showed atypical activity in a wide range of brain areas (Seara-Cardoso & Viding, 2014). Most consistently, high levels of psychopathic traits were associated with reduced levels of neural activation to emotional/salient stimuli in areas associated with affect processing, such as the amygdala and anterior insula (Seara-Cardoso & Viding, 2014) and with abnormal activation in areas implicated in reward and punishment processing (Bjork, Chen, & Hommer, 2012; Buckholtz et al., 2010; Gregory et al., 2012; Pujara, Motzkin, Newman, Kiehl, & Koenigs, 2013).

Finally, criminals with high levels of psychopathic traits are distinctive because they tend to be resistant to many extant treatment programs (Hare & Neumann, 2010), with psychopathic traits predicting a range of poor treatment outcomes such as drop out (Salekin, Worley, & Grimes, 2010). This is perhaps unsurprising considering that such programs typically focus on enhancing the very traits that individuals with psychopathy lack, such as victim empathy (Hare & Neumann, 2010). Psychopathic traits are therefore a marker of particularly high-risk antisocial individuals with distinct aetiology, and structural and functional brain abnormalities. These individuals commit a disproportionately high number of crimes, are more likely to recidivate, and are harder to treat. As such, individuals with high levels of psychopathic traits are a particularly important subgroup of antisocial individuals, worthy of careful research attention.

### *1.1.3. Psychopathy as a dimensional construct*

Clinicians and researchers using the PCL-R often use a cut-off score of 30 to distinguish individuals with and without psychopathy (Hare, 2003).[1] However, such a cut off is arbitrary, and primarily used for the assessment of risk (in particular, criminal recidivism and dangerousness; Salekin, Rogers, & Sewell, 1996) and to group participants for research purposes (e.g. Decety, Skelly, Yoder, & Kiehl, 2014). In reality, it is now well understood that psychopathy is a dimensional construct (e.g. Hare & Neumann, 2008). Psychopathic traits do not exist as a dichotomy, but rather are distributed continuously throughout the population. This is true in forensic samples, whether psychopathic traits are assessed using the PCL-R (Edens, Marcus, Lilienfeld, & Poythress Jr, 2006; Guay, Ruscio, Knight, & Hare, 2007) or self-report measures such as the Self-Report Psychopathy scale (SRP; Tew, Harkins, & Dixon, 2014), but also true of psychopathic traits assessed by self-report measures in the general population (Levenson, Kiehl, & Fitzpatrick, 1995; Lilienfeld & Widows, 2005; Paulhus, Neumann, & Hare, 2015).

### *1.1.4. Psychopathy in the general population mimics forensic samples*

Research assessing psychopathic traits in the general population has shown that psychopathy is not merely a forensic phenomenon. Much psychopathy research has focused on measuring these traits in community samples and studying how normal variation in subclinical levels of psychopathic traits relates to patterns of behaviour and neurocognitive performance. These studies have extended our understanding of the psychopathy construct as a whole.

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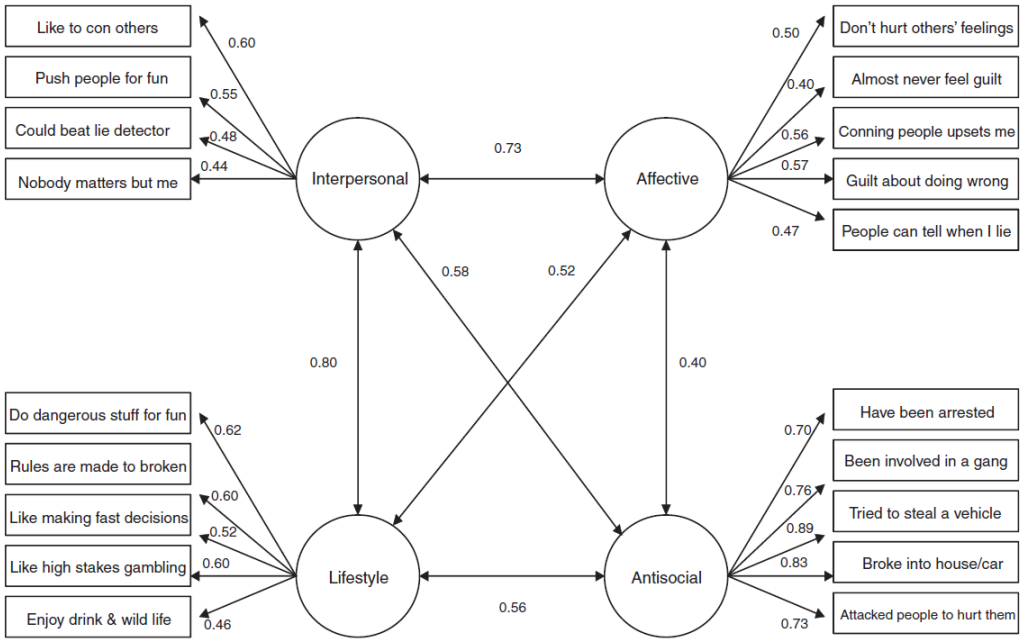
[1] It is interesting to note that the PCL-R cut-off typically used in Europe (e.g. Sweden, United Kingdom) to define psychopathy is 28 rather than 30 (Cooke, et al., 2005). This is because equivalent scores on the PCL-R appear to reflect higher level of psychopathic traits in Europe than in North America, particularly with respect to the interpersonal factor (Cooke, et al., 2005). Therefore, a lower cut-off score is required in Europe to detect clinically relevant levels of psychopathy. This cultural difference may be due to differences in socialisation processes in the two continents, and possibly the culture of individualism that is particularly promoted in North America (Cooke, 1996).

Several self-report measures have been developed to assess psychopathic traits in the general population, primarily the following: the Levenson Self-Report Psychopathy Scale (LSRP; Levenson, Kiehl, & Fitzpatrick, 1995), the Psychopathic Personality Inventory (PPI; Lilienfeld & Andrews, 1996) and its revision (PPI-R; Lilienfeld & Widows, 2005) and the Self-Report Psychopathy Scale and its revisions (SRP; Paulhus, Neumann & Hare, 2015). In the current thesis, I will focus primarily on studies using the SRP, and use the SRP in all but one of the adult studies reported in the subsequent chapters (see Appendix 1 for a copy of the SRP). This is for two reasons. Firstly, the SRP was explicitly developed to assess the same construct as measured by the PCL-R (Paulhus, Neumann, & Hare, 2015). Specifically, a four-factor structure of affective, interpersonal, antisocial and lifestyle traits, with two superordinate factors (affective/interpersonal and lifestyle/antisocial) and one superordinate psychopathy factor, has been found in community-based samples across the world (See Error! Reference source not found.; Neumann, Schmitt, Carter, Embley, & are, 2012). Secondly, the SRP has been comprehensively validated with the largest samples of participants (Neumann, et al., 2012). This indicates that in the general population, the psychopathy construct shows a similar latent structure to that in forensic samples, allowing direct comparisons of research findings from the two groups (Mahmut, Menictas, Stevenson, & Homewood, 2011).

In addition, work using the SRP has demonstrated that, although at lower levels than in prison samples, psychopathic traits in the general population show a similar pattern of associations with behavioural and neural correlates to those expected from research with forensic populations (Paulhus, Neumann & Hare, 2015). For example, psychopathic traits as measured by the SRP are positively associated with number of criminal offences in a community sample (Neumann & Pardini, 2014). These traits are also associated with weaker self-report empathic responses to sad faces (Seara-Cardoso, Neumann, Roiser, McCrory, & Viding, 2012), lower self-reported empathic concern (Lockwood, Bird, Bridge, & Viding, 2013) and attenuated neural responses to images of others in pain (Seara-Cardoso, Viding, Lickley, & Sebastian, 2015) and to fearful faces (Carré, Hyde, Neumann, Viding, & Hariri, 2013). A study using another self-report derivative of the PCL-R, the PCL: Screening Version (PCL:SV) found that psychopathic traits is the

community were associated with violent behaviour, alcohol use and intelligence in a pattern that mimics prison samples (Neumann & Hare, 2008). Together, this research shows that psychopathic traits in the general population are similar to those seen in forensic samples, providing support for psychopathy as a continuously distributed set of personality traits with a four-factor latent structure and a unique profile of associations with neural and behavioural measures.

**Figure 1.1. Four-factor model of psychopathy, based on items from the SRP (Paulhus, Neumann, & Hare, 2015).** Reprinted from Neumann et al. (2012) with permission of the copyright owner




## 1.2. Development of psychopathy

A diagnosis of psychopathy can only be made for individuals aged eighteen or over (Hare, 2003). However, these problematic personality traits do not appear suddenly at this age; psychopathic-type traits can be seen in much younger samples. Specifically, atypical affective and interpersonal traits, such as a lack of empathy and a tendency to manipulate others, are referred to as *callous-unemotional* (CU) traits in children and adolescents. CU traits in adolescence are predictive of psychopathic traits in adulthood: one study found that scores on the

Childhood Psychopathy Scale (Lynam, 1997) at age 13 positively predicted scores on the PCL: Screening Version at age 24 (Lynam, Caspi, Moffitt, Loeber, & Stouthamer-Loeber, 2007). In sum, atypical affective and interpersonal traits are apparent in young samples, and the presence of such traits is an important risk factor for developing adult psychopathy.

### *1.2.1. CU traits delineate a distinct group of antisocial youth*

CU traits in children and adolescents mimic psychopathic traits in adults in several important ways. Firstly, elevated levels of CU traits delineate a subset of a much larger group of chronically antisocial youth (e.g. Frick, Ray, Thornton, & Kahn, 2013). In DSM-V, *conduct disorder* is defined in children and adolescents as a chronic pattern of antisocial behaviour that harms or violates the rights of others (American Psychiatric Association, 2013). Only a subset of youth diagnosed with conduct disorder - approximately half - will also show elevated levels of CU traits, now included as a specifier in DSM-V named 'limited prosocial emotions (Frick et al., 2013). This mirrors the adult research, in which individuals with high levels of psychopathic traits are only a small proportion of chronically antisocial adults (e.g. Hare, 1996).

Young people with high levels of CU traits also appear to have a distinct aetiology for their conduct problems, compared with their peers who have conduct problems but low levels of CU traits. For those with high levels of CU traits, conduct problems are strongly heritable; for those with low levels of CU traits, conduct problems are more prominently influenced by environmental factors (Viding, Blair, Moffitt, & Plomin, 2005; Viding, Jones, Paul, Moffitt, & Plomin, 2008).

Again mirroring the adult literature, the subset of children and adolescents with both high levels of antisocial behaviour *and* CU traits show a particularly severe and chronic pattern of antisocial behaviour (Rowe et al., 2010). For example, young people with high levels of CU traits who have committed a crime are more likely to reoffend: psychopathic-type traits in 9-18 year olds undergoing court assessment predicted levels of recidivism 3-4 years later (Salekin, 2008). These

individuals are also less likely to benefit from treatment, with most studies showing that high levels of CU traits are associated with poor treatment outcomes (Hawes, Price, & Dadds, 2014). Therefore, children and adolescents with conduct problems and high levels of CU traits are a particularly high-risk group of antisocial youth, and careful research and clinical attention is required to best understand how to treat these individuals.

As in adults, CU traits in children and adolescents do not exist only in individuals who have committed crimes. Instead, CU traits can be measured in both community samples and in samples of children/adolescents who have been referred to specialist clinics for their behavioural difficulties (Essau, Sasagawa, & Frick, 2006; Frick, Bodin, & Barry, 2000). Importantly, and again mimicking the adult research, these traits are dimensional in young samples, indicating that CU traits exist along a continuum (Murrie et al., 2007). A final similarity between adolescent and adult samples is that CU traits show a similar pattern of external correlates to that seen for adult psychopathic traits. For example, neuroimaging evidence has demonstrated that CU traits are associated with a distinct pattern of structural and functional atypicalities, particularly in brain areas implicated in emotion processing and decision making, and these are comparable with the neural correlates implicated in the adult literature (Seara-Cardoso & Viding, 2014; Viding, Seara-Cardoso, & McCrory, 2014).

In sum, CU traits delineate a subgroup of antisocial youth with atypical affective and interpersonal traits (e.g. Frick, Ray, Thornton, & Kahn, 2013; Rowe et al., 2010). Children and adolescents with high levels of CU traits are more likely to recidivate if they commit crime (Salekin, 2008), and are less likely to respond to treatment than their antisocial peers with low levels of CU traits (Hawes, Price, & Dadds, 2014). Furthermore, research into CU traits in children/adolescents has demonstrated that these traits mimic adult psychopathic traits with respect to their relationship to antisocial behaviour, outcomes for interventions, and external correlates (e.g. Viding & McCrory, 2015). In addition, without intervention, children and adolescents with high levels of CU traits are at greater risk of becoming adults with high levels of psychopathic traits (Lynam, Caspi, Moffitt, Loeber, & Stouthamer-Loeber, 2007). The recognition that psychopathic traits

may have antecedents in childhood and adolescence provides an important window for early intervention, and the possibility to reduce levels of psychopathic traits and antisocial behaviour before these young people become adults. Specifically, understanding the neurocognitive profile of children and adolescents with high levels of CU traits as distinct from other antisocial youth will allow interventions to be tailored to their specific needs and vulnerabilities (Viding & McCrory, 2015).

## 1.3. Psychopathy as a barrier to successful socialisation

### *1.3.1. Many psychopathic traits relate to atypical social interactions*

It is noteworthy that many of the defining characteristics of psychopathy relate to atypical and problematic social interactions and relationships. For example, within the four-factor model of the construct (e.g. Hare & Neumann, 2008), the *affective* traits include a lack of guilt or remorse for causing others harm and a lack of empathy towards others' distress. The *interpersonal* traits include being superficially charming towards others whilst also having a tendency to pathologically lie to and manipulate them. The *lifestyle* traits less explicitly involve social interactions, but do include a parasitic lifestyle (a willingness to leech off and take advantage of others). Finally, the traits of the *antisocial* facet by definition refer to causing other people harm, whether that is directly (e.g. violence) or indirectly (e.g. damaging others' property). Together, these traits delineate a group of adults who have exceptionally negative and selfish social interactions. Similarly, children and adolescents with high levels of CU traits are noteworthy even amongst other antisocial youth for their cruel and callous treatment of others (Frick, 2009; Pardini, 2011; Viding, Simmonds, Petrides, & Frederickson, 2009). Overall, the social deficits seen in those with high levels of psychopathic/CU traits can be simplified into two observations: an unusual *absence* of prosocial relationships and affiliative behaviours, and an unusual *presence* of antisocial behaviours and attitudes towards others.

### *1.3.2. One explanation for the increased presence of antisocial behaviour is that psychopathy interferes with socialisation*

It has been argued that the high levels of antisocial behaviour seen in psychopathy may in part arise from some difficulty in processing information required for successful socialisation (Blair, 2001; Blair, 2003; Frick, Marsee, & Patrick, 2006; Vitale et al., 2005). Socialisation is the process by which children learn and apply societal norms about how to behave appropriately (Vitale et al., 2005). With regard to antisocial behaviour, the likelihood that a child will learn to avoid such behaviour is dependent on two processes. Firstly, the child must learn that antisocial behaviour leads to a specific outcome, typically someone else's distress. Secondly, the child must find that outcome (e.g. someone's distress) aversive. For most individuals, the distress of others is inherently aversive, and even animals will avoid causing harm to others because it is aversive for themselves (Blair, Mitchell, & Blair, 2005). One successful parenting strategy capitalises on this phenomenon; in which the parent emphasises to the child that his/her behaviour has had unpleasant outcomes for another person (Hastings, Utendale, & Sullivan, 2007). In most cases, the child then associates his/her bad behaviour with this negative outcome, and seeks to avoid repeating that behaviour in the future (Hastings et al., 2007).

Many researchers have argued that this socialisation process fails in individuals with psychopathy (Blair, 2001; Blair, 2003; Blair, Mitchell, & Blair, 2005; Frick, Marsee, & Patrick, 2006; Vitale et al., 2005). The Integrated Emotion Systems model of psychopathy (IES; Blair, 2005) states that individuals with high levels of psychopathic traits have reduced activity in the amygdala, a brain region involved in processing emotional information and in learning associations between stimuli and outcomes. As a result, they do not associate their antisocial behaviour with an outcome that they find negative, and subsequently are less likely to inhibit violent and antisocial behavior. In line with this, studies show that psychopathic traits are associated with reduced autonomic responses to typically distressing stimuli (Blair, Jones, Clark, & Smith, 1997; Patrick, Cuthbert, & Lang, 1994). For example, one study measured skin conductance response in psychopathic prison

inmates and non-psychopathic forensic patients whilst viewing a set of pictures (Blair et al., 1997). The images were either distressing (e.g. a crying face), threatening (e.g. a shark) or neutral (e.g. a book). The researchers found that the psychopathic group displayed a significantly reduced autonomic response to the distressing images compared to the non-psychopathic group (Blair et al., 1997), and this result was replicated in adolescents who scored highly on the Antisocial Process Screening Device (previously called the Psychopathy Screening Device), which charts CU traits, narcissism and impulsivity (Blair, 1999).

Related research has shown that individuals with high levels of psychopathic traits show reduced recognition of emotional expressions in others (Dawel, O'Kearney, McKone, & Palermo, 2012). This is true of both adults with psychopathy and children with high CU traits, and true whether the emotional expressions are conveyed as facial or vocal expressions (Dawel et al., 2012). Most consistently, deficits have been found in the recognition of processing sad and fearful expressions in others (Blair, Mitchell, & Blair, 2005). However, other researchers have highlighted the inconsistency of findings, and provided evidence that individuals may have difficulty with processing other emotional expressions too, including happiness (Brook, Brieman, & Kosson, 2013; Decety, Skelly, Yoder, & Kiehl, 2014; Hastings, Tangney, & Stuewig, 2008). Together, the IES model (Blair, 2005) and empirical evidence indicate that individuals with high levels of psychopathic/CU traits do not recognize and respond to others' emotional expressions in the same way that typical individuals do. As such, these individuals may not learn to associate their own antisocial behaviour with distress in others. In turn, these individuals may be more likely to behave antisocially towards others, because others' negative emotional cues are not the same 'brake system' that they are in other individuals (Blair, 2005).

In sum, successful socialisation relies on the association of one's own behaviour with another person's distress, and the inherent unpleasantness of seeing that distress (Hastings, Utendale, & Sullivan, 2007). There is evidence that individuals with high levels of psychopathic traits have deficits in these processes (Blair, 2005; Brook et al., 2013; Dawel et al., 2012; Patrick et al., 1994). This has useful explanatory power when understanding the frequency with which these

individuals behave badly towards others, including the use of instrumental aggression for personal gain (Cornell et al., 1996; Vitacco, Neumann, Caldwell, Leistico, & Van Rybroek, 2006). In particular, these explanations have been valuable in understanding why the self-focussed, goal-driven antisocial behaviour seen in individuals with psychopathy is so unfettered by the distress of others, a consequence that would deter typical individuals.

### *1.3.3. Additional deficits in reward and punishment processing*

Additionally, psychopathic traits have been associated with deficits in reward and punishment processing (Bjork, Chen, & Hommer, 2012; Blair, 2013; Buckholtz et al., 2010; Gregory et al 2015; Newman & Kosson, 1986; Newman & Schmitt, 1998; Pujara et al 2014; Vitale et al, 2005). As such, the psychopath's antisocial behaviour may not merely be due to the fact that others' distress does not serve as such an aversive stimulus to them. Instead, this deficit may be combined with global atypicalities in learning associations between stimuli/behaviour and rewarding or punishing outcomes (e.g. Buckholtz et al., 2010; Newman et al 2005).

With regard to negative/punishing outcomes, it is now well established that individuals with high levels of psychopathic traits perform poorly on passive avoidance tasks (Newman & Kosson, 1986; Newman & Schmitt, 1998; Vitale et al, 2005). These tasks assess an individual's capacity to learn from negative experiences by pairing neutral stimuli with a negative outcome such as loss of money (e.g. Newman & Kosson, 1986). In the task, the participant must learn these associations and then learn to avoid responding to stimuli (e.g. avoid pressing a button) that have previously been paired with a negative outcome. One study found that adolescent boys with high levels of psychopathic traits made significantly more passive avoidance errors than boys with low levels of psychopathic traits (Vitale et al, 2005). In an adult prison sample, offenders with high scores on the PCL-R performed worse on a passive avoidance task than offenders with low levels of psychopathic traits (Newman & Kosson, 1986). An fMRI study indicates a more nuanced picture of punishment processing deficits in psychopathy

(Gregory et al., 2015). Specifically, this study demonstrated that offenders with psychopathy show increased neural activation in the posterior cingulate cortex and anterior insula in response to punished errors in a response reversal task, indicating atypical punishment processing (Gregory et al., 2015). However, there were no behavioural differences between the psychopathic and non-psychopathic groups, indicating that the participants with psychopathy were still able to use punishment information to change subsequent behaviour. The authors interpret the neuroimaging findings as evidence that these individuals at least at a neural level process punishment information differently (Gregory et al., 2015).

There are also mixed findings with regard to the association between psychopathic traits and the processing of positive/rewarding outcomes, although together the findings indicate that psychopathic traits are likely associated with some atypicality in reward processing Several authors have found that psychopathic traits in adults are associated with a hyperresponsitivity to one rewarding outcome: money (Bjork, Chen, & Hommer, 2012; Buckholtz et al., 2010; Pujara et al 2014). In contrast, one study with adolescents found that psychopathic traits were not associated with neural responsivity to cues predicting monetary reward (Cohn et al., 2014), while another found that adolescents with psychopathic traits showed reduced neural activity in response to rewards compared to controls (Fingers et al., 2011).

In sum, a wealth of evidence indicates that individuals with high levels of psychopathic traits have at least some kind of atypical processing of punishment and reward information (Blair, 2013). Although the exact pattern of abnormality in these processes remains unclear, it is likely that this atypical processing may contribute to the increased levels of antisocial processing seen in psychopathy. Specifically, an increased hypersensivity to reward may make individuals with high levels of psychopathic traits more likely to resort to antisocial behaviour in an effort to achieve highly rewarding outcomes, such as financial gain (Pujara et al., 2014. Secondly, a reduced responsiveness of punishment may lead these individuals to engage in bad behaviour because potential sanctions are not recognised or not aversive. These potential reward and punishment processing deficits may combine with established difficulties in recognising and responding

to others' emotional expressions to create an environment in which antisocial behaviour can flourish (Blair, 2013; Buckholtz et al., 2010).

## 1.4. A new focus on processing positive (social) information

### *1.4.1. Existing explanations focus on negative social information*

In Section 1.3.1, I highlighted that the social deficits in psychopathy, which form a substantial part of the construct, fall into two categories: an atypical *absence* of prosocial relationships, and an atypical *presence* of antisocial behaviour and attitudes. To date, explanations such as the IES model (Blair, 2005) have focused on atypical cognitive/affective processes that may lead to increased levels of antisocial behaviour. However, these accounts do not adequately explain the well-documented absence of affiliation or prosocial behaviour seen in adults and adolescents with high levels of psychopathic/CU traits. A hallmark of psychopathic tendencies in adults and CU traits in children/adolescents is that these individuals are simply not interested in forming affiliative bonds with others (Frick et al., 2013; Hare, 2003; Pardini, 2011), but to date this aspect of psychopathy has been relatively underexplored.

### *1.4.2. Social reward processing should be explored*

One possibility that might partly explain the absence of prosocial relationships and presence of antisocial behaviour in psychopathy is that individuals with high levels of psychopathic traits may have deficits in their social reward processing. There is some limited evidence that individuals with high levels of psychopathic traits do not find positive social stimuli and relationships rewarding to the same extent that typical individuals do, which I will review in Sections 1.6.1. to 1.6.6. Here I will start by reviewing existing research on the construct of social reward to provide context.

## 1.5. Social reward

It is widely agreed across psychology and neuroscience that positive social stimuli and interactions are a fundamental source of reward (e.g. Báez-Mendoza & Schultz, 2013; Bhanji & Delgado, 2014; Bora, Yucel, & Allen, 2009; Krach, Paulus, Bodden, & Kircher, 2010). Despite this, to date, a comprehensive assessment of exactly what constitutes social reward has remained elusive. Specifically, there have been limited attempts to document what types of social interactions are considered rewarding, and how this might vary between individuals. In the following section, I will provide a brief overview of the extant research into what is classified as social reward.

### *1.5.1. Classifications of social reward*

The earliest attempt to classify social rewards identified six 'interpersonal reinforcers' (Turner, Foa, & Foa, 1971): *money, goods, services, information, love* and *status/praise*. The authors defined these rewards as resources that are exchanged between individuals. However, the first four (money, goods, services, information) are better considered as economic reinforcers, since although they are exchanged between people they are not fundamentally social in nature (Buss, 1983). Therefore, this classification was not a fully comprehensive attempt to categorise different sources of truly social reinforcers.

Buss (1983) proposed a more comprehensive classification of social rewards. This wide spectrum of rewards was classified broadly into two categories: *process* and *content* social rewards. Process social rewards occur naturally and are an intrinsic part of social interaction, whereas content social rewards are dependent on the type of social interaction that one person offers the other (Buss, 1983). Four process social rewards are given: the mere *presence* of others, *attention* from others (i.e. being looked at or listened to), *responsiveness* from others, and *initiation* of social interaction from others. Four content rewards are proposed: *deference* (receiving respect for status), *praise*, *sympathy* and *affection*. In addition to eight social reinforcers, Buss (1983) described six 'social opportunities' that act as social

rewards. These opportunities are distinct from the social reinforcers because they must be sought out by an individual, rather than received. These are opportunities for the following: *social comparison, self-disclosure, competition, aggression, dominance* and *control*.

Buss (1983) emphasized that individual differences in personality might influence the extent to which each of these eight social reinforcers are rewarding. For example, he suggested that 'exhibitionists' would find praise particularly rewarding, whereas shy people would find this less rewarding. People who are particularly emotional, on the other hand, are likely to find sympathy highly rewarding (Buss, 1983). A strength of Buss' (1983) approach was the comprehensiveness of the attempt to categorise all types of social reward. In addition, he made predictions about how personality traits might be associated with individual differences in the value of different social rewards. However, a major drawback of this classification is that it was not empirically driven or evaluated. As such, Buss' (1983) categorization of social rewards is only an interesting preliminary speculation about different types of social reward and individual differences in their value.

More recently, social reward has been defined as an event in a social context that satisfies all of the following criteria: elicits learning, elicits approach behavior, and produces positive emotions (Báez-Mendoza & Schultz, 2013). These authors provide several examples. Firstly, *prosocial behavior* is defined as a social reward in which an individual improves the welfare of a second person and in doing so, that individual may experience reward themselves. *Vicarious reward* is a related concept, in which another person is the initial recipient of reward, but seeing this is pleasurable for the observer, even if the reward was not instigated by him/her (Báez-Mendoza & Schultz, 2013; Mobbs et al., 2009). There are also social rewards generated by others, which include *praise, pleasant touch, receiving gifts* and *being liked* (Báez-Mendoza & Schultz, 2013). Experimental evidence demonstrating the reward value of these experiences and others is documented in Sections 1.5.2. and 1.5.3.

### *1.5.2. Experimental evidence assessing social reward*

In the following section, I provide an overview of experimental evidence assessing social reward. It is important to note that the majority of such studies use neuroimaging methods, although behavioural studies are described where relevant.

*Happy faces*

Experimental evidence has demonstrated the rewarding nature of the most basic and fundamental social stimuli: a happy face. One fMRI study showed participants a series of faces that were rated as highly attractive in pilot testing, and participants were asked to make a judgement of whether the face was male or female (O'Doherty et al., 2003). Viewing the faces activated the medial orbitofrontal cortex (mOFC), a region involved in representing the reward value of stimuli, and faces that were interpreted as smiling activated this region to a greater extent than faces with a neutral expression (O'Doherty et al., 2003). Subsequent research has assessed neural response to both happy faces (social reward) and monetary gains (financial reward) in the same task, and found that both types of reward elicit activation in neural networks involved in processing reward, including the ventral striatum (Lin, Adolphs, & Rangel, 2012; Spreckelmeyer et al., 2009). The pattern of neural activation for social and monetary rewards is not identical (Rademacher et al., 2010), but the overlapping areas of activation suggest a partially common neural currency (Güroğlu et al., 2008), suggested that happy faces are motivating stimuli processed in a similar way to other rewards such as monetary gain (Levy & Glimcher, 2012; Lin et al., 2012); Spreckelmeyer et al., 2009). An interesting point to note is that while looking at images of loved ones activates reward circuitry (Bartels & Zeki, 2000; Güroğlu et al., 2008), the majority of experiments showing the rewarding nature of happy faces use images of strangers (e.g. O'Doherty et al., 2003; Lin et al., 2012; Rademacher et al., 2010; Spreckelmeyer et al., 2009). This indicates that the inherent reward value of happy faces is not tied to positive associations with specific individuals.

*Prosocial behaviour*

Happy faces are useful experimental stimuli for investigating social reward because they are highly salient images that are known to elicit approach behaviours (Willis, Palermo, & Burke, 2011) as well as activation in brain areas involved in reward processing (e.g. O'Doherty et al., 2003). However, a happy face without social context lacks ecological validity, and some have argued that more complex interactions should be used to study social reward (Krach et al., 2010). Several studies have investigated prosocial behaviour as an example of more complex social reward. Prosocial behaviour describes an act intended to benefit another person, such as helping or sharing (Batson & Powell, 1998). It has long been recognised that prosocial behaviour is not only beneficial to the recipient; it is also experienced as rewarding for the person who performs the prosocial act. Indeed, the 'warm-glow' hypothesis of altruism states that we are motivated to help others *because* it feels good for us too (Andreoni, 1990; Crumpler & Grossman, 2008).

Charitable giving is often used as an index of prosocial behaviour in experimental studies. This is presumably because it is an easily quantifiable behaviour in which one's own wealth is given up to improve the wellbeing of other people, typically strangers. Charitable giving has consistently been found to be rewarding for the donating individual. One study analysed data from 136 countries and found that donating money to charity in the past month was positively associated with subjective wellbeing in the majority of countries (Aknin et al., 2013). The same authors then conducted an experiment in which participants in Canada and Uganda were randomly assigned to recall a time either when they had spent money on themselves or when they had spent the same amount of money on others. In both countries, participants who were asked to recall a time when they spent money on others reported significantly higher levels of subjective happiness afterwards than those who recalled spending money on themselves (Aknin et al., 2013). Finally, the authors conducted an experiment in Canada and South Africa in which participants were randomly assigned to buy a goody bag for themselves, or buy the same gift to donate to a children's hospital. In both countries, self-reported happiness ratings after spending were significant higher for the group randomly assigned to buy a gift for the children's hospital. Together, these studies provide

evidence of the self-reported rewarding nature of giving to others, which was consistent across cultures varying in wealth (Aknin et al., 2013).

Neuroimaging studies provide further evidence that the prosocial act of charitable giving is rewarding. In one study, participants underwent fMRI whilst viewing a series of different charities and choosing to either donate a small amount of money to that charity or to receive the money themselves (Moll et al., 2006). Both donating money to charity and receiving money activated the midbrain ventral tegmental area (VTA) and the dorsal and ventral striatum, all brain areas involved in processing rewards (Moll et al., 2006). In fact, giving to charity activates reward-related regions even when it is a mandatory, 'tax-like' donation, although neural activations and self-reported satisfaction are higher when the donation was made as a free choice (Harbaugh, Mayr, & Burghart, 2007). Although interesting, it is important to note that many of these fMRI findings rely on reverse inference, i.e. interpreting activation of areas known to process rewards as an indication that the condition is rewarding. Secondly, some have interpreted overlapping activations between two conditions (i.e. donating money to someone else and receiving money oneself) as an indication that both conditions are similarly rewarding. In future studies it will be important to supplement fMRI methods with subjective ratings and behavioural measures of reward value to best understand the rewarding nature of acts such as charitable giving.

*Approval/being liked*

Giving to charity may be particularly rewarding if combined with another social reward: approval from others. In one study, participants were asked to read about the goals and aims of a list of different charities (Izuma, Saito, & Sadato, 2010). Each participant then underwent fMRI whilst choosing whether or not to donate to each charity. Critically, sometimes the participant thought they were being observed, via what they believed to be a live video image of another participant in an adjacent room (in fact a confederate). Afterwards, the participant was asked to rate how important he/she thought other people would find each charity. For charities considered of middle importance, participants were significantly more likely to donate when they believed they were being observed versus when they believed they were alone. These behavioural findings indicated that in at least

some cases, the presence of others increased the incentive to donate to charity. The fMRI evidence showed that activity in the ventral striatum was significantly greater when participants chose to donate in the presence of the other person when compared to donating when he thought he was alone. Together this evidence suggests that donating to charity may be more rewarding when others are watching, possibly because the potential approval of others is rewarding and motivating (Izuma et al., 2010).

