DEFICITS IN EMOTION RECOGNITION: AN EYE-TRACKING INVESTIGATION

A Thesis

by

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ABSTRACT

Historical conceptualizations of psychopathic personality emphasized affective deficits as characteristic of the disorder. Contemporary research reports deficits in facial emotion recognition, with particularly strong effects for recognition of fearful faces. Researchers have proposed a number of theories to explain the interaction between psychopathic traits and emotion processing deficits. The response modulation hypothesis emphasizes deficits in shifting attention from goal-directed behavior, whereas the Integrated Emotions System model emphasizes deficits in moral socialization due to abnormalities in fear processing. The current research investigated whether individuals elevated in psychopathic traits displayed deficits in recognizing emotion overall, deficits specific to fear recognition, and/or deficits in attention to fearful faces. A sample of 110 undergraduate students completed the Triarchic Psychopathy Measure, a facial emotion recognition task, and a visual dot probe task. Participants relatively elevated in psychopathic traits also completed an attentional retraining task to determine if their attention could be directed to fearful faces. Finally, an ASL Eye-Trac 6 eye-tracker was used to investigate whether gaze fixations on the eyes or the mouth of an emotional face were associated with deficits in emotion processing. Accuracy of emotion identification was recorded for each participant. Additionally, a facilitation index was calculated for the dot probe task to measure attentional orientating to emotional stimuli.

Contrary to hypotheses, individuals elevated in psychopathic traits did not display overall deficits in identification of emotional faces overall or for fear faces specifically. Results indicated that individuals elevated in psychopathic traits displayed deficits in identifying disgusted faces. As hypothesized, reduced response time to fearful faces in the dot probe task was associated with elevations in psychopathic traits. However, the attentional retraining task did not increase attention to fearful faces. Finally, deficits in emotion recognition and emotional attention were not associated with eye gaze. The results suggest that psychopathy may not be universally associated with emotion recognition performance. Instead, deficient emotion processing in psychopathic individuals may be due to attentional deficits rather than inability to identify emotional facial expressions. Interpretations of these results are limited by small sample size and the use of an undergraduate student sample.

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1. INTRODUCTION

Psychopathy is a personality disorder consisting of a combination of behavioral and personality traits, such as deceitfulness, charm, insufficiently motivated antisocial behavior, and dysfunctional emotional responding (Cleckley, 1941). It has long been a challenging subject in both psychiatric and forensic settings (Cleckley, 1941; Hare, 1993). Offenders diagnosed as psychopathic commit a disproportionate amount of violent crime, are a difficult population to treat, and researchers continue to debate the scope, measurement, and definition of the disorder (Patrick, Fowles, & Krueger, 2009).

Scores from the most widely researched psychopathy assessment instrument, the Psychopathy Checklist-Revised (PCL-R; Hare, 1991/2003), have been reliably associated with adverse outcomes for society, with high-scoring individuals committing particularly violent and instrumental forms of aggression and crime (Hare, 1998; Reidy, Kearns, & DeGue, 2013; Reidy, Shelley-Tremblay, & Lilienfeld, 2011). PCL-R-defined psychopathic individuals can be difficult to manage in institutional settings, creating a pressing problem even when such individuals are incarcerated (Guy, Edens, Anthony, & Douglas, 2005). Although exact statistics are difficult to quantify, PCL-R-defined psychopaths are alleged to commit between 30-50% of all violent crimes (Hare, 1999; Reidy et al., 2011) with an estimated cost to society of at least $250 billion annually (Anderson, 1999; Kiehl & Hoffman, 2011). Recent research has also examined the possible impact of so-called “successful” psychopaths in the workplace, or psychopathic individuals committing white-collar crime (Babiak, Neumann, & Hare, 2010; Ragatz & Fremouw, 2012; S. F. Smith & Lilienfeld, 2013).

Due to its high societal and monetary costs, psychopathy remains an urgent target for research. Yet, despite decades of research, debate continues as to the relevance of different behavioral, personality, and interpersonal traits to psychopathic personality. Central to this debate is whether criminal behavior is central to the construct or simply correlated with psychopathy (Skeem & Cooke, 2010a). Tendencies to engage in antisocial behavior, and particularly criminal behavior, are considered by many to be central to the construct due to strong associations between criminal behavior and psychopathy when operationalized by the PCL-R (Hare, 1991/2003). As a result, some discredit other measures and theories of the disorder when these newer models fail to strongly correlate with criminal behavior (Skeem & Cooke, 2010b).

Despite such claims, psychopathy is arguably associated with criminal behavior because many of the items comprising the PCL-R (e.g., criminal versatility, juvenile delinquency, failure on conditional release) are in fact quantifications of overt criminal behaviors (rather than personality traits), resulting in criterion contamination and reification of non-specific ‘bad conduct’ as a core part of the syndrome (Skeem & Cooke, 2010a). Skeem and Cooke (2010a) warn against the reification of the PCL-R and equating the measure with the construct itself. Although many conceptualizations of psychopathy emphasize antisocial behavior, other theories emphasize to a greater degree personality traits associated with the disorder. In particular, emotional detachment or dysfunction is considered central to psychopathy by many classic (Cleckley, 1976; Lykken, 1957) and modern (Lilienfeld et al., 2012; Patrick et al., 2009) conceptualizations of the construct.

Emotional dysfunction in particular may result in antisocial behavior in a variety of ways (Herpertz & Sass, 2000). Moral behavior is theorized to require being able to experience feelings evoked by reward and punishment (Dolan, 1999). Emotional detachment prevents experiencing the affective states of others, which in normal individuals is assumed to inhibit antisocial behavior (Dolan, 1999; Herpertz & Sass, 2000; Raine, 1993). Additionally, poor conditioning may lead to failure to consider the consequences of one's actions. Deficient emotional learning, such as poor conditioning, is associated with poor development of the conscience (Raine, 1993).

The purpose of this research is to clarify the relevance of emotional dysfunction, specifically deficient fear recognition, to psychopathic personality. The paper begins with a discussion of historical and current conceptualizations of the disorder, as well as theories concerning the development of psychopathy. Next, the paper examines research findings regarding attentional and emotional dysfunction in psychopathic individuals, including the relevance of fear to the construct. Finally, the review concludes with an examination of the Triarchic conceptualization of psychopathy (Patrick et al., 2009) and methods proposed by this model for examining the relationship between fearlessness and psychopathy.

1.1 PSYCHOPATHY

Psychopathic individuals typically are defined by a combination of interpersonal, affective, and behavioral traits. Behaviorally, psychopathic individuals may be impulsive, sensation seeking, and have low frustration tolerance, which may result in antisocial behavior such as violence and crime. Interpersonally, psychopathic individuals are callous, selfish, superficial, charming, and manipulative. In the affective domain, psychopathic individuals display fearlessness, emotional detachment, and lack of empathy and remorse.

The modern construct of psychopathy is most often operationalized by the traits measured by the PCL-R (Hare, 2003). The PCL-R contains items that tap interpersonal, affective, impulsive, and antisocial behavior features of psychopathy. Factor analyses of the PCL-R historically identified two factors (Hare et al., 1990; Harpur, Hakstian, & Hare, 1988; Harpur, Hare, & Hakstian, 1989). Factor 1 encompasses the interpersonal and affective traits of psychopathy whereas Factor 2 encompasses antisocial deviance. A more recent factor model divides the measure into four factors (Hare & Neumann, 2006). Factor 1 consists of the two facets of affective (callousness, shallow affect) and interpersonal (charm, deceitfulness, manipulation) traits, whereas Factor 2 consists of an “impulsive-irresponsible” factor in addition to the antisocial factor that includes items tapping aggressiveness, juvenile delinquency, and criminal versatility. Factor 1 correlates positively with social dominance, narcissism, and exploitativeness and negatively with depression, fearfulness, and anxiety. Factor 2 correlates positively with aggression, impulsivity, sensation seeking, frequency and severity of criminal offending, and drug and alcohol abuse.

Due to the popularity of the PCL-R, most studies define groups as non-psychopaths or psychopaths based on a score on the PCL-R of below 20 or above 30, respectively; studies that present a middle or “mixed” psychopathy group include individuals scoring between 20 and 30. Additionally, due to the necessity of file information to score the PCL-R and the number of items measuring antisocial and criminal behavior, most studies use offender populations. Unless otherwise stated, studies cited in this review compared psychopathic offenders with controls using the Psychopathy Checklist (Hare, 1980) and its derivatives.

Psychopathy is a personality disorder with evidence of developmentally similar traits in child and adolescent age ranges, such as callous-unemotionality observed in children and adolescents (Frick, Ray, Thornton, & Kahn, 2013; Frick, Stickle, Dandreaux, Farrell, & Kimonis, 2005). Though many conceptualizations of psychopathy place an emphasis on antisocial behavior (Hare, 2006; McCord & McCord, 1964), several models consider emotional deficits to play a central causal role in the development of the disorder (Blair, Mitchell, & Blair, 2005; Lykken, 1995; Patrick, 1994; Patrick et al., 2009).

Cleckley’s (1941) seminal work “The Mask of Sanity” presented one of the first and most influential modern descriptions of psychopathic personality. Cleckley described psychopathic individuals as superficially appearing to be well-adjusted and normal members of society, with serious interpersonal difficulties but otherwise lacking in distress or apparent mental illness. He described the inability of psychopathic individuals to experience emotions as a form of “semantic aphasia.” Other historical conceptualizations of the disorder also emphasized the relationship between lack of affect – specifically negative affect – and the development of psychopathy. For example, Karpman differentiated between primary and secondary psychopathy; primary psychopaths are low in anxiety and thought to develop the disorder due to deficient negative affect, whereas secondary psychopaths experience negative affect and are thought to acquire psychopathy due to environmental factors such as poor upbringing (Karpman, 1941). Hare (1968) proposed that a lack of negative emotion in response to punishment leads to the development of psychopathic behavior, as these individuals lack motivation to avoid risks.

Similarly, some developmental perspectives propose that an inability to experience negative emotions in response to others’ distress may lead to the development of psychopathic personality. Specifically, Blair (1995) proposes the Violence Inhibition Mechanism (VIM), a cognitive model of moral development and socialization . The VIM was described as an early developing system that generates emotionally aversive reactions when activated by distress cues (Blair, 2005). As a result, individuals learn to avoid causing distress in others to prevent an aversive response; even the thought of causing pain is aversive. The VIM hypothesis proposes that this deficient moral socialization impairs the ability of psychopathic individuals to experience empathy. Another proposed mechanism in the development of psychopathy is the response modulation (RM) hypothesis (Newman, 1998; Patterson & Newman, 1993). The RM hypothesis is an attention-based model that proposes that impulsivity, poor avoidance learning, and emotion processing deficits emerge from an inability to shift attention from goal-directed behavior to peripheral information (Lorenz & Newman, 2002). Both of these hypotheses concerning the development of psychopathy are partially supported by research investigating the relationship between attention, emotion, and psychopathy.

1.2 ATTENTION, EMOTION, AND PSYCHOPATHY

Attention and Emotion

Attention is the process by which stimuli are selected for processing (Blair & Mitchell, 2009). Stimulus selection is influenced by both top-down and bottom-up processing. Multiple stimuli are processed in a mutually inhibitory manner, in which a gain in activity in neurons representing one stimulus occurs at the cost of activity for another (Desimone & Duncan, 1995). This theory of attention is known as the biased competition model (Duncan, 1998). Bottom-up and top-down processes influence which stimuli "win" this competition for attention. Bottom-up processes are biased towards visually salient objects, such as objects that are moving or bright. In contrast, top-down processes occur as a function of task demands, such as searching for an object of a particular color. Bias as a result of task demands may result in stimuli that are not visually salient "winning" the competition for attention (Blair & Mitchell, 2009).

