UNDERSTANDING THE COGNITIVE DIFFERENCES IN PSYCHOPATHY: EMOTIONAL DISTRACTION ACROSS PSYCHOPATHIC TRAITS

BY

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Abstract

Emotional stimuli naturally draw our attention. In emotional distraction paradigms, such stimuli can interrupt performance on a simple cognitive task. There are, however, individual differences in the extent to which emotional distractors impact performance. Previous research has found that highly psychopathic people perform better than others in these tasks, indicating that they are less distracted by emotional stimuli. We tested two separate accounts of the cognitive differences in psychopathy. Emotional processing accounts believe the deficit is specific to processing of aversive stimuli. Conversely, the Attention deficit accounts suggest the deficit is rather ineffective processing of peripheral information. To tease these hypotheses apart we investigated emotional distraction using positive and negative peripheral distractors. Negative distraction but not positive distraction should be reduced if emotional processing accounts are correct; all types of distraction should be reduced for Attention-deficit accounts.

The current study employs an emotional distraction paradigm that includes peripheral task-irrelevant distractors that vary in valence and arousal. We measured trait psychopathy using the Psychopathic Personality Inventory in a university sample and grouped participants into low, intermediate, or high Fearless Dominance groups. Participants (N = 83) were instructed to ignore distracting images (positive, negative, or neutral) in the periphery while completing a simple perceptual task at fixation. Participants low in Fearless Dominance showed greater distraction by emotional stimuli than neutral stimuli. In contrast, those high in Fearless Dominance showed no greater distraction by emotional than neutral stimuli. The findings suggest there is no fear-specific deficit in psychopathy, instead, we see an overall decrease in emotional distraction for those high in Fearless Dominance. This finding also supports attention-deficit accounts, however, distraction by neutral stimuli was not associated with Fearless Dominance indicating the reduced distraction is specific to emotional stimuli.

Preface

In March 2020, we designed an ERP study that investigated emotional attention in psychopathy. Due to the six-week lockdown and social distancing measures in place for months after, we could no longer complete an ERP investigation in the year. So, we pivoted from running the paradigm for the ERP investigation to running the same paradigm online without the neurophysiological measures. This study was our lab's first attempt at running the emotional distraction paradigm online. Typically, attention experiments are run in a lab-controlled environment with well-calibrated monitors and chin rests that allow for precise control of visual angle and control of fixation. Although the current study is investigating cognitive differences in psychopathy, we also trialled whether our lab's emotional distraction paradigm can be run online. For the experiment to be successful in an online environment, we needed to test whether we could replicate the pattern of results that we see in the lab. Indeed, we found the same pattern of emotional distraction overall as we do in our lab-based studies showing that the emotional distraction paradigm can be run online.

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Table of Contents

Abstract i

Preface ii

Acknowledgements iii

List of Tables vi

List of Figures vii

Emotional Distraction Across Psychopathic Traits 1

What is Psychopathy? 2

Cognitive Differences in Psychopathy: Emotion Processing 3

Cognitive Differences in Psychopathy: Attention Deficit 7

Emotional Distraction in Psychopathic Traits 10

The Current Study 13

Method 19

Preregistration 19

Participants 19

Materials 20

Questionnaires 20

Emotional Distraction Paradigm 22

Picture Stimuli 24

Procedure 25

Statistical Analysis 26

Design 26

Results 27

Response time assumption checks 27

Response times 27

Distraction indices 30

Accuracy 35

Exploratory dimensional analyses 37

Trait anxiety analyses 42

Discussion 45

Models of the Cognitive Profile of Psychopathy 45

Attentional Mechanisms in Psychopathy 50

Early selection mechanism 50

Top-down mechanism. 51

Selection history mechanism. 52

Factors of Psychopathy 53

Anxiety and Psychopathy 55
Limitations 56
Future Directions 58
Conclusion 59
References 60
Appendix A 75
Appendix B 77

List of Tables

Table 1.Gender Distribution of Participants Across Fearless Dominance Groups 20

Table 2.Means (SD) of valence and arousal split by gender for each of the distractor valence image sets 25

Table 3.Means and Standard Deviations for RT (in ms) in Distractor-Present and Distractor-Absent Trials Across Each Valence Condition and Distraction Indices [RT present-RT absent] Across Valence Conditions... 28

Table 4. Means and standard deviations for DI for each Valence condition across the three groups of Fearless Dominance 31

Table 5. Means and standard deviations for accuracy as a function of a 3(Valence) X 3(Fearless Dominance) design. 37

Table 6. Hierarchical Regression Results Using DI as the Criterion. 38

Table 7.Linear Mixed Effect Model Results Using DI as the Criterion................................. 40

Table 8.Zero-order Correlations with confidence intervals between DI, PPI-R factors and trait anxiety measures.. 43

Table 9.Linear regression results using DI as the criterion 45

List of Figures

Figure 1.Diagram of a single distractor present trial.. 23

Figure 2.Response times for each valence block (Negative, Neutral and Positive) split by Distractor Presence. Error bars represent 95% confidence intervals. 29

Figure 3.Distraction Index [RT present – RT absent] for each valence (Negative, Neutral and Positive). Error bars represent confidence intervals. 32

Figure 4. Distraction Index [RT present – RT absent] for each Fearless Dominance group split by valence of the distractor (Negative, Neutral and Positive). Error bars represent confidence intervals 33

Figure 5.Distraction Index [RT present – RT absent] versus Fearless Dominance scores split by valence of the distractor (Negative, Neutral and Positive).. 41

Emotional Distraction Across Psychopathic Traits

Visual scenes are packed with information. Our visual field is consequently faced with more information than our brains can process. We therefore need to prioritise some stimuli over others for further processing. Emotional stimuli are an example of prioritised stimuli, as they signal important environmental and social cues (for reviews, see Carretié, 2014; Okon-Singer et al., 2013; Pourtois et al., 2013; Yiend, 2010). Because these stimuli are salient in a visual scene, they are also very distracting – but not to the same degree for everyone.

Psychopathy is one such dimension that affects how people attend to emotional stimuli. People who are highly psychopathic are less likely to attend to emotional stimuli (Mitchell et al., 2006). Normally, people are distracted by threatening stimuli as they could pose a threat to our survival. For example, while watching a horror film, the monster lurking in the background will draw our attention away from the focus of the scene. A highly psychopathic individual though would not be distracted by these threatening stimuli to the same degree. Psychopathy is associated with reduced attention to emotional stimuli, especially threat-related stimuli (Patrick, 1994). It is not understood, however, where or how these differences arise in the processing of these emotional stimuli.

Psychopathy is a well-known concept used in forensic psychology; however, it remains an enigma from a neuropsychological perspective. Cleckley (1988) was the first to scientifically describe the phenomenon of *psychopathy* in his work, The Mask of Sanity. He described a highly psychopathic individual as someone who showed no observable dysfunction on the surface, masking their lack of empathy and guilt. Based on Cleckley's description, psychopathy is characterised by a collection of traits such as superficial charm and lack of remorse. People in incarcerated samples who score high in psychopathy are more likely to commit violent crime and more likely to recommit crimes than other inmates (Douglas et al., 2018; Heilbrun, 1979). As there are social costs associated with psychopathy, there is an interest to develop treatments for these people. But to develop a treatment, we must first understand the cognitive profile of psychopathy. A variety of cognitive differences exist in how highly psychopathic individuals process information compared to non-psychopathic individuals (Blair, 2013). These differences are particularly notable in how they process emotional stimuli.

We are automatically drawn to emotional stimuli as they signal important information, but these stimuli can also work against current goals as they are not relevant for completing a task. Emotional distraction tasks measure attention to these emotional stimuli by the disruption they cause to task performance. But those high in psychopathy do not prioritise emotional stimuli to the same degree as others so we would expect them to be better able to ignore these types of distractors. The current study investigates how emotional distraction varies across psychopathic traits. We wish to understand the atypical processing of information associated with psychopathic traits to better understand the mechanisms that give rise to the phenomena of psychopathy. Particularly, what differences exist in the processing of emotional stimuli for highly psychopathic people that allow them to be less distracted by these stimuli?

What is Psychopathy?

Psychopathy is a personality construct that contains a constellation of traits which can be measured dimensionally. Though there are many traits that are associated with psychopathy, the construct can be characterised by at least two major factors. Affective-Interpersonal traits capture the callousness and lack of affect in psychopathy, whereas Impulsive-Antisocial traits capture antisocial aspects and disinhibition associated with psychopathy (Fowles & Dindo, 2006). These two factors were identified in a factor analysis of the Psychopathy Checklist-Revised (PCL-R; Hare, 1991), a clinical tool used to measure psychopathy in forensic populations. Equivalent factor structures have been found in self-report measures of psychopathy as well (Bresin et al., 2014). There is evidence that these two factors have distinct etiological pathways and so arise through different mechanisms (Neumann et al., 2012; Seara-Cardoso & Viding, 2015).

Most research in psychopathy has investigated the cognitive differences between highly psychopathic individuals and controls (people who do not rate highly in psychopathy) in prison samples, as differences are most apparent at the extreme ratings of psychopathy. But evidence suggests that psychopathy is a dimensional construct rather than taxonic and is normally distributed throughout the population (Edens et al., 2006; Guay et al., 2007). Only recently, has research turned to community samples to investigate cognitive differences associated with psychopathic traits (Dindo & Fowles, 2011; Heritage & Benning, 2012; Kimonis et al., 2019; Maes & Brazil, 2015). Investigating, psychopathy in community samples enables us to examine how trait severity affects cognitive ability and allows us to investigate which factors are associated with specific cognitive differences.

Behaviourally, psychopathy is typified by impulsivity and callousness. Highly psychopathic people show have a wide range of maladaptive behaviours such as substance use problems (Hemphill et al., 1994), reduced affective empathy (Ali et al., 2009; Blair, 2007), antisocial behaviour (Iselin et al., 2008) and reduced fear response (Patrick et al., 1993). Altogether the behaviours associated with psychopathy are diverse and show a variety of outcomes, though most differences observed are related to their emotional response.

There is still debate over the core cognitive differences in psychopathy. Two prominent groups of theories exist: one group suggests that the differences are due to deficits in emotional processing, while the other suggests that there are differences in attention.

Cognitive Differences in Psychopathy: Emotion Processing

Emotional processing accounts[1] of psychopathy suggest that psychopathy is associated with difficulties in experiencing and learning associations with emotional stimuli.

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[1] Emotional processing accounts is a term used here to refer to an array of theories that, at their core, share an explanation for the cognitive differences in psychopathy based on deficits in affective processing.

These theories are based on an amygdala dysfunction tied to psychopathy. The amygdala is an important hub in the brain for processing and learning associations with emotional stimuli (Dalgleish, 2004). So, it seems logical that if highly psychopathic people have amygdala dysfunction then there would be deficits in how they process emotional stimuli. Neurologically, there is evidence of abnormal structure and function in the amygdala of highly psychopathic individuals (Blair, 2008; Boccardi et al., 2011; Moul et al., 2012; Yang et al., 2009). Based on this dysfunction, Lykken (1995) proposes the Low-fear hypothesis, which suggests that people who are highly psychopathic are less sensitive to punishment especially in the face of reward. Other emotion processing accounts of psychopathy suggest that the deficit is based on the processing of affective stimuli but not specific to fear, rather all emotional processing (Blair, 2008; Kiehl & Hoffman, 2011). All the emotion processing accounts suggest that the core deficit of psychopathy is a reduced sensitivity to emotional stimuli that underlies psychopathy. There are three main sources of evidence for these theories.

First, highly psychopathic people do not learn implicit cues to avoid punishment. For instance, Lykken (1957) had highly psychopathic individuals and controls learn a sequence of four lever responses to complete a task while avoiding punishment. Participants responded by pulling one out of four levers in each stage of the sequence. The explicit goal of the experiment was to correctly remember the sequence of levers to pull that led to the completion of the task. If participants made an incorrect response, there was a chance that participants would be punished as one of the three remaining levers would elicit an electric shock (while the remaining two did not). Participants therefore had an implicit goal of remembering which levers at each stage of the sequence gave an electric shock. Highly psychopathic individuals were significantly more likely to pull the lever which delivered the punishment. The highly psychopathic individuals did not prioritise learning which levers were punishing to the same degree as controls, suggesting they are less sensitive to punishment cues when pursuing a goal.

Second, highly psychopathic individuals show decreased aversive conditioning (Birbaumer et al., 2005; Flor et al., 2002; López et al., 2013; Rothemund et al., 2012). In aversive conditioning paradigms, an aversive stimulus (for example, foul odour or painful pressure) is paired with a neutral stimulus. After being paired with the aversive stimulus, the conditioned stimulus elicits an aversive response, for example, an increase in skin conductance response compared to a stimulus not paired with an aversive stimulus. Highly psychopathic individuals, however, failed to show differences in their skin conductance responses between conditioned and unconditioned stimuli. Findings from this research therefore showed little to no conditioning with aversive stimuli suggesting a deficit in fear learning.

Finally, reductions in emotional modulation of the startle response to threat stimuli are found for highly psychopathic compared to non-psychopathic participants (Patrick et al., 1993). Startle reflexes are automatic responses to physical threats such as a puff of air to the eye and can be measured by, for example, the magnitude of an eyeblink. Normally, the startle reflex magnitude is potentiated in the presence of threatening or unpleasant stimuli and attenuated in the presence of pleasant stimuli. In highly psychopathic groups, pleasant stimuli still attenuate the startle response. Their response to unpleasant stimuli, however, are not potentiated to the same degree as in the non-psychopathic group. People high in psychopathy show a decreased startle response in the presence of threat indicating a dampened fear response compared to controls.

The evidence presented for the emotion processing accounts suggest that the affective response to threat in highly psychopathic individuals for threat stimuli is reduced. Responses, whether physiological or behavioural, are not inhibited by punishment cues and aversive stimuli to the same degree in highly psychopathic individuals as compared to others. These emotional processing differences may add up overtime such that emotional stimuli that should elicit a response, (e.g. a sad expression) are not prioritized for processing. Over time poor processing of emotional stimuli may lead to the wider array of deficits associated with psychopathy, such as the observed reduced empathic response (Ali et al., 2009; R. Blair, 2007; Brook & Kosson, 2013). Emotional processing differences might also explain why highly psychopathic individuals are not distracted by emotional stimuli; the emotional stimuli are not effectively conditioned to be prioritised.

The emotion processing accounts, however, struggle to explain how highly psychopathic individuals outperform non-psychopathic individuals in some tasks that contain no emotional stimuli. For example, Hiatt and colleagues (2004) found that there are differences in highly psychopathic individuals' performance on the Box Stroop tasks compared to controls. Similar to the traditional Stroop task, the Box Stroop task requires participants to ignore conflicting information (the word ‘red’) and respond by naming the physical colour. The Box Stroop task differs from the traditional Stroop task in that the colour participants respond with is the colour of a box outlining the word rather than the colour of the word itself. The Box Stroop task therefore spatially separates the stimuli participants respond to from the conflicting information participants are tasked with ignoring. Highly psychopathic individuals perform similarly to controls in the traditional Stroop task but outperform controls on the Box Stroop task. Emotion processing accounts of psychopathy have difficulty explaining the differences observed here as there are no threatening or rewarding stimuli in this paradigm. Instead, people high in psychopathy show a reduced processing of non-goal-relevant information.

Additionally, emotion processing accounts have difficulty explaining highly psychopathic people’s normal fear response when the aversive stimuli are attended. The reduced fear potentiated startle response and decreased aversive conditioning are used as evidence by the emotion processing accounts to show that highly psychopathic individuals lack a normal fear response. But these effects were found to be modulated by attention (Baskin-Sommers et al., 2011; Newman et al., 2010). For example, the fear potentiated startle response deficit in highly psychopathic individuals was only found when the threat information was in the periphery and not when the threat was the focus of the task. The findings show that attention deployment modulates the fear deficit found in psychopathy. If the threat information is attended, the differences between highly psychopathic and non-psychopathic groups disappear. The fear deficit of psychopathy only occurs when the threat stimuli are not related to the goal.

Cognitive Differences in Psychopathy: Attention Deficit

Modern theories on the psychopathic deficit propose cognitive differences in psychopathy are attention-based rather than emotional processing-based. The Response Modulation Hypothesis (Newman et al., 1997; Patterson & Newman, 1993) and Impaired Integration framework (Hamilton et al., 2015) both propose that the core deficit of psychopathy is attention-based. The Response Modulation Hypothesis suggests the core deficit is disinhibition by punishment in the pursuit of reward. In other words, when a goal is set, highly psychopathic people will have difficulty changing their goal even when punished for that behaviour. The Impaired Integration framework suggests the etiology of psychopathy is deficient connectivity between cortical regions; due to a lack of integration between brain regions, there is a deficit in perceptual integration. Peripheral information is not processed effectively and therefore does not interfere with goal-relevant processing. Though the Impaired Integration framework lacks specificity in which regions are deficiently integrated, the framework lays the groundwork for a neuropsychological explanation of attention-deficit accounts[2] of psychopathy.

Both attention-deficit accounts of psychopathy propose a similar mechanism, the “attention bottleneck” (Baskin-Sommers et al., 2011; Newman & Baskin-Sommers, 2011). The attention bottleneck distinguishes two types of information: primary information, that is related to a goal, and secondary information which is anything not related to the goal. The attention bottleneck proposes that, due to a lack of attentional resources, secondary information is not as effectively processed in highly psychopathic individuals as it is in non-psychopathic individuals. People high in psychopathy prioritise primary information while forgoing secondary information more than non-psychopathic individuals. In sum, the

[2] Attention-deficit accounts is a term used here to describe both the Impaired Integration framework and Response Modulation Hypothesis which share an explanation for the cognitive profile of psychopathy based on deficits in information processing.

attention bottleneck proposes that non-goal-relevant information is ineffectively processed in psychopathy.

Attention-deficit accounts of psychopathy can explain previous evidence for the emotion processing account. Attention has been shown to modulate both fear potentiated startle and aversive conditioning (Baskin-Sommers et al., 2011; Newman & Kosson, 1986). The reduced ability to learn punishment cues (as measured by increased passive avoidance errors) associated with psychopathy have been shown to be modulated by attention as well (Newman et al., 1985). The attention-deficit accounts can therefore adequately explain the findings used as evidence for emotion processing accounts. Moreover, the attention-deficit accounts can explain the differences observed in emotion processing when the emotional stimuli are attended. Namely, that for diminished emotional response to be observed, the emotional stimuli must not be the focus of the task. Emotion processing accounts struggle to explain the normal emotional response when participants are attending to the emotional stimuli. The attention-deficit accounts, therefore, better explain emotion processing differences observed in psychopathy.

Attention-deficit accounts are also broader in the range of deficits that they can explain compared to emotion processing accounts. Deficits in attention in psychopathy are also found in contexts where no emotional stimuli are used (Baskin-Sommers et al., 2011; Hiatt et al., 2004; Wolf et al., 2012; Zeier et al., 2009). For example, in an attentional blink paradigm, participants are required to identify a white letter in a rapid serial visual presentation of other black letters (80ms each). Participants then respond to whether an ‘X’ had appeared in the stream after the white letter; this second target is presented on half of trials. When the lag between the white letter and ‘X’ is short (between 160 and 800ms), accuracy in responding to the presence of the ‘X’ decreases. The decreased accuracy is thought to be due to processing of the white target letter otherwise known as the attentional blink. Highly psychopathic individuals show an attenuated attentional blink compared to non-psychopathic individuals (Wolf et al., 2012). The authors justify the finding as evidence of superior selective attention associated with psychopathy.[3] As there are no affective stimuli present in this experiment only the attention-deficit can adequately explain the effect.

A meta-analysis of attention-based paradigms investigating differences associated with psychopathy found partial support for the Response Modulation Hypothesis (Smith & Lilienfeld, 2015). Across 94 different samples, the effect size was small to medium. Differences were observed for neutral as well as affective tasks in highly psychopathic groups compared to controls. A publication bias, however, was identified, including unpublished works lowers the effect size and weakens the support for the Response Modulation Hypothesis. Previous research, therefore, supports the Response Modulation Hypothesis but the differences between highly psychopathic and non-psychopathic groups in attention-related tasks are small.

