Improving Attention to Emotion in Individuals with High Levels of Psychopathic Traits: A Role for Value-Driven Attentional Capture?

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Thesis declaration form

I 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.

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Overview

This thesis focuses on the information processing in individuals with high levels of psychopathic traits. Part 1 reviews the research literature that has investigated whether individuals with psychopathy, or high levels of psychopathic traits, show deficits in the processing of punishment and/ or reward information, and the extent to which the reported studies provide support for the two current competing theories of psychopathy. The review demonstrates that whilst there is strong evidence for intact processing of reward information, there is less conclusive evidence of a deficit in punishment processing. Furthermore, the literature reviewed was more supportive of an emotional dysfunction account of psychopathy, relative to an attention-based account.

Part 2 presents an experimental study that investigates whether emotional face training is able to modify attentional capture by fearful faces in a community-based sample of individuals with high levels of psychopathic traits. The results showed that those who received the training were more captured by a task-irrelevant fearful face, and that this was the case, regardless of level of psychopathic traits.

Part 3 considers some of the methodological and conceptual issues that arose while conducting the study reported in Part 2. Due to the specific nature of the research question, several decisions concerning the design and statistical analysis of the data needed to be made. This section discusses the advantages and disadvantages of those particular decisions.

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Part 1: Literature Review

Is psychopathy associated with deficits in reward and punishment processing?

A review of the current literature.

Abstract

Aim. To review the current literature investigating potential reward and punishment processing in individuals with psychopathy or high levels of psychopathic traits, and to evaluate the extent to which they provide support for either the Response Modulation Hypothesis or an amygdala dysfunction account of psychopathy.

Method. PsychINFO, Ovid Medline, PubMed, Web of Science and Embase searches for studies using a behavioural index of reward and/ or punishment processing in psychopathy identified 16 articles meeting quality and relevance criteria for review.

Results. Reviewed studies suggest that reward processing in psychopathy is intact, but the results concerning punishment processing are mixed. Whilst some studies have found evidence for poorer processing of punishment information, others have found no difference between those with high levels of psychopathy and those with low levels. Furthermore, the paradigms used have made it difficult to delineate the relative effects of reward and punishment cues on individuals' task performances.

Conclusions. Whilst there was some support for the Response Modulation Hypothesis, it is not possible to say conclusively that individuals with psychopathy have a deficit in attention processing that can explain differential processing of reward and possibly punishment information. It is possible, however, that the differences between those with high and low levels of psychopathy can be explained in terms of poor processing of affective information and/ or poor instrumental learning, which are known to be associated with amygdala function in healthy individuals.

Introduction

Within a clinical research context psychopathy is usually conceptualised as an antisocial personality disorder, with a description of its core features being traced back to Cleckley's seminal work, 'The Mask of Sanity' (Cleckley, 1941). Psychopaths are thought of as being callous and unemotional individuals who show little regard for the effects of their behaviour on others. They often have scant regard for societal rules and engage in a wide range of antisocial behaviours. Furthermore, they often present as being confident and charming, aiding their manipulation of others for personal gain (Cleckley, 1941; Hare, 1991).

Factor analytic work reliably suggests that psychopathic traits (in both incarcerated and community samples) can be delineated into two distinct factors of emotional dysfunction and overt antisocial behaviour (e.g., Hare, Hemphill & Paulhus, 2002, Kiehl & Fitzpatrick, 1995; Lillenfield & Andrews, 1996). The emotional dysfunction dimension of psychopathy includes traits such as reduced guilt, empathy and attachment to others, and the antisocial behaviour dimension includes an early predilection towards antisocial behaviour, impulsivity and irresponsibility (see Hare, 2003). Antisocial behaviour can and does occur in the absence of emotional dysfunction, i.e. not all antisocial individuals are psychopathic. Because of this, the emotional dysfunction element has often been considered the core, distinguishing feature of psychopathy (Blair, Mitchell & Blair, 2005; Frick & Viding, 2009).

Although research into psychopathy has a long and significant history with many models being proposed, few of these models are able to account for the entire range of cognitive and affective difficulties that have been associated with it. Two main accounts of psychopathy at the cognitive/

affective level currently exist. The first account posits that psychopathy can be best understood in terms of an attention-processing deficit (e.g., Baskin-Somers, Curtin & Newman, 2011; Hiatt & Newman, 2006; MacCoon, Wallace & Newman, 2004). The Response Modulation Hypothesis (RMH; Newman, 1998) is an information-processing model that theorises that response modulation involves a rapid, non-effortful shift of attention away from effortful pursuit of goal-directed behaviours. Lorenz and Newman (2002) have suggested that the role of this modulation system is to monitor the areas peripheral to the current focus of attention for potentially important information, and it is this theoretical system that is proposed to be impaired in individuals with high levels of psychopathy. Newman and colleagues have suggested that, unlike individuals low in psychopathic traits, psychopaths are unable to orient attention to information that is not compatible with current goals (Hiatt & Newman, 2006).

The second account posits that psychopathy can be understood as an amygdala dysfunction (AD; e.g., Blair, 2003, Blair, Mitchell & Blair, 2005; Kiehl, 2006), which results in a deficit in emotion and cognitive processing. The amygdala is a subcortical brain structure that forms part of the limbic system; it has been implicated in a range of functions in typical individuals, including emotion processing and various forms of learning. Most proponents of this account agree that the core features of psychopathy are, at least in part, associated with hypo-responsivity of the amygdala (Blair, Mitchell & Blair, 2005; Kiehl, 2006; Patrick, 1994). A wealth of neuroimaging studies have found poor amygdala responsivity in psychopaths in tasks involving the formation of aversive stimulus-reinforcement associations (e.g., Blair, 2013; Seara-Cardoso & Viding, 2014), empathic responding (e.g., Blair, 2005) the

processing of emotionally valenced information such as threatening images (e.g., Levenson, Patrick, Bradley & Lang, 2002) and facial expressions (Blair et al., 1999)

Research suggests that individuals with psychopathy have a poor ability to learn from the aversive experiences of both themselves and others (e.g., Hare, 1991). The development of adaptive behaviour is thought to occur through a process of operant conditioning (Grey, 1981; 1987). If behaviour becomes associated with a reward, we are likely to engage in it again, and conversely, if behaviour is associated with a punishment, we are likely to avoid it in the future. Based on this it makes sense that persistent antisocial behaviour associated with psychopathy may have its basis in difficulty with correctly processing reward and/ or punishment information. Over-sensitivity to reward cues or insensitivity to punishment cues, or indeed a combination of both, might explain why individuals with psychopathy continue to engage in behaviours that would be thought of as maladaptive by others.

Antisocial behaviour is extremely costly to society (Scott et al., 2001), and previous research has indicated that individuals with psychopathy make up a disproportionate number of those responsible for criminal acts (e.g., Leistico, Salekin, DeCoster, & Rogers, 2008). There is little evidence to suggest that current psychological treatments for psychopathy are effective (e.g., Looman, Abracen, Serin & Marquis, 2005; Seto, 2003; Seto & Barbaree, 1999), and whilst the body of evidence investigating potential mechanisms underlying psychopathy is extensive, it is also inconclusive. An important step in developing effective interventions is gaining a clearer understanding of those processes that appear to be deficient, and more specifically, gaining a

better understanding of how individuals with psychopathy differ from others in their processing of reward and punishment information.

Aims of the review

The aims of this review are two-fold. First, it seeks to synthesise current research on reward and punishment processing in individuals with psychopathy, and to evaluate the extent to which these individuals show deficits in reward processing, punishment processing or both. The second aim is to assess the degree to which studies investigating reward and/ or punishment processing are able to provide evidence in support of the two main competing models of psychopathy at the level of cognitive and affective processing, the Response Modulation Hypothesis and the Amygdala Dysfunction account.

Method

Inclusion/ Exclusion Criteria

To have been included in the review, each study must have:

1. Had a study population comprised of adults over the age of 18
2. Used an established measure of psychopathy appropriate for the population (e.g., a score of 28 or above on the Psychopathy Checklist – Revised [PCL-R; Hare, 1991] in a forensic sample)
3. Included a task assessing punishment processing, reward processing, or both
4. Included a behavioural index of reward/ punishment processing (i.e., not self-report, psychophysiological or imaging measures)
5. Been published in English in a peer-reviewed journal

6. Received a rating of .55 or above on the 'QualSyst' measure of quality and relevance (Kmet, Lee & Cook, 2004; see below).

Whilst much of the research in psychopathy has been conducted in prison populations – both psychopathy generally, and reward and punishment processing specifically – there is good evidence to suggest that it is a disorder that represents extremes on normal continua of individual differences in emotional functioning and antisocial behaviour (e.g., Patrick, 2001), Because of this, studies investigating reward and punishment processing in both prison and community samples were considered in this review.

Regarding the fourth criterion, studies that did not use a behavioural index of reward/ punishment processing were excluded. Although studies looking at self-reported reward and punishment processing in individuals with high levels of psychopathy do exist (e.g., Hunt, Hopko, Bare, Lejeuz & Robinson, 2005), as these processes are thought to be automatic in nature and not under conscious control (e.g., Grey, 1981; 1987), participant insight is likely to be limited. Therefore, in order to gain a more accurate understanding of differences in processing reward and/ or punishment information, only studies in which punishment and/ or reward processing had been explicitly manipulated were included. Additionally, although there is a growing body of literature examining the neurobiological underpinnings of reward and/or punishment processing in psychopathy as well as studies including a psychophysiological measure of response, it was beyond the scope of this review to include them here. In order to maintain a relatively focussed review, only those studies that have examined reward/ punishment processing at the

level of behaviour (i.e., how differential responses to reward/punishment cues may lead to groups of individuals behaving in a different way) were included.

Search Strategy

To identify studies meeting the above criteria, PsycINFO and Ovid Medline were searched on the 1st of September, 2014 using the following terms (and synonyms) as keywords: psychopathy, reward, punishment, learning and adult/18 years +. In order to increase the initial range of entries retrieved search terms were broad and studies were not, at this stage, filtered by paradigm (i.e., inclusion criterion 2). Table 1 shows the results of the search. A further search using the same terms in PubMed, Web of Science and Embase located several additional papers meeting the inclusion criteria. Reference lists of studies meeting criteria for inclusion were also examined for articles that were not located in the search of the electronic databases

Study Selection

The study selection process is outlined in Figure 1. The search of PsycINFO and Ovid Medline yielded 27 papers and the search of PubMed, Web of Science and Embase located a further 16, making a total of 43. One additional paper was found through reviewing the reference lists of the above papers, making the total papers found 44. Following the screening of each abstract, nine articles were excluded as they did not utilise a behavioural index of reward/ punishment processing (all were either imaging or psychophysiological studies), and 16 were excluded due to not meeting inclusion criterion points two, three and five, leaving 19 papers to be subjected to a quality and relevance assessment (criterion 6).

Table 1. Search Terms

	Terms	Results
1	*Psychopathy/	1924
2	*Internal rewards/ or *Rewards/ or * External Rewards/ or *Preferred Rewards or *Monetary Rewards/	7929
3	*Punishment/ or exp reinforcement/	40642
4	Exp *Learning/	153604
5	Exp conditioning/	48815
6	Exp Implicit Learning/	1197
7	Exp Incidental Learning/	1471
8	Exp Perceptual Learning/	4930
9	(trial and error learning).mp. [mp=title, abstract, heading word, table of contents, key concepts, original title, tests & measures]	472
10	Risk taking/	9455
11	Avoidance conditioning/	7941
12	Response reversal.mp.	69
13	Or/2-12	194927
14	1 and 13	62
15	limit 14 to adulthood <18+ years> [Limit not valid in Ovid MEDLINE(R); records were retained]	31
16	limit 15 to peer reviewed journal [Limit not valid in Ovid MEDLINE(R); records were retained]	27

Further searches of PubMed, Web of Science and Embase using the above terms yielded an additional 15 articles and a review of reference lists an additional one.

Quality and Relevance Selection

Though a wide range of quality and relevance assessment tools exist, the 'QualSyst' (Kmet et al., 2004) (See Appendix 1) was chosen as it is one of the few that has been specifically designed to assess non-randomised, experimental studies for inclusion in systematic and meta-analytic reviews. QualSyst uses a systematic and comprehensive checklist that evaluates each stage in the research process, allocating a score of between two and zero (with a higher score indicating greater quality). A total score for each paper is generated by taking the actual score achieved and dividing it by the calculated

maximum possible score (which may vary between papers depending on the design). In line with the cut offs reported in Kmet, et al., articles with a score of less than .55 were excluded from the review. Table 2 displays the score for each of the 19 papers that were subjected to this quality assessment process.

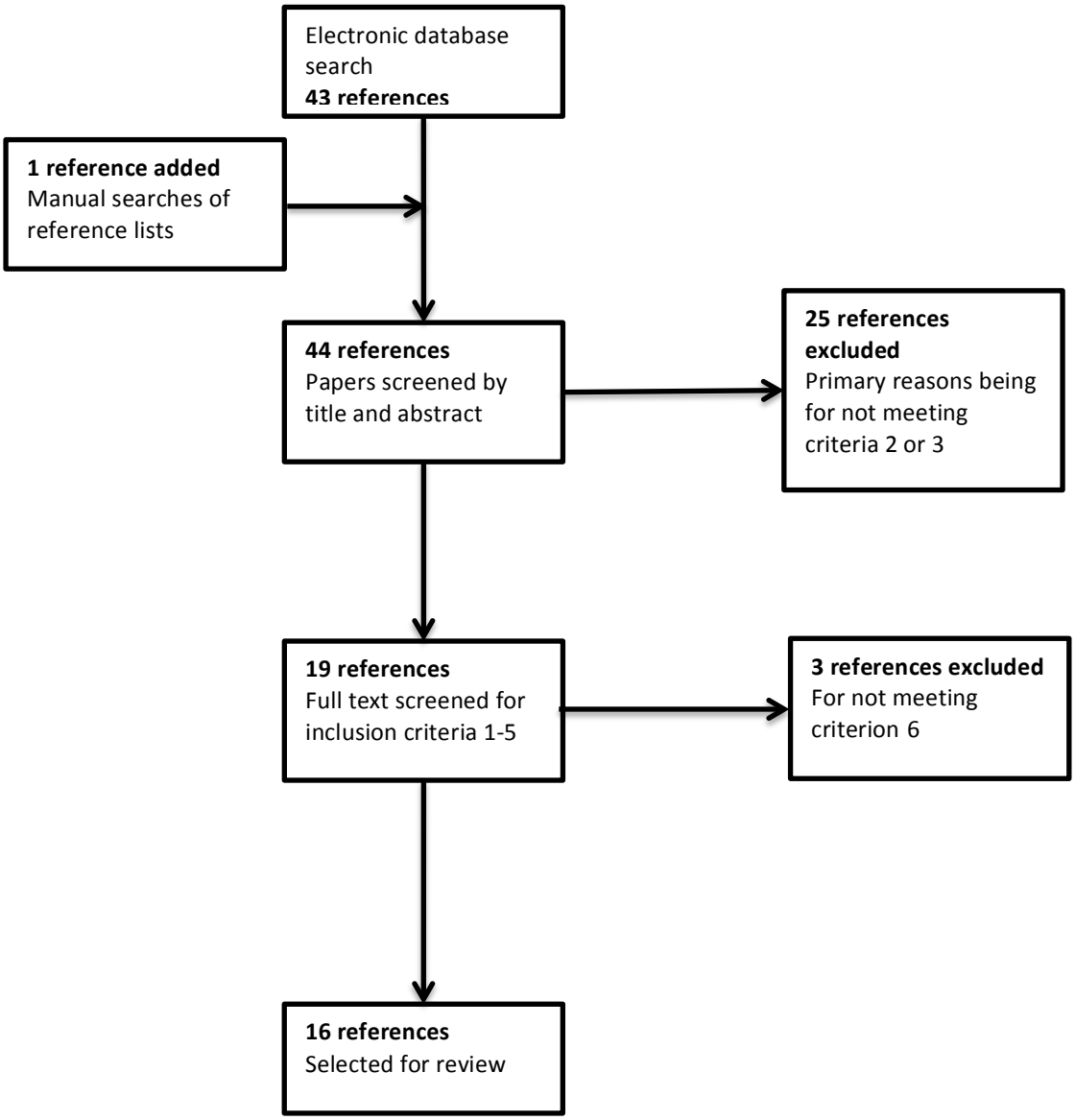

Figure 1. Study Selection Process

Three papers were excluded as they did not meet the minimum QualSyst score to be included (see Table 2). The main reasons for these low scores include the fact that no comparison groups were recruited, and the characteristics of the sample were poorly described (Loeser & Schmucker, 2004; Thornqvist & Zuckerman, 1995; Newman, 1987). Additionally, one

paper (Newman, 1987) failed to describe any methodological procedures at all, meaning that it was difficult to fully understand the conclusions drawn.