Emotional attention is a form of processing bias in which emotional representations in the temporal cortex are enhanced by input from the amygdala (Pessoa & Ungerleider, 2004). Emotional stimuli are aversive or appetitive unconditioned and conditioned stimuli. Conditioning involves the interaction between the temporal cortex and the amygdala, such that stimuli that are associated with valence information activate the amygdala (LeDoux, 1998). Reciprocal activation between the temporal cortex and amygdala means that when emotional stimuli are a distracter to stimuli relevant to task performance, interference from this stimulus will be greater than if the stimuli were neutral, an assertion that is supported by the emotional attention research literature (K. S. Blair et al., 2007; Erthal et al., 2005; Vuilleumier, Armony, Driver, & Dolan, 2001). In contrast, emotional stimuli will enhance performance when the stimulus is relevant to task demands, as demonstrated by research with emotional lexical decision paradigms (Lorenz & Newman, 2002). Some researchers have proposed that amygdala activation from emotions such as fear is automatic (Dolan & Vuilleumier, 2003). However, several studies show that amygdala activation due to fear and other emotions can be altered by attentional manipulations (Mitchell et al., 2007; Pessoa, 2005; Pessoa, McKenna, Gutierrez, & Ungerleider, 2002).

Decreased emotional responsiveness has been consistently observed in psychopathic populations (Patrick, Bradley, & Lang, 1993), including decreased responsiveness to punishment (Schmauk, 1970; Siegel, 1978). The most common finding in the literature is that psychopathic individuals show deficient avoidance learning (Blair, 2005; R.J.R. Blair et al., 2004; Flor, Birbaumer, Hermann, Ziegler, & Patrick, 2002; Newman & Schmitt, 1998). Changing behavior in response to aversive consequences is challenging for psychopathic individuals, particularly when in scenarios where a reward is being lost (Newman, Widom, & Nathan, 1985). Psychopathy is associated with lowered autonomic response to aversive stimuli in both psychopathic offenders (Hare, 1968; Hare & Quinn, 1971; Lorber, 2004; Patrick, Cuthbert, & Lang, 1994) and adolescents (Fung et al., 2005) classified using the Child Psychopathy Scale (CPS; Lynam, 1997). Additionally, psychopathic personality is inversely related to self-reported reactions of shame and guilt (Mullins-Nelson, Salekin, & Leistico, 2006). The inability to learn from aversive conditioning or experience punishment is generally known as the fear dysfunction model (Blair, 2005). These observed deficits in emotional responsiveness might be a result of dysfunctional emotional attention; however, it is unclear whether the deficits are due to overall dysfunctions in shifting attention or specific to emotional attention.

Research testing the RM hypothesis supplies some evidence that psychopathy is associated with deficient emotional attention. For example, psychopathic individuals show less interference in Stroop tasks (Hiatt, Schmitt, & Newman, 2004; Newman, Schmitt, & Voss, 1997) and are less quick to respond to emotional high-frequency words than neutral low-frequency words in lexical decision tasks (Lorenz & Newman, 2002). In non-psychopathic individuals, emotional words are more easily recognizable as words and therefore individuals respond more quickly. However, the assertion of the RM hypothesis that psychopathic individuals have inherent difficulty in shifting attention to nondominant cues is contradicted by some research findings (Blair & Mitchell, 2009). Psychopathic offenders (LaPierre, Braun, & Hodgins, 1995; Mitchell, Colledge, Leonard, & Blair, 2002) and adolescents classified using the Antisocial Process Screening Device (APSD; Frick & Hare, 2001) are unimpaired in shifting attention in set shifting tasks, such as the Wisconsin Card-Sorting Task (R.J.R. Blair, Colledge, & Mitchell, 2001). Additionally, executive attention is not dysfunctional and may even be enhanced in psychopathic offenders (Hiatt et al., 2004; Newman et al., 1997) and students classified with the Psychopathy Personality Inventory-Revised (PPI-R; Lilienfeld & Widows, 2005) subscales (Dvorak-Bertsch, Curtin, Rubenstein, & Newman, 2009). Research demonstrating deficient passive avoidance learning in psychopathic individuals supports deficient stimulus-reinforcement learning, such as the reciprocal relationship between the temporal cortex and the amygdala during conditioning implicated in emotional attention, rather than overall deficient attentional mechanisms (Blair & Mitchell, 2009).

If psychopathy is the result of deficient emotional attention then psychopathic individuals should display less interference from emotional stimuli. Indeed, although normal individuals show interference on motor tasks from positive or negative rather than neutral stimuli, psychopathic individuals show no significant interference due to these emotional distracters (Mitchell, Richell, Leonard, & Blair, 2006). Additionally, psychopathic individuals do not display reduced recall for peripheral information when presented with emotional images (Christianson et al., 1996). Other research supports the VIM hypothesis that psychopathic individuals do not experience distress in response to others' pain. For example, psychopathic offenders (Aniskiewicz, 1979; House & Lloyd Milligan, 1976) and children measured by the APSD (Blair, 1999) have shown reduced autonomic responses to displays of distress in others and do not show the expected augmented startle response when primed with victimization scenes (Levenston, Patrick, Bradley, & Lang, 2000). More recent research suggests that top-down attention modulates amygdala activation in psychopathy (Larson et al., 2013). Decreased amygdala activity was found in psychopathic offenders only when their attention had been previously engaged in an alternative goal-relevant task prior to the threat-relevant information; when focus was on the threat, amygdala activation did not differ between psychopaths and non-psychopaths (Larson et al., 2013). Overall, the research evidence supports the hypothesis that deficient emotional attention, and therefore possible dysfunction in the amygdala, is associated with impaired emotional responsiveness in psychopathic individuals.

Psychopathy and Fear

As noted above, early clinical conceptualizations of psychopathy referenced a negative relationship between psychopathy and fear. Karpman (1941) noted that primary psychopaths did not experience negative affect, and Cleckley (1976) wrote, "he appears almost as incapable of anxiety as of profound remorse" (Cleckley, 1976, pg. 340). Lykken proposed that fearlessness is the core trait out of which the full condition of psychopathy arises (Lykken, 1957). Even McCord and McCord, who viewed psychopathy as more centrally related to antisocial behavior, commented that psychopathic individuals experience little anxiety or worry (McCord & McCord, 1964). These clinical descriptions are supported by research evidence implicating amygdala dysfunction and malfunctioning fear systems in psychopathy.

The amygdala is involved in learning and aversive conditioning, as well as responses to fearful and sad faces (Blair, Morris, Frith, Perrett, & Dolan, 1999; LeDoux, 1998). Blair (2003) proposed that impaired socialization processes, namely aversive conditioning and instrumental learning, are associated with the pathology of psychopathy, and that these impaired processes result from damaged fear systems in the brain, particularly amygdala dysfunction. Fear systems in the brain are involved in aversive conditioning, autonomic responses to threat, startle reflex from visual threat primes, and passive avoidance learning, all areas of demonstrated deficits in psychopathic individuals (Flor et al., 2002; Hare, 1982; Levenston et al., 2000; Lykken, 1957; Mitchell et al., 2002; Newman & Kosson, 1986; Newman, Patterson, & Kosson, 1987; Ogloff & Wong, 1990). Additionally, neuroimaging studies provide evidence for amygdala dysfunction in psychopathy (Ermer, Cope, Nyalakanti, Calhoun, & Kiehl, 2012; Kiehl, 2006; Kiehl et al., 2001; Motzkin, Newman, Kiehl, & Koenigs, 2011; Tiihonen et al., 2000). Psychopathic individuals display a reduced amygdala response when processing words of negative valence in PCL-R high scoring versus low scoring individuals and present with reduced amygdala activation during emotional memory and aversive conditioning tasks (Kiehl et al., 2001; Veit et al., 2002).

As stated in the VIM hypothesis, distress recognition deficits are another proposed theory for the relevance of fearlessness to psychopathy (Blair et al., 2002). Psychopathy is associated with poorer facial affect recognition, including failure to react in the presence of a fearful face (Iria & Barbosa, 2009). Several studies report that children and adults who are high in psychopathic traits are impaired in naming sad and, particularly, fearful facial expressions and vocal tones (Colledge, Murray, & Mitchell, 2001; R.J.R. Blair et al., 2002; Hastings, Tangney, & Stuewig, 2008; Stevens, Charman,

& Blair, 2001). Children with psychopathic traits as measured by the APSD and the Strengths and Difficulties Questionnaire (Goodman, 1999) are also impaired in recognizing fearful facial expressions, a deficit associated with their lack of attention to the eyes of the stimulus (Dadds, Masry, Wimalaweera, & Guastella, 2008; Dadds et al., 2006). A meta-analysis of affect recognition in antisocial populations reported that these individuals display a consistent deficit in recognizing expressions of fear and sadness with the strongest effects for lack of recognition of fear; furthermore, this deficit in identifying fear could not be explained by task difficulty (Marsh & Blair, 2008).

However, some studies have failed to find a significant difference in facial emotion recognition. For example, PCL-R Factor 1 elevated inmates did not differ from non-psychopathic offenders in facial emotion recognition (Glass & Newman, 2006). More research evidence is needed to determine whether psychopathic individuals consistently differ from non-psychopathic populations in their recognition of fearful affect. Furthermore, it is of yet unclear whether these research findings result from performance deficits or an underlying inability, though some results suggest that there is not a lack of capacity to identify fearful affect (Dadds et al., 2006). Evidence of improved affect recognition in psychopathic individuals would suggest that they do not lack the capacity altogether.

A neuroscience model, the Integrated Emotions System (IES) model, is an integration of the VIM and fear dysfunction positions (Blair, 2005). The position of the IES is not that the amygdala itself is dysfunctional in psychopathic individuals; rather, that some functional tasks (such as aversive conditioning) that require the amygdala are impaired in these individuals. As stated by the author, the IES "predicts that individuals with psychopathy should present with impairment on any task reliant on the amygdala's role in the formation of stimulus–reinforcement associations" (Blair, 2005, pg. 877). The amygdala deficits impair psychopathic individual's ability to form stimulus-punishment associations, which interferes with moral socialization. As a result, individuals may not learn to associate antisocial behavior with aversive responses and may be more likely to engage in antisocial behavior to achieve their goals. This theory is consistent with models of psychopathy that stress the importance of the amygdala and emotion in the formation of psychopathy (Kiehl, 2006; Lykken, 1995; Patrick, 1994). Similarly, recent examinations of the response modulation hypothesis suggest that deficient attention shifting may produce or affect the observed amygdala deficits, resulting in lack of attention to affective cues and deficient aversive learning (Larson et al., 2013; Newman & Baskin-Sommers, 2011). Evidence for this hypothesis includes that psychopathic individuals show a normal fear-potentiated startle response when explicitly attending to threat cues, and that the diminished fear-potentiated startle responses in psychopaths compared to non-psychopaths is observed when attention was already engaged by another task (Baskin-Sommers, Curtin, & Newman, 2011; Newman, Curtin, Bertsch, & Baskin-Sommers, 2010). Therefore, training psychopathic individuals to attend to non-relevant affective cues could in theory result in observable changes in their behavior.

In addition to neuroscientific evidence supporting the relevance of fear to psychopathy, trait fear is also consistently associated with psychopathy in assessment measures. PCL-R Factor 1 is negatively associated with anxiety, and research using the

PCL-R has identified an emotionally stable subtype of psychopathic offenders with low trait anxiety and high positive emotionality (Harpur et al., 1989; Hicks, Markon, Patrick, Krueger, & Newman, 2004).

The Psychopathic Personality Inventory (PPI; Lilienfeld & Andrews, 1996) was created to measure psychopathic traits in community samples, in contrast to the offender samples of the PCL-R. Factor analyses of the PPI reveal two factors, fearless dominance (PPI-FD) and self-centered impulsivity (PPI-SCI; Benning, Patrick, Hicks, Blonigen, & Krueger, 2003). PPI-SCI is composed of subscales measuring impulsive nonconformity, blame externalization, egocentricity, and carefree nonplanfulness. Fearless dominance is composed of the subscales social potency, stress immunity, and fearlessness. PPI-FD is related to reduced processing of fearful facial expressions and diminished physiological reactivity to threat (Lilienfeld et al., 2012). High scores on PPI-FD are associated with positive psychological and social adjustment as well as with narcissism, thrill seeking, and low empathy. In contrast, PPI-SCI generally reflects the relationships of PCL-R Factor 2, with positive associations with impulsivity, aggressiveness, antisocial behavior, drug and alcohol problems, and negative affect (Benning et al., 2003; Benning, Patrick, Salekin, & Leistico, 2005; Blonigen et al., 2005; Patrick, Edens, Poythress, & Lilienfeld, 2006). Fearlessness is correlated positively with positive emotionality and negatively with negative emotionality, and is positively associated with adaptive factors such as stress immunity (Marcus, Fulton, & Edens, 2013).