A problem with attention-deficit accounts is that they do not account for the reward sensitivity associated with psychopathy that shows attention to rewarding stimuli. Gray's motivational theory proposes two behavioural systems: Approach and Inhibition. Psychopathy can be considered as involving a weak behavioural inhibition system. This weak inhibition system can be used to explain their reward-seeking behaviour. Highly psychopathic individuals are motivated by rewarding and pleasant stimuli even when they are non-goal-relevant stimuli. Attention-deficit accounts make the claim that there are no differences in emotional processing in psychopathy, instead differences observed are due to deficient processing of non-goal-relevant stimuli. But people high in psychopathy show a normal response to pleasant stimuli (Blair et al., 2004; Budhani et al., 2006; Eisenbarth et al., 2013; Patrick et al., 1993). For example, the startle response observed in highly psychopathic individuals show no differences in attenuation of their startle response when primed with a pleasant stimulus compared to non-psychopathic individuals. Attention-deficit accounts would predict that highly psychopathic individuals would not show any attenuation

[3] Note that although we name this group of theories attention-deficit accounts, the 'deficits' can lead to improved performance in tasks such as these. The deficit proposed is a lack of sensitivity towards peripheral information.

as the pleasant stimuli are outside their goal-oriented focus. Another example of differences in response based on valence is a study by Eisenbarth and colleagues (Eisenbarth et al., 2013), using EEG methods, finding decreased reactivity to only negative (but not to positive) emotional facial expressions. Both examples show no differences in response to pleasant stimuli, only unpleasant. The evidence suggests a bias towards specifically rewarding stimuli. As there is an observed decreased response to negative stimuli but not to positive stimuli.

Altogether, the research suggests that neither emotion processing nor attention-deficit accounts of psychopathy are entirely able to explain the cognitive differences associated with psychopathy. As there are a multitude of differences observed between highly psychopathic individuals and non-psychopathic individuals there is reason to believe that there is not a single mechanism (see Lilienfeld et al., 2016) that underlies the construct. Additionally, attention and emotion are not independent systems. They influence one another and play a role in each other’s processing. So, the goal for understanding cognitive differences in psychopathy should not be to define it as one deficit or another but rather to understand where differences exist and understand the cognitive processes that underlie those differences.

Emotional Distraction in Psychopathic Traits

Emotional distractors are salient in a visual scene, so they are also very distracting. Some situations, however, require that you filter out these emotional distractors and focus on a goal. For example, while driving, a roadside billboard of food will distract you from concentrating on the road. Emotional distraction tasks test participants’ ability to ignore highly salient distractors. Psychopathy is associated with a reduction in emotional distraction. For example, Mitchell and colleagues (2006) employed a simple distraction task that masked a shape (either square or circle) with a distractor image that could either be emotionally salient, or neutral. Participants responded to whether a circle or square was presented, and response times were recorded. Controls showed lower accuracy and slower response times when trials were masked by emotional images compared to neutral images. Highly psychopathic individuals did not show this effect, they were not more distracted by emotional compared to neutral image trials. Mitchell and colleagues (2006) investigated emotional distraction in a prison sample that compared highly psychopathic individuals against non-psychopathic individuals so did not investigate the effect associated with the separate factors of psychopathy. As the compared highly psychopathic individuals against controls they also did not investigate the dimensional nature of psychopathy.

Dimensional studies of psychopathy allow researchers to investigate if psychopathy is associated with emotional distraction in the general population and also allows for investigation of factors that are related to the reduced emotional distraction observed in psychopathy. In non-incarcerated samples, psychopathic traits are also shown to be associated with emotional distraction (Ahmed et al., 2018; Hodsoll et al., 2014; Kimonis et al., 2019; Maes & Brazil, 2015; Yoon & Knight, 2015).

Maes and Brazil (2015) examined the effects of emotional distraction in psychopathy in a university sample using a dimensional approach to measure the effect of separate factors within psychopathy on emotional distraction. The task presented participants with a number and letter to the right of fixation. Participants made a decision based on whether a vowel and even number were presented together or not. On every trial, distractor was presented to the left of fixation, it was either highly arousing (gore) or not arousing (buildings). Affective-Interpersonal traits were associated with emotional distraction but the direction of the effect was modulated by Impulsive-Antisocial traits. Affective-interpersonal traits were negatively correlated with greater distraction by emotional distractors only when scores of Impulsive-Antisocial traits were low. Conversely, when Impulsive-Antisocial traits were high, Affective-Interpersonal traits were positively correlated with greater distraction by emotional distraction. Extending Mitchell and colleague's (2006) findings to the general population, the study provides more support that emotional distraction is associated with psychopathy. Additionally, Maes and Brazil (2015) found that specific dimensions of psychopathy drive this effect. No significant effect of overall psychopathy scores were found on emotional distraction– only the interaction between the two factors was associated with reduced emotional distraction. The improved performance in emotional distraction tasks may then be best captured by the interaction of high levels of Affective-Interpersonal traits and low levels of Impulsive-Antisocial traits.

Two studies have investigated the effect of another type of emotional distraction, attentional capture by emotional expressions, with psychopathic traits (Ahmed et al., 2018; Hodsoll et al., 2014). Participants were presented three faces and had to respond to the orientation of a target face. Distractor faces (the two non-target faces) expressed either neutral, happy, fearful, or angry expressions. Response times were measured to examine the distracting effect of emotional facial expressions. Both studies' results showed a negative relation between Affective-Interpersonal traits and emotional distraction. Hodsoll and colleagues (2014) investigated the relationship of attention capture by emotional faces in children finding those with high Affective-Interpersonal-like[4] traits showed an overall decrease in emotional distraction. In an adult sample, Ahmed and colleagues (2018) found that there was a negative relationship between Affective-Interpersonal traits and emotional distraction for only fearful expressions. Additionally, Ahmed and colleagues (2018) found that the negative relationship between Affective-Interpersonal and emotional distraction only holds when Impulsive-Antisocial traits are low. The results are consistent with those found by Maes and Brazil (2015) where the negative relationship of emotional distraction and psychopathy was only found for people low in Impulsive-Antisocial traits.

Kimonis and colleagues (2019) employed an Emotion-Induced Blindness (EIB) paradigm to investigate how psychopathy was associated with emotion processing. In task, participants view a stream of rapidly presented images and respond by indicating the orientation (left or right) of a rotated image (target image). On some trials, emotionally salient images are presented a few images before the target in the stream. On these trials,

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[4] Hodsol and colleagues measured callous and unemotional traits in children using the Inventory of Callous-Unemotional Traits (Frick et al., 2003). Callous-Unemotional traits are one component of the constellation of affective-interpersonal traits (Cooke & Michie, 1997; J. L. Skeem & Cauffman, 2003).

participants' accuracy normally decreases as they are thought to be processing the emotional stimuli and not have the resources to process the rotation of the target image. This is known as emotion-induced blindness (EIB). They found less EIB in those with greater Affective-Interpersonal-like[5] traits only when scores of Impulsive-Antisocial-like traits were high. When Impulsive-Antisocial-like traits were low, greater EIB was found for those with greater Affective-Interpersonal-like traits. These results corroborate the association between psychopathic traits and emotional distraction but show the opposite interaction effect to previous studies, in that the relationship between Affective-Interpersonal and emotional distraction is only observed in those *high* in Impulsive-Antisocial traits.

As shown by the previous research, people high in specifically Affective-Interpersonal traits of psychopathy are less distracted by emotional stimuli compared to those low in the same traits. There is however mixed evidence for the moderating effect of Impulsive-Antisocial traits in the relationship between Affective-Interpersonal and emotional distraction. The specific combination of psychopathic traits that are related to emotional distraction are therefore not clearly defined. Previous literature in emotional attention differences associated with psychopathy has laid the groundwork for further research into the cognitive differences within psychopathy.

The Current Study

Previous research has investigated psychopathic traits that are most involved with decreased distraction to emotional stimuli (i.e. interaction between Affective-Interpersonal traits and Impulsive-Antisocial traits) and has employed a variety of emotional distraction tasks to understand the mechanisms by which the decreased emotional distraction effect exists in psychopathy. The current study seeks to extend the research in this area by addressing some shortcomings of the previous paradigms.

[5] Kimonis and colleagues employed the Triarchic Psychopathy Measure which conceptualises psychopathy into Meanness, Boldness and Disinhibition. Boldness is similar conceptually to Affective-Interpersonal and Disinhibition is similar to Impulsive-Antisocial (Hall et al., 2014).

The current study uses a task based on a paradigm originally created by Forster and Lavie (2008b) to investigate the effect of irrelevant distractors on performance. Participants are tasked with responding to which target letter (‘K’ or ‘N’) is presented on a trial at fixation. A distractor image is presented in a peripheral location on 25% of trials. Response time is measured, and distraction is indexed by response time differences between distractor-absent and distractor-present trials. The paradigm was adapted by Grimshaw et al (2018) to study the effect of emotional distractors. Emotional distractors (both positive and negative distractor images) cause more distraction that neutral distractors.

One shortcoming of previous paradigms used to study emotional distraction in psychopathy is that their distractors are not truly task irrelevant. Previous paradigms investigating emotional distraction in psychopathic traits have included a distractor that shares features with the target. For example, Mitchell and colleagues (2006) and Kimonis and colleagues (2019) used paradigms which separated distractor and target stimuli temporally, but the distractor and target share the same spatial location. Ahmed and colleagues (2018) and Hodsoll and colleagues flanker tasks do not use truly task-irrelevant distractors. Though distractors are presented peripherally, and the target is presented centrally (i.e., location is not shared), the identity of the target and distractor are both faces. They therefore share features that may account for their ability to capture attention.

Irrelevant distractors are a unique feature of the current study’s paradigm. As the distractor images share no feature or location with the target letter, they are truly task irrelevant. In other words, disruption to performance during trials in which distractors are present is due to attention capture by bottom-up feature selection. From a theoretical point of view, the attention bottleneck mechanism proposes that non-goal-relevant information is ineffectively processed but no previous study investigating emotional distraction across psychopathic traits has employed a paradigm that separates goal-relevant and non-goal-relevant information. The current study’s paradigm does distinguish between goal-relevant and non-goal-relevant information well. In the current study, participants’ goal is to respond to the simple perceptual task at fixation. The distractors are presented in the periphery and share no features with the target. We can test the effect of distraction by non-goal-relevant information with the current paradigm to test the attention bottleneck mechanism proposed by attention-deficit accounts.

Another shortcoming of previous paradigms is that distractors appear on every trial. A design that includes distractors on every trial compares emotional distractor trials to neutral distractor trials. So, neutral trials are used as the baseline measure. Unfortunately, we cannot then infer the distraction caused by neutral trials themselves. Neutral distractors still cause some distraction, their salience is driven by physical features rather than emotional content. The neutral distractors do not cause a great deal of distraction, though there are a variety of manipulations that can modulate it (Grimshaw et al., 2018, Walsh et al. 2021). The current study can measure distraction by neutral distractors because the baseline is provided by the distractor absent trials. We can therefore compare distractor present trials against distractor-absent trials to measure distraction for each distractor valence separately. Proponents of the attention-deficit accounts would suggest that all types of distraction should be reduced, not just emotional distraction. If an attention bottleneck exists in psychopathy, we would then expect that as psychopathic traits increase, distraction by neutral distractors should be reduced.

Another benefit of including infrequent distractor trials is that it, paradoxically, increases the amount of distraction. When distractors are presented frequently, we devote more resources to suppressing them as we can predict those attentional resources will be spent effectively. The Dual Mechanisms of Control Framework (DMC; Braver, 2012) can be used to understand how we employ cognitive control strategies to prevent distraction. The DMC describes two strategies by which we try to control our attention. Reactive control is the default strategy which corrects for deviations from goal-directed cognition when conflict is detected. Proactive control, on the other hand, employs continuous control of goal-directed cognition. As proactive control requires continuous goal-oriented cognition, it is more resource intensive. There are many factors that promote proactive control. One factor is the frequency of conflict arising (Grimshaw et al., 2018). In a distraction paradigm, conflict is caused by the presence of the distractor. All previously mentioned studies on emotional attention associated with psychopathy employed paradigms that had a distractor on every trial. Therefore, proactive control is promoted in these types of paradigms. Unlike previous research investigating emotional distraction in association with psychopathic traits, the current study uses a rare distractor. As the frequency of the distractor is relatively low (25%), the study's paradigm is thought to not promote proactive control to the same degree as previous studies (Braver, 2012). Therefore, the effect of feature-driven, bottom-up distraction is greater. We can compare the results of the current studies feature-driven distraction to previous studies to investigate if differences in top-down or bottom-up control differ across psychopathic traits.

A final notable feature of the current paradigm is that it uses both positively and negatively valenced stimuli that are matched in levels of arousal. The distractor images can be either gore (negative distractor), a non-emotional image (neutral distractor) or erotic images (positive distractor). Emotional distractors are highly salient so should cause a greater amount of distraction compared to neutral trials. Both positive and negative stimuli are equally motivating when matched on arousal and biological relevance (e.g. Most et al., 2007; Vogt et al., 2009). Mitchell and colleagues (2006) investigated the effect of positive distraction but found no effect, however, positive stimuli were rated as less arousing compared to negative stimuli in their study. It is possible that if more arousing pleasant images were used by Mitchell and colleagues, then distraction by positive images could occur. There are however motivational differences between negative and positive distractors. Pleasant stimuli differ from unpleasant stimuli in that they are inherently rewarding, whereas unpleasant stimuli are aversive. As pleasant stimuli are inherently rewarding, they may still be distracting regardless of psychopathic traits. Moreover, there is some evidence that suggests psychopathy is associated with increased reward sensitivity (Fowles, 1988; Levenston et al., 2000; Newman et al., 2005). It is possible then that valence of the distractor will affect distraction across psychopathic traits.

We can distinguish between theories of psychopathy using distractors split by valence. An attention-deficit perspective would suggest that due to the attention bottleneck, all peripheral information, regardless of valence, should not be processed effectively. If positive distractors, and not negative distractors, affect performance over neutral non-emotional distractors then the attention-deficit hypothesis is cast into doubt. Differential distraction based on valence means that people are attending to the positive stimuli, which has been presented outside of the primary focus of attention. The emotion processing accounts could explain such a result more easily. Negative distractors would not elicit the same emotional response in people high in trait psychopathy as they would in people low in trait psychopathy; positive distractors on the other hand would still be distracting as these stimuli are inherently rewarding to view. Previous research in our own lab using the same paradigm has found that those who rate high in Fearless Dominance (an Affective-Interpersonal trait) are not distracted by negative stimuli but are still distracted by positive stimuli. (Bryant et al. in prep). If this effect is robust, then attention-deficit accounts are cast into doubt.

In the current study, we will measure psychopathic traits using the Psychopathic Personality Inventory (PPI-R-40; Eisenbarth et al., 2015) The PPI-R is a validated measure of psychopathic traits in community samples (Salekin et al., 2001). It shows a similar factor structure to the PCL-R (Poythress et al., 1998). It has two major factors: Fearless Dominance and Self-centred Impulsivity. Fearless Dominance (equivalent to Affective-Interpersonal; Ray et al., 2009) has also been shown to be the driving factor that reduces emotional distraction within psychopathy. So, for the current study we will investigate the effect of these callous traits primarily. The interaction observed between the two major factors will also be investigated using Self -centred Impulsivity (equivalent to Impulsive-Antisocial; Ray et al., 2009).

To collect a spectrum of Fearless Dominance scores we will recruit an equal number of participants from each tercile (three quantiles). Terciles will be based on Fearless Dominance scores measured at the start of an academic semester. This design will allow us to have a large enough sample at both extremes of the Fearless Dominance spectrum. We can then categorise people into their tercile and investigate whether differences exist between groups in terms of distraction by emotional (and neutral) distractors. We can also run dimensional analyses as we have collected participants from across the spectrum of Fearless Dominance scores. Scores in Self-centred impulsivity will also be collected so that we can investigate the interaction between these two factors.

We will also measure anxiety ratings to account for alternative explanations of the results. Anxiety is another dimension that can be related to emotional distraction (Krug & Carter, 2012; Verkuil et al., 2009). There is a proposed low-anxious component associated with Affective-Interpersonal factors (such as Fearless Dominance; Falkenbach et al., 2008; Hicks et al., 2004; Kimonis et al., 2008; Skeem et al., 2007; Vassileva et al., 2005), although, there is debate about whether anxiety is inversely related to psychopathy (Schmitt & Newman, 1999; Visser et al., 2012). It is therefore possible that differences in emotional distraction could be accounted for by anxiety rather than psychopathy. To account for alternative explanations of the relationship between emotional distraction and psychopathy, we included the miniature Mood and Anxiety symptoms questionnaire (Mini MASQ; Clark & Watson, 1991) and the Penn State Worry Questionnaire (PSWQ; Meyer et al., 1990).

We predict that high Fearless Dominance traits of psychopathy are associated with a decrease in emotional distraction. We expect then that distraction by emotional stimuli will be reduced in the high Fearless Dominance group relative to the low Fearless Dominance group. These effects could be valence specific, so we have separate predictions for positive distractors. We expect that, if the attention bottleneck mechanism proposed by the attention-deficit accounts holds, then people high in Fearless Dominance traits will show less distraction by positive distractors. On the other hand, if the emotion processing accounts hold then we expect that people high in Fearless Dominance traits will show more distraction by positive than neutral distractors.

We also expect that, in a dimensional analysis, there will be a negative relationship between Fearless Dominance and emotional distraction. Based on the previous research, this negative relationship may only be observed in an interaction by Self-centred Impulsivity (Ahmed et al., 2018; Kimonis et al., 2019; Maes & Brazil, 2015). We will explore the effect of Self-centred impulsivity on the relationship between Fearless Dominance and emotional distraction. If the attention-deficit account holds, we will see this pattern across emotional distractor valances. If the specific emotion processing account holds then there will only be a negative association between Fearless Dominance traits and negative distractors but not positive.

Method

Preregistration

This study was preregistered at Open Science Framework (OSF; osf.io/gu7ae) prior to data collection. This study was approved by the Victoria University of Wellington's Human Ethics Committee.

Participants

At the beginning of the academic semester all students in first-year psychology courses at Victoria University of Wellington were given the opportunity to complete the PPI-R (see materials). Those who completed the questionnaire (*N* = 580) were assigned into low, intermediate, or high trait Fearless Dominance groups based on their scores in the Fearless Dominance sub-trait of trait psychopathy. If participants' Fearless Dominance scores were equal to or less than the 33rd percentile of overall Fearless Dominance scores they were placed in the low trait psychopathy group. The intermediate group ranged from the 33rd percentile to the 66th percentile of Fearless Dominance scores. Finally, the high trait psychopathy group contained participants with Fearless Dominance scores greater than the 66th percentile. We attempted to invite an equal proportion of participants from each Fearless Dominance group.

We preregistered to run 108 participants with 36 in each Fearless Dominance group, with 18 men and women in each group but rates of participation were particularly low in our student pool in 2020. Ultimately there were 83 participants (51 women, 32 men) ranging from 18-30 years of age recruited from first-year undergraduate psychology courses who completed the online-based experiment. Participants received course credits for participation. Participants were required to have normal or corrected-to-normal vision, be fluent in English, have access to a computer with mouse and keyboard and be willing to participate in an experiment that included gory and erotic images.

We remeasured scores of trait psychopathy with the PPI-R-40 for participants again after the completion of the online-based experiment. Participants were reclassified into low, intermediate and high Fearless Dominance groups based on their remeasured scores of Fearless Dominance and these classifications were used for analysis. See Table 1. below for the number of participants in each group split by gender. We initially invited an equal proportion of each gender for each of the Fearless Dominance groups because men and women differ in their ratings of valence and arousal for the distractor images. However, by using gender-tailored images (see Table 2.), ratings of valence and arousal were equated overall.

Table 1.

Gender Distribution of Participants Across Fearless Dominance Groups

Gender	Low	Intermediate	High
Women	18	23	10
Men	10	15	7
Total	28	38	17

Materials

Questionnaires

The Psychopathic Personality Inventory (PPI-R-40; Eisenbarth et al., 2015) was administered to students in first-year undergraduate psychology at the beginning of the academic semester as part of an online mass-testing questionnaire to determine the cut-offs for each tercile, and to select participants to invite to the online emotional distraction experiment. The PPI-R-40 was readministered to the 83 participants immediately after completing the online experiment. The inventory consists of 40 items on which participants responded on a four-point Likert scale (1= False, 2= Mostly false, 3= Mostly true, 4= True) to statements with which they may or may not agree with. An example item is “I have always seen myself as something of a rebel.” The PPI-R-40 consists of 8 subscales measuring common psychopathic personality traits. The 8 primary subscales group into three major factors: Fearless Dominance, Self-centred Impulsivity and Cold-heartedness. Fearless Dominance factor was the sum of scores on the Social Influence, Fearlessness, and Stress Immunity subscales. This factor was used to group participants into low, intermediate, and high Fearless Dominance groups. The Self-centred Impulsivity factor included the Machiavellian Egocentricity, Rebellious Nonconformity, Blame Externalization, and Carefree Non-planfulness subscales. The Cold-heartedness factor consists of a single subscale: Cold-Heartedness, this factor was not used in the analysis as it has shown no effect on distraction by emotional stimuli. In the online mass testing questionnaire, we excluded students from participation if they showed an inconsistent pattern of responding on the PPI-R-40 using the PPI-R-40 inconsistent responding scale (Kelley et al., 2016). No participants showed inconsistent responding after they completed the PPI-R-40 again after the online emotional distraction experiment so we did not exclude anyone from analysis on the basis of inconsistent responding.