Data Extraction

Key data for each included study were extracted, including author, sample characteristics, design, type of reward/ punishment administered details of control groups and a summary of main findings. Additionally, whether or not the results of each study provide evidence in favour of the RMH or an AD account of psychopathy (as stated by the original authors) was recorded.

Table 2. Quality and Relevance Assessment Results

	Study	QualSyst Score
1	Blair et al.(2004)	0.86
2	Blair et al.(2006)	0.82
3	Brazil et al.(2013)	0.59
4	Budhani et al.(2006)	0.82
5	De Brito et al.(2013)	0.64
6	Dean et al.(2013)	0.59
7	Mahmut et al.(2007)	0.77
8	Masui & Nomura (2011)	0.59
9	Mitchell et al.(2002)	0.82
10	Mitchell et al.(2006)	0.91
11	Molto et al.(2007)	0.77
12	Newman & Schmitt (1998)	0.82
13	Newman et al.(1987)	0.55
14	Newman et al.(1990)	0.64
15	Schmitt et al.(1999)	0.91
16	Swogger et al.(2010)	0.82
17	Losel & Schmucker (2004)	0.50 †
18	Thornquist & Zuckerman (1995)	0.45 †
19	Newman (1987)	0.05 †

† Studies with a score below .55 were excluded from review

Results

Sixteen papers reporting 19 studies met the inclusion criteria and were deemed of sufficient quality (based on the quality assessment measure scores) to be included in the review. The papers revealed that behavioural work investigating reward and punishment processing in psychopathy has used tasks that can be categorised into three distinct paradigms: risk-taking, passive avoidance and response reversal. Studies presenting results from each of these three areas are presented below. For each, a brief overview of the paradigm and description of tasks is given, followed by a summary of the main findings. Characteristics of the included studies are presented in Tables 3 to 5.

Additionally, each study was categorised according to whether or not it provided evidence for the RMH or the AD account, and this is recorded in each table. Studies were categorised as supporting the RMH if the results could be understood in terms of a deficit in attention processing, that is, that individuals with high levels of psychopathy performed worse than comparison individuals and this could be accounted for by a failure to shift attention to peripheral information, where responding to that information would require a change in the dominant response. Studies were categorised as providing evidence for the AD account if, firstly, the data could not be explained in terms of poorer automatic attention shifting between competing stimuli (this required at least two possible stimuli to be displayed) and, secondly, if, the results could be understood in terms of poor instrumental learning, a function that is widely thought to involve intact amygdala functioning. Where no result was

found (i.e., no differences between psychopaths/ individuals with psychopathy and a comparison group), the study was categorised as ‘null’.

Risk-Taking Tasks

Risk-taking tasks can be conceptualised as those that investigate individuals’ ‘approach’ behaviour in response to reward in the face of potential punishment. Tasks used to investigate risk-taking in those with psychopathy or high levels of psychopathic traits have included the Iowa Gambling Task (Bechara et al., 1994), the Cambridge Gambling Task (Rogers et al., 1999) and the Balloon Analogue Risk Task (BART; Lejuez et al., 2002).

The Iowa Gambling task is a well-established task that is thought to provide a measure of real-world risk taking (Bechara et al., 1997). In order to be successful, participants must both learn reward-punishment contingencies and then take these into account when making decisions about each response. Participants are presented with four (computerised) decks of cards from which they must select one card on each turn. Each card selection results in a (virtual) monetary gain of differing amounts, and some card selections will result additionally in a loss that occurs immediately after the gain. Of the four decks, two are designated as ‘bad’ decks, which yield high rewards, but even higher losses. The other two decks are labelled as ‘good’, with moderate rewards but smaller losses. The task is comprised of 100 trials during which the participant is free to select from any deck, but with the aim being to win as much money as possible. Participants are explicitly informed that some decks are ‘good’ and others are ‘bad’ and that it is possible to ‘win’ the game by avoiding the ‘bad’ decks.

Four studies examining risk-taking using the Iowa Gambling Task were identified (see Table 3), and the results they present are somewhat mixed. Mitchell et al. (2002) found that in a male forensic sample, individuals with high levels of psychopathy performed significantly worse on the gambling task than those with low levels of psychopathy, scoring fewer overall points. Mahmut et al. (2008) found a comparable pattern of responding in a large, mixed sample of college students; those with high levels of psychopathic traits played more cards from the higher risk decks and earned fewer total points relative to those with low levels of psychopathic traits. However, in a similar sample of college students, Dean et al. (2013) found that whilst high level of psychopathic traits were associated with poorer task performance, this was related to self-reported levels of risk-taking, rather than to levels of emotional dysfunction, per se. Finally, in contrast to the other studies found, Schmitt et al. (1999) found that there were no group differences in risk-taking behaviour, with performance on the gambling task being comparable in an all-male forensic sample that was divided into high and low psychopathy groups.

Table 3. Studies using Risk Taking Tasks

Author	Sample Characteristics	Task	Reward-Type	Main Findings	Theory Supported ‡
De Brito et al (2013)	*N* = 66 Mean age = 37 100% male Forensic (ASPD HP vs. LP) and community comparisons	Cambridge Gambling Task	Points only	No differences between forensic sample and community in risk taking.	Null
Dean et al (2013)	*N* = 129 Mean age = 19 30% male College students (HPT vs. LPT)	Iowa Gambling Task	Written feedback, virtual money that participants were asked to pretend was real.	No group differences during learning phase, but during stabilisation phase, HP were more likely to choose from the risky decks, and this was associated by scores in secondary, rather than primary P.	AD
Mahmut et al (2007)	*N* = 101 Mean age = 23 27% male College students (HPT vs. LPT)	Iowa Gambling Task	Written feedback and virtual money	HPT students perform similarly to forensic samples, and this can be explained by scores on the Emotion Dysfunction factor	AD
Mitchell et al (2002)	*N* = 40 Mean age = 33 100% male Forensic (HP vs. LP)	Iowa Gambling Task	Written feedback and virtual money	HP < LP	AD
Schmitt et al (1999)	*N* = 157 Mean age = Not reported 100% male Forensic (HP vs. MP vs. LP)	Iowa Gambling Task	Money	No group diffs. In P, however anxiety predicted performance with high anxious individuals selecting less risky cards performing worse	Null
Swogger et al (2010)	*N* = 119 Mean age = 28 100% male Forensic (HP vs. LP)	BART	Visual and auditory feedback,	No relationship found between P scores and risk-taking on the BART	Null

‡ Null refers to the fact that no strong support for either hypothesis was found; AD refers to support for the Amygdala Dysfunction account; RMH refers to support for the Response Modulation Hypothesis. “HP” refers to ‘High Psychopathy’; “LP” to ‘Low Psychopathy’; “HPT” to ‘High Psychopathic Traits’; “LPT” to ‘Low Psychopathic Traits”.

The Cambridge Gambling Task differs from the Iowa Gambling Task in that participants are required to make two separate decisions. They are informed that a yellow marker is hidden inside one of ten boxes that are displayed on a computer screen. The boxes are coloured red and blue, and

the ratio of each colour changes across the experiment. On each trial, participants' task is to decide whether the marker is hidden in a red or blue box. Once this selection has been made, they are then prompted to gamble a proportion of their points (5%, 25%, 50%, 75% and 95%) on the likelihood that their colour choice is correct (each participant begins with 100 points). In one half of the experiment bets are presented in ascending order, and in the other half, descending. High bets in both ascending and descending conditions are thought to indicate high levels of risk-taking, whereas betting quickly in either condition is thought to be indicative of impulsivity.

Only one study used the Cambridge Gambling Task (De Brito et al., 2013). Whilst male offenders with a diagnosis of Antisocial Personality Disorder were slower to make decisions relative to a non-offender comparison group, there was no difference between offenders with high versus low psychopathy. Similarly, whilst offenders made poorer quality decisions (as indexed by the proportion of trials in which the participant gambled on the colour box with the highest representation) relative to the comparison group, there was no difference in terms of psychopathy grouping. Whilst not reaching significance, there was a trend toward offenders being less likely to adjust their betting in response to the ratios of boxes, but again, there was no difference between the high and low psychopathy groups. There was no difference across all groups in terms of impulsivity, suggesting that group differences reported are not likely to be driven by one group in particular being more impulsive than the others.

The BART is somewhat different to both the Iowa Gambling Task and the Cambridge Gambling task as almost all responses are rewarded. In this task, participants are again asked to score as highly as they can, but rather

than make a decision about which stimulus to choose, they must choose how much to inflate a balloon presented on a computer screen. The more they inflate the balloon, the greater number of points they will score, however, after a certain point the balloon will burst leading to a loss of earnings. The aim of the task is to 'bank' as many points as they can before the balloon bursts. As with the Cambridge Gambling Task, just one study used this task. Swogger et al. (2010) found that in a large sample of male offenders there were no differences in the point at which individuals with high psychopathy and low psychopathy banked money, or the number of times that the balloon burst. However, it is worth noting that as no non-forensic comparison group was included in this study, it is not possible to say whether the offenders differ from the general population on this task, which would be in line with both DeBrito et al's and Dean et al's findings.

Summary of Risk-Taking Tasks

Overall, results reported by studies using risk-taking tasks vary considerably. Three of the four studies employing the Iowa Gambling Task found significant differences between individuals high and low in psychopathy or psychopathic traits. This suggests that (at least in this task), even when individuals with psychopathy are explicitly told that they will perform better if they avoid some decks and use others, they are less able than those with low levels of psychopathy to inhibit risk-taking behaviour, leading them to continue to seek high reward in the face of even higher punishments. However, one study found that this performance was not related to the 'core' psychopathic traits of emotional dysfunction to more antisocial and impulsive traits. In

support of this, one study found that whilst psychopaths performed poorly relative to healthy controls, there was no difference relative to other offenders.

Poor performance on risk-taking tasks is thought to be indicative of a reward dominant response style (Byrd, Loeber & Pardini, 2014) and so taken together this suggests that whilst psychopaths may indeed show a likelihood towards high-risk behaviours, this might be related to other aspects of antisocial and impulsive behaviours, rather than to psychopathy itself. The two other tasks reported found no differences between individuals with high and low psychopathy. It is important to note that the BART, however, is quite different to the Iowa Gambling Task, in that there are no fixed probabilities for reward and punishment contingencies, and most responses (i.e., clicking to inflate the balloon and gain points) are rewarded, which in turn means that the opportunities for learning are limited. Additionally, the Cambridge Gambling Task differs from the Iowa Gambling Task in that there are two stages of decision-making that need to be successfully navigated in order to do well. The Cambridge Gambling task appears to be more complex than either the Iowa Gambling Task or the BART in that the decisions involved are likely to require individuals to be think carefully about the meaning of their actions, and to have a good understanding of what it means to gamble a differing percentage of their current points in order to win or lose more. As this task is likely to place greater cognitive demands on individuals without any real-world gain (i.e., points only) it is possible that offenders with a diagnosis of Antisocial Personality Disorder may not have been sufficiently motivated to perform to the best of their ability, and this may have been the case regardless of level of psychopathic traits.

Passive Avoidance Tasks

Passive avoidance tasks assess individuals' ability to learn through the use of reward and punishment cues. In passive avoidance tasks, participants must respond to some stimuli that are associated with rewards (e.g., money, points, etc.) and withhold a response to other stimuli that are associated with punishment (e.g., the removal of earned money, or points etc.). Over the course of the experiment, participants learn the stimulus-reward and stimulus-punishment pairings through trial-and-error; a successful performance on this task involves being able to learn from early errors so that subsequent responses are in line with gaining rewards and avoiding punishments. Participants' learning is measured through both passive avoidance (or 'commission') errors, in which a response is made to a cue when it should have been withheld, and omission errors, in which a response to a cue is withheld when it should have been made. Although there are several different combinations of reward and punishment contingencies, all of the studies reviewed used a 'mixed' design in which participants are rewarded for responding to a reward cue, punished for responding to a punishment cue (i.e., making a commission or passive avoidance error), with no punishment for errors of omission.

Six studies investigated the ability of those with high levels of psychopathy to withhold behavioural responses, and again, the results are mixed (see Table 4). Newman et al. (1990) found that in a task involving both monetary punishments and rewards, individuals with high levels of psychopathy made more passive avoidance errors relative to controls when the importance of obtaining rewards (relative to avoiding errors) was stressed. However, when the contingencies were changed so that both punishment and reward cues

were equally explicit from the beginning of the task, the performance of individuals with high psychopathy equalled that of the controls. Additionally, psychopaths paused less than controls following feedback information, and the latency between the end of one trial and the start of another was positively correlated with passive avoidance learning. This suggests that time taken to make a response decision is important in avoiding errors, and that individuals with high levels of psychopathy are more likely to respond quickly.

In an attempt to replicate the above findings, Newman and Schmitt (1998) conducted a similar study, with the aim of extending the results to African American individuals and those with differing levels of anxiety. White American individuals made more passive avoidance errors, but the same amount of omission errors than controls, however, this replication was confined to this group; African American psychopaths and those with higher levels of anxiety could not be distinguished from their matched controls. In line with Newman and colleagues, Masui and Nomura (2011) found that in a task with both punishment and rewards available, individuals with low levels of psychopathic traits were able to inhibit responses to punishment stimuli, and that this inhibition increased with the magnitude of the punishment. However, in individuals with high levels of psychopathic traits, the presence of a reward (relative to a no-reward and punishment-only condition), regardless of magnitude, was enough to disrupt punishment processing, regardless of the size of the punishment.