Other experimental evidence has shown that being liked, praised, or receiving approval is experienced as social rewarding, even if the approval is not attached to a specific behaviour such as charitable giving (Davey, Allen, Harrison, Dwyer, & Yücel, 2010; Izuma, Saito, & Sadato, 2008; Powers, Somerville, Kelley, & Heatherton, 2013). In one study, 15-24 year olds were told that a photo of themselves had been shown to other study participants, who were in fact fictional (Davey et al., 2010). Each participant was then shown a series of photographs of these fictitious individuals whilst undergoing fMRI. A coloured frame around each photograph indicated whether that individual did (green) or did not (white) express a desire to meet the participant. Neural activation in reward-related areas, including the nucleus accumbens and ventral tegmental area, was significantly greater when viewing the green-framed images of people who 'liked' the participant, compared to the white-framed images of those who did not (Davey et al., 2010). In a second fMRI study, participants viewed an image of their own face alongside an adjective that they believed another participant had used to describe them. These adjectives were defined by the authors as either high social reward (e.g. 'trustworthy') or low social reward (e.g. 'modest'), while a third condition gave no social reward ('XXX'). In a separate monetary reward task, participants completed a gambling game in which money could be won. It was found that both seeing positive adjectives ascribed to oneself and winning money activated an overlapping region of the striatum, indicating that receiving praise may be processed in a similar way to other rewards such as winning money (Izuma et al., 2008).

*Cooperation and fairness*

A number of studies have used economic exchange games to demonstrate that cooperation and fairness are also social rewards (Tabibnia & Lieberman, 2007). For example, one study asked participants to play a game that required the participant to arrange a pattern of shapes according to certain rules (Decety, Jackson, Sommerville, Chaminade, & Meltzoff, 2004). The game was played either alone, in cooperation with another player or in competition with another player. Activity in the orbitofrontal cortex (OFC), a region associated with reward processing, was specifically associated with the condition in with participants cooperated with the other player. This suggests that cooperating with others may be experienced as socially rewarding (Decety et al., 2004). Experimental evidence has also found that fairness is rewarding (e.g. Tabibnia, Satpute, & Lieberman, 2008). In one fMRI study, participants were shown a series of monetary offers from a fictional second participant. In each offer, the participant was shown the size of the total stake, and the proportion of the stake that was offered to them. The participant could choose whether or not to accept each offer. Because the size of the stake varied from trial to trial, some trials were unfair (e.g. $2 offered out of a total $10), while some were fair ($2 out of $4), despite the offers having equal monetary value. Compared to an unfair offer of the same monetary value, fair offers were associated with higher ratings of subjective happiness and greater activation in reward-related areas of the brain including the ventral striatum and the OFC, indicating that fairness in itself is processed as rewarding (Tabibnia et al., 2008). In sum, studies using economic exchange games have suggested that cooperation and fairness can be considered social rewards (Tabibnia & Lieberman, 2007).

*Affiliation*

The final category of social reward is affiliation and love. It is well established that for the vast majority of individuals, there is an enduring desire to have meaningful, close attachments to others (Baumeister & Leary, 1995) and that such attachments are a fundamental source of reward (Esch & Stefano, 2005). Evidence from fMRI studies demonstrate that viewing images of romantic partners elicits more activity in brain regions implicated in reward processing when compared to viewing images of other familiar individuals (Aron et al., 2005; Bartels & Zeki, 2000), and

this activity is positively associated with marital satisfaction (Acevedo, Aron, Fisher, & Brown, 2012). An additional study demonstrated that the subliminal presentation of the name of the participant's romantic partner elicits activity in similar regions (Ortigue, Bianchi-Demicheli, Hamilton, & Grafton, 2007). These studies provide neuroimaging support for the well-established observation that intimate, affiliative relationships with others are motivating and rewarding (Baumeister & Leary, 1995).

### *1.5.3. Antisocial reward*

To date, much evidence has demonstrated the rewarding value of positive stimuli such as happy faces, and positive social interactions such as behaving prosocially or receiving approval from others. However, there is also a smaller body of evidence demonstrating that, for some contexts and/or individuals, *antisocial* interactions can be rewarding. *Sadism* is a surprisingly underexplored concept in personality and social psychology research (Buckels, Jones, & Paulhus, 2013; Meloy, 1997; O'Meara, Davies, & Hammond, 2011), but can be defined as pleasure derived from controlling or dominating others and seeing them suffer as a result (Meloy, 1997). *Sexual sadism* is a narrower concept describing sexual arousal derived from others' suffering, and confusion regarding overlap between sadism and sexual sadism has led to little research attention given to sadism outside the context of sexual paraphilia (O'Meara et al., 2011). Only a minority of individuals find being cruel to others rewarding, with most others finding it abhorrent (Nell, 2006). However, to understand the full scope of social reward, recognising that there is a minority who find pleasure in others' pain and distress could be particularly important. This is because it provides a rare contrast with the commonly found evidence that positive social behaviour is rewarding, and cruelty to other is aversive (Buckels et al., 2013). In addition, antisocial reward may be particularly important when understanding the profile of social reward processing in individuals with high levels of psychopathic traits (see Section 1.6).

*Experimental evidence assessing antisocial reward*

Experimental evidence demonstrates that some individuals find acts of antisocial behaviour and cruelty rewarding (Buckels et al., 2013). One study used the Short Sadistic Impulse Scale (O'Meara et al., 2011) to measure sadistic traits, i.e. the tendency to experience pleasure from hurting others, in an undergraduate sample. The participants were given a choice of four 'challenging' tasks to complete: killing three bugs with a modified coffee grinder; helping the experimenter kill the bugs, cleaning a toilet, or putting their hand in ice water. Participants who chose to kill bugs had the highest sadism scores (Buckels et al., 2013). Additionally, participants with high levels of sadism who chose to kill bugs reported significantly more pleasure from their task than those with high levels of sadism who had chosen other tasks (Buckels et al., 2013). In a second study, the authors used an experimental paradigm in which the participant played a game with an opponent in an adjacent room, in fact a confederate (Buckels et al., 2013). If the participant pressed a button faster than their opponent on each trial, they were given the opportunity to blast the opponent with white noise. The set-up was designed such that the 'opponent' never chose to blast the participant, to remove the possibility that blasting from the participant was an expression of retaliation or provoked aggression. Scores on the sadism measure predicted the strength of the participants' aggressive response (a composite score of the intensity and duration of the white noise blasts that the participant chose; (Buckels et al., 2013). A second condition required participants to work on a boring and tedious letter-counting task to gain the opportunity to blast their opponent. Sadism scores were associated with the number of times the participant chose to work on this task in order to blast their opponent. Together, the studies provide evidence that sadistic traits are associated with an increased likelihood of antisocial behaviour towards others (Buckels et al., 2013). More generally, the research on sadism has shown that whilst social reward is most commonly obtained via positive social interactions, there exists a minority of individuals for whom the opposite – cruelty towards others – is socially rewarding.

### *1.5.4. Atypical social reward processing is associated with clinical disorder*

There is an emerging consensus that atypical experience of social reward is associated with a broad range of mental disorders (Bora et al., 2009; Krach et al., 2010), indicating that it is a highly relevant domain for our understanding of psychopathology. Most commonly, dysfunctional social reward has been associated with the following psychiatric conditions: depression, schizophrenia and autism spectrum disorders (ASDs). A fundamental aspect of depression is anhedonia, the global reduced capacity to experience pleasure, but the reduced capacity to experience social rewards may be particularly relevant to the illness (Forbes, 2009; Forbes & Dahl, 2012). In schizophrenia, social anhedonia is considered to be a trait-like symptom, which remains elevated even after symptoms of schizophrenia are reduced (Blanchard, Horan, & Brown, 2001). Finally, according to the social motivation hypothesis of autism, individuals with high levels of autistic traits experience reduced levels of reward from social interactions (Chevallier, Kohls, Troiani, Brodkin, & Schultz, 2012). There is support for this hypothesis from neuroimaging studies: individuals with ASD have shown reduced neural activation in reward-related brain regions during social reward tasks when compared to typically developing controls (reward anticipation: Richey et al., 2012; receipt: Delmonte et al., 2012; learning: (Zeeland et al., 2010). In addition, an EEG study found that children with ASD showed reduced event-related potentials while anticipating and receiving social rewards compared with typically developing controls (Stavropoulos & Carver, 2014). In sum, dysfunctional social reward processing has been implicated in several clinical disorders that have disrupted social relationships as a fundamental part of the disorder.

## 1.6. Psychopathic traits and social reward

The evidence reviewed above indicates that atypical social reward is implicated in a range of clinical disorders. Surprisingly, however, remarkably little research has aimed to systematically explore the associations between social reward and

psychopathic traits, despite the fact the atypical social interactions are a fundamental part of the disorder (see Section 1.3.1). In this section I will review existing evidence that indicate that social reward processing may be disrupted in individuals with high levels of psychopathic traits.

### *1.6.1. Happy faces*

Happy, smiling faces are salient social stimuli, and experimental evidence has frequently demonstrated their rewarding value (e.g. (O'Doherty et al., 2003). Some evidence suggests that all facial expressions, including happy ones, are processed differently by individuals with high levels of psychopathic traits. One study assessed three groups of adolescent boys: those with conduct problems and high levels of CU traits (CP/HCU), those with conduct problems and low levels of CU traits (CP/LCU), and a typically developing (TD) group (Hodsoll, Lavie, & Viding, 2014). The participants performed an attentional capture task, in which three faces appeared simultaneously on the screen and the participant was required to judge the orientation (tilted left or right) of the single male face. On some trials, either the target or a non-target face showed an emotional expression (fearful, angry or happy). For the CP/HCU group, reaction times were not reduced by the presence of an emotional face, regardless of whether that emotional face was a target or a non-target. In contrast, both the CP/LCU and TD groups were distracted by the emotional faces. In other words, the group with high levels of CU traits did not find the emotional faces distracting or attention-grabbing. This was true for all emotional expressions, including happy faces, indicating that these stimuli may not have the same bottom-up salience for individuals with high levels of CU traits (Hodsoll et al., 2014). Other researchers have also found that children with high levels of CU traits make less eye contact with their mothers, regardless of their mother's behaviour, and that this may reflect a general deficit in orienting towards emotionally salient faces (e.g. Dadds et al., 2014). In adults, when shown images of happy faces, prison inmates with high levels of psychopathic traits showed reduced recognition accuracy (Hastings, Tangney, & Stuewig, 2008), and reduced neural activation in face-processing regions when compared to those with lower levels of psychopathic traits (Decety et al., 2014).

Together, this evidence suggests that psychopathy may be associated with a deficit in processing happy facial expressions in others (Dawel et al., 2012), and contrasts with earlier evidence that psychopaths primarily have difficulty processing others' fear and sadness (e.g. Marsh & Blair, 2008). The discrepant findings may be due to different paradigms used to assess emotional processing across the studies. Happy faces are easy to recognise, and so performance in emotion recognition tasks may be at ceiling for most individuals – indeed, most studies have failed to report an association between the level of psychopathic traits and recognition of happy facial expressions (Hastings, Tangney, & Stuewig, 2008, providing an exception). Emotion recognition tasks may thus not be sufficiently sensitive to capture potential atypicalities in the processing of happy facial expressions in individuals with high levels of psychopathic traits. Instead, more sensitive paradigms such as those assessing automatic orienting to salient facial information (Dadds, Masry, Wimalaweera, & Guastella, 2008; Hodsoll, Lavie, & Viding, 2014) suggest that there may be difficulties in this domain. Together, although reward value was not directly assessed, these studies present an interesting possibility that happy faces may have less reward value for individuals with high levels of psychopathic traits.

### *1.6.2. Prosocial behaviour*

One study assessed associations between psychopathic traits and prosocial behaviour, a common social reward for most people (e.g. Andreoni, 1990; Crumpler & Grossman, 2008). In the correlational study, 539 students were asked to fill in a questionnaire that asked how often they carried out different prosocial acts, such as helping others (White, 2014). The researchers found that as psychopathic traits increased, the likelihood of reporting *public* prosocial acts increased, such as helping others in front of an audience. However, they also found that psychopathic traits were associated with significantly fewer reports of *private* prosocial acts, such as helping others who would not find out who had helped them (White, 2014). Together these findings suggest that individuals with high levels of psychopathic traits are less intrinsically motivated to be prosocial (White, 2014).

### *1.6.3. Approval/being liked*

To our knowledge, no studies have investigated associations between psychopathic/CU traits and the reward value of social approval or being liked by others. However, one study explored associations between levels of empathic traits and social approval and monetary reward (Gossen et al., 2014). This study may provide useful clues as to the association between psychopathic traits and response to social approval, as it is well established that individuals with high levels of psychopathic traits lack empathy (e.g. Lockwood et al., 2013; Seara-Cardoso et al., 2012). To represent social reward, the authors used videos of an actor showing 'gestures of approval': smiling, nodding her head and making a 'thumbs up' gesture. Individuals with low scores on the Empathy Quotient (EQ) questionnaire showed reduced right NAcc activation – an area involved in processing rewards - in anticipation of the videos showing gestures of social approval, compared to videos representing monetary reward (two coins dropping into an open wallet; Gossen et al., 2014). In contrast, participants with high scores on the EQ measure showed the opposite pattern: significantly increased NAcc activation to anticipated social reward compared to monetary reward. While this study did not assess psychopathic traits directly, low levels of empathy are characteristic of psychopathy, and as such these findings present an interesting possibility that individuals with high levels of psychopathic traits may also assign less reward value to social stimuli associated with approval and being liked.

### *1.6.4. Cooperation*

Evidence from experimental tasks suggests that individuals with high levels of psychopathic traits are less motivated to cooperate with and help others (Curry, Chesters, & Viding, 2011; Mokros et al., 2008; Rilling et al., 2007). For example, several studies have investigated how psychopathic traits are associated with behaviour in the Prisoners' Dilemma game. Although there are several variations, the basic premise of a Prisoners' Dilemma game is a two-player game in which there is no clear winning strategy, but where possible gains and losses are available

for each person depending on what the other player chooses. For example, if one player chooses to defect, he risks losing all the money, but also has a chance of winning the maximum amount of money depending on the behaviour of his partner. In one study, a group of prisoners who met diagnosis for psychopathy were significantly more likely to 'defect' in the game than the non-psychopathic control group (Mokros et al., 2008). Other studies with student samples have also found that psychopathic traits were negatively associated with levels of cooperation (Curry, Chesters, & Viding, 2011; Rilling et al., 2007). Furthermore, participants with high levels of psychopathic traits showed reduced activation in the orbitofrontal cortex when choosing to cooperate, an area implicated in reward processing (Rilling et al., 2007). Although social reward value was not subjectively measured in these studies, the findings are compatible with the notion that individuals with high levels of psychopathic traits find cooperation – a typical social reward – less motivating than other individuals.

### *1.6.5. Affiliation*

Individuals with high levels of psychopathic traits are less likely to form enduring, affiliative bonds with others (Hare, 2003). Exploring the types of relationships these individuals do and do not engage in is a useful indicator of their experience of social reward. For example, one study assessed psychopathic traits in a community sample and found that psychopathic traits were negatively associated with the importance individuals placed on having long-term, affiliative relationships (Baird, 2002). Similarly, adolescents with high levels of psychopathic traits tend to have shorter friendships (Muñoz, Kerr, & Besic, 2008). When asked what qualities they valued in potential friends, adults with high levels of psychopathic traits are less likely to value kindness and trustworthiness and more likely to favour friends who can increase their access to sexual mates or provide protection (Jonason & Schmitt, 2011). With regards to sexual relationships, individuals with high levels of psychopathic traits prefer one-night stands to committed relationships (Jonason, Luevano, & Adams, 2012). Indeed, promiscuity and a tendency to engage in extra-marital affairs are markers of psychopathy in the PCL-R (Hare, 2003). Together, this evidence suggests that, for

individuals with high levels of psychopathic/CU traits, affiliative and loving behaviour towards others may be less rewarding than it is for typical individuals (e.g. (Baumeister & Leary, 1995; Esch & Stefano, 2005).

### *1.6.6. Antisocial reward*

As mentioned in Section 1.3.1, the pattern of social behaviour in psychopathy can be parsed into two observations: an absence of prosocial behaviour/relationships, and a presence of antisocial behaviour. In Sections 1.6.1 – 1.6.5, I outlined some preliminary evidence that the absence of prosocial behaviour may in part be due to a lack of motivation or reward associated with these interactions. I will now outline some limited evidence that psychopathy may also be associated with an atypical *increased* reward value of antisocial and cruel behaviour. Firstly, sadism - the experience of pleasure from other people's pain or distress (see Section 1.5.3) - has moderate associations with psychopathy (Chabrol, Van Leeuwen, Rodgers, & Séjourné, 2009; Holt, Strack, & others, 1999; Mokros, Osterheider, Hucker, & Nitschke, 2011). Secondly, psychopathic traits in adults are associated with enjoyment of antisocial entertainment such as violent sports and video games (Williams, McAndrew, Learn, Harms, & Paulhus, 2001) and internet 'trolling' - online antisocial behaviour (Buckels, Trapnell, & Paulhus, 2014), indicating that violence and antisocial behavior have reward value for these individuals. Furthermore, adolescent offenders with high levels of psychopathic traits are more likely to lie because of 'duping delight', in other words, they lie to others because they enjoy it (Spidel, Hervé, Greaves, & Yuille, 2011). Together, this evidence suggests individuals with high levels of psychopathic/CU traits not only lack empathy towards others' distress (Lockwood et al., 2013; Seara-Cardoso, Neumann, Roiser, McCrory, & Viding, 2012; Seara-Cardoso, Dolberg, Neumann, Roiser, & Viding, 2013) but may actually take pleasure from it. It is important to explore this further, considering the high levels of antisocial behaviour seen in these populations (Frick et al., 2013; Hare, 2003), in order to understand the potential contribution that atypical social reward processing may make to this costly behaviour.

## 1.7. Summary and current thesis

A wealth of evidence now suggests that psychopathic traits exist on a continuum throughout community and forensic samples, and callous-unemotional (CU) traits have consistently been found in child and adolescent samples. At high levels, psychopathic and CU traits are predictive of particularly chronic and treatment-resistant antisocial behaviour, and as such are an important target for research efforts.

The social deficits in psychopathy consist of two primary abnormalities: a reduction in typical affiliative behaviour, and an increase in antisocial behaviour. To date, many existing explanations of psychopathy have focussed on deficits in emotional processing as an explanation for their increased antisocial behaviour (e.g. Blair, 2001). In particular, accounts have emphasised that individuals with high levels of CU/psychopathic traits have difficulty in identifying and responding to others' negative emotions, and so never learn to associate their own bad behaviour with negative consequences in others. The process of socialisation is not completed effectively, and these individuals are then more likely to engage in antisocial behaviour for their own gains, unrestrained by the empathy and guilt that reduce antisocial behaviour in typical individuals.

However, to date there has been limited explanations as to why individuals with high levels of psychopathic/CU traits *lack* the typical prosocial, affiliative behaviours seen in others. Indeed, there have been surprisingly few attempts to document their experience of prosocial stimuli and relationships. The limited evidence suggests that these individuals may have disrupted processing of positive social stimuli (Dawel et al., 2012; Hodsoll et al., 2014) and are less motivated to form relationships that are typically socially rewarding (Baird, 2002; Jonason et al., 2012). Better understanding the experience of social reward in individuals with high levels of psychopathic traits may provide an important contribution to the understanding of their social behaviour, which is so fundamental to the disorder of psychopathy.

In this thesis, I will present a series of studies that explore the possible associations between psychopathic traits and social reward and address a number of outstanding research questions. Firstly, *what types of social interactions and relationships are valued by individuals with high levels of psychopathic traits?* In Chapter 2, I describe a study that explored associations between psychopathic traits and a number of social functioning measures in a community sample of adults. The aim of this study was to investigate the possible types of social relationships that individuals with high levels of psychopathic traits find rewarding, using existing measures of social functioning.

Secondly, *what is the structure of social reward?* In Chapter 3, I present a study that describes the development and validation of the Social Reward Questionnaire (SRQ). This validation study addressed a gap in the existing literature: there was no questionnaire, to our knowledge, that measured individual differences in the reward value of different types of social interaction. The purpose of this study was to develop a valid and reliable self-report measure of social reward value that could be used in subsequent studies alongside measures of psychopathic traits.

Thirdly, *in what way are psychopathic traits in adults associated with self-report and experimental measures of social reward?* In Chapter 4, I present a study that assessed relationships between the SRQ and psychopathic traits. In addition, the study presented in Chapter 4 examined associations between psychopathic traits and experimental tasks measuring social and monetary reward processing. The purpose of this was to explore associations between psychopathic traits and social reward without the limitations of the self-report SRQ, and to provide a more comprehensive investigation of the associations between psychopathic traits and social reward.

Finally, *what types of social interactions are socially rewarding for adolescents, and in what way are they associated with callous-unemotional traits?* In Chapter 5, I present an adapted version of the SRQ to use with adolescent populations, the Social Reward Questionnaire – Adolescent Version (SRQ-A). The purpose of this study was to validate a self-report measure of social reward with younger populations that could be used alongside measures of CU traits. This was achieved

in the second part of the study presented in Chapter 5, in which associations between the SRQ-A and CU traits are presented. Together, the aim of the studies presented in this thesis was to provide an initial exploration into associations between psychopathic/CU traits and social reward processing, whilst considering how these associations might impact on the atypical pattern of social behaviour seen in psychopathy. Below, I will describe the content of each chapter in further detail.

As highlighted above, in **Chapter 2** of this thesis I present a study that systematically explored associations between psychopathic traits and existing measures of social functioning in a community sample of males. These measures assessed the following: the value of social/material goals, perceived social standing, the importance of friendships, and the desire for social acceptance. In addition, I developed and used a novel experimental vignettes task that assessed the extent to which participants identified dominance in themselves and admired this trait in others. Together, this battery provided a comprehensive assessment of aspects of social functioning. I conducted correlational analyses, correcting for multiple comparisons, to investigate which of these aspects of social functioning were associated with psychopathic traits, and also assessed whether these associations were unique to either of the two psychopathy factors (Affective/Interpersonal and Lifestyle/Antisocial traits). The purpose of this study was to better understand the types of social relationships that might be valued by individuals with high levels of psychopathic traits. However, this study did not directly assess the reward value of different types of social relationships, as to our knowledge there was no existing measure of the value of different social rewards.

In **Chapter 3** of this thesis, I describe the development and validation of a new measure, the Social Reward Questionnaire (SRQ). Previously, there was no empirically-driven categorisation of social reward, and no existing measure that assessed individual differences in the value of different social rewards. This study was conducted to address these two issues, with the aim of using this measure in subsequent studies to assess associations between psychopathic traits and social reward. To develop this measure, we conducted exploratory factor analysis on an initial set of 75 items in a large community sample (N=305). Based on this

analysis, the set was refined to 23 items with a proposed six-factor structure and confirmatory factor analysis was then conducted on a second sample (N=505). In addition, the second sample completed a number of additional measures to assess the construct validity of the scale. Internal and test-retest reliability analyses were also run. The final SRQ is a valid, reliable measure of individual differences in the value of social reward.

In **Chapter 4** of this thesis, I examined associations between psychopathic traits, the new SRQ, and experimental measures of social and monetary reward processing. In the first sample (N=505), participants completed the SRQ and a measure of psychopathic traits, the Self-Report Psychopathy Scale (SRP; Paulhus et al., 2015). The purpose of this study was to assess associations between the two self-report constructs, to explore what types of social relationships, if any, might have high reward value for individuals with high levels of psychopathic traits. In the second sample (N=110), the SRQ and SRP were administered to a new group of participants along with two experimental tasks investigating monetary and social reward value. The purpose of assessing associations between psychopathic traits and an *experimental* measure of social reward was to provide a more comprehensive assessment of how psychopathic traits might be associated with social reward, without the limitations of the self-report SRQ. Together, these studies provide a novel exploration of possible associations between psychopathic traits and social reward processing.

In **Chapter 5** of this thesis, I validated the SRQ in an adolescent sample. As in adults, to our knowledge there was no existing measure of individual differences in social reward value for this age group. In this study, 11-16 year olds (N=568) completed an adapted version of the questionnaire, the Social Reward Questionnaire – Adolescent Version (SRQ-A), and also completed a short personality measure for construct validity purposes. Confirmatory factor analysis was conducted to assess model fit, and internal and test-retest reliability analysis were also conducted. In addition, participants completed the callous-unemotional (CU) subscale of the Antisocial Process Screening Device, and correlational analyses were run to investigate associations between this CU measure and the SRQ-A. Therefore, the purpose of this study was twofold. Firstly, it validated a

slightly adapted measure of the SRQ for use in adolescent populations. Secondly, this study assessed how individual differences in social reward value in adolescents may be associated with CU traits. This study provided novel insight into how associations between psychopathic traits and social reward processing may be downwardly extended to adolescent populations.

In summary, this thesis sets out to explore the relationship between psychopathic/CU traits and social reward processing. Ultimately, this thesis seeks to answer the following question: what do individuals with high levels of psychopathic/CU traits find rewarding about social interactions, and how might this contribute to their atypical social behaviour? To answer this question, Chapter 2 provides a broad overview of the possible social interactions that individuals with high levels of psychopathic traits might value. In Chapter 3, a general measure of individual differences in social reward value, the Social Reward Questionnaire, is developed and validated. In Chapter 4, this measure is used alongside experimental measures of social and monetary reward to assess how social reward processing is associated with psychopathic traits. Chapter 5 documents the validation of the Social Reward Questionnaire – Adolescent Version, and explores how social reward value is associated with callous-unemotional traits in this age group. Finally, in Chapter 6, I summarise these findings and consider their potential usefulness for understanding the problematic and costly social behaviour seen in psychopathy.

# Chapter 2: Associations between psychopathic traits and measures of social motivation and functioning in a community sample of males

## 2.1. Abstract

Individuals with high levels of psychopathic traits do not typically form enduring bonds with others. However, few studies have documented the associations between psychopathic traits and social functioning. This study systematically explored associations between psychopathic traits and a number of existing measures characterising social/material goals, social beliefs and the need for belonging. Additionally, a novel experimental vignettes task assessed the extent to which participants identified dominance in themselves and admired this trait in others. Together, the purpose of these assessments was to provide a comprehensive assessment of which aspects of social functioning are considered valuable or rewarding for individuals with high levels of psychopathic traits. It was found that community males with high levels of psychopathic traits appeared not to be motivated by meaningful, long-term relationships. Instead, they seemed to be motivated by goals relating to their own image and financial success. Additionally, these individuals admired dominance in others, but did not clearly identify this trait in themselves. Thus, this study empirically explored multiple areas of social functioning in relation to psychopathic traits, with a view to understanding which types of social relationships and interactions might be rewarding for individuals with high levels of psychopathic traits. The findings provide empirical evidence that individuals with high levels of psychopathic traits seem motivated to look after themselves, but do not value affiliative relationships with others, suggesting that experiences of social reward may be atypical in this population.

## 2.2. Chapter Introduction

As described in the General Introduction of this thesis (Section 1.1.1), individuals with psychopathy are selfish, lack empathy and guilt, and aspire to dominate and manipulate other people for their own gains (Hare, 2003). Unsurprisingly, their friendships and romantic relationships tend to be short-lived (Baird, 2002; Jonason, Li, Webster, & Schmitt, 2009; Jonason, Luevano, & Adams, 2012). The absence of long-term relationships seen in these individuals is in contrast to the well-established need for closeness and belonging seen in typical people (Baumeister & Leary, 1995). That is, most people are motivated to form and maintain meaningful, enduring bonds with others (Baumeister & Leary, 1995) and find these bonds rewarding (Esch & Stefano, 2005).

Psychopathy is typically conceptualised as a two-factor construct[2]. Factor 1 consists of dysfunctional affective/interpersonal (AI) traits such as a lack of empathy and guilt, whereas Factor 2 consists of problematic lifestyle/antisocial (LA) behaviours such as impulsivity and sensation seeking. The AI traits of Factor 1 are considered to distinguish individuals who are psychopathic from those who are antisocial but not psychopathic (Blair, Mitchell, & Blair, 2005; Hare, 1996). The unique variance of these two dimensions of psychopathy, AI and LA, present distinct associations with various measures of personality, emotionality and behaviour (Hicks & Patrick, 2006; Seara-Cardoso, Neumann, Roiser, McCrory, & Viding, 2012). Specifically, suppressor effects between these two dimensions exist. Suppressor effects occur when the shared variance between two correlated variables hides the association between one or both of them and the variable of interest; controlling for this shared variance allows the otherwise hidden associations with the variable of interest to be revealed (Hicks & Patrick, 2006).

[2]The more recent four-factor model of psychopathy can easily be viewed in terms of the traditional two-factor model (e.g. Hare & Neumann, 2008). The latter model was chosen for the current study as it allows the study to be integrated with the wealth of literature using the Psychopathic Checklist-Revised (Hare, 2003) and its two-factor conception of psychopathy.

In the current study we were particularly interested in assessing the degree to which the AI dimension is associated with measures of social functioning and motivation, as this dimension is considered to reflect the fundamentally important characteristics of psychopathy.

Despite a long clinical tradition reporting shallow affect and atypical social relationships in individuals with psychopathy (Cleckley, 1988), only a handful of studies have probed what type of social interactions and positions these individuals engage in and value (Baird, 2002; Jonason et al., 2009; Jonason & Schmitt, 2011; Muñoz, Kerr, & Besic, 2008). This research has shown that psychopathic traits are negatively associated with the value of having enduring and meaningful relationships (Baird, 2002). Adolescents who score highly on the Youth Psychopathic traits Inventory (Andershed, Kerr, Stattin, & Levander, 2002) tend to have shorter friendships (Muñoz et al., 2008), while adults with high levels of psychopathic traits devalue the importance of kindness in potential partners (Jonason, Valentine, Li, & Harbeson, 2011) and friends (Jonason & Schmitt, 2011), and favour a short-term mating strategy over a long-term partner (Jonason et al., 2009; Jonason et al., 2012). Thus, it seems likely that people with high levels of psychopathic traits are not motivated to seek meaningful, affiliative bonds with others. However, no studies to date have systematically investigated what such individuals do find motivating in social relationships.

Associations between psychopathic traits and external variables should provide some clues in this regard. Firstly, AI traits of psychopathy are associated with increased self-esteem (Cale & Lilienfeld, 2006; Falkenbach, Howe, & Falki, 2013) and individuals with these traits may be motivated by the opportunity to be admired, gain attention, and nourish their inflated self-esteem (Buss, 1983). Another interpersonal quality associated with psychopathy is the seeming desire to dominate others and be ‘in charge’ of social situations (Hare, 2003). Individuals who strive for dominance are likely to find controlling others socially rewarding (Buss, 1983). However, very few studies have directly measured interpersonal dominance in relation to psychopathy. One study found that social potency, the belief that one is superior to and able to influence others, is significantly associated with psychopathy (Baird, 2002; Gaughan, Miller, Pryor, & Lynam, 2009). In fact,

social influence is a subscale of the revised Psychopathic Personality Inventory - Revised, a popular self-report measure of psychopathy (PPI-R; Lilienfeld & Widows, 2005). Although a desire to dominate social situations characterises psychopathy (Hare, 2003) there has been very little research to formally investigate the association between dominance and psychopathy, or whether exerting dominance is motivating for individuals with high levels of psychopathic traits.

Exploring what characteristics individuals with high levels of psychopathic traits value in others may yield further clues about their social functioning. On one hand, these individuals devalue kindness in partners (Jonason et al., 2011) and befriend other individuals high in psychopathic traits (Muñoz et al., 2008), suggesting they would value their own cold traits in others. On the other hand, people with high levels of psychopathic traits also have an enhanced memory for sad and unsuccessful characters (Wilson, Demetrioff, & Porter, 2008), so they may value submissive traits in others as these people are the easiest to manipulate and victimise (Wilson et al., 2008). To understand the kind of social interactions that individuals with high levels of psychopathic traits engage in and enjoy, it is important to explore what traits they value in others.

### *2.2.1. The current study*

In the current study, we administered a battery of existing social functioning measures to a community sample of males. The aim of the study was to explore what types of social relationships and interactions are considered valuable or motivating to individuals with high levels of psychopathic traits. We tested the hypotheses that individuals with high levels of psychopathic traits would not be motivated by affiliative social relationships, and would instead be motivated by selfish social goals. To explore this, we administered a wide battery of tasks and questionnaires to measure social motivation and behaviour. Firstly, we measured the importance of different life aspirations, which included both social and non-social aspirations (Grouzet et al., 2005), and the desire for close friendships and social acceptance. To measure dominance, a hallmark of psychopathy that we

consider central to social behaviour, we measured perceived social standing, and created a novel Dominance Judgements Task using character vignettes. This task explores what interpersonal traits individuals identify in themselves, as well as what traits they admire in others. Both the AI and LA dimensions of psychopathy were explored, but we predicted that selfish social attitudes would be most strongly associated with the AI dimension.

## 2.3. Materials and methods

### *2.3.1. Ethics statement*

All participants provided written informed consent and the study was approved by the University College London Clinical, Educational and Health Psychology Research Ethics committee.

### *2.3.2. Participants*

One hundred and one English-speaking males were recruited via the University College London Psychology and Institute of Cognitive Neuroscience subject pools. These subject pools consist of students as well as employed and unemployed individuals; fifty-nine participants (58.42%) were students. Participants had a mean age of 26.76 years (SD=7.45, range=18-54) and the ethnicity of the sample was as follows: 40.6% White British, 28.7% White Other, 23.8% Asian, 5.94% Black, 0.99% Other. The highest completed education level for the sample was as follows: 51.49% Undergraduate degree, 39.60% Postgraduate, 8.91% Senior school. Participants received course credit or payment of £5 for taking part.

### *2.3.3. Procedure*

The Dominance Judgements Task and questionnaires were presented on a computer using Psytools software (Delosis Ltd).