We also investigated anxiety to account for alternative explanations of the findings. To measure anxiety, we administered two self-report questionnaires. The first is the Penn State Worry Questionnaire (PSWQ; Meyer et al., 1990). The PSWQ is a 16-item questionnaire used to assess trait worry and is used to differentiate general anxiety disorder (GAD) from other anxiety disorders. It asks participants to rate how well each item describes their own thoughts and behaviours on a five-point Likert scale (1= Not typical of me at all, 5= Very typical of me). An example item (reverse-scored) for the PSWQ is “If I do not have enough time to do everything, I do not worry about it.” The second questionnaire we used to measure anxiety is the Mini Mood and Anxiety Symptoms Questionnaire (Mini MASQ; Clark & Watson, 1991). The Mini MASQ is a 26-item questionnaire that is adapted from the 90-item MASQ questionnaire. This questionnaire measures anxiety and depression based on the Tripartite model of depression. It contains three factors: Anxious Arousal, General Distress and Anhedonic Depression. Anxious Arousal measures participants' physiological symptoms of anxiety. We were interested in how the Anxious Arousal factor relates to emotional distraction as it is specifically related to anxiety rather than depression. Participants responded on a five-point Likert scale (1= not at all, 2= a little bit, 3= moderately, 4= quite a bit, 5= extremely) to indicate how much they felt certain sensations during the past week. An example item of this questionnaire is “Was short of breath.” Total scores for the PSWQ and factor scores for each of the three factors of the Mini MASQ were used to compare ratings of anxiety across Fearless Dominance groups.

Emotional Distraction Paradigm

The emotional distraction paradigm is adapted from Forster and Lavie (2008b). In this paradigm, participants are asked to ignore distracting images that are displayed peripherally to a central task display. The experiment was programmed using PsychoPy (Ferwerda, 2018) and was completed online, hosted on Pavlovia (Pavlovia). Figure 1. shows a trial diagram of a peripheral emotional distractor paradigm.

Figure 1.

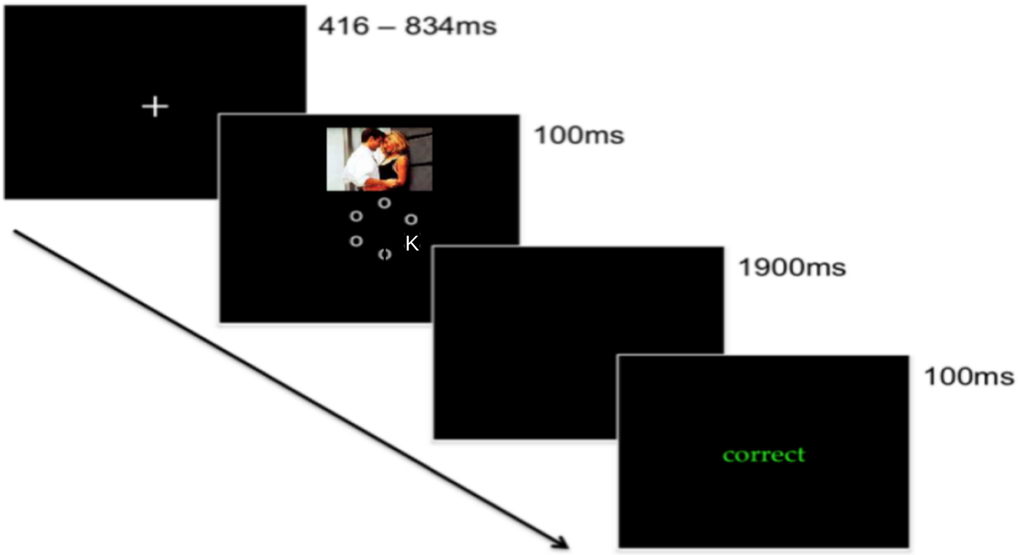

Figure 1. shows a diagram of a single distractor present trial. Diagram is not to scale.

At the beginning of each trial, a jittered fixation cross was displayed in the centre of the screen. The timing was jittered (416-834ms) so that participants could not predict the onset of the central display. On every trial, participants were tasked with deciding whether a target letter was displayed. The target letter (‘K’ or ‘N’) was one of six letters (font: Arial, subtending 0.92° of visual angle) that were displayed in a hexagonal formation in the centre of the participant’s screen. The other five letters were the letter ‘O’ capitalised making it easy to discriminate between target and non-target letters (Forster & Lavie, 2008a). The target letter was presented randomly in one of the 6 locations. The letters in the hexagonal formation were all presented at 1.75° eccentricity from the fixation in the centre of the display. Participants indicated whether a ‘K’ or ‘N’ was presented by pressing either the ‘1’ or ‘2’ key (the corresponding keys were counterbalanced across participants). A peripheral task-irrelevant image was presented for 100ms on 25% of trials. The images were displayed such that the nearest edge of the image was 3.34° either above or below the centre of the display. Image position varied randomly across trials. Participants’ response window began at the onset of the central display and continued for 2000ms. After participants responded, a screen presented feedback (100ms). The feedback screen either showed the word ‘correct’ in green or ‘incorrect’ in red based on participant’s performance. If participants did not make a response within the time window, then the answer was scored as incorrect.

Trials were blocked so that there was only one valence (negative, neutral, or positive) of distractor images in each block. Each block contained 48 trials, 12 of which had an image present (distractor-present trial). Between each block, participants had a self-paced break with a minimum of five seconds. They were then able to continue to the next block once they pressed the ‘1’ key to do so. A countdown of five seconds was displayed to the participants so that they could prepare themselves for the block to begin. Participants completed six blocks of the emotional distraction paradigm. The order of the first three blocks were counterbalanced (i.e. ABC, BCA, CAB, CBA, BAC, ACB) and then this order was repeated for the next three blocks.

Picture Stimuli

Altogether, the experiment contained 65 unique images that were used as the distractor images during the emotional distraction paradigm (see Appendix A for list of all images numbers and their ratings of arousal and valence for men and women). Images were taken from the International Affective Picture System (IAPS; Lang et al., 2008). All images occupied 6.68° by 6.68° of the visual field and were presented in colour against a grey background. We also matched the images’ luminance and contrast using Matlab SHINE toolbox (Willenbockel et al., 2010), so that only their content differed across valence conditions.

Each valence group (negative, neutral, and positive) contained 12 images and there were separate image sets for female and male participants (with some overlap). Negative images were of mutilations and positive images were of erotic heterosexual couples. Images that contained people but were not arousing were used for the neutral image set. Images that showed people not social distancing were not included for the neutral image set due to concerns that those scenes would be associated with negative emotions due to the COVID-

19 pandemic. Image ratings were obtained through the nine-point Self-assessment Manikin rating scale reported by Lang and colleagues (2008). Negative and positive image sets were chosen to be both highly arousing but differ in their valence. The neutral image set was chosen to be rated low in arousal overall and to be rated near the midpoint for valence ratings. See Table 2 for the mean valence and arousal ratings for both the female and male stimuli image sets split by the valence of the distractor.

Table 2.

Means (SD) of valence and arousal split by gender for each of the distractor valence image sets

	Valence Mean (SD)		Arousal Mean (SD)	
	Female	Male	Female	Male
Neutral	4.97(.28)	4.97(.28)	3.16(.40)	3.16(.40)
Negative	1.64(.21)	1.83(.18)	6.53(.42)	6.43(.41)
Positive	6.23(.52)	7.09(.36)	6.31(.29)	6.39(.51)

Note. Valence and arousal scores range from 1 – 9, 1 represents low arousal and negative valence and 9 represents high arousal and positive valence.

Procedure

Participants were able to access the study online and completed the experiment on their own laptop or computer. The experiment began by displaying instructions for the participant. The instructions asked participants to first place a credit card to the display and resize a red square on screen with their arrow keys to match the size of the credit card. The size of the red square allowed us to calculate visual angle on any display so that images and central display were the same size regardless of participant's screen resolution or size. The instructions then asked participants to complete the experiment in a space where they would be free from distraction by others and their phone and that they should keep an arm's length away from the display while completing the experiment. Instructions were then given for the emotional distraction paradigm. Participants were instructed to focus on the central task while ignoring distractors. An example of a trial was shown, and participants were given twelve practice trials to get used to the task. Practice trials included a distractor image of a scrambled version of a neutral image on 25% of trials. After completion of the practice trials, participants continued onto the emotional distraction paradigm. Once participants had completed the experiment, they completed a battery of questionnaires. The PPI-R was administered to retest scores of trait psychopathy. We administered the PPI-R again to make sure trait psychopathy groups differed in their scores of Fearless Dominance. The Mini-MASQ as well as the PSWQ were also administered to measure anxiety ratings. Altogether, the experiment took around 30 minutes to complete. Participants were debriefed and credited for their participation after they completed the task.

Statistical Analysis

We excluded trials on the emotional distraction task with a response time less than 200ms as their response occurred too quickly to be anything other than an anticipatory response. Participants were excluded if their accuracy was below 70% for any one valence condition or if it was below 75% overall as indicated in the preregistration. Three participants were excluded on this basis. The dependent variables were accuracy of participants' response to the task, their response time in milliseconds and distraction index measured in milliseconds. Response times were calculated for each participant by averaging correct trials for each valence condition for distractor-present and distractor-absent trials. Accuracy was measured as the proportion of correct trials. The response time for each trial was used to create a distraction index by subtracting response times of distractor-absent trials from distractor-present trials for each valence condition.

Design

The experiment used a mixed design. We manipulated valence of the distractor (negative, neutral, and positive) and distractor presence (present and absent) within subjects. Trait Fearless Dominance groups (low, intermediate, and high), were analysed as a between subjects factor.

Results

We preregistered our analyses on OSF (osf.io/gu7ae), all included exploratory analyses and deviations from preregistered analyses are noted as such. Resources needed to replicate these analyses are provided on OSF.

Response time assumption checks

We first examined whether our dependent variables were normally distributed and whether there was homogeneity of variance and found them to not meet these assumptions A log transformation of the mean response times and an exclusion of a single participant allowed the assumptions to be met; however, these changes did not affect the outcome of our analyses. We have therefore reported the findings with no transformation for ease of interpretation (see Appendix B for supplementary analyses). A Greenhouse-Geisser correction has been used to adjust degrees of freedom for violations of sphericity where necessary.

Response times

Table 3. shows the means and standard deviations for response times (RT) for both Distractor-Present and Distractor-Absent trials in each of the valence conditions. Figure 2. displays mean response times on Distractor Present and Distractor-Absent trials across each Valence condition.

Table 3.

Means and Standard Deviations for RT (in ms) in Distractor-Present and Distractor-Absent Trials Across Each Valence Condition and Distraction Indices [RT present-RT absent] Across Valence Conditions

Valence: Negative			
Distractor presence	*M* (*SD*)	DI (*SD*)	95% CI [LL, UL]
Absent	543 (76)	44 (69)	[526, 559]
Present	587 (106)		[563, 610]
Valence: Neutral			
Distractor presence	*M* (*SD*)	DI (*SD*)	95% CI [LL, UL]
Absent	544 (69)	19 (30)	[529, 559]
Present	563 (75)		[547, 580]
Valence: Positive			
Distractor presence	*M* (*SD*)	DI (*SD*)	95% CI [LL, UL]
Absent	543 (65)	52 (66)	[529, 558]
Present	595 (109)		[571, 619]

Note. M, DI, and *SD* represent mean, distraction indices and standard deviation, respectively. *LL* and *UL* indicate the lower and upper limits of the 95% confidence interval for the mean, respectively. The confidence interval is a plausible range of population means that could have created a sample mean (Cumming, 2014).

Figure 2.

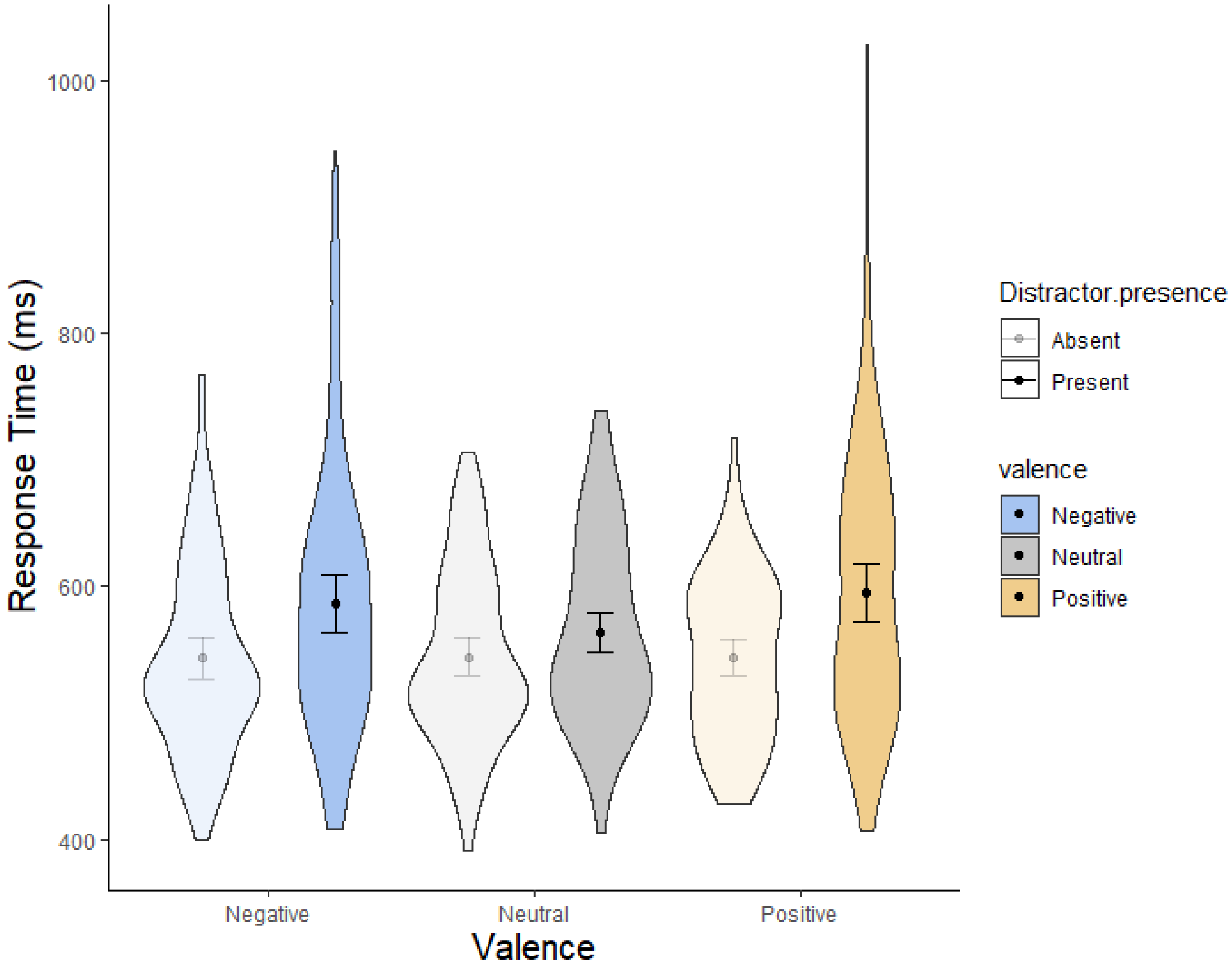

Figure 2 shows response times for each valence block (Negative, Neutral and Positive) split by Distractor Presence. Error bars represent 95% confidence intervals

We analysed mean RTs in a 2 (Distractor Presence: Present, Absent) × 3 (Valence: Negative, Neutral, Positive) × 3 (Fearless Dominance group: Low, Intermediate, High) mixed-model ANOVA. Fearless Dominance groups were included as a between-subject variable and Distractor Presence and Valence were included as within-subject variables.

The main effect of Distractor Presence (F(1, 80) = 67.44, p <.001, η_p^2 = .457) and valence (F(1.93, 154.52) = 3.12, p = .049, η_p^2 = .038) were qualified by the interaction of Valence × Distractor Presence, F(1.98, 158.54) = 8.82, p <.001, η_p^2 = .099. On Distractor-Present trials, participants responded slower when distractors were Negative (t (82) = 2.68, p = .009, d_z = 0.29) or Positive (t (82) = 3.46, p = .009, d_z = 0.38) compared to Neutral. In contrast, no differences were found in Distractor-Absent trials when comparing across valence conditions, p = .952.

As predicted, participants responded slower during Distractor-Present trials compared to Distractor-Absent trials. Participants' responses were especially slow during Distractor-Present trials that included either positive or negative distractors compared to neutral distractors. The results show a successful manipulation of emotional distraction by irrelevant peripheral distractors.

We examined the effect of Fearless Dominance and found no main effect, $F(2, 80)$ = 1.32, p = .272, η_p^2 = .032. There was, however, a three-way interaction of Distractor Presence × Valence × Fearless Dominance group, $F(3.96, 158.54)$ = 2.58, p = .040, η_p^2 = .061. To simplify the investigation of the three-way interaction, we transformed Distractor-Present and Distractor-Absent RTs into one variable, Distraction Indices (DI). DI is calculated by subtracting RT of Distractor-Present trials from Distractor-Absent trials. This transformation of our dependent variable allows us to eliminate Distractor Presence as a factor and investigate the amount of distraction caused by the distractor images.

Distraction indices

DIs for each Valence across the Fearless Dominance groups are reported in Table 4. See Figure 3. for distraction indices in each condition and Figure 4. for distraction indices in each condition across the three Fearless Dominance groups.

Table 4.

Means and standard deviations for DI for each Valence condition across the three groups of Fearless Dominance

Fearless Dominance: High (*n* = 17)		
Valence	DI *(SD)*	*M* 95% CI [LL, UL]
Negative	36 (50)	[21, 52]
Neutral	24 (31)	[14, 33]
Positive	26 (57)	[9, 43]
Fearless Dominance: Intermediate (*n* = 33)		
Valence	DI *(SD)*	*M* 95% CI [LL, UL]
Negative	30 (58)	[16, 44]
Neutral	16 (29)	[9, 23]
Positive	58 (55)	[45, 72]
Fearless Dominance: Low (*n* = 28)		
Valence	DI *(SD)*	*M* 95% CI [LL, UL]
Negative	66 (86)	[43, 89]
Neutral	19 (29)	[12, 27]
Positive	64 (79)	[43, 85]

Note. DI represents Distraction Index *[RT present – RT absent]. SD* represent standard deviation. *LL* and *UL* indicate the lower and upper limits of the 95% confidence interval for the mean, respectively. The confidence interval is a plausible range of population means that could have created a sample mean (Cumming, 2014).

Figure 3.