Table 4. Studies Using Passive Avoidance Tasks

Author	Sample Characteristics	Task	Reward-Type	Main Findings	Theory Supported‡
Blair et al.(2004)	*N* = 40 Mean age = 40 100% male Forensic (HP vs. LP)	Passive avoidance task with differential reward values (4 S-s and 4 S+s)	Points only	Authors explain results as being indicative of an amygdala dysfunction in individuals with HP	AD
Blair et al. (2006)	*N* = 40 Mean age = 34 100% male Forensic (HP vs. LP)	Differential reward/ punishment learning task	Written feedback and points	F1 scores accounted for group differences	AD
De Brito et al. (2013)	*N* = 66 Mean age = 37 100% male Forensic (ASPD HP vs. LP) and community comparisons	Passive avoidance task (4 S-s and 4 S+s)	Points only	Trend towards differences between offenders and non-offenders; no differences between HP and LP	Null
Masui et al.(2011)	*N* = 40 Mean age = 19 50% male Japanese college students	Response inhibition; stop-signal task (stop tone presented in 50% of trials) No reward/ punishment (p/r) vs. low v. high value reward/punishment	Points only; flat rate paid	No p/r and lower value r/p associated with impulsivity in HPT; but higher value r/p was associated with less impulsivity - accounted for by secondary P scores	AD
Newman et al.(1990)	*N* = 229 Mean age = 24 100% male Forensic (HP vs. LP)	Go/ No Go task (4 S+; 4 S-)	Partial Visual, auditory feedback, money	Low anxious HPs PA errors > controls than controls. No group diff. on omission errors. Low anxious HP paused less following punishment. HP slower than LP in the reward condition and faster in punishment condition, contrary to authors' hypotheses.	RMH

Table 4. Continued…

Author	Sample Characteristics	Task	Reward-Type	Main Findings	Theory Supported‡
Newman & Schmitt (1998)	*N* = 207 Mean age = not reported 100% male Forensic (HP vs. LP)	Go/ No Go task (5 S+; 5 S-)	Visual and auditory feedback, money	Low anxious HP = Low anxious LP for PA and omission errors.	RMH

‡ Null refers to the fact that no strong support for either hypothesis was found; AD refers to support for the Amygdala Dysfunction account; RMH refers to support for the Response Modulation Hypothesis. "HP" refers to 'High Psychopathy'; "LP" to 'Low Psychopathy'; "HPT" to 'High Psychopathic Traits'; "LPT" to 'Low Psychopathic Traits".

Out of all six studies investigating passive avoidance learning, Masui and Nomura were the only authors to have used a punishment only (i.e., no reward) condition. However, they found that there were no differences in task performance between individuals with high and low levels of psychopathic traits.

Blair et al. (2004) presented participants with stimuli that were either associated with reward or punishment. This differed from the work of Newman and colleagues presented above, in that they varied the amount of reward and punishment associated with each cue. They found that individuals with high levels of psychopathy made more passive avoidance errors relative to controls, and that the value of the punishment did not modulate performance (unlike the controls who performed better in the face of greater punishment). Both groups' performance was modulated by the value of the reward, but there was no difference between the two. Taken together these results

suggest that psychopaths' performance on this task can be moderated by reward information, but not by punishment information.

Using a slightly different task to the five already outlined, in a subsequent study, Blair et al. (2006) further investigated decision-making in response to reward and punishment cues. Rather than having to respond to a stream of stimuli across trials, participants were asked to choose between two objects on a computer screen, each of which was associated with a differing level of reward or punishment. Individuals with psychopathy were impaired relative to controls when choosing between objects with differing levels of reward as well as impaired when choosing between objects with differing levels of punishment.

However, not all studies found support for the notion of impaired passive avoidance in those with high levels of psychopathy. De Brito et al. (2013) used the task as reported by Blair et al. (2004), described above. However, in contrast to Blair's findings and to their own hypotheses, they found no differences in passive avoidance errors between offenders with and without psychopathy, and only a trend approaching significance for offenders relative to controls. They found no differences across all three groups in rate of errors of omission.

Summary of Passive Avoidance Tasks

Five out of the six studies using passive avoidance tasks reported that individuals with high levels of psychopathy or psychopathic traits have deficits in passive avoidance learning. Whilst this is strong evidence that these individuals may process punishment and reward cues differently to others, the design of most of the studies precludes the drawing of conclusions about

whether it is a specific deficit in reward processing or punishment processing. The majority of the studies used a 'mixed' design in which participants were faced with competing reward and punishment information, meaning that poor performance on this task is not easily attributable to either hyper-responsivity to rewards or hypo-responsivity to punishment, or indeed a combination of both. The one study that reported performance in a punishment-only condition found there to be no group differences in passive avoidance between individuals with high and low psychopathy. This could suggest that poor performance on passive avoidance tasks in individuals with psychopathy is specific to conditions where both punishment and reward information are presented in competition with each other; however more research is needed to clarify this finding. Blair and colleagues (Blair et al., 2004; Blair et al., 2006) have attempted to delineate reward and punishment based learning in their object discrimination task and report that the performance of individuals with psychopathy is not modulated by the degree of punishment. Additionally, they found that they have comparable performance to controls in the reward condition, suggesting intact reward processing but a deficit in punishment processing.

Although the majority of the studies found some level of deficits in passive avoidance learning, it is important to note the lack of an effect amongst African American individuals (Newman & Schmitt, 1998) with high levels of psychopathy, relative to controls. Additionally, participants in Masui and Normura's (2011) study were Japanese, meaning that the lack of a deficit in the punishment-only condition of their passive avoidance task could be an artefact of using non-Caucasian participants. This suggests that passive avoidance deficits as reported in the studies above are something that may be

confined to a specific ethnic group (i.e., Caucasians). If this were the case then it would be difficult to generalise any potential mechanisms underlying the hypothesised deficit, as why it would not be shared across ethnic groups is not easily explained.

Response Reversal Tasks

Similarly to passive avoidance tasks, response reversal tasks involve participants learning about reward and punishment cues through trial and error. However, the critical difference between the two types of task is that whereas in passive avoidance tasks response to a stimulus will be the same throughout, in response reversal tasks the contingencies change, meaning that a stimulus may require a different response at a different point in the experiment. Most typical is that participants will begin with a 90% chance of receiving a reward (e.g., points, money) for making a response to a specific stimulus and a 10% chance of receiving a punishment (e.g., loss of points, money). Every ten trials this probability changes to decrease the chance of reward by ten and increase the chance of punishment by ten (i.e., 80:20, 70:30, etc.) until there is 100% chance of punishment and 0% chance of reward for that stimulus-response pairing. Participants are told that they are able to stop playing the game at any point to collect the amount that they have earned, meaning that an adaptive performance on the task would involve quitting the game as the likelihood of punishment outweighs the likelihood of reward.

Seven studies investigated reward and punishment processing using response reversal tasks (see Table 5). Newman et al. (1987) presented offenders with high and low levels of psychopathy with three versions of a

card-playing task. In line with the description above, the probability of reward declined by 10%, every 10 cards as the probability of punishment increased by 10% meaning that successful performance (i.e., maximum earnings) would have meant ceasing play at around half way through the game. In the first version of the task, participants were given feedback after each card, but no cumulative feedback. In the second, they were given a total score at the end of each trial, and on the third version participants both received a total score, and were forced to wait five seconds before the next trial commenced. The results showed impaired response inhibition in the first two conditions for individuals with psychopathy, but that this was extinguished by enforcing a waiting period after each trial, with no differences between groups in the final condition. In a task using the first two conditions of Newman et al.'s study, Molto et al. (2007) also found that individuals with psychopathy were impaired in terms of response reversal, and further, they found that this maladaptive style was associated with the 'social deviance' features of psychopathy (included in Factor 2). Brazil et al. (2013) also replicated elements of Newman et al.'s work and found reversal only when individuals with high psychopathy were given explicit feedback ("correct" or "incorrect" appeared on the screen); when learning about contingencies occurred in an implicit (i.e., with no feedback other than the running total of points scored), rather than explicit manner, psychopaths showed no deficits in response reversal.

Table 5. Studies Using Response Reversal Tasks

Author	Sample Characteristics	Task	Reward-Type	Other Findings	Theory Supported‡
Brazil et al.(2013)	*N* = 39 Mean age = 39 100% male Forensic (HP) with community comparison	Probabilistic Go/No Go task (80-20; 20-80) Exp. 1 = implicit learning; Exp. 2 = explicit learning	Written feedback and points	Response reversal deficits only occur when told about the reversal of contingencies	RMH
Budhani et al.(2006)	*N* = 37 Mean age = 36 100% male Forensic (HP vs. LP)	Probabilistic reversal learning task (100-0; 80-20; 20-80; 0-100)	Written feedback and points	Non-impaired acquisition; impaired reversal on both contingencies	AD
De Brito et al.(2013)	*N* = 66 Mean age = 37 100% male Forensic (ASPD HP vs. LP) and community comparisons	Probabilistic response reversal task (100-0; 80-20)	Points only	No group differences	Null
Mitchell et al.(2002)	*N* = 40 Mean age = 33 100% male Forensic (HP vs. LP)	Probabilistic response reversal task	Written feedback and virtual money	HP poorer performance relative to controls (community and forensic). Results comparable to patients with amygdala/OFC lesions	AD
Mitchell et al.(2006)	*N* = 29/88 Mean age = 33/31 100% male Forensic (HP vs. LP) community comparisons	Snake learning task; points won for choosing between two tokens (acquisition and two reversals for four different tokens).	Points only	Performance comparable to lesion patient, suggesting HP associated with amygdala dysfunction. Degree of deficits were related to P scores.	AD
Molto et al.(2007)	*N* = 47 Mean age = 34 100% male Forensic (HP vs. LP)	Card perseveration task (0.9- 0 in 0.10 increments)	Money	Maladaptive perseveration was associated with P scores, and this was entirely explained by emotional factor (F1).	AD

Table 5 Continued…

Author	Sample Characteristics	Task	Reward-Type	Main Findings	Theory Supported‡
Newman & Schmitt (1998)	*N* = 207 Mean age = not reported 100% male Forensic (HP vs. LP)	Go/ No Go task (5 S+; 5 S-)	Visual and auditory feedback, money	Low anxious HP = Low anxious LP for PA and omission errors.	RMH

‡ Null refers to the fact that no strong support for either hypothesis was found; AD refers to support for the Amygdala Dysfunction account; RMH refers to support for the Response Modulation Hypothesis. "HP" refers to 'High Psychopathy'; "LP" to 'Low Psychopathy'; "HPT" to 'High Psychopathic Traits'; "LPT" to 'Low Psychopathic Traits".

Budhani et al. (2006) and De Brito et al. (2013) used a task that was derived from that used by Blair et al. (2004). In this task, participants selected between two stimuli; one of which was rewarded, and the other, punished. During subsequent phases, the likelihood of reward and punishment changed, meaning that in order to be successful (i.e., to earn the most points) participants needed to change their choice. Budhani et al. found that whilst there was no difference between high and low psychopathic individuals during the acquisition phase, those with high levels of psychopathy were impaired on the reversal of both the reward and punishment contingencies. Further analysis attributed this difference to psychopaths being less likely to maintain a response to a rewarded stimulus on a subsequent presentation of that stimulus. Conversely, De Brito et al. found there to be no differences in performance in high vs. low psychopathy offenders, but that there was a trend towards a significant difference between offenders and non-offenders (with offenders making more errors).

In a more complex version of the tasks used by Budhani et al. and De Brito et al., an earlier study by Mitchell et al. (2002) also investigated

response reversal deficits in offenders with psychopathy. In this task, participants were required to learn whether a stimulus was rewarded or punished via onscreen feedback. The stimuli presented - and whether they were rewarded or punished - changed throughout the task, meaning that successful performance again involved participants being able to learn and relearn which responses would gain reward and avoid punishment, and then use this information to make the correct choice. The authors found that whilst those with high levels of psychopathy did not differ from controls in terms of learning which stimuli should be chosen when those stimuli were novel, in direct contrast to the results presented by Budhani et al., they made more errors when the stimuli remained the same and the contingencies were reversed (i.e., the perseverated in responding to a previously rewarded stimulus).

Finally, Mitchell et al. (2006) compared individuals with psychopathy to a number of patients known to have amygdala or orbitofrontal cortex damage, which have previously been shown to be implicated in the processing of punishment and reward associations (Baxter & Murray, 2002) and supporting reversal learning (Rolls, 2004). During this task, participants also had to choose between two tokens on a screen. Four different tokens (differentiated by colour) were shown across the experiment and the likelihood of reward or punishment associated with these tokens was altered three times. After each trial, feedback was given as a message detailing the number of points that had been won or lost, as well as a running total. In the first experiment, results showed that psychopathic individuals performed worse relative to both a forensic and a community control group, but moreover, that their pattern of

results was comparable to that of patients with lesions of the amygdala and orbitofrontal cortex.

Summary of Response Reversal Tasks

Results from response reversal tasks are more conclusive relative to other paradigms reported; all but one of the seven studies reported at least some differences between individuals with high levels of psychopathy relative to controls. Interestingly, all of the studies showed that psychopaths were comparable to controls in terms of their ability to learn the initial stimulus-reward associations, suggesting strongly that reward processing is, at least on these tasks, intact. The majority of the other studies (that used risk-taking and passive avoidance tasks) indicated that individuals with psychopathy show marked deficits in their ability to reverse this learning and to choose a different response when the contingencies changed (i.e. the previously rewarded stimuli was now punished) so that an established response set became deleterious to performance. This could be interpreted as meaning that psychopaths have poor sensitivity to punishment cues, even when these cues become more apparent as the experiment goes on; however it could also mean that individuals with psychopathy struggle to flexibility incorporate new information following the establishment of a dominant response. Whilst it is likely that results from this paradigm suggest preserved reward processing, it is not clear whether this perseveration is a result of an overvaluing of reward relative to controls, or whether this is in addition to poor punishment-processing, or both.

Discussion

Overall, the results of the 16 studies in this review suggest that reward processing in individuals with psychopathy or high levels of psychopathic traits is likely to be intact, but what is less clear is whether psychopaths demonstrate reward processing that is comparable to controls, or whether they are more sensitive to reward information (to the extent to which it overrides any influence of punishment information). Results concerning punishment processing are unclear; the design of the studies reviewed do not readily allow for conclusions about the relative contribution of punishment processing deficits to be drawn.

As outlined in the Introduction, two major accounts of psychopathy at the level of cognitive/ affective functioning exist, the Response Modulation Hypothesis (RMH) and the Amygdala Dysfunction (AD) account. The RMH suggests that deficits in reward and punishment processing in individuals with psychopathy can be accounted for by impairments in attentional processes; that is, individuals with psychopathy are unable to use peripheral cues in the environment that are not currently at the focus of attention. Proponents of the AD account, however, disagree with this attention-based account and argue that impairment in amygdala functioning is responsible for differential reward (and sometimes punishment) processing in individuals with high levels of psychopathy.