Researchers continue to debate the relevance of PPI-FD, and in turn, fearlessness, to the psychopathy construct (Lilienfeld et al., 2012; Marcus et al., 2013; J.

D. Miller & Lynam, 2012). Some consider PPI-FD to represent the "mask of sanity" described by Cleckley, because it reflects a quasi-adaptive collection of traits that, in isolation, appear to have little relationship with dysfunction. Others view the adaptive qualities of fearlessness to be separate from the construct of psychopathy because of the small convergent correlations exhibited by PPI-FD and other psychopathy measures, as well as whether the external correlates of PPI-FD fit conceptually with the psychopathy construct as measured by other methods (Miller & Lynam, 2012). Comparisons of the factors of the PPI and the PCL-R show only modest correspondence, with PPI-FD only modestly correlated with the interpersonal component of the PCL-R (Benning, Patrick, Blonigen, Hicks, & Iacono, 2005). Additionally, while PPI-SCI shows correlations with aggressive behavior, PPI-FD does not correlate with aggression (J. D. Miller & Lynam, 2012). A meta-analysis of the nomological network of the PPI-R claimed to find good support for the validity of the PPI total and SCI scores, but weak support for PPI-FD; additionally, PPI-FD is uncorrelated with PPI-SCI and only minimally correlated with the PCL-R factors (J. D. Miller & Lynam, 2012).

Despite these claims, a considerable body of research supports the relevance of PPI-FD to the construct of psychopathy, and the external correlations of PPI-FD are consistent with Cleckley's classic description of psychopathy (Lilienfeld et al., 2012). More recently, it has been proposed that fearlessness may lead to the development of psychopathy in combination with other personality characteristics, such as impulsivity and coldheartedness; while fearlessness may be an adaptive trait on its own, it is the combination of fearlessness with other, more maladaptive, traits that result in a prototypically psychopathic personality pattern (Lilienfeld et al., 2012; Marcus et al., 2013). Supporting this proposition, one study found that forensic inpatients with high levels of both PPI-SCI and PPI-FD were at the highest risk for predatory aggression (S. T. Smith, Edens, & McDermott, 2013). Another recent assessment model, the Triarchic model, seeks to conceptualize how the combination of different traits contributes to the presentation of psychopathic personality (Patrick et al., 2009).

1.3 THE TRIARCHIC MODEL

The Triarchic model is not a new theory of psychopathy; rather, it is a descriptive framework for integrating findings across alternative conceptualizations and clarifying the nature of constructs embodied in differing measures of psychopathy (Patrick, Drislane, & Strickland, 2012). The model includes descriptions of three phenotypic components of psychopathy: disinhibition, meanness, and boldness. Disinhibition represents the general proneness to impulse control problems that is often observed in psychopathic individuals and is associated with negative affect and deficient behavioral restraint. Disinhibition and proneness to externalizing behavior have been emphasized to varying degrees in historical conceptualizations of psychopathy; in particular, the construct of secondary psychopathy (Karpman, 1941; Lykken, 1995) is consistent with externalizing behavior. Additionally, variance in PCL-R Factor 2 that is separate from variance in Factor 1 reflects externalizing proneness (Patrick, Hicks, Krueger, & Lang, 2005). Boldness is a concept that encompasses confidence, tolerance for risk, and quick recovery from stressful or threatening situations. Boldness is minimally represented in PCL-R Factor 1, particularly in items reflecting charm and grandiosity (Patrick, Hicks, Nichol, & Krueger, 2007). Finally, meanness encompasses traits such as deficient empathy, lack of close attachments, and tendency to engage in exploitative behavior. Meanness is well represented by affective and interpersonal items in the PCL-R (Patrick et al., 2012). Additionally, modeling research on externalizing psychopathology demonstrates that meanness can be separated from general disinhibition (Krueger, Markon, Patrick, Benning, & Kramer, 2007; Venables & Patrick, 2012). Most other models identify only one (e.g., DSM) or two (e.g., Hare, 1991/2003) of these components in their descriptions of psychopathy—usually disinhibition and meanness. The Triarchic framework combines the behavioral and interpersonal-affective traits most commonly identified in the PCL-R with personality factors such as those measured in the PPI (i.e., boldness is similar to PPI-FD).

The Triarchic model does not propose that these components are underlying indicators of an overall psychopathy construct; instead, combinations of these components may create different "pictures" of psychopathy such as the differing descriptions of psychopathic individuals in the literature (low anxiety vs. high anxiety, criminal vs. psychiatric, successful vs. non-successful; Patrick et al., 2012). For example, disinhibition is closely related to externalizing behavior, yet externalizing behavior is not a trait unique to psychopathic personality – other clinical disorders such as ADHD and substance abuse are also characterized by externalizing behavior. It is the combination of disinhibition with traits associated with boldness and meanness that creates the clinical picture of psychopathy. Patrick (2012) recently described a dual-process model that integrates various attentional and emotional theories of psychopathy, in which impairments in attentional processing and emotional responding contribute differently to the affective and antisocial behavioral components of the disorder.

Dispositional fearlessness, which reflects underlying deficits in the fear processing systems of the brain such as the defensive motivational system, may contribute to both boldness and meanness. It is important to note, however, that the global construct of psychopathy is not a disorder on the opposite pole of anxiety. Some factors of psychopathy actually demonstrate a positive relationship with anxiety; for example, PPI-SCI demonstrates a small positive correlation with anxiety (.25) (J. D. Miller & Lynam, 2012). Secondary psychopathy is characterized by high rather than low levels of anxiety, which partly differentiates it from primary psychopathy (Lykken, 1995). Fearlessness gives rise to the clinical presence of psychopathy in the presence of other, maladaptive traits such as disinhibition and meanness; as the Triarchic model proposes that these components combine to create the clinical picture of psychopathy, it is to be expected that different combinations of levels of traits would result in different "types" of psychopaths who show divergent correlations with external criterion variables such as anxiety (Patrick et al., 2009).

Furthermore, the Triarchic model proposes that these components are phenotypic expressions of underlying genotypes. For example, fearlessness as identified by behavioral and neurological studies may be a genotypic component of psychopathy, but may then be expressed as phenotypic boldness or meanness. Both components are associated with fearlessness (Patrick et al., 2009). Theoretical models and research evidence suggest that risk taking and tolerance for threatening situations are characteristic of boldness, whereas work with children with CU traits suggests that weak fear responses contribute to phenotypic meanness (Frick & Marsee, 2006; Frick & Morris, 2004). For example, children's fearlessness to a loud noise at age 2 is significantly related to persistence of conduct problems between the ages of 2 and 8 (Shaw, Gilliom, Ingoldsby, & Nagia, 2003) and antisocial children with CU traits are less distressed by the negative effects of their behavior on others (Blair, Jones, Clark, & Smith, 1997; Frick, Lilienfeld, Ellis, Loney, & Silverthorn, 1999; Pardini, Lochman, & Frick, 2003). Patrick et al. (2009) proposed that phenotypic pathways to boldness and meanness emerge as a result of parenting and socialization during development. Based on research investigating internalized conscience in toddlers (Kochanska, 1995; Kochanska, 1997), Patrick et al. hypothesized that security of attachment leads to development of conscience. However, conflict with a difficult to control child could interfere with the development of a mutually positive relationship, contributing to meanness rather than boldness. Boldness evolves naturally from low fear, with low stress reactivity resulting directly from low defense-system sensitivity. In contrast, meanness could represent the outcome of low fear temperament in failed socialization processes.

Understanding underlying genotypic components contributing to psychopathic personality disorder eventually may contribute to the development of interventions tailored to unique clinical pictures of psychopathy (Patrick et al., 2012). Patrick et al. (2012) suggests the potential utility of attentional retraining procedures, which are focused on modifying existing attentional biases through presentation of reward cues.

Attentional retraining using the dot-probe task has proven successful for individuals with anxiety disorders as measured by lower scores on anxiety measures, reduction in threat-related attention bias, and a greater effect on state rather than trait anxiety (Hakamata et al., 2010). Attentional retraining reduces symptoms measured by both self-report and interviewer-rated measures and results in a significantly larger proportion of individuals who no longer meet criteria for generalized anxiety disorder than individuals completing a control task (Amir, Beard, Burns, & Bomyea, 2009). Symptom reduction is maintained in anxious individuals at a four-month follow-up (Amir, Beard, Taylor, et al., 2009). Dot probe tasks present two stimuli (usually pictures or text) simultaneously on a screen for a short time interval. This presentation is followed immediately by one or two dots in the location of one of the stimuli. The dots appear in the location of both types of stimuli equally (50% of the time at each stimulus). Attentional bias is indicated through quicker reaction times to dots that appear in the location of a particular type of stimulus. Anxious individuals are biased towards threatening or anxiety-inducing pictures or words, compared to neutral cues. Attentional retraining modifies the existing dot probe task by presenting the reward cue (dots) at the location of one type of stimulus 90% of the time.

Though a simple procedure, attentional retraining has been shown to have positive effects, such as symptom reduction outside of the context of treatment, across a variety of anxiety disorders (Hakamata et al., 2010). As anxiety is associated with a lower rather than a higher threshold for activation of the brain's defensive motivational system due to overgeneralized anticipatory responding to threat (Craske & Waters, 2005;

Luu, Tucker, & Derryberry, 1998; Stein, Goldin, Sareen, Zorrilla, & Brown, 2002), it can be considered the converse of some aspects of psychopathic personality, particularly fearlessness and boldness (Patrick, Drislane, & Strickland, 2012). Therefore, using attentional retraining to establish rather than eliminate biases towards aversive stimuli could be beneficial for reducing psychopathy.

The dot probe task has recently been used to examine attention to aversive stimuli in youth with traits of primary and secondary psychopathy (Kimonis, Frick, Cauffman, Goldweber, & Skeem, 2012). Participants were classified as psychopathic or non-psychopathic using their scores on the Youth Psychopathic Traits Inventory (YPI; Andershed, Kerr, Stattin, & Levander, 2002), a self-report measure aimed at capturing the interpersonal and affective personality features of psychopathy. A cluster analysis identified primary and secondary subtypes of psychopathy in the sample using scores on the subscales of the YPI and the Revised Children's Manifest Anxiety Scale (RCMAS; Reynolds & Richmond, 1985; 2000). The secondary subgroup reported significantly higher anxiety, worry, social and concentration concerns, and impulsivity than the primary subgroup. The results did not demonstrate any significant differences in attention to aversive stimuli between psychopathic individuals and a comparison group of individuals scoring lower than 12.5 on the YPI. However, the high anxious and low anxious subtypes did differ in responding to distressing stimuli, which supports the presence of different subtypes of psychopathy. The primary subgroup was not attentionally engaged by presentation of distressing stimuli while the secondary subgroup was more attentive to distressing emotional stimuli. Additionally, as traits associated with meanness have been associated with deficient empathy and recognition of fearful affect (see callous unemotional traits and impaired fearful affect recognition; Dadds et al. 2006, 2008), Patrick proposed that the presentation of fearful versus neutral faces, instead of aversive versus neutral pictures, could be relevant for individuals elevated in meanness (Patrick et al., 2012). Regardless of the usefulness of attentional retraining as an intervention, the research literature suggests that psychopathic individuals can be expected to display emotional attention deficits to aversive stimuli or fearful faces in the dot probe task.

Though researchers continue to debate the centrality of fearlessness to the construct of psychopathy, evidence consistently demonstrates a negative relationship between psychopathy and fear. It remains unclear whether deficient fear responding in psychopathic individuals is due to a deficit in general attention to emotions, shifting attention, or emotion recognition failures. This study aims to contribute to the growing research literature on fearlessness and psychopathy. Specifically, this research investigates whether individuals scoring high in psychopathy, particularly in boldness and meanness, display general facial emotion recognition deficits or deficits for particular emotions. Furthermore, this study will measure whether deficits in facial emotion recognition are associated with eye gaze to features of the displayed face, such as the lack of attention to the eyes observed in children with psychopathic traits (Dadds et al., 2006). Finally, to further investigate deficient attention as a possible source of fearlessness contributing to boldness and meanness, a dot-probe task will be used to measure whether individuals scoring high in psychopathy show significantly lower attention to fearful compared to neutral facial expressions when their attention is directed towards alternative cues. Hypotheses include:

1. Individuals elevated in TriPM measured psychopathy will differ significantly in their identification of and attention to fearful faces from individuals scoring lower on these traits,
2. High versus low psychopathy scoring individuals will show significantly less attention to fearful compared to neutral faces in a dot-probe task when their attention is directed towards other cues, and
3. Attentional retraining using the dot-probe task will result in increased attention to fearful faces in individuals scoring high in psychopathy

2. METHOD

2.1 PARTICIPANTS

Participants were undergraduate students at a large southwestern U.S. university recruited through the Psychology Department subject pool. Participants were compensated with research credit or extra credit in their undergraduate psychology courses. Students had the option of an alternative assignment instead of participation in a research study. Participants were asked to bring corrective eyewear if needed, resulting in normal or corrected vision for all participants. Power computations using G*Power suggested a conservative sample of approximately 100 participants, based on the effect sizes reported in the Dadds et al. (2006) and Kimonis et al. (2012) studies.