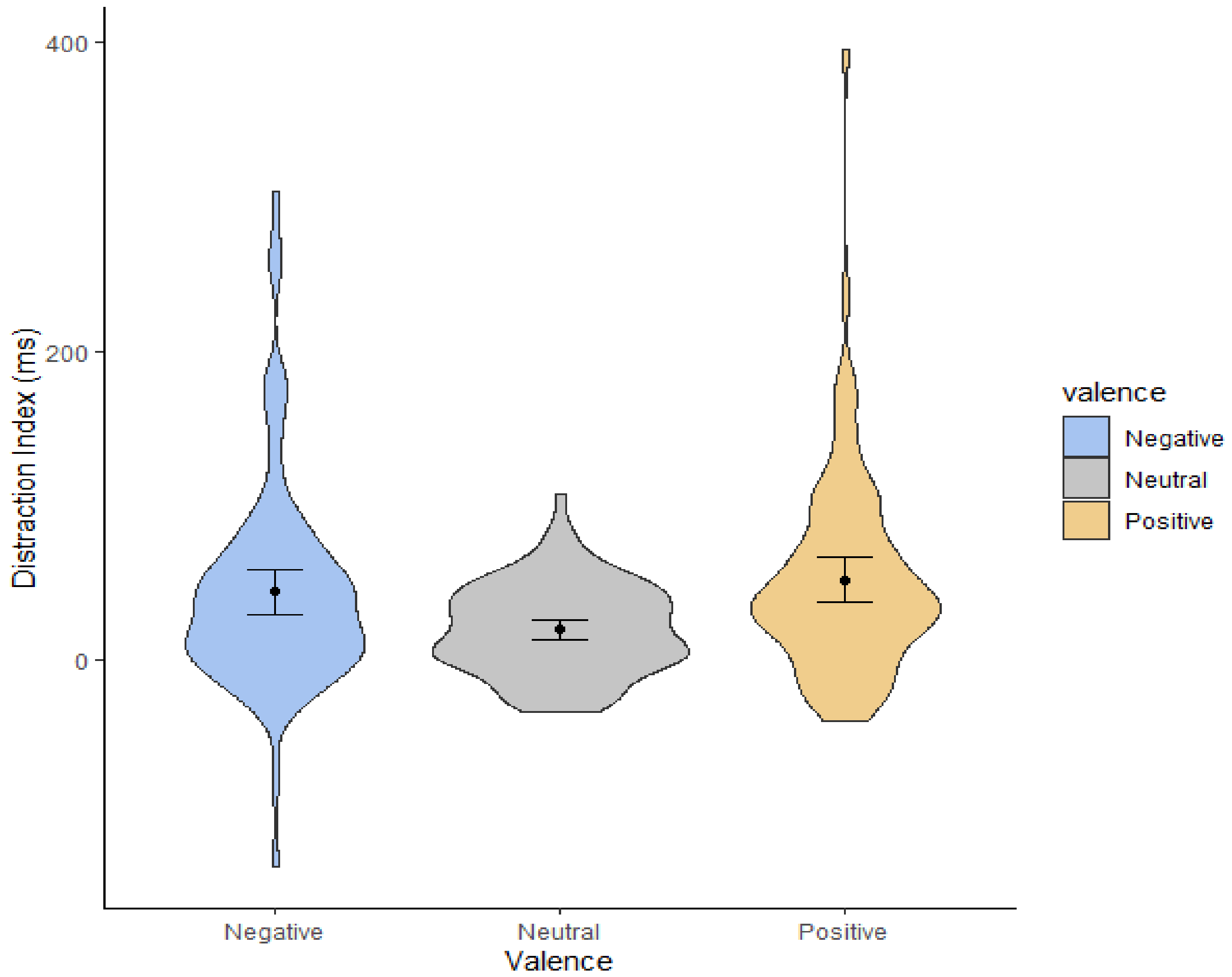

Figure 3. displays Distraction Index [RT present – RT absent] for each valence (Negative, Neutral and Positive). Error bars represent confidence intervals.

Figure 4.

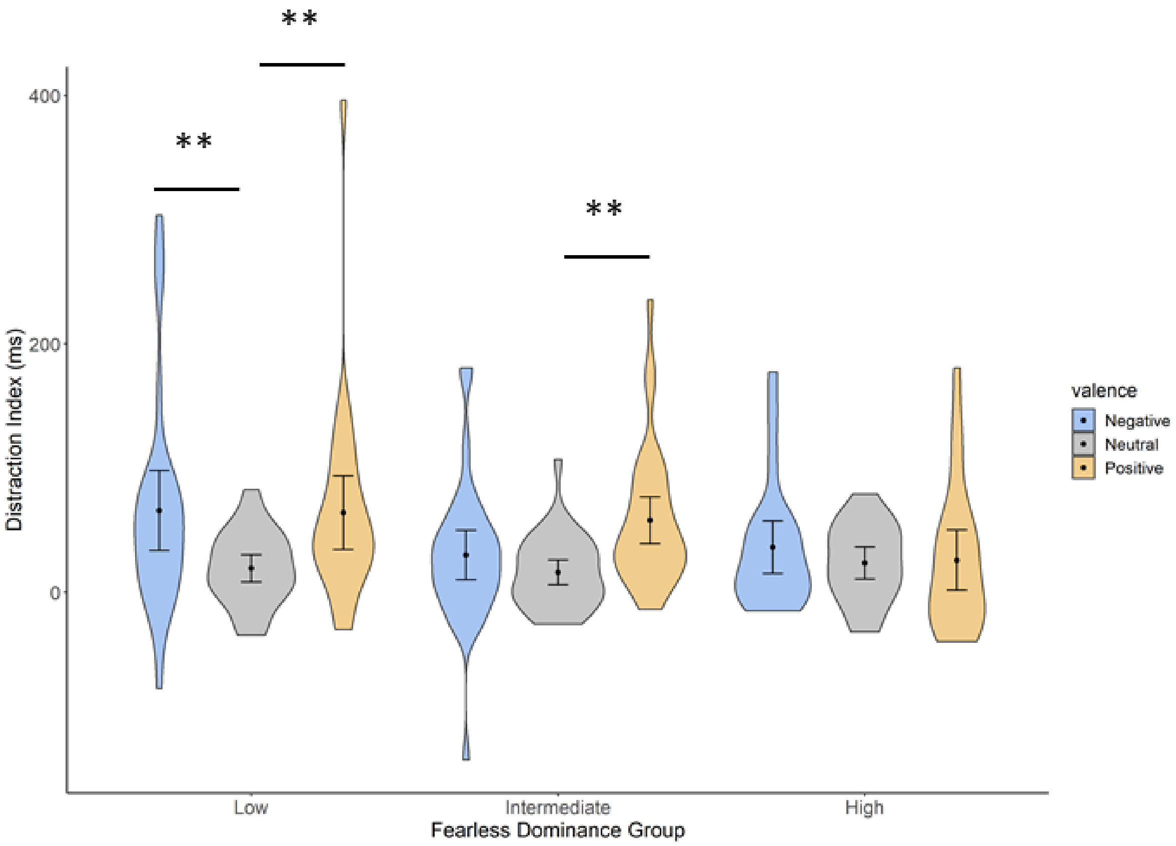

Figure 4. Displays Distraction Index [RT present – RT absent] for each Fearless Dominance group split by valence of the distractor (Negative, Neutral and Positive). Error bars represent confidence intervals
** indicates $p < .001$.

To examine whether Fearless Dominance groups differed in distraction, DI was analysed in a 3 (Fearless Dominance group: Low, Intermediate and High) × 3 (Valence: Negative, Neutral and Positive) mixed-model ANOVA. Fearless Dominance groups were entered as a between subject-factor, and Valence of distractor was entered as a within-subjects factor.

As predicted, the main effect of Valence was significant, $F(2, 160) = 10.82$, $p < .001$, $\eta_p^2 = .119$. Post hoc comparisons with a Bonferroni corrected alpha ($\alpha = .017$) were used to investigate the main effect. Comparing DI across each Valence condition showed that Negative images ($M = 43.76$, $SD = 68.53$) were more distracting than Neutral images ($M = 19.17$, $SD = 29.51$), $t(82) = 3.37$, $p = .001$, $d_z = 0.37$. Positive images ($M = 51.55$, $SD = 66.32$)

were also more distracting than Neutral ones, $t(82) = 4.31$, $p < .001$, $d_z = 0.47$. And distraction by Negative and Positive images did not differ, $t(82) = 0.99$, $p = .327$, $d_z = 0.11$. As in the results of the response time analysis, the results here show greater distraction by Negative and Positive images compared to Neutral images. There was no main effect of Fearless Dominance group, $F(2, 80) = 1.81$, $p = .170$, $\eta_p^2 = .043$. There was, however, an interaction of Valence × Fearless Dominance, $F(3.96, 158.54) = 2.58$, $p = .040$, $\eta_p^2 = .061$.

One-way ANOVAs for each Fearless Dominance group were used to investigate the interaction of Fearless Dominance and Valence. Bonferroni adjusted alpha ($\alpha = .017$) was used for post-hoc comparisons when required.

The Low Fearless Dominance group showed differences in DI across valence conditions, $F(1.96,53) = 6.63$, $p = .003$, $\eta_p^2 = .197$. Positive distractors caused greater distraction than Neutral ones, $t(27) = 3.49$, $p < .001$, $d_z = 0.63$. Negative distractors were also more distracting than Neutral ones, $t(27) = 3.63$, $p < .001$, $d_z = 0.59$. But distraction by Negative and Positive distractors were not significantly different, $t(27) = 0.14$, $p = .906$, $d_z = 0.02$.

In the Intermediate Fearless Dominance group, a one-way ANOVA for Valence conditions revealed a significant effect, $F(1.96, 62.50) = 7.64$, $p < .001$, $\eta_p^2 = .193$. Positive distractors caused greater distraction than Neutral ones, $t(32) = 3.56$, $p < .001$, $d_z = 0.67$. Negative distractors, however, were not more distracting than Neutral, $t(32) = 1.36$, $p = .182$, $d_z = 0.24$. And distraction by Positive distractors were numerically more distracting than Negative distractors but they were not significantly more distracting at our more conservative Bonferroni correct alpha, $t(32) = 2.41$, $p = .022$, $d_z = 0.42$.

In the High Fearless Dominance group, a one-way ANOVA did not show a significant effect of Valence, $F(1.93, 40.62) = 0.52$, $p = .591$, $\eta_p^2 = 0.24$. The High Fearless Dominance group therefore does not show an emotional distraction effect.

Finally, we investigated whether differences in DI existed in each valence condition across Fearless Dominance groups. Three one-way ANOVAs compared distraction for each valence across the Fearless Dominance groups. No significant effect was found for Negative

(p = .104), Neutral (p = .657) or Positive (p = .099) distractors. Distraction by each separate valence of distractor therefore did not differ between the Fearless Dominance groups. It should be noted that this analysis involves between-subject comparisons and is underpowered compared to the previous within-subjects comparison analyses.

Overall, the results show different patterns of emotional distraction between Fearless Dominance groups. The Low Fearless Dominance group shows an expected pattern of emotional distraction where Positive and Negative distractors cause similar amounts of distraction and cause more distraction than Neutral distractors. In the Intermediate Fearless Dominance group, Positive distractors were significantly more distracting compared to Neutral but Negative distractors were not. Participants in the High Fearless Dominance group, however, displayed no emotional distraction effect. Positive and Negative distractors did not cause more distraction than Neutral distractors. Neutral distraction was consistently low in all groups and in the High Fearless Dominance group there are no differences in distraction between valences, indicating that emotional distraction dropped to similar levels to Neutral distraction in this group.

Accuracy

Mean and standard deviations for accuracy in each condition are reported in Table 5. A decrease in performance by distractors in this task is measured most sensitively in RT but should cause a decrease in performance overall. It is possible though that participants were slowing their responses so that they could be more accurate. To verify that there are no speed-accuracy trade-offs in any of the Fearless Dominance groups, we investigated participants' accuracy in a 2(Distractor Presence: Present, Absent) × 3(Valence: Negative, Neutral, Positive) × 3(Fearless Dominance group: Low, Intermediate, High) mixed-model ANOVA.

A main effect of distractor presence, $F(1, 80) = 29.27$, $p < .001$, $\eta_p^2 = .268$ was found where Distractor-Present trials (M = 0.93, SD = 0.07) had lower accuracy than Distractor-Absent trials (M = 0.95, SD = 0.06). There was also a main effect of Valence, F(1.90, 152.15) = 36.17, $p < .001$, $\eta_p^2 = 0.31$. Post-hoc t-tests using a Bonferroni adjusted alpha (α = .017) showed that participants were significantly less accurate during Negative blocks (*M* = 0.93, *SD* = 0.07) compared to Neutral blocks (*M* = 0.97, *SD* = 0.06), $t(165) = 6.80$, $p < .001$, $d_z = 0.53$. Participants were also significantly less accurate during Positive blocks (*M* = 0.93, *SD* = 0.06), than during Neutral blocks, $t(165) = 6.73$, $p < .001$, $d_z = 0.52$. Participants did not differ in their accuracy during Positive and Negative blocks, $t(165) = 1.21$, $p = .226$, $d_z = 0.09$. No main effect of Fearless Dominance group was found, $F(2, 80) = .30$, $p = .742$. No interactions of Fearless Dominance × Valence ($p = .235$) or Fearless Dominance × Distractor Presence ($p =.177$) or Fearless Dominance × Valence × Distractor Presence ($p = .947$) were found either.

Both accuracy and response times show a decrease in performance during Distractor Present trials and especially Positive and Negative distractor trials. As the accuracy analyses show the same pattern of decrease in performance as the response time analyses, there is no evidence of speed-accuracy trade-offs.

Table 5.

Means and standard deviations for accuracy as a function of a 3(Valence) X 3(Fearless Dominance) design

Valence	*M*(*SD*)	95% CI [LL, UL]
Fearless Dominance: High (*n* = 17)		
Negative	0.94 (0.06)	[0.92, 0.96]
Neutral	0.97 (0.05)	[0.96, 0.99]
Positive	0.94 (0.04)	[0.93, 0.95]
Fearless Dominance: Intermediate (*n* = 33)		
Negative	0.93 (0.07)	[0.91, 0.95]
Neutral	0.96 (0.06)	[0.95, 0.98]
Positive	0.94 (0.06)	[0.92, 0.95]
Fearless Dominance: Low (*n* = 28)		
Negative	0.92 (0.08)	[0.90, 0.94]
Neutral	0.97 (0.05)	[0.96, 0.99]
Positive	0.92 (0.08)	[0.90, 0.94]

Note. M and *SD* represent mean and standard deviation, respectively. *LL* and *UL* indicate the lower and upper limits of the 95% confidence interval for the mean, respectively. The confidence interval is a plausible range of population means that could have created a sample mean (Cumming, 2014).

Exploratory dimensional analyses

We preregistered the categorical analysis above, in which participants were split into three Fearless Dominance groups (Low, Intermediate and High). Additionally, we can investigate the relationship between Fearless Dominance and emotional distraction using participants' Fearless Dominance scores. This continuous measure of Fearless Dominance allows us to investigate how emotional distraction varies across the Fearless Dominance spectrum. We can also investigate the effect of other factors, such as Self-centred Impulsivity and anxiety, on the relationship between emotional distraction and Fearless Dominance. We hypothesised that people who were higher in Fearless Dominance scores would be less distracted by emotional stimuli. We also looked at the interaction between Fearless Dominance and Self-centred Impulsivity that has been found in previous literature (Maes & Brazil, 2015; Kimonis et al. 2019). We investigated these relationships in a hierarchical regression. Table 6. presents the model for the hierarchical regression.

Table 6.

Hierarchical Regression Results Using DI as the Criterion

Predictor	*b*	95% *CI* [LL, UL]	R^2	ΔR^2
Neutral DI	0.65*	[0.16, 1.15]		
			.079*	
Neutral DI	0.62*	[0.14, 1.09]		
PPI_FD	-3.48**	[-5.91, -1.05]		
PPI_SCI	-1.20	[-3.73, 1.33]		
			.176**	.096*
Neutral DI	0.63*	[0.15, 1.10]		
PPI_FD	-1.65	[-14.14, 10.84]		
PPI_SCI	0.75	[-12.54, 14.05]		
PPI FD × PPI SCI	-0.05	[-0.41, 0.31]		
			.176**	.001

Note. *b* represents unstandardized regression weights. *LL* and *UL* indicate the lower and upper limits of a confidence interval, respectively. R^2 represents variance explained and ΔR^2 represents the increase in variance explained from the previous model.
* indicates $p < .05$. ** indicates $p < .01$.

We first entered Neutral DI as a predictor to the model so that we could examine the effect of emotional distraction (average of both Negative and Positive) that is associated with Fearless Dominance scores and Self-centred Impulsivity scores. Adding Fearless Dominance and Self-centred impulsivity significantly improved the fit of the model, $\Delta R^2 = .096$, $p = .013$. Fearless Dominance was found to significantly predict emotional distraction, $b = -3.48$, $p = .006$. As Fearless Dominance increased, participants showed less distraction by emotional distractors. Self-centred Impulsivity did not significantly associate with emotional distraction, $p = .349$. Finally, when adding the interaction term of Fearless Dominance × Self-centred Impulsivity, the model did not significantly improve the fit of the model, $p = .767$. Only Fearless Dominance was found to be associated with emotional distraction.

The hierarchical regression analysis averaged both Negative and Positive distraction into one value of emotional distraction. We wanted to further understand how DI varies in relationship to Fearless Dominance as a function of Valence. To examine the relationship between Fearless Dominance and DI for each Valence, we analysed the interaction of Valence and Fearless Dominance in a linear mixed-effects model. As we have a mixed design, a linear mixed-effects model allows us to account for the random effects of variability between participants in each valence condition. Table 7. below shows the linear mixed-effects model of Fearless Dominance and DI scores nested within each Valence. Figure 5. displays the relationship between Fearless Dominance and DI for each Valence.

Table 7.

Linear Mixed Effect Model Results Using DI as the Criterion

Predictors	*b*	95% *CI* [*LL* – *UL*]	*p*
Neutral vs Negative	156.01	[57.98 – 254.05]	**.002**
Neutral vs Positive	143.81	[45.78 – 241.84]	**.004**
Negative vs Positive	-12.20	[-110.24 – 85.83]	.807
PPI-FD vs Neutral	-0.17	[-2.27 – 1.93]	.874
PPI-FD vs Negative	-3.63	[-5.74 – -1.53]	**.001**
PPI-FD vs Positive	-3.11	[-5.21 – -1.00]	**.004**
PPI-FD × Neutral vs Negative	-3.46	[-6.02 – -0.91]	**.008**
PPI-FD × Neutral vs Positive	-2.94	[-5.49 – -0.38]	**.024**
PPI-FD × Negative vs Positive	0.53	[-2.03 – 3.08]	.686
Random effects			
σ^2	2295.10		
τ_{00}	813.15		
ICC	0.26		
N	83		
Observations	249		
Marginal R^2 / Conditional R^2	0.124 / 0.353		

Note. b represents unstandardized regression weights. *LL* and *UL* indicate the lower and upper limits of a confidence interval, respectively. Each row compares baseline against a contrast. σ^2 represent the total variance in the model and τ_{00} represents the between-subject variance in the model. The ICC represents the Intraclass Correlation Coefficient. The marginal R-squared considers only the variance of the fixed effects, while the conditional R-squared takes both the fixed and random effects into account.

Figure 5.

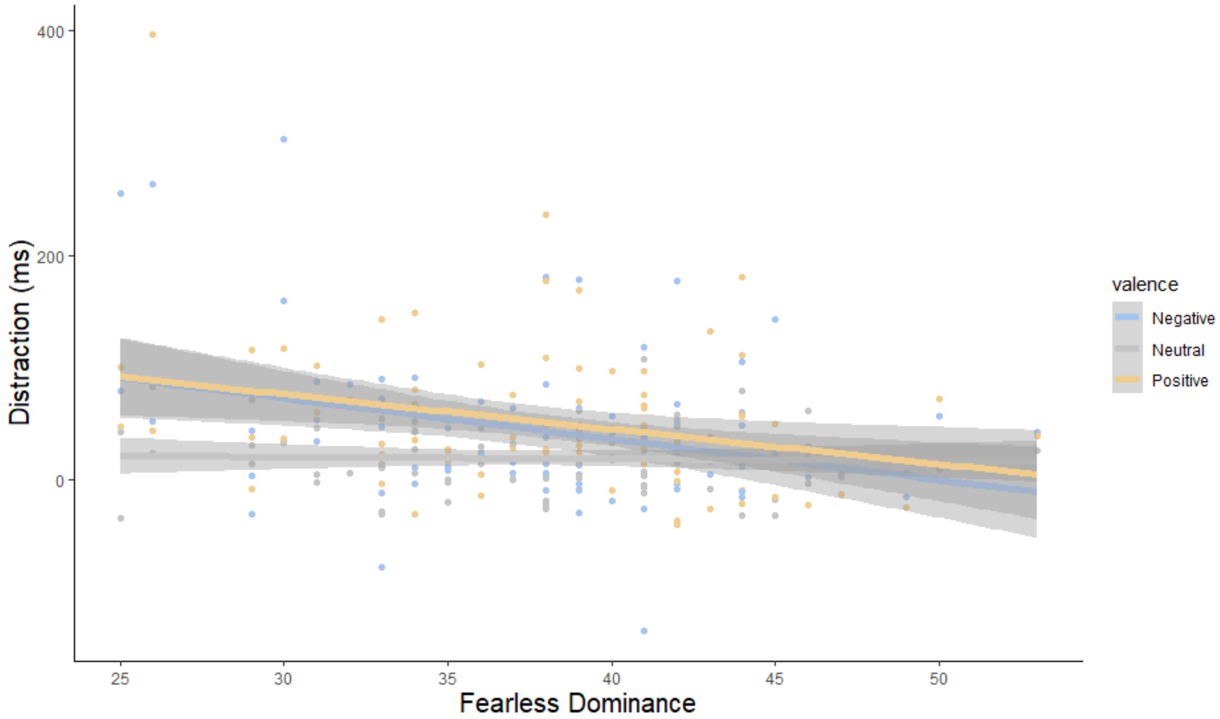

Figure 5. displays Distraction Index [RT present – RT absent] versus Fearless Dominance scores split by valence of the distractor (Negative, Neutral and Positive). Grey area for each line represents confidence intervals.