Of the 16 studies reviewed, five found no differences between those with psychopathy or high psychopathic traits and those without psychopathy, meaning that they are not able to provide evidence in support for either the RMH or the AD account. Of the remaining 11 studies, three explicitly present

their results with reference to the RMH. Newman and colleagues (Newman et al., 1990; Newman & Schmitt, 1998, Newman et al., 1987) explain the finding that psychopaths are more likely to make passive avoidance errors and show poor response reversal learning as being due to their relatively poor ability to shift attention to non-dominant cues. That is, psychopaths are theorised to be poorer at using information that is not immediately relevant to them. Although at first glance this account makes sense, it is important to note that this account of attention is not compatible with the attention literature that exists regarding the healthy population (Corbetta & Schulman, 2002; Desimone & Duncan, 1995; Lavie, 1995). Whilst it seems that Newman and colleagues explain their results in terms of an inability to shift attention to non-dominant cues, in both the passive avoidance tasks and response reversal tasks, when a punishment cue appears on the screen, there is no competing stimulus that can reduce its processing. Furthermore, the RMH suggests that there is an attention deficit at the behavioural level, that is, failing to shift attention to peripheral information, which is then indexed by a differential behavioural response. However, it is not clear from this account whether this 'attentional' difference between individuals with high and low levels of psychopathy is a global attentional deficit (in which all salient information that is not the current focus of attention is ignored) or one that is specific to poor orienting to peripheral affective stimuli.

In a similar vein to Newman and colleagues, Brazil et al. (2013) state that psychopaths' poor response reversal can be modulated by the instructions given in the task. When the learning occurred implicitly, psychopaths were impaired, but this was not the case when learning was explicit (when task instructions were clear). The authors conclude that this is

evidence that psychopaths have a reduced capacity to use information for adaptive behaviour, but the exact mechanism underlying this difference in performance is not clear; why psychopaths would be less likely to incorporate additional information when it is explicitly given (thus making the information goal-directed and task-relevant) is not clear. The RMH remains an influential account and should be credited for stimulating research into psychopathy, but it does not seem that the majority of the studies reviewed here can provide unequivocal evidence to support it.

Of the remaining 10 studies reviewed, seven explicitly make references to an emotion processing deficit or amygdala dysfunction to explain their results (Blair et al., 2004; Blair et al., 2006; Buhdani et al., 2002; Mahmut, 2002; Mitchell et al., 2002 Experiments 1 and 2; Mitchell et al., 2006) and the remaining three can be easily conceptualised using this framework (Dean et al., 2006; Masui & Nomura, 2002; Molto et al., 2007). As described in the introduction, the AD account of psychopathy is based on a long-standing literature that shows that the amygdala is associated with a range of functions such as instrumental learning and emotion processing (e.g., Adolphs, 2013; Blair, Mitchell & Blair, 2005;). All three of the paradigms reviewed (risk-taking, passive avoidance and response reversal) can be thought of as involving instrumental learning and emotional processing. Instrumental learning (or operant conditioning) is said to have taken place when an individual's behaviour changes as a result of its antecedents and its subsequent consequences (Skinner, 1937); the reward and punishment tasks reviewed here all include learning that takes place under these circumstances. Additionally, the three types of task could be said to include emotion processing. Reward cues can be thought of as appetitive, and punishment

cues as aversive, and as such are inherently valenced. It makes sense, then, that if psychopaths and those with high levels of psychopathy perform poorly in tasks that use both instrumental learning and emotional processing, it is possible that amygdala processing may well be dysfunctional.

This review suggests that there is substantial evidence for an AD account of psychopathy. However, it must be pointed out that the studies reported here do not elucidate exactly how the mechanisms that might be involved work together to produce the effects seen. Additionally, it is also known that the amygdala is highly connected to many parts of the brain, and what role these other brain areas play – both individually and in a reciprocal relationship with each other - cannot be determined from these studies alone. However, what can be said is that there is less evidence for an attention deficit in psychopathy based on poor processing of non-goal based information, relative to a deficit that may be primarily driven by a dysfunction in the processing of affective information.

Based on what is known about psychopathy in terms of what drives individuals to act in certain ways (i.e., manipulation of others or rule breaking for personal gain; Cleckley, 1941; Hare, 1991), it would be expected that experiments that use rewards and punishments with real-world value, such as money, would have greater effects than those that use points, etc. However, this was not the case. As can be seen across the 16 studies reviewed, four used real money incentives; whilst differences between psychopaths and non-psychopaths were found in these studies, the reward/punishment processing deficits do not appear any stronger than those presented in which only points were used as an incentive. This suggests that the mechanisms underlying this effect are likely to be more complex than simply performing certain behaviours

for immediate monetary reward; indeed, it is possible that other types of reward need to be considered. For example, a recent paper by Foulks et al. (2013) demonstrated that symbols of social reward (the “like” sign used on the social media website, Facebook) was equally effective as virtual money when incentivising individuals with high levels of psychopathic traits. This adds an interesting dimension to the concept of reward and punishment processing that might yield further insights into the deficits associated with the disorder in future research.

It is also of note that out of the 16 studies presented, five used a sample of individuals from the community. Of these, four showed that individuals with high levels of psychopathic traits performed in a similar way to those with psychopathy in forensic samples. Mahmut et al. (2007) compared a sample of community-based individuals with psychopathic inmates and found that those non-incarcerated individuals showed a similar, but attenuated pattern of results. Additionally, in Blair’s (2004) study, which used high, medium and low level of psychopathic traits/ psychopathy groupings, the performance of those with middling levels of psychopathy fell between the high and low groups. Taken together, this is further evidence that psychopathy is less likely to be a discrete disorder affecting a small proportion of the population and more likely to be a series of traits that exist on a continuum, with individuals in the non-forensic population displaying a similar pattern of deficits to psychopaths in prison.

Additionally, it is important to note that apart from trait anxiety (reported in 3 studies) and risk-taking behaviour (reported in one study) none of the studies reports other variables that may potentially have confounded the results. For example, Attention Deficit Hyperactivity Disorder has been found

to be highly comorbid with diagnoses of Conduct Disorder (which is a necessary condition for the later diagnosis of Psychopathy) (Gresham, Lane & Lambros, 2000). It is possible that some other, highly correlated variable is responsible for the differences found (or not found) between individuals with high vs low levels of psychopathy. Furthermore, none of the studies describe other potentially important factors that may vary between the groups, for example, length of incarceration, level of education and other socioeconomic factors. Further work should potentially investigate these potential moderator variables, and their impact on individuals' ability to learn from reward and punishment information.

Finally it should be said that whilst there is obvious value in synthesising research across a number of paradigms, this review did not use meta-analytic techniques. There is some question as to how valid it is to compare across different experimental designs as it could be argued that although the authors appear to be reporting the same phenomena, without direct empirical evidence it is difficult to know that each type of paradigm reviewed is tapping into exactly the processes involved in reward and punishment processing; indeed, as mentioned previously, even different experimental designs within the same general paradigm can be quite different from each other. Due to the time constraints involved in the producing of this review, it was not possible to use meta-analytic techniques. However, it would potentially interesting to subject the studies reviewed to a formal comparison of effect sizes as the combining of studies may lead to a greater power to detect an effect. Additionally, it would allow for the inconsistencies across the sampled studies to be analysed and quantified.

Study Quality and Methodological Considerations

The studies selected for this review were subject to a quality and relevance procedure to ensure that the methods used and the results reported were of a good standard. However, this meant that several studies had to be excluded; this method of selection also precluded the contacting of key authors in the field to potentially access any unpublished results that they may have had. Whilst it is not possible to reliably draw conclusions from studies that have not been through the rigours of the peer-review process, it is quite possible that studies exist that wholly contradict those published, but have not been submitted for publication for a variety of reasons. Although this 'file drawer' phenomenon is not ideal, in the interests of balancing quality and reliability over breadth of results, it was decided that strict inclusion/ exclusion criteria should be implemented.

Clinical Implications and Future Research

The results of this review suggest that further research into delineating potential deficits in reward and punishment processes in psychopathy is necessary. Whilst it appears that psychopathy is associated with intact reward processing, more needs to be done to elucidate the exact nature of any deficits in the processing of punishment cues, as this could directly affect the development of treatment interventions. For example, a tendency to focus on reward in the face of punishment could explain why psychotherapies that focus on problem-solving or relapse prevention or other cognitive skills have not been successful, as they require individuals to reasonably appraise the relative costs and benefits of different behaviours before being able to come to a successful solution.

Psychopathy is thought to be a developmental disorder with difficulties beginning before the age of ten years (Frick & Viding, 2009). Although there is a substantial literature concerning reward and punishment processing in children with psychopathic traits, less research has been done concerning the developmental pathway of this disorder. Further longitudinal research looking into how reward and punishment processing may change over time may offer interesting insights into the disorder.

Conclusions

This review aimed to address two key issues. First, to synthesise what is known about reward and punishment processing in individuals with psychopathy and high levels of psychopathic traits, and second, to assess the extent to which the reviewed literature offers support to two competing models of psychopathy at the cognitive/ affective level. The reviewed studies suggest that whilst reward processing appears to be intact in this population, more research needs to be done before it is possible to fully understand the potential punishment processing deficits. Finally, the results reported in the studies reviewed appear to be more readily explained using a model of amygdala dysfunction relative to an attention processing account; the amygdala is known to be involved in both instrumental learning and emotional processes which are central to each of the tasks reported here. Further work is necessary to fully understand how the amygdala interacts with other brain areas to understand how these mechanisms lead to poorer task performance in reward and punishment paradigms, as well as to extrapolate from these empirical tasks to begin to develop useful treatments for this disorder.

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Part 2: Empirical Paper

Improving Attention to Emotion in Individuals with High Levels of Psychopathic Traits: A Role for Value-Driven Attentional Capture?

Abstract

Aim. Previous research has shown that individuals with high levels of psychopathic traits are poor at processing fearful faces, and this effect extends to them showing poor capture by task-irrelevant emotional faces. The current study aimed to investigate whether training individuals to orient to a fearful face by associating it with a reward, was able to increase capture by a fearful face in a subsequent attentional capture task

Method. A total of 160 participants were recruited from the community. All completed a self-report measure of psychopathy, and were allocated into three groups based on their emotional dysfunction scores. Seventy-two individuals formed a comparison group that completed an emotional capture task and 88 individuals took part in an emotional training task, followed by the emotional capture task.

Results. The results showed that individuals who took part in the training task were more distracted by a task-irrelevant fearful face, compared to those who did not receive training. This increased capture effect was seen across all three levels of psychopathic traits.

Conclusion. The findings demonstrate that training individuals to attend to a fearful face leads to an increase in capture by a distractor fearful face, when the emotional content of the face is no longer relevant. This effect is of particular interest in regards to individuals with higher levels of psychopathic traits, whose poor processing of emotional information is likely to contribute to their higher levels of antisocial behaviour.

Introduction

Paying attention to emotions is important for everyday social interactions. Failing to notice facial expressions may lead to being unable recognise what behaviour is appropriate in different situations. For example, not noticing another's angry face could mean that individuals miss out on one of the first cues that their own behaviour is not acceptable and should be discontinued. Not being able to interpret distress (e.g., fear or sadness) in others may also lead to inappropriate behaviour, for example, continued aggression even when another person is clearly upset.

Psychopathy is a developmental condition that is characterised by two core components: emotional dysfunction (e.g., callous-unemotional traits) and antisocial behaviour (Blair & Viding, 2008; Frick, 1995; Hare, 1991). Although the majority of research has focused on individuals in prison, there is evidence to suggest that it is a syndrome that represents extremes on normal continua of individual differences in both emotional dysfunction and antisocial behaviour (Lilienfeld & Fowler, 2006). Of these psychopathic features, the emotional dysfunction component is most central to the construct of psychopathy and is what differentiates individuals with psychopathic personality disorder from other people who display antisocial behaviour (Blair, Mitchell & Blair, 205; Blair & Viding, 2008).

The emotional dysfunction component of psychopathic traits is associated with diminished reactivity to emotional stimuli, both at a neural and a behavioural level (Birbaumer et al., 2005; Blair & Viding, 2008; Gordon, Baird & End, 2004; Jones et al., 2009; Kiehl et al., 2001; Marsh et al., 2008; Veit et al., 2002. See also Blair, 2013; Blair & Viding, 2008; Viding, McCrory &

Seara-Cardoso, 2014 for reviews). An established body of evidence demonstrates that individuals (both adults and children) with high levels of antisocial behaviour and emotional dysfunction are poor at processing distress and threat stimuli (Blair, 2010; Blair, Colledge, Murray & Mitchell, 2001; Frick & Viding, 2009; Hodsoll, Viding & Lavie, 2014; Kimonis, Frick, Fazekas & Loney, 2006; Vitale et al., 2005), and that this impairment plays a central role in the development of the disorder (Blair, 2008, 2010). Despite the evidence suggesting that emotion processing, recognition and attribution may be impaired in individuals with core psychopathic traits (e.g., Dadds et al., 2006; de Wied, van Boxtel, Matthys, Meeus, 2011; Jones, Happé, Gilbert, Burnett, & Viding, 2010), very little research has focused on investigating attention to emotion in this population.

In day-to-day life, the decisions that we have to make about others' emotional states (as indexed by their facial expressions of emotion) rarely occur under circumstances where there are no other stimuli competing for our attention. In healthy adults and typically developing children, it has been shown that emotional faces (fearful, angry and happy) are able to capture attention even when they are completely irrelevant to the task at hand (Hodsoll, 2010; Hodsoll, Viding & Lavie, 2011). From an evolutionary point of view this makes sense; in order to successfully navigate the social world it is essential to be able to attend to and react appropriately to emotional faces in our surroundings, even when they are not the current focus of our task. Moreover, it has also been demonstrated that there is an association between the emotional dysfunction component in adults and decreased attentional capture by task-irrelevant faces (Hodsoll, 2010). Based on our own findings and the evidence presented in the previous literature, we have suggested that

it is this deficit in attentional capture by emotional facial expressions that may contribute to poorer reading of social cues, which may in turn lead to an increase in the expression of antisocial behaviours in individuals with high levels of psychopathic traits (Blair, 2008, 2010; Hodsoll, 2010; Hodsoll et al., 2014). Based on this premise, it makes sense to assess whether it is possible to increase involuntary capture of task-irrelevant emotional expressions in individuals with high levels of psychopathic traits.

Recent work by Anderson and colleagues (Anderson, Laurent & Yantis, 2011, 2012) has demonstrated that through the creation of personally meaningful reward associations (i.e., money earned in compensation for participation), it is possible to increase attentional capture by (non-emotional) task-irrelevant stimuli. Across a range of visual search experiments, Anderson et al. rewarded participants for correct responses; in some trials the correct response to a green target was associated with a high probability of a higher reward (e.g., 5 cents) and the correct response to a red target was associated with a low probability of a lower reward (e.g., 1 cent). Participants were not told explicitly of the reward rule, but a running total of money earned was displayed after each trial. During a second phase of the experiment, the authors asked participants to complete a similar visual search task in which the previously rewarded targets now appeared as task-irrelevant distractor items. The results consistently showed that despite being task-irrelevant, participants were distracted by these previous targets, with distraction from the previous higher reward stimulus being greater than that of the lower reward item (which was in turn more distracting than an item with no previous reward association).

As described above, it is likely that paying attention to faces in our environment is important for socialisation and the development of appropriate behavioural interactions (Blair, 2003). Additionally, a negative association between core psychopathic traits and capture by emotional faces has been found (Hodsoll, 2010). Previous work in the visual search field has shown that the creating of reward associations with non-emotional, task-irrelevant items is able to produce a value-driven attentional capture (Anderson et al., 2011, 2012). It is not yet known whether training individuals with high levels of psychopathic traits can lead to an increase in their processing of these task-irrelevant emotional faces. This study therefore aims to extend previous work on emotional capture by investigating whether attentional capture by emotional faces can be increased, and whether this varies as a function of psychopathic traits.