### *2.3.4. Measures*

*Psychopathic traits*

Psychopathic traits were measured with the Self-Report Psychopathy Scale 4 Short Form (SRP-4-SF; Paulhus, Neumann, & Hare, 2015). This scale contains 29 items that participants rated on a 5-point Likert scale (1=Strongly disagree to 5=Strongly agree). The SRP-4-SF yields a total psychopathy score and also scores for the two dimensions of psychopathy: affective/interpersonal (AI) and lifestyle/antisocial (LA). All scores are calculated by adding together the scores of the relevant items. The SRP has good construct validity: it is strongly correlated with the most commonly used clinical psychopathy assessment, the PCL-R (Lilienfeld & Widows, 2005; Paulhus et al., 2015), the Youth Psychopathic Traits Inventory (YPI; e.g. Andershed et al., 2002) and a psychopathy self-report measure based on the five-factor model of personality (Lynam et al., 2011). The internal consistency of the scale was good, with Cronbach Alpha scores for each dimension as follows: AI .80, LA .80. Given the limitations of Alpha and that it is not an indicator of scale unidimensionality (Schmitt, 1996), we also computed mean inter-item correlations (MICs) for these two composites, which were acceptable (AI=.24, LA=.22) and suggested that they tapped unidimensional features of psychopathy. A confirmatory factor analysis using the current sample data demonstrated acceptable model fit for the two-factor SRP-4-SF ($X=0.30$, $p<.05$, CFI=1.00, SRMR=.007)

*Aspirations*

The Aspiration Index assesses the importance of personal life goals (Kasser & Ryan, 1993). Seven relevant life goal subscales were chosen for use in the current study: affiliation, community, conformity, hedonism, image, money and popularity (Grouzet et al., 2005). These were chosen as being the most relevant goals based on the selfish social profile seen in psychopathy and this procedure of using only relevant domains is supported by Kasser (Sheldon, Ryan, Deci, & Kasser, 2004). Participants viewed 27 life goals and rated how important each was to them on a 9-point scale (1=Not at all; 9=Extremely). In order to control for overall importance ratings, the subject's mean importance rating for all domains

was subtracted from the subject's mean importance score for each domain (Kasser & Ryan, 1993).

*Social comparison*

Perceived social standing was measured using the Social Comparison Scale (Allan & Gilbert, 1995). Participants view the statement, "In relation to others I feel…" followed by 11 bipolar constructs, for example "Superior/Inferior" and "Unattractive/More attractive". Participants rated how they see themselves in comparison to others on each construct, on a 1 to 10 scale. The mean of the 11 items is calculated to give the final score.

*Friendship*

A 13-item Friendship Questionnaire was developed for the current study and assessed the tendency to engage in long-term, meaningful friendships, such as "Having close friendships is very important to me." The questionnaire was created for this study as no existing friendship questionnaire suitably measures general tendency to engage in intimate friendships. Participants rated how much they agreed with each statement on a 5-point scale (1=Strongly disagree, 5=Strongly agree). Three items are reverse-scored. Reliability for this scale was good (Cronbach's Alpha=.85, MIC=.32). The validity of this measure is demonstrated by the significant correlation between this scale and the Affiliation subscale of the Aspiration Index (Grouzet et al., 2005), which measures the importance placed on intimate relationships ($r=.34$, $p<.001$). See Appendix 2 for the list of items in the Friendship Questionnaire. The mean of the 13 items is calculated (after reverse-scoring three items) to give the final score.

*Need to belong*

Participants completed the Need to Belong Scale (Leary, Kelly, Cottrell, & Schreindorfer, 2007), which measures the desire for social acceptance and consists of 10 items, such as "I want other people to accept me". Participants rated how much they agreed with each statement on a 5-point scale (1=Strongly disagree, 5=Strongly agree). The mean of the ten items is calculated to give the final score.

*Dominance Judgements Task*

I created 24 short character vignettes to assess which interpersonal traits participants considered to be similar to their own, likeable in others, and desirable in others. Six core situations were represented in the vignettes; for example, someone working on a group presentation. For each core situation, four character descriptions were created, each portraying a different personality type: dominant/warm, dominant/cold, submissive/warm and submissive/cold. These personality types were chosen as they are extremes on the interpersonal values circumplex (e.g. Wiggins, 1979). To ensure validity, a panel of eight researchers performed a Q-sort to categorise each vignette into one of the four personality types. Vignettes were categorised into the correct personality type in 97.40% of cases. See Appendix 2 for a copy of the vignettes.

All vignette protagonists were male students, in order to increase the likelihood that participants would identify with them and that their judgements would not be influenced by protagonists' occupations. Names were selected from a list of popular boys' names from the Office of National Statistics (www.ons.gov.uk/ons/rel/vsob1/baby-names--england-and-wales/1904-1994/index.html). Names and ages were assigned randomly to each vignette.

Vignettes were presented in one of two orders with the following constraint: vignettes portraying the same core situation or personality type could not appear consecutively. Each vignette was presented on the screen individually for the participant to read in his own time. On the following screen, the vignette was presented again, along with three questions: how much do you like the character, how similar are the character's personality traits to your own, and how desirable do you think the character's personality traits are. Answers were given on a 5-point scale (1=Dislike a lot to 5= Like a lot; 1=Very dissimilar to 5=Very similar; 1=Very undesirable to 5=Very desirable). Mean scores were calculated for likeability, similarity and desirability, for each of the four personality types (dominant/warm, dominant/cold, submissive/warm and submissive/cold). The reliability of the vignettes measure was good (Cronbach Alphas: submissive/warm .71, submissive/cold .82, dominant/warm .82, dominant/cold .89).

### *2.3.5. Data analyses*

Pearson correlational analyses were conducted using SPSS version 19.0 for Windows. Firstly, the AI and LA dimensions of psychopathy were correlated with all other variables using zero-order correlations. Secondly, to examine the unique variance of each SRP dimension in relation to criterion variables, the dimensions were partialled out from one another. Benjamini and Hochberg False Discovery Rate (Benjamini & Hochberg, 1995) was used to control for the probability of making a Type I error on multiple comparisons, and corrected p-values are presented. Where distinct associations between the two SRP dimensions and a given criterion variable were identified, Steiger's Z-tests (two-tailed) were conducted to test if the difference between the correlations was significant.

## 2.4. Results

Descriptive statistics are presented in **Table 2.1**, and a complete correlational table for all experimental measures is presented in **Table 2.2**.

Pearson correlation coefficients and False Discovery Rate adjusted p-values between psychopathy dimensions and all measures used are reported in **Table 2.3**. Z and p-values of the difference between regression coefficients are also presented. Both zero-order and partial correlations coefficients are reported in **Table 2.3**, but from here onwards only partial correlation coefficients will be discussed as these relate to the unique variance associated with each dimension of psychopathy and remove the suppressor effects that may disguise significant associations. Only adjusted p-values are reported in the text.

**Table 2.1. Descriptive statistics for all experimental variables**

| | Internal consistency[1] | Minimum | Maximum | Mean (SD) |
|---|---|---|---|---|
| **SRP-4-SF** | | | | |
| Total | .87 | 30.00 | 100.00 | 58.40 (13.96) |
| Affective/Interpersonal | .80 | 14.00 | 53.00 | 29.91 (7.96) |
| Lifestyle/Antisocial | .80 | 14.00 | 48.00 | 27.44 (7.37) |
| **Aspirations** | | | | |
| Image | .71 | -3.09 | .68 | -1.26 (.86) |
| Community | .72 | -3.19 | 3.70 | 1.06 (1.37) |
| Affiliation | .81 | -.48 | 4.32 | 1.57 (1.04) |
| Money | .86 | -3.26 | 2.38 | -.41 (1.23) |
| Popularity | .67 | -3.30 | 3.30 | -.48 (1.16) |
| Conformity | .75 | -3.53 | 1.33 | -1.02 (1.13) |
| Hedonism | .78 | -3.00 | 4.00 | .81 (1.31) |
| **Questionnaires** | | | | |
| Friendship | .85 | 2.00 | 4.77 | 3.81 (.55) |
| Need to belong | .75 | 1.70 | 4.80 | 3.23 (.57) |
| Social comparison | .81 | 32.00 | 98.00 | 64.63 (11.22) |
| **Vignettes: Likeability** | | | | |
| Submissive/warm | .72 | 1.33 | 4.67 | 3.21 (.51) |
| Submissive/cold | .87 | 1.17 | 3.83 | 2.21 (.54) |
| Dominant/warm | .83 | 1.50 | 4.83 | 3.47 (.57) |
| Dominant/cold | .89 | 1.00 | 3.83 | 1.98 (.59) |
| **Vignettes: Similarity** | | | | |
| Submissive/warm | | 1.50 | 4.33 | 2.74 (.54) |
| Submissive/cold | | 1.00 | 3.50 | 1.93 (.62) |
| Dominant/warm | | 1.33 | 5.00 | 3.09 (.67) |
| Dominant/cold | | 1.00 | 4.33 | 1.93 (.72) |
| **Vignettes: Desirability** | | | | |
| Submissive/warm | | 1.83 | 3.83 | 2.82 (.45) |
| Submissive/cold | | 1.00 | 3.00 | 1.79 (.47) |
| Dominant/warm | | 2.00 | 4.83 | 3.47 (.54) |
| Dominant/cold | | 1.00 | 3.50 | 1.81 (.55) |

[1]Internal consistency measured by Cronbach's Alpha scores. [2]Reliability figure for each character type, collapsed across the three subscales (likeability, similarity, desirability)

## Table 2.2. Correlations between all experimental variables

| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Aspirations** | | | | | | | | | | | | | | | | | | | | | |
| 1. Image | | | | | | | | | | | | | | | | | | | | | |
| 2. Community | -.37* | | | | | | | | | | | | | | | | | | | | |
| 3. Affiliation | -.60* | .34* | | | | | | | | | | | | | | | | | | | |
| 4. Money | .16 | -.54* | -.50* | | | | | | | | | | | | | | | | | | |
| 5. Popularity | -.04 | -.06 | -.22* | -.15 | | | | | | | | | | | | | | | | | |
| 6. Conformity | .14 | -.32* | -.49* | .17 | -.02 | | | | | | | | | | | | | | | | |
| 7. Hedonism | -.23* | -.01 | .34* | -.27* | -.30* | -.52* | | | | | | | | | | | | | | | |
| **Questionnaires** | | | | | | | | | | | | | | | | | | | | | |
| 8. Friendship | -.35* | .18 | .34* | -.21* | -.02 | -.06 | .10 | | | | | | | | | | | | | | |
| 9. Need to belong | -.04 | -.25* | -.10 | .14 | .23* | .07 | -.02 | .26* | | | | | | | | | | | | | |
| 10. Social comparison | -.07 | -.12 | .01 | .03 | .00 | .15 | -.02 | .29* | .11 | | | | | | | | | | | | |
| **Vignettes: Likeability** | | | | | | | | | | | | | | | | | | | | | |
| 11. Submissive/warm | -.08 | .19 | .00 | -.04 | .13 | .02 | -.20* | .09 | .05 | .10 | | | | | | | | | | | |
| 12. Submissive/cold | .06 | .05 | -.11 | -.02 | .18 | .09 | -.19 | -.25* | -.14 | -.11 | .52* | | | | | | | | | | |
| 13. Dominant/warm | -.03 | .14 | .00 | -.14 | .10 | .02 | -.05 | .17 | .11 | .32** | .33* | .04 | | | | | | | | | |
| 14. Dominant/cold | .17 | -.10 | -.27* | .12 | .03 | .18 | -.12 | -.22* | .02 | .17 | -.11 | .34* | .23* | | | | | | | | |
| **Vignettes: Similarity** | | | | | | | | | | | | | | | | | | | | | |
| 15. Submissive/warm | .14 | .00 | -.20* | .06 | .23* | .03 | -.20* | -.23* | .09 | -.43* | .42* | .41* | .21 | -.05 | | | | | | | |
| 16. Submissive/cold | .25* | -.19 | -.24* | .10 | .09 | .08 | -.05 | -.46* | .10 | -.39* | .13 | .63* | -.19 | .29* | .58* | | | | | | |
| 17. Dominant/warm | -.11 | .12 | .05 | -10 | .00 | -.04 | .10 | .23* | .15 | .35* | -.06 | -.30* | .58* | .30* | -.34* | -.41* | | | | | |
| 18. Dominant/cold | .08 | -.07 | -.10 | .09 | .01 | .05 | -.06 | -.12 | .12 | .17 | -.10 | .11 | .24* | .77* | .17 | .18 | .51* | | | | |
| **Vignettes: Desirability** | | | | | | | | | | | | | | | | | | | | | |
| 19. Submissive/warm | -.02 | .12 | -.11 | -.03 | .07 | .11 | -0.11 | -.03 | .12 | .18 | .60* | .35* | .29* | .18 | .36* | .21* | .18 | .17 | | | |
| 20. Submissive/cold | .20* | -.10 | -.18 | .02 | .11 | .18 | -.20* | -.24* | .00 | -.19 | .04 | .62* | -.10 | .55* | .28* | .60* | -.13 | .39* | .32* | | |
| 21. Dominant/warm | -.11 | .23* | .03 | -.19 | .08 | -.05 | .06 | .17 | .05 | .08 | .09 | -.01 | .69* | .29* | .09 | -.12 | .60* | .33* | .22* | .05 | |
| 22. Dominant/cold | .20* | -.14 | -.18 | .11 | -.10 | .19 | -.08 | -.16 | .07 | .02 | -.20* | .20* | .14 | .82* | -.01 | .32* | .26* | .69* | .14 | .56* | .32* |

*p<.05

## Table 2.3. Correlations between SRP scores and experimental measures

| | SRP total | | SRP AI | | | | SRP LA | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | Zero order | | LA controlled | | Zero order | | AI controlled | |
| | **r** | ***p*** | **r** | ***p*** | **r** | ***p*** | **r** | ***p*** | **r** | ***p*** |
| **Aspirations** | | | | | | | | | | |
| Image | .05 | ns | .15 | ns | .25† | .05 | -.06 | ns | -.20† | ns |
| Community | -.02 | ns | -.14 | ns | -.28† | .03 | .11 | ns | .26† | .05 |
| Affiliation | .00 | ns | -.12 | ns | -.25† | .05 | .12 | ns | .25† | .05 |
| Money | .10 | ns | .23 | ns | .34† | .01 | -.06 | ns | -.27† | .05 |
| Popularity | -.07 | ns | -.10 | ns | -.11 | ns | -.02 | ns | .05 | ns |
| Conformity | -.31 | .01 | -.16 | ns | .14† | ns | -.41 | .00 | -.41† | .00 |
| Hedonism | .27 | .03 | .13 | ns | -.14† | ns | .36 | .00 | .36† | .00 |
| **Questionnaires** | | | | | | | | | | |
| Friendship | -.33 | .01 | -.41 | .00 | -.40† | .00 | -.17 | ns | .13† | ns |
| Need to belong | -.05 | ns | -.12 | ns | -.18 | ns | .03 | ns | .14 | ns |
| Social comparison | -.27 | .03 | -.26 | .04 | -.15 | ns | -.23 | ns | -.09 | ns |
| **Vignettes: Likeability** | | | | | | | | | | |
| Submissive/warm | -.23 | .07 | -.22 | ns | -.14 | ns | -.19 | ns | -.06 | ns |
| Submissive/cold | .00 | ns | .05 | ns | .11 | ns | -.05 | ns | -.11 | ns |
| Dominant/warm | -.14 | ns | -.14 | ns | -.08 | ns | -.12 | ns | -.05 | ns |
| Dominant/cold | .15 | ns | .21 | ns | .22 | .07 | .06 | ns | -.10 | ns |
| **Vignettes: Similarity** | | | | | | | | | | |
| Submissive/warm | .00 | ns | .08 | ns | .18 | ns | -.09 | ns | -.18† | ns |
| Submissive/cold | .28 | .03 | .34 | .01 | .31† | .01 | .16 | ns | -.07† | ns |
| Dominant/warm | .03 | ns | -.02 | ns | -.09 | ns | .07 | ns | .11 | ns |
| Dominant/cold | .32 | .01 | .32 | .01 | .21 | .09 | .26 | .06 | .08 | ns |
| **Vignettes: Desirability** | | | | | | | | | | |
| Submissive/warm | -.06 | ns | -.06 | ns | -.05 | ns | -.04 | ns | .00 | ns |
| Submissive/cold | .08 | ns | .13 | ns | .17 | ns | .01 | ns | -.10 | ns |
| Dominant/warm | -.01 | ns | .02 | ns | .07 | ns | -.05 | ns | -.08 | ns |
| Dominant/cold | .14 | ns | .20 | ns | .23 | .07 | .04 | ns | -.11 | ns |

Pearson correlation coefficients are reported; p values >.1 are shown

†After controlling for shared variance, SRP AI and LA presented significantly different correlation coefficients with image (Z=2.49*), community (Z=-3.00**), affiliation (Z=2.82**), money (Z=3.43**), conformity (Z=3.14**) and hedonism aspirations (Z=-2.83**), friendship (Z=-2.99**) and similarity to submissive/cold characters (Z=2.10*) [*p<.05, **p<.01]

### *2.4.1. Questionnaires*

After partialling out the effect of the other dimension and correcting p-values for multiple comparisons, the Friendship Questionnaire showed a negative association with the AI dimension of psychopathy and no association with the LA dimension. The AI dimension was positively associated at-trend with image goals, positively associated with money goals, and negatively associated with community and affiliation goals as measured by the Aspiration Index (Grouzet et al., 2005). In contrast, the LA dimension was positively associated with community, affiliation and hedonism goals and negatively associated with conformity and money goals. Neither dimension was associated with popularity goals, the Social Comparison Scale or the Need to Belong Scale.

### *2.4.2. Dominance Judgements task*

After correcting p-values for multiple comparisons and partialling out the effect of the other dimension, the AI dimension of psychopathy was positively associated with similarity to submissive/cold characters. There were also at-trend positive associations between this dimension and the likeability, similarity and desirability of dominant/cold characters. There were no associations between the LA dimension and any element of the Dominance Judgements Task.

## 2.5. Discussion

This study explored the associations between psychopathic traits and existing measures of social motivation and functioning. The study confirms previous findings that individuals with high levels of the core affective/interpersonal (AI) traits of psychopathy lack affiliative goals, and extends previous findings by exploring what such individuals do find motivating.

Specifically, we found that the AI dimension of psychopathy was negatively associated with the tendency to form long-lasting, meaningful friendships and with goals relating to affiliation and community; positively associated with goals relating to money; and positively associated at-trend with goals relating to image. In contrast, the

lifestyle/antisocial (LA) dimension was positively associated with goals pertaining to community, affiliation and hedonism, and negatively associated with goals pertaining to money and conformity. Thus, it was specifically the AI dimension of psychopathy that was associated with an absence of affiliative aspirations, although the positive association between LA and hedonism does complement the notion that high levels of psychopathic traits are associated with self-focussed rather than affiliative goals. Finally, our study did not support predictions that individuals with high levels of psychopathic traits are clearly dominant: the AI dimension was positively associated (at trend) with perceived likeability, similarity and desirability of dominant/cold characters in our Dominance Judgements Task, but also positively associated with perceived similarity to submissive/cold character profiles. Additionally, there was no association between psychopathy and the Social Comparison Scale, a measure of perceived social standing.

We had hypothesised that, due to the grandiose self-image seen in psychopathy (Hare, 2003), individuals with high levels of these traits would find the opportunity to be admired important. In support of this, we found an at-trend positive association between the AI dimension and goals related to portraying an attractive image. However, we found no association (positive or negative) between psychopathy and goals relating to popularity, or between psychopathy and the need to belong. Thus while individuals with high levels of AI psychopathic traits are motivated to look attractive, this may be for reasons other than intrinsically wanting other people's admiration or approval. For example, they may be motivated to portray an attractive impression if it will increase access to other gains.

Our findings indicate that it is specifically the AI dimension of psychopathy that is negatively associated with long-term friendships and affiliation. This supports previous research showing that other elements of problematic social functioning, such as empathic concern, are specifically associated with the AI component of psychopathy (Seara-Cardoso et al., 2012). However, the associations between the LA dimension of psychopathy and the Aspiration Index (Grouzet et al., 2005) are worthy of note. Firstly, there was a negative association between this dimension and the importance of conformity goals. This makes intuitive sense considering the rebellious and antisocial characteristics that define the LA factor. We also found a negative association between this dimension and goals relating to financial success. This finding was unexpected,

because the LA dimension has previously been associated with neural hyper-responsiveness to monetary reward in an experimental paradigm (Buckholtz et al., 2010). However, this previous study (Buckholtz et al., 2010) investigated immediate financial gratification, rather than long-term goals relating to financial success explored in the current study. Thus while the neural response to monetary reward is exaggerated in individuals with high levels of LA psychopathic traits, these individuals do not appear to be necessarily motivated to achieve financial success in their future. This finding warrants further exploration of the relationship between dimensions of psychopathy and monetary goals. Finally, we found a positive association between the LA dimension and goals relating to hedonism (i.e. having a great sex life, a lot of excitement, and experiencing a great deal of sensual pleasure). Given that individuals with high levels of psychopathic traits tend to have short-lived romantic relationships (Jonason et al., 2009; Jonason et al., 2012) and a higher number of sexual partners (Jonason et al., 2009), it is unsurprising that these individuals highly value sensual pleasure. It is perhaps the combination of this hedonistic motivation from the LA dimension and the atypical affiliation motivation from the AI dimension that leads to the exploitative short-term mating strategy seen in psychopathy.

It is important to note the suppressor effects that exist between the two dimensions of psychopathic traits. That is, the association between the two dimensions of psychopathy and other variables in the current study become significant only once shared variance with the other dimension is controlled, consistent with other studies of psychopathic traits (e.g. Hicks & Patrick, 2006). This emphasises that there are two overlapping but distinct elements of psychopathy, and some authors argue that their unique associations should always be explored to fully understand the construct (e.g. Hicks & Patrick, 2006). Itis important to note that there is also concern about exploring unique associations in this way (Lynam, Hoyle, & Newman, 2006). In particular, there is concern about how to interpret findings when shared variance between a variable of interest and and a correlated variable (in this case, different dimensions of psychopathic traits) has been removed (Lynam, et al., 2006). For this reason, and to explore the finer nuances of psychopathy afforded by the four-factor model, Chapter 4 of this thesis assesses zero-order, not partial, correlations and uses the four-factor, not two-factor, model of psychopathy.

We had hypothesised that individuals with high levels of psychopathic traits would report higher social standing, as such individuals are widely considered to seek dominance (Hare, 2003). However, the current study found that the Social Comparison Scale (Allan & Gilbert, 1995), which measures perceived social standing in a range of domains, was not associated with psychopathy. Secondly, in our Dominance Judgements Task, the AI dimension of psychopathy was positively associated (at-trend) with similarity to dominant/cold characters, but also positively associated with similarity to submissive/cold characters. Thus individuals with high levels of psychopathic traits clearly identified themselves as cold, but did not clearly identify themselves as dominant. It is important to note that the Social Comparison Scale asks respondents to compare themselves to others on a range of domains, including attractiveness and belongingness, so it is not a 'pure' measure of dominance. However, studies that have measured dominance more directly have also found inconclusive results. One study used a self-report measure of interpersonal traits and found similar results to the current study: individuals with high levels of psychopathic traits were consistently cold, but heterogeneous in terms of dominance (Blackburn & Maybury, 1985). Additionally, social influence is considered to be a core aspect of psychopathy (Lilienfeld & Widows, 2005), but psychopathy is negatively associated with the number of leadership roles currently held (Baird, 2002). Thus while individuals with high levels of psychopathic traits may feel a sense of superiority to others (Baird, 2002; Lilienfeld & Widows, 2005), this may not clearly translate into dominant behaviour or higher social standing. It could be that it is specifically the process of manipulating and deceiving others that is characteristic of psychopathy, and that this does not necessarily require dominance. Interestingly, in our Dominance Judgements Task, we found an at-trend association between the AI dimension of psychopathy and the perceived desirability and likeability of the dominant/cold characters. Although this finding is only at the level of a trend, it presents the possibility that in the community, while individuals with high levels of psychopathic traits do not clearly express dominance themselves, they do admire and aspire to be like dominant/cold characters. Further research is required probing the desire for dominance, actual achieved dominance, and manipulation, using a more comprehensive set of measures.

### *2.5.1. Limitations*

There were several limitations of the current study. Firstly, this study relied on self-report measures, which can be subject to bias and may not objectively reflect all aspects of social functioning. We also did not include a 'pure' measure of interpersonal dominance (e.g. Mehrabian & Hines, 1978); this may have clarified the relationship between dominance and psychopathic traits in our community sample. Finally, and of particular importance to this thesis, we did not include a measure that directly assessed the reward value of different social interactions. This was because, to our knowledge, such a measure did not exist in the literature. A goal for future research would be to develop and validate an appropriate instrument that assesses social reward value, and then use this alongside a measure of psychopathic traits to explore associations between the two constructs.

### *2.5.2. Conclusion*

Psychopaths are callous, have short-lived friendships and relationships, and manipulate others for their own gains (Hare, 2003). This study aimed to explore what elements of social relationships are motivating for individuals with high levels of psychopathic traits, as a preliminary exploration of whether or not experiences of social reward may be atypical in this population. We found that individuals with high levels of AI psychopathic traits do not value affiliative or community relationships and instead value goals relating to money and their image. The LA dimension of psychopathy had a contrasting profile of associations with life goals, providing support that it is specifically the AI dimension that is associated with the trademark cold and amoral social functioning of psychopathy (Seara-Cardoso et al., 2012). In the absence of affiliation and community goals, it remains unclear exactly what individuals with high levels of AI traits find socially motivating. These individuals did not especially value popularity and were not clearly dominant; they may admire dominance in others, but in a community sample this trait was not clearly expressed, so it remains unclear if exerting dominance is a motivating aspect of social interaction for individuals with high levels of psychopathic traits. In addition, this study did not include a measure that directly assessed the reward value of different social interactions. Thus, while the current study suggests that individuals with high levels of core psychopathic traits are not motivated to form meaningful bonds with others and are

instead motivated by selfish goals, understanding the exact elements of social reward associated with psychopathy remains a challenge.

# Chapter 3: Development and validation of the Social Reward Questionnaire (SRQ)

## 3.1. Abstract

Human beings seek out social interactions as a source of reward. To date, there have been limited attempts to identify different forms of social reward. This study aimed to address this issue by developing the Social Reward Questionnaire (SRQ), a measure of individual differences in the value of different social rewards. Exploratory factor analysis (EFA) was run on an initial set of 75 items (N=305). Based on this analysis, confirmatory factor analysis (CFA) was then conducted on a second sample (N=505) with a refined 23-item scale. This analysis was used to test a six-factor structure, which resulted in good model fit (CFI=.96, RSMEA=.07). The factors represent six subscales of social reward defined as follows: Admiration; Negative Social Potency; Passivity; Prosocial Interactions; Sexual Reward; and Sociability. All subscales demonstrated good test-retest reliability and internal consistency. Each subscale also showed a distinct pattern of associations with external correlates measuring personality traits, attitudes and goals, thus demonstrating construct validity. Taken together, the findings suggest that the SRQ is a reliable, valid measure that can be used to assess individual differences in the value experienced from different social rewards. In addition, the SRQ can be used to assess whether social reward value differs between those with high and low levels of psychopathic traits (see Chapter 4).

## 3.2. Chapter Introduction

Social stimuli are typically rewarding. For example, viewing static images of smiling faces results in increased activation in the striatum, part of the brain's reward network (Rademacher et al., 2010; Spreckelmeyer et al., 2009). More complex social experiences, such as sharing with a friend or being liked, are also found to activate the brain's reward network and are subjectively rated as enjoyable (sharing: Fareri, Niznikiewicz, Lee, & Delgado, 2012; being liked: (Izuma et al., 2008). Indeed, an absence or reduction in the reward value of social relationships is often associated with psychopathology. For example, social anhedonia is associated with depression (Blanchard, Horan, & Brown, 2001; (Forbes, 2009) and a reduced responsiveness to some social rewards is seen in autism (Dawson, Meltzoff, Osterling, Rinaldi, & Brown, 1998; Zeeland et al., 2010). It is therefore well established that social interactions are a source of reward for typically developing individuals, and that atypical social reward processing can be associated with clinical disorder.

More broadly, research with other types of rewards has found that individual differences in responsiveness to reward stimuli are predictive of individual differences in behaviour towards those stimuli. For example, one study found that higher levels of trait reward sensitivity positively predicted overeating behaviour, which in turn predicted a higher Body Mass Index (Davis et al., 2007). Heightened sensitivity to reward has also been found to predict alcohol misuse (Loxton & Dawe, 2001). By extension, understanding individual differences in the value of different social rewards may provide a useful clue to typical and dysfunctional social behaviour.

However, experimental studies that measure social reward tend to use only one type of stimuli or experience to represent social reward. In general, the term *social reward* is used somewhat loosely across studies and typically denotes any social stimuli or interaction that participants appear to experience as rewarding/pleasurable. These issues preclude a fuller understanding of what social reward is and the range of social stimuli/experiences that elicit such reward (see General Introduction, Section 1.5.1).

One of the only existing attempts to catalogue different types of social rewards was made by Buss (1983), who defined a wide spectrum of social rewards from very basic (e.g. the presence of others) to more complex (e.g. the opportunity to self-disclose) and also predicted which personality traits may be associated with the value of different social rewards. Unfortunately, however, Buss's (1983) taxonomy of rewards was not empirically evaluated.

Empirically-driven categorisations of social goals may provide useful clues to the structure of social reward. Social goals can be defined as cognitive representations of desired social outcomes (McCollum, 2005) and one factor analysis study resulted in a seven-factor structure of social goals defined as follows: social responsibility and concern; social attractiveness; power; intimacy and interpersonal play; receiving assistance; belongingness; and giving (McCollum, 2005). Other studies have defined social goals in terms of the interpersonal circumplex (dominance, submissiveness, warmth and hostility; (Dryer & Horowitz, 1997; Hill, 1987), compared approach and avoidance goals (Gable, 2006) or based categorisations on video-taped observation of social interactions (Melnick & Hinshaw, 1996). These social goal categorisations are relevant to social reward, as goals are influenced by reward value (Elliot, 1999). However, these constructs are not equivalent to social reward, as measuring long-term goals does not necessarily measure the hedonic value of experiences (Ryan & Deci, 2001). For example, an individual could report a social goal to be fair to others, but does not necessary *enjoy* being fair. An outstanding challenge, therefore, is to identify and empirically evaluate a set of social rewards.

### *3.2.1. The current study*

The current study aimed to create a questionnaire that both categorises different types of social reward and measures individual differences in the degree to which each reward is valued. With regard to this thesis, the aim of developing this questionnaire was to create a measure of social reward value that, provided the measure was reliable and valid, could later be used to assess what individuals with differing levels of psychopathic traits find socially rewarding. Questionnaire items were generated after reviewing papers that either explicitly discussed social reward or that assessed related social constructs (e.g. social

goals). This initial questionnaire was completed by a first sample of participants. Exploratory factor analysis (EFA; Marsh et al., 2010) was used to identify the latent structure of the item set and to reduce its length, creating the Social Reward Questionnaire (SRQ). A second sample of participants then completed this refined questionnaire and a confirmatory factor analysis (CFA) was conducted to rigorously test the model generated via EFA. Participants in the second sample also completed a set of other questionnaires to assess the construct validity of the SRQ, and a subset of these participants completed the SRQ again 10 to 14 days later in order to assess test-retest reliability.

## 3.3. Materials and methods

### *3.3.1. Ethics statement*

All participants provided written informed consent and the study was approved by the University College London Clinical, Educational and Health Psychology Research Ethics committee.

### *3.3.2. Sample 1: Questionnaire development and exploratory factor analysis (EFA)*

As a starting point for item generation, theoretical and empirical literature discussing social reward and related constructs (e.g. social goals) were reviewed. The following conceptualisations and instruments were reviewed to identify a wide range of potential social rewards: Buss's (1983) theoretical taxonomy of social rewards, the Interpersonal Goal Inventory (Dryer & Horowitz, 1997), the resource theory of social exchange (Foa & Foa, 1980; Foa & Foa, 2012), approach and avoidance social motives and goals (Gable, 2006), social subscales of the Aspiration Index (Grouzet et al., 2005), the Interpersonal Orientation Scale (Hill, 1987), an adolescent Social Goals Questionnaire (Jarvinen & Nicholls, 1996), the Circumplex Scales of Interpersonal Values (Locke, 2000), McCollum's (2005) conceptualisation of social goals, a taxonomy of children's social goals (Melnick & Hinshaw, 1996), the Short Sadistic Impulse Scale (O'Meara et al., 2011) and social items from the Snaith-Hamilton Pleasure Scale (Snaith et al., 1995).

Following this process, nineteen potential types of social rewards were identified: affiliation/intimacy, aggression, being admired, being accepted/belonging, being sexually attractive, being socially responsible, competing with others, cruelty, dominance, having fun with others, instrumental gain, leadership, manipulation/coercion, nurturance/helping others, popularity, receiving assistance/care, sensation seeking with others, sexual reward and submissiveness. It is important to note that the aim of this stage was to generate a wide range of social rewards, without presuming that the types of rewards identified would correspond to the actual factor structure of social reward.

Questionnaire items were then created to reflect the content of this wide array of social rewards. To ensure that items examined the hedonic value of each reward, all of the items began with the phrase "I enjoy" (Snaith et al., 1995). For example, the reward value of fairness was assessed with the statement "I enjoy being fair". This phase generated a total of 123 items (five to nine items for each proposed type of social reward).