A total of 113 individuals participated in the study. Of these 113 participants, three participants' data were not able to be collected due to computer errors, resulting in a final sample of 110 participants. Of these 110 participants, 74 identified as women and 36 identified as men. The majority of participants reported their racial/ethnic status as Caucasian (70%; Hispanic or Latino = 18.2%, Black or African American = 3.6%, Asian or Pacific Islander = 5.5%, Other = 1.8%; 1 participant not reporting) and were between 18 and 19 years old (46.4% and 33.6%, respectively; 20 = 10.9%, 21 = 6.4%, 22 = 2.7%). All participants were unmarried and did not have children. Independent samples *t*-tests revealed significant differences between men and women in terms of boldness, $t(108) = 2.45$, $p = .016$, $d = 0.50$, meanness, $t(108) = -4.44$, $p < .001$, $d = 0.91$, disinhibition, $t(108) = 3.07$, $p = .003$, $d = 0.63$, and total TriPM scores, $t(108) = 4.40$, $p < .001$, $d = 0.90$. Examinations of means determined that men scored higher than women on all TriPM subscales. There were more women in the low psychopathy group (*n* = 49) than the low psychopathy group (*n* = 25). However, there were far more men in the high psychopathy group (*n* = 30) than the low psychopathy group (*n* = 6). These findings are consistent with a large body of literature on gender differences in psychopathy that generally reports higher psychopathy scores in men than in women on a number of measures (for reviews, see Cale & Lilienfeld, 2001; Forouzan & Cooke, 2005; Verona & Vitale, 2006).

2.2 APPARATUS AND MATERIALS

Triarchic Psychopathy Measure (TriPM)

The TriPM is a 58-item self-report measure of the Triarchic conceptualization of psychopathy. It is composed of 3 scales intended to measure boldness (19 items), meanness (19 items), and disinhibition (20 items). Using a 4-point scale, participants rate the degree to which the items apply to them (*mostly false, false, mostly true, true*). Rather than a total score, the measure yields three domain scores. Internal consistency reliability estimates have ranged from .77 to .90 in correctional samples, and between .82 and .88 in college student samples (Sellbom & Phillips, 2012).

ASL Eye-Trac 6

Visual interest was measured using an infrared eye-tracker with remote optics (Model D6, Applied Science Laboratories). The remote optics system uses corneal and retinal reflections of infrared light to measure gaze position with an accuracy of approximately 0.5 degrees of visual angle, a margin of error consistent with the natural function of the human eye. The video head tracking camera, situated below the computer monitor, uses face recognition software to compensate for head movement. Consequently, participants sit freely in front of the computer. ASL software was used for stimulus presentation/data collection (Paradigm Elements, ASL) and data analyses (ASL Results Plus). ASL Eye-Trac 6 recorded fixations, defined as a period of at least 100 milliseconds during which the point of regard did not change more than 1-degree visual angle (i.e., less than ½ in on the display). Regions ("areas of interest") were defined in ASL Results, which allowed determination of whether fixations were on the eye region or the mouth region of each stimulus. Additionally, the software recorded the duration in milliseconds of each fixation. Total fixations and total duration were calculated for each emotion in both tasks. Before conducting analyses of the eye tracking results, the accuracy of eye tracking was assessed by calculating the percent of eye data tracked (e.g., the percent of eye movements that were recorded by the eye tracking device) for each participant. To account for outliers resulting from program errors, participants with percentage of eye data tracked two or more standard deviations below the mean were excluded from analyses.

NimStim Face Stimulus Set

The NimStim is a set of 646 facial expression stimuli developed for the study of face and emotion recognition. The set consists of 70 models of different gender and racial backgrounds displaying the following emotions: fearful, happy, sad, angry, surprised, calm, neutral, and disgusted (Tottenham et al., 2009). The set was validated using 81 untrained volunteers who are similar to individuals who typically participate in face processing studies. Images are naturally posed with separate open- and closedmouth versions for each emotion. In order to compute an average emotion identification accuracy score, 10 pictures of each emotion (with calm and neutral expressions combined, resulting in a total of 70 images) were randomly selected from the 646 total pictures for inclusion in the emotion identification task.

Dot Probe Task

The dot probe task was adapted from Miller and Fillmore (2010) and presented using Paradigm software. After presentation of a fixation cross in the center of the screen (500 milliseconds), participants were presented with two pictures from the NimStim from fearful and neutral categories. The position of the pictures was randomly presented at the left or the right of the fixation cross. After 1000 milliseconds, the two pictures disappeared and the probe stimulus (either “<” or “>”) appeared in the location of one of the pictures. Participants were asked to press one key (“<”) if the probe was to the left of the fixation cross and another key (“>”) if the probe was to the right of the fixation cross. The probe was presented for a maximum of 1000 milliseconds. The dot probe task consisted of one block of 12 practice trials and three blocks of 40 trials. For participants who were in the top 10% of meannesss and disinhibition, in the first block the probe was presented equally behind the fearful and neutral faces. In the second block, the attentional retraining task, the probe was presented paired with the fearful face 90% of the time. Finally, in the last block the participants completed the first block again, with the probe presented 50% of the time at each category of stimuli. For participants who were in the bottom 10% of meanness and disinhibition, the first block with the probe presented equally behind the fearful and neutral faces was completed three times. These participants did not complete the attentional retraining task in order to act as a comparison group for the participants high in meanness and disinhibition. All trials were sampled randomly without replacement.

Participant scores on the dot probe task were determined by calculating the mean number of correct keyboard responses (left arrow or right arrow) to the location of the probe for each of the three experimental blocks. A correct response was coded as "1" and an incorrect response was coded "0", resulting in a score range of 0 to 1 when computing an average of all responses. A nonresponse was recorded as an incorrect response; however, nonresponses were not included in calculations of average response time (latencies). The time between when the probe appears and when the participant presses a key corresponding to its location is recorded in milliseconds and used for calculation of a facilitation index (see Kimonis et al., 2012). The facilitation index is calculated by subtracting the average response time in milliseconds (latency) to probes in the location of fear faces from the average response time to probes in the location of calm faces (MacLeod & Mathews, 1988): facilitation = 1/2 [(calm, probe left – fear, probe left) + (calm, probe right – fear, probe right)]. This formula controls for potential location effects (participant's tendency to attend to the left or the right of the screen) by summing latencies for left and right picture locations and taking their average. The assumption of dot probe tasks is that if the spatial location of the probe (in this case, left or right of the fixation cross) corresponds to the location where a participant's attention is allocated, then their response time will be faster than if their attention were allocated elsewhere. Therefore, higher scores indicate greater attentional orientating to emotional stimuli (in this case, fearful faces; see Kimonis, Frick, Fazekas, & Loney, 2006; Kimonis, Frick, Muñoz, & Aucoin, 2008; Kimonis et al., 2012).

Facilitation indices were calculated for 87 of the 89 dot probe participants due to insufficient data (e.g., participants responded to less than 90% of the 40 slides, or less than 50% of probes for calm or fear faces; these participants' dot probe responses fell more than 3 standard deviations above or below the mean).

2.3 PROCEDURE

To recruit participants, we adapted a recruitment strategy from Guarraci et al. (2013), which demonstrated that the TriPM Meanness and Disinhibition scales can provide an experimental sample consistent with characterizations of "primary" psychopathy (i.e., high in self-reported externalizing tendencies and low in internalizing problems). Potential participants completed the TriPM electronically on Qualtrics, an online survey platform. These participants participated in a prescreening assessment for the undergraduate subject pool. Participants provided informed consent prior to enrolling in the prescreening process. The TriPM was completed as part of a larger battery of questionnaires used to prescreen participants for a number of psychological studies at the university. The order of questionnaires was randomly generated for each participant. Participants were not required to answer any of the questions in a section before proceeding to the next questionnaire. Across three semesters, a total of 3,402 participants completed the TriPM as part of the prescreening assessment (32% women, 68% men; 3 not reporting gender). Participants' scores on the TriPM during the prescreening process were used solely for recruitment purposes and were not used in subsequent analyses.

Individuals scoring in the top and bottom 10% of both Meanness and Disinhibition (high meanness/high disinhibition and low meanness/low disinhibition) were contacted for participation in the experimental tasks. These individuals had no further obligation to participate in the study.

A total of 110 participants completed the experimental tasks. After completing informed consent, participants were presented with a demographic survey and the TriPM on a desktop computer, both administered using the Qualtrics survey platform. Following the completion of these surveys, participants completed the emotion identification task. To obtain valid and reliable eye-movement data, 9 gaze positions covering over 80% of the viewing area were be collected for each participant (i.e., a 9-point calibration). After calibration, participants were presented with the randomized 70 facial emotion recognition stimuli. Participants were instructed to click the word corresponding to the emotion displayed by the face on their screen (choice options of fearful, happy, sad, angry, surprised, neutral, and disgusted). Correct identification rate for each emotion was determined by calculating the average score for all 10 faces displayed for each emotion (an incorrectly identified emotion was scored as "0" and a correctly identified emotion was scored as "1"); resulting in a scale of 0 to 1. Following the emotion recognition task, participants completed the dot probe task. At the completion of the experiment, participants were debriefed and compensated with research participation credit.

Due to hardware issues with the experiment computers that resulted in discontinuation of data collection between Qualtrics survey completion and the experimental tasks, data for a total of 96 of the 110 participants was available for the emotion identification task. For the dot probe task, additional errors in responses recorded by the Paradigm software (e.g., the software did not record keyboard responses by the participants in the data output file in these cases) resulted in missing data for 7 additional participants, resulting in a sample size of 89 participants. Finally, hardware and program errors in the Eye-Trac 6 system as well as a number of computer crashes resulted in missing or lost eye tracking data. As a result, eye tracking data was available for only 54 of the 110 participants. All statistical analyses were conducted a second time to determine if there were significant differences between the participants with eye tracking data available and participants without eye tracking data available on all outcome variables. Comparisons of the two groups of participants (those with and without eye tracking data) revealed no significant differences. Furthermore, the number of men (19 in "no eye tracking" group, 17 in "eye tracking" group) and women (38 in "no eye tracking", 36 in "eye tracking") was similar whether eye tracking data was available or not available. Finally, there were comparable numbers of participants in the high psychopathy (28 in "no eye tracking", 27 in "eye tracking") and low psychopathy (29 in "no eye tracking", 26 in "eye tracking") groups. Therefore, results were reported collapsed across participants with and without eye tracking data available.

2.4 ANALYTIC PLAN

To examine whether individuals high in "primary psychopathy" made significantly more errors on an emotion identification task than individuals scoring low on these traits, one-way ANOVAs comparing accuracy of emotion recognition (and response time to that emotion) by psychopathy group were conducted. For eye-tracker data, I conducted multiple hierarchical regressions (one analysis for each of the six emotions) with TriPM scores and interactions entered in steps one and two and eye tracking data (fixations on eyes and mouth) entered in step three, with correct emotion identification as the dependent variable.

For the dot-probe task, I conducted ANOVAs comparing errors and reaction time latencies for the high and low psychopathy groups. To determine the effectiveness of the attentional retraining task at altering the attention of the group high in meanness and disinhibition, mean latencies from the first trial block and final trial block of the dot-probe task were compared using repeated-measures ANOVA.

Finally, to investigate the relationship between scores on boldness and meanness and fear deficits, linear regressions were conducted with TriPM subscale score (boldness and meanness) as independent variables, and accuracy of fear identification and fear response latency as dependent variables. A number of exploratory analyses were also conducted to address hypotheses about general emotion processing deficits in individuals scoring higher in psychopathy.