Each one unit increase in Neutral DI showed a significant increase in DI for both Negative DI (b = 156.01, p = .002) and Positive DI (b = 143.81, p = .004). Additionally, the relationship between Negative Valence and Positive Valence in DI did not significantly differ, p = .807. As Fearless Dominance scores increased DI in both the Negative Valence (b = -3.63, p = .001) and Positive Valence (b = -3.11, p = .004) decreased. There was however no relationship between Fearless Dominance scores and DI in the Neutral Valence condition, p = .874.

There was a significant interaction of Fearless Dominance and Valence. The relationship between Negative DI and Fearless Dominance was significantly different compared to the relationship of Fearless Dominance and Neutral DI, b = -3.46, p = .008. Also, the relationship between Positive DI and Fearless Dominance was significantly different compared to the relationship of Fearless Dominance and Neutral DI, b = -2.94, p =

.024. No significant differences in relationship existed between Positive DI and Fearless Dominance compared to Negative DI and Fearless Dominance, $p = .686$.

Altogether the results of the linear mixed model show that as Fearless Dominance increases, DI in both Negative and Positive valence conditions decrease. Fearless Dominance scores therefore do not show a bias for distraction by either Positive or Negative Valence. For Neutral valence, Fearless Dominance does not show a significant relationship with DI.

Trait anxiety analyses

To account for the possibility that anxiety offers an alternative explanation of the results, we measured trait anxiety using the Penn State Worry Questionnaire (PSWQ) and the Miniature Mood and Anxiety Symptoms Questionnaire (Mini-MASQ). Table 8 shows the zero-order correlation between DI, Psychopathic Personality Inventory (PPI-R) subfactors and our measures of anxiety.

Table 8.

Zero-order Correlations with confidence intervals between DI, PPI-R factors, and trait anxiety measures

Variable	1	2	3	4	5	6
1. DI						
2. PPI-FD	-.30** [-.49, -.09]					
3. PPI-SCI	-.12 [-.33, .09]	.04 [-.17, .26]				
4. MMQ-AA	-.01 [-.22, .21]	.07 [-.15, .28]	.26* [.04, .45]			
5. MMQ-AD	.15 [-.07, .35]	-.30** [-.49, -.09]	.31** [.10, .49]	.23* [.01, .42]		
6. MMQ-GD	.03 [-.19, .24]	-.34** [-.52, -.13]	.31** [.11, .50]	.61** [.45, .73]	.52** [.35, .67]	
7. PSWQ	.26* [.05, .45]	-.12 [-.32, .10]	-.05 [-.26, .17]	.01 [-.21, .23]	-.06 [-.27, .16]	.12 [-.10, .33]

Note. Values in square brackets indicate the 95% confidence interval for each correlation. The confidence interval is a plausible range of population correlations that could have caused the sample correlation (Cumming, 2014). PPI-FD denotes Fearless Dominance sub-factor of the Psychopathic Personality Inventory, PPI-SCI denotes Self-centred Impulsivity sub-factor of the Psychopathic Personality Inventory, MASQ-AA denotes Anxious Arousal sub-scale of the Mood and Anxiety Symptoms Questionnaire, MASQ-AD denotes Anhedonic Depression sub-scale of the Mood and Anxiety Symptoms Questionnaire, MASQ-GD denotes General Distress sub-scale of the Mood and Anxiety Symptoms Questionnaire and PSWQ denotes Penn State Worry Questionnaire.
* indicates $p < .05$. ** indicates $p < .01$.

The PSWQ was the only anxiety measure to positively correlate with DI, $r(81) = .26$, $p = .017$. No subscale of the Miniature Mood and Symptoms Questionnaire correlated with distraction. Fearless Dominance was also inversely correlated with DI, $r(81) = -.30$, $p = .005$. As the PSWQ was significantly correlated with DI, we will compare Fearless Dominance scores and PSWQ ratings in a linear regression to investigate the variance captured by each model.

Fearless Dominance was also negatively correlated with both Anhedonic Depression, $r(81) = -.30$, $p = .005$ and General Distress, $r(81) = -.34$, $p = .002$. It was, however, not related to our specific measures of anxiety; both Anxious Arousal, $p = .557$ and the PSWQ, $p = .297$ were not related it. Self-centred Impulsivity was positively related to all sub scales of the MASQ: Anxious Arousal ($r(81) = .26$, $p = .018$), Anhedonic Depression ($r(81) = .31$, $p = .004$) and General Distress ($r(81) = .31$, $p = .004$). As opposed to Affective-Interpersonal factors which are associated with low anxiety, Impulsive-Antisocial factors (such as Self-centred Impulsivity) have a high-anxious component. The positive correlation between anxious arousal and Self-centred Impulsivity supports the claim that Self-centred Impulsivity and Impulsive-Antisocial factor have a high-anxious component. Conversely, our other measure of anxiety, PSWQ, was not related to Self-centred Impulsivity, $r(81) = -.0.5$, $p = .656$.

To account for the possibility that PSWQ scores could explain the relationship between Fearless Dominance and DI by emotional distractors, we ran a hierarchical regression to see the effect of PSWQ scores on the relationship between DI and Fearless Dominance. Table 9. shows the linear regression model.

Overall, the model was significant, $R^2 = .203$, $p < .001$. The regression analysis shows that, when Neutral distraction is held constant, emotional DI is predicted by Fearless Dominance ($b = -3.27$, $p = .013$) but not the PSWQ ($b = 1.03$, $p = .060$).

Table 9.

Linear regression results using DI as the criterion

Predictor	*b*	*b* 95% CI [LL, UL]	*beta*	*beta* 95% CI [LL, UL]	R^2
Neutral DI	0.57*	[0.10, 1.04]	0.24	[0.04, 0.45]	
PSWQ	1.03	[-0.05, 2.11]	0.19	[-0.01, 0.40]	
PPI-FD	-3.27**	[-5.67, -0.86]	-0.27	[-0.48, -0.07]	
					.203**

Note. A significant *b*-weight indicates the beta-weight and semi-partial correlation are also significant. *b* represents unstandardized regression weights. *beta* indicates the standardized regression weights. *LL* and *UL* indicate the lower and upper limits of a confidence interval, respectively. * indicates $p < .05$. ** indicates $p < .01$.

The results show that, even when accounting for the effect of anxiety as measured by the PSWQ, there is still a significant effect of Fearless Dominance on emotional distraction. Altogether, Fearless Dominance scores explain a significant portion of the variance in emotional distraction whereas PSWQ scores do not. anxiety is therefore not an alternative explanation that confounds the current studies results.

Discussion

This thesis aimed to investigate how people who vary in psychopathic traits are affected by irrelevant emotional distractors. Given the COVID-19 pandemic we developed an online version of the emotional distraction paradigm. It was previously unknown whether we would observe the typical pattern of emotional distraction without the control that lab-based experiments allow for (e.g. environmental and equipment controls). Overall, the findings replicated the well-established finding that irrelevant negative and positive distractor images caused greater distraction than irrelevant neutral distractors. As we found the expected pattern of results overall, we can infer that the online version of the emotional distraction paradigm is a viable alternative to online lab-based testing.

As predicted, emotional distraction was reduced as Fearless Dominance (an Affective-Interpersonal trait) increases. In our categorical analysis, which split participants into low, intermediate and high Fearless Dominance groups, we found different patterns of emotional distraction in each group. Our low Fearless Dominance group showed a typical pattern of emotional distraction where both negative and positive emotional stimuli were more distracting than non-emotional neutral stimuli. In the intermediate group, positive but not negative distraction was more distracting than neutral. And, in the high Fearless Dominance group, there was no emotional distraction effect. Positive and negative stimuli were not more distracting than neutral stimuli. The results show that emotional capture by both positive and negative stimuli is reduced in those with higher levels of Fearless Dominance traits of psychopathy.

We also conducted a dimensional analysis of the results to investigate the relationship between Fearless Dominance and emotional distraction. We determined that there was a negative relationship between emotional distraction and Fearless Dominance. But there is no relationship between Fearless Dominance and neutral distraction. Using a dimensional analysis, we also found that the relationship between Fearless Dominance and emotional distraction was not modulated by Self-centred Impulsivity or anxiety measures. The reduction in emotional distraction is therefore specific to Fearless Dominance scores.

Models of the Cognitive Profile of Psychopathy

The Low-fear hypothesis (Lykken, 1995) is an emotional processing account of psychopathy that proposes cognitive differences in psychopathy are due to a specific reduction in fear response. We found that negative distraction decreased as Fearless Dominance scores increased. This finding is consistent the Low-fear hypothesis as the distraction caused by aversive stimuli is reduced as Fearless Dominance increases. Conversely, the Low-fear hypothesis is contradicted by the observed reduction in distraction by positive images with Fearless Dominance. As the proposed deficit is specific to highly psychopathic individuals' fear response, we should not observe a decrease in distraction by positive stimuli associated with Fearless Dominance.

Additionally, the results do not support the proposed reward sensitivity in psychopathy (Fowles, 1988; Gray, 1987). Based on motivational theory that proposes a behavioural inhibition and an approach system, psychopathy can be considered as involving a weak behavioural inhibition system. A weak inhibition system can be used to explain their reward-seeking behaviour. We included positive stimuli in the current experiment to investigate their inhibition to reward. As positive stimuli are inherently rewarding to view, we may have expected these stimuli to cause more distraction than negative stimuli for those high in Fearless Dominance. It is also important to note that there are no rewards for completing the task nor is the task motivating in itself, so it would be reasonable to expect that those in the high Fearless Dominance group would attend more to the positive stimuli than the task. Previously, Mitchell and colleagues (2006) used an emotional distraction paradigm that investigated how both positive and negative images interrupt performance on a simple cognitive task for highly psychopathic people compared to controls. They found that for highly psychopathic individuals (as measured by the Psychopathy Checklist in an incarcerated sample), distraction by both positive and negative stimuli was reduced. Their positive distractors were, however, less arousing (and thus less distracting) than negative distractors. Conversely, the current study used equally arousing negative and positive stimuli. We may then expect that due to reward sensitivity in psychopathy, we would observe greater distraction by positive distractors over negative distractors. Instead, overall emotional distraction fell as Fearless Dominance increased. This evidence opposes a reward sensitivity in psychopathy as both negative and positive distraction has decreased as Fearless Dominance scores increased.

The results are not entirely consistent with previous evidence found in our lab using the same paradigm. We found participants high in Fearless Dominance were more distracted by positive stimuli compared to neutral (Bryant et al., in press). The different pattern of results may be due to the number of participants in our high Fearless Dominance group, which is lower in the current study compared to the previous work. So, greater distraction by positive stimuli may be revealed with greater experimental power in the current experiment. It is also notable that the pattern found in our high group of our previous research is the same as in our intermediate Fearless Dominance group. Both found significant amounts of distraction by positive stimuli over neutral. So, it may be that the high Fearless Dominance group will continue this pattern with the preregistered sample size. Another possibility is that measurements of Fearless Dominance were more accurate in the current experiment as we based groups of Fearless Dominance on scores taken from the self-report questionnaire immediately after participants completed the experiment. The previous study used Fearless Dominance scores collected at the beginning of the academic semester. So, it could be that scores changed over that period and did not accurately reflect Fearless Dominance scores at the time of the experiment. As disparities in outcome exist between studies, further research is needed to test if the effect found in the current study is replicable.

An alternative emotion processing account supported by the findings of the current study is the Integrated Emotion Systems (IES) model of psychopathy. The IES model of psychopathy purports that the cognitive differences are due to malfunctioning of emotion systems within the brain— so is not confined to a reduced fear response (Blair, 2006). As we observed an overall deficit in specifically emotional distraction, the IES model is supported by the current study. We also find that distraction by non-emotional distractor images, such as we included in the neutral valence condition, were not associated with Fearless Dominance scores. If only emotional distraction is reduced and not neutral, then the results support the IES model of psychopathy.

It could be that the reduced emotional distraction we observe in the current study is associated with Fearless Dominance (and more broadly Affective-Interpersonal traits) only. The dual-deficit model of psychopathy (Fowles & Dindo, 2006, 2009) proposes two separate etiological pathways for Affective-Interpersonal traits (e.g. Fearless Dominance) and Impulsive-Antisocial (e.g. Self-centred Impulsivity) respectively. Affective-Interpersonal traits are thought to reflect a diminished emotional response. In support of this claim, Fearless Dominance has been shown to specifically relate to a diminished acquisition of fear, irrespective of Impulsive-Antisocial traits (López et al., 2013). As we used Fearless Dominance traits as our main predictor variable, it may be that we are specifically investigating the reduced emotional response component of psychopathy. It should be mentioned that we are not inducing an emotional response in the current study but rather investigating attention to emotional stimuli. The experiment, therefore, does not directly tap into the etiological pathway proposed for Fearless Dominance. Nevertheless, the results may reflect reduced emotional response associated with Fearless Dominance.

The attention-deficit accounts propose that cognitive differences in psychopathy stem from deficits in the processing of peripheral information. Specifically, both the Impaired Integration framework (Hamilton et al., 2015) and Response Modulation Hypothesis (RMH; Newman et al., 1997; Patterson & Newman, 1993) propose that there is reduced sensitivity to peripheral information in those that are highly psychopathic. The attention-deficit accounts purport that when focusing on a primary target (for example, deciding whether a ‘K’ or ‘N’ was displayed), peripheral information (the distractors) will not be as effectively processed in people who are highly rated in psychopathic traits. In support of the attention-deficit accounts, there was a reduction in both negative and positive distraction associated with Fearless Dominance. Yet the current study also shows evidence against the attention-deficit accounts. There was found to be no reduction in distraction by neutral stimuli associated with Fearless Dominance. The attention-deficit accounts would predict that *any* task irrelevant distraction is reduced in those high in psychopathy. Distractors of any kind should, therefore, not impact people who rate more highly in psychopathic traits. While not emotional, neutral distractors still contain salient images that are large and luminant compared to the grey background of the experiment. They still cause some distraction. Based on attention-deficit accounts then, participants in the high Fearless Dominance group should show a reduction in distraction by neutral stimuli, which we did not observe.

There is the possibility however that the current study shows a floor effect where the variability of neutral distraction across Fearless Dominance scores is constrained by the limited distraction that neutral distractors cause. Response times were, however, significantly greater during neutral distractor-present trials compared to distractor-absent trials. So, the reduction in distraction associated with Fearless Dominance seems to be specific to emotional distraction. This finding is in contrast with previous findings which have found reduced distraction by non-emotional stimuli associated with psychopathy (Hiatt et al.2004; Hoppenbrouwers et al., 2016; Zeier et al., 2009). Altogether, the current study does not show support for the attention-deficit accounts.

Future research should further investigate whether non-emotional distraction is associated with psychopathic traits. To do so, we need to increase the amount of distraction that is caused by neutral distractors. We can increase the physical salience of the distractors to increase the amount of distraction they cause, for example by using larger distractor images in the centre of a display (see Walsh et al., 2018). Attention-deficit accounts would be supported if we observe that salient but non-emotional stimuli show reduced distraction for those high in psychopathic traits. Alternatively, if no association exists, this provides evidence against attention-deficit accounts as reduced distraction should be observed for all peripheral stimuli regardless of valence.

Attentional Mechanisms in Psychopathy

Early selection mechanism. The current study helps elucidate the attentional mechanisms associated with cognitive differences in psychopathy. One mechanism proposed is the attention bottleneck mechanism of psychopathy which suggests that an early selection mechanism that gates peripheral information from further processing is at play in psychopathy. Any information that is not goal-related is therefore not processed effectively in highly psychopathic individuals. The current study's paradigm is a good test of this mechanism as it separates goal-relevant information and non-goal-relevant information clearly by including truly irrelevant distractors. People in the high Fearless Dominance group showed less distraction by the peripheral emotional distractors regardless of their valence. As these distractor images are peripheral to the task, the attention bottleneck would suggest that they are ineffectively processed. The attention bottleneck is partially supported as both negative and positive distraction were decreased in the high Fearless Dominance group.

Top-down mechanism. It is also possible, however, that differences in processing associated with psychopathy are due to differences in top-down control. It could be that those high in psychopathy have superior top-down control, which allows them to prevent emotional distraction. Previous work using the current paradigm has found manipulations that enhance top-down control to reduce distraction (Grimshaw et al., 2018; Walsh et al., 2018). It could be that improved performance (as shown by the reduced emotional distraction) associated with psychopathy we observed is due to top-down control mechanisms (see Morgan & Lilienfeld, 2000).

To investigate if differences exist in top-down attentional control, our paradigm included infrequently presented distractors. When distractors are infrequent, people are less likely to engage in sustained proactive control, as the cost of maintaining sustained control outweighs the cost to performance by infrequent distraction. So, they instead use reactive control, which is engaged after conflict arises (Braver, 2012). The effect of distraction is greater when reactive control is employed as bottom-up distraction is more likely to break through suppression. Our paradigm included infrequent distractors, which encourages the use of reactive control. If superior top-down control were present in psychopathy, then we would still see distraction for those high in Fearless Dominance as top-down control mechanisms are only employed transiently in the current study. The study therefore offers no support of superior top-down control as we see a reduction in distraction associated with Fearless Dominance.

Yet we can only infer that the high Fearless Dominance group did not use top-down control mechanisms from a theoretical basis. We did not manipulate or measure proactive control to investigate the use of top-down mechanisms in psychopathy. Further research is therefore required to test whether differences in attention in psychopathy exist in bottom-up or top-down of information. Previously, neurological differences based on attention have been associated with psychopathy (for a review, see Clark et al., 2019). For example, early attentional abnormalities, as indexed by the N100 ERP component, an early attention selection component, were found in highly psychopathic individuals during the Box Stroop task that spatially separates conflicting information (Hamilton et al., 2014). Deficits in early attention were also found in the processing of peripheral threat information at early processing time-points (Baskin-Sommers et al., 2012). The evidence suggests that differences are found most prevalently at early time points in processing (i.e. 100-200ms after stimulus onset). Top-down control can, however, shift selection early. Information. Research has yet to investigate differences in cognitive control associated with psychopathy using neurophysiological methods though. To test whether people high in psychopathic traits display superior top-down control we can measure their use of proactive control. It is difficult to infer whether people high in psychopathy are employing superior top-down control from behavioural measures in our paradigm. So instead, we can measure neurophysiological responses from participants to measure markers of proactive control. Using spectral analysis, pre-stimulus alpha suppression has been shown to index proactive control (Murphy et al., 2020). If people high in psychopathic traits are more likely to use proactive control, then we should observe greater amounts of pre-stimulus alpha suppression positively associated with those traits. Greater use of proactive control in psychopathy would evidence the claim that superior top-down control is observed in psychopathy.

Selection history mechanism. Alternatively, it could be that differences in attention in psychopathy are not due to differences in bottom-up processing of information or top-down control of attention. Differences associated with psychopathy could instead lie in selection history (Awh et al., 2012). Selection history is a bias in attention based on past selection episodes, for example, reward history. Selection history cannot be classified as bottom-up processing as it is not based on the physical components of the stimulus that make it salient (e.g. bright, large, or moving). And it can bias attention away from the current goals of the task, so it is not voluntary top-down control either (Maljkovic & Nakayama, 1994). Selection history may also bias attention to emotional stimuli (Belopolsky, 2015). Emotional stimuli are conditioned stimuli that we, over time, associate with reward (positive stimuli) and threat (negative stimuli). As deficits in attention in psychopathy are, for the most part, observed in their lack of attention to emotional stimuli, it could be that differences in attention associated with psychopathy are due to differences in selection history (Hoppenbrouwers et al., 2016). People who are high in psychopathy may simply not have a strong selection history bias towards emotional stimuli compared to those low in psychopathy.

Factors of Psychopathy

The current study investigated both factors of psychopathy. We specifically investigated the effects of Fearless Dominance because Affective-Interpersonal traits (such as Fearless Dominance) are thought to be related to the deficit in the processing of emotional stimuli that are task-irrelevant (Blair, 2008; Patterson & Newman, 1993).