A panel of eight graduate-level psychology researchers with expertise in reward processing, social processing and/or social neuroscience were shown all 123 items grouped into the proposed types of social reward. Within each item group, the panel members were asked to score each item from 1 to 10 on how well it represented that proposed social reward (1=Very badly to 10=Very well). Each panel member worked independently. Within each group, the three to six items with the highest total scores were retained. The variance of the raters' scores for the retained items was low (mean SD=1.01), indicating that there was high agreement of the best items. This process resulted in a total of 75 items, and the order was then randomised to create the pilot questionnaire. The category *sensation seeking with others* was dropped altogether in response to concerns from the panel about the clarity of this category. See Appendix 3 for the list of 75 preliminary items.

A seven-point response scale (1=Strongly disagree to 7=Strongly agree) was chosen in order to sensitively capture differences in responses. Instructions were as follows: *"Here is a list of statements about what you enjoy when you interact with other people. The statements refer to all people in your life, e.g. friends, partners, family, colleagues or people you have just met. Consider how well each statement relates to you and indicate*

*your answer from 1 to 7. NOTE: If there is something you have never experienced, imagine how much you* would *enjoy it."*

*Participants*

Participants were recruited via Amazon's Mechanical Turk (MTurk; www.mturk.com), a crowd-sourcing website. MTurk is an international online platform that allows researchers to post tasks or questionnaires that participants complete in return for payment. MTurk is increasingly being used as a means of accessing experimental participants and conducting comprehensive surveys of general population samples (Buhrmester, Kwang, & Gosling, 2011; Mathieu, Hare, Jones, Babiak, & Neumann, 2013). In the current study, participants signed up via MTurk and were then directed to the online survey software LimeSurvey (www.limesurvey.org) to complete the questionnaire. The questionnaire took approximately 10 minutes to complete and participants were compensated $0.40 for their time.

The 75-item pilot questionnaire (see Appendix 3) was completed 320 times. Ten responses were removed because the same participant had completed the questionnaire twice (the second response was removed). A further five participants were excluded due to lack of variability in responses (e.g. one answered "Neither agree nor disagree" to 74 of the 75 items). This left a total of 305 participants in Sample 1.

Participants (151 females; 127 males; 27 undisclosed gender) were aged 18-70 years old (mean=33.9, SD=12.1). The highest completed education level of the sample was as follows: 38.4% Bachelor's degree, 19.0% College, 17.7% Postgraduate degree and 16.1% senior school (undisclosed for 8.9%).

*Data analysis procedure*

To explore the latent structure of the social reward item set, a series of EFAs were run using Mplus (Muthén & Muthén, 2012). Due to the ordinal nature of the items, the items were treated as polytomous and analysed using polychoric correlations via the mean and variance adjusted weighted least squares (WLSMV) estimation procedure (Muthén & Muthén, 2012). This analysis provided model fit statistics, which allowed the relative strengths of exploratory-derived factor solutions to be assessed without the need for

specifying the factor structure in advance (Marsh, Morin, Parker, & Kaur, 2014; Mora et al., 2011).

As recommended by Hu and Bentler (1999), we used a two-index strategy to assess model fit: the incremental Comparative Fit Index (CFI) and the Root Mean Square Error of Approximation (RMSEA), an absolute fit index. Hu and Bentler (1999) suggested that a CFI of .95 or higher and an RMSEA of .08 or lower were indicative of good model fit. However, these fit indices may be too strict and can be questioned in terms of both practical and substantive significance (Hopwood & Donnellan, 2010; Marsh, Hau, & Wen, 2004). We therefore adopted the traditional CFI of .90 or above and RMSEA of .08 or below (West, Taylor, & Wu, 2012) as indicative of acceptable model fit.

*Results from EFA*

There were no missing data, as the questionnaire was programmed in such a way that all items required a response. The EFA identified nine factors with an eigenvalue greater than 1.5, which suggested a nine-factor structure. The nine-factor solution was also the most parsimonious solution that was associated with good model fit (CFI=.96, RMSEA=.04). However, two factors were weak: one factor contained only two items, both of which crossloaded >.50 onto other factors; the other contained only three items, two of which crossloaded >.50 onto other factors. These two factors were dropped from the solution. A third factor had two items that loaded very strongly (>.80) and four weak items (i.e. they had a secondary loading that was >.40 and/or <.15 difference between the primary and secondary loading). The two strong items correlated very highly with each other (r=.83, p<.001), suggesting that this factor may be a very narrow construct. For this reason, this factor was also dropped from the solution. The remaining six factors all had at least three items with loadings >.46. These six factors were defined as follows: Admiration, Negative Social Potency, Passivity, Prosocial Interactions, Sexual Relationships and Sociability (see **Table 3.1**).

**Table 3.1. Description of factors identified via EFA**

| Name of factor | Description | Example item |
|---|---|---|
| Admiration | Being flattered, liked and gaining positive attention | *"I enjoy achieving recognition from others"* |
| Negative Social Potency | Being cruel, callous and using others for personal gains | *"I enjoy embarrassing others"* |
| Passivity | Giving others control and allowing them to make decisions | *"I enjoy following someone else's rules"* |
| Prosocial Interactions | Having kind, reciprocal relationships | *"I enjoy treating others fairly"* |
| Sexual Relationships | Having frequent sexual experiences | *"I enjoy having an active sex life"* |
| Sociability | Engaging in group interactions | *"I enjoy going to parties"* |

*Item reduction*

Several further steps were taken to reduce the length of the questionnaire (Worthington & Whittaker, 2006). All decisions were based on the results from the original EFA. Firstly, items that did not load strongly onto any of the six factors were removed (10 items; all loaded <.40 on all factors). Secondly, any item that crossloaded onto two or more factors was removed (12 items; all loaded >.40 on at least two factors). Finally, in order to create a succinct scale, only the best items from each factor were selected for retention (on the basis of meaningfully representing the factor, having the highest loading, and/or the lowest crossloading; Worthington & Whittaker, 2006). This resulted in a 23-item scale with six subscales; see Appendix 4.

To explore the strength of the proposed 23-item scale before collecting data from a new sample, a confirmatory factor analysis (CFA) was run with Sample 1 on the chosen 23 items. The model fit supported the proposed six-factor structure (CFI=.95, RMSEA=.06).

### *3.3.3. Sample 2: Confirmatory factor analysis (CFA) and construct validation*

Sample 2, the replication sample, was collected in the second phase to confirm the structure, validity and reliability of the 23-item SRQ. The replication sample (N=505) was adequate for testing a model consisting of 61 parameters (i.e. 23 factor loadings, 23 error variances, 15 factor correlations). Specifically, the 23-item model approximates an 8:1 subjects-to-parameters ratio, approaching the 10:1 ratio recommended by Bentler and Chou (1987). We note that Bentler and Chou (1987) suggested that this ratio could go as low as 5:1 if the items have good measurement characteristics. Given that the SRQ items were derived from established measures, it is reasonable to propose that they have robust statistical properties, and therefore the 8:1 ratio was deemed adequate for the replication CFA. The analyses that follow support this proposal.

Firstly, CFA was conducted on the 23-item SRQ. We again used the WLSMV estimation procedure as recommended for analysis of ordinal data (Muthén & Muthén, 2012). Secondly, participants in Sample 2 also completed a set of established questionnaires measuring personality traits, attitudes and goals to confirm the construct validity of the SRQ. Finally, a subset of participants from Sample 2 (N=45) completed the SRQ for a second time in order to measure test-retest reliability. All correlational analyses were Pearson zero-order correlations, conducted using IBM SPSS Statistics 20 for Windows.

*Participants*

Amazon's MTurk platform was used again to recruit 529 participants. Participants were excluded for providing obviously repetitive answers (N=5), or for completing the questionnaire battery twice (second attempt excluded; N=19). The final sample therefore consisted of 505 participants (270 males, 235 females) aged 18 to 79 years (mean 34.0, SD 12.2). The ethnicity of the sample was as follows: 72.3% White, 11.1% South Asian, 6.1% Black, 2.8% Hispanic, 2.0% East Asian and 5.7% Mixed/Other. The highest completed education level of the sample was as follows: 38.2% Bachelor's degree, 30.9% Senior/high school, 18.8% College, 12.1% Postgraduate degree. The questionnaires took approximately 10 minutes to complete and participants were paid $0.40 for their time.

*Measures*

In addition to the SRQ, participants completed the following questionnaires for the purposes of construct validity:

**Dirty Dozen (Jonason & Webster, 2010):** This is a 12-item scale with three subscales, each measuring one component of the 'Dark Triad' of non-clinical, socially aversive personality traits, which the authors name Machiavellianism, narcissism and psychopathy (Delroy L. Paulhus & Williams, 2002). Respondents are asked to indicate how much they agree with each item on a 1 to 5 scale (1=Not at all, 5=Very much). We included this questionnaire as it provides a brief but broad overview of socially problematic personality traits that will be useful for validating the Social Reward Questionnaire. We hypothesised that SRQ Negative Social Potency would be positively associated with all Dark Triad subscales and SRQ Prosocial would be negatively associated with them. We also hypothesised that SRQ Admiration would be positively associated with narcissism.

**Interpersonal Goal Inventory (Dryer & Horowitz, 1997):** This is a 32-item questionnaire that measures the importance of different interpersonal goals. It consists of eight subscales that reflect the four extremes of the interpersonal circumplex (e.g. Wiggins, 1979): Dominance, Submissiveness, Friendliness and Hostility, and the octants between them (Dominant/friendly, Dominant/hostile, Submissive/friendly, Submissive/hostile). Each item begins "It would be important for me to…" and responses are given on a 0 to 4 scale (0=No, definitely not, 4=Yes, definitely). We hypothesised that SRQ Passivity would be positively correlated with Submissiveness and negatively correlated with Dominance. We also hypothesised that SRQ Prosocial would be positively associated with Friendliness. Finally, we hypothesised that SRQ Negative Social Potency would be positively associated with Hostility.[3]

**Ten-Item Personality Inventory (Gosling, Rentfrow, & Swann, 2003):** This is a 10-item scale that measures the "Big Five" personality traits (agreeableness,

[3] In the current study, we analysed only the subscales representing the extremes of the circumplex (Dominance, Submissiveness, Friendliness and Hostility) and not those representing the octants between them. This was for purposes of clarity and simplicity).

conscientiousness, extraversion, neuroticism and openness to experience; e.g. Costa & McCrae, 1992). All items begin "I see myself as" and are followed by two descriptive items such as "Anxious, easily upset". Responses are given on a 1 to 7 scale (1=Disagree strongly, 7=Agree strongly). We hypothesised that SRQ Prosocial would be positively associated with agreeableness and conscientiousness. We also hypothesised that SRQ Negative Social Potency would be negatively correlated with these traits. Finally, we hypothesised that SRQ Sociability would be positively correlated with extraversion.

**Revised Sociosexual Orientation Inventory (Penke & Asendorpf, 2008):** This is a nine-item scale with subscales indicating three aspects of sexual promiscuity: behaviour, attitude and desire. Responses are given on nine-point scales. We hypothesised that SRQ Sexual Relationships would be positively correlated with all three subscales.

## 3.4. Results

There were no missing data. The six-factor model developed from Sample 1 achieved good fit using the data from the replication sample, Sample 2 ($\chi^2(215)=747.77$, $p<.001$; CFI=.96; RMSEA=0.07, 90% CI=.07-.08). Factor loadings were in the range .62 to .92 (mean=.79, SD=.08) and are shown in **Table 3.2**.

**Table 3.2. Standardised factor loadings from the six-factor CFA**

| Factor | Loading | Item number |
|---|---|---|
| Admiration | .82 | 1 |
| | .69 | 7 |
| | .80 | 11 |
| | .76 | 18 |
| Negative Social Potency | .80 | 3 |
| | .77 | 5 |
| | .85 | 8 |
| | .85 | 14 |
| | .92 | 17 |
| Passivity | .79 | 12 |
| | .62 | 21 |
| | .90 | 23 |
| Prosocial Interactions | .81 | 2 |
| | .72 | 6 |
| | .74 | 16 |
| | .76 | 19 |
| | .84 | 22 |
| Sexual Relationships | .90 | 9 |
| | .78 | 13 |
| | .86 | 20 |
| Sociability | .71 | 4 |
| | .62 | 10 |
| | .90 | 15 |

### *3.4.1. Reliability*

Correlations, Cronbach alphas and mean inter-item correlations (MICs) of manifest subscale scores are shown in **Table 3.3**. Cronbach alphas for all subscales were good and demonstrate that they are internally consistent (mean=.82, SD=.04; range=.77-.87). With regard to scale homogeneity, the MICs were acceptable (mean=.56, SD=.05; range=.51-.65) for subscales measuring relatively narrow constructs (Clark & Watson, 1995), as was

our intention. This further suggests that the items reflect unidimensional measures of their respective subscales.

**Table 3.3. Correlations, descriptives (mean and SD), Cronbach alphas and mean inter-item correlations (MIC) for manifest factor totals in Sample 2 (N=505)**

| | 1 | 2 | 3 | 4 | 5 | 6 | Mean$^{+}$ (SD) | MIC |
|---|---|---|---|---|---|---|---|---|
| 1. Admiration | *.82* | | | | | | 5.09 (1.14) | .53 |
| 2. Neg Soc Pot | -.03 | *.87* | | | | | 2.04 (1.09) | .58 |
| 3. Passivity | -.02 | **.32**** | *.78* | | | | 3.13 (1.27) | .54 |
| 4. Prosocial | **.35**** | **-.56**** | **-.09*** | *.84* | | | 5.98 (.85) | .51 |
| 5. Sexual | **.34**** | .00 | -.01 | **.22**** | *.84* | | 5.06 (1.53) | .65 |
| 6. Sociability | **.53**** | .02 | .03 | **.25**** | **.32**** | *.77* | 4.61 (1.39) | .53 |

Only factor correlations with p<.05 are shown; **p<.01, *p<.05
Cronbach alphas appear on the diagonal
$^{+}$Mean item score in each factor

### *3.4.2. Test-retest reliability*

In order to measure test-retest reliability of the SRQ, 45 participants from Sample 2 completed the SRQ twice. (Participants who had most recently taken part (N=100) were invited to complete the questionnaire a second time for a small fee; 45 participants responded). The time between the two testing points ranged from 10 to 14 days (mean=12.0, SD=1.3).

Pearson correlations between each subscale at the two time points were good (mean=.80, SD=.06, all p<.001; see **Table 3.4**). This indicates the stability of questionnaire responses across time.

**Table 3.4. Test-retest reliability: Pearson correlations between factor subtotal scores at Time 1 and Time 2 (mean time interval = 12 days)**

| Subscale | Correlations between SRQ subscales at Time 1 & Time 2 |
|---|---|
| Admiration | .69 |
| Negative Social Potency | .88 |
| Passivity | .83 |
| Prosocial Interactions | .78 |
| Sexual Relationships | .82 |
| Sociability | .78 |

All p<.001

### *3.4.3. Construct validity*

Pearson correlational analyses were used to explore the pattern of associations between the six SRQ subscales and other related measures. Benjamini and Hochberg False Discovery Rate (Benjamini & Hochberg, 1995) was used to control for the probability of making a Type I error on multiple comparisons, and corrected p-values are presented in **Table 3.5**.

The subscales of the SRQ showed expected associations with the external correlates, providing evidence that each subscale is measuring a relatively distinct social reward. SRQ Admiration was positively correlated with narcissism, the attitude and desire subscales of sociosexual orientation, extraversion, and openness. SRQ Negative Social Potency was positively associated with all three Dark Triad traits, hostility, sexual behaviour and desire, and openness. SRQ Passivity was positively correlated with submissiveness, Machiavellianism, and psychopathy, and negatively associated with dominance, conscientiousness, emotionality and openness. SRQ Prosocial Interactions was positively associated with dominance, friendliness and all personality subscales, and negatively associated with all Dark Triad traits, hostility, and sexual desire. SRQ Sexual Relationships was positively associated with Machiavellianism, narcissism, all sociosexual orientation subscales, extraversion and openness. Finally, SRQ Sociability

was positively correlated with narcissism, dominance, friendliness, all sociosexual orientation subscales and all personality subscales except conscientiousness.

**Table 3.5. Pearson correlations between SRQ subscales and external measures**

| | *SRQ subscale* | | | | | |
|---|---|---|---|---|---|---|
| | **Admiration** | **Negative Social Potency** | **Passivity** | **Prosocial Interactions** | **Sexual Relationships** | **Sociability** |
| **Dark Triad** | | | | | | |
| Machiavellianism | .05 | **.62**** | **.12*** | **-.34**** | **.11*** | .08 |
| Narcissism | **.42**** | **.31**** | .07 | **-.10*** | **.16**** | **.32**** |
| Psychopathy | -.04 | **.59**** | **.13*** | **-.41**** | .08 | -.07 |
| **Interpersonal goals** | | | | | | |
| Dominance | **.32**** | **-.24**** | **-.25**** | **.44**** | **.23**** | **.19**** |
| Friendliness | **.16**** | **-.41**** | -.03 | **.52**** | **.16**** | **.15**** |
| Hostility | **.20**** | **.31**** | -.05 | **-.19**** | -.04 | .04 |
| Submissiveness | .05 | **-.20**** | **.12*** | **.28**** | .03 | -.04 |
| **Sociosexual orientation** | | | | | | |
| Attitude | **.16**** | .07 | -.06 | -.01 | **.53**** | **.22**** |
| Behaviour | .05 | **.16**** | -.05 | -.08 | **.33**** | **.24**** |
| Desire | **.11*** | **.26**** | .02 | **-.11*** | **.47**** | **.13**** |
| **Personality** | | | | | | |
| Agreeableness | .05 | **-.48**** | -.02 | **.44**** | .00 | **.10*** |
| Conscientiousness | .08 | **-.39**** | **-.15*** | **.34**** | .02 | .04 |
| Emotionality | .05 | **-.19**** | **-.19**** | **.15**** | .06 | **.17**** |
| Extraversion | **.19**** | -.03 | -.09 | **.13**** | **.11*** | **.37**** |
| Openness | **.29**** | **.19**** | **-.14**** | **.33**** | **.28**** | **.28**** |

Correlations of $p<.05$ after correcting for multiple comparisons are in bold
*$p<.05$ **$p<.01$

## 3.5. Discussion

The 23-item Social Reward Questionnaire (SRQ) is a comprehensive measure of individual differences in the value of social rewards. Using EFA and CFA, we identified six subscales of the SRQ that equate to six social reward domains: Admiration; Negative Social Potency; Passivity; Prosocial Interactions; Sexual Relationships; and Sociability.

The results indicate that the SRQ has a clear factor structure and strong psychometric properties.

Different subscales of the SRQ showed distinct associations with external correlates, which provides support for the meaning of each scale and suggests that the subscales capture different aspects of social reward. Discussion of every association between the different subscales and external correlates is beyond the scope of this paper, but here we highlight some key findings. For example, SRQ Admiration was positively correlated with narcissism, a cluster of traits defined by self-love (D. N. Jones & Paulhus, 2010). SRQ Negative Social Potency was positively correlated with all Dark Triad traits and negatively correlated with friendliness, agreeableness and conscientiousness, suggesting this subscale does indeed capture enjoyment of callous and inconsiderate behaviour towards others. SRQ Prosocial Interactions showed the mirror opposite pattern of associations to SRQ Negative Social Potency, although it is important to note that the association between these two factors, while moderately strong ($r=-.56$, $p<.001$), does not indicate that they are two extremes of the same concept. SRQ Passivity was positively associated with submissiveness and negatively associated with dominance as predicted, but was unexpectedly positively correlated with narcissism and psychopathy and negatively with conscientiousness, emotionality and openness. We are not entirely sure how to interpret these associations, but it may be that SRQ Passivity does not measure the enjoyment of mere submissiveness but rather a social laziness, a desire to be a 'free rider' and let others do the work. Finally, SRQ Sexual Relationships showed the expected correlations with sociosexual orientation, and SRQ Sociability was correlated with extraversion as expected.

This pattern of associations with external correlates suggests the utility of the SRQ in understanding certain social behaviours. For example, the positive correlation between SRQ Negative Social Potency and all Dark Triad traits could provide an overlooked clue as to why people behave cruelly towards others: they enjoy it. Sadism is primarily the enjoyment of seeing others in physical pain (O'Meara et al., 2011), but pleasure from others' *psychological* pain, as measured by SRQ Negative Social Potency, could be a significant adjunct to this. This is an important avenue to explore when trying to understand antisocial behaviour. In general, the relationship between social reward, personality and social behaviour needs to be explored in future research and it may be

fruitful to extend these investigations beyond normative individual differences to include clinical samples. As alluded to in the Introduction, many clinical conditions such as depression and autism may be characterised by atypical processing of social rewards, but the range of social rewards that have been explored in relation to these conditions has typically been limited. Knowing more about what these individuals may find rewarding, as well as knowing what they do not, could be helpful in devising more targeted intervention strategies. There may also be interest in exploring gender or ethnicity differences in relation to social reward.

Beyond understanding individual differences in typical populations, we suggest that the SRQ may have clinical relevance. For example, a diminished experience of reward, including from social relationships, is symptomatic of depression (Blanchard et al., 2001). Secondly, individuals with autistic spectrum disorders (ASD) experience lower levels of reward from social stimuli and this may be a key feature of the condition (Social Motivation Hypothesis; Dawson et al., 1998; Zeeland et al., 2010). It would be important to accurately delineate the profile of attenuated and preserved social reward across these conditions. The SRQ may be helpful in this regard, but as a self-report measure should be interpreted with caution in individuals with ASD, given the known difficulties with introspection in this group (e.g. Lombardo et al., 2010).

Atypical social reward may also be relevant in a number of personality disorders, as indicated by associations in the current study between the SRQ subscales and the Dirty Dozen scales named Machiavellianism, narcissism and psychopathy. Of particular importance, this study indicates that high levels of socially undesirable personality traits may be associated with reduced reward value of positive, prosocial interactions and increased reward value of negative, antisocial interactions. However, the Dirty Dozen subscales each contains only four items and are unidimensional. Of particular relevance to this thesis, further research using a more comprehensive and standard measure of psychopathic traits is necessary to understand fully how different dimensions of psychopathy are associated with social reward.

### *3.5.1. Limitations*

It is important to note limitations of the SRQ. Firstly, social reward is a complex construct; as a questionnaire, the SRQ will entail a degree of simplification that may obscure more nuanced aspects of the phenomenon. Secondly, this is the first study to empirically explore the underlying structure of social reward. It will be important for future studies to replicate the factor structure in other samples, and also to replicate the test-retest reliability with larger samples (Watson, 2004). Finally, there may be other aspects of social reward that are not explored with the SRQ, and which have yet to be accurately identified in the existing literature. However, the SRQ provides a promising basis to further empirically assess individual differences in social reward and their association with psychopathology such as psychopathic traits.

It is also worth emphasizing that the SRQ assesses reward value of six relatively distinct social reward types. That is, the SRQ does not measure an overall reward value of social contact in general. To check this, a CFA was run to assess whether a one-factor model would fit the data well (i.e., whether there was one simpler latent construct of general social reward value). However, this one-factor model achieved poor model fit. This may be due to the very different types of social reward being assessed in the SRQ items (particularly the opposing dimension of Prosocial Interactions – enjoyment of being kind, and Negative Social Potency – enjoyment of being cruel). Therefore, the SRQ cannot be used to measure an overall social reward value. A possible future research direction would be to develop an instrument that does assess this more general social motivation.

### *3.5.2. Conclusion*

The Social Reward Questionnaire (SRQ) is the first measure of individual differences in the value of different types of social rewards. Using EFA and CFA, six social rewards were identified in the current study: Admiration, Negative Social Potency; Passivity; Prosocial Interactions; Sexual Relationships; and Sociability. These six social rewards were found to be robustly and differentially associated with a variety of self-reported personality traits, attitudes and goals. We propose that the SRQ is a valid, reliable measure that has value in the study of social reward.

# Chapter 4: Associations between psychopathic traits and self-report and experimental measures of social reward

## 4.1. Abstract

Individuals with high levels of psychopathic traits tend to undervalue long-term, affiliative relationships, but it remains unclear what motivates them to engage in social interactions at all. Their experience of social reward may provide an important clue. In Study 1 of this chapter, a large sample of participants (N=505) completed a measure of psychopathic traits (Self-Report Psychopathy Scale Short-Form) and a measure of social reward value (Social Reward Questionnaire) to explore what aspects of social reward are associated with psychopathic traits. In Study 2 (N=110), the same measures were administered to a new group of participants along with two experimental tasks investigating monetary and social reward value. Psychopathic traits were found to be positively correlated with the enjoyment of callous treatment of others and negatively associated with the enjoyment of positive social interactions. This indicates a pattern of 'inverted' social reward in which being cruel is enjoyable and being kind is not. Interpersonal psychopathic traits were also positively associated with the difference between mean reaction times (RTs) in the monetary and social experimental reward tasks; individuals with high levels of these traits responded comparatively faster to social than monetary reward. I speculate that this may be because social approval/admiration has particular value for these individuals, who have a tendency to use and manipulate others. Together, these studies provide evidence that the self-serving and cruel social behaviour seen in psychopathy may in part be explained by what these individuals find rewarding.

## 4.2. Chapter Introduction

As described in the General Introduction, psychopathy is a personality disorder characterised by lack of empathy, shallow affect and callous treatment of other people, as well as impulsivity and a greater propensity towards criminal behaviour (Hare, 2003). Psychopathic traits are continuously distributed in the population and can be reliably measured in community samples (Mahmut, Menictas, Stevenson, & Homewood, 2011; Neumann & Hare, 2008).

Findings from Chapters 2 and 3 of this thesis suggest that psychopathic traits may be associated with an atypical experience of social reward, which can be defined as the motivational and pleasurable aspects of interactions with other people. In Chapter 2, we found that Factor 1 (Affective/Interpersonal) psychopathic traits were negatively associated with the tendency to form long-lasting, meaningful friendships and with goals relating to affiliation and community. This suggests that prosocial interactions and relationships may have less reward value to individuals with high levels of psychopathic traits. However, this is speculative, as we did not directly assess social reward value. In Chapter 3, we assessed associations between a systematic measure of social reward, the Social Reward Questionnaire (SRQ) and socially aversive personality traits as quantified by the brief Dirty Dozen measure (Jonason & Webster, 2010). We found that all three subscales (named Machiavellianism, narcissism and psychopathy) were negatively associated with enjoyment of prosocial interactions and positively associated with enjoyment of callous, antisocial interactions (Foulkes, Viding, McCrory, & Neumann, 2014; see Chapter 3). However, this four-item measure of psychopathy is unidimensional, so it remains unclear how different aspects of psychopathic personality are associated with dimensions of social reward.

Findings from Chapters 2 and 3 are in line with other evidence suggesting that psychopathic traits may be associated with an atypical experience of social reward (Baird, 2002; Curry, Chesters, & Viding, 2011; Mokros et al., 2008; White, 2014; see General Introduction, Section 1.6). For example, individuals with high levels of psychopathic traits do not place equal importance on affiliative, long-term friendships and relationships (Baird, 2002). Instead they favour friends who can increase their access to sexual mates

or provide protection (Jonason & Schmitt, 2011) and prefer one-night stands to committed relationships (Jonason et al., 2012). In addition, evidence from experimental tasks shows that individuals with high levels of psychopathic traits are less likely to cooperate with and help others (Curry et al., 2011; Mokros et al., 2008; Rilling et al., 2007; White, 2014). Together with the finding from Chapters 2 and 3, this evidence suggests that individuals with high levels of psychopathic traits may not find affiliative and prosocial behaviour towards others rewarding. This is in stark contrast to typical individuals, for whom interpersonal kindness and closeness is a fundamental social reward (Buss, 1983; Esch & Stefano, 2005; Foa & Foa, 1980).

The positive association found in Chapter 3 between the socially aversive Dirty Dozen personality traits and the enjoyment of cruel social behaviour fits with existing evidence about what individuals with high levels of psychopathic traits might find socially rewarding. Specifically, psychopathic traits are associated with enjoyment of antisocial entertainment such as violent sports and video games (Williams et al., 2001) and internet 'trolling' - online antisocial behaviour (Buckels et al., 2014). Together, this evidence suggests individuals with high levels of psychopathic traits not only lack empathy towards others' distress (Lockwood, Bird, Bridge, & Viding, 2013; Seara-Cardoso, Neumann, Roiser, McCrory, & Viding, 2012), but may actually take pleasure from it. Thus individuals with high levels of psychopathic traits appear to show an unusual pattern of social reward: decreased reward value of prosocial and affiliative interactions (Baird, 2002; Foulkes, Seara-Cardoso, Neumann, Rogers, & Viding, 2014), and increased reward value of cruelty towards others (Buckels et al., 2014; Williams, Spidel, & Paulhus, 2001).

However, the measure of socially problematic personality traits used in Chapter 3 (Dirty Dozen; Jonason & Webster, 2010) is brief and unidimensional, and does not constitute a comprehensive measure of psychopathic traits (Miller et al., 2012). As such, it is currently unclear how different aspects of psychopathic personality are associated with social reward. There remains a need to systematically explore associations between the value of different social rewards and a comprehensive, well-validated measure of psychopathic traits.

There is an equal need to employ experimental measures that can more sensitively assess the experience of social reward in relation to psychopathic traits. Such measures have the

potential to overcome several of the limitations inherent in using self-report questionnaires, including the ability and/or willingness of participants to reflect on and state their personality traits. Some research has assessed responsiveness to *monetary* reward in relation to psychopathic traits, and found that individuals with high levels of these traits may be hyperresponsive to this type of reward (Bjork, Chen, & Hommer, 2012; Buckholtz et al., 2010). Although the last decade has seen a surge in the number of studies using experimental paradigms to measure social reward (e.g. Izuma, Saito, & Sadato, 2010; Kohls et al., 2013), to our knowledge these paradigms have not yet been used in association with a measure of psychopathic traits.

### *4.2.1. The current study*

In the current paper, we report two studies that explore the relationship between psychopathic traits and social reward. In the first study, we aimed to assess the association between dimensions of psychopathic traits, measured by the well-validated Self-Report Psychopathy Scale (SRP; Paulhus, Neumann, & Hare, 2015) and the value of different social rewards, measured by the Social Reward Questionnaire developed and validated in Chapter 3 (Foulkes, Viding, McCrory, & Neumann, 2014). In the second study, we again measured psychopathic traits with the SRP and also employed an experimental measure of social reward to investigate its association with psychopathic traits (Study 2).

## 4.3. Study 1

### *4.3.1. Introduction*

In Study 1, our aim was to explore associations between psychopathic traits and the value of different social rewards, in order to elucidate some of the processes that may motivate the unpleasant interpersonal behaviour seen in individuals with high levels of these traits. To do this, we explored associations between psychopathic traits, as measured by the Self-Report Psychopathy Scale Short-Form (SRP-SF; Paulhus et al., 2015), and the value of different types of social reward, as measured by the Social Reward Questionnaire (SRQ; Foulkes, Viding, McCrory, & Neumann, 2014; see Chapter 3).

The SRP-SF measures four dimensions of psychopathy: Affective (e.g. lack of empathy), Interpersonal (e.g. manipulativeness), Lifestyle (e.g. impulsivity) and Antisocial (e.g. aggressive or unlawful behaviour). We decided to use the four-factor model of psychopathy here, rather than the two-factor model used in Chapter 2 (Foulkes, Seara-Cardoso, Neumann, Rogers, & Viding, 2014), in order to assess the associations between psychopathic traits and social reward in as much detail as possible. In addition, we decided to use zero order correlations to assess associations with social reward, rather than partial out shared variance with other psychopathy dimensions as in Chapter 2. This is because there is some concern about how to interpret findings when shared variance between the variable of interest and a correlated variable (in this case, different dimensions of psychopathic traits) has been removed (Lynam, Hoyle, & Newman, 2006). In particular, we were concerned about how to interpret what the variable of interest actually represented once shared variance had been removed, and in turn, how to interpret any associations with external variables (Lynam et al., 2006). In addition, since we were particularly interested in the nuances afforded by studying the four facets of psychopathy separately, it was unclear which facets it would be appropriate to control for in this type of analysis. For these reasons, we decided to analysis the four facets of psychopathic traits separately in this analysis, without controlling for shared variance with other psychopathy scores.

The SRQ quantifies the enjoyment of six types of social reward: Admiration (being flattered and gaining attention), Negative Social Potency (being cruel and callous), Passivity (allowing others control), Prosocial Interactions (being kind and fair), Sexual Relationships (frequent sexual encounters) and Sociability (frequent socialising). We hypothesised that psychopathic traits would be positively associated with Negative Social Potency and negatively associated with Prosocial Interactions. In addition, we hypothesised that psychopathic traits would be positively associated with Sexual Relationships, due to the high rates of affairs and short-term relationships reported in this group (Harris, Rice, Hilton, Lalumiere, & Quinsey, 2007; Williams, Spidel, & Paulhus, 2005). Finally, we predicted that psychopathic traits would be positively associated with enjoyment of Admiration, due to the elevated levels of narcissism seen in individuals with high levels of psychopathic traits (Paulhus & Williams, 2002). We made no specific hypotheses regarding which dimensions of psychopathy would show these associations.

Associations between psychopathic traits and other types of social reward were exploratory.

### *4.3.2. Materials and methods*

Data for this study were collected as part of a wider battery of measures that have been partly reported in Chapter 3 (Foulkes, Viding, McCrory, & Neumann, 2014).