3. RESULTS

3.1 PSYCHOPATHY SCORES

Data were collected from 55 participants who were in the bottom 10% of meanness and disinhibition in the prescreening sample ("low psychopathy" group) and 55 participants who were in the top 10% of meanness and disinhibition ("high psychopathy" group). Summary statistics for TriPM total and subscale scores can be found in Table 1. An independent samples *t*-test was conducted to determine if the recruitment strategy was successful, resulting in higher and lower TriPM score groups. There was a significant difference between the groups, $t(108) = 8.56$, $p < .001$, $d = 1.65$. The high TriPM group scored significantly higher than the low TriPM group in boldness, $t(108) = 2.31$, $p = .023$, $d = 0.44$, meanness, $t(85.30) = 9.07$, $p < .001$, $d = 1.75$, and disinhibition, $t(108) = 7.69$, $p < .001$, $d = 1.48$, indicating that the recruitment strategy was successful and allowing for group comparisons on dependent variables. Mean TriPM scores for the total sample and for each experimental task are presented in Table 1.

3.2 EMOTION IDENTIFICATION TASK

A total of 96 participants' data were available for data analysis due to previously mentioned computer hardware errors. Overall, participants were most accurate at identifying happy faces ($M = .94$, $SD = .11$) and least accurate at identifying fearful faces ($M = .50$, $SD = .21$). In contrast with predictions, there were no significant correlations between boldness, meanness, disinhibition, or total TriPM scores and correct identification of fearful, happy, sad, calm, or angry faces (Table 2). Correct identification of disgusted faces was moderately correlated with both meanness (r = -.21, p = .041) and disinhibition (r = -.21, p = .041) but was not correlated with boldness or total TriPM scores.

Mean emotion identification scores for the high and low psychopathy groups are presented in Table 3. Prior to comparing means between the groups, exploratory independent-samples *t*-tests were conducted to determine if there were significant differences in emotion identification scores between men and women. There were no significant differences between men and women on correct emotion identification scores for any of the emotion faces. As such, it was determined that gender was not necessary to include as a covariate in the following analyses. Additionally, to investigate whether there were gender differences in overall emotion identification accuracy, a multivariate analysis of variance (MANOVA) with gender as a fixed factor and accurate identification of each emotion as outcome variables was conducted. There was no significant effect of gender on emotion identification accuracy, $F(7, 88) = 1.90$, $p = .078$.

To examine our first hypothesis that individuals relatively higher in psychopathic traits would demonstrate overall deficits in accurate emotion identification, MANOVA was conducted with accurate identification of each emotion as outcome variables and psychopathy group (high or low) as a fixed factor. In contrast with the hypothesized results, there was no significant effect of psychopathy group on emotion identification accuracy, $F(7, 88) = 1.34$, $p = .24$.

In a series of exploratory analyses intended to determine whether individuals elevated in psychopathy displayed deficits in facial emotion recognition for specific emotions, differences in correct emotion identification were analyzed with single-factor between-subjects ANOVAs, with group (high or low psychopathy) as a fixed factor and correct emotion identification as the outcome variable (Table 4). For calm face identification, a significant effect of group was not found, $F(1, 95) = 1.12$, $p = .29$. Our second primary hypothesis was that participants relatively elevated in psychopathic traits would show emotion recognition deficits specific to fearful faces. However, for fear face identification there was no significant effect of group, $F(1, 95) = 0.06$, $p = .81$. There were also no significant group effects for anger faces, $F(1, 95) = 0.00$, $p = .96$, sad faces, $F(1, 95) = 1.14$, $p = .29$, disgust faces, $F(1, 95) = 2.03$, $p = .16$, or happy faces, $F(1, 95) = 1.78$, $p = .19$.

Independent samples *t*-tests examining differences in mean response times to emotion faces between men and women were also conducted. The mean response time to calm faces was significantly greater for men ($M = 1698.41$, $SD = 705.26$) than for women ($M = 1402.29$, $SD = 497.73$), $t(49.93) = 2.13$, $p = .039$, $d = 0.52$. Mean response times to fear faces were significantly greater for men ($M = 1794.12$, $SD = 629.27$) than women ($M = 1473.99$, $SD = 601.72$), $t(94) = 2.42$, $p = .017$, $d = 0.53$. The difference in mean response times to anger faces for men ($M = 1727.29$, $SD = 692.88$) and women ($M = 1439.04$, $SD = 794.95$) was not significant, $t(94) = 1.75$, $p = .084$, $d = 0.38$. Mean response times to sad faces were significantly greater for men ($M = 1857.15$, $SD = 778.96$) than women ($M = 1362.01$, $SD = 664.78$), $t(94) = 3.25$, $p = .002$, $d = 0.71$. The difference in mean response times to disgust faces for men ($M = 1462.63$, $SD = 688.92$) and women ($M = 1144.69$, $SD = 518.92$) was significant, $t(94) = 2.53$, $p = .013$, $d = 0.55$.

Finally, mean response times to happy faces were significantly greater for men (*M* = 1246.38, *SD* = 455.87) than women (*M* = 1014.58, *SD* =46.02), *t*(94) = 2.31, *p* = .023, *d* = 0.51. Given these differences, gender was treated as a covariate in the next set of analyses, excluding analyses for anger faces. Additionally, to investigate whether there were gender differences in overall emotion identification response time, a MANOVA with gender as a fixed factor and response time to each emotion as outcome variables was conducted. There was no significant effect of gender on emotion identification response time, *F*(7, 88) = 1.78, *p* = .10.

For an exploratory analysis investigating whether individuals relatively higher in psychopathic traits would demonstrate overall deficits in response times to emotion faces, a MANOVA was conducted with response time to each emotion as outcome variables and psychopathy group (high or low) as a fixed factor. Similar to the previous results that reported no difference in emotion identification accuracy, there was no significant effect of psychopathy group on emotion identification response times, *F*(7, 88) = 0.73, *p* = .65.

A series of exploratory analyses examined whether individuals scoring higher in psychopathy performed significantly slower on identifying specific emotions than individuals scoring low on these traits. A series of one-way ANOVAs and analyses of covariance (ANCOVAs) were conducted. Differences in anger face response time between psychopathy groups were analyzed with a single-factor between-subjects ANOVA. For response time to anger faces, a significant effect of group was not found, *F*(1, 95) = 0.00, *p* = .99. Given the significant relationship between gender and mean response times for calm, fear, sad, disgust, and happy faces, psychopathy group mean differences were examined with gender as a covariate. Adjusted mean response times are presented in Table 5. To examine group differences in calm face response times, a one-way analysis of covariance (ANCOVA) was conducted. A test of the assumption of homogeneity of slopes revealed no significant interaction between gender and the two psychopathy groups, $F(1, 95) = 1.07$, $p = .30$. The overall model was not significant, $F(2, 95) = 2.82$, $p = .064$, and there was no significant difference among psychopathy groups, $F(1, 95) = 0.04$, $p = .84$, $\eta^2 = .00$. To test the hypothesis that individuals elevated in psychopathy would differ significantly in responses to of fearful faces from individuals lower in psychopathy, another ANCOVA examining psychopathy group differences in fear face response times was conducted. A test of the assumption of homogeneity of slopes revealed no significant interaction between gender and the two psychopathy groups, $F(1, 95) = 0.54$, $p = .46$. The overall model was marginally significant, $F(2, 95) = 2.91$, $p = .059$. However, in contrast to the hypothesis that there would be significant differences in responses to fear faces between psychopathy groups, after partialling out the variance associated with gender there was no significant difference among the psychopathy groups, $F(1, 95) = 0.02$, $p = .88$, $\eta^2 = .00$.

Next, group differences in sad face response times were examined. A test of the assumption of homogeneity of slopes revealed no significant interaction between gender and the two psychopathy groups, $F(1, 95) = 0.52$, $p = .473$. The overall model was significant, $F(2, 95) = 5.23$, $p = .007$. After partialling out the variance associated with gender, there was no significant difference among the psychopathy groups, $F(1, 95) =$

0.02, $p = .88$, $\eta^2 = .00$. Another ANCOVA examining psychopathy group differences in disgust face response times was conducted. A test of the assumption of homogeneity of slopes revealed no significant interaction between gender and the two psychopathy groups, $F(1, 95) = 1.53$, $p = .220$. The overall model was significant, $F(2, 95) = 3.17$, $p = .047$. After partialling out the variance associated with gender, there was no significant difference among the psychopathy groups, $F(1, 95) = 0.00$, $p = .96$, $\eta^2 = .00$. Finally, group differences in happy face response times were examined. A test of the assumption of homogeneity of slopes revealed no significant interaction between gender and the two psychopathy groups, $F(1, 95) = 3.82$, $p = .054$. The overall model was not significant, $F(2, 95) = 2.77$, $p = .068$, and there was no significant difference among psychopathy groups, $F(1, 95) = 0.23$, $p = .64$, $\eta^2 = .00$ (Table 6).

To test the hypothesis that boldness and meanness would predict fear face identification, separate linear regressions with correct fear identification as the dependent variable and boldness and meanness as independent variables were conducted. In contrast to our predictions neither boldness, $F(1,94) = 0.04$, $p = .84$, nor meanness, $F(1,94) = 0.52$, $p = .47$, were significant predictors of fear face identification.

As an exploratory analysis, given the recruitment strategy of selecting individuals high in meanness and disinhibition to create a sample high in “primary psychopathy” and the hypothesized relationship between higher psychopathy scores and fear identification, a linear regression with a meanness x disinhibition interaction predicting correct fear identification was conducted. The interaction between meanness and disinhibition did not significantly predict correct fear identification, $F(1, 94) = 1.78$, $p = .16$.

Eye Tracking Results

For the emotion identification task, the average percent eye data tracked was 83.34% (SD = 18.76%) with a range from 23.38% - 98.87%. To account for outliers, participants with percentage of eye data tracked two or more standard deviations below the mean were excluded from analyses. This resulted in the exclusion of five participants, for a final *n* of 49 participants.

The average number of fixations on the eyes and mouth of each emotion are reported in Table 7. Across all emotions, the average number of fixations per face was 3.38 ($SD = 1.34$) and the average duration of fixations per face was 0.97 seconds ($SD = 0.50$). The average number of fixations on the eyes of each face was 1.08 ($SD = 1.09$; $M_{duration} = 0.32$, $SD = 0.33$) and the average number of fixations on the mouth of each face was 1.60 ($SD = 1.05$; $M_{duration} = 0.46$, $SD = 0.33$). In an exploratory analysis to determine if fixations on the eyes or mouth of emotion faces predicted emotion identification errors, multiple linear regressions were conducted for each of the six emotions, with the total eye and mouth fixations for each emotion as predictors and emotion identification errors as the dependent variable. Total fixations on the eyes and the mouth did not predict identification errors for calm, happy, sad, anger, or disgust faces (Table 8). The model for predicting fear identification errors was significant, $F(2,46) = 6.14$, $p = .004$. Total fixations on the eyes of fear faces significantly predicted fear identification errors, β = -.46, $t(45)$ = -3.42, p = .001. Total fixations on the mouth of fear faces did not predict fear identification errors.

To examine the hypothesis that deficits in facial emotion recognition for individuals higher in psychopathic traits would be associated with eye gaze to features of the displayed face, a series of multiple hierarchical regressions were conducted. Prior to conducting all hierarchical multiple regressions, the relevant assumptions of this statistical analysis were tested and met for all independent and dependent variables in these analyses. The data met the assumptions of collinearity, independent and normally distributed errors, homogeneity of variance, linearity, and non-zero variances.

To determine the contribution of fixations on the eye area and mouth area on the prediction of correct emotion identification above and beyond the contribution of TriPM scores, a three-step multiple hierarchical regression was conducted for each of the six emotions. Boldness, meanness, and disinhibition scores were entered at step one, the interaction variables (boldness*meanness, boldness*disinhibition, meanness*disinhibition, boldness*meanness*disinhibition) were entered at step two, and the eye tracking variables (average fixations on eyes, average fixations on mouth) were entered in step three. A summary of the hierarchical regression results can be found in Table 9. In contrast with predicted results, TriPM scales and interactions did not significantly predict identification rate for calm, fear, sad, anger, or happy faces. Fixations on eyes and mouth of emotion faces were also not significant predictors for those emotions.