Whilst there is now a large body of literature investigating the processing of emotional information in individuals with psychopathic traits, what is unclear is it the extent to which emotions other than fear and sadness are affected (however, see Dawel, O'Kearney, McKone & Polermo, 2012, for a review). Because of this, and because fear processing is most likely to have downstream consequences for social learning and antisocial behaviour, this study aimed to test a relatively focused hypothesis in that the main question was whether or not training can increase capture by fearful faces. It was of less interest to explore how reward values affect attention to fearful relative to happy facial expressions, but more whether increasing attention to fearful faces is possible at all. Fearful faces were associated with a high probability of a high reward, and happy faces were associated with a low probability of a low reward; this design was chosen to maximise potential learning to attend to

fearful faces and has the advantage of increasing statistical power. Happy faces were chosen because they are relatively 'neutral' in comparison with other emotional faces, particularly those that have a negative valence, meaning that interpretation of results is likely to be easier than if another similarly valenced emotion was used.

Dadds et al. (2006) demonstrated that fear recognition deficits in children can be temporarily extinguished by training children with high levels of psychopathic traits to focus on the eye-region of emotional faces. This suggests that it is possible to improve the processing of fearful faces with some form of training. If the Emotional Training task presented here is able to improve processing of fearful faces in individuals with high levels of core psychopathic traits (i.e., *emotional dysfunction)*, then it might be expected that this would result in increased capture of attention, even when the fearful face is task-irrelevant. It is therefore predicted that RTs to fearful distractors in participants with high levels of core psychopathic traits (i.e., *emotional dysfunction*) will be higher in the group that received Emotional Training compared to those with high levels of psychopathic traits who did not.

The current study aimed to assess whether a community sample of individuals with low, medium and high levels of psychopathic traits (i.e., *emotional dysfunction*) who received emotion training performed differently to individuals who did not receive training, in subsequent emotional capture task. Previous research (Hodsoll, 2010; Hodsoll et al., 2014) has demonstrated that whilst individuals with low levels of psychopathic traits show attentional capture to fearful faces (i.e., slower reaction times to the target in the presence of a fearful distractor), individuals with higher levels of psychopathic traits do not. It was therefore predicted that if the emotional training task was

successful (i.e., all individuals learned to attend to a fearful face), when the emotional content of the face became task-irrelevant in the subsequent task, all individuals would be captured by a fearful distractor face, regardless of their level of psychopathic traits.

Method

Overview

The study was conducted in two phases. In the first, a comparison group of participants was recruited to take part in the Emotional Capture task only, and received £3 for their participation. In the second, a different group of participants was recruited to take part firstly in the Emotion Training task, followed by the Emotional Capture task. The second group received £7 for their participation (as the total duration of the session was longer than for the comparison group). Participants were recruited from the university Psychology Department's 'Subject Pool'. This is an online tool through which university researchers can advertise their study, and is accessible by both university students and the general public.

All participants completed a self-report measure of psychopathy before participating in the experimental tasks.

Ethical Approval

The study was granted ethical approval by the UCL Ethics Committee (1444/002) (see Appendix 2 for Approval form and Appendix 3 for Information and Consent Forms.)

Participants

In total, 160 participants (100 male) aged between 18 and 52 (mean age 27) were recruited. Seventy-two participants took part in the first phase of the study and 88 different participants took part in the second phase. All reported normal or corrected-to-normal colour vision. Forty-nine of the participants were university students, with the remaining 111 participants coming from the wider community.

Measure

The *Self-Report Psychopathy Scale-III Short Form* (*SRP- III- SF*; Paulhus, Hemphill & Hare, in press; see Appendix 4) is a self-report measure comprising 29 items that assess the level of psychopathic personality traits in non-prison populations. The questions are scored on a scale of one to five, with a score of one indicating *"Disagree strongly"* and a score of five indicating *"Agree strongly".* The total score indicates the overall level of psychopathic personality traits for the respondent. Additionally, the SRP-III-SF yields four sub-scales that assess different dimensions of psychopathic personality: Interpersonal scale (e.g., *"It's fun to see how far you can push people before they get upset"*), Affective scale (e.g., *"I never feel guilty over hurting others"),* Lifestyle scale (e.g., *"I've often done something dangerous just for the thrill of it"*), and Anti-social scale (e.g., *"I have threatened people into giving me money, clothes, or makeup"*). Factor analytic work has shown that the SRP- III- SF contains two factors, with the first factor assessing the core interpersonal and affective features of psychopathy (*emotional dysfunction*) and the second assessing antisocial and impulsive lifestyle (*antisocial behaviour*) (Neumann, 2010, personal communication).

Emotional Training Task

The Emotional Training task was developed as a combination of the tasks used by Anderson et al. (2011, 2012) and the Emotional Capture paradigm first outlined in Hodsoll et al. (2011). Participants were tested individually in a testing room at the university, with stimuli presented and reaction times (RTs) recorded on a PC using PsychoPy Version 8.1. Stimuli in the Emotion Training task consisted of nine grey-scale scale images of the faces of six different identities, three female and three male (see Figure 1). Images were taken from the MacBrain Face Stimulus Set (Tottenham et al., 2009). Each identity had an image showing a neutral, fearful and happy expression and each face subtend 2.1 cm (vertically) by 1.7cm (horizontally). On each trial, six faces were presented on a black background in a virtual circle with the centre of each image placed at 1 cm from the central fixation cross. A central fixation point was presented for 500 msec followed by the search displays, which were presented until response.

On each trial, participants were told to locate the one emotional face (either happy or fearful, counterbalanced across the experiment) amongst the five other neutral faces. Once the target was located, participants indicated whether it was tilted 15° to the left or 15° to the right by pressing the left or right arrow keys on a standard keyboard.

Correct trials were followed by visual feedback of virtual monetary reward, both for that trial and cumulative reward. Fearful faces were associated with an 80% chance of a £90 reward, and happy faces were associated with a 20% chance of a £10 reward. Participants were instructed to try and earn as much money as possible. Although Anderson et al. (2011, 2012) used real monetary rewards, a systematic inspection of the literature

looking into reward associations in psychopathic traits suggests that there is no significant advantage to using real money as opposed to virtual money as reward. Financial constraints for the project also meant that it was not possible to use real monetary rewards of a value that would have been sufficiently motivating. There were 240 trials, with target location, identity and sex randomised across trials.

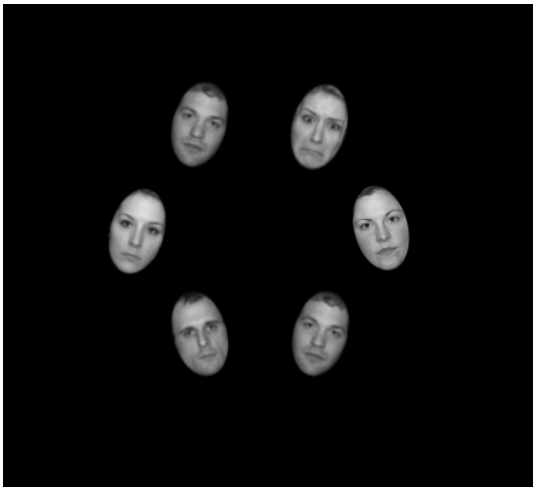


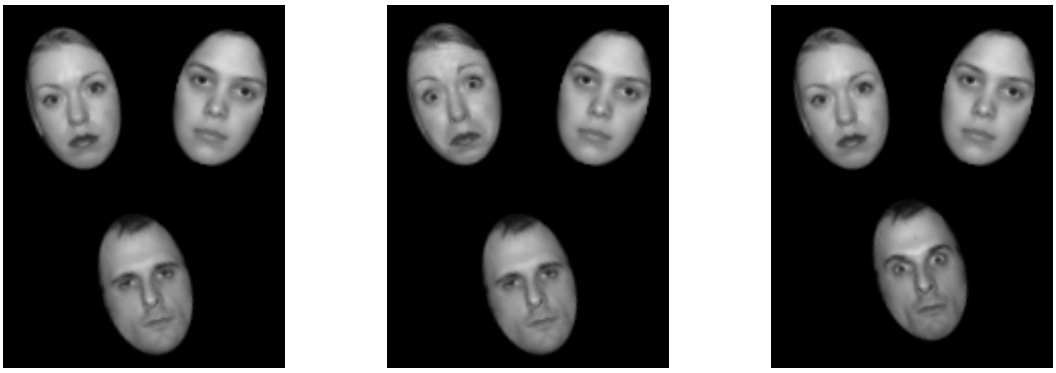
Figure 1: Example Display from the Emotion Training Task Showing a Fearful Target Face

Emotional Capture Task

All participants took part in the Emotional Capture task (Hodsoll, Lavie & Viding, 2014). For those who also took part in the Emotional Training task, the Emotional Capture task followed after a short break. All stimuli used were the same as were used in the Emotional Training task, but only three faces were presented (in a virtual triangle) per trial (see Figure 2). In this experiment, participants were told to locate the male face amongst the two other female faces, again indicating whether it was tilted to the left or the right. The dependant variables were RTs to the target and trial accuracy.

Participants were explicitly told to ignore any facial expressions, as they were not relevant to this task. The Emotional Capture task consists of three blocks of 80 trials (containing either happy or fearful singleton faces). In each experimental block, two-thirds of trials contained an emotional face. Of these emotional face trials, one quarter of trials contained an emotional target face and the remaining trials contained an emotional distractor face, thus ensuring that there was never any advantage in paying attention to an emotional facial expression. Onscreen feedback was given on each trial ('correct' or 'incorrect'), but no 'reward' was given.

Within each block, the type of trial (i.e., emotional face absent, emotional male target singleton present or emotional female distractor face present) was randomised. The location of the identities and the orientation of each stimulus was randomised across trials. The identities of the faces were randomised across trials, but the presentation was constrained so that none of the face identities repeated on two successive trials.



Neutral Condition Distractor Fear Singleton Target Fear singleton

Figure 2: Example displays for neutral, emotional (fearful) distractor singleton and emotional (fearful) target singleton conditions in the Emotional Test task.

Statistical Analysis

Power Analysis

Sample size was based on the expected difference between a group high in the *emotional dysfunction* component of the SRP and the general population. Effect size was calculated from previous research (Hodsoll, 2010). This was on a group of 54 participants recruited from the community. Although participants in this group may have included participants high in *emotional dysfunction,* there is no published effect size available that has excluded individuals with high *emotional dysfunction* scores. In this previous study the mean distraction effect for fearful faces (relative to neutral) equaled 11ms, with a standard deviation of 45ms. For *emotional dysfunction* the mean distraction effect was expected to be 0ms with a standard deviation of 45ms. This resulted in an effect size of .244, meaning that a sample size based on 80% power was calculated to be 126 individuals in total.

Experimental Design

A between-subjects design was used for this study in order to maximise the potential for seeing differences between the trained and non-trained groups. If a within-subjects design had been used, it is possible that any potential effects of learning might be extinguished due to practice effects. It has been previously shown that exposing participants to many attentional capture trials can reduce capture, as participants learn to ignore task-irrelevant stimuli (e.g., Kelley & Yantis, 2009) although this has yet to be demonstrated using emotional stimuli. As the aim of the study was to investigate whether learning can increase capture by fear in those who have

previously been shown to have poor capture (i.e., those with high levels of psychopathic traits), it seemed prudent not to subject all participants to the training so that a comparison group could be formed.

Similarly, it was decided to include the same stimuli in the capture task as were used in the training task in order to give the best chance for learning to occur. Whilst this means that it is not possible to say conclusively that any effects seen are purely driven by the valence of the face rather than perceptual features per se, previous research has demonstrated that a range of different faces do produce the same level of capture in this paradigm (Hodsoll et al., 2011).

Participant Groupings (Between-Subjects Factor)

The SRP can be divided into two distinct factors: *emotional dysfunction* (i.e., core psychopathic traits) and *antisocial behaviour,* which are relatively independent of each other. Participants were divided into high (High-ED), medium (Medium-ED) and low (Low-ED) groups based on tertial (i.e., 33.3%) ranks of emotional dysfunction scores, which resulted in cut-offs of 23 and below for the Low-ED group, between 24 and 30 for the Medium-ED group, and 31 and above for the High-ED group. These groupings were in keeping with Paulus et al., (in press) who found mean emotional dysfunction scores of 22 in a community sample, and 35 in a prison sample. The decision to group the emotional dysfunction data categorically rather than continuously was made in order to aid interpretation of the results (e.g. interpreting interactions) and to more readily extrapolate the findings in a clinically relevant way. Participant characteristics are displayed in Table 1.

Table 1: Mean Emotional Dysfunction Scores as a Function of Emotional Dysfunction and Emotional Dysfunction Group and Training Group

	No Training		Training	
	N	Mean ED Score *(SD)*	N	Mean ED Score *(SD)*
High-ED	24	33.8 *(3.7)*	29	37.1 *(5.7)*
Medium-ED	24	25.8 *(1.8)*	29	27.6 *(1.9)*
Low-ED	24	18.1 *(3.2)*	29	19.5 *(2.9)*

Results

Emotional Training Task

In keeping with similar research in the field (e.g., Hodsoll, 2010; Hodsoll et al., 2012, 2014), trials with an error or an RT above 2500 msec (4% of total number of trials) were excluded from further RT analysis. In order to assess learning across the experiment, a mixed model ANOVA was conducted, with RTs to the target in each experiment block (one to four) as the within-subjects factor and group (Low-ED; Medium-ED; High-ED) as the between-subjects factor. In order to attempt to isolate the effect of the *Emotional Dysfunction* scores on the variance of RTs to the target, scores for *Antisocial Behaviour* were centred and entered as covariates of no interest. There was a main effect of block on RTs ($F (3, 145) = 36.40$, $p < .001$, $\eta\rho^2 = .322$), and pairwise comparisons (with Bonferroni corrections) showed that RTs to the fearful target reduced significantly as from blocks one to four (see Figure 3). There was no main effect of *emotional dysfunction* group, ($F (2, 75) = .382$, $p = .684$, $\eta\rho^2 = .010$) and no interaction between block and *emotional dysfunction* group ($F (6, 145) = .805$, $p = .520$, $\eta\rho^2 = .030$); all groups responded to the training in a similar manner, by reducing their RTs to fearful targets.

A similar ANOVA for accuracy (with mean percentage accuracy in blocks one to four as the within-subjects factor, *emotional dysfunction* groups as the between-subjects factor and scores for *Antisocial Behaviour entered* as covariates of no interest) revealed that there was no main effect of block on accuracy ($F (3, 75) = .754$, $p = .504$, $\eta\rho^2 = .010$), no main effect of *emotional dysfunction* group ($F (2, 75) = 1.024$, $p = .364$, $\eta\rho^2 = .029$) and no interaction between the two ($F (6, 196) = 1.180$, $p = .320$, $\eta\rho^2 = .036$).

The results of the RT ANOVA thus suggest that learning did occur, and it did so equally across all three *emotional dysfunction* groups. The error data did not reveal a learning effect, possibly due to low number of errors overall.