*Ethics Statement*

All participants provided written informed consent and the study was approved by the University College London Clinical, Educational and Health Psychology Research Ethics committee.

*Participants*

Amazon's Mechanical Turk platform (MTurk) was used to recruit participants. MTurk is an international crowdsourcing website on which participants complete tasks or questionnaires for payment, and is increasingly being used as a source of valid and reliable data (Buhrmester et al., 2011).

The questionnaires were completed 529 times. Participants were excluded for providing obviously repetitive answers (i.e. giving the same answer to all questions in at least three of the six questionnaires in the original battery; N=5) or for completing the questionnaire battery twice (second attempt excluded; N=19). This left a final sample of 505 participants (270 males, 235 females) aged 18 to 79 years (mean=34.0, SD=12.2). The majority of respondents lived in the USA (N=457); other respondents lived in India (N=35), Canada (N=6), the UK (N=6) or another European country (N=1). The ethnicity of the sample was as follows: 72.3% White, 11.1% South Asian, 6.1% Black, 2.8% Hispanic, 2.0% East Asian and 5.7% Mixed/Other. The highest completed education level of the sample was as follows: 38.2% Bachelor's degree, 30.9% Senior/high school, 18.8% College, 12.1% Postgraduate degree.

*Measures*

**Psychopathic traits:** these were measured with the Self-Report Psychopathy Scale Short Form (SRP-SF; Paulhus, Neumann, & Hare, 2015), a well-validated instrument modelled

on the Psychopathy Checklist Revised (PCL-R; Hare, 2003). The SRP-SF contains 28 items that participants rate on a 5-point Likert scale (1=Strongly disagree to 5=Strongly agree). The SRP-SF yields scores for four dimensions of psychopathy: Affective (e.g. lack of empathy), Interpersonal (e.g. manipulativeness), Lifestyle (e.g. impulsive) and Antisocial (e.g. harmful and potentially criminal behaviour). There are seven items for each of the four dimensions, which can be summed to form a total psychopathy score. We chose to use the SRP-SF rather than the original SRP as it takes less time to complete, whilst still retaining strong psychometric properties (Paulhus, Neumann, & Hare, 2015).

The SRP-SF and the SRP on which it is based both have good basic psychometrics, as well as theoretically sound and mathematically strong latent structures (Carré, Hyde, Neumann, Viding, & Hariri, 2013; Foulkes, Seara-Cardoso, Neumann, Rogers, & Viding, 2014; Lynam et al., 2011; Mahmut, Menictas, Stevenson, & Homewood, 2011; Neal & Sellbom, 2012; Neumann & Pardini, 2014; Seara-Cardoso, Neumann, Roiser, McCrory, & Viding, 2012; Williams, Paulhus, & Hare, 2007). There is good evidence for convergent validity between the SRP/SRP-SF and other measures of psychopathic traits. For example, both measures are strongly positively correlated with the PCL-R and also have the same four-factor structure (24), and three factors of the SRP-SF (Interpersonal, Affective, Lifestyle) are strongly correlated with the three factors of the Youth Psychopathic Traits Inventory (Grandiose/Manipulative, Callous/Unemotional, Impulsive/Irresponsible; Neumann & Pardini, 2014). Finally, SRP subscales are strongly correlated with expected subscales of the Elemental Psychopathy Assessment, a measure of psychopathic traits based on the five-factor model of personality (EPA; e.g. SRP Interpersonal is strongly correlated with EPA Manipulation and Self-Centeredness (Lynam et al., 2011).

Across a wide diversity of samples, the SRP traits are associated in the expected theoretical directions with relevant external correlates, such as criminal offences and externalizing psychopathology (Fite, Raine, Stouthamer-Loeber, Loeber, & Pardini, 2009; Nathanson, Paulhus, & Williams, 2006; Neumann & Pardini, 2014; Vitacco, Neumann, & Pardini, 2014; Wilson, Miller, Zeichner, Lynam, & Widiger, 2011), moral reasoning (Seara-Cardoso, Neumann, Roiser, McCrory, & Viding, 2012), amygdala activation to fearful faces (Carré, Hyde, Neumann, Viding, & Hariri, 2013), and lower amygdala volume (D. A. Pardini, Raine, Erickson, & Loeber, 2014). The construct

validity of both the SRP and SRP-SF are further supported by studies demonstrating theoretically meaningful associations with related personality measures (Neal & Sellbom, 2012; Williams, Paulhus, & Hare, 2007), as well as cognitive functioning (Mahmut, Menictas, Stevenson, & Homewood, 2011), social information processing (Lockwood, Bird, Bridge, & Viding, 2013), and social functioning (Foulkes, Seara-Cardoso, et al., 2014). Based on the use of a mega world-sample (30k+), latent variable model-based research with the SRP has shown it to be invariant across sex, and the SRP factors were associated with world regional data such as Gross Domestic Product (GDP), fertility, and infant mortality (Neumann et al., 2012). In the current sample, Cronbach's Alpha scores indicated acceptable to good reliability (mean=.76, SD=.10; Affective=.76, Interpersonal=.86, Lifestyle=.80, Antisocial=.61).

**Social reward:** the Social Reward Questionnaire (SRQ; Foulkes, Viding, et al., 2014; Chapter 3) is a 23-item scale used to measure individual differences in the value of social rewards. Each item begins "I enjoy" and then describes a different type of social interaction. Participants are asked to consider the item in relation to all their social interactions, e.g. friends, partners, family, colleagues or people they have just met. Responses are given on a 1 to 7 scale (1=Disagree strongly, 7=Agree strongly). The SRQ consists of six subscales, each representing a domain of social reward: Admiration, Negative Social Potency, Passivity, Prosocial Interactions, Sexual Relationships and Sociability (see **Table 3.1**). In the current sample, Cronbach's Alpha scores indicated good reliability (mean=.82, SD=.04; Admiration=.82, Negative Social Potency=.87, Passivity=.78, Prosocial=.84, Sexual=.84, Sociability=.77).

*Data analysis procedure*

Pearson and Spearman correlational analyses (as appropriate depending on the normality of the bivariate residuals) were conducted using IBM SPSS Statistics 20.0 for Windows. Scores for the four psychopathy factors and the total psychopathy score were correlated with all SRQ subscales using zero-order correlations. Benjamini and Hochberg False Discovery Rate (Benjamini & Hochberg, 1995) was used to control for the probability of making a Type I error on multiple comparisons, and only corrected p-values are presented. There were no missing data, as the questionnaire was programmed in such a way that all items required a response.

### *4.3.3. Results*

Descriptives for SRQ and SRP-SF scores are shown in **Table 4.1**. Results from the correlational analyses are shown in **Table 4.2**. All psychopathy scores were positively associated with the Negative Social Potency subscale of the SRQ and negatively associated with the Prosocial Interactions subscale. All psychopathy scores except the Antisocial factor were positively associated with Sexual Relationships, and all except the Affective factor were positively associated with Passivity. Finally, Lifestyle psychopathic traits were positively associated with Sociability, and Interpersonal psychopathic traits were positively associated with Admiration.

**Table 4.1. Descriptives for Study 1 (N = 505)**

| | **Minimum** | **Maximum** | **Mean (SD)** |
|---|---|---|---|
| ***SRQ subscale*** | | | |
| Admiration | 1.00 | 7.00 | 5.09 (1.14) |
| Negative Social Potency | 1.00 | 6.00 | 2.04 (1.09) |
| Passivity | 1.00 | 7.00 | 3.13 (1.27) |
| Prosocial Interactions | 2.60 | 7.00 | 5.98 (0.85) |
| Sexual Relationships | 1.00 | 7.00 | 5.06 (1.53) |
| Sociability | 1.00 | 7.00 | 4.61 (1.39) |
| ***SRP subscale*** | | | |
| Affective | 7.00 | 30.00 | 14.21 (5.10) |
| Interpersonal | 7.00 | 33.00 | 14.01 (5.59) |
| Lifestyle | 7.00 | 35.00 | 15.13 (5.31) |
| Antisocial | 7.00 | 31.00 | 10.60 (4.34) |
| ***SRP Total*** | 28.00 | 122.00 | 53.96 (17.61) |

**Table 4.2. Correlations between SRP and SRQ scores in Study 1 (N=505)**

| | SRP subscale | | | | SRP Total[a] |
|---|---|---|---|---|---|
| | **Affective[a]** | **Interpersonal[a]** | **Lifestyle[a]** | **Antisocial[b]** | |
| ***SRQ subscale*** | | | | | |
| Admiration | .01 | .10* | .07 | -.06 | .05 |
| Negative Social Potency | .63** | .65** | .50** | .60** | .70** |
| Passivity | .08 | .12* | .11* | .13** | .14** |
| Prosocial Interactions | -.43** | -.39** | -.27** | -.45** | -.45** |
| Sexual Relationships | .15** | .14** | .34** | .05 | .20** |
| Sociability | .00 | .07 | .15** | .07 | .08 |

[a]Zero order Pearson correlations are reported
[b]Zero order Spearman correlations are reported
Corrected p values are shown. *p<.05, **p<.01

*Post-hoc analyses*

Previous evidence has shown that age and gender can affect both reward processing (age: Rademacher, Salama, Gründer, & Spreckelmeyer, 2013; gender: Spreckelmeyer et al., 2009) and level of psychopathic traits (age: Harpur & Hare, 1994; gender: Forth, Brown, Hart, & Hare, 1996). We therefore conducted post-hoc analyses to explore possible effects of age and gender on the associations between psychopathic traits and social reward (see **Table 4.3**, **Table 4.4** and **Table 4.5**).

*Age*

We re-ran the correlations between the two measures as partial correlations, controlling for age (see **Table 4.3**). When age is controlled, the following associations are no longer significant: Admiration and Interpersonal psychopathic traits (r=.06, adjusted p=.24) and Passivity and Lifestyle psychopathic traits (r=.09, adjusted p=.07), and the association between Admiration and Antisocial psychopathic traits becomes significant (r=-.10, adjusted p<.05). However, the pattern of associations largely remained the same.

**Table 4.3. Descriptives for SRQ and SRP scores in Study 2 (N = 505), controlling for age**

| | SRP-SF subscale | | | | SRP-SF |
|---|---|---|---|---|---|
| | **Affective[a]** | **Interpersonal[a]** | **Lifestyle[a]** | **Antisocial[b]** | **Total[a]** |
| *SRQ subscale* | | | | | |
| Admiration | -.03 | .06^ | .03 | -.10*+ | -.00 |
| Negative Social Potency | .61** | .63** | .47** | .58** | .69** |
| Passivity | .06 | .10* | .09^ | .10* | .12** |
| Prosocial Interactions | -.42** | -.39** | -.26** | -.45** | -.45** |
| Sexual Relationships | .12** | .12** | .32** | .04 | .17** |
| Sociability | -.04 | .04 | .12** | .05 | .05 |

[a]Pearson correlation, [b]Spearman correlation
**p<.01,*p<.05
^Association loses significance when age is controlled, +Association gains significance when age is controlled

*Gender*

We re-ran the correlations between the two measures in Study 1 for each gender independently. We then used the Fisher r-to-z transformation to assess if the differences between associations for each gender were significant (see **Table 4.4** and **Table 4.5**). The pattern of associations was largely the same for males and females, but the differences are worthy of note. Firstly, females showed a stronger association between Sexual Relationships and Affective psychopathic traits (z=2.19, p<.05). Four associations were significantly stronger in males than females: Passivity and Antisocial psychopathic traits (z=2.79, p<.01), Sexual Relationships and Antisocial psychopathic traits (z=-2.86, p<.01), SRQ Sociability and Interpersonal psychopathic traits (z=2.14, p<.05) and Sociability and Total psychopathic traits score (z=2.05, p<.05).

**Table 4.4. Associations between SRP and SRQ in Study 1 for males only (N=270)**

| | SRP-SF subscale | | | | SRP-SF |
|---|---|---|---|---|---|
| | **Affective[a]** | **Interpersonal[a]** | **Lifestyle[a]** | **Antisocial[b]** | **Total[a]** |
| *SRQ subscale* | | | | | |
| Admiration | -.01 | .13* | .06 | -.03 | .05 |
| Negative Social Potency | .61** | .62** | .45** | .60** | .69** |
| Passivity | .12* | .11 | .09 | **.24**[+]** | .18** |
| Prosocial Interactions | -.34** | -.29** | -.18** | -.41** | -.36** |
| Sexual Relationships | **-.03**[+] | .08 | .28** | **-.14***[+] | .07 |
| Sociability | .01 | **.14***[+] | .21** | .14* | **.15***[+] |

[a]Pearson correlation, [b]Spearman correlation

**p<.01,*p<.05

[+]Correlation coefficient significantly different to that in female sample

**Table 4.5. Associations between SRP and SRQ in Study 1 for females only (N=235)**

| | SRP-SF subscale | | | | SRP-SF |
|---|---|---|---|---|---|
| | **Affective[a]** | **Interpersonal[a]** | **Lifestyle[a]** | **Antisocial[b]** | **Total[a]** |
| *SRQ subscale* | | | | | |
| Admiration | .04 | .07 | .07 | -.08 | .04 |
| Negative Social Potency | .59** | .63** | .48** | .53** | .66** |
| Passivity | .05 | .17* | .14* | **-.00**[+] | .13 |
| Prosocial Interactions | -.45** | -.44** | -.29** | -.42** | -.48** |
| Sexual Relationships | **.16***[+] | .07 | .30** | **.12**[+] | .18** |
| Sociability | -.07 | **-.05**[+] | .04 | -.03 | **-.04**[+] |

[a]Pearson correlation, [b]Spearman correlation

**p<.01,*p<.05

[+]Correlation coefficient significantly different to that in male sample

### *4.3.4. Study 1 Discussion*

All psychopathic traits were positively associated with Negative Social Potency and negatively associated with Prosocial Interactions. This is in line with findings from Chapter 3, and together these findings support our hypothesis of an 'inverted' pattern of social reward in individuals with high levels of psychopathic traits, in which being cruel is enjoyable and being kind is not. Affective, Interpersonal and Lifestyle psychopathic traits were positively associated with enjoyment of Sexual Relationships, consistent with our hypothesis and in line with previous evidence of increased promiscuity in these individuals (Harris, Rice, Hilton, Lalumiere, Quinsey, 2007; Williams, Spidel, & Paulhus, 2005). In addition, there was a positive association between Interpersonal psychopathic traits and enjoyment of Admiration. The Interpersonal psychopathy factor includes manipulativeness and superficial charm, and we speculate that an admiring individual would be more susceptible to this manipulative control. Therefore, gaining others' admiration could facilitate the self-serving social strategy of individuals with high levels of Interpersonal psychopathic traits, instilling this social interaction with high reward value. Additionally, admiration may be rewarding because it feeds the narcissistic traits associated with Interpersonal psychopathic traits (Schoenleber, Sadeh, & Verona, 2011).

There were positive associations between Interpersonal, Lifestyle and Antisocial psychopathic traits and enjoyment of Passivity. We speculate this may be due to the parasitic relationship style of individuals with high levels of psychopathic traits (Hare, 2003; Jonason & Schmitt, 2011), which may lead these individuals to enjoy social interactions in which another person expends effort to bring them gains. Lastly, there was a positive association between Lifestyle psychopathic traits and Sociability. We speculate that individuals with high levels of Lifestyle psychopathic traits may enjoy socialising with others because this provides a context for the risk-taking and sensation-seeking behaviours that this factor represents (Hare, 2003). For example, attending parties may increase the opportunity to take recreational drugs.

Our post-hoc analyses revealed some interesting effects of age and gender, although the pattern of associations between social reward and psychopathic traits largely remained

the same. Overall, the associations found here between dimensions of psychopathic traits and different types of social reward provide evidence for possible motivations behind the patterns of social behaviour seen in psychopathy.

## 4.4. Study 2

### *4.4.1. Introduction*

In Study 2, we tested a sample of UK participants in person. The first goal of this study was to explore the associations that we found between social reward and psychopathic traits in Study 1 in a different sample. The second goal was to use two experimental reward tasks to assess how monetary and social reward value relates to psychopathic traits. These experimental tasks were intended to provide a sensitive index of reward value that would be less susceptible to possible impression management than could be the case for self-report measures such as the SRQ. The tasks also allowed social reward to be explored in the context of another type of salient reward, money.

Tasks that compare responses to monetary and social reward are already available (e.g. Rademacher, Salama, Gründer, Spreckelmeyer, 2013; Richey et al., 2012; Spreckelmeyer et al., 2009). However, the stimuli used to represent the two types of reward are conceptually and perceptually different from each other, which somewhat complicates the interpretation of the findings from these studies. For example, one study (Richey et al., 2012) represented monetary reward often with a currency symbol (a dollar sign), a simple conceptual representation for which an association with reward has been learned over time. In contrast, social reward was represented with a smiling face: a visually complex, biologically salient image (Richey et al., 2012). In order to comparably address individuals' relative processing of monetary and social reward, there is a need to use stimuli that allow these two rewards to be represented as equally as possible. To address this issue in the current study, social reward was represented using the 'Like' symbol from the social networking site Facebook (www.facebook.com). This is a thumbs-up symbol used to express approval/admiration from one user to another in response to user-posted items, such as photos or comments. We then used a pound sterling symbol to represent monetary reward, and using these symbols together has two benefits.

Firstly, both the Like and pound symbols are images that have a learnt association with reward. In other words, these symbols both indicate a conceptual representation of reward. Secondly, both symbols have similar, abstract visual features. Together, these characteristics allow us to compare the relative processing of monetary and social reward value as validly as possible.

Existing studies of monetary reward value have shown that psychopathic traits are positively associated with increased activity in reward-related brain areas, such as the nucleus accumbens, when processing monetary reward (Bjork et al., 2012; Buckholtz et al., 2010). In addition, behavioural research has found positive associations between psychopathic traits and importance of life goals relating to money (Foulkes, Seara-Cardoso, Neumann, Rogers, & Viding, 2014). We therefore hypothesised that psychopathic traits would be positively associated with reaction times (RTs) to reward in the monetary task. With regard to social reward, findings from Study 1 of this paper suggest that psychopathic traits are associated with less reward from prosocial interactions. On the basis of this, we hypothesised that psychopathic traits would be negatively associated with RTs to reward in the social task. Finally, we hypothesised that psychopathic traits would be negatively associated with a monetary–social RT difference score (i.e. RTs to social reward will be relatively slower than those to monetary reward). Based on the findings from Study 1, we hypothesised that all psychopathy factors would show this pattern of association. In addition, we hypothesised that RTs in the social condition would be negatively associated with scores on the SRQ Admiration and Prosocial Interaction subscales, i.e., people who responded faster to the social condition would have higher scores on these subscales. This is because we hypothesised that the Facebook Like symbol represents social approval and positive social exchanges, so individuals who find such exchanges particularly rewarding may be more likely to respond quickly to such a symbol.

### *4.4.2. Materials and methods*

*Ethics Statement*

All participants provided written informed consent and the study was approved by the University College London Clinical, Educational and Health Psychology Research Ethics committee.

*Participants*

Participants were 110 males recruited from two participant pools at University College London (UCL): the UCL Psychology Subject Pool and the ICN (Institute of Cognitive Neuroscience) Subject Database. Both pools are open to students across the university and to members of the public. Only males were recruited due to the higher prevalence of psychopathic traits in males and to ensure we did not lose power in the relatively small sample size by controlling for another variable (gender). Participants were aged 18-39 years (mean=22.45, SD=4.07) and all met the following criteria: fluent English-speaker, no dyslexia and a current Facebook user. Ninety percent of the sample were current students (6.4% unemployed, 3.6% employed) and all lived in the UK. The highest completed education level was as follows: 65.4% senior school/A level college, 19.1% Bachelor's degree, 15.5% postgraduate degree. Ethnicity of the sample was as follows: 28.2% Chinese, 21.8% White other, 20.9% Mixed/Other, 19.1% White British, 10.0% Indian.

*Questionnaires*

**Psychopathic traits:** the SRP-SF (Paulhus, Neumann, & Hare, 2015) was used to measure psychopathic traits as in Study 1.

**Social reward:** the SRQ (Foulkes, Viding, McCrory, & Neumann, 2014; Chapter 3) was used to measure the value of different types of social reward as in Study 1.

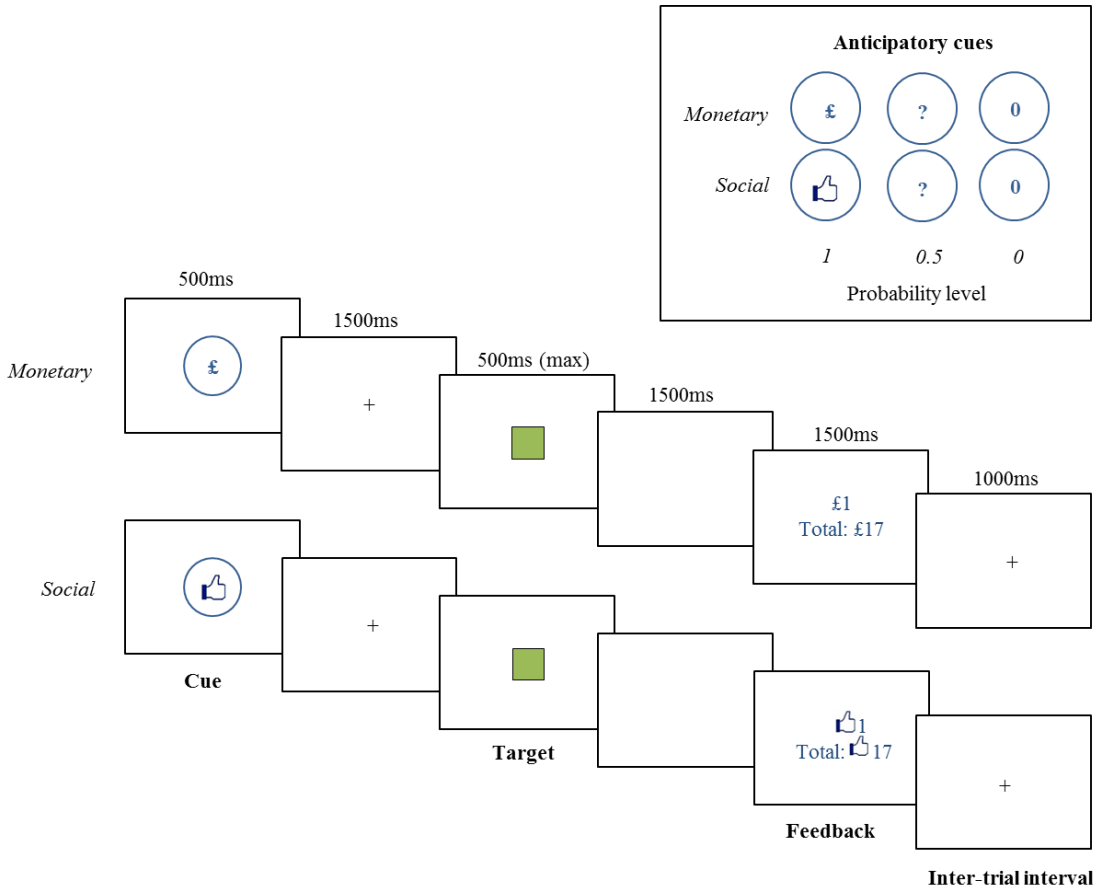
**Facebook usage:** use of the social media website Facebook was measured with the Facebook Intensity Scale (Ellison, Steinfield, & Lampe, 2007). This is an 8-item questionnaire that assesses frequency and duration of Facebook usage as well as emotional connectedness to the site. This measure was given in order to control for the

effect of Facebook usage on the reward value of the 'Like' symbol in the experimental social reward task.

*Monetary and social reward tasks*

Two versions of a probabilistic reward anticipation task (monetary and social) were used. These tasks were based on the Factorial Reward Anticipation task (Bjork et al., 2012) and the Monetary Incentive Delay task (Knutson, Westdorp, Kaiser, & Hommer, 2000). The monetary and social tasks were conducted separately (rather than as part of one task) for two reasons. Firstly, separating the two tasks with a battery of questionnaires in-between reduced the possibility of boredom or fatigue effects. Secondly, conducting separate tasks removed the effect of shifting costs that could incur if participants had to change frequently between the two symbolic representations. Comparing two types of reward by using two separate tasks has been done previously (e.g. Izuma et al., 2010). In both tasks, a cue indicates how likely it is that a key press response will yield rewarding feedback. The participant then responds to a target by pressing the space bar, and subsequently receives feedback, which is either reward (a monetary or social point gain) or no reward (no point gain; there is no loss condition). Therefore, each trial has 6 sequential components: (1) 500ms anticipatory cue, (2) 1500ms fixation cross, (3) 500ms green square target, (4) 1500ms blank screen, (5) 1500ms feedback, (6) 1000ms inter-trial interval (each trial is 6.5 seconds). There are three possible cues, shown in **Figure 4.1**, which indicate to the participant that there is a p=0, p=0.5 or p=1 probability level of receiving a point in that trial, provided they press the space bar quickly (within 500ms) when the target appears. If the space bar is pressed within 500ms on a rewarded trial (i.e. in 100% of the 1 probability trials and a randomised 50% of the 0.5 probability trials), '+1' is presented with the reward symbol (either a pound or Like symbol). If the space bar is not pressed, is pressed outside of the 500ms window, or is pressed within the 500ms window but on a no-reward trial (i.e. in all 0 probability trials and 50% of 0.5 probability trials), '+0' is presented with the reward symbol. On each feedback screen, cumulative winnings are shown underneath the trial winnings (see **Figure 4.1**). Within each task, the sequence of trials (0, 0.5 or 1) was randomised for each participant.

**Figure 4.1. Monetary and social reward task trial sequences**




It is worth noting that no actual reward was awarded on the basis of task performance. Participants were given a flat rate of £10 for taking part in the study, and were told that the objective of the reward tasks was simply to earn as many points as possible. We made this decision because we wanted to keep the two tasks as equivalent as possible (i.e., translating the monetary points into winnings in the monetary condition could not be matched in the social condition). Therefore, we relied on the learned association between the two symbols (pound sign and Like symbol) and reward value. This is in line with other studies comparing the two types of reward, where winnings are not translated into actual monetary reward (Kohls, Peltzer, Herpertz-Dahlmann, & Konrad, 2009; Rademacher et al., 2013).

*Procedure*

Participants completed the questionnaires and monetary and social reward tasks as part of a wider data collection. One experimental reward task (either money or social;

counterbalanced across participants) appeared at the beginning of the battery and the other appeared at the end (approximately 40 minutes apart).

*Data analysis procedure*

Zero order correlational analyses were used to assess associations between SRP-SF and SRQ, as in Study 1. Benjamini and Hochberg False Discovery Rate (Benjamini & Hochberg, 1995) was used to control for the probability of making a Type I error on multiple comparisons, and only corrected p-values are presented. There were no missing data, as the questionnaire was programmed in such a way that all items required a response.

In the experimental reward tasks, trials with RTs that were <100ms or >1000ms (including any missing trials) were excluded from analysis. According to these criteria, eight participants had >20% invalid trials in either the monetary or social reward task and were excluded from analysis, giving a final sample size of N=102.

Mean reaction times (RTs) for each probability level (0, 0.5 and 1) were calculated in both conditions (monetary and social) for each participant. In addition, a difference score was calculated that represented the relative value of the monetary and social conditions. To do this, the mean score for each probability level in the social condition was deducted from the corresponding mean score in the monetary condition.

We first compared general task performance on the monetary and social tasks. A 2 (reward type: monetary, social) x 3 (reward probability: 0, 0.5, 1) ANOVA was conducted to investigate this. To explore associations between psychopathic traits and performance on the experimental reward tasks, correlational analyses were run between the psychopathy factor and total scores and the mean RTs and monetary-social difference scores from the experimental tasks. Finally, we explored associations between mean RTs and monetary-social difference scores and SRQ subscale scores, to explore what type of social reward might be being assessed with the Facebook 'Like' symbol. Benjamini and Hochberg False Discovery Rate (Benjamini & Hochberg, 1995) was used, and only corrected p-values are presented.

### *4.4.3. Results*

*Questionnaires*

Descriptives for SRQ and SRP-SF scores are shown in **Table 4.6**. The four psychopathy factor scores (Affective, Interpersonal, Lifestyle and Antisocial) and total psychopathy score were all positively associated with Negative Social Potency, as in Study 1 (see **Table 4.7**). Affective and Antisocial factors were negatively associated with Prosocial Interactions. All scores except the Antisocial factor were positively associated with Sexual Relationships. Finally, only the Interpersonal factor was positively associated with Passivity and Admiration, and there were no significant associations with Sociability.

**Table 4.6. Descriptives for SRQ and SRP scores in Study 2 (N = 110)**

| | Minimum | Maximum | Mean (SD) |
|---|---|---|---|
| *SRQ subscale* | | | |
| Admiration | 2.50 | 7.00 | 5.73 (0.85) |
| Negative Social Potency | 1.00 | 4.80 | 2.27 (0.88) |
| Passivity | 1.00 | 5.70 | 3.00 (1.03) |
| Prosocial Interactions | 4.80 | 7.00 | 6.12 (0.54) |
| Sexual Relationships | 1.00 | 7.00 | 5.22 (1.30) |
| Sociability | 3.00 | 7.00 | 5.44 (0.87) |
| *SRP subscale* | | | |
| Affective | 7.00 | 27.00 | 14.37 (3.86) |
| Interpersonal | 7.00 | 31.00 | 16.27 (4.63) |
| Lifestyle | 7.00 | 27.00 | 17.10 (4.35) |
| Antisocial | 7.00 | 18.00 | 9.75 (2.88) |
| Total | 29.00 | 85.00 | 57.49 (12.32) |

**Table 4.7. Correlations between SRP and SRQ scores in Study 2 (N = 110)**

| | SRP-SF subscale | | | | SRP-SF |
|---|---|---|---|---|---|
| | **Affective[a]** | **Interpersonal[a]** | **Lifestyle[a]** | **Antisocial[b]** | **Total[a]** |
| *SRQ subscale* | | | | | |
| Admiration | .06 | .21* | .10 | -.09 | .12 |
| Negative Social Potency | .56** | .60** | .36** | .32** | .58** |
| Passivity | .18 | .20* | .07 | -.03 | .15 |
| Prosocial Interactions | -.26* | -.02 | -.12 | -.22 | -.19 |
| Sexual Relationships | .30** | .31** | .45** | .16 | .41* |
| Sociability | -.05 | .05 | .21 | .00 | .08 |

[a]Zero order Pearson correlations are reported
[b]Zero order Spearman correlations are reported
Corrected p values are shown. *p<.05, **p<.01

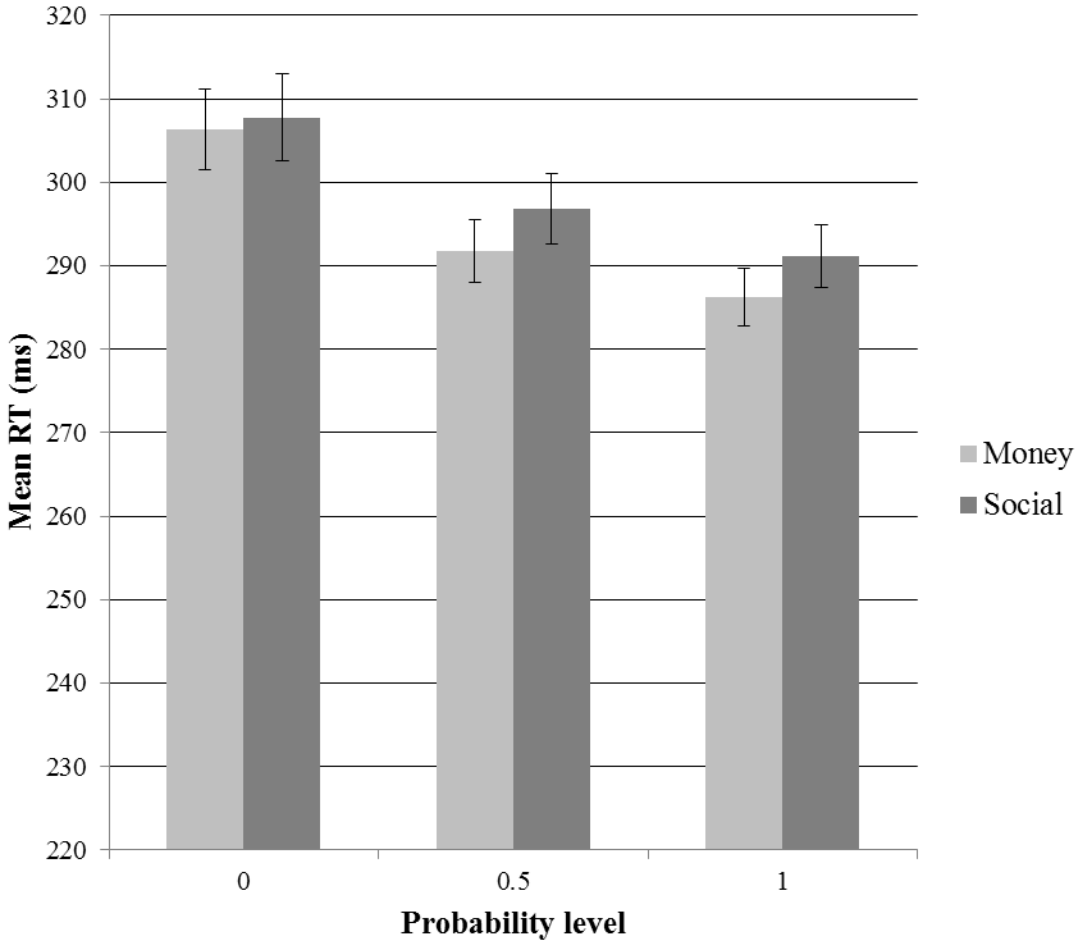
*Monetary and social reward tasks*

Descriptives of RTs for each probability level in monetary and social tasks can be found in **Table 4.8**. Mean RTs were analysed with a 2 (reward type: monetary, social) x 3 (reward probability: 0, 0.5, 1) ANOVA. There was a significant main effect of reward probability ($F(1,101) = 38.82$, $p<.001$; see **Figure 4.2**); participants responded more quickly to increased probability of reward. Analysis of simple effects showed that the decrease in RT between increases in reward probability (0 and 0.5; 0.5 and 1) were both significant, in both monetary and social conditions (all $p<.05$; see **Table 4.9**). There was no main effect of reward type and no interaction between reward type and reward probability.