For disgust faces, the model was not significant at step one (F (3,45) = 2.41, p = .079). Introducing the interaction variables explained 19% of variation in disgust face identification rate and this change in R^2 was significant, F (7,41) = 2.86, p = .016, F (ΔR^2) = 2.88, p = .034. Although the overall model was significant at step three, (F (9,39) = 2.40, p = .028), introducing the eye and mouth fixation variables did not significantly account for additional variance in the prediction of disgust identification rate, ΔR^2 = .03, F (ΔR^2) = 0.87, p = .43. The model at step two accounted for 33% of the variance in disgust identification rate. The only significant predictor was the meanness*disinhibition interaction, (β = .48, t(41) = 2.76, p = .009), which accounted for 13% of the variation in disgust identification rate (Table 10). However, this finding should be interpreted cautiously given the potential for spurious effects due to small sample size and large number of analyses.

3.3 DOT PROBE TASK

Mean response time and dot probe scores are presented in Table 11. At least 64% of participants gave correct answers to all 40 slides and only two participants provided fewer than 70% correct responses[1]. There were no significant correlations between boldness, meanness, disinhibition, or total TriPM scores and dot probe task total scores or fear face scores (Table 12). However, there was a significant correlation between meanness and Block 1 calm scores (r = -.24, p = .023).

There were also no significant correlations between boldness, meanness, disinhibition, or total TriPM scores and total response time for any of the three blocks

[1] 98% of participants scored between .90 and 1.00 on the dot probe task.

(Table 13). As expected, there was a significant positive correlation between meanness and Block 1 response time (r = .24, p = .021) for fear faces, indicating that response time to fearful faces increased as meanness scores increased. Additionally, for calm faces there were significant correlations between Block 2 response time and meanness (r = .28, p = .007) and TriPM total scores (r = .23, p = .027). To further examine the hypothesized relationship between meanness and response time to the probe replacing fear faces, linear regressions were conducted with meanness predicting response time in Blocks 1, 2, and 3. Meanness significantly predicted Block 1 response times, β = .24, R^2 = .04, $t(89)$ = 2.28, p = .025, but it did not significantly predict response times to fear faces in Block 2, $F(1,88)$ = 1.64, p = .20, or Block 3, $F(1,88)$ = 1.74, p = .19.

Facilitation was not calculated for Block 2, as half of the participants completed an attentional retraining block with the probe replacing calm faces only 10% of the time to examine whether the retraining task affected performance of individuals in the high psychopathy group. Participants in the low psychopathy group did not complete the attentional retraining task in order to act as a comparison group for the participants high in meanness and disinhibition. Average facilitation indices in Block 1 (M = 1.86, SD = 18.21) and Block 3 (M = 2.34, SD = 25.36) suggest that all participants responded more quickly to probes replacing fear pictures. Contrary to predictions, there were no significant correlations between the facilitation indices and TriPM scores (Table 14). As an exploratory analysis, independent samples t-tests examining differences in facilitation in Block 1 and Block 3 between genders were conducted. In Block 1, mean facilitation was significantly greater for women (M = 4.63, SD = 19.79) than men (M = -3.70, SD =

13.17), *t*(78.07) = -2.33, *p* = .022, *d* = 0.47. There was not a significant difference in mean facilitation between men (*M* = 7.52, *SD* = 25.36) and women (*M* = -0.25, *SD* = 25.18) in Block 3, *t*(85) = 1.35, *p* = .18, *d* = 0.31.

To test the hypothesis that boldness and meanness would predict fear response latency, separate linear regressions for boldness and meanness were conducted with facilitation in Block 1 and in Block 3 as dependent variables. Boldness was not a significant predictor of facilitation in Block 1, *F*(1,85) = 0.04, *p* = .84, or Block 3, *F*(1,85) = 0.86, *p* = .38. Meanness was also not a significant predictor of facilitation in Block 3, *F*(1,85) = 0.68, *p* = .41. However, the model for meanness predicting facilitation approached significance in Block 1, *F*(1,85) = 3.49, *p* = .065, β = -0.20, R^2 = .04, consistent with the hypothesis that individuals higher in meanness would respond more slowly to fearful faces than individuals lower in meanness. As an exploratory analysis, linear regressions with a meanness x disinhibition interaction predicting facilitation in Blocks 1 and 3 were conducted. The interaction between meanness and disinhibition did not significantly predict facilitation in Block 1, *F*(1, 83) = 1.17, *p* = .33, or Block 3, *F*(1, 83) = 0.33, *p* = .80.

Mean facilitation scores in Block 1 and Block 3 split by gender and psychopathy group are presented in Table 15. Given the differences in facilitation between men and women, gender was included as a fixed factor in the following analysis. A two-way repeated measures ANOVA was conducted to compare the effect of gender on change in facilitation between Blocks 1 and 3 in the high and low psychopathy conditions (Table 16). In contrast to the hypothesis that attentional retraining would result in increased attention to fearful faces in Block 3 in individuals scoring high in psychopathy, there not a significant change in facilitation across dot probe task blocks, Wilks' $\lambda = 1.00$, $F(1,83) = 0.23$, $p = .64$. There was no significant interaction between psychopathy group and change in facilitation across blocks, $F(1, 83) = 1.42$, $p = .24$, or between gender and change in facilitation across blocks, $F(1, 83) = 0.34$, $p = .56$. Additionally, there was no significant interaction between psychopathy group, gender, and change in facilitation across blocks, $F(1, 83) = 2.39$, $p = .13$. There were no significant effects of the between-subjects factors, psychopathy group $F(1, 83) = 0.03$, $p = .87$, and gender, $F(1, 83) = 0.17$, $p = .68$.

Eye Tracking Results

For the dot probe task, the average percent eye data tracked was 78.84% (*SD* = 23.11%) with a range from 10.76%-99.40%. To account for outliers, participants with percentage of eye data tracked two or more standard deviations below the mean were excluded from analyses. This resulted in the exclusion of five participants, for a final *n* of 47 participants. The average number of fixations and duration of fixations for calm and fear faces are reported in Table 17. On average, participants fixated more on fearful faces and on the eye area of both fearful and calm faces.

Inconsistent with our hypotheses, there were no significant correlations between TriPM scores and any of the eye tracking variables in Block 1 (Table 18). In Block 2, there was a significant correlation between total fixations on calm faces and meanness ($r = -.34$, $p = .022$), and between total fixations on calm faces and disinhibition ($r = -.34$, $p = .018$), indicating that participants higher in meanness and disinhibition had significantly fewer numbers of fixations on calm faces. In Block 3, meanness (r = .38, p = .009), disinhibition (r = .33, p = .025), and total TriPM scores (r = .36, p = .013) were significantly correlated with fixations on the eye area of calm faces. To determine whether fixations on areas of interest predicted facilitation, linear regressions were conducted with fixations on the eye and mouth areas of fear and calm faces predicting facilitation in Block 1 and Block 3. None of the fixation variables predicted facilitation in Block 1, $F(6,37)$ = 0.96, p = .47, or Block 3, $F(8,78)$ = 1.19, p = .33.

To investigate the possible moderating effects of gender and interactions between boldness, meanness, and disinhibition on the relationship between fixations on areas of interest and facilitation, two hierarchical linear regressions were conducted with facilitation in Block 1 and in Block 3 as dependent variables. Participant gender was entered in step one, boldness, meanness, and disinhibition in step two, TriPM subscale interactions in step three, and fixation variables in step four. Inconsistent with predictions that individuals higher in psychopathy would demonstrate less attention to fear faces than individuals low in psychopathy, the models were not significant for predicting facilitation in Block 1 or Block 3 (hierarchical regression results presented in Table 19).

4. DISCUSSION AND CONCLUSIONS

The current project examined the associations among psychopathic traits, eye gaze, and facial emotion processing in a sample of college students. More specifically, this research investigated if individuals higher in psychopathic traits (specifically boldness and meanness) demonstrate general emotion identification deficits, or deficits for specific emotions such as fear or sadness. Finally, this research examined the extent that individuals scoring higher in psychopathic traits showed decreased attention to fearful faces when their attention was directed towards alternative cues, and if these attention tendencies could be altered by a retraining task.

The hypothesis that individuals scoring higher on TriPM-measured psychopathy would differ significantly in their identification of fearful faces from individuals scoring lower in psychopathy was not supported. There were no differences between the high and low psychopathy groups on accuracy of fear face identification or in response time to fear face identification. Furthermore, specific psychopathic traits such as boldness and meanness did not predict accuracy of fear face identification. Some prior research (Dawel, O'Kearney, McKone, & Palermo, 2012; Hastings et al., 2008) suggests that individuals high in psychopathic traits display overall emotion recognition deficits. For example, deficient processing of sad faces has been implicated in the Violence Inhibition Mechanism literature (Blair, 1995). Results of this research do not provide support for general emotion recognition deficits, as there were no differences between the low and high psychopathy groups in identification of, or response time to, any of the emotion faces. In summary, TriPM-measured psychopathy was not significantly associated with accurate identification of facial emotions.

These results are inconsistent with a large body of literature that reports deficits in the processing of fear and sadness in psychopathic individuals (Blair et al., 2002; Colledge et al., 2001; Hastings et al., 2008; Marsh & Blair, 2008; Stevens et al., 2001). However, consistent with the current findings, a number of studies have *not* found deficits in recognizing facial expressions of fear (Book, Quinsey, & Langford, 2007; Del Gaizo & Falkenbach, 2008; Eisenbarth, Alpers, Segrè, Calogero, & Angrilli, 2008; Glass & Newman, 2006; Hansen, Johnsen, Hart, Waage, & Thayer, 2008; Hastings et al., 2008; Kosson et al., 2002) and/or sadness (Del Gaizo & Falkenbach, 2008; Glass & Newman, 2006; Hansen et al., 2008). One possible reason for inconsistent findings in the field is procedural differences between studies. A recent meta-analysis investigated the nature of facial affect recognition deficits in psychopathy (Wilson, Juodis, & Porter, 2011). Specifically, the researchers examined possible procedural moderators to explain why some studies find deficits in recognizing fear or other emotions while some studies do not find these effects. Twenty-two studies met the inclusion criteria of the meta-analysis, which required studies to a) have tested the association between psychopathy and facial affect recognition accuracy, b) provide sufficient statistical information, and c) use an acceptable operational definition of psychopathy (e.g., not just Antisocial Personality Disorder). The researchers examined whether response style (verbal of nonverbal), age of the sample, and sample source (forensic, community) of the studies moderated the relationship between psychopathy and facial affect recognition accuracy.

For fear, sadness, and anger, larger emotion recognition deficits were found in studies with verbal responses given by participants. Other factors such as age and sample source did not influence the association between psychopathy and affect recognition deficits.

The findings in this research and those reported by Wilson et al. (2011) are consistent with the left hemisphere activation (LHA) hypothesis (Kosson, 1998), which proposes that psychopathy is only associated with information-processing deficits when the left hemisphere of the brain is preferentially required for the completion of a task (such as language processing). Accordingly, tasks that require participants to generate a verbal description while processing emotion should be associated with worse recognition than when responding nonverbally, such as by pressing a button. In the current study participants viewed an emotion face and pressed a button on the successive computer slide to identify the emotion. Providing emotion names in a multiple-choice format may not have sufficiently activated the left hemisphere to see emotion recognition deficits. Future studies in this area should investigate emotion deficits in psychopathic individuals with tasks that require alternate response styles, such as oral responses or fill-in-the-blank, typed responses.

Although attention to the eyes of fear faces predicted accuracy of fear identification, psychopathy scores were not associated with fixations on particular areas of the face. Contrary to our hypotheses, the present study also found no associations between eye gaze, psychopathy, and identification of facial emotions. These findings are inconsistent with the research of Dadds et al. (2006/2008) that reported associations between callous-unemotional traits and attention to the eyes of fearful faces. Possible explanations for differences in these results include that these eye-tracking studies examined callous-unemotional traits in children using broader measures of antisocial behavior rather than measures of psychopathy. Furthermore, the participants in these studies were children rather than adults.