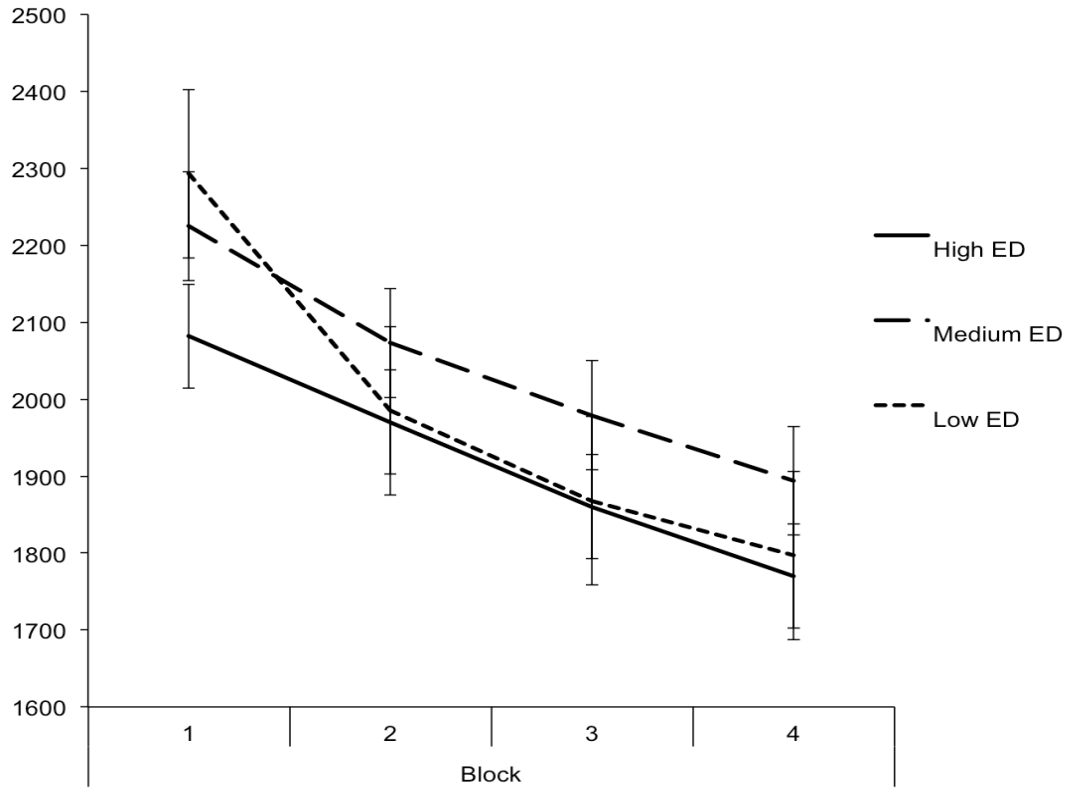


Figure 3: RTs (msec) to the Fearful Target in Experimental Blocks One to Four as a function of Emotional Dysfunction Group. NB, Error bars display standard errors.

Emotional Capture Task

RT Analysis

Trials with an error or an RT above 2500msec (6% of total trials) were removed from further RT analysis. For each participant, two sets of 'Emotional Capture' scores were calculated by subtracting the mean RT in the all-neutral condition from the mean RT in the fearful distractor singleton condition, and the mean RT in the all-neutral trials from the mean RT in the fearful target condition. These subtractions yielded a 'capture' score for fearful targets and distractors; a positive score means that RTs to the target were longer in the presence of a fearful face, and a negative score means that RTs to the target were faster in the presence of a feaful face.

Fearful Distractor Capture

A between-subjects ANOVA with Emotional Training condition (no training; training) and *emotional dysfunction* group (Low-ED; Medium-ED; High-ED) as the factors was conducted. As with the training task, centred scores for *Antisocial Behaviour* on the SRP were entered as a covariate of no interest. There was a main effect of Emotional Training condition, with participants who received training showing greater capture by a distractor fearful face relative to those who did not receive training ($F (1, 151) = 4$, $p = .047$, $\eta\rho^2 = .026$). There was no statistically significant main effect of *emotional dysfunction* group ($F (2, 151) = 2.23$, $p = .111$, $\eta\rho^2 = .029$). There was no interaction between Emotional Training group and *emotional dysfunction* group, suggesting that the increase in capture between the trained and untrained groups did not differ according to level of *emotional*

dysfunction (F (2, 151) = .043, p = .958, $\eta\rho^2$ = .001). The means are displayed in Figure 4.

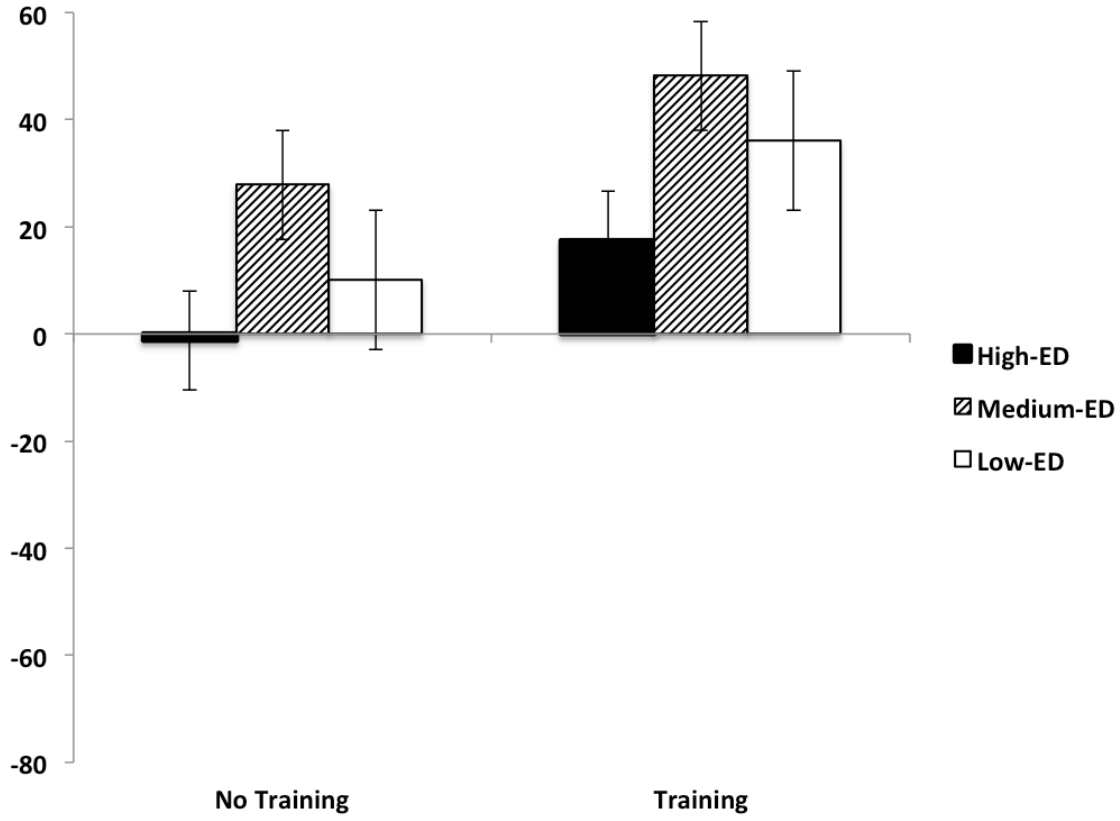


Figure 4. Fearful Distractor Capture Effect (RTs) in Untrained and Trained Groups, as a Function of *Emotional Dysfucntion* Group. NB, Error Bars show Standard Error.

Fearful Target Capture

A between-subjects ANOVA with Emotional Training condition (no training; training) and *emotional dysfunction* group (*Low-ED; Medium-ED; High-ED)* as the factors was conducted. As previously, centred scores for *Antisocial Behaviour* on the SRP were entered as a covariant of no interest. There was a main effect of Emotional Training condition, with those who received training being faster to locate a feaful target face relative to those who had not received training (F (1, 151) = 6.59, p = .011, $\eta\rho^2$ = .042). There was no main effect of *emotional dysfunction* group, with all levels of *emotional*

dysfunction performing similarly (F (2, 151) = .118, p = .888, $\eta\rho^2$ = .002). There was no interaction between Emotional Training condition and *emotional dysfunction* group, suggesting that the facilitation to the target seen in those who had received training, did not vary as a function of *emotional dysfunction* group (F (2, 151) = .957, p = .386, $\eta\rho^2$ = .013). The means are displayed in Figure 5.

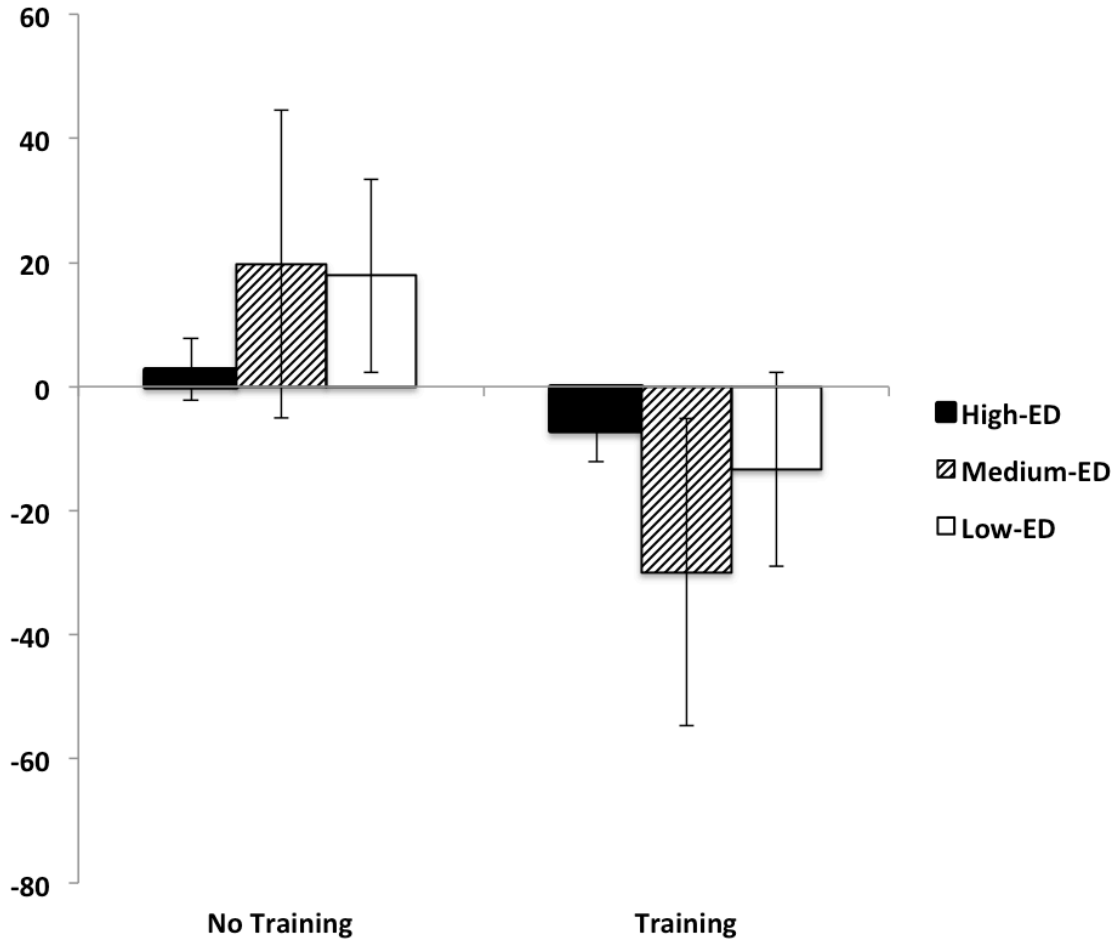


Figure 5. Fearful Target Capture Effect (RTs) in Untrained and Trained Groups, as a Function of *Emotional Dysfucntion* Group. NB, Error Bars show Standard Error.

Accuracy Analysis

Analysis of percentage accuracy was conducted in the same manner as for RTs: Emotional Capture scores for each participant were calculated by

subtracting the mean percentage accuracy on all-neutral trials from the mean percentage accuracy on Fearful distractor trials, with the same procedure being followed for fearful target trials. Centred scores for *Antisocial Behaviour* on the SRP were entered as a covariant of no interest in both ANOVAs.

Fearful Distractor Capture

A between-subjects ANOVA with Emotional Training and *emotional dysfunction* group was conducted. There was no main effect of Emotional Training condition ($F (1, 151) = 1.91$, $p = .151$, $\eta\rho^2 = .025$), no main effect of *emotional dysfunction* group ($F (2, 151) = .512$, $p = .476$, $\eta\rho^2 = .003$) and no interaction between the two ($F (2, 151) = .451$, $p = .638$, $\eta\rho^2 = .006$). This suggests that training did not affect the accuracy of responses to the target in the presence of a fearful distractor face, and that this was the case, regardless of level of *emotional dysfunction.* The lack of effect of these conditions on accuracy suggest that capture effect on RTs by a fearful distractor face cannot be explained in terms of a speed-accuracy trade off. The means are displayed in Figure 6.