**Table 4.8. Means and SDs for RTs at each reward probability level in both social and monetary conditions**

| | Probability | Mean (SD) |
|---|---|---|
| *Monetary* | 0 | 306.30 (42.98) |
| | 0.5 | 291.79 (39.86) |
| | 1 | 286.22 (36.30) |
| *Social* | 0 | 307.78 (43.72) |
| | 0.5 | 296.80 (42.05) |
| | 1 | 291.12 (36.76) |

**Figure 4.2. Plot of mean RTs for each probability level in both monetary and social conditions**




N.B. Error bars represent standard error.

**Table 4.9. Simple effects analysis of all probability levels in both social and monetary conditions**

| | **Probability (*A*)** | **Probability (*B*)** | **Mean *A* – Mean *B* difference (SE)** |
|---|---|---|---|
| *Monetary* | 0 | 0.5 | 14.51** (2.52) |
| | | 1 | 20.08** (2.84) |
| | 0.5 | 1 | 5.57* (2.43) |
| *Social* | 0 | 0.5 | 10.98** (2.64) |
| | | 1 | 16.66** (2.45) |
| | 0.5 | 1 | 5.68* (2.40) |

**p<.001,*p<.05

*Associations between psychopathic traits and performance on reward tasks*

Degree of Facebook usage as measured by the Facebook Intensity Scale (Ellison et al., 2007) was entered as a control variable in all analyses, and Benjamini and Hochberg False Discovery Rate (Benjamini & Hochberg, 1995) was used to control for the probability of making a Type I error on multiple comparisons.

There were no significant associations between psychopathy scores and mean RTs at any probability level in either the monetary or social task. However, Interpersonal psychopathic traits were significantly positively associated with the RT *difference* scores for the 0.5 and 1 probability conditions. Specifically, as Interpersonal traits increased, RTs to the social condition were faster relative to the monetary condition (see **Table 4.9**).

**Table 4.10. Correlations between SRP scores and reward task RTs and difference scores**

| | | SRP-SF subscale | | | | SRP-SF Total[a] |
|---|---|---|---|---|---|---|
| | | Affective[a] | Interpersonal[a] | Lifestyle[a] | Antisocial[b] | |
| | ***Prob.*** | | | | | |
| *Monetary* | 0 | .08 | -.02 | -.03 | .03 | -.01 |
| | 0.5 | .03 | .02 | .00 | -.05 | .00 |
| | 1 | .04 | .09 | -.01 | -.11 | .01 |
| *Social* | 0 | .03 | -.11 | -.15 | -.07 | -.14 |
| | 0.5 | .01 | -.20 | -.15 | -.12 | -.16 |
| | 1 | .05 | -.14 | -.15 | -.09 | .13 |
| *Monetary - Social*[c] | 0 | .08 | .13 | .18 | .14 | .18 |
| | 0.5 | .02 | .30* | .22 | .12 | .23 |
| | 1 | -.02 | .27* | .17 | .00 | -.16 |

[a]Pearson correlations are reported. [b]Spearman correlations are reported
[c]Difference score calculated by subtracting mean RT in social condition from mean RT in monetary condition.
Prob. = Probability
Facebook usage controlled for in all analyses. Corrected p values are shown. *p<.05

*Associations between SRQ subscales and performance on reward tasks*

One participant was identified as a multivariate outlier for the monetary-social difference score and the SRQ Negative Social Potency score ($D^2$=25.25, p<.0001) so was excluded from analysis. Pearson correlations were calculated for the remaining 101 participants. Benjamini and Hochberg False Discovery Rate (Benjamini & Hochberg, 1995) was used to control for the probability of making a Type I error on multiple comparisons.

No associations between mean RTs or the monetary-social difference score and any of the SRQ subscales survived correction for multiple comparisons (see Table 4.11).

**Table 4.11. Correlations between SRQ scores and reward task RTs and difference scores**

| | | Admiration | Negative Social Potency | Passivity | Prosocial Interactions | Sexual Relationships | Sociability |
|---|---|---|---|---|---|---|---|
| | ***Prob.*** | | | | | | |
| Monetary | 0 | .07 | .14 | .01 | .04 | -.05 | -.04 |
| | 0.5 | .07 | .11 | -.05 | .06 | -.16 | -.03 |
| | 1 | .03 | .20 | .06 | .06 | -.04 | .11 |
| Social | 0 | .16 | .11 | -.01 | -.05 | -.11 | -.06 |
| | 0.5 | .06 | .12 | -.05 | -.05 | -.15 | -.08 |
| | 1 | .06 | .13 | .03 | -.07 | -.11 | .00 |
| Monetary - Social[a] | 0 | -.16 | .04 | .03 | .14 | .10 | .03 |
| | 0.5 | .01 | -.02 | -.01 | .15 | .00 | .07 |
| | 1 | -.03 | .08 | .03 | .16 | .10 | .14 |

[a]Difference score calculated by subtracting mean RT in social condition from mean RT in monetary condition.
Prob. = Probability
Corrected p values are shown. *p<.05

### *4.4.4. Study 2 Discussion*

In Study 2, the pattern of associations between psychopathic traits and social reward found in Study 1 was largely replicated. Specifically, in both samples there was a positive association between all psychopathy scores and Negative Social Potency, the enjoyment of being cruel and controlling towards others. Both studies found positive associations between Affective, Interpersonal, Lifestyle and Total psychopathic traits and Sexual Relationships, and a positive association between Interpersonal psychopathic traits and Admiration. Both studies also found a negative association between Affective psychopathic traits and Prosocial Interactions and Interpersonal psychopathic traits and Passivity, although Study 1 found these associations with all psychopathic traits. In addition, Lifestyle psychopathic traits were positively associated with Sociability in Study 1, but not Study 2.

In the social reward experimental task, a novel symbol of social reward was used: the 'Like' thumbs-up symbol from the social networking site Facebook. RTs to both the Like and pound symbol were faster with each incremental reward probability level. There were no significant differences between mean RTs in the monetary and social reward tasks.

This suggests that the Like symbol was serving as a reward stimulus in a manner similar to monetary reward, and so it may have value in future studies of social reward.

Interpersonal psychopathic traits were positively associated with the monetary-social RT difference score in both the 0.5 and 1 probability level conditions. Specifically, as Interpersonal traits increased, RTs in the social task became faster relative to the monetary task. We interpret this in the context of the narcissism and manipulation associated with the Interpersonal factor (Paulhus & Williams, 2002). Specifically, the Like symbol represents social admiration/approval, and so this symbol may have a higher subjective value for individuals who tend to trick and manipulate others.

Finally, there were no associations between performance on the reward tasks (mean RTs or the monetary-social difference score) and any of the SRQ subscales that survived correction for multiple comparisons. We had hypothesised that there would be a negative association between both SRQ Prosocial Interactions and SRQ Admiration and RTs in the social task, indicating that individuals with high scores on these social reward domains would be more responsive to the 'Like' symbol. However, the findings indicate this was not the case. It is difficult to interpret null findings, but these findings suggest that the social reward represented by the 'Like' symbol does not clearly align with any of the social reward domains captured by the SRQ.

## 4.5. General Discussion

In the two studies reported here we explored associations between psychopathic traits and the value of different social rewards. The purpose of Study 1 was to explore in detail the associations between different faces of psychopathy and the reward value of different social interactions, using the newly validated Social Reward Questionnaire from Chapter 3. The purpose of Study 2 was to replicate these associations in a different sample and also to assess how psychopathic traits are associated with performance in an experimental social reward task. The main finding from our studies was that individuals with high levels of psychopathic traits reported that they enjoy behaving antisocially and did not enjoy behaving prosocially towards others. Data from the experimental reward tasks (Study 2) suggested that individuals with high levels of Interpersonal psychopathic traits

appeared to find social admiration/approval especially motivating relative to monetary reward. Together, these findings shed light on what might motivate the social behaviour characteristic of individuals with high levels of psychopathic traits.

The implication that individuals with high levels of psychopathic traits enjoy cruel behaviour is in line with findings from other studies (e.g. Buckels et al., 2014). A careful consideration of sadism is important here, which is defined as the enjoyment of controlling, dominating, and/or causing suffering to others, and can refer to physical or psychological suffering (Meloy, 1997; O'Meara et al., 2011). There is some existing support that psychopathy and sadism are overlapping constructs (Buckels et al., 2014; Chabrol et al., 2009; Holt et al., 1999; Mokros et al., 2011), and the current study provides further support for this. However, it remains unclear exactly why individuals with high levels of psychopathic traits enjoy cruel behaviour. One possibility is that inflicting suffering on others may be pleasurable purely because of causing a person pain (physical or psychological). Alternatively, the enjoyment may stem from the power and control that comes with inflicting suffering, and it is this rather than the pain per se that has reward value. Further research should probe the exact nature of the Negative Social Potency reward that is associated with psychopathic traits, and this value in antisocial behaviour should be incorporated into explanations of why psychopaths behave so badly towards others.

In addition, the current study found a negative association between psychopathic traits and enjoyment of prosocial interactions (Study 1: all factors; Study 2: Affective factor only). This finding suggests that individuals with high levels of psychopathic traits do not just feel indifferent towards being kind and helpful, they find it unappealing. Psychopathic traits have previously been associated with an increased report of *public* prosocial behaviours but a decreased report of *anonymous* and *altruistic* prosocial behaviours (White, 2014).. This is consistent with the current findings as it appears that individuals with high levels of psychopathic traits do not experience an intrinsic reward from behaving prosocially towards others (White, 2014). This contrasts with evidence from typical individuals, which shows that people behave prosocially at least in part because they experience inherent enjoyment from it (the 'warm glow' hypothesis of altruism; Andreoni, 1990; Crumpler & Grossman, 2008). The absence of this enjoyment in individuals with high levels of psychopathic traits is an important avenue for further

research as it likely contributions to their reduced levels of cooperative and prosocial behaviour (e.g. Mokros et al., 2008).

It is important to note that not all significant associations between psychopathic traits and social reward in Study 1 were replicated in Study 2. For example, Prosocial Interactions were negatively associated with all psychopathic traits in Study 1, but only Affective psychopathic traits in Study 2. There are a number of possible explanations for these discrepancies. For example, the two samples were drawn from different populations and the sample in Study 1 completed the questionnaires online rather than in the presence of the experimenter. These factors or others could have contributed to the difference between the two samples. It is also important to note the effects of age and gender seen in the post-hoc analyses in Study 1. It will be valuable to study social reward and psychopathic traits further to fully understand the relationship between these two constructs and how this might be influenced by demographic characteristics. However, the fact that the association between all psychopathic traits and Negative Social Potency was found in both samples, despite their demographic differences, suggests this may be a particularly important aspect of social reward for individuals with high levels of psychopathic traits.

In Study 2, we also conducted two experimental reward tasks with the aim of further elucidating the relationship between psychopathic traits and social reward. There were no significant associations between psychopathic traits and RTs at any probability level of monetary or social rewards. However, a significant positive association was found between Interpersonal traits and monetary-social difference scores for the 0.5 and 1 probability levels. In other words, as Interpersonal traits increased, the RTs to possible reward became faster in the social task relative to the monetary task.

As there were no significant associations between Interpersonal traits and RTs to either monetary or social conditions, these difference score associations are not clearly explained by either slower RTs to monetary reward or faster RTs to social reward. Rather, it is the relative difference between these two rewards that appears important, suggesting that individuals with high levels of Interpersonal traits confer relatively stronger value for social than monetary reward. It is important to note the type of social reward that the Facebook Like symbol represents: approval or admiration of one's actions or lifestyle.

The Interpersonal dimension of psychopathy describes the manipulative use of others, for which winning others' approval may be particular useful. This may partly explain the relative importance that individuals with high levels of these traits placed on this type of social reward. This speculation is supported by the self-report findings from both samples reported here that Interpersonal traits (but not other psychopathy factors) were positively associated with the enjoyment of Admiration.

We had hypothesised that psychopathic traits would be positively associated with RTs to monetary reward, but this was not supported. Previous studies have found that psychopathic traits are associated with increased neural responsiveness to monetary reward (Bjork et al., 2012; Buckholtz et al., 2010). However, these associations were with neural responses, and have not been demonstrated behaviourally. Therefore, one explanation is that the association between psychopathic traits and hypersensitivity to monetary reward is only apparent at a neural level. In addition, both previous studies used a different measure of psychopathic traits (Psychopathic Personality Inventory; Lilienfeld & Andrews, 1996) than the one used in the current study, which furthers limits the extent to which we can compare between studies. A hypersensitivity to financial gain may have important implications for behaviour, particularly in combination with other psychopathic characteristics such as impulsivity and a lack of empathy, so the relationship between psychopathic traits and monetary reward value is worthy of further clarification in future studies.

We had also hypothesised that there would be a negative association between both SRQ Prosocial Interactions and SRQ Admiration and RTs in the social task. However, there were no associations between performance on the reward tasks (mean RTs or the monetary-social difference score) and any of the SRQ subscales that survived correction for multiple comparisons. It is difficult to interpret null findings, but we speculate that the social reward represented by the 'Like' symbol may not exactly align with any of the social reward domains captured by the SRQ. Further investigations are required to understand the nature of the reward represented by this symbol, and to design tasks that more closely behaviourally assess the social reward domains captured by the SRQ.

### *4.5.1. Limitations*

Some limitations to the present study should be noted. Firstly, the sample size of the second study is small and the experimental findings should be replicated with larger samples. The current analyses were also exploratory and correlational. It would be interesting to test more directional hypotheses using more sophisticated regression analyses in the future. For example, it would be interesting to explore whether Interpersonal psychopathic traits predict performance in a social reward task above and beyond the variance shared with other aspects of psychopathic personality. Secondly, difference scores can be difficult to interpret, and it is important to further probe the relative contribution of monetary and social reward value to fully understand the current association between Interpersonal psychopathic traits and the monetary-social difference scores in the experimental tasks. In addition, it would be helpful to collect data measuring the subjective value of the Like and pound symbols for each participant, to assess the impact of this on task performance. Finally, the current study used community samples of adults, and so it will be important to explore if the same pattern of associations between social reward and psychopathic traits is present in forensic and adolescent samples.

### *4.5.2. Conclusions*

In summary, the current studies extend the findings from Chapters 2 and 3 by presenting a more nuanced picture of the relationship between psychopathic traits and social reward. Firstly, both Study 1 and Study 2 present evidence that individuals with high levels of psychopathic traits may have an inverted pattern of social reward: they devalue affiliative and prosocial interactions, and instead take pleasure in treating others cruelly. Our experimental evidence in Study 2 suggests that individuals with high levels of Interpersonal traits place particular value on gaining social approval, which we speculate may be due to their manipulative treatment of others and the usefulness of approval in this context. Research addressing social reward in psychopathy is in its infancy, and there are likely to be a host of different processes that contribute to the value of different types of social reward. An important future direction will be to replicate the current findings in other samples (e.g. prison inmates, adolescents) and to extend the current findings by

elucidating the mechanisms behind the ‘inverted’ social reward associated with psychopathic traits.

# Chapter 5: Social Reward Questionnaire – Adolescent Version and its association with callous-unemotional traits

## 5.1. Abstract

During adolescence, social interactions can be a particularly powerful source of reward. However, to date, no existing measure has been developed to assess individual differences in the value of social rewards in this age group. In addition, although adolescents with high levels of callous-unemotional (CU) traits have highly problematic social interactions, no existing research has systematically investigated social reward value in this group. In the current study we developed and validated the Social Reward Questionnaire – Adolescent version (SRQ-A), and assessed associations between this measure and a measure of CU traits. The SRQ-A is based on the adult Social Reward Questionnaire (SRQ), which was adapted in order to be appropriate for a younger age group. Adolescents aged 11-16 (N=568) from two schools in London, England were asked to complete the 20-item SRQ-A, as well as measures of personality traits and CU traits for construct validity purposes. A confirmatory factor analysis (CFA) was conducted to assess whether a five-factor structure based on the adult questionnaire would fit the data well. This analysis demonstrated that the five-factor model resulted in good model fit (CFI = 0.90; RMSEA = 0.07). The five factors equated to the five subscales of the questionnaire, defined as follows: Admiration, Negative Social Potency, Passivity, Prosocial Interactions and Sociability. Each subscale showed adequate internal consistency and test-retest reliability, and each subscale showed a unique pattern of associations with the external measures, indicating that each subscale was capturing a distinct type of social reward. In addition, associations between the SRQ-A subscales and the measure of CU traits indicated an 'inverted' pattern of social reward in adolescents with high levels of these traits, in which being cruel and antagonistic towards others is enjoyable, and being kind and prosocial is not. This was in line with associations found between the SRQ and a measure of psychopathic traits in adults (Chapter 4). In sum, the SRQ-A is a valid, reliable measure of individual differences in social reward in adolescent populations, and has potential clinical utility.

## 5.2. Chapter Introduction

In Chapter 2 of this thesis, I described the development and validation of the Social Reward Questionnaire (SRQ), a measure of individual differences in the reward value of different social interactions, for use in adult samples. In Chapter 4, I assessed associations between the SRQ and a measure of psychopathic traits. The findings indicated that adults with high levels of psychopathic traits display an 'inverted' pattern of social reward, in which being cruel is enjoyable and being kind is not. This finding is potentially important when trying to understand the mechanisms behind the atypical social behaviour seen in psychopathy – i.e. the high levels of antisocial behaviour and low levels of affiliative, prosocial behaviour (see General Introduction, Section 1.3.1). Specifically, the findings from Chapter 4 suggest that individuals with high levels of psychopathic traits may be motivated to behave badly towards others at least in part because this behaviour is rewarding for them, and equally these individuals may be less motivated to behave prosocially because this has reduced reward value for them compared to typical individuals.

It is well established that psychopathic-type traits such as a lack of empathy and guilt can be detected in children and adolescents, and are termed callous-unemotional (CU) traits in this age group (Frick et al., 2013; see General Introduction, Section 1.2). Young people with high levels of these traits are likely to have high levels of psychopathic traits when they become adults, and so CU traits are considered to be antecedents to adult psychopathy (Lynam et al., 2007). Like adults with high levels of psychopathic traits, adolescents with high levels of CU traits display problematic social behaviour. For example, compared to adolescents with low levels of CU traits, those with high levels of CU traits tend to endorse more antisocial solutions to achieve their goals, such as using aggression (Pardini, 2011), and are more likely to bully others (Viding, Simmonds, Petrides, & Frederickson, 2009). Unsurprisingly, their friendships tend to be shorter than those of typical adolescents (Muñoz et al., 2008). It is important to understand possible mechanisms behind the problematic social behaviour seen in these adolescents, and one such mechanism is atypical social reward. As psychopathic traits are associated with atypical social reward in adults (Chapter 4), and CU traits are antecedents to psychopathic

traits, one important research avenue is to understand whether atypical social reward processing is also associated with CU traits in children/adolescents.

There is some limited existing evidence that adolescents with high levels of CU traits may have atypical processing of typically rewarding social stimuli such as happy faces (Dadds et al., 2014; Hodsoll, Lavie & Viding, 2014). In one study, adolescents with high levels of CU traits were less distracted by irrelevant happy faces compared to typically developing controls (Hodsoll, et al. 2014). Other research has demonstrated that children with high levels of CU traits spend less time looking at their mothers' faces, irrespective of the mothers' behaviour (Dadds, et al., 2014). Together, this research presents an interesting possibility that typically socially rewarding stimuli (such as happy faces) may have less reward value in adolescents with high levels of CU traits. However, social reward has not yet been systematically examined in relation to CU traits. It is important to understand the possible association between CU traits and social reward value in adolescents, as this may increase understanding of the mechanisms behind their callous and antisocial behaviour towards others.

More generally, it is also important to understand social reward processing in typical adolescents. Adolescence describes the period of transition between childhood and adulthood when individuals undergo considerable psychological and physical change (Blakemore & Choudhury, 2006). In particular, social cognition and behaviour changes dramatically, underpinned by rapid development of the 'social brain', the network of numerous brain areas involved in social information processing (Blakemore, 2008). Because of this, social relationships become increasingly salient in adolescence, particularly with regard to gaining approval and avoiding rejection from peers (Jones et al., 2014; Sebastian, Viding, Williams, & Blakemore, 2010). Additionally, neural and psychological responsiveness to social rewards increases during adolescence, due to the rapid development of the brain's dopaminergic system, which processes rewarding stimuli (Davey, Yücel, & Allen, 2008; Steinberg, 2008). Together, the neural changes in social and reward processing networks mean that adolescents find social interactions particularly motivating and influential, which can lead to more risky behaviour in the presence of peers (e.g. Chein, Albert, O'Brien, Uckert, & Steinberg, 2011). Understanding social reward processing in adolescents – both typical and atypical, such

as those with high levels of CU traits - is therefore critical for understanding social behaviour and wellbeing in this age group.

Experimental evidence has documented the reward value of social stimuli in adolescence. One study asked a group of 8-12 year olds to complete an incentivised go/no-go task, in which feedback was given at the end of each trial (Kohls et al., 2009). The feedback was either a scrambled image (no reward), an image of a smiling face (social reward) or an image of a wallet (monetary reward). The researchers found that performance was significantly improved in both the social and monetary reward conditions compared to the no reward condition, indicating that smiling faces have reward value for this age group, as they do with adults (Kohls et al., 2009). A second study asked 8-16 year olds to complete a version of the Social Incentive Delay task in which social reward was operationalised as cartoon images of a person giving a 'thumbs up' gesture and a compliment to another person (Demurie, Roeyers, Baeyens, & Sonuga-Barke, 2012). The authors found that these images were subjectively rated as likeable and also improved performance in the task (Demurie et al., 2012). Other research has indicated that social reward may actually be more salient for adolescents than it is for adults. For example, distracting smiling faces impaired performance in a working memory task for adolescents (aged 12-14) but not adults, indicating that smiling faces may be especially salient for the adolescents (Cromheeke & Mueller, 2015).

Despite the theoretical and empirical data that indicate that social stimuli and interactions are an important source of reward for adolescents, to our knowledge no research has attempted to systematically identify and categorise the different types of social interactions that adolescents find rewarding. Some researchers only discuss that social relationships, in general, become more rewarding in adolescence (e.g. Davey, Yücel, & Allen, 2008). Others evaluate a specific type of social reward, such as the presence of peers (Chein, Albert, O'Brien, Uckert, & Steinberg, 2011) or smiling faces (Cromheeke & Mueller, 2015; Kohls et al., 2009). However, as yet, there has not been a comprehensive assessment of the full range of social experiences that are rewarding for adolescents. There is also no existing measure, to our knowledge, that assesses individual differences in the reward value of social experiences for use in adolescents.

In adults, the Social Reward Questionnaire (SRQ; Foulkes, Viding, McCrory & Neumann, 2014; see Chapter 3) is a valid and reliable measure of individual differences in the value of different social rewards. To assess the structure of social reward, the study in Chapter 3 used exploratory and confirmatory factor analyses (EFA and CFA), which identified six types of social reward: Admiration, Negative Social Potency, Passivity, Prosocial Interactions, Sexual Relationships and Sociability (Foulkes, et al., 2014; see Chapter 3). Each type of social reward equates to a subscale in the SRQ, and descriptions and example items of each subscale are given in **Table 3.1** in Chapter 3. Each subscale has good psychometric properties and also showed a unique pattern of associations with external measures, providing support for the meaning of each subscale. For example, there was a negative association between enjoyment of Negative Social Potency and the personality trait agreeableness, and it makes sense that individuals who tend to be kind and affiliative towards others (i.e. those high in agreeableness) would be less likely to report enjoyment from being cruel. In addition, there was a positive association between enjoyment of Sociability and the personality trait extraversion, and again it makes sense that individuals who seek out social stimulation (those high in extraversion) are likely to enjoy socialising and spending time with others.

### *5.2.1. The current study*

In the current study, we sought to validate a version of the adult SRQ for use with adolescent populations, named the Social Reward Questionnaire – Adolescent Version (SRQ-A). There were three main aims of this study. The first aim was to assess whether the structure of social reward is similar in adolescents as it is in adults. The second aim was to create a questionnaire that could be used to assess individual differences in the reward value of social interactions in adolescent samples. The final aim was to explore associations between social reward value and CU traits, and to relate these to the pattern of associations found in adult samples using a measure of psychopathic traits (Foulkes, et al., 2014; see Chapter 3). The purpose of this final aim was to understand whether social reward processing may in part contribute to the callous and manipulative social behaviour seen in adolescents with high levels of CU traits.

To develop the SRQ-A, we dropped the Sexual Relationships subscale (three items) from the adult SRQ and simplified some of the wording. We then administered the 20-item SRQ-A to a large sample of adolescents. We conducted a confirmatory factor analysis on this sample to explore whether the dimensions of social reward found in the adult sample (Chapter 3) were also found in an adolescent sample. A brief self-report measure of personality traits was collected to assess the construct validity of the new measure, and a self-report measure of CU traits was collected to explore associations between social reward and CU traits. Finally, a subset of participants completed the SRQ-A a second time, seven days after the first, in order to assess test-retest reliability.

## 5.3. Method

### *5.3.1. Participants*

Data were collected from two state secondary schools in Greater London: one in South London (N=382) and one in East London (N=196). Ten participants had more than 20% of the SRQ-A data missing indicating that the questionnaire had not been answered carefully. These participants were removed from all further analyses, leaving a final sample of N=568. Participants were 11-16 years old (mean= 12.89, SD=1.18; N=19 did not disclose age). The sample was 50.0% male (N=284) and 47.4% female (N=269); 2.7% (N=15) of the sample did not disclose gender.

### *5.3.2. Data entry*

Data were collected as paper questionnaires and entered into an SPSS (version 20) database by two researchers. Researcher 1 entered 60.03% (N=347) of the total dataset; Researcher 2 entered 39.97% (N=231) of the dataset. To ensure accuracy of data entry, 9.86% (N=57) of the total sample was crossed checked. Specifically, Researcher 1 checked 9.96% (N=23) of Researcher 2's entries, and Researcher 2 checked 9.80% (N=34) of Researcher 1's entries. Of the checked 9.86% of data, which equates to 2052 data points, 13 data entry errors were found (five errors by Researcher 1, eight errors by Researcher 2; 0.63% of total checked). All errors were incorrect by a single unit (e.g. 6 instead of 5), and all were corrected at time of checking.

### *5.3.3. Scale development*

The items in the SRQ-A were taken from the adult SRQ, with some items removed or modified to ensure the content was appropriate for use with 11-16 year olds. These decisions were made based on discussions with a panel of six researchers with expertise in adolescent development. Firstly, the Sexual Relationships subscale was removed altogether due to the inappropriate nature of this content for young adolescents. (This subscale consisted of three items: *I enjoy having erotic relationships; I enjoy having many sexual experiences; I enjoy having an active sex life*). Therefore, the SRQ-A consists of five subscales: *Admiration*, the enjoyment of being flattered and gaining positive attention; *Negative Social Potency*, the enjoyment of being cruel, antagonistic and using others; *Passivity*, the enjoyment of giving others control and allowing them to make decisions; *Prosocial Interactions*, the enjoyment of having kind and reciprocal relationships; and *Sociability*, the enjoyment of engaging in group interactions.

In addition, the wording of two items was simplified: *I enjoy achieving recognition from others* was changed to *I enjoy getting praise from others* and *I enjoy feeling emotionally connected to someone* was changed to *I enjoy feeling emotionally close to someone*. The final questionnaire has a Flesch-Kincaid Reading Grade Level of 6.64[4] (Kincaid, Fishburne Jr, Rogers, & Chissom, 1975), indicating that the wording should be understood by pupils in Grade 6 (United States) and above, i.e. aged 11 years old and older. See Appendix 5 for the final 20-item questionnaire.

### *5.3.4. Measures*

In addition to the SRQ-A, participants completed the following questionnaires for the purposes of construct validity and to assess associations between the SRQ-A and CU traits. Brief measures were chosen due to constraints on testing time imposed by the schools.

[4] The Flesch–Kincaid Grade Level is computed using the following calculation: Grade Level = .39(Total words/Total sentences) + 11.8(Total syllables/Total words) – 15.59

*Ten Item Personality Inventory (TIPI; Gosling et al., 2003)*

The TIPI is a 10-item scale that measures the "Big Five" personality traits (agreeableness, conscientiousness, extraversion, neuroticism and openness to experience; e.g. Costa & McCrae, 1992). All items begin with 'I see myself as' and are followed by two descriptive items such as 'anxious, easily upset'. Responses are given on a 1–7scale (1 = Disagree strongly, 7 = Agree strongly). The TIPI was originally validated in an adult sample, but has since been used with adolescents (e.g. Erol & Orth, 2011; Harden & Tucker-Drob, 2011). We had several hypotheses: SRQ-A Prosocial Interactions would be positively associated with agreeableness and conscientiousness; SRQ-A Negative Social Potency would be negatively correlated with these traits; and SRQ-A Sociability would be positively correlated with extraversion.

*Callous-unemotional (CU) subscale of the Antisocial Process Screening Device (APSD; Frick & Hare, 2001)*

The CU subscale is a six-item measure, with each item scored from 0 to 2 (0 = Not at all true, 1 = Sometimes true, 2 = Definitely true). This subscale measures CU traits, with items such as 'You are concerned about the feelings of others' and 'You feel bad or guilty when you do something wrong' (both reverse-coded). The self-report version of the ASPD used here has good psychometric properties (e.g. Munoz & Frick, 2007). We hypothesised that CU traits would be positively associated with SRQ-A Negative Social Potency and negatively associated with SRQ-A Prosocial Interactions, in line with findings from an adult measure of psychopathic traits in Chapter 4.

### *5.3.5. Data analysis procedure*

*Missing data strategy*

Before any analyses were conducted, ten participants were removed for having between 20% and 100% of SRQ data missing (mean=41.50%, SD=.27%), as this indicated that the questionnaire had not been answered carefully. For all remaining analyses, all participants were retained (i.e. including those with less than 20% missing SRQ-A data). Participants with missing questionnaire data (SRQ-A, TIPI or ASPD; N=106) did not differ from those without (N=462) on gender ($\chi^2$ (1,N=553)=1.36, p=.24; N=15 did not

disclose gender) or age (t(547)=-.247, p=.80; N=19 did not disclose age). Specific strategies for dealing with missing data are described in the following sections.

*Confirmatory factor analysis (CFA)*

To assess the latent structure of the social reward item set in adolescents, confirmatory factor analysis (CFA) was conducted on the 20-item SRQ-A using Mplus version 7.11 (Muthén & Muthén, 2012). The sample size (N=568) was adequate for testing a model consisting of 50 parameters (i.e. 20 factor loadings, 20 error variances and 10 factor correlations). Specifically, the subjects-to-parameters ratio for the 20-item model is approximately 11:1, which is higher than the 10:1 minimum ratio recommended by Bentler and Chou (1987).

We used the mean and variance adjusted weighted least squares (WLSMV) estimation procedure as recommended for analysis of ordinal data (Muthén & Muthén, 2012). Our intention was to assess whether the item set from adolescents showed the same factor structure (minus the Sexual Relationships factor) as that from adults (Foulkes, et al., 2014; see Chapter 3).. The default in Mplus is to estimate latent models using all available data, including cases that have some missing values for some variables. Therefore, all available data was used for the CFA. The proportion of missing values for the current study was examined by a covariance coverage matrix, which provides an estimate of available observations for each pair of variables. The percentage of data present for each pair of variables ranged from 98% to 100%, indicating that the amount of missing data was minimal.

As recommended by Hu and Bentler (1999), we used a two-index strategy to assess model fit: the incremental Comparative Fit Index (CFI) and the Root Mean Square Error of Approximation (RMSEA), an absolute fit index. As in Chapter 3, we adopted the traditional CFI of 0.90 or above and RMSEA of 0.08 or below (West et al., 2012) as indicative of acceptable model fit.

*Internal consistency*

Cronbach alphas and mean inter-item correlations (MICs) were measured to assess the internal consistency of each SRQ-A subscale.

*Construct validity*

Using SPSS (version 20), Pearson correlational analyses were conducted to assess associations between SRQ-A subscales and measures of personality and CU traits. Pairwise correlations were calculated to maximise the use of available data. Benjamini and Hochberg False Discovery Rate (Benjamini & Hochberg, 1995) was used to control for the probability of making a Type I error on multiple comparisons.

*Test retest reliability*

In order to measure the stability of responses over time, a subset of participants from Sample 2 completed the SRQ twice, exactly one week apart. Pairwise Pearson correlational analyses were conducted to assess associations between subscale scores at the two time points, and Benjamini and Hochberg False Discovery Rate (Benjamini & Hochberg, 1995) was used to control for the probability of making a Type I error on multiple comparisons.