The current study's results replicate the diminished emotional distraction effect associated with Affective-Interpersonal based traits of psychopathy (Ahmed et al., 2018; Kimonis et al., 2019; Maes & Brazil, 2015). Inconsistent with previous research, our findings show no interaction between Self-centred Impulsivity traits and Fearless Dominance predicting emotional distraction. Instead, Fearless Dominance *alone* is associated with decreased emotional distraction. Previously, the reduction in emotional distraction associated with Affective-Interpersonal traits has been found to interact with Impulsive-Antisocial traits, although not in consistent ways. For example, Maes and Brazil (2015) and Ahmed and colleagues (2018) found that Fearless Dominance traits were associated with decreased emotional distraction only for people with *low* Impulsive-Antisocial traits. Conversely, Kimonis and colleagues (2019) found the same association except only for people who were *high* in scores of Impulsive-Antisocial traits.

One explanation for the divergent results might be the different tasks used across studies. Maes and Brazil's (2015) task, for example, included a distractor on every trial. As previously discussed, frequent distractors increase the use of proactive control. There is debate about whether Impulsive-Antisocial traits such as Self-centred Impulsivity are related to executive functioning (Baskin-Sommers et al., 2015; Maes & Brazil, 2013). Executive functioning is involved in higher-level processes such as cognitive control. If executive functioning deficits are inversely related to Impulsive-Antisocial traits, then participants low in Impulsive-Antisocial traits might show better cognitive control. As executive function is used to employ sustained proactive control, only those low in Impulsive-Antisocial traits (associated with *better* executive function) would show a negative relationship between Affective-Interpersonal traits and emotional distraction. In the current study, distractors were infrequently presented and did not encourage the use of proactive control methods. Executive functioning ability therefore may not impact distraction in the current study's paradigm. If so, individual differences in Self-centred Impulsivity would not affect emotional distraction.

Another explanation is that psychopathy and its traits were operationalised differently in each study, so findings are not directly comparable. Trait psychopathy measurement differed between studies. Kimonis and colleagues (2019) used the Triarchic Psychopathy Measure (TriPM; Patrick & Drislane, 2014) of psychopathy, whereas Maes and Brazil (2015) and the current study used the Psychopathic Personality Index (PPI; Lilienfeld & Widows, 2005). For their measure of spatial attention, Kimonis and colleagues (2019) employed the dot-probe task. Both the dot-probe task and the emotional distraction paradigm of the current study assess spatial attention as the distractors are located in spatially separate locations. The results of the dot-probe task are, therefore, the most directly comparable. For Kimonis and colleagues (2019), an interaction between Meanness and Disinhibition was found for the dot-probe task where, as meanness increased, dot-probe task performance improved but only for those high in Disinhibition. Meanness, however, is not correlated with Fearless Dominance but rather Self-centred Impulsivity (van Dongen et al., 2017). As Disinhibition and Meanness do not measure the same conceptual interaction as in our study or Maes and Brazil's (2015), no comparison can be made between these studies measures of spatial attention.

Anxiety and Psychopathy

The current study included exploratory analyses investigating the effect of anxiety on emotional distraction and interactions with Fearless Dominance. We were interested in the effect of anxiety, as there is evidence that anxious traits are related to emotional distraction. Highly anxious individuals are prone to greater emotional distraction (Krug & Carter, 2012). Moreover, Affective-Interpersonal traits have a proposed low anxious component (Falkenbach et al., 2008; Hicks et al., 2004; Kimonis et al., 2008; Skeem et al., 2007; Vassileva et al., 2005), although there is also debate about whether psychopathy and anxiety are related constructs (Schmitt & Newman, 1999; Visser et al., 2012). Anxiety was not the primary topic of investigation for this study, but we wanted to ensure that the relationship between psychopathy and emotional distraction was not mediated by anxiety. To account for alternative explanations of the results being due to anxiety we included two trait anxiety questionnaires in the study, the miniature Mood and Anxiety Symptoms Questionnaire (mini-MASQ) and the Penn State Worry Questionnaire (PSWQ).

The mini-MASQ measures depression and anxiety using the tripartite model. The questionnaire measures three separate factors which make up the tripartite model. One factor, Anxious Arousal, measures specifically anxiety through physiological-based items. As this factor measures specifically anxiety rather than depression, we may expect that this factor would be related to emotional distraction. We found, however, that no factor of the mini-MASQ was related to emotional distraction. An explanation for this result could be that Anxious Arousal factor is measured with items that ask participants about their physiological state. Perhaps the physiological components of anxiety that are measured by the Anxious Arousal factor are not related to cognitive control.

Our other measure of anxiety, the PSWQ, indexes worry. Worry is an important feature of Generalised Anxiety Disorder and is pervasive within anxiety disorders (Barlow, 1988). We found that the PSWQ was positively correlated with distraction. However, Fearless Dominance still accounts for unique variance even when PSWQ scores are taken into account. The results suggest that although anxiety (and specifically worry) are related to emotional distraction, they do not provide an alternative account of the current study's results.

Limitations

One limitation of the current study is that we cannot generalise to extreme high scores of psychopathy. Ultimately, we wish to understand the cognitive mechanisms that give rise to psychopathy so that the social costs associated with it can be alleviated with treatment. We investigated emotional distraction associated with psychopathic traits using a university sample. These scores are not clinically relevant, and psychopathy in incarcerated samples is measured primarily with the Psychopathy Checklist (PCL-R) which includes items on criminal misconduct. Differences may exist in the interaction of psychopathic traits in severe samples such as those found in prisons. If we investigate emotional distraction in clinical samples, we can see the effect of emotional distraction in extreme ratings of psychopathy. Thus, this paradigm should be applied to an incarcerated sample using the PCL-R to examine whether Affective-Interpersonal traits are associated with a decrease in emotional distraction.

There is also an issue of statistical power in the study; our desired sample size was not reached. In our pre-registration, we planned to collect data from 108 participants, 36 for each Fearless Dominance group. The current study collected the data from 83 participants despite running across two academic semesters. The low rate of recruitment rate reflects the overall low rate of participation of students studying online. Running the study in a larger community-based sample in the future will increase the amount of recruitment for the study.

Additionally, Fearless Dominance groups were not of equal size. The number of participants in the intermediate group (33 participants) was almost double than in the high Fearless Dominance group (17 participants). A possible reason for this discrepancy is that overall Fearless Dominance scores were more average when remeasured during the online-based study. Participants who were previously high or low in Fearless Dominance were reclassified into the intermediate group. To overcome a lack of recruitment of participants in the low and high Fearless Dominance groups, we can sample from more extreme cut-off criteria. For example, we can recruit participants from the top and bottom quartiles for the high and low Fearless Dominance groups respectively. Then, when scores are remeasured, and become more average, they would be more likely to meet the qualifications for being in the top and bottom 33rd percentile compared to sampling from the top and bottom tercile to begin with.

We found no differences in distraction across each valence condition in the high Fearless Dominance group. We interpret this result as showing that those high in Fearless Dominance are no more distracted by irrelevant emotional stimuli as compared to neutral stimuli. The high Fearless Dominance group however lacked a complete sample. The null result can then be the result of an underpowered analysis. If we had more power, we might find that there are differences in distraction between neutral and emotional stimuli. There are still differences however between Fearless Dominance groups as we find an overall interaction between Fearless Dominance and valence with distraction. So, we can still conclude that differences in emotional distraction are associated with Fearless Dominance.

Another limitation is the study’s potential gender confound. We aimed to collect an equal number of male and female participants for each Fearless Dominance group. The sample analysed, however, was not complete, so our sample was 61% female. We found no effect of gender in our study. Regardless, we should be cautious with the current study’s findings. As there are a greater number of female participants, this affects our interpretation of results in two ways. First, distractor stimuli used for each gender differed. As there are gender differences in arousal and valence ratings of the distractor images, we chose separate sets of these images so that there were no differences in these ratings between genders. So, our study may currently have an effect of image sets. There are also gender differences in emotional distraction (Iordan et al., 2013). Evidence suggests that women have greater emotional reactivity than men. Our low Fearless Dominance group contained more women than the high Fearless Dominance group. Therefore, Fearless Dominance groups may be confounded by gender.

Second, there are a myriad of gender differences in psychopathy. Differences in psychopathic traits are found across genders (Cale & Lilienfeld, 2002; O'Leary et al., 2007). There are also differences in factor structure in psychopathy between men and women (Dolan & Völlm, 2009, Salekin, et al., 1997). Additionally, when collecting PPI-R scores in an undergraduate sample, Lilienfeld and Andrews (1996) found that men exhibited significantly higher scores in total scores and sub-traits, including Fearlessness, a component of Fearless Dominance. Our groups did not contain equal numbers of men and women, so gender is potentially driving the effect by an unequal number of women in the low group (64% female participants). Therefore, we have to be cautious when interpreting the results due to unbalanced gender groups. To fix these limitations we can run with only one gender to allow for a more homogenous sample that is not affected by gender differences.

Future Directions

One future research direction to consider is distraction by familiar faces associated with psychopathy. Familiar faces (for example famous faces) are highly salient stimuli and may act as special stimuli that are still distracting even for people high in psychopathy. Load theory posits that there is a capacity limit on the amount of perceptual information that can be processed. When perceptual load is low (e.g. detecting a single stimulus) there is perceptual capacity left over for processing task-irrelevant stimuli. On the other hand, when perceptual load is high (e.g. detecting a complex stimulus among other perceptually similar stimuli), there is no perceptual capacity left over for processing irrelevant stimuli (Lavie et al., 2004). Distraction is reduced when perceptual load is high because participants only have enough resources to process the target. Supporting this theory, irrelevant distractors under high perceptual load do not cause as much distraction compared to low perceptual load conditions (Forster & Lavie, 2008a). Interestingly, familiar faces are still distracting even under high perceptual load (Lavie et al., 2003). The attention bottleneck mechanism proposed by attention-deficit accounts suggests that only goal-relevant stimuli are effectively processed (Hamilton et al., 2014; Newman & Baskin-Sommers, 2011; Smith & Lilienfeld, 2015). The attention bottleneck of psychopathy could then just reflect a low perceptual capacity in general. If this was the case, we would still see distraction by familiar faces even in those high in psychopathy. This future research could tell us if familiar faces are special stimuli that are still distracting for highly psychopathic people and if load theory and the attentional bottleneck of psychopathy work off similar principles.

Conclusion

Emotional stimuli automatically draw our attention. For those high in specifically Affective -Interpersonal traits of psychopathy (measured in the current study with Fearless Dominance) these emotional stimuli are, however, not as distracting. Our findings replicate previous research that finds a reduction in emotional distraction in psychopathy. Contrary to previous findings the reduction in emotional distraction was specific to Affective-Interpersonal traits only, we found no interaction of Impulsive-Antisocial traits. The current study also extended previous work investigating emotional distraction in psychopathy by analysing the effect of valence to test cognitive accounts of psychopathy. The current study found support for an affective deficit in psychopathy that is not specific to fear. Attention-deficit accounts on the other hand were not supported by our findings as we found a reduction in distraction for emotional stimuli only.

References

Ahmed, S. P., Hodsoll, S., Dalton, P., & Sebastian, C. L. (2018). Emotional capture by fearful expressions varies with psychopathic traits. *Cognition and Emotion*, *32*(1), 207–214. https://doi.org/10.1080/02699931.2016.1278358

Ali, F., Amorim, I. S., & Chamorro-Premuzic, T. (2009). Empathy deficits and trait emotional intelligence in psychopathy and Machiavellianism. *Personality and Individual Differences*, *47*(7), 758–762. https://doi.org/10.1016/j.paid.2009.06.016

Awh, E., Belopolsky, A. V., & Theeuwes, J. (2012). Top-down versus bottom-up attentional control: A failed theoretical dichotomy. *Trends in Cognitive Sciences*, *16*(8), 437–443. https://doi.org/10.1016/j.tics.2012.06.010

Babiak, P. (1995). When Psychopaths Go to Work: A Case Study of an Industrial Psychopath. *Applied Psychology*, *44*, 171–188. https://doi.org/10.1111/j.1464-0597.1995.tb01073.x

Babiak, P., Neumann, C. S., & Hare, R. D. (2010). Corporate psychopathy: Talking the walk. *Behavioral Sciences & the Law*, *28*(2), 174–193. https://doi.org/10.1002/bsl.925

Barlow, D. H. (1988). Anxiety and its disorders. New York. *Guilford Press. Davidson, JA, & McWilliam, C.(1987). Range of Mental Illness among the Elderly in the Community: Prevalence in Liverpool Using the GMS-AGECAT Package, British Journal Of Psychiatry*, *150*, 815–823.

Baskin-Sommers, A., Curtin, J. J., Li, W., & Newman, J. P. (2012). Psychopathy-related differences in selective attention are captured by an early event-related potential. *Personality Disorders: Theory, Research, and Treatment*, *3*(4), 370–378. https://doi.org/10.1037/a0025593

Baskin-Sommers, A. R., Brazil, I. A., Ryan, J., Kohlenberg, N. J., Neumann, C. S., & Newman, J. P. (2015). Mapping the association of global executive functioning onto diverse measures of psychopathic traits. *Personality Disorders*, *6*(4), 336–346. https://doi.org/10.1037/per0000125

Baskin-Sommers, A. R., Curtin, J. J., & Newman, J. P. (2011). Specifying the Attentional Selection That Moderates the Fearlessness of Psychopathic Offenders: *Psychological Science*. https://doi.org/10.1177/0956797610396227

Belopolsky, A. V. (2015). Common Priority Map for Selection History, Reward and Emotion in the Oculomotor System. *Perception*, *44*(8–9), 920–933. https://doi.org/10.1177/0301006615596866

Birbaumer, N., L, Veit, R., Lotze, M., Erb, M., Hermann, C., Grodd, W., & Flor, H., (2005). Deficient Fear Conditioning in Psychopathy: A Functional Magnetic Resonance Imaging Study. *Archives of General Psychiatry*, *62*(7), 799–805. http://dx.doi.org/10.1001/archpsyc.62.7.799

Blair, R. (2007). Empathic dysfunction in psychopathic individuals. *Empathy in Mental Illness*, *206*, 3–16. https://doi.org/10.1017/CBO9780511543753.002

Blair, R. J. R. (2006). The emergence of psychopathy: Implications for the neuropsychological approach to developmental disorders. *Cognition*, *101*(2), 414–442. https://doi.org/10.1016/j.cognition.2006.04.005

Blair, R. J. R. (2008). The amygdala and ventromedial prefrontal cortex: Functional contributions and dysfunction in psychopathy. *Philosophical Transactions of the Royal Society B: Biological Sciences*, *363*(1503), 2557–2565. https://doi.org/10.1098/rstb.2008.0027

Blair, R. J. R., Mitchell, D. G. V., Leonard, A., Budhani, S., Peschardt, K. S., & Newman, C. (2004). Passive avoidance learning in individuals with psychopathy: Modulation by reward but not by punishment. *Personality and Individual Differences*, *37*(6), 1179–1192. https://doi.org/10.1016/j.paid.2003.12.001

Boccardi, M., Frisoni, G. B., Hare, R. D., Cavedo, E., Najt, P., Pievani, M., Rasser, P. E., Laakso, M. P., Aronen, H. J., Repo-Tiihonen, E., Vaurio, O., Thompson, P. M., & Tiihonen, J. (2011). Cortex and amygdala morphology in psychopathy. *Psychiatry Research: Neuroimaging*, *193*(2), 85–92. https://doi.org/10.1016/j.pscychresns.2010.12.013

Boddy, C. R., Ladyshewsky, R. K., & Galvin, P. (2010). The Influence of Corporate Psychopaths on Corporate Social Responsibility and Organizational Commitment to Employees. *Journal of Business Ethics*, *97*(1), 1–19. https://doi.org/10.1007/s10551-010-0492-3

Braver, T. S. (2012). The variable nature of cognitive control: A dual mechanisms framework. *Trends in Cognitive Sciences*, *16*(2), 106–113. https://doi.org/10.1016/j.tics.2011.12.010

Bresin, K., Finy, M. S., Sprague, J., & Verona, E. (2014). Response Monitoring and Adjustment: Differential Relations with Psychopathic Traits. *Journal of Abnormal Psychology*, *123*(3), 634–649. https://doi.org/10.1037/a0037229

Brook, M., & Kosson, D. (2013). Impaired Cognitive Empathy in Criminal Psychopathy: Evidence From a Laboratory Measure of Empathic Accuracy. *Journal of Abnormal Psychology, 122(1), 156-166.* http://dx.doi.org/10.1037/a0030261

Budhani, S., Richell, R. A., & Blair, R. J. R. (2006). Impaired reversal but intact acquisition: Probabilistic response reversal deficits in adult individuals with psychopathy. *Journal of Abnormal Psychology*, *115*(3), 552–558. http://dx.doi.org/10.1037/0021-843X.115.3.552

Cale, E. M., & Lilienfeld, S. O. (2002). Sex differences in psychopathy and antisocial personality disorder: A review and integration. *Clinical Psychology Review*, *22*(8), 1179–1207. https://doi.org/10.1016/S0272-7358(01)00125-8

Carretié, L. (2014). Exogenous (automatic) attention to emotional stimuli: A review. *Cognitive, Affective, & Behavioral Neuroscience*, *14*(4), 1228–1258. https://doi.org/10.3758/s13415-014-0270-2

Clark, A. P., Bontemps, A. P., Batky, B. D., Watts, E. K., & Salekin, R. T. (2019). Psychopathy and neurodynamic brain functioning: A review of EEG research. *Neuroscience & Biobehavioral Reviews*, *103*, 352–373. https://doi.org/10.1016/j.neubiorev.2019.05.025

Clark, L. A., & Watson, D. (1991). Tripartite model of anxiety and depression: Psychometric evidence and taxonomic implications. Journal of Abnormal Psychology, 100(3), 316–336. https://doi.org/10.1037/0021-843X.100.3.316

Cleckley, H. M. (1988). *The mask of sanity: An attempt to clarify some issues about the so-called psychopathic personality*. E.S. Cleckley.

Cooke, D. J., & Michie, C. (1997). An item response theory analysis of the Hare Psychopathy Checklist—Revised. *Psychological Assessment*, *9*(1), 3–14. https://doi.org/10.1037/1040-3590.9.1.3

Dalgleish, T. (2004). The emotional brain. *Nature Reviews Neuroscience*, *5*(7), 583. https://doi.org/10.1038/nrn1432

Dindo, L., & Fowles, D. (2011). Dual temperamental risk factors for psychopathic personality: Evidence from self-report and skin conductance. *Journal of Personality and Social Psychology*, *100*(3), 557–566. http://dx.doi.org/10.1037/a0021848

Dolan, M., & Völlm, B. (2009). Antisocial personality disorder and psychopathy in women: A literature review on the reliability and validity of assessment instruments. International Journal of Law and Psychiatry, 32, 2–9. http://dx.doi.org/10.1016/j.ijlp.2008.11.002

Douglas, K. S., Vincent, G. M., & Edens, J. F. (2018). Risk for criminal recidivism: The role of psychopathy. In *Handbook of psychopathy, 2nd ed* (pp. 682–709). The Guilford Press.

Edens, J., Marcus, D., Lilienfeld, S., & Poythress, N. (2006). Psychopathic, Not Psychopath: Taxometric Evidence for the Dimensional Structure of Psychopathy. *Journal of Abnormal Psychology*, *115*, 131–144. https://doi.org/10.1037/0021-843X.115.1.131

Eisenbarth, H., Angrilli, A., Calogero, A., Harper, J., Olson, L. A., & Bernat, E. (2013). Reduced negative affect response in female psychopaths. *Biological Psychology*, *94*(2), 310–318. https://doi.org/10.1016/j.biopsycho.2013.07.007

Eisenbarth, H., Lilienfeld, S. O., & Yarkoni, T. (2015). Using a genetic algorithm to abbreviate the Psychopathic Personality Inventory–Revised (PPI-R). *Psychological Assessment*, *27*(1), 194–202. https://doi.org/10.1037/pas0000032

Falkenbach, D., Poythress, N., & Creevy, C. (2008). The exploration of subclinical psychopathic subtypes and the relationship with types of aggression. *Personality and Individual Differences*, *44*(4), 821–832. https://doi.org/10.1016/j.paid.2007.10.012

Ferwerda, J. (2018). PsychoPysics: A suite of tools for teaching Psychophysics using PsychoPy. *Journal of Vision*, *18*(10), 589–589. https://doi.org/10.1167/18.10.589

Flor, H., Birbaumer, N., Hermann, C., Ziegler, S., & Patrick, C. J. (2002). Aversive Pavlovian conditioning in psychopaths: Peripheral and central correlates. *Psychophysiology*, *39*(4), 505–518. http://dx.doi.org/10.1017/S0048577202394046

Forster, S., & Lavie, N. (2008a). Failures to ignore entirely irrelevant distractors: The role of load. *Journal of Experimental Psychology: Applied*, *14*(1), 73. https://doi.org/10.1037/1076-898X.14.1.73

Forster, S., & Lavie, N. (2008b). Attentional capture by entirely irrelevant distractors. *Visual Cognition*, *16*(2–3), 200–214. https://doi.org/10.1080/13506280701465049

Fowles, D. (1988). Psychophysiology and psychopathology: A motivational approach. *Psychophysiology*, *25(4)*, 373–391.