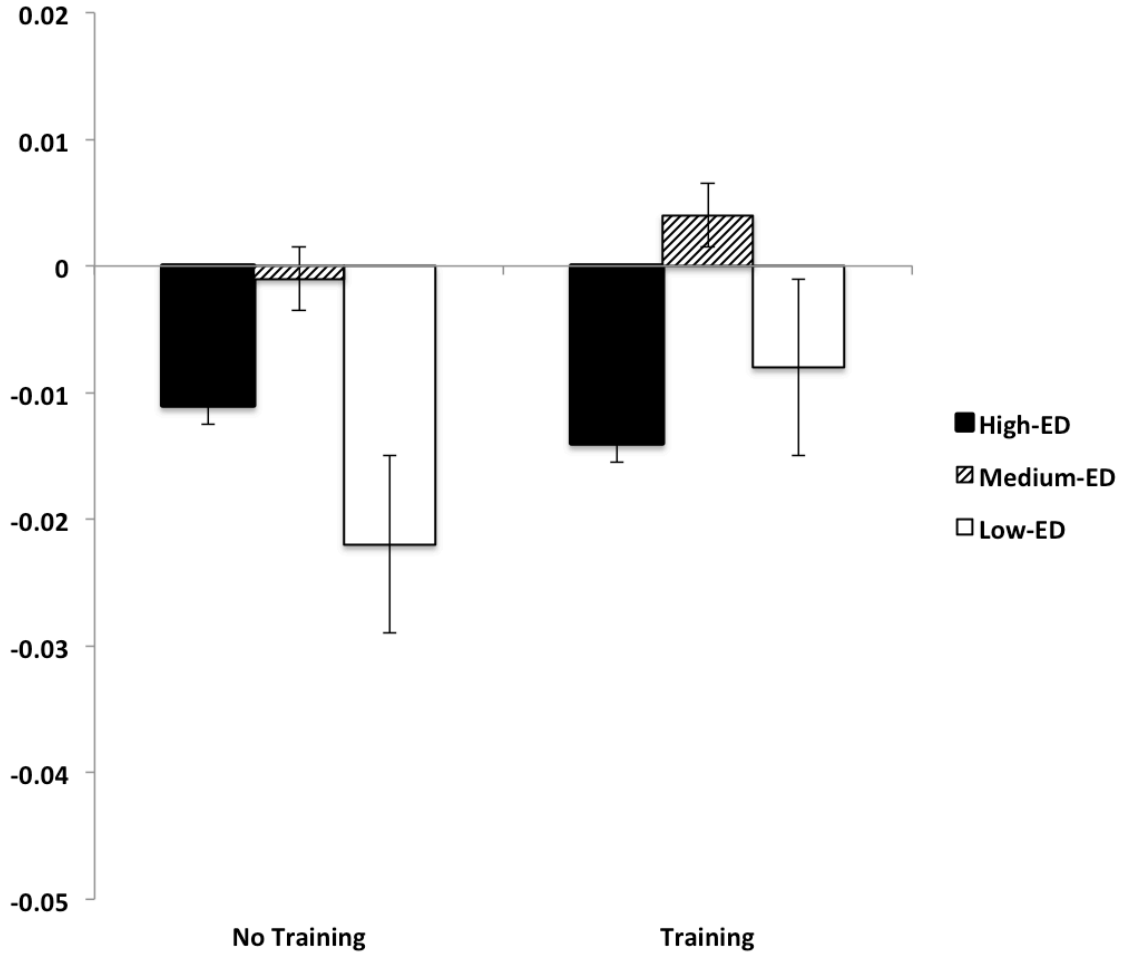


Figure 6. Fearful Distractor Capture Effect (Mean Percentage Accuracy) in Untrained and Trained Groups as a Function of *Emotional Dysfunction* Group. NB. Error Bars display Standard Error

Fearful Target Capture

A between-subjects ANOVA with Emotional Training and *emotional dysfunction* group was conducted. There was no main effect of Emotional Training condition ($F (1, 151) = 1.97$, $p = .163$, $\eta\rho^2 = .013$), no main effect of *emotional dysfunction* group ($F (2, 151) = .928$, $p = .398$, $\eta\rho^2 = .012$) and no interaction between the two ($F (2, 151) = .854$, $p = .428$, $\eta\rho^2 = .011$). This suggests that training did not affect the accuracy of responses to a fearful target, and that this was the case, regardless of level of *emotional dysfunction.* Additionally, these results for accuracy suggest that the RT

facilitation to fearful faces is not the result of a speed accuracy trade-off. The means are displayed in Figure 7.

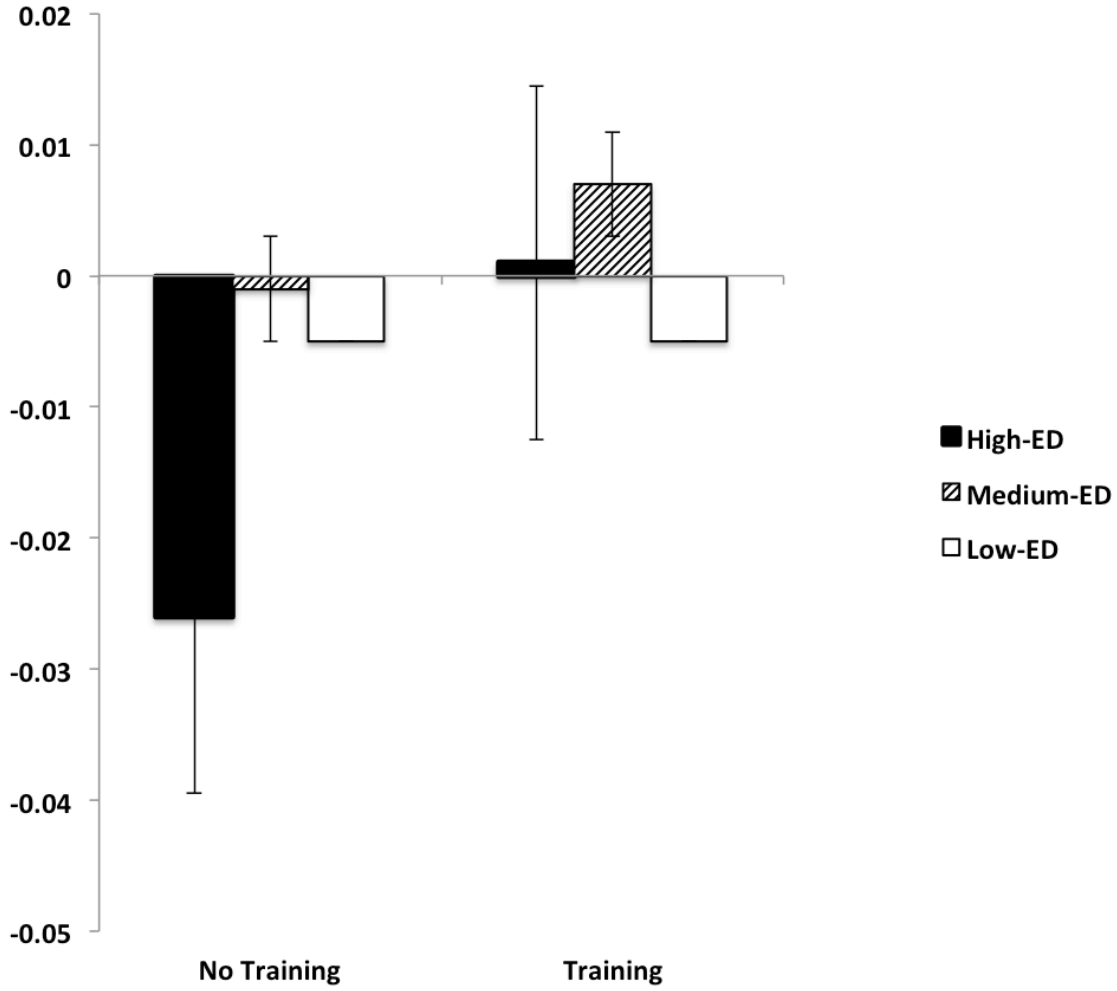


Figure 7. Fearful Target Capture Effect (Mean Percentage Accuracy) in Untrained and Trained Groups as a Function of *Emotional Dysfunction* Group. NB. Error Bars display Standard Error

Discussion

The results of the Emotional Training task clearly demonstrate that across the experiment, participants were able to learn to locate the fearful facial expression, and this rate of learning did not differ as a function of *emotional dysfunction* group. That is, individuals with high and medium levels of *emotional dysfunction* were able to learn as well as those with low levels of psychopathy. The results of the Emotional Capture task showed that

regardless of *emotional dysfunction* group, participants who received training showed greater capture by fearful faces than those who did not receive training. This increased capture was demonstrated in both distractor and target conditions; RTs to the target were slower in the presence of a distractor fearful face, and faster to a target fearful face in the trained group relative to the non-trained group. This suggests that those in the trained group experienced greater processing of the fearful face, even when it was not relevant to the task at hand. The fact that this increased emotional capture was not associated with any differences in task-accuracy, suggests that the effect cannot be explained by a simple speed-accuracy trade-off.

Our ability to detect emotional faces that are not at the centre of our current focus of attention is likely to be linked to our ability to understand and respond to social situations appropriately. One of the primary functions of salient features such as emotional faces is to automatically attract attention to facilitate an orienting response so that they can receive priority processing. Previous research has consistantly demonstrated that individuals with high levels of psychopathic traits are poor at correctly recognising fearful emotional expressions (e.g., Blair, 2010; Blair, Colledge, Murray & Mitchell, 2001; Frick & Viding, 2009; Hodsoll, Viding & Lavie, 2014; Kimonis, Frick, Fazekas & Loney, 2006; Vitale et al., 2005) and that this deficit extends to fearful faces that are not relevant to the current task (Hodsoll, 2010; Hodsoll et al., 2014). It has also been demonstrated that the difficulty in recognising fear faces can be ameliorated, at least temporarily, by training individuals with high levels of psychopathy to attend to the eye-region of fearful faces (Dadds et al., 2006). The current study aimed to assess whether a community sample of individuals with low, medium and high levels of psychopathic traits (i.e.,

emotional dysfunction) who received emotion training performed differently to individuals who did not receive training, in subsequent emotional capture task.

It was predicted that successful training of individuals to attend to a fearful face would lead to an increase in emotional capture by a task-irrelevant fearful face on a subsequent task, in which the emotional content of the face was no longer relevant. Previous research has demonstrated that individuals with higher levels of psychopathic traits do not show capture by a task-irrelevant fearful face (Hodsoll, 2010; Hodsoll et al, 2014), but, it was predicted that following training, RTs to the target would be slower in the presence of a fearful distractor for all individuals, regardless of level of psychopathic traits. The results of this study support these predictions.

It is interesting to note that there were no differences between the *emotional dysfunction* groups in terms of the magnitude of increase in capture by a fearful distractor face (although no specific hypotheses about potential group differences were made). The pattern of results indicates that although all three groups showed greater capture when trained, the increase in capture appears to be proportional to the level of capture shown before training. That is, individuals with High-ED still show less capture than those with Medium and Low-ED in the trained group. Despite this, these results are of significance as without training, individuals with high levels of psychopathic traits have consistently been found to show no capture by task-irrelevant faces (as is demonstrated in the comparison group data presented here, but also in Hodsoll, 2010 and Hodsoll et al., 2014).

It is a limitation of the study design that it was not possible to assess the relationship between *emotional dysfunction* and capture (without losing statistical power) in a continuous, rather than categorical way, which might

have provided more insight into the exact nature of the training effect. Indeed, the use of tertile splits is, without doubt, not the most sensitive way to look for differences between *emotional dysfunction* groups, particularly as group differences did not emerge. However, analysing the scores in a continuous way, rather than categorical, does make the assumption that *emotional dysfunction* scores in the general population are linear, and there is no evidence to suggest that this is the case. It may, however, prove to be useful to investigate this futher, perhaps by assessing the effect of training on fear-processing using a clinical population with significant levels of psychopathic traits.

Whilst this study does not have obvious immediate implications for treatment interventions for individuals with psychopathy, if thought of as a pilot study, it does provide the basis for further work in the area. As mentioned above, it might be useful to investigate the direct relationship between training and capture by fear in those individuals with middling to high levels of psychopathy (as opposed to 'traits'). If this were to be done in a clinical sample, the effect sizes found in this study suggest that future studies would need to have a substantially larger sample (as is common in personality research) to enable sufficient statistical power to detect differences.

Whilst this study has demonstrated that it is possble to alter processing of fearful faces, whether this translates to something that is therapeutically useful, is an empirical question. For example, the concept of 'rewarding' attention to distress emotions in others (i.e., fearful faces) is inherantly problematic; whether improving attention to fearful faces in those with psychopathic traits leads to an increase of pro-social behaviour, as opposed to an increase in antisocial behaviour (perhaps as a result of increased

detection of potentially vulnerable people in the environment), would need to be investigated empirically. It is likely that measurements of real-life behaviour and a prosocial experimental task would help to address whether the training presented here is able to engender something approaching a more socially adaptive affective and behavioural response when encountering distress stimuli.

As mentioned in the Method section, several of the decisions in the designing of this study were made to maximise the potential for learning in the training condition. It is possible, for example, that the learning effect is specific to the stimuli that were used, meaning it is not possible to say whether the carry-over effect on the capture task is an emotional one. Further work should be done to investigate whether it is the emotional valence of the faces that affect capture by distractor fearful faces, or whether it is simply an artefact of using the same stimuli in both the training and the capture tasks. It would also be interesting to investigate further the effect of reward on capture; by varying the reward value in the training task it might be possible to learn more about how processing of emotional faces and reward value interact in those with higher levels of *emotional dysfunction*, and whether this differs depending on the emotional expression used. Finally, time and financial constraints meant it was not possible to assess how long the increase capture effects found lasted. It would be interesting to retest participants at several future time points to see whether the effect is maintained.

This study has demonstrated that by training individuals with varying levels of *emotional dysfunction* to attend to a fearful face it is possible to improve later processing of fearful faces. Whilst further work is necessary to fully understand the effect training can have on capture and subsequent

downstream effects on social learning and behaviour, these results provide a promising beginning to understanding how poor processing of peripheral emotional information in individuals with high levels of psychopathy might begin to be compensated for.

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Part 3: Critical Appraisal

Introduction

The aim of this Critical Appraisal is to consider and reflect upon some of the methodological and conceptual issues that were raised during the completion of the study reported in Part 2. In the first section I will reflect on some of the decisions made in regards to the design of the study, specifically, the use of a between-subjects design, using categorical rather than continuous data, and the choice of stimuli. The second section will explore the extent to which the data reported in the study fit with the two main models of psychopathy. In the final section I will discuss the utility of using a community-based sample and the implications of this for generalisation of the findings.

Methodological issues

As outlined in Part 2, several decisions were made to maximise the potential for learning to occur in the training condition, and then to assess whether this learning made a difference in capture in individuals with high levels of core psychopathic traits (i.e., *emotional dysfunction*). The first of these concerned the use of a between-subjects design over a within-subjects design. Standard experimental practice dictates that in order to prevent type 1 error, all variables bar the experimental variable should be held constant. Often, the best way to achieve this is to use the same sample across the study, as participant-based variance is assumed to be the same. By using different samples in each condition, it is inherent that some of the variance between the two conditions will be due to participant differences that are unrelated to the experimental manipulation.

One way of removing the problem of between-group variance would have been to use only one sample, with no baseline or comparison condition.

That is, to have exposed all participants to the training condition and the capture condition only. This design, however, presents other difficulties. As was also noted in Part 2, previous research has demonstrated that individuals with high levels of psychopathic traits differ from those with low levels of psychopathic traits in that they do not show attentional capture by task-irrelevant emotional faces. The aim of the study was to assess whether it is possible to increase fear-capture through training. In order for the null hypothesis to be rejected, therefore, the group differences that had previously been observed would have had to be extinguished. That is, if training were to have worked, then there would be no differences across all three groups. This is a relatively unusual experimental design in that it would be difficult to say conclusively whether the lack of group differences observed was due to successful training, or, because in fact there were no differences in capture between groups, regardless of the training (i.e., that the original result of group differences had failed to replicate in this sample). Because of this difficulty it made good sense to include a group that was not exposed to training so that their performance could be compared to those who had received training.

The nature of the research question meant that using a between-subjects design was necessary to be able to obtain potentially meaningful results. As stated above, ideally, across all conditions, only the experimental variable would be manipulated in order to reduce variance that is not accounted for by the manipulation. However, the nature of attentional capture paradigms make the use of the same participants in both groups somewhat problematic. Attentional capture is a phenomenon that can be best understood if thought about in terms of what the function of attention is

proposed to be. At any one time we are bombarded by pieces of information in the environment that are competing for processing. Attention can be thought of as being the process in which information is prioritised and selected for further processing. This involves directing the limited processing capacity, either consciously or unconsciously, of our information processing system, the brain, towards specific pieces of information in order to encode them more thoroughly than their competitors (Allport, 1980; Corbetta & Schulman, 2002; Desimone & Duncan, 1995; James, 1898; Lavie, 1995; Posner & Rothbart, 2007; Treisman & Galade, 1980; Treisman & Gormican, 1988). This process of selective attention is not always under explicit, conscious control and there are many situations in which we are distracted by something that is not relevant to our current task (Broadbent & Broadbent, 1987; Remington & Johnston, 1992; Theeuwes, 1992; Yantis & Jonides, 1984).