## 5.4. Results

### *5.4.1. Confirmatory factor analysis*

The five-factor model based on the adult version of the questionnaire achieved good fit using the data from the adolescent sample ($\chi^2_{(160)} = 659.69$, $p < .001$; CFI = .90; RMSEA = .07, 90% CI = .07–0.08). Factor loadings were in the range .33–.82 (mean = .65, *SD* = .13) and are shown in **Table 5.1.**

**Table 5.1. Standardised factor loadings from the five-factor CFA**

| Factor | Loading | Item number |
|---|---|---|
| *Admiration* | .73 | 1 |
| | .65 | 7 |
| | .80 | 10 |
| *Negative Social Potency* | .70 | 3 |
| | .48 | 5 |
| | .68 | 8 |
| | .79 | 12 |
| | .78 | 15 |
| *Passivity* | .82 | 11 |
| | .54 | 18 |
| | .68 | 20 |
| *Prosocial Interactions* | .65 | 2 |
| | .33 | 6 |
| | .50 | 14 |
| | .64 | 17 |
| *Sociability* | .60 | 4 |
| | .50 | 9 |
| | .75 | 13 |

### *5.4.2. Internal consistency*

Cronbach alphas and mean inter-item correlations (MICs) were calculated for each subscale to assess internal consistency (see **Table 5.2**). Cronbach alphas were in the range .56 to .74 (mean=.67, SD=.09). For some of the subscales, alpha falls below the cut-off point that is considered acceptable (.70). However, Cronbach alpha is influenced by item number, and these subscales contain only three to five items. It is also not a measure of scale unidimensionality. We therefore also calculated mean inter-item correlations (MICs), a measure of scale unidimensionality that is not affected by item number. MICs were in the range .25 to .43 (mean=.35, SD=.08). These fall within the acceptable range of .15 to .50 suggested by Clark and Watson (1995).

**Table 5.2. Correlations, Cronbach alphas and Mean interitem correlations (MIC) for manifest factor totals (N=568)**

| | 1 | 2 | 3 | 4 | 5 | MIC |
|---|---|---|---|---|---|---|
| *1. Admiration* | *.74* | | | | | .43 |
| *2. Negative Social Potency* | .05 | *.76* | | | | .39 |
| *3. Passivity* | .05 | -.07 | *.67* | | | .40 |
| *4. Prosocial Interactions* | .39** | -.40** | .04 | *.60* | | .25 |
| *5. Sociability* | .49** | .00 | .02 | .37** | *.56* | .30 |

Corrected p values shown; **p<.01, *p<.05
Cronbach alphas appear on the diagonal

### *5.4.3. Test-retest reliability*

A subset of participants completed the SRQ-A twice, seven days apart (N=46). To select participants to complete the SRQ-A twice, two classes were chosen at random from one of the schools. Data from five participants were excluded from the test-retest analysis: one participant answered 'strongly disagree' to 19/20 questions at Time 2, indicating that the questionnaire was not answered carefully; one participant had more than 20% of SRQ data missing at Time 1; and three participants who gave data at Time 1 were not available at Time 2. This left a final sample of N=41, aged 11-13 (mean = 12.54, SD = .55). The sample was 36.60% (N=15) male.

At each time point, subscale scores were calculated if participants had 50% or more valid data for that subscale (i.e. <50% missing data). Therefore, subscale scores were calculated for Admiration, Negative Social Potency and Prosocial Interactions if the participant had three or more valid answers (75% valid), and for Passivity and Sociability if the participants had two or more valid answers (66.66% valid).

Pairwise Pearson correlations were conducted between SRQ-A subscale scores and Time 1 and Time 2. These were in the range .77 to .90 (mean=.81, SD = .06; all p<.001; See Table 5.3). These high correlations indicate the stability of the responses across time.

**Table 5.3. Test-retest reliability: Pearson correlations between factor subtotal scores at Time 1 and Time 2 (time interval = 7 days)**

| Subscale | Correlation between Time 1 and Time 2 |
|---|---|
| Admiration | .84 |
| Negative Social Potency[+] | .77 |
| Passivity | .78 |
| Prosocial Interactions | .90 |
| Sociability | .77 |

[+]N=40; for all other correlations N=41. All p<.001

### *5.4.4. Construct validity: TIPI and CU subscale of ASPD*

As described in Section 5.3.3, subscale scores were calculated if participants had 50% or more valid data for that subscale (i.e. <50% missing data). Pearson correlational analyses were used to explore the pattern of associations between the five SRQ subscales, the TIPI personality subscales and the CU subscale of the ASPD (see **Table 5.4**; only corrected p-values are presented).

Each SRQ-A subscale demonstrated a distinct pattern of associations with the personality subscales, indicating that each SRQ-A measures a relatively distinct aspect of social reward. Admiration was positively associated with conscientiousness, extraversion and openness; Negative Social Potency was negatively associated with agreeableness, conscientiousness and openness; Passivity was negatively associated with extraversion; Prosocial Interactions was positively associated with agreeableness, conscientiousness, extraversion and openness; and Sociability was positively associated with agreeableness, extraversion and openness. These associations were in line with hypotheses (see Section 5.2.4.1), and provide support for the meaning of each SRQ-A subscale.

As hypothesised, CU traits were positively associated with Negative Social Potency and negatively associated with Prosocial Interactions. In addition, CU traits were negatively associated with Admiration and Passivity.

**Table 5.4. Pearson correlations between SRQ subscales and external measures of personality and CU traits**

| | | SRQ subscale | | | | |
|---|---|---|---|---|---|---|
| | | **Admiration** | **Negative Social Potency** | **Passivity** | **Prosocial Interactions** | **Sociability** |
| ***Personality subscale*** | | | | | | |
| *Agreeableness* | r | .06 | **-.39**** | .07 | **.28**** | **.11*** |
| | N | 541 | 540 | 541 | 541 | 541 |
| *Conscientiousness* | r | **.19**** | **-.20**** | .01 | **.24**** | .07 |
| | N | 548 | 547 | 548 | 548 | 548 |
| *Extraversion* | r | **.24**** | 0 | **-.17**** | **.19**** | **.29**** |
| | N | 549 | 548 | 549 | 549 | 549 |
| *Neuroticism* | r | .07 | -.07 | -.02 | .01 | .05 |
| | N | 540 | 549 | 550 | 550 | 550 |
| *Openness* | r | **.20**** | **-.15**** | -.01 | **.30**** | **.26**** |
| | N | 547 | 546 | 547 | 547 | 547 |
| ***CU traits*** | r | **-.14**** | **.39**** | **-.12*** | **-.37**** | -.08 |
| | N | 554 | 553 | 554 | 554 | 554 |

All comparisons corrected for multiple comparisons. Correlations of p<.05 after correcting for multiple comparisons are in bold.
*p<.05, **p<.01

### *5.4.5. Descriptives*

Means, standard deviations, and minimum and maximum scores for each subscale are given in **Table 5.5**.

**Table 5.5. Descriptives for each SRQ-A subscale**

| Subscale | Minimum | Maximum | Mean (SD) | N |
|---|---|---|---|---|
| Admiration | 2.33 | 7.00 | 5.46 (1.06) | 568 |
| Negative Social Potency | 1.00 | 7.00 | 2.77 (1.21) | 567 |
| Passivity | 1.00 | 6.00 | 2.69 (1.16) | 568 |
| Prosocial Interactions | 2.20 | 7.00 | 5.73 (0.79) | 568 |
| Sociability | 1.00 | 7.00 | 5.40 (1.08) | 568 |

## 5.5. Discussion

The aim of the current study was to adapt the adult Social Reward Questionnaire (SRQ; (Foulkes, Viding, McCrory, & Neumann, 2014; see Chapter 3) for use with adolescent populations. The resulting 20-item SRQ-Adolescent Version (SRQ-A) is a valid and reliable measure of individual differences in the value of social rewards, for use with 11-16 year olds. Confirmatory factor analysis was used to demonstrate that a five-factor model based on the adult SRQ fit the adolescent data well, with these factors equating to five subscales of social reward domains: Admiration, Negative Social Potency, Passivity, Prosocial Interactions and Sociability. Further analyses demonstrated that the SRQ-A has good internal consistency, test-retest reliability and construct validity. In addition, callous-unemotional (CU) traits were positivity associated with Negative Social Potency (enjoyment of being cruel and antagonistic) and negatively associated with Prosocial Interactions (enjoyment of being kind and prosocial). This indicates that adolescents with high levels of CU traits show a pattern of 'inverted' social reward, in which being cruel is enjoyable and being kind is not, much like adults with high levels of psychopathic traits (Foulkes, McCrory, Neumann, & Viding, 2014; Chapter 4).

Associations between the SRQ-A subscales and personality domains provide support for the meaning of each subscale and indicate that they are capturing distinct types of socially rewarding interactions. For example, the personality trait extraversion was positively associated with SRQ-A Admiration. Individuals with high levels of extraversion are sociable, friendly and seek out social interactions (e.g. Costa & McCrae, 1992), so the positive association with the enjoyment of admiration found here provides support that

the Admiration subscale is capturing enjoyment of positive social attention. Agreeableness, a personality trait describing warmth and kindness interactions (e.g. Costa & McCrae, 1992), was positively associated with SRQ-A Prosocial Interactions and negatively associated with SRQ-A Negative Social Potency. Agreeableness has previously been associated with motivation to use prosocial tactics, such as compromise, to resolve conflict (Jensen-Campbell & Graziano, 2001). Its positive association with SRQ-A Prosocial Interactions provides support that this subscale is capturing enjoyment of behaving prosocially, and its negative association with SRQ-A Negative Social Potency provides support that this subscale captures the reward value of behaving in an antagonistic and antisocial manner towards others.

Associations between the SRQ-A subscales and CU traits indicate that adolescents with high levels of CU traits show an pattern of 'inverted' social reward, in a similar manner to adults with high levels of psychopathic traits (Foulkes, McCrory, Neumann, & Viding, 2014; Chapter 4). Specifically, adolescents with high levels of CU traits report more enjoyment from being cruel, callous and antagonistic towards others, and less enjoyment from having affiliative, prosocial exchanges with others. This evidence of increased enjoyment from antisocial behaviour is in line with other research showing a moderate association between psychopathic and sadistic personality traits in adolescents (Chabrol, Van Leeuwen, Rodgers & Séjourné, 2009) – indicating that adolescents with high levels of psychopathic-type traits experience a degree of enjoyment from hurting others. The positive association reported here between CU traits and SRQ-A Negative Social Potency suggests that the increased levels of antisocial behaviour seen in adolescents with high levels of CU traits (e.g. Rowe et al., 2010) may be motivated partly by the reward value that this behaviour has for these individuals.

Equally, the negative association between CU traits and enjoyment of prosocial relationships may provide an important explanation for why these individuals are less likely to affiliate with and behave prosocially towards others (Dadds et al., 2014; Frick et al., 2013) and have long-term friendships (Muñoz et al., 2008). The findings reported here present an interesting possibility that prosocial interactions and relationships may simply not be as enjoyable – or enjoyable at all – for adolescents with high levels of CU traits. If this is the case, it makes intuitive sense that these individuals are not motivated to engage

in these behaviours (unless, of course, there is some later consequence that *is* rewarding for them, such as gaining money or favours).

This 'inverted' pattern of social reward – where being cruel is enjoyable and being kind is not – should be taken into account when considering interventions to reduce levels of CU traits. For example, it would be interesting to explore whether it is possible to modify the low levels of social reward experienced from prosocial interactions by these adolescents. Some authors have suggested that a particular emphasis on parental warmth and responsiveness may be important when designing interventions for adolescents with high levels of CU traits (e.g. Frick & White, 2008), and in line with this, children both with and without high levels of CU traits responded equally well to an intervention that focussed on increasing parental positive reinforcement to encourage prosocial behaviour (Hawes & Dadds, 2005). More longitudinal, randomised control studies are needed to explore if such parental interventions are effective at reducing CU traits, and importantly if the mechanism of change is associated with a change in the reward value of prosocial exchanges. Indeed, it would be important to understand whether social reward in interactions with parents differs from that to peers, and whether any changes in the reward value of interactions with parents can be generalised to other contexts. Equally, it would be important to understand whether the *increased* reward value of antisocial behaviour could be reduced, for example by emphasising potential costs to the individual of behaving antisocially, or potential gains of behaving prosocially.

It is interesting to note differences between the current adolescent sample and the previous adult sample traits (Foulkes, McCrory, Neumann, & Viding, 2014; Chapter 4) with regard to associations between the SRQ subscales and psychopathic/CU traits. For example, the current study showed a modest *negative* association between CU traits and both enjoyment of admiration and enjoyment of passivity. In contrast, the previous adult sample showed *positive* associations between interpersonal psychopathic traits and enjoyment of admiration, and between interpersonal, lifestyle and antisocial psychopathic traits and enjoyment of passivity (Foulkes, et al., 2014; Chapter 4). This presents an interesting possibility that gaining approval and praise (Admiration) and allowing others to take the lead (Passivity) may have different reward values for adults with high levels of psychopathic traits compared to adolescents with high levels of CU traits – or indeed for typical adults compared to typical adolescents. For example, for adults with high

levels of psychopathic traits, the Admiration subscale may be interpreted as social attention that is flattering and useful for manipulating others. Adolescents with high levels of CU traits, on the other hand, may interpret the items in the Admiration subscale as indicative of gaining approval from authority figures such as teachers and parents, which may be undesirable to them. Similarly, passivity may be enjoyable for adults with high levels of psychopathic traits as allowing others to make decisions means less effort for the individual and more opportunity to be a 'free loader' (Foulkes, et al., 2014; Chapter 4), whereas for adolescents, passivity may be interpreted as submission to authority. This may be particularly undesirable for adolescents with high levels of CU traits, who tend to rebel (Frick et al., 2013). We acknowledge the speculative nature of these interpretations; further investigations are necessary to comprehensively understand how adults and adolescents interpret the meaning of the different SRQ subscales.

Additionally, it is interesting to consider the negative association between CU traits and the Admiration subscale in the context of what is known to be rewarding for typical adolescents. Specifically, gaining approval and avoiding rejection from peers is known to be particularly salient for adolescents (Jones et al., 2014; Sebastian et al., 2010). The current findings suggest that, as CU traits increase, admiration or approval from others is less rewarding. This is particularly interesting as this source of reward is considered to be so potent for typical adolescents (Jones et al., 2014; Sebastian et al., 2010). As the SRQ-A asks participants to answer the questions in relation to *all* people in their lives, it is not clear whether this reduced reward value of admiration relates to interactions with peers, parents, teachers, or some combination of these. It would be interesting to explore this further in future studies to better understand in what way gaining admiration and approval from others, a salient reward for most adolescents, may be less rewarding for those with high levels of CU traits.

### *5.5.1. Limitations*

It is important to note a number of limitations of the current study. Firstly, the items in the SRQ-A were taken from the adult SRQ (Foulkes, Viding, McCrory, & Neumann, 2014; Chapter 3), after the Sexual Relationships subscale was dropped and the wording of two items was adjusted. For the adult SRQ, the final items were chosen after an

exploratory factor analysis (EFA) was conducted on a wider item set (75 items); the items in the final questionnaire were those that loaded most strongly and unambiguously onto their respective factors. In the adolescent version described here, these final adult items (with two slightly adjusted) were used to conduct a confirmatory factor analysis (CFA) with an adolescent sample. It is important to consider that if an entirely data-driven approach was used with adolescents, in which an EFA was first conducted on a wider item set, different factors and items may have been discovered. However, the five-factor model taken from the adult SRQ did have good model fit with the adolescent sample. This indicates that, although an entirely data-driven approach was not used, the five-factor model used here still captures meaningful aspects of social reward in adolescents; this is also indicated by associations between the SRQ-A subscales and external variables.

A limitation with respect to the associations between the SRQ-A subscales and CU traits is that a relatively brief measure of CU traits was used. This brief measure was chosen due to time constraints imposed by the schools. With future samples it would be interesting to assess associations between the SRQ-A subscales and a more comprehensive measure of CU traits such as the 24-item Inventory of Callous-Unemotional Traits (ICU; Kimonis et al., 2008). In addition, it is important to assess whether the associations found here are replicated in samples of adolescents with clinically significant levels of CU traits.

### *5.5.2. Conclusion*

In this study we described the development and validation of the 20-item Social Reward Questionnaire – Adolescent Version (SRQ-A). The SRQ-A is a valid and reliable measure of individual differences in the value of social rewards, for use with 11-16 year olds. Using CFA, we demonstrated that a five-factor model, based on the adult version of the SRQ, had good model fit with the adolescent sample. These five factors equate to the five subscales of the questionnaire: Admiration, Negative Social Potency, Passivity, Prosocial Interactions and Sociability. The questionnaire assesses individual differences in the reward value experienced from each of these social interaction domains. In addition, we presented analyses that demonstrated the construct validity, internal reliability, and test

re-test reliability of the SRQ-A. In sum, the SRQ-A is a valid and reliable measure of individual differences in the value of social reward, for use in adolescent populations.

# Chapter 6: General Discussion

## 6.1. Overview

Psychopathic traits delineate a subgroup of antisocial individuals who are affectively cold, lack empathy and guilt, and show a tendency to manipulate and deceive others for their own gain (Hare, 2003). These individuals also show an increased tendency to engage in impulsive and risk-taking behaviours, and display a pattern of disruptive acts that violate the rights of others (Hare, 2003). Similarly, high levels of CU traits characterise a subgroup of antisocial youth who show dysfunctional affective and interpersonal traits such as a lack of empathy and guilt (Frick, 2009). Both adults with high levels of psychopathic traits and youth with high levels of CU traits show a distinctive pattern of problematic social behaviour, which can be parsed into two observations: a reduction in prosocial, affiliative behaviour, and an increase in antisocial behaviour (see General Introduction, Section 1.3.1).

To date, theories that attempt to understand psychopathy have focused on the increased levels of cruel and antisocial behaviour seen in the disorder. These theories have often focused on the disruption of typical socialization processes, such as learning to experience others' distress as aversive (Blair, 2005). Although such theories are useful for understanding the increased presence of antisocial behaviour in psychopathy, they do not adequately explain the other social deficit associated with the disorder: the reduced presence of prosocial, affiliative behaviour. Furthermore, the possible role of social reward processing in psychopathy has largely been overlooked. This is surprising, considering the proportion of psychopathic/CU traits that relate to atypical social interactions, and the evidence that deficits in social reward processing are implicated in other disorders with problematic social interactions (e.g. Bora, Yucel, & Allen, 2009; see General Introduction, Section 1.5.4.). This thesis used behavioural methods to investigate the associations between psychopathic or CU traits and several indices of social reward, with the goal of better understanding how atypical social reward processing may contribute to the dysfuntional social behaviour seen in psychopathy.

## 6.2. Research questions

As detailed in the General Introduction, this thesis explores the relationship between psychopathic traits and social reward by addressing the following research questions:

1) *What types of social functioning and relationships are valued by individuals with high levels of psychopathic traits?*
2) *In general, what is the structure of social reward?*
3) *In what way are psychopathic traits in adults associated with self-report and experimental measures of social reward?*
4) *What types of social interactions are rewarding for adolescents, and in what way are they associated with callous-unemotional traits?*

Findings from the current thesis, which address each of these questions in turn, are discussed in the following sections.

### *6.2.1. What types of social interactions and relationships are valued by individuals with high levels of psychopathic traits?*

In Chapter 2 of this thesis, I described a study that employed a measure of psychopathic traits and a number of existing measures of social functioning in a community sample of males. Specifically, this study employed measures assessing social/material goals, social beliefs and the need for belonging, and a novel experimental vignettes task (the Dominance Judgements task) that measured the extent to which participants identified dominance in themselves and admired this trait in others. The aim of the study was to provide an initial exploration of which aspects of social functioning might be considered valuable or rewarding for individuals with high levels of psychopathic traits. It was found that individuals with high levels of affective/interpersonal (AI; "Factor 1") psychopathic traits appeared not to be motivated by meaningful, long-term relationships. Instead, they reported being motivated by goals relating to their own image and financial success. Additionally, findings from the Dominance Judgements task indicated that these individuals admired dominance in others, but did not clearly identify this trait in themselves.

Overall, the findings from this study suggest that individuals with high levels of psychopathic traits are motivated to look after themselves, but do not value affiliative and long-term relationships with others. These findings are in line with existing literature showing that psychopathy is associated with reduced importance of affiliative long-term relationships (Baird, 2002; Hare, 1999). Together, these findings indicate that individuals with high levels of psychopathic traits may not place the same reward value on affiliative social interactions as typical individuals do (Esch & Stefano, 2005).

Additionally, Chapter 2 presented interesting findings regarding the relationship between psychopathic traits and interpersonal dominance. In the Dominance Judgements task, the AI dimension of psychopathy was positively associated (at-trend) with perceived similarity to dominant/cold characters, but also positively associated with perceived similarity to submissive/cold characters. Thus individuals with high levels of psychopathic traits clearly identified themselves as cold, but did not clearly identify themselves as dominant. In addition, we found an at-trend association between the AI dimension of psychopathy and the perceived desirability and likeability of the dominant/cold characters. Although this finding is only at the level of a trend, it presents the possibility that in the community, while individuals with high levels of psychopathic traits do not clearly express dominance themselves, they do admire and aspire to be like dominant/cold characters. Further research is required to clarify the relationship between psychopathic traits and interpersonal dominance (see Section 6.3.1).

The study presented in Chapter 2 was an initial exploration of the association between psychopathic traits and various measures of social functioning. The study indicated that individuals with high levels of psychopathic traits may not place the same reward value on affiliative social interactions as typical individuals do (Esch & Stefano, 2005). However, an important limitation of this study is the battery did not include a measure that directly assessed the reward value of different social interactions. This was because, to our knowledge, such a measure did not exist in the literature at that time. Therefore, further research was required to directly address what individuals with high level of psychopathic traits do find rewarding in social interactions.

### *6.2.2. What is the structure of social reward?*

This question was addressed in Chapter 3. To our knowledge, no existing measure has been developed to assess individual differences in the value of social reward, and therefore no existing measure that could be used to assess associations between psychopathic traits and social reward value. In addition, existing attempts to document and categorise exactly what types of social interactions were rewarding were generally theoretically driven (Buss, 1983; Turner, Foa, & Foa, 1971). The study described in Chapter 3 was designed to overcome these two gaps in the literature. Specifically, we developed and validated a questionnaire that used data-driven methods (exploratory and confirmatory factor analysis; EFA and CFA) to identify the structure of social reward. These analyses identified a six-factor structure that fit the data well. The final 23-item Social Reward Questionnaire is a measure of individual differences in the value of six types of social reward, for use with adults aged 18 and over.

The six factors identified in the EFA and CFA can be described as follows: *Admiration*, the enjoyment of being flattered and gaining attention; *Negative Social Potency*, the enjoyment of being cruel and using others for personal gains; *Passivity*; the enjoyment of giving others control and allowing them to make decisions; *Prosocial Interactions*, the enjoyment of having kind, reciprocal relationships; *Sexual Relationships*, the enjoyment of having frequent sexual experiences; and *Sociability*, the enjoyment of socializing and engaging in group interactions. Each of these factors equates to a subscale in the SRQ.

Different subscales of the SRQ showed distinct associations with external measures, such as those assessing personality and interpersonal goals. This provides support for the meaning of each subscale and suggests that they each capture a distinct aspect of social reward. The subscales also showed good internal consistency and test-retest reliability. Together, the study demonstrated that the SRQ is a valid, reliable measure of individual differences in the reward value of different social interactions.

Although the purpose of this study was not to explore associations between psychopathic traits and social reward, a brief measure of socially undesirable personality traits, the Dirty Dozen (Jonason & Webster, 2010), was included as part of the battery to assess construct validity. We found that all three subscales – named Machiavellianism, narcissism and psychopathy by the authors – were positively associated with the enjoyment of Negative Social Potency and negatively associated with the enjoyment of Prosocial Interactions. This presented an interesting preliminary finding that individuals with high levels of psychopathic traits may have an atypical profile of social reward value. However, as this psychopathy subscale is unidimensional and consists of only four items, some researchers have questioned its validity for assessing psychopathic traits (Miller et al., 2012). Therefore, additional research was required to comprehensively assess the relationship between psychopathic traits and social reward.

### *6.2.3. In what way are psychopathic traits in adults associated with self-report and experimental measures of social reward?*

In Chapter 4, I presented results from two studies designed to address this question. In Study 1, participants completed a measure of psychopathic traits (Self-Report Psychopathy Scale Short-Form; Paulhus, Neumann, & Hare, 2015) and the Social Reward Questionnaire (SRQ) developed in Chapter 3. The purpose of this study was to explore which aspects of self-reported social reward value are associated with psychopathic traits. In Study 2, the same measures were administered to a new group of participants along with two experimental tasks assessing monetary and social reward processing. In both samples, psychopathic traits were found to be positively associated with the enjoyment of callous treatment of others and negatively associated with the enjoyment of positive social interactions. This indicated a pattern of 'inverted' social reward, in which being cruel is enjoyable and being kind is not. In the experimental tasks in Chapter 4, interpersonal psychopathic traits were also positively associated with the difference between mean reaction times (RTs) in the monetary and social tasks; in other words, individuals with high levels of these traits responded comparatively faster to social than monetary reward.

The first key finding of this study – that individuals with high levels of psychopathic traits appear to show an 'inverted' pattern of social reward – is in line with other studies assessing the types of interactions these individuals tend to engage in. For example, previous studies have shown that individuals with high levels of psychopathic traits tend to devalue kindness in potential friends, report fewer long-term goals relating to affiliation, and prefer one night stands to long term romantic relationships (Baird, 2002; Jonason, Luevano, & Adams, 2012; Jonason & Schmitt, 2011). The negative association between psychopathic traits and the enjoyment of affiliative interactions is in line with the findings from Chapter 2 indicating that individuals with high levels of psychopathic traits placed less importance on long-term, intimate relationships. Together, these findings suggest that individuals with high levels of psychopathic traits may not be motivated to engage in affiliative interactions and relationships because these exchanges simply do not have the same reward value for these individuals as they do for other people. In addition, the current finding that psychopathic traits are associated with increased enjoyment of cruel and antagonistic behaviour is in line with previous evidence that individuals with high levels of these traits enjoy antisocial forms of entertainment, such as internet 'trolling' (Buckels et al., 2014) and playing violent video games (Williams et al., 2001). In sum, the current findings are in line with studies showing the types of relationships and activities individuals with high levels of psychopathic traits prefer to engage in, and suggest that these preferences may be explained, at least in part, by what these individuals find socially rewarding.

The second key finding was that interpersonal psychopathic traits were significantly associated with the difference score between RTs to monetary and social reward, indicating that individuals with high levels of these traits may place particular value on social reward relative to monetary reward. To interpret this finding, it is important to consider what the social reward symbol used in this study - the Facebook 'Like' symbol - might represent. Specifically, this 'thumbs up' symbol represents social approval and admiration on the social networking site. Therefore, we speculate that the social approval/admiration associated with this symbol may have particular value for individuals with high levels of interpersonal psychopathic traits because they have a tendency to use and manipulate others, and others' admiration is useful in this regard (Hare, 2003). It is also worth noting the public nature of the approval represented by

the ‘Like’ symbol – as opposed to, for example, a private exchange of approval/admiration between two individuals. It may be this well-publicized form of flattery, which is likely to be seen by many others, that is particularly appealing and useful for individuals with high levels of interpersonal psychopathic traits.

Together, the studies presented in Chapter 4 provide an interesting insight into the types of social interactions and relationships that might have reward value for individuals with high levels of psychopathic traits. Firstly, these individuals appear to enjoy behaving cruelly towards others, and do not enjoy being kind. Secondly, individuals with high levels of interpersonal psychopathic traits appeared to be particularly responsive to the social reward represented by the Facebook ‘Like’ symbol, relative to a symbol of monetary reward. These findings are interesting considering the types of social interactions that are characteristic of psychopathy: these individuals are antagonistic, antisocial and manipulative, and are unlikely to engage in affiliative interactions unless there is some additional benefit from themselves (e.g. Hare, 1999). Together these studies provide evidence that the self-serving and cruel social behaviour seen in psychopathy may in part be explained by what these individuals find (and do not find) rewarding.

### *6.2.4. What types of social interactions are socially rewarding for adolescents, and in what way are they associated with callous-unemotional traits?*

We addressed these questions in Chapter 5. In the study presented in this chapter, we validated the Social Reward Questionnaire – Adolescent Version (SRQ-A), a modified version of the adult Social Reward Questionnaire (SRQ) for use with 11-16 year olds. To do this, we removed the Sexual Relationships subscale from the adult SRQ and simplified some of the language, in order to make the measure appropriate for use in young populations. We then asked a group of 11-16 year olds to complete the questionnaire, alongside brief measures of personality traits and callous-unemotional (CU) traits. We conducted a confirmatory factor analysis to explore whether or not a model based on the structure of the adult SRQ would have good model fit with the data provided by the adolescent participants. We found that a five-factor model based on the adult SRQ (the six-factor model with the Sexual Relationships subscale

removed) had good model fit with the adolescent data. This indicates that these five types of social reward – Admiration, Negative Social Potency, Passivity, Prosocial Interactions and Sociability – were also types of social interactions that can be experienced as rewarding by adolescents. In addition, each subscale showed a unique pattern of associations with the measures of personality and CU traits, indicating that each subscale captured a distinct aspect of social reward in this age group. Further analyses demonstrated that the SRQ-A had acceptable internal consistency and test-retest reliability.

Associations between the SRQ-A subscales and the measure of CU traits demonstrated that adolescents with high levels of CU traits displayed an 'inverted' pattern of social reward, much like adults with high levels of psychopathic traits (Chapter 4; Foulkes, McCrory, Neumann, & Viding, 2014). Specifically, we found that CU traits were positively associated with the enjoyment of cruel social behaviour and negatively associated with enjoyment of kind, prosocial behaviour.

A limitation of the SRQ-A is that its items were taken from the adult SRQ (after the Sexual Relationships subscale was dropped, and two items had slightly adjusted wording). It is important to consider that if an entirely data-driven approach was used with adolescents, in which an EFA was conducted on a wider item set and then CFA was conducted on a refined item set, different factors and items may have been shown to best capture the structure of social reward in this age group. However, the five-factor model taken from the adult SRQ did have good model fit with the adolescent sample. This indicates that, although an entirely data-driven approach was not used, this five-factor model is still an accurate representation of the structure of social reward in adolescents. Therefore, the SRQ-A is a valid, reliable measure of individual differences in social reward value in adolescents, and its association with CU traits indicates that this measure may have clinical utility.

## 6.3. Implications and future research

There are a number of implications of the findings presented in this thesis, which I will now discuss in turn.

### *6.3.1. The relationship between psychopathic traits and dominance should be further explored*

In Chapter 2 of this thesis, I presented findings regarding the relationship between psychopathic traits and interpersonal dominance using a novel vignettes task, the Dominance Judgements task. We found that affective/interpersonal (AI) psychopathic traits were positively associated (at-trend) with similarity to dominant/cold characters, but also positively associated with similarity to submissive/cold characters. We interpreted this as meaning that individuals with high levels of psychopathic traits clearly identified themselves as cold, but did not clearly identify themselves as dominant. In addition, we found an at-trend association between the AI dimension of psychopathy and the perceived desirability and likeability of the dominant/cold characters. Although this finding is only at the level of a trend, it presents the possibility that in the community, while individuals with high levels of psychopathic traits do not clearly express dominance themselves, they do admire and aspire to be like dominant/cold characters. These findings add to a mixed existing literature on the relationship between psychopathic traits and dominance (see Chapter 2, Discussion and this General Discussion, Section 6.2.1).

In Chapter 2, our goal was to provide a broad, exploratory assessment of the association between dominance and psychopathic traits. In future research, it would be valuable to explore this relationship in more detail. In particular, it would be interesting to specifically identify what aspects of dominance, if any, are motivating or rewarding for individuals with psychopathic traits. For example, it may be that these individuals are motivated to be dominant over others only if this leads to some further goal, such as being sexually successful or gaining a promotion in the workplace; they are not motivated by dominance in and of itself. Alternatively, it may be that individuals with high levels of psychopathic traits enjoy the control over others that results from social dominance, while not enjoying dominance per se. Finally, it may be that dominance is associated with psychopathic traits but is not considered to have reward value for these individuals, or indeed it may neither be associated with nor rewarding for these individuals.

Carefully designed studies are required, which assess the finer nuances of dominance in various social situations. For example, well-controlled paradigms using confederates or virtual reality technology could allow different social scenarios to be created in the laboratory, in which levels of interpersonal dominance, control and outcomes are carefully calibrated and assessed. Such paradigms may be required to gain a more comprehensive understanding of the relationship between dominance and psychopathic traits and the extent to which this social situation is rewarding for individuals with these traits.