Two recent studies have examined eye-tracking indices and psychopathic traits in adult samples (Boll & Gamer, 2016; Gillespie, Rotshtein, Wells, Beech, & Mitchell, 2015). Consistent with the results of the current project, neither study found that psychopathic traits significantly predicted emotion identification accuracy. However, primary psychopathic traits were associated with reduced number of fixations and reduced duration of fixations on the eyes relative to the mouth (Gillespie et al., 2015). Additionally, there were significant relationships between primary psychopathic traits and attention to the eyes of fearful and angry faces for low intensity emotional expressions. Similar to the present study, Gillespie et al. (2015) used NimStim faces in their emotion recognition tasks. However, the researchers used the NimStim photos to create expressions of low, moderate, and high intensity based on evidence that ambivalent expressions make tasks more sensitive to differences in facial expression processing. The use of the original NimStim photos in the current project may explain differences in results between this study and Gillespie et al. (2015). Boll and Gamer (2016) reported that PPI-R Fearless Dominance and Coldheartedness scores predicted reduced face exploration, and participants elevated on Self-Centered Impulsivity had a reduced bias to shift attention to the eyes of faces. In contrast with the present project, both of these studies limited their samples to male participants. The studies also differed from the current project in stimulus presentation. In addition to the aforementioned differences in emotional intensity in the Gillespie at al. study, Boll and Gamer (2016) applied an elliptic mask to photos in order to present faces without hair and ears. Future research should examine whether reduced exploration of faces, as well as the relationship between facial expression intensity and psychopathic traits, can be replicated in samples of both men and women using ecologically valid stimulus sets and larger samples.

The hypothesis that individuals higher in psychopathic traits would differ in their attention to fearful faces was partially supported. In general, participants responded more quickly and allocated more attention to fearful faces. There were no associations between TriPM scores and overall performance and response times on the dot probe task. However, as expected, meanness was positively associated with response time to fearful faces in the first dot probe task block, indicating that increased meanness was associated with slower responses to probes replacing fearful faces. This finding suggests that participants higher in meanness were allocating more attention to calm faces than to fear faces, resulting in slower responses to probes replacing fearful faces. Further supporting this result, the relationship between meanness and facilitation in Block 1 approached significance, indicating that increased meanness predicted less attentional orienting to fearful faces. However, other psychopathic traits (such as boldness) did not predict attention to fearful faces.

The results of the present research are consistent with prior research that demonstrates psychopathic individuals are not deficient in shifting attention in general

(Blair et al., 2001; LaPierre et al., 1995; Mitchell et al., 2002). Furthermore, the current results are consistent with the work of Kimonis and colleagues (2012) that reported no differences in dot probe task performance between nonpsychopathic and psychopathic groups of adolescents. The significant relationship between meanness and Block 1 facilitation is also consistent with results in the aforementioned study that reported differences in performance between “types” of psychopathy. However, although the present study did not find a relationship between attention to fear faces and boldness, Kimonis and colleagues did report differences between low anxiety and high anxiety psychopathy groups’ performance on the dot probe task. Overall, the results of these studies suggest that boldness may be related to less attention to threatening or distressing images (Kimonis et al., 2012), whereas meanness is related to attention to fearful faces. These findings are consistent with Patrick et al.’s (2009) proposal that boldness and meanness may share the same genotypic fearlessness but differ in phenotypic expression. Similar to the current findings, research with children high in callous unemotional traits reports connections between fear responses and meanness, whereas tolerance for risk and threat is connected to boldness (Frick & Marsee, 2006; Frick & Morris, 2004).

The hypothesis that psychopathic traits and eye gaze indices would predict attention to fearful faces in the dot probe task was not supported. The finding that meanness and disinhibition were associated with fewer fixations on calm faces in Block 2 of the dot probe task can be explained by the presence of the attentional retraining task. Individuals higher in meanness and disinhibition were in the high psychopathy group that completed the retraining task. In the retraining task, probes appeared in the position of calm faces only 10% of the time. As such, participants in the high psychopathy group may have quickly learned to allocate attention to the fearful face. Finally, the hypothesis that an attentional retraining task would increase attention to fearful faces in individuals higher in psychopathic traits was not supported. There were no significant differences in facilitation between Block 1 and Block 3 of the dot probe task overall or within the psychopathy groups. Participants in the high psychopathy group did not allocate more attention to the fearful faces after the retraining task. In fact, in Block 3 of the dot probe task, meanness, disinhibition, and total TriPM scores were positively associated with fixations on the eye area of calm faces. This result suggests that individuals higher in psychopathic traits were allocating significant attention to calm faces even after the retraining task.

The response modulation hypothesis (Newman et al., 1997) suggests that deficiencies in shifting attention from goal-oriented behavior to peripheral information are responsible for emotion processing deficits observed in psychopathic individuals. Significant findings regarding attention to fearful faces in Block 1 of the dot probe task but not Block 3 may be a result of habituation to the task affecting goal orientation of the participants. As stated previously, participants may have determined that the goal of the task was to allocate attention to fearful faces, attenuating the relationship between psychopathic traits and facilitation in Block 3. For example, Larson et al. (2013) reported no differences in amygdala activation in response to threat between psychopathic and nonpsychopathic individuals when focus was on threat-relevant information.

Though hypotheses concerning overall emotion identification deficits were not supported, both meanness and disinhibition scores were negatively associated with accurate identification of disgusted faces. Furthermore, disgust face identification accuracy was significantly negatively predicted by the interaction between meanness and disinhibition scores. This finding should be interpreted cautiously given the potential for spurious effects due to small sample size and large number of analyses, as well as the exploratory nature of this analysis. However, it is worth noting that although this result was not hypothesized, deficits in classifying disgust faces have been reported previously (Hansen et al., 2008; Kosson, Suchy, Mayer, & Libby, 2002). Similarly, psychopathic individuals have been reported to differ in their response to disgust induction and to images depicting mutilation that would be expected to induce disgust responses (Forth, 1992; Levenston et al., 2009). As research on identification of disgust faces in psychopathic individuals is limited, future research should examine if disgust processing deficits in psychopathic individuals can be replicated. Additionally, experience of disgust has been linked to right-hemisphere brain mechanisms (Phillips et al., 1997), which may suggest that a right-hemisphere dysfunction underlies some of the observed deficits in emotional processing observed in psychopathic individuals (c.f. Kosson et al, 2002). Given that left-hemisphere dysfunction has also been proposed as the origin of emotion processing deficits (Kosson, 1998), future research should examine the extent that deficits in processing specific emotions are related to dysfunctions in the left or right hemisphere, rather than assuming that all emotion processing deficits in psychopathic individuals arise from the same brain mechanism. For example, deficits in processing of specific emotions likely originate from different parts of the brain. Evidence suggests that fear, anger, and sadness are preferentially processed by the left amygdala (Killgore & Yurgelun-Todd, 2001; c.f. Wilson et al., 2011). Rather than functional impairment of specific brain areas brain resulting in emotion processing deficits, it is possible that activation of multiple areas contribute to dysfunction in an underlying mechanism involved in emotion processing (Wilson et al., 2011).

Another possible explanation for nonsignificant findings in the present study is that deficits in facial emotion recognition may vary by gender. One study investigating emotion recognition deficits and personality traits reported that psychopathy was related to deficits in fear recognition in men but not women (Snowden, Craig, & Gray, 2011). The majority of research exploring psychopathy and emotion recognition has used correctional or clinical samples (Marsh & Blair, 2008), and many of these samples were composed primarily of men. Although the researchers did not perform separate analyses for men and women, another study with undergraduates (68% women) reported that PPI scores were associated with *improved* performance on fear recognition tasks (Del Gaizo & Falkenbach, 2008). The proportion of men to women in this sample is similar to the demographics of the current study. We did not find fear recognition deficits in psychopathic men, but there were significant differences between men and women in response time to the majority of emotion faces. Additionally, men responded slower than women to probes replacing fearful faces in the dot probe task. The ability to observe interactions between psychopathic traits and gender in this study may have been limited by sample size. Analyses in the current project almost certainly lacked sufficient power to find significant effects because the number of men in the low psychopathy group (n = 3, versus 26 men in the high psychopathy group).

Although this project contributes to the body of knowledge concerning the relationship between psychopathy and emotion processing, conclusions that can be drawn from these results are affected by a number of limitations. Statistical analyses were likely underpowered due to small sample size ($n < 100$). Unfortunately, a significant portion of the eye tracking results were lost due to equipment failure, further decreasing the number of participants included in eye-tracking analyses. Additionally, the number of statistical analyses may have increased the likelihood of spurious findings. Also, conclusions that can be drawn from the results of this project are limited by the use of a college student sample. Finally, the unequal number of men and women in the high psychopathy and low psychopathy groups may have limited the ability to detect interactions between psychopathy, gender, and emotion processing. Possible gender differences in the relationship between emotion processing and psychopathy (Snowden et al., 2011) suggest that this study should be replicated in additional mixed gender samples of both offenders diagnosed with psychopathic personality disorder and community participants.

Broadly, the results of this project add to the growing literature examining emotion processing deficits in psychopathic individuals. These results, in addition to the results of recent eye-tracking studies in psychopathic adult men (Boll & Gamer, 2016;

Gillespie et al., 2015), suggest that deficient emotion processing in psychopathic individuals may be due to attentional deficits rather than an inability to identify emotional facial expressions. Though further studies are needed before this conclusion can be drawn, it is worth noting that the most consistent results for deficient emotional processing in psychopathic individuals are reduced startle potentiation in response to aversive stimuli, as well as reductions in passive avoidance learning and responses to punishment (for a recent review of the research literature on psychopathic fearlessness, see Hoppenbrouwers, Bulten, & Brazil, 2016). Genotypic fearlessness may phenotypically express as deficits in threat detection and responsivity rather than inabilities to detect or recognize fear. The current body of research suffers from a lack of consensus about the components of the fearlessness construct. The inconsistent results in this area of research suggest that future projects should examine specific constructs under the umbrella of fearlessness (such as threat, punishment, or subjective experiences of fear) in order to better understand the relationship between psychopathy and fearlessness.

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APPENDIX

Table 1

Mean (SD) Triarchic Psychopathy Measure (TriPM) Scores

	Boldness	Meanness	Disinhibition	TriPM Total
Total Sample (N = 110)	33.02 (7.83)	12.05 (10.11)	13.92 (8.03)	58.99 (20.64)
Emotion Identification Task (N = 96)	33.21 (7.91)	12.29 (10.33)	13.77 (7.69)	59.27 (20.87)
Dot Probe Task (N = 89)	33.42 (7.80)	12.82 (10.52)	14.25 (7.76)	60.48 (21.01)

Table 2

Correlations (r) Between TriPM Scores and Correct Emotion Identification (N = 96)

	Emotion					
	Calm	Fear	Sad	Happy	Anger	Disgust
M identification rate (*SD*)	.85 (*.16*)	.50 (*.21*)	.64 (*.20*)	.94 (*.11*)	.82 (*.13*)	.76 (*.13*)
Boldness	-.06	.02	-.01	-.09	-.09	-.01
Meanness	.08	-.07	-.05	-.09	.14	-.21*
Disinhibition	-.01	-.01	.05	-.14	.10	-.21*
Total TriPM	.01	-.03	-.01	-.13	.14	-.19

* $p < .05$

Table 3

Mean (SD) Correct Emotion Identification Scores by Group

	High psychopathy (*N* = 49)	Low psychopathy (*N* = 47)
Calm faces	.86 (.17)	.83 (.16)
Fear faces	.51 (.19)	.50 (.23)
Anger faces	.82 (.13)	.81 (.13)
Sad faces	.62 (.20)	.66 (.20)
Disgust faces	.74 (.12)	.78 (.13)
Happy faces	.93 (.11)	.96 (.20)

Table 4

Correct Emotion Identification ANOVA Results

Source	SS	df	MS	*F*	*p*	η^2
Calm Faces						
Group	0.03	1	0.03	1.12	.292	.01
Error	2.55	94	0.03			
Total	2.58	95				
Fear Faces						
Group	0.00	1	0.00	0.06	.810	.00
Error	4.19	94	0.05			
Total	4.19	95				
Anger Faces						
Group	0.00	1	0.00	0.00	.958	.00
Error	1.65	94	0.02			
Total	1.65	95				
Sad Faces						
Group	0.05	1	0.05	1.14	.288	.01
Error	3.70	94	0.04			
Total	3.75	95				
Disgust Faces						
Group	0.03	1	0.03	2.03	.158	.02
Error	1.60	94	0.02			