Although attentional capture by task-irrelevant information may be disruptive, it can be beneficial in the wider scheme of our lives. If one imagines oneself working at a computer and seeing something moving out of the corner of our eye, it is likely that we will be distracted and will orient towards that stimulus. If the task-irrelevant object turns out to be a harmless fly, we may then be able to redirect our attention back the task at hand. However, if the task-irrelevant object is a large, angry-looking wasp, we may temporarily abandon our task to take some preventative action. Previous research has demonstrated that it is possible to capture salient stimuli through repeated exposure (Kelley & Yantis, 2009). If we consider the proposed nature and purpose of attentional capture, that is, to redirect attention to some stimulus that may be of use to approach or avoid, then it makes sense that

once a salient, task-irrelevant stimulus has been attended to, processed, and deemed of no current interest, capture to that stimulus should be reduced. It is on this premise that it was decided that, in the current study, it would not make sense to expose one sample of participants to two sessions of the capture task in relatively quick succession. If the training was successful, meaning that greater capture of fear was achieved through the pairing of fearful faces with a reward, this effect may well have been diluted through the habituation to repeated exposure to salient stimuli that is known to occur. Although no research currently exists to say that it is possible to habituate to emotional faces (and there is good argument for emotional faces being a 'special case' as they are rich sources of information concerning threat and benefits in the environment; see Öhman, Flykt & Esteves, 2001), the decision not to confound any potential capture effects with potential habituation was made, meaning that two different samples were used.

The second major decision regarding the design and analysis of the experiment came when choosing to group the data into *emotional dysfunction* categories, rather than to treat it as a continuous variable. Whilst the *Self-Report Psychopathy Scale-III Short Form* (*SRP- III- SF*; Paulhus, Hemphill & Hare, in press) does give continuous, rather than categorical data, there is no evidence to suggest that the relationship between training, attentional capture of fearful faces and em*otional dysfunction* scores is actually linear. It was thought that in order to protect against this potentially complicating issue, it made more sense to group participants into three groups, rather than run the risk of producing findings that were difficult to interpret in a meaningful manner.

Initially, the data were analysed as a continuous variables, which would be typical in personality research. However, it soon became apparent that due to the relatively complex nature of the design, using a correlational design made answering the research question difficult. Thinking of the data continuously made it much harder to say whether there had been an effect of training on capture by *emotional dysfunction* scores, as it was not a case of saying whether those with higher levels of *emotional dysfunction* were different from those with lower levels. The nature of regression analysis means that the results can only be interpreted in terms of how much one variable changes when other variables change, and as there were three main variables (training condition; *emotional dysfunction* score; singleton condition), interpreting a three-way interaction so that the results were meaningful, was difficult. In reference to the research question (does training individuals with varying levels *emotional dysfunction* to pay attention to fearful faces increase capture by a distractor fearful face in a subsequent experiment) a categorical analysis of the data provided much more readily interpretable results. The main disadvantage of using categorical groups rather than using continuous data is the loss of statistical power. However, as the study did find an increase in capture by fearful faces across all of the groups, this was less of a concern.

The final methodological issue to consider is the one of stimuli choice. The faces used in the training task were the same identities of those used in the capture task. It could be said that by using the same stimuli, the differences in capture between the untrained group and the trained group are not due to the conditioning of emotional content of the face, but rather the perceptual components of the individual faces. In order to assess whether it is the emotional content of the face that is affecting performance in the trained

group on the capture task, it would be necessary to use different fearful faces in the training task to the capture task. The decision to use the same faces in both tasks was twofold. First, as has been said previously, no studies to date have investigated whether training of emotional faces is able to modify capture by these faces, regardless of individual differences in psychopathic traits. Because of this, it seemed prudent to maximise the potential for learning across the two experiments; if different faces had been used and no effect had been found, it would not be possible to investigate the additional effects of emotional dysfunction.

The second basis for the decision to use the same stimuli in both experiments was that as the faces chosen were taken from a well-established battery of emotional faces (the MacBrain Face Stimulus Set; Tottenham et al., 2009). Relatively few such batteries are currently in existence. The MacBrain Faces Set is made up of over 50 faces, but these are divided into different ethnicities. Again, in order to minimise the number of variables, it was decided to use only Caucasian identities in the experiment, as there is a body of research suggesting that people's recognition and processing of different ethnicities is dependent on many things (e.g., the cross-race effect, see Josephson & Holmes, 2008; Levine, 2000). Because of this, the number of faces available for use was reduced greatly. If time and funding for the project had not been an issue, the natural next step in this research would have been to create and validate a larger battery of emotional faces that could then have been used to assess the degree to which the effect could be said to be due to the carry-over of emotional content, rather than perceptual features alone.

Findings in relation to current models of psychopathy

There are two current influential models of psychopathy. The first, the Emotional Dysfunction account (e.g., Blair, 2003, Blair, Mitchell & Blair, 2005; Kiehl, 2006) suggests that psychopathy can be best understood in terms of an emotion-processing deficit that occurs due to dysfunctional amaygdala activity. The second model, the Response Modulation Hypothesis (Newman, 1998) posits that the emotional processing deficits in psychopathy can be accounted for by poor attentional processing of peripheral emotional information, that is, emotional information that is not concerned with current goal-directed processing. Interestingly, these models lead to different predictions in terms of the potential effects of training for those with higher levels of psychopathic traits. If psychopathy is due to poorer processing of emotional stimuli, then training individuals to correctly identify fearful faces (which one might assume involves fuller processing of their emotional content), might be expected to result in their greater capture when these faces are then not relevant in the next task. However, if psychopathy is due to poor processing of peripheral stimuli, then there should be no improvement in the capture task as the emotional face is still not the focus of the task.

As described above, it is possible that the results of the study can be attributed to the perceptual differences in the faces, rather than the emotional content per se, which means that better processing of the faces as indexed by greater capture in the capture task might not be due to the emotional content. However, even if this were the case, if the Response Modulation hypothesis were correct, one would still not expect to see any improvement in task-irrelevant capture at all. The results of this study are in no way conclusive,

because of the many issues raised earlier; however it appears that they may provide some tentative evidence in favour of an emotion processing account, over an attention based one.

The utility of using a community-based sample

This study was originally conceived to test training effects on capture with children with conduct problems and high vs. low levels of callous-unemotional traits (which are thought to be analogous to psychopathic traits in adults). If one assumes that poorer processing of emotional faces may lead to poorer social learning and potentially antisocial behaviour, it makes sense that teaching young children to accurately process emotional faces may be the first stage to reducing later antisocial behaviours. However, due to anticipated difficulties with recruiting a suitable sample that was large enough to test the hypothesis that training improves capture, it was decided that it would be better to recruit a non-clinical, adult sample. This was beneficial in that it allowed the study to be properly piloted before recruiting a difficult to recruit population, but there are some significant drawbacks in terms of generalizability of the results. Whilst there is much evidence to suggest that psychopathy is a trait that can be conceptualised as being continuous rather than discrete, there are likely to be real differences between those individuals who have high levels of psychopathic traits in the community, and those who make up populations in clinical and forensic settings. Indeed, it is those who have come to the attention of services that are most in need of interventions for antisocial behaviour, and understanding this group's level of emotional processing may well be key to developing those interventions.

It is also important to note that there are likely to be differences between children and adults with high levels of callous-unemotional/ psychopathic traits. Psychopathy is a developmental disorder, and the development that occurs across the life span cannot be ignored. It is not possible to know without testing whether children are better able than adults to learn to process emotional faces, and whether this has effects on their ability to learn from social cues, and, more importantly, whether this would then impact on behaviour. Additionally, it is an open question as to whether these effects do vary with developmental stage (e.g., do younger children learn better than adolescents?).

Future research would need to consider carefully what type of reward would be effective for use with children (and adults with high levels of psychopathic traits), as it is likely that virtual monetary reward may not be a sufficient motivator for engaging in the training process. Furthermore, it would be of interest to assess whether the effects of increased capture last beyond the capture task, and whether any behavioural changes are found at a later time. One would imagine that, as with any psychological intervention, in order for effects to be maintained, the training should take place over a number of sessions, and that any behaviour changes would need to be monitored and rated by adults close to the child.

Conclusions

The issues discussed here address some central methodological issues encountered when conducting this study. Several key decisions concerning the design and analysis of the study were made; whilst some these had some negative aspects, the positive aspects meant that the study

was more focused and the results consequently clearer to interpret. The findings suggest that it could be helpful to train individuals with high levels of psychopathic traits to orient to fearful faces. Furthermore, the study provides some potentially exciting avenues for further research into the development of strategies to help compensate for poor emotional processing, which may in turn lead to an improvement in antisocial behaviour.

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Appendices

Appendix 1: Checklist for Assessing the Quality of Quantitative Studies

	Criteria	Yes (2)	Partial (1)	No (0)	N/A
1	Is the question/ objective sufficiently described?				
2	Study design evident and appropriate?				
3	Method of subject/ comparison group or source of information/ input variables apparent and appropriate?				
4	Subject (and comparison group, if applicable) characteristics sufficiently described?				
5	If interventional and random allocation was possible, was it described?				
6	If interventional and blinding of investigators was possible, was it reported?				
7	If interventional and blinding of participants was possible, was it reported?				
8	Outcome (and, if applicable) exposure measures well defined and robust to measurement/ misclassification bias? Means of assessment reported?				
9	Sample size appropriate?				
10	Analytic methods described and appropriate?				
11	Some estimate of variance is reported for the main result?				
12	Controlled for confounding?				
13	Results reported in sufficient detail?				
14	Conclusions supported by the results?				

Appendix 2: Ethical Approval

UCL RESEARCH ETHICS COMMITTEE

Amendment Approval Request Form

1	**Project ID Number:** 1444/002	**Name and Address of Principal Investigator:** Prof. Essi Viding, Clinical, Educational & Hlth Psychology Div of Psychology & Language Sciences, Room BW 434 26 Bedford Way London WC1E 7HB
2	**Project Title:** Improving Attention to Task-Irrelevant Emotional Faces in Individuals with Callous-Unemotional Traits: A Role for Emotion Recognition Training?	
3	**Type of Amendment/s (tick as appropriate)** ☐ Research procedure/protocol (including research instruments) ☐ Participant group ☐ Sponsorship/collaborators ☒ Extension to approval needed (extensions are given for one year) ☐ Information Sheet/s ☐ Consent form/s ☐ Other recruitment documents ☐ Principal researcher/medical supervisor* ☒ Other * *Additions to the research team other than the principal researcher, student supervisor and medical supervisor do not need to be submitted as amendments but a complete list should be available upon request.	
4	**Justification** (give the reasons why the amendment/s are needed) This research has been delayed due to the fact that Sara Hodsoll has been completing Clinical training on a part time basis. Because of this we estimate that the project will run from between August, 2014 to February, 2015, and as such request a one year extension to the project that has previously been approved. Additionally, it has come to our attention that the previous amendment we made we forgot to alter the title of the project to better reflect the participants recruited. We would like to do this in this application (the above title recorded in section '2' is correct).	
5	**Details of Amendments** (provide full details of each amendment requested, state where the changes have been made and attach all amended and new documentation) As outlined above, we request that the Ethics for this project be granted a year's extension as due to a change in Sara Hodsoll's working hours, the project has yet to begin. Additionally, we overlooked the fact that the title of the project needs to be updated, which we would like to do now.	
6	**Ethical Considerations** (insert details of any ethical issues raised by the proposed amendment/s) There are no changes to the project that need to be considered by the committee.	
7	**Other Information** (provide any other information which you believe should be taken into account during ethical review of the proposed changes) N/A	

Declaration (to be signed by the Principal Researcher)

- I confirm that the information in this form is accurate to the best of my knowledge and I take full responsibility for it.
- I consider that it would be reasonable for the proposed amendments to be implemented.
- For student projects I confirm that my supervisor has approved my proposed modifications.

Signature:

Date: 22.08.2014

FOR OFFICE USE ONLY:

Amendments to the proposed protocol have been ..Approved.. by the Research Ethics Committee.

Signature of the REC Chair, Professor John Foreman:  ....

Date: 26/8/2014.

Appendix 3: Information Sheet and Consent Form

INFORMATION FOR PARTICIPANTS

The aim of the study

The aim of the study is to investigate factors that might affect how well we can pay attention to tasks that we are doing – in particular, factors that might make us more or less easily distracted.

Why is the study being done?

Some individuals seem to find focusing on the task at hand more difficult than others, and as you may know, this can make some every day tasks difficult. We are trying to find out more about the factors that affect the extent to which people are able to focus. In particular, we are keen to find out whether people's personality traits are related to how well they are able to concentrate. Some people find it harder to figure out some of the social signals around them, such as other people's emotions. We are interested in finding out whether it is possible to train people so that they find this task a bit easier. We hope that our findings will eventually help in developing ways of improving focus and understanding social cues.

What will happen if I take part?

There are two parts to the study. If you agree to take part in the study then you will first be asked to complete the questionnaires in this booklet. They should not take more than about 10 minutes to fill out. Please complete them as honestly as possible, as your responses will be kept anonymous.

The second part of the study is a series of computer-based tasks that will assess how well you're able to concentrate and what sorts of things might cause you to be distracted. These should take no longer than half an hour to complete. The computer-based tasks will begin as soon as you are ready after completing the questionnaires.

Are there any risks of discomfort?

We do not anticipate any risks to the individuals taking part in this study, and The UCL Research Ethics committee has approved this study (114/002).

What are the potential benefits?

We hope that our findings will eventually help in developing ways of improving concentration and sensitivity to social signals, for example by helping individuals who find perceiving emotional information difficult to improve. However, any research has to be thorough before practical recommendations are made. This is likely to mean that there is no immediate benefit for you, but we hope that your help will be beneficial to other people in the future.

Do I have to take part in this study?

It is up to you whether or not you take part in this study. If you do decide to take part, then please sign the consent form below. If you decide now, or at a later date, that you do not wish to participate in this research you are free to withdraw, without giving a reason. We want to make sure that everyone is happy when taking part in our project.

Will information about my performance be available to anyone?

All information collected from you during the course of this research will be kept strictly confidential. It is important for you to know that we are interested in the average performance of all the people that take part, not the performance of any one individual. All research reports we will produce contain information about average performance of several people in any of our tasks.

Who will have access to the research records?

Only members of our research team will be able to look at the information we collect. The use of some types of personal information is safeguarded by the Data Protection Act of 1998 (DPA). The DPA places an obligation on those who record or use personal information, but also gives rights to people about whom information is held.

How to contact the researcher

Sara Hodsoll ([redacted])

We are happy to talk through any questions with you. Thank you for taking time to read this information.

Consent Form – to be detached from questionnaires

Please ensure that you have taken the time to read the information sheet, and have asked any questions that you would like.

I have read the information sheet and have had the opportunity to ask any questions about the study.

I understand that I am free to withdraw any time without giving a reason.

I understand that by continuing on to the questionnaires I am giving my consent to take part in the questionnaires, and in the computer-based tasks that follow.

Participant's Name:

Participant's Signature:

Date:

(Researcher)

Appendix 4: SRP III – SF (Paulhus, Hemphill & Hare, (in press)

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