Fowles, D. C., & Dindo, L. (2006). A Dual-Deficit Model of Psychopathy. In *Handbook of psychopathy* (pp. 14–34). The Guilford Press.

Fowles, D. C., & Dindo, L. (2009). Temperament and Psychopathy: A Dual-Pathway Model. *Current Directions in Psychological Science*, *18*(3), 179–183. https://doi.org/10.1111/j.1467-8721.2009.01632.x

Frick, P. J., Cornell, A. H., Barry, C. T., Bodin, S. D., & Dane, H. E. (2003). Callous-Unemotional Traits and Conduct Problems in the Prediction of Conduct Problem Severity, Aggression, and Self-Report of Delinquency. *Journal of Abnormal Child Psychology*, *31*(4), 457-470.

Gray, J. (1987). The psychology of fear and stress. *Cambridge University Press*.

Grimshaw, G. M., Kranz, L. S., Carmel, D., Moody, R. E., & Devue, C. (2018). Contrasting reactive and proactive control of emotional distraction. *Emotion*, *18*(1), 26–38. http://dx.doi.org/10.1037/emo0000337

Guay, J.-P., Ruscio, J., Knight, R. A., & Hare, R. D. (2007). A taxometric analysis of the latent structure of psychopathy: Evidence for dimensionality. *Journal of Abnormal Psychology*, *116*(4), 701–716. https://doi.org/10.1037/0021-843X.116.4.701

Hall, J. R., Drislane, L. E., Patrick, C. J., Morano, M., Lilienfeld, S. O., & Poythress, N. G. (2014). Development and Validation of Triarchic Construct Scales from the Psychopathic Personality Inventory. *Psychological Assessment*, *26*(2), 447–461. https://doi.org/10.1037/a0035665

Hamilton, Rachel K. B., Hiatt Racer, K., & Newman, J. P. (2015). Impaired integration in psychopathy: A unified theory of psychopathic dysfunction. *Psychological Review*, *122*(4), 770–791. http://dx.doi.org/10.1037/a0039703

Hamilton, Rachel K. Bencic, Baskin-Sommers, A. R., & Newman, J. P. (2014). Relation of frontal N100 to psychopathy-related differences in selective attention. *Biological Psychology*, *103*, 107–116. https://doi.org/10.1016/j.biopsycho.2014.08.012

Hare, R. D. (1991). *Manual for the Hare Psychopathy Checklist-Revised. Toronto, Ontario, Canada: Multi-Health Systems*. Inc.

Heilbrun, A. B. (1979). Psychopathy and violent crime. *Journal of Consulting and Clinical Psychology*, *47*(3), 509–516. https://doi.org/10.1037/0022-006X.47.3.509

Hemphill, J. F., Hart, S. D., & D. Hare, R. (1994). Psychopathy and Substance Use. *Journal of Personality Disorders*, *8*(3), 169–180. http://dx.doi.org/10.1521/pedi.1994.8.3.169

Heritage, A. J., & Benning, S. (2012). Impulsivity and Response Modulation Deficits in Psychopathy: Evidence From the ERN and N1. *Journal of Abnormal Psychology*, *122*. https://doi.org/10.1037/a0030039

Hiatt, K. D., Schmitt, W. A., & Newman, J. P. (2004). Stroop tasks reveal abnormal selective attention among psychopathic offenders. *Neuropsychology*, *18*(1), 50–59. http://dx.doi.org/10.1037/0894-4105.18.1.50

Hicks, B. M., Markon, K. E., Patrick, C. J., Krueger, R. F., & Newman, J. P. (2004). Identifying Psychopathy Subtypes on the Basis of Personality Structure. *Psychological Assessment*, *16*(3), 276–288. https://doi.org/10.1037/1040-3590.16.3.276

Hodsoll, S., Lavie, N., & Viding, E. (2014). Emotional attentional capture in children with conduct problems: The role of callous-unemotional traits. *Frontiers in Human Neuroscience*, *8*. https://doi.org/10.3389/fnhum.2014.00570

Hoppenbrouwers, S. S., Van der Stigchel, S., Sergiou, C. S., & Theeuwes, J. (2016). Top-down attention and selection history in psychopathy: Evidence from a community sample. *Journal of Abnormal Psychology*, *125*(3), 435–441. https://doi.org/10.1037/abn0000133

Iordan, A. D., Dolcos, S., Denkova, E., & Dolcos, F. (2013). Sex differences in the response to emotional distraction: An event-related fMRI investigation. *Cognitive, Affective, & Behavioral Neuroscience*, *13*(1), 116–134. https://doi.org/10.3758/s13415-012-0134-6

Iselin, A.-M., Salekin, R., DeCoster, J., & Rogers, R. (2008). A meta-analysis relating the Hare measures of psychopathy to antisocial conduct. Law and Human Behavior, 32, 28-45. *Law and Human Behavior*, *32*, 28–45. https://doi.org/10.1007/s10979-007-9096-6

Kelley, S. E., Edens, J. F., Donnellan, M. B., Ruchensky, J. R., Witt, E. A., & McDermott, B. E. (2016). Development and validation of an inconsistent responding scale for an abbreviated version of the Psychopathic Personality Inventory—Revised. *Personality and Individual Differences*, *91*, 58–62. https://doi.org/10.1016/j.paid.2015.11.033

Kiehl, K. A., & Hoffman, M. B. (2011). The Criminal Psychopath: History, Neuroscience, Treatment, and Economics. *Jurimetrics*, *51*, 355–397.

Kimonis, E. R., Frick, P. J., Skeem, J. L., Marsee, M. A., Cruise, K., Munoz, L. C., Aucoin, K. J., & Morris, A. S. (2008). Assessing callous–unemotional traits in adolescent offenders: Validation of the Inventory of Callous–Unemotional Traits. *International*

Journal of Law and Psychiatry, *31*(3), 241–252. https://doi.org/10.1016/j.ijlp.2008.04.002

Kimonis, E. R., Kidd, J., Most, S. B., Krynen, A., & Liu, C. (2019). An elusive deficit: Psychopathic personality traits and aberrant attention to emotional stimuli. *Emotion*. http://dx.doi.org/10.1037/emo0000601

Krug, M. K., & Carter, C. S. (2012). Proactive and reactive control during emotional interference and its relationship to trait anxiety. *Brain Research*, *1481*, 13–36. https://doi.org/10.1016/j.brainres.2012.08.045

Krusemark, E. A. (2016). Endogenous attention modulates early selective attention in psychopathy: An ERP investigation. *Cogn Affect Behav Neurosci*, 16, 779–788. https://doi.org/10.3758/s13415-016-0430-7

Lang, P. J., Bradley, M. M., & Cuthbert, B. N. (2008). *International affective picture system (IAPS): Affective ratings of pictures and instruction manual. University of Florida, Gainesville*. Tech Rep A-8.

Lavie, N., Ro, T., & Russell, C. (2003). The Role of Perceptual Load in Processing Distractor Faces. *Psychological Science*, *14*(5), 510–515. https://doi.org/10.1111/1467-9280.03453

Lavie, N., Viding, E., Lavie, N., Hirst, R., Fockert, J. W. D., & Viding, E. (2004). Load Theory of Selective Attention and Cognitive Control. *Journal of Experimental Psychology General*, 339–354.

Levenston, G. K., Patrick, C. J., Bradley, M. M., & Lang, P. J. (2000). The psychopath as observer: Emotion and attention in picture processing. *Journal of Abnormal Psychology*, *109*(3), 373–385. https://doi.org/10.1037/0021-843X.109.3.373

Lilienfeld, S. O., & Andrews, B. P. (1996). Development and Preliminary Validation of a Self-Report Measure of Psychopathic Personality Traits in Noncriminal Population. *Journal of Personality Assessment*, *66*(3), 488. https://doi.org/10.1207/s15327752jpa6603_3

Lilienfeld, S. O., Smith, S. F., & Watts, A. L. (2016). The perils of unitary models of the etiology of mental disorders—The response modulation hypothesis of psychopathy as a case example: Rejoinder to Newman and Baskin-Sommers (2016). *Psychological Bulletin*, *142*(12), 1394–1403. http://dx.doi.org/10.1037/bul0000080

Lilienfeld, S. O., & Widows, M. R. (2005). *Psychopathic Personality InventoryTM-Revised*. 6.

López, R., Poy, R., Patrick, C. J., & Moltó, J. (2013). Deficient fear conditioning and self-reported psychopathy: The role of fearless dominance. *Psychophysiology*, *50*(2), 210–218. http://dx.doi.org/10.1111/j.1469-8986.2012.01493.x

Lykken, David T. (1957). A study of anxiety in the sociopathic personality. *The Journal of Abnormal and Social Psychology*, *55*(1), 6–10. http://dx.doi.org/10.1037/h0047232

Lykken, David Thoreson. (1995). *The Antisocial Personalities*. Psychology Press.

Maes, J. H. R., & Brazil, I. A. (2013). No clear evidence for a positive association between the interpersonal-affective aspects of psychopathy and executive functioning. *Psychiatry Research*, *210*(3), 1265–1274. https://doi.org/10.1016/j.psychres.2013.09.028

Maes, J. H. R., & Brazil, I. A. (2015). Distraction from cognitive processing by emotional pictures: Preliminary evidence for an association with interactions between psychopathy-related traits in a non-clinical sample. *Personality and Individual Differences*, *75*, 53–58.

Maljkovic, V., & Nakayama, K. (1994). Priming of pop-out: I. Role of features. *Memory & Cognition*, *22*(6), 657–672. https://doi.org/10.3758/BF03209251

Meyer, T. J., Miller, M. L., Metzger, R. L., & Borkovec, T. D. (1990). Development and validation of the penn state worry questionnaire. *Behaviour Research and Therapy*, *28*(6), 487–495. https://doi.org/10.1016/0005-7967(90)90135-6

Mitchell, D. G. V., Richell, R. A., Leonard, A., & Blair, R. J. R. (2006). Emotion at the expense of cognition: Psychopathic individuals outperform controls on an operant response task. *Journal of Abnormal Psychology*, *115*(3), 559–566. http://dx.doi.org/10.1037/0021-843X.115.3.559

Morgan, A. B., & Lilienfeld, S. O. (2000). A meta-analytic review of the relation between antisocial behavior and neuropsychological measures of executive function. *Clinical Psychology Review*, *20*(1), 113–136. https://doi.org/10.1016/S0272-7358(98)00096-8

Most, S. B., Smith, S. D., Cooter, A. B., Levy, B. N., & Zald, D. H. (2007). The naked truth: Positive, arousing distractors impair rapid target perception. *Cognition and Emotion*, *21*(5), 964–981. https://doi.org/10.1080/02699930600959340

Moul, C., Killcross, S., & Dadds, M. (2012). A Model of Differential Amygdala Activation in Psychopathy. *Psychological Review*, *119*, 789–806. https://doi.org/10.1037/a0029342

Mrkva, K., Westfall, J., & Van Boven, L. (2019). Attention Drives Emotion: Voluntary Visual Attention Increases Perceived Emotional Intensity. *Psychological Science*, *30*(6), 942–954. https://doi.org/10.1177/0956797619844231

Murphy, J., Devue, C., Corballis, P. M., & Grimshaw, G. M. (2020). Proactive Control of Emotional Distraction: Evidence From EEG Alpha Suppression. *Frontiers in Human Neuroscience*, *14*. https://doi.org/10.3389/fnhum.2020.00318

Neumann, C. S., Schmitt, D. S., Carter, R., Embley, I., & Hare, R. D. (2012). Psychopathic Traits in Females and Males across the Globe. *Behavioral Sciences & the Law*, *30*(5), 557–574. https://doi.org/10.1002/bsl.2038

Newman, J. P., & Baskin-Sommers, A. R. (2011). Early Selective Attention Abnormalities in Psychopathy, Implications for Self-Regulation. In *Cognitive Neuroscience of Attention, Second Edition* (pp. 421–440). Guilford Publications. http://ebookcentral.proquest.com/lib/vuw/detail.action?docID=800603

Newman, J. P., Curtin, J. J., Bertsch, J. D., & Baskin-Sommers, A. R. (2010). Attention Moderates the Fearlessness of Psychopathic Offenders. *Biological Psychiatry*, *67*(1), 66–70. https://doi.org/10.1016/j.biopsych.2009.07.035

Newman, J. P., & Kosson, D. S. (1986). Passive avoidance learning in psychopathic and nonpsychopathic offenders. *Journal of Abnormal Psychology*, *95*(3), 252–256. http://dx.doi.org/10.1037/0021-843X.95.3.252

Newman, J. P., MacCoon, D. G., Vaughn, L. J., & Sadeh, N. (2005). Validating a Distinction Between Primary and Secondary Psychopathy With Measures of Gray's BIS and BAS Constructs. *Journal of Abnormal Psychology*, *114*(2), 319–323. http://dx.doi.org/10.1037/0021-843X.114.2.319

Newman, J. P., Schmitt, W. A., & Voss, W. D. (1997). The impact of motivationally neutral cues on psychopathic individuals: Assessing the generality of the response modulation hypothesis. *Journal of Abnormal Psychology*, *106*(4), 563–575. https://doi.org/10.1037/0021-843X.106.4.563

Newman, J. P., Widom, C. S., & Nathan, S. (1985). Passive avoidance in syndromes of disinhibition: Psychopathy and extraversion. *Journal of Personality and Social Psychology*, *48*(5), 1316–1327. https://doi.org/10.1037/0022-3514.48.5.1316

Okon-Singer, H., Lichtenstein-Vidne, L., & Cohen, N. (2013). Dynamic modulation of emotional processing. *Biological Psychology*, *92*(3), 480–491. https://doi.org/10.1016/j.biopsycho.2012.05.010

O'Leary, M. M., Loney, B. R., & Eckel, L. A. (2007). Gender differences in the association between psychopathic personality traits and cortisol response to induced stress. *Psychoneuroendocrinology*, *32*(2), 183–191. https://doi.org/10.1016/j.psyneuen.2006.12.004

Patrick, C. J. (1994). Emotion and psychopathy: Startling new insights. *Psychophysiology*, *31*(4), 319–330. https://doi.org/10.1111/j.1469-8986.1994.tb02440.x

Patrick, C. J. (2007). Antisocial personality disorder and psychopathy. In *Personality disorders: Toward the DSM-V.* (pp. 109–166). Sage Publications, Inc. https://doi.org/10.4135/9781483328980.n6

Patrick, C. J., & Drislane, L. E. (2014). Triarchic model of psychopathy: Origins, operationalizations, and observed linkages with personality and general psychopathology. Journal of Personality, 83, 627–643.

Patrick, C. J., Bradley, M. M., & Lang, P. J. (1993). Emotion in the criminal psychopath: Startle reflex modulation. *Journal of Abnormal Psychology*, *102*(1), 82–92. http://dx.doi.org/10.1037/0021-843X.102.1.82

Patterson, C. M., & Newman, J. P. (1993). Reflectivity and learning from aversive events: Toward a psychological mechanism for the syndromes of disinhibition. *Psychological Review*, *100*(4), 716–736. https://doi.org/10.1037/0033-295X.100.4.716

Pourtois, G., Schettino, A., & Vuilleumier, P. (2013). Brain mechanisms for emotional influences on perception and attention: What is magic and what is not. *Biological Psychology*, *92*(3), 492–512. https://doi.org/10.1016/j.biopsycho.2012.02.007

Poythress, N., Edens, J., & Lilienfeld, S. (1998). Criterion-based validity of the Psychopathic Personality Inventory in a prison sample. *Psychological Assessment*, *10*, 426–430. https://doi.org/10.1037/1040-3590.10.4.426

R. Blair, R. J. (2013). Psychopathy: Cognitive and neural dysfunction. *Dialogues in Clinical Neuroscience*, *15*(2), 181–190.

Ray, J. V., Poythress, N. G., Weir, J. M., & Rickelm, A. (2009). Relationships between psychopathy and impulsivity in the domain of self-reported personality features. *Personality and Individual Differences*, *46*(2), 83–87. https://doi.org/10.1016/j.paid.2008.09.005

Rothemund, Y., Ziegler, S., Hermann, C., Gruesser, S. M., Foell, J., Patrick, C. J., & Flor, H. (2012). Fear conditioning in psychopaths: Event-related potentials and peripheral measures. *Biological Psychology*, *90*(1), 50–59. https://doi.org/10.1016/j.biopsycho.2012.02.011

Salekin, R. T., Rogers, R., & Sewell, K. W. (1997). Construct validity of psychopathy in a female offender sample: A multitrait–multimethod evaluation. *Journal of Abnormal Psychology, 106*(4), 576–585. https://doi.org/10.1037/0021-843X.106.4.576

Salekin, R. T., Trobst, K. K., & Krioukova, M. (2001). Construct Validity of Psychopathy in a Community Sample: A Nomological Net Approach. *Journal of Personality Disorders*, *15*(5), 425–441. https://doi.org/10.1521/pedi.15.5.425.19196

Schmitt, W. A., & Newman, J. P. (1999). Are all psychopathic individuals low-anxious? *Journal of Abnormal Psychology*, *108*(2), 353–358. https://doi.org/10.1037/0021-843X.108.2.353

Seara-Cardoso, A., & Viding, E. (2015). Functional Neuroscience of Psychopathic Personality in Adults. *Journal of Personality*, *83*(6), 723–737. https://doi.org/10.1111/jopy.12113

Skeem, J., Johansson, P., Andershed, H., Kerr, M., & Louden, J. E. (2007). Two subtypes of psychopathic violent offenders that parallel primary and secondary variants. *Journal of Abnormal Psychology*, *116*(2), 395–409. https://doi.org/10.1037/0021-843X.116.2.395

Skeem, J. L., & Cauffman, E. (2003). Views of the downward extension: Comparing the Youth Version of the Psychopathy Checklist with the Youth Psychopathic traits Inventory. *Behavioral Sciences & the Law*, *21*(6), 737–770. https://doi.org/10.1002/bsl.563

Smith, S. F., & Lilienfeld, S. O. (2015). The response modulation hypothesis of psychopathy: A meta-analytic and narrative analysis. *Psychological Bulletin*, *141*(6), 1145–1177. http://dx.doi.org/10.1037/bul0000024

van Dongen, J. D. M., Drislane, L. E., Nijman, H., Soe-Agnie, S. E., & van Marle, H. J. C. (2017). Further Evidence for Reliability and Validity of the Triarchic Psychopathy Measure in a Forensic Sample and a Community Sample. *Journal of Psychopathology and Behavioral Assessment*, *39*(1), 58–66. https://doi.org/10.1007/s10862-016-9567-5

Vassileva, J., Kosson, D. S., Abramowitz, C., & Conrod, P. (2005). Psychopathy versus psychopathies in classifying criminal offenders. *Legal and Criminological Psychology*, *10*(1), 27–43. https://doi.org/10.1348/135532504X15376

Verkuil, B., Brosschot, J. F., Putman, P., & Thayer, J. F. (2009). Interacting effects of worry and anxiety on attentional disengagement from threat. *Behaviour Research and Therapy*, *47*(2), 146–152. https://doi.org/10.1016/j.brat.2008.11.003

Visser, B. A., Ashton, M. C., & Pozzebon, J. A. (2012). Is Low Anxiety Part of the Psychopathy Construct? *Journal of Personality*, *80*(3), 725–747. https://doi.org/10.1111/j.1467-6494.2011.00745.x

Viviani, R. (2013). Emotion regulation, attention to emotion, and the ventral attentional network. *Frontiers in Human Neuroscience*, *7*. https://doi.org/10.3389/fnhum.2013.00746

Vogt, J., De Houwer, J., Koster, E., Van Damme, S., & Crombez, G. (2009). Allocation of Spatial Attention to Emotional Stimuli Depends Upon Arousal and Not Valence. *Emotion (Washington, D.C.)*, *8*, 880–885. https://doi.org/10.1037/a0013981

Walsh, A. T., Carmel, D., Harper, D., Bolitho, P., & Grimshaw, G. M. (2021). Monetary and non-monetary rewards reduce attentional capture by emotional distractors. *Cognition and Emotion*, *35*(1), 1–14. https://doi.org/10.1080/02699931.2020.1802232

Walsh, A. T., Carmel, D., Harper, D., & Grimshaw, G. M. (2018). Motivation enhances control of positive and negative emotional distractions. *Psychonomic Bulletin & Review*, *25*(4), 1556–1562. https://doi.org/10.3758/s13423-017-1414-5

Willenbockel, V., Sadr, J., Fiset, D., Horne, G. O., Gosselin, F., & Tanaka, J. W. (2010). Controlling low-level image properties: The SHINE toolbox. *Behavior Research Methods*, *42*(3), 671–684. https://doi.org/10.3758/BRM.42.3.671

Wolf, R. C., Warren, C. M., Carpenter, R. W., Zeier, J. D., Baskin-Sommers, A. R., & Newman, J. P. (2012). Reduced Susceptibility to the Attentional Blink in Psychopathic offenders: Implications for the Attention Bottleneck Hypothesis. *Neuropsychology*, *26*(1), 102–109. https://doi.org/10.1037/a0026000

Yang, Y., Raine, A., Narr, K. L., Colletti, P., & Toga, A. W. (2009). Localization of Deformations Within the Amygdala in Individuals With Psychopathy. *Archives of General Psychiatry*, *66*(9), 986–994. https://doi.org/10.1001/archgenpsychiatry.2009.110

Yiend, J. (2010). The effects of emotion on attention: A review of attentional processing of emotional information. *Cognition and Emotion*, *24*(1), 3–47. https://doi.org/10.1080/02699930903205698

Yoon, J., & Knight, R. A. (2015). Emotional processing of individuals high in psychopathic traits. *Australian Journal of Psychology*, *67*(1), 29–37. https://doi.org/10.1111/ajpy.12063

Zeier, J. D., Maxwell, J. S., & Newman, J. P. (2009). Attention Moderates the Processing of Inhibitory Information in Primary Psychopathy. *Journal of Abnormal Psychology*, *118*(3), 554–563. https://doi.org/10.1037/a0016480

Appendix A

IAPS Images and Ratings

Appendix A.
Mean (SD) ratings for valence and arousal in each valence group for both Male and Female image sets. Image ratings taken from (Lang et al., 2008).