Table 4 Continued

Source	SS	df	MS	*F*	*p*	η^2
Total	1.63	95				
Happy Faces						
Group	0.02	1	0.02	1.78	.186	.02
Error	1.05	94	0.01			
Total	1.07	95				

Table 5

Adjusted Mean (SE) Emotion Identification Response Times by Group

	High psychopathy (*N* = 49)	Low psychopathy (*N* = 47)
Calm faces	1513.99 (88.08)	1487.45 (90.17)
Fear faces	1569.85 (93.67)	1592.02 (95.89)
Sad faces	1514.74 (108.02)	1539.89 (110.58)
Disgust faces	1246.91 (89.02)	1254.59 (91.13)
Happy faces	1066.81 (70.87)	1117.95 (72.55)

Table 6

Emotion Identification Response Time ANCOVA Results

Source	SS	df	MS	F	p	η^2
Calm faces						
Group	13146.36	1	13146.36	3.98	.049	.00
Gender	1327282.13	1	1327282.13	0.04	.843	.04
Error	31013498.10	93	333478.47			
Total	32897297.20	95				
Fear faces						
Group	9170.95	1	9170.95	0.02	.876	.00
Gender	1820152.59	1	1820152.59	4.83	.031	.05
Error	35076198.30	93	377163.42			
Total	37271810.60	95				
Sad faces						
Group	11799.20	1	11799.20	0.02	.878	.00
Gender	4276686.25	1	4276686.25	8.53	.004	.08
Error	46639678.70	93	501501.92			
Total	51881736.60	95				
Disgust faces						
Group	1101.33	1	1101.33	0.00	.955	.00
Gender	1717836.57	1	1717836.57	5.04	.027	.05
Error	31676214.70	93	340604.46			

Table 6 Continued

Source	SS	df	MS	*F*	*p*	η^2
Total	33833808.90	95				
Happy faces						
Group	48782.32	1	48782.32	0.23	.636	.00
Gender	1098984.84	1	109894.84	5.09	.026	.05
Error	20075440.70	93	215864.95			
Total	21270559.20	95				

Table 7

Summary of Total Fixations by Emotion and Area of Interest

Emotion	*M (sd)* Fixations on Eyes	*M (sd)* Fixations on Mouth
Calm	8.74 (8.56)	15.07 (11.83)
Fear	9.96 (10.03)	15.28 (11.34)
Sad	12.15 (14.64)	14.60 (11.49)
Anger	9.38 (8.92)	17.91 (12.94)
Happy	10.68 (12.33)	15.19 (12.38)
Disgust	10.53 (9.86)	15.36 (12.11)

Table 8

Summary of Regression Analyses for Fixations Predicting Emotion Identification Errors

Emotion	F^a	p	R^2
Calm	1.38	.262	.06
Fear	6.14	.004	.21
Sad	.58	.563	.03
Anger	1.16	.322	.05
Happy	1.46	.243	.06
Disgust	.30	.745	.01

[a] df = 2, 46

Table 9

Summary of Hierarchical Regression Analyses for TriPM Scores and Fixations Predicting Emotion Identification Errors

Emotion	*F* (df)	*p*	R^2	ΔR^2
Calm				
Step 1[a]	1.54	.22	.09	.09
Step 2[b]	1.20	.33	.17	.08
Step 3[c]	1.15	.35	.21	.04
Fear				
Step 1	.49	.69	.03	.03
Step 2	.79	.60	.12	.09
Step 3	1.93	.08	.31	.19**
Sad				
Step 1	1.08	.37	.07	.07
Step 2	.75	.63	.11	.05
Step 3	.76	.66	.15	.04
Anger				
Step 1	1.37	.27	.08	.08
Step 2	1.89	.10	.24	.16
Step 3	1.49	.19	.26	.01
Happy				
Step 1	.55	.65	.04	.04
Step 2	1.03	.43	.15	.11

Table 9 Continued

Emotion	*F* (df)	*p*	R^2	ΔR^2
Step 3	1.23	.31	.22	.07
Disgust				
Step 1	2.41	.08	.14	.14
Step 2	2.86	.02	.33	.19*
Step 3	2.40	.03	.36	.03

[a] Predictors: boldness, meanness, disinhibition; *df* = 3,45

[b] Predictors: boldness*meanness, boldness*disinhibition, meanness*disinhibition, boldness*meanness*disinhibition; *df* = 7,41

[c] Predictors: Sum of fixations on eye area, sum of fixations on mouth area; *df* = 9,39

* $p \leq .05$

** $p < .001$

Table 10

Results of Hierarchical Regression Analyses for TriPM Scores and Fixations Predicting Disgust Identification Errors

Variable	β	t	sr^2	R	R^2	ΔR^2
Step 1				.37	.14	.14
Boldness	-.06	-.42	.00			
Meanness	.23	1.05	.02			
Disinhibition	.18	.85	.01			
Step 2				.57	.33	.19*
Boldness	-.02	-.08	.00			
Meanness	.45	1.83	.05			
Disinhibition	.17	.69	.01			
Boldness*Meanness	-.12	-.42	.00			
Boldness*Disinhibition	.12	.52	.00			
Meanness*Disinhibition	.48	2.76**	.13			
Boldness*Meanness* Disinhibition	-.05	-.19	.00			
Step 3				.60	.36	.03
Boldness	-.06	-.28	.00			
Meanness	.50	2.00*	.07			
Disinhibition	.13	.64	.01			
Boldness*Meanness	-.10	-.36	.00			
Boldness*Disinhibition	.12	.54	.00			

Table 10 Continued

Variable	*β*	*t*	sr^2	*R*	R^2	ΔR^2
Meanness*Disinhibition	.51	2.90**	.14			
Boldness*Meanness* Disinhibition	.00	-.01	.00			
Sum of fixations on eyes	-.03	-.22	.00			
Sum of fixations on mouth	-.17	-1.31	.03			

* $p \leq .05$

** $p < .01$

Table 11

Summary of Dot Probe Task Results

M (*sd*)	Block 1	Block 2	Block 3
Total			
Score	.97 (.14)	.98 (.11)	.98 (.11)
Response Time	384.83 (55.39)	380.47 (54.75)	390.93 (54.82)
Probe at Fear Face			
Score	.99 (.03)	.98 (.11)	.98 (.11)
Response Time	385.27 (51.74)	379.97 (55.11)	389.74 (55.81)
Probe at Calm Face			
Score	.99 (.03)	.99 (.11)	.98 (.11)
Response Time	385.36 (58.84)	388.56 (62.68)	392.24 (57.08)

Table 12

Correlations (r) Between TriPM Scores and Dot Probe Scores (N = 90)

	Boldness	Meanness	Disinhibition	TriPM Total
Total				
Block 1	-.03	-.01	.01	-.01
Block 2	-.14	.01	.10	-.01
Block 3	-.15	.02	.11	-.01
Probe at Fear Face				
Block 1	-.06	-.15	-.07	-.13
Block 2	-.13	.01	.11	.00
Block 3	-.15	.06	.15	.02
Probe at Calm Face				
Block 1	-.02	-.24*	-.14	-.18
Block 2	-.14	.02	.10	-.01
Block 3	-.14	-.01	.07	-.03

* $p < .05$

Table 13

Correlations (r) Between TriPM Scores and Dot Probe Response Times (N = 90)

	Boldness	Meanness	Disinhibition	TriPM Total
Total				
Block 1	.11	.20	.07	.17
Block 2	.03	.16	.14	.14
Block 3	.02	.16	.09	.12
Probe at Fear Face				
Block 1	.09	.24*	.11	.20
Block 2	.02	.14	.12	.12
Block 3	.05	.14	.06	.11
Probe at Calm Face				
Block 1	.11	.16	.04	.14
Block 2	.07	.28*	.18	.23*
Block 3	-.01	.17	.11	.13

* $p < .05$

Table 14

Correlations (r) Between Facilitation and TriPM Scores (N = 87)

	Block 1	Block 3
Boldness	-.02	-.10
Meanness	-.20	.09
Disinhibition	-.14	.10
TriPM Total	-.16	.05

Table 15

Mean Facilitation by Psychopathy Group and Gender Across Dot Probe Task Blocks

		Means (*SD*)	
Group	*N*	Block 1	Block 3
LP Women	36	4.91 (19.27)	1.87 (24.82)
HP Women	22	3.85 (21.30)	-2.25 (25.29)
LP Men	3	3.03 (14.01)	-8.37 (21.00)
HP Men	26	-4.20 (13.01)	8.11 (26.64)

Note: LP = "low psychopathy" group, HP = "high psychopathy" group

Table 16

Summary of Two-Way Repeated Measures ANOVA Results – Group by Gender Facilitation Performance Across Dot Probe Task Blocks

Source	SS	df	MS	*F*	*p*
Between Subjects					
Group	18.65	1	18.65	0.03	.865
Gender	107.96	1	107.96	0.17	.682
Error (between)	52834.73	83			
Within Subjects					
Block	76.27	1	76.27	0.23	.635
Block * Group	478.56	1	478.56	1.42	.236
Block * Gender	113.43	1	113.43	0.34	.563
Block * Group * Gender	805.38	1	805.38	2.39	.126
Error (within)	27934.34	83	336.56		

Table 17

Summary of Eye Tracking Results for Dot Probe Task

	M (sd)		
	Block 1	Block 2	Block 3
Total fixations	155.36 (64.70)	155.45 (63.15)	146.49 (63.17)
Total duration	45.71 (15.05)	46.67 (15.60)	43.98 (17.13)
Fear fixations	31.09 (19.62)	26.36 (18.52)	27.62 (17.75)
Eye fixations	18.51 (15.94)	16.85 (15.32)	15.15 (14.45)
Mouth fixations	2.96 (3.90)	3.89 (4.68)	2.89 (3.89)
Calm fixations	16.06 (12.19)	15.38 (12.22)	14.81 (11.04)
Eye fixations	16.72 (13.96)	17.51 (13.87)	14.98 (13.89)
Mouth fixations	3.81 (4.36)	6.09 (5.94)	4.15 (4.28)

Table 18

Correlations (r) Between Eye Tracking Results and TriPM Scores in Dot Probe Task

	Boldness	Meanness	Disinhibition	TriPM Total
Block 1				
Fear fixations	.18	-.04	-.01	.04
Eye fixations	.16	.16	.16	.20
Mouth fixations	.08	-.11	-.19	-.10
Calm fixations	.14	-.15	-.11	-.07
Eye fixations	.24	.24	.16	.27
Mouth fixations	.00	.05	.01	.03
Block 2				
Fear fixations	.14	-.05	-.07	.00
Eye fixations	.13	.25	.21	.25
Mouth fixations	.19	.08	.03	.11
Calm fixations	.09	-.34*	-.34*	-.27
Eye fixations	.21	.17	.12	.21
Mouth fixations	.13	.23	.19	.23
Block 3				
Fear fixations	.17	-.05	-.08	.00
Eye fixations	.15	.23	.18	.23
Mouth fixations	.05	.03	-.04	.02
Calm fixations	.07	-.16	-.21	-.13

Table 18 Continued

	Boldness	Meanness	Disinhibition	TriPM Total
Eye fixations	.14	.38**	.33*	.36*
Mouth fixations	.07	.14	.01	.10

* $p < .05$

** $p < .01$

Table 19

Summary of Hierarchical Regression Analyses for Gender, TriPM Scores, and Fixations Predicting Facilitation

Block 1	*F*	df	*p*	R^2	ΔR^2
Step 1[a]	1.43	1, 42	.238	.03	.03
Step 2[b]	1.26	4, 39	.301	.16	.08
Step 3[c]	.75	8, 35	.646	.15	.03
Step 4[d]	.68	14,29	.778	.25	.10
Block 3	*F*	df	*p*	R^2	ΔR^2
Step 1	1.30	1, 42	.260	.03	.03
Step 2	.91	4, 39	.469	.09	.06
Step 3	.43	8, 35	.896	.09	.00
Step 4	.53	14, 29	.894	.20	.12

[a] Predictor: gender

[b] Predictors: boldness, meanness, disinhibition

[c] Predictors: boldness*meanness, boldness*disinhibition, meanness*disinhibition, boldness*meanness*disinhibition

[d] Predictors: total fear fixations, fixations on fear face eyes, fixations on fear face mouths, total calm fixations, fixations on calm face eyes, fixations on calm face mouths