### *6.3.2. The pattern of 'inverted' social reward seen in individuals with high levels of CU/psychopathic traits provides some explanation for their atypical social behaviour*

As described in the General Introduction (Section 1.3.1), the dysfunctional social behaviour seen in individuals with high levels of psychopathic traits can be grouped into two broad observations. Firstly, these individuals engage in unusually high levels of antisocial behaviour. Secondly, they engage in unusually low levels of prosocial behaviour and affiliative relationships. To date, explanations of the atypical social behaviour seen in psychopathy have largely focused on the increased tendency to behave antisocially towards others, whilst the reduction of positive social behaviour seen in adults and adolescents with these traits has received little research attention. For example, the Integrated Emotions System model of psychopathy (IES; Blair, 2005) has focused largely on how amygdala dysfunction leads to a breakdown in typical socialization processes, particularly with regard to learning associations between one's own bad behaviour and negative outcomes for others. The IES model proposes that due to the failure of this socialization system, individuals with high levels of psychopathic traits are unfettered by the empathy and guilt caused by other people's distress that typically prevents antisocial behaviour. As a result, they are more likely to engage in antisocial behaviour to achieve their goals. There is substantive evidence to support this model, from evidence of amygdala dysfunction in response to negative emotional stimuli in these individuals (Seara-Cardoso & Viding, 2014) to evidence of their difficulty recognizing others' distress (Dawel et al., 2012).

It is perhaps logical that research attention has focused so heavily on the increased levels of antisocial behaviour in psychopathy, since it is the presence of this behaviour that is so costly to others (e.g. Kiehl & Hoffman, 2011). However, to fully understand the spectrum of social dysfunction in this disorder, I argue that it is critical to understand why they are not simply more antisocial, but also less prosocial. Specifically, clinical descriptions of both adults and adolescents with psychopathic/CU traits note their marked disinterest in forming close bonds with others – unless it may lead to some other gain for themselves (Hare, 2003). Experimental evidence has also demonstrated the short-lived friendships of adolescents with high levels of CU traits (Muñoz et al., 2008), and, in adults with high levels of psychopathic traits, the reduced levels of private prosocial behaviour (White, 2014) and lack of motivation to form long-term intimate relationships (Jonason et al., 2012). Thus, some research has documented the atypically low levels of affiliative and prosocial behaviour in individuals with high levels of psychopathic traits, but little research has attempted to understand the mechanisms underlying this. The aim of this thesis was to explore associations between psychopathic/CU traits and social reward, and specifically to explore the possibility that an atypical experience of social reward in this population may provide some explanation for the unusual profile of social behaviour seen in psychopathy.

Studies in the current thesis indicated that adults with high levels of psychopathic traits are not motivated to form affiliative bonds with others (Chapter 2), do not find prosocial interactions rewarding (Chapter 4), and instead find antagonistic and cruel behaviour towards others rewarding (Chapter 4). I also demonstrated that a similar pattern of 'inverted' social reward can be seen in adolescents with high levels of CU traits (Chapter 5). These findings – that individuals with high levels of psychopathic/CU traits enjoy being cruel and do not enjoy being kind – have potentially important consequences for understanding the social behaviour seen in these individuals. These findings suggest that individuals with high levels of psychopathic/CU traits may not seek out prosocial interactions because these interactions simply do not have the same reward value as they do for typical individuals.

Significantly, these findings also indicate that individuals with high levels of psychopathic traits do not just feel indifferent about their cruelty towards others, or see it merely as a means to an end. Instead, they report finding enjoyment in their antisocial behaviour towards others. This has important consequences for considering interventions to reduce bad behaviour in these individuals; such interventions must address the reality that antisocial behaviour in these people is not merely a tool, or a consequence of failed inhibitory mechanisms, but instead is an enjoyable pursuit with inherent reward value. If future research continues to find an association between psychopathic/CU traits and the enjoyment of cruel behaviour towards others, then incorporating this knowledge into interventions may be critical for their success.

As mentioned in the General Discussion of Chapter 4, it remains unclear exactly why these individuals report finding cruel social behaviour rewarding. One possibility is that the reward comes directly from causing a person pain (physical or psychological). Alternatively, the enjoyment may stem from the power and control that is associated with causing another person to suffer, and it is this rather than the pain per se that has reward value. Both possibilities have been included in definitions of sadism, a surprisingly underexplored concept in social psychology (Buckels et al., 2014; Meloy, 1997; O'Meara, Davies, & Hammond, 2011). Further research should probe the exact nature of the antisocial reward that is associated with psychopathic/CU traits, including which aspects of sadism may be particularly relevant to psychopathy.

### *6.3.3. The neural underpinnings of social reward processing in individuals with high levels of psychopathic traits should be explored*

The research presented in the current thesis explored associations between psychopathic/CU traits and behavioural measures of social reward, using both questionnaire and experimental methodology. This has provided a valuable initial exploration between psychopathic traits and social reward processing. However, it is important to explore these associations further using other methodologies. Firstly, it would be interesting to explore the possible neural underpinnings of the atypical social

reward processing seen in individuals with high levels of psychopathic traits, for example by using an fMRI paradigm that explores social reward processing. Existing evidence of reward processing has suggested that psychopathic traits are associated with hyperresponsiveness to monetary reward (Bjork, Chen, & Hommer, 2012; Buckholtz et al., 2010; Pujara, Motzkin, Newman, Kiehl, & Koenigs, 2013). It would be informative to use similar paradigms used in these existing studies, such as the Social Incentive Delay task used in Chapter 4, to explore the neural response to social reward in this population.

Secondly, it would be interesting to investigate the possible genetic and epigenetic basis behind the atypical social reward processing in individuals with high levels of psychopathic traits. Existing studies have found that callous-unemotional (CU) traits in adolescents are associated with higher methylation of the oxytoxin receptor gene (Dadds, Moul, Cauchi, Dobson-Stone, Hawes, Brennan, & Ebstein, 2014) and with a specific allele of this gene (Dadds, Moul, Cauchi, Dobson-Stone, Hawes, Brennan, Urwin, et al., 2014). Oxytocin is a neuropeptide that has been associated with many aspects of social functioning, including prosocial behaviour and attachment (Meyer-Lindenberg, Domes, Kirsch, & Heinrichs, 2011). As such, having a certain variant (or variants) of oxytocin system gene(s), or experiencing epigenetic changes that may influence availability of oxytocin, may predispose an individual to lower affiliative tendencies and reduced levels of social reward. This in turn may contribute to the atypical social behaviour seen in individuals with high levels of CU/psychopathic traits. Future research should explore this further by assessing the association between specific genetic variants, epigenetic changes, social reward processing and psychopathic/CU traits.

### *6.3.4. Paradigms should be developed that assess how individuals with high levels of psychopathic traits process happy faces*

This thesis presents evidence that individuals with high levels of psychopathic traits report an atypical profile of social reward experience, and in addition may respond atypically to a symbol that represents social reward (the Facebook 'Like' symbol; Foulkes et al., 2014; Chapter 3). It would be fruitful to explore this further by

investigating how individuals with high levels of psychopathic/CU traits process other potentially socially rewarding stimuli. In particular, it would be important to assess how these individuals process happy faces. This is because there is considerable evidence demonstrating that happy faces are powerful positive social stimuli that are subjectively experienced as rewarding and activate neural regions implicated in reward processing (O'Doherty et al., 2003; Lin, Adolphs, & Rangel, 2012; Rademacher et al., 2010; Spreckelmeyer et al., 2009).

This future work would build on a small existing literature indicating that individuals with high levels of psychopathic/CU traits process happy faces differently to typical individuals. For example, as described in the General Introduction (Section 1.6.1), one study found that adolescents with high levels of CU traits are not distracted by irrelevant happy faces, unlike typical adolescents (Hodsoll et al., 2014). Other researchers have found that children with high levels of CU traits make less eye contact with their mothers, regardless of their mother's behaviour, and suggest that this may reflect a general deficit in orienting towards emotionally salient faces (e.g. Dadds, et al., 2014). In adults, prison inmates with high levels of psychopathic traits showed reduced recognition accuracy of happy faces (Hastings et al., 2008), and reduced neural activation in face-processing regions when viewing happy faces (Decety et al., 2014), compared to those with lower levels of psychopathic traits. Together these studies indicate that individuals with high levels of psychopathic/CU traits may process happy faces atypically, but they did not directly assess the reward value of these stimuli. Therefore, an important future research direction would be to explore the extent to which happy faces are rewarding for individuals with high levels of psychopathic traits, using a range of behavioural and neuroimaging methods. Specifically, future studies could assess the extent to which these individuals experience happy faces as subjectively rewarding, and use neuroimaging techniques such as fMRI to assess activation of the brain's reward circuitry when processing these images.

### *6.3.5. More complex social interactions*

Static images of happy faces are useful experimental stimuli for studying social reward, and it is vital that future studies explore the processing of happy faces in individuals with high levels of psychopathic/CU traits as a means of understanding social reward processing in these individuals. However, static happy faces lack ecological validity. In real-life social interactions, faces are dynamic stimuli interpreted alongside other social information such as body language, vocal cues and situational context. It will therefore be important to build on basic research with using happy faces by devising controlled experiments that assess how individuals with high levels of psychopathic traits respond to more complex and realistic social interactions. For example, participants could be recording having a social exchange with a confederate or a known other such as a friend or partner. Dyadic interactions could be filmed and later coded by researchers to assess various aspects of social interaction such as proximity-seeking and affection. Existing studies have already investigated how often individuals with high levels of psychopathic traits cooperate in economic exchange games (e.g. Curry, Chesters, & Viding, 2011; Mokros et al., 2008; Rilling et al., 2007); it would be valuable to expand on these studies by assessing other aspects of social interactions, such as conflict resolution or impression management. Furthermore, it may be possible to investigate the social behaviour of individuals with high levels of psychopathic/CU traits using a virtual reality paradigm, in which behaviour of the computerized social partner can be carefully controlled (Blascovich et al., 2002).

### *6.3.6. Modifying social reward value*

The findings from Chapters 4 and 5 of this thesis indicated that individuals with high levels of psychopathic/CU traits may experience reduced levels of reward from prosocial interactions compared to typical individuals. An interesting future research direction would be to explore whether the reward value of prosocial interactions could be increased via training. In particular, it would be interesting to explore whether such training could be incorporating into existing treatment approaches that aim to reduce levels of CU/psychopathic traits and antisocial behaviour. For example, it would be interesting to assess whether the reward value of happy faces could be modulated via

computerised training, such as by pairing images of happy faces with other rewarding stimuli like money or points, so that over time the positive affect associated with the rewarding stimuli becomes associated with happy faces. If the reward value of happy faces could be increased in this way, it would be important to assess if this effect extends to outside of the training environment. For example, real-life prosocial behaviour, which is typically associated with a happy face in the recipient, may subsequently have increased reward value for the individual who took part in the training. Such training could even utilise virtual reality (VR) applications. VR technology has been utilized for social skills training with other disorders such as schizophrenia, with some success (Park et al., 2011). However, the importance of motivation to take part in such training has been noted (Park et al., 2011), so it would be important to understand how best to encourage individuals with high levels of psychopathic/CU traits to engage in similar interventions. These proposed training ideas are highly speculative, but understanding whether reward value of prosocial interactions can be modulated in individuals with high levels of psychopathic/CU traits, and whether this then increases prosocial behaviour and reduces antisocial behaviour, is a key future research direction.

Importantly, while considering interventions that can reduce levels of psychopathic/CU traits, it may be necessary to accept that the inherent reward value of prosocial behaviour and stimuli may not be amenable to change in individuals with high levels of these traits. Instead of attempting to enhance the inherent reward value of being prosocial, it may instead (or in addition) be important to emphasize to these individuals the selfish benefits of behaving prosocially. Specifically, interventions could focus on the personal gains of playing nice by addressing the question *'What's in it for me?'* to motivate the individual; this is similar to token economies in schools that reward prosocial behaviour with points or other benefits.

In addition, future intervention efforts could capitalize on the finding in the current thesis that individuals with high levels of interpersonal psychopathic traits may find admiration, or whatever is represented by the Facebook 'Like' symbol, to be socially rewarding (Chapter 4, Study 2). For example, some existing parent-led interventions for children/adolescents with high levels of CU traits emphasize warmth and praise (e.g. Hawes & Dadds, 2005). This could be tailored to include praise that emphasizes

impressing others, such as saying ‘Well done, that was really impressive’ or ‘People will admire you if they see you behaving like this’.

### *6.3.7. Extending findings to other populations*

The current thesis presents data from non-clinical, community samples. It is critical for future studies to ask similar research questions and use similar paradigms to those in the current thesis but in clinical populations. This may involve collecting data from young people who are either attending a specialist school or have been referred to a clinic for their high levels of antisocial behaviour. In adults, this may involve collecting data from individuals in prisons or forensic hospitals who exceed the diagnostic cut-off for psychopathy on the PCL-R. Although psychopathic and CU traits are dimensional (Hare & Neumann, 2008; Murrie et al., 2007), it will be informative to assess whether the associations between social reward and high levels of psychopathic/CU traits found in the current thesis are also present in individuals with clinically significant levels of these traits.

## 6.4. Conclusions

Both adults with high levels of psychopathic traits and adolescents with high levels of CU traits display an unusual pattern of social behaviour: they are more likely to engage in callous, antisocial behaviour, and less likely to engage in affiliative, prosocial behaviour. This pattern of social behaviour can be highly costly to anyone who interacts with these adults and adolescents, who are defined – even amongst other antisocial individuals - by their alarming willingness to disregard the impact their behaviour has on others. The current thesis set out to explore associations between psychopathic/CU traits and social reward processing, a topic which has garnered surprisingly little research attention to date. The goal of this thesis was to explore the extent to which atypical social reward processing may contribute to the unusual and costly profile of social behaviour associated with psychopathy.

In the study presented in Chapter 2, I found that adults with high levels of affective and interpersonal psychopathic traits were not motivated to have affiliative, long-term

relationships, and were instead motivated by goals relating to their own image and financial success, suggesting that prosocial relationships may have less reward value for these individuals. In order to explore this further, I developed and validated the Social Reward Questionnaire (SRQ) in Chapter 3. Analyses showed that this measure was a valid and reliable measure of individual differences in the reward value of six types of social interaction: Admiration, Negative Social Potency, Passivity, Prosocial Interactions, Sexual Relationships and Sociability. In Chapter 4, I used the SRQ alongside an experimental measure of social reward and a measure of psychopathic traits. I found that adults with high levels of psychopathic traits showed a pattern of 'inverted' social reward, in which being cruel was enjoyable and being kind was not. In addition, adults with high levels of interpersonal psychopathic traits responded faster to a symbol of social approval – the Facebook 'Like' symbol – than to a symbol of monetary reward, indicating that this type of social interaction may have reward value for these individuals. In Chapter 5, I validated the Social Reward Questionnaire – Adolescent Version (SRQ-A), for use with 11-16 year olds. Findings from this study indicated that adolescents with high levels of CU traits, much like adults with high levels of psychopathic traits, displayed a pattern of 'inverted' social reward, in which being cruel is enjoyable and being kind is not.

Together, the studies presented in this thesis are an important initial exploration of the association between psychopathic/CU traits and social reward processing. Considerable additional research is required to clarify the role that atypical social reward processing may play in the problematic social behaviour seen in this disorder. Potential future research avenues include behavioural experiments that assess the processing of happy face stimuli and also more complex controlled social interactions; in addition, genetic, epigenetic and neuroimaging techniques should be utilised to explore possible mechanisms underpinning the atypical social reward processing seen in individuals with high levels of psychopathic/CU traits. Perhaps most importantly, research into the possible modification of social reward value may ultimately inform interventions that can increase the reward value of prosocial interactions and reduce the reward value of antisocial behaviour in these individuals. At present, the findings from this thesis are an important contribution to understanding the possible role that atypical social reward processing may play in the highly costly personality disorder of psychopathy.

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# Appendices

# Appendix 1. Self-Report Psychopathy Scale Short-Form (Paulhus et al., 2015)

| Item | Subscale |
|---|---|
| 1. I'm a rebellious person | *Lifestyle* |
| 2. I have never been involved in delinquent gang activity | *Antisocial* |
| 3. Most people are wimps. | *Affective* |
| 4. I've often done something dangerous just for the thrill of it. | *Lifestyle* |
| 5. I have tricked someone into giving me money | *Antisocial* |
| 6. I have assaulted a law enforcement official or social worker. | *Antisocial* |
| 7. I have pretended to be someone else in order to get something. | *Interpersonal* |
| 8. I like to see fist-fights. | *Affective* |
| 9. I would get a kick out of 'scamming' someone. | *Interpersonal* |
| 10. It's fun to see how far you can push people before they get upset. | *Interpersonal* |
| 11. I enjoy doing wild things. | *Lifestyle* |
| 12. I have broken into a building or vehicle in order to steal something or vandalize. | *Antisocial* |
| 13. I don't bother to keep in touch with my family any more. | *Affective* |
| 14. I rarely follow the rules. | *Lifestyle* |
| 15. You should take advantage of other people before they do it to you. | *Interpersonal* |
| 16. People sometimes say that I'm cold-hearted. | *Affective* |
| 17. I like to have sex with people I barely know. | *Lifestyle* |
| 18. I love violent sports and movies. | *Affective* |
| 19. Sometimes you have to pretend you like people to get something out of them. | *Interpersonal* |
| 20. I was convicted of a serious crime. | *Antisocial* |
| 21. I keep getting in trouble for the same things over and over. | *Lifestyle* |
| 22. Every now and then I carry a weapon (knife or gun) for protection. | *Antisocial* |
| 23. You can get what you want by telling people what they want to hear. | *Interpersonal* |
| 24. I never feel guilty over hurting others. | *Affective* |
| 25. I have threatened people into giving me money, clothes, or makeup. | *Antisocial* |
| 26. A lot of people are "suckers" and can easily be fooled. | *Interpersonal* |
| 27. I admit that I often "mouth off" without thinking. | *Lifestyle* |
| 28. I sometimes dump friends that I don't need any more. | *Affective* |
| 29. I purposely tried to hit someone with the vehicle I was driving. | *Antisocial* |

# Appendix 2. Friendship Questionnaire

| Item |
| --- |
| 1. I like having regular contact with my friends |
| 2. I call my friends just to see how they are |
| 3. Having close friendships is very important to me |
| 4. If a friend is in need, I would go out of my way to help them |
| 5. I see my friends as often as I can |
| 6. My friendships are often short lived* |
| 7. My friends call on me to support or help them |
| 8. I have a core group of friends |
| 9. The main purpose of a friend is someone to have fun with* |
| 10. I am loyal to my friends |
| 11. I think about my friends a lot |
| 12. My friendships tend to be long-lasting |
| 13. It irritates me when friends ask me for help* |

*Reserve scored item

# Appendix 3. Dominance Judgements task vignettes

| Number | Vignette | Type |
|---|---|---|
| 1a | Paul is a 23 year old student. He has been in a relationship with his girlfriend for over a year. When they go on dates, Paul always decides where they will go, but checks that his girlfriend is happy with his decision. Occasionally, Paul and his girlfriend have an argument, and when this happens, Paul always insists that he is in the right. He respects his girlfriend's opinions, but always persuades her to agree with him. | *Dom/Warm* |
| 1b | Mike is a 23 year old student. He has been in a relationship with his girlfriend for over a year. When they go on dates, Mike always decides where they will go, regardless of what his girlfriend thinks. Occasionally, Mike and his girlfriend an argument, and when this happens, Mike always insists that he is in the right. He dismisses his girlfriend's opinions, and always pushes her to agree with him. | *Dom/Cold* |
| 1c | Adam is a 22 year old student. He has been in a relationship with his girlfriend for over a year. When they go on dates, Adam always wants his girlfriend to decide where they will go because he wants to be considerate. Occasionally, Adam and his girlfriend have an argument, and when this happens, Adam always ends up agreeing with his girlfriend. He respects her opinions, and doesn't mind giving in to her. | *Sub/Warm* |
| 1d | Matt is a 23 year old student. He has been in a relationship with his girlfriend for over a year. When they go on dates, Matt always wants his girlfriend to decide where they will go because it's easier for him. Occasionally, Matt and his girlfriend have an argument, and when this happens, Matt always ends up agreeing with his girlfriend. He dislikes her opinions, and resents giving in to her. | *Sub/Cold* |
| 2a | Dave is a 20 year old student. He is considering what kind of job he wants when he leaves university. He likes the idea of leading a team and wants to be in control of what he does each day, so he is keen to progress quickly to a senior role. When Dave thinks about his future job, he cares most about leading a team that feel they can approach him if they need support. | *Dom/Warm* |

| | | |
|---|---|---|
| 2b | Lee is a 23 year old student. He is considering what kind of job he wants when he leaves university. He likes the idea of leading a team and wants to be in control of what he does each day, so he is keen to progress quickly to a senior role. When Lee thinks about his future job, he cares most about leading a team that gets results with minimal effort from him. | *Dom/Cold* |
| 2c | Simon is a 22 year old student. He is considering what kind of job he wants when he leaves university. He finds the idea of leading a team stressful and would rather someone else made the decisions about what he does each day, so is content to work in a team member role. When he thinks about his future job, Simon cares most working in a team that he will have a good relationship with. | *Sub/Warm* |
| 2d | Craig is a 22 year old student. He is considering what kind of job he wants when he leaves university. He finds the idea of leading a team stressful and would rather someone else made the decisions about what he does each day, so is content to work in a team member role. When he thinks about his future job, Craig cares most working in a team that will makes his life easy. | *Sub/Cold* |
| 3a | Rob is a 21 year old student. He lives in a house with several other students. Whenever a decision needs to be made in the house, Rob will push his point of view across and likes to have the final say on the matter. He will listen to his housemates' opinions and if he anyone has a different opinion to him, he will respect them but try to win them over to his way of thinking. | *Dom/Warm* |
| 3b | Anthony is a 21 year old student. He lives in a house with several other students. Whenever a decision needs to be made in the house, Anthony will push his point of view across and likes to have the final say on the matter. He will listen to his housemates' opinions but if he anyone has a different opinion to him, he will discredit them and try to enforce his way of thinking. | *Dom/Cold* |
| 3c | John is a 20 year old student. He lives in a house with several other students. Whenever a decision needs to be made in the house, John will keep his opinion to himself and likes someone else to have the final say on the matter. He will listen to his housemates' opinions and if he anyone has a different opinion to him, he will respect them and willingly go along with their decision. | *Sub/Warm* |

| | | |
|---|---|---|
| 3d | Andy is a 21 year old student. He lives in a house with several other students. Whenever a decision needs to be made in the house, Andy will keep his opinion to himself and likes someone else to have the final say on the matter. He will listen to his housemates' opinions but if he anyone has a different opinion to him, he will resent them and begrudgingly go along with their decision. | *Sub/Cold* |
| 4a | Ben is a 22 year old student who works part-time as a waiter. He recently found out that friends in similar jobs are getting paid more than him. He feels confident speaking to people in authority so he is keen to ask his manager about getting a pay rise. He is sure she has made a mistake, but doesn't want her to be embarrassed. If she suggests a compromise, Ben will be sensitive but will convince her to give him a full pay rise. | *Dom/Warm* |
| 4b | Mark is a 20 year old student who works part-time as a waiter. He recently found out that friends in similar jobs are getting paid more than him. He feels confident speaking to people in authority so he is keen to ask his manager about getting a pay rise. He is sure she has made a mistake, and doesn't care if she is embarrassed. If she suggests a compromise, Mark will be pushy and convince her to give him a full pay rise. | *Dom/Cold* |
| 4c | Dan is a 21 year old student who works part-time as a waiter. He recently found out that friends in similar jobs are getting paid more than him. He finds it difficult talking to someone in authority so he is reluctantly going to speak to his manager about getting a pay rise. He thinks she may have made a mistake, but wants to be respectful of her. If she suggests a compromise, Dan will go along with it willingly and will want to maintain a good relationship with her. | *Sub/Warm* |
| 4d | Steve is a 21 year old student who works part-time as a waiter. He recently found out that friends in similar jobs are getting paid more than him. He finds it difficult talking to someone in authority so he is reluctantly going to speak to his manager about getting a pay rise. He thinks she may have made a mistake, and feels bitter towards her. If she suggests a compromise, Dan will go along with it but will resent her for it. | *Sub/Cold* |
| 5a | Tom is a 20 year old student. As part of his course, he is working in a group to write and give a presentation. At the start of the project, Tom nominated himself to be team leader as he feels comfortable managing a group. He wants everyone in the group to get a good grade, so if conflict arises in the group, Tom takes control and tries to resolve the issue fairly. | *Dom/Warm* |

| | | |
|---|---|---|
| 5b | Pete is a 23 year old student. As part of his course, he is working in a group to write and give a presentation. At the start of the project, Pete nominated himself to be team leader as he feels comforfigure managing a group. He wants to get himself a good grade, so if conflict arises in the group, Pete takes control and tries to resolve the issue in a way that reflects well on him. | *Dom/Cold* |
| 5c | Richard is a 20 year old student. As part of his course, he is working in a group to write and give a presentation. At the start of the project, Richard waited for someone else to give him instructions as he didn't want to manage the group. He wants everyone in the group to get a good grade, so if conflict arises in the group, Richard remains quiet and hopes they reach a fair compromise. | *Sub/Warm* |
| 5d | Gary is a 23 year old student. As part of his course, he is working in a group to write and give a presentation. At the start of the project, Gary waited for someone to give him instructions as he didn't want to manage the group. He wants to get himself a good grade, so if conflict arises in the group, Gary remains quiet and hopes the problem will have minimal impact on him. | *Sub/Cold* |
| 6a | James is a 22 year old student who has a younger sister. If his sister has a problem, she sometimes asks him what she should do. James is happy to give her advice because he likes telling people what to do, and also wants to help her out. He is very influential and convinces her to do what he says, but is also concerned about her resolving the problem. | *Dom/Warm* |
| 6b | Alex is a 20 year old student who has a younger sister. If his sister has a problem, she sometimes asks him what she should do. Alex is happy to give her advice because he likes telling people what to do, and it also gives him an ego boost. He is very influential and convinces her to do what he says, but isn't concerned about her resolving the problem. | *Dom/Cold* |
| 6c | Chris is a 21 year old student who has a younger sister. If his sister has a problem, she sometimes asks him what she should do. Chris is reluctant to give her advice because he feels uncomfortable telling people what to do, but he wants to help her out. He struggles to think of advice and suggests she should just do what she thinks is best, but is also concerned about her resolving the problem. | *Sub/Warm* |

| | | |
|---|---|---|
| 6d | Nick is a 22 year old student who has a younger sister. If his sister has a problem, she sometimes asks him what she should do. Nick is reluctant to give her advice because he feels uncomfortable telling people what to do, and finds it hard work on his part. He struggles to think of advice and suggests she should just do what she thinks is best, and isn't concerned about her resolving the problem. | *Sub/Cold* |

# Appendix 4. 75-item Social Reward Questionnaire

| Item | Proposed social reward type |
|---|---|
| I enjoy controlling others | *Dominance* |
| I enjoy exerting power over someone | |
| I enjoy having the final say for others | |
| I enjoy gaining influence over others | |
| I enjoy enforcing my opinion when disagreements arise | |
| I enjoy being violent if the situation calls for it | *Aggression* |
| I enjoy hurting someone who threatens me | |
| I enjoy being forceful towards others | |
| I enjoy making others do what I want | *Manipulating/coercing* |
| I enjoy tricking someone into doing things my way | |
| I enjoy tricking someone out of something | |
| I enjoy lying successfully to someone | |
| I enjoy having a committed, intimate relationship | *Intimacy/affiliation* |
| I enjoy having close, long-term friendships | |
| I enjoy feeling emotionally connected to someone | |
| I enjoy making someone feel happy | *Nurturance/helping others* |
| I enjoy helping someone in need, asking nothing in return | |
| I enjoy caring for someone | |
| I enjoy making someone else's life easier | |
| I enjoy putting someone's needs before my own | |
| I enjoy taking responsibility for others | *Leadership* |
| I enjoy being the one in charge | |
| I enjoy being relied on for instructions | |
| I enjoy being in a position of authority | |
| I enjoy it if someone looks up to me | |
| I enjoy it if everyone wants me for a friend | *Popularity* |
| I enjoy it if many people want to invite me to their parties | |
| I enjoy it if everyone who knows me likes me | |
| I enjoy it if people like me better than anyone else | |
| I enjoy "fitting in" with others | *Belonging/being accepted* |
| I enjoy it if someone accepts me as I am, no matter what | |
| I enjoy being accepted by others | |
| I enjoy being a member of a group/club | |

| Item | Proposed social reward type |
|---|---|
| I enjoy it if others say I am attractive | *Being sexually attractive* |
| I enjoy it if someone fancies me | |
| I enjoy someone asking for my number | |
| I enjoy being propositioned by someone attractive | |
| I enjoy going to parties | *Having fun with others* |
| I enjoy sharing activities with others, e.g. watching a film or playing sport | |
| I enjoy being playful with someone else | |
| I enjoy causing someone else physical pain | *"Dark" social rewards* |
| I enjoy making someone else cry | |
| I enjoy embarrassing someone | |
| I enjoy seeing others get hurt | |
| I enjoy making someone angry | |
| I enjoy teasing people | |
| I enjoy being around people who are impressed with what I am like and what I do | *Being admired/getting attention* |
| I enjoy being around others who think I am an important, exciting person | |
| I enjoy being the centre of attention | |
| I enjoy achieving recognition | |
| I enjoy competing with someone | *Competing* |
| I enjoy playing competitive games | |
| I enjoy doing better than someone else | |
| I enjoy keeping promises I make to other people | *Social responsibility* |
| I enjoy treating others fairly | |
| I enjoy cooperating with someone | |
| I enjoy being considerate of others' wishes and beliefs | |
| I enjoy living up to the expectations of others | |
| I enjoy someone supporting me when I have problems | *Receiving assistance/care* |
| I enjoy others taking care of me | |
| I enjoy getting help from others | |
| I enjoy someone listening to my problems | |
| I enjoy someone showing concern for how I am feeling | |
| I enjoy letting someone else tell me what to do | *Submissiveness* |
| I enjoy doing what someone wants me to do | |
| I enjoy following someone else's rules | |
| I enjoy someone else making decisions for me | |

| Item | Proposed social reward type |
|---|---|
| I enjoy having many sexual experiences | *Sexual reward* |
| I enjoy having an active sex life | |
| I enjoy having erotic relationships | |
| I enjoy having one night stands | |
| I enjoy making an effort conversing with a relative if it means I am more likely to receive money or a gift from them | *Personal gain* |
| I enjoy helping someone if I know they will owe me in return | |
| I enjoy being nice to someone only if I gain something out of it | |
| I enjoy cooperating with someone on a work project if it means better promotion prospects/coursework grades for me | |

# Appendix 5. Social Reward Questionnaire

| Item | Subscale |
|---|---|
| 1. I enjoy being around people who think I am an important, exciting person | *Admiration* |
| 2. I enjoy treating others fairly | *Prosocial Interactions* |
| 3. I enjoy making someone angry | *Negative Social Potency* |
| 4. I enjoy going to parties | *Sociability* |
| 5. I enjoy being nice to someone only if I gain something out of it | *Negative Social Potency* |
| 6. I enjoy feeling emotionally connected to someone | *Prosocial Interactions* |
| 7. I enjoy it if others looks up to me | *Admiration* |
| 8. I enjoy tricking someone out of something | *Negative Social Potency* |
| 9. I enjoy having erotic relationships | *Sexual Relationships* |
| 10. I enjoy being a member of a group/club | *Sociability* |
| 11. I enjoy being around people who are impressed with who I am and what I do | *Admiration* |
| 12. I enjoy letting someone else tell me what to do | *Passivity* |
| 13. I enjoy having many sexual experiences | *Sexual Relationships* |
| 14. I enjoy embarrassing others | *Negative Social Potency* |
| 15. I enjoy many people wanting to invite me to their social events | *Sociability* |
| 16. I enjoy keeping promises I make to others | *Prosocial Interactions* |
| 17. I enjoy seeing others get hurt | *Negative Social Potency* |
| 18. I enjoy achieving recognition from others | *Admiration* |
| 19. I enjoy it if someone accepts me as I am, no matter what | *Prosocial Interactions* |
| 20. I enjoy having an active sex life | *Sexual Relationships* |
| 21. I enjoy someone else making decisions for me | *Passivity* |
| 22. I enjoy making someone feel happy | *Prosocial Interactions* |
| 23. I enjoy following someone else's rules | *Passivity* |

# Appendix 6. Social Reward Questionnaire – Adolescent Version

| Item | Subscale |
|---|---|
| 1. I enjoy being around people who think I am an important, exciting person | *Admiration* |
| 2. I enjoy treating others fairly | *Prosocial Interactions* |
| 3. I enjoy making someone angry | *Negative Social Potency* |
| 4. I enjoy going to parties | *Sociability* |
| 5. I enjoy being nice to someone only if I gain something out of it | *Negative Social Potency* |
| 6. I enjoy feeling emotionally close to someone | *Prosocial Interactions* |
| 7. I enjoy it if others looks up to me | *Admiration* |
| 8. I enjoy tricking someone out of something | *Negative Social Potency* |
| 9. I enjoy being a member of a group/club | *Sociability* |
| 10. I enjoy being around people who are impressed with who I am and what I do | *Admiration* |
| 11. I enjoy letting someone else tell me what to do | *Passivity* |
| 12. I enjoy embarrassing others | *Negative Social Potency* |
| 13. I enjoy many people wanting to invite me to their social events | *Sociability* |
| 14. I enjoy keeping promises I make to others | *Prosocial Interactions* |
| 15. I enjoy seeing others get hurt | *Negative Social Potency* |
| 16. I enjoy getting praise from others | *Admiration* |
| 17. I enjoy it if someone accepts me as I am, no matter what | *Prosocial Interactions* |
| 18. I enjoy someone else making decisions for me | *Passivity* |
| 19. I enjoy making someone feel happy | *Prosocial Interactions* |
| 20. I enjoy following someone else's rules | *Passivity* |

# Appendix 7. Published papers