	Valence	Arousal
Image Number	Mean (SD)	Mean (SD)
Neutral	Female/Male	Female/Male
2026	4.85 (0.85)/ 4.77 (1.1)	3.38 (1.88)/ 3.43 (1.8)
2745.1	5.38 (1.22)/ 5.22 (0.89)	3.31 (1.95) /3.21 (1.97)
2102	5.13 (0.99)/ 5.19 (0.93)	2.92 (2.02) /3.12 (1.68)
2104	4.42 (1.84)	3.11 (1.09)
2221	4.33 (1.24)/ 4.47 (1.2)	3.05 (1.88) /3.11 (2.4)
2393	4.92 (1.05)/ 4.82 (1.08)	2.95 (1.95) /2.9 (1.8)
2411	5.06 (0.89)/ 5.1 (0.8)	2.96 (1.9) /2.71 (1.74)
2512	4.78 (0.94)/ 4.96 (0.71)	3.29 (1.94) / 3.63 (1.5)
2595	4.97 (1.31)/ 4.79 (1.15)	3.65 (1.89) / 3.8 (1.88)
2840	4.9 (1.23)/ 4.92 (0.89)	2.55 (1.76) / 2.31 (1.88)
2870	5.31 (1.41)	3.01 (1.72)
2890	4.95 (1.09)	2.95 (2.17)
Negative (Female)		
3015	1.34 (0.71)	6.11 (2.87)
3030	1.51 (1.07)	7.13 (1.88)
3059	1.47 (0.95)	6.5 (2.52)
3103	1.71 (1.02)	6.6 (2.07)
3131	1.4 (0.84)	6.62 (2.3)
3140	1.5 (0.97)	6.94 (1.68)
3150	1.98 (1.54)	6.94 (2.07)
3195	1.79 (1.06)	6.42 (2.53)
9253	1.92 (1.34)	6.62 (1.9)
9405	1.6 (0.99)	5.65 (2.58)
9420	1.59 (1.02)	6.77 (2.22)
3550.1	1.87 (1.54)	6.1 (2.37)
Negative (Male)		
3000	1.69 (1.47)	6.74 (2.37)
3015	1.83(1.19)	5.54 (2.74)
3053	1.5(1.16)	6.2 (2.71)
3060	1.94(1.39)	6.89 (2.08)
3069	2.1(1.66)	6.7 (2.6)
3071	2.06(1.59)	6.6 (2.13)
3080	1.63(1.11)	6.84 (2.06)
3100	1.88(1.14)	5.88 (2.34)
3120	1.8(1.32)	6.2 (2.55)
3130	1.9(1.57)	6.56 (2.11)

3131	1.68(1.12)	6.61 (2.42)
9410	1.96(1.56)	6.38 (2.26)
Positive (Female)		
4658	6.08 (2.05)	6.16 (2.17)
4659	6.15 (2.01)	6.47 (2.18)
4660	7.22 (1.4)	6.31 (1.95)
4668	6.31 (1.7)	6.85 (1.65)
4680	6.91 (1.92)	6.07 (2.26)
4690	6.43 (1.84)	5.79 (2.17)
4693	5.63 (1.91)	6.56 (1.76)
4694	6.22 (1.69)	5.99 (2.09)
4695	6.38 (1.55)	6.25 (2.04)
4697	5.58 (1.73)	6.28 (1.79)
4698	6.38 (1.56)	6.58 (1.79)
4800	5.45 (2.28)	6.39 (1.91)
Positive (Male)		
4645	6.56 (1.46)	5.56 (1.88)
4650	6.98 (1.46)	5.56 (1.88)
4653	7.1 (1.27)	5.98 (1.97)
4658	7.35 (1.37)	6.89 (2.06)
4660	7.63 (1.3)	6.92 (1.74)
4666	6.87 (1.38)	6.48 (2.12)
4669	6.84 (1.93)	6.44 (2.43)
4680	7.73 (1.61)	5.94 (2.3)
4690	7.42 (1.96)	6.46 (2.22)
4692	7 (1.66)	6.85 (2.15)
4693	6.92 (1.66)	6.58 (2.11)
4698	6.71 (1.87)	7 (1.55)

Appendix B

Assumption checks for Response Time analyses

All analyses for assumption check scripts are available on OSF (osf.io/gu7ae). Response Time (RT) was used as our main dependent measure for our analyses. Untransformed RTs did not meet all assumptions for the current studies analyses. The Shapiro-Wilk confirmed data were not normal, $W(249) = 0.94$, $p < .001$ Therefore, the data were transformed to meet these assumptions. Figure B1 shows the Q-Q plots of RT before the transformation.

Figure B1.

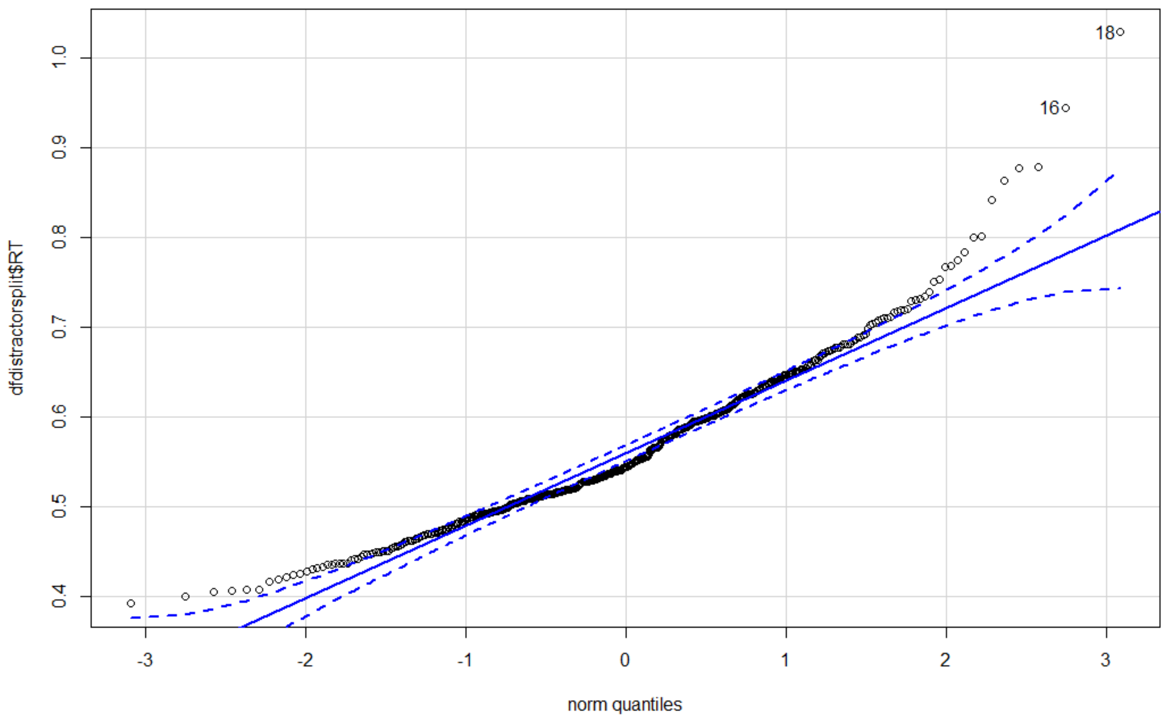

Figure B1. displays the Q-Q plot of RT on a normal distribution. RT values are presented on the x-axis against quantiles in a normal distribution. The solid blue line represents perfect normal and the dotted blue line indicates the acceptable bounds of the normal distribution.

As the assumption of normality is not met by RT, we transformed the data to meet the normality assumption. A logarithmic transformation was made to the data so that it could fit the normal distribution. We also excluded an outlier participant recommended by the Q-Q plot. Figure B2. shows the Q-Q plot of logarithmic RTs with removed data.

Figure B2.

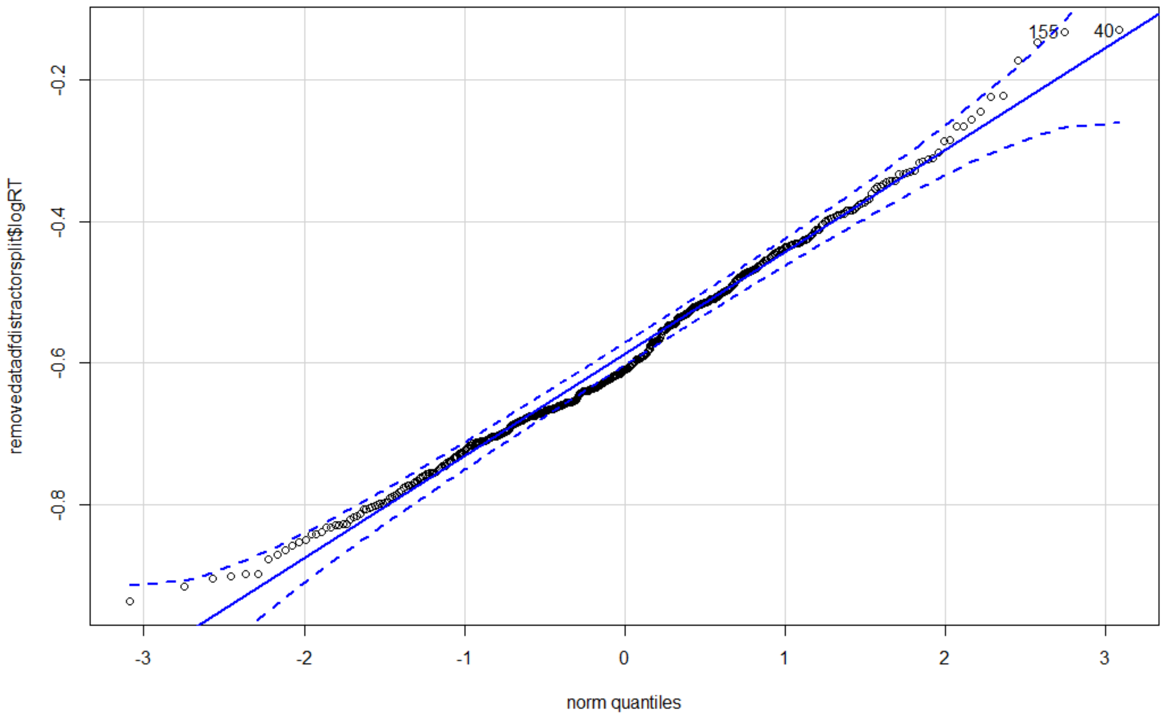

Figure B2. displays the Q-Q plot of logarithmic RT on a normal distribution. logarithmic RT values are presented on the x-axis against quantiles in a normal distribution. The solid blue line represents perfect normal and the dotted blue line indicates the acceptable bounds of the normal distribution. We excluded values that were previously noted by the Q-Q plot as being outside the normal distribution.

The transformation improved the fit of the model so that most data fit inside the acceptable bounds of the normal distribution. This model met all assumptions. When the data were split by each condition however, there were some individual conditions that did not meet the assumption of normality. Conditions that were non-normal after transformation were Negative, Distractor-Absent in the Low group (p = .007), Negative, Distractor-Present in the Low group (p = .024), Neutral, Distractor-Absent in the Intermediate group (p = .026), Neutral, Distractor-Absent in the Low group (p = .021), Neutral, Distractor-Present in the

Intermediate group (p = .016) and Positive, Distractor-Present in the Intermediate group (p = .046). Figure B3. Shows the Q-Q plots for each condition across all groups.

Figure B3.

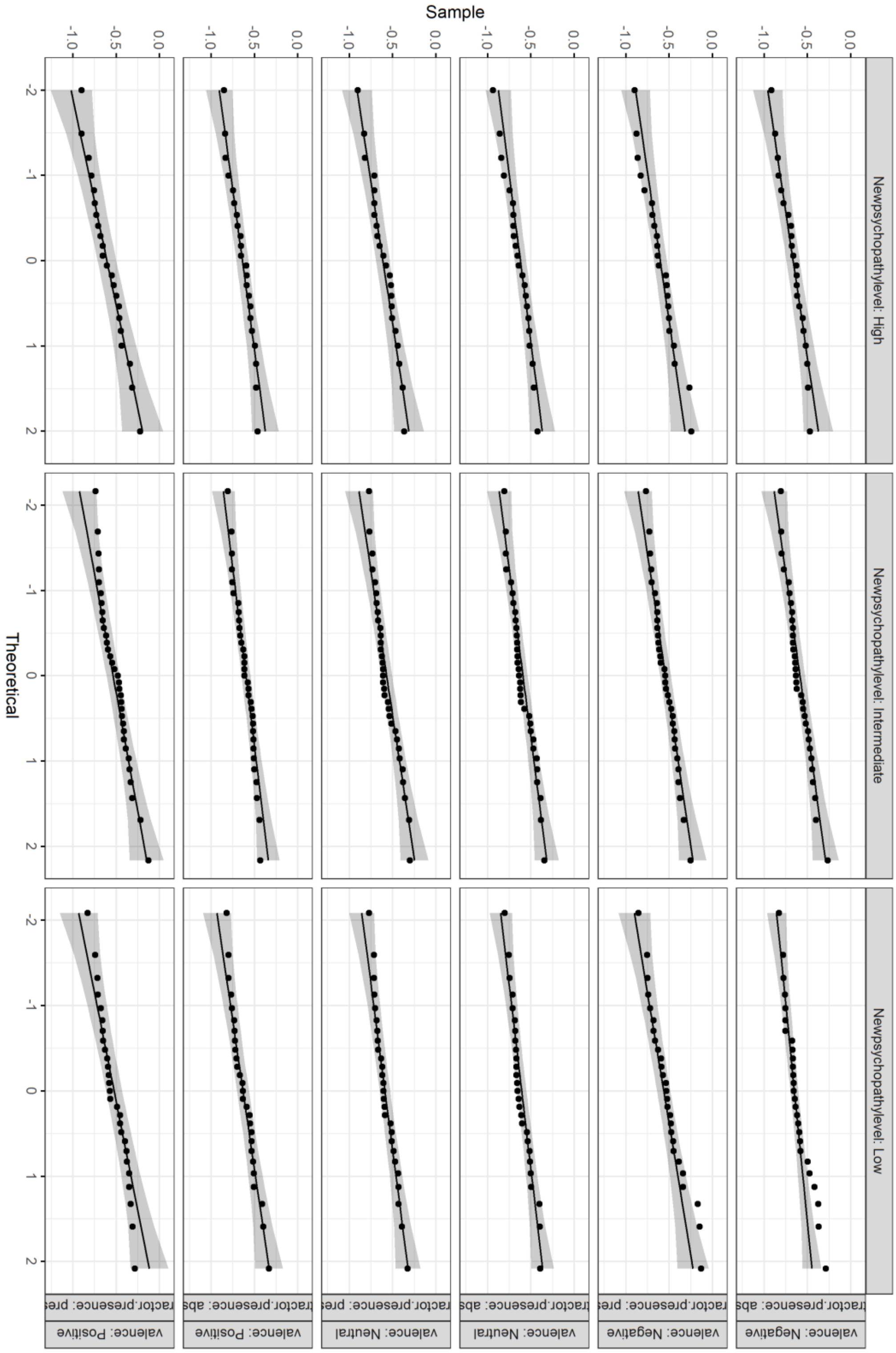

Figure B3. Displays the Q-Q plot of logarithmic RT on a normal distribution. Logarithmic RT values are presented on the x-axis against quantiles in a normal distribution. The grey area around the line of normality indicates the acceptable bounds of the normal distribution.

Altogether the results call for some caution in interpreting the results but there were at least 17 participants for each group and at least 28 participants for the conditions that did not meet normality. There is then at least some assurance the results of the analyses are interpretable.

We ran the dimensional analyses using the logarithmic transformed RTs. To examine whether differences existed between the analyses using it and the non-transformed data. Presented below are the same analyses as seen in the results section but using LogRT as the dependent variable Table B1 shows the Hierarchical regression with LogRT scores. And Table B2 shows the linear mixed model.

Table B1.

Hierarchical Regression results using overall LogRT as the criterion

Predictor	*b*	*b* 95% CI [LL, UL]	Fit	Difference
Neutral LogRT	1.61**	[1.25, 1.98]		
			R^2 = .487**	
Neutral LogRT	1.57**	[1.22, 1.92]		
PPI_FD	-0.01**	[-0.01, -0.00]		
PPI_SCI	-0.00	[-0.01, 0.00]		
			R^2 = .542**	ΔR^2 = .056*
Neutral LogRT	1.57**	[1.22, 1.93]		
PPI_FD	-0.01	[-0.03, 0.02]		
PPI_SCI	0.00	[-0.02, 0.03]		
FD × SCI	-0.00	[-0.00, 0.00]		
			R^2 = .543**	ΔR^2 = .000

Note. *b* represents unstandardized regression weights. *LL* and *UL* indicate the lower and upper limits of a confidence interval, respectively. R^2 represents variance explained and ΔR^2

represents the increase in variance explained from the previous model.
* indicates $p < .05$, ** indicates $p < .01$.

Table B2.

Linear Mixed Effect Model using LogRT as the criterion

		LogRT	
Predictors	*Estimates*	*CI*	*p*
Neutral vs Negative	0.28	0.11 – 0.46	**.001**
Neutral vs Positive	0.25	0.07 – 0.42	**.005**
Positive vs Negative	0.04	-0.14 – 0.21	.669
PPI_FD x Neutral	-0.00	-0.01 – 0.00	.480
PPI_FD x Negative	-0.01	-0.01 – -0.00	**.004**
PPI_FD x Positive	-0.01	-0.01 – -0.00	**.015**
PPI-FD × Neutral vs Negative	-0.01	-0.01 – -0.00	**.004**
PPI-FD × Neutral vs Positive	-0.01	-0.01 – -0.00	**.024**
PPI_FD x Negative vs Positive	0.00	-0.00 – 0.01	.556
Random Effects			
σ^2	0.01		
τ_{00}	0.02		
ICC	0.71		
N	83		
Observations	249		
Marginal R^2 / Conditional R^2	0.070 / 0.732		

Note. b represents unstandardized regression weights. *LL* and *UL* indicate the lower and upper limits of a confidence interval, respectively. σ^2 represent the total variance in the model and τ_{00} represents the between-subject variance in the model. The ICC represents the Intraclass Correlation Coefficient. The marginal R-squared considers only the variance of the fixed effects, while the conditional R-squared takes both the fixed and random effects into account.

The results we obtained using transformed RT scores did not differ from the non-transformed RT scores. Both LogRT and DI show the same pattern of results as presented in the results section. Therefore, we used DI in our analyses so that the results are more easily interpretable.