EYE SPY? EMOTION RECOGNITION AND DETECTION

IN PSYCHOPATHY

by

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ABSTRACT

Psychopathy is a constellation of personality traits including callousness, manipulativeness, social dominance, and antisocial behavior. Psychopathy is associated with deficits in the recognition of emotions in others, which along with poor emotional responsivity may facilitate in the perpetration of criminal or immoral treatment of others. Emotional features detection is the orientation of visual attention to the emotionally salient aspects of an image that convey the emotion expressed. Thus, emotional features detection is necessary to accurately identify the emotions in others and subsequently for social learning abilities. Previous research on emotional features detection related to emotion recognition has focused mainly on children and adolescents with callous unemotional traits. The current study examined emotion recognition errors in two adult samples and features detection in a sample of university students. Participants exhibiting affective-interpersonal traits of psychopathy tended to have more difficulty recognizing fearful emotions in others and spent less time looking at the emotionally salient aspects of facial images than individuals higher on disinhibition. The garnered information will be useful in elaborating upon the fundamental understanding of psychopathic personalities, and it will potentially guide treatment approaches.

DEDICATION

This dissertation is dedicated to my family, close friends, and mentors, who have encouraged me throughout my academic career and have offered endless support through all of my endeavors.

LIST OF ABBREVIATIONS AND SYMBOLS

M Mean: the sum of a set of measurements divided by the number of measurements in the set

N Sample size of group

p Probability associated with the occurrence under the null hypothesis of a value as extreme as or more extreme than the observed value

r Pearson product-moment correlation

SD Standard Deviation: value of variation from the mean

< Less than

> Greater than

= Equal to

± Plus or minus

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CHAPTER 1

INTRODUCTION

Emotional detachment has long been identified as a characteristic of psychopathy, and evidence suggests that individuals high on psychopathy have deficits in the recognition of emotions in others. While a number of studies have shown deficits in fear recognition in adolescents and male inmates high on psychopathy, results related to other affective expressions are less clear. The current project will attempt to clarify these findings and extend them to a university sample as well as a community sample of individuals with externalizing traits.

Preliminary research has shown that instructing adolescent boys high on psychopathy-like traits to look at the eye region of a face increases their ability to correctly identify the emotions including fear (Dadds, Masry, Wimalaweera, & Guastella , 2008). The current study will continue the investigation of allocation of visual attention to emotionally salient aspects of an image in a university sample using eye-tracking technology. Differences across conceptual features of psychopathy as well as attentional control will also be examined.

A lack of affective cues detection may underlie reported deficits in ability to accurately recognize emotional expressions. The aim of the study is to assess emotional features detection as an explanation for poor affect recognition. Emotion recognition, particularly for negative emotions, is important for development of social functioning such as empathy (Dadds et al., 2012). Understanding the perceptual mechanisms of social cue detection may have implications for treatment through gaze redirection.

Psychopathy

Psychopathy is a severe personality disorder that appears in high rates among incarcerated individuals (Hare & McPherson, 1984). Some estimate a prevalence rate of 1% in the general population but 15% to 25% in prison populations indicating a disproportionate amount of serious crime committed by individuals high on psychopathy (Hare, 1996). Global psychopathy has been associated with cold-blooded, instrumental violence and greater likelihood of using a weapon during crimes, which illustrates the ability to commit premeditated acts with little remorse (Serin, 1991; Woodworth & Porter, 2002). Additionally, psychopathy consistently has been shown to predict antisocial behavior (see Leistico, Salekin, DeCoster, & Rogers, 2008), youth recidivism (Edens, Campbell, & Weir, 2007), and aggression (Patrick & Zempolich, 1998). Psychopathy is an important construct to study because of the devastating impact criminals with the disorder have on society.

Hervey Cleckley in 1941 was the first modern scholar to describe the psychopathic personality in his book *The Mask of Sanity*, which is based upon his work with male psychiatric patients. He posited sixteen characteristics of psychopathy including absence of “nervousness” or psychoneurotic manifestations, pathologic egocentricity and incapacity for love, general poverty in major affective reactions, and unresponsiveness in general interpersonal relations (Cleckley, 1988). Cleckley’s descriptions of the psychopathic personality have been foundational for the past seven decades of research on the subject.

Psychopathy is currently described as a heterogeneous personality type characterized by traits including glibness, superficial charm, callousness, and having a manipulative interpersonal style. Individuals high on psychopathy are often drawn to sensation seeking and antisocial behaviors that may be criminal in nature. Furthermore, psychopathy is associated with a lack of emotional responsiveness, fearlessness, and low startle response which are related to a shallow affect (Cleckley, 1988). Low anxiety and failure to learn from consequences have also been described (Lykken, 1995).

Elaborating upon Cleckley's conceptualization with developments in research, Robert Hare developed a rating scale for these traits to generate more consistent, empirical assessment of the clinical construct for use in incarcerated populations (Hare, 1996). Today, the Psychopathy Checklist – Revised (PCL-R; Hare, 2003) is widely regarded as the best validated measure of psychopathy (Hare & Neumann, 2006) and is widely used in research and forensic clinical settings. The measure contains twenty items on which individuals are rated using information gathered from interviews and records (Hare, 2003). Conceptually, the PCL-R has shaped modern models of psychopathy as two broad dimensions of psychopathy emerge from factor analysis of these items. Factor 1 is often described as Interpersonal/Affective (e.g., glibness/superficial charm, conning/manipulation, lack of remorse or guilt, failure to accept responsibility for actions) and Factor 2 is described as Social Deviance (e.g., impulsivity, irresponsibility, juvenile delinquency, criminal versatility; Hare, 1993; Hare, 2003; Hare & Neumann, 2006;). Further analyses have suggested a four-factor structure with dimensions labeled Interpersonal, Affective, Lifestyle, and Antisocial (see Hare & Neumann, 2008 for review).

The PCL-R items are scored using material from extensive interviews and record reviews, which pose limitations of time and resources outside of the prison population for which it was developed (Lilienfeld & Fowler, 2006). Some have argued that the PCL-R as an assessment measure has become conflated with the construct of psychopathy, which in turn has drifted from Cleckley's original conceptualization (see Hare & Neumann, 2008 for discussion). Specifically, absence of stress immunity and fear have been noted as missing from the PCL-R whereas impulsivity and criminal behavior are included in contrast with Cleckley's emphasis on interpersonal and affective traits (Lilienfeld & Andrews, 1996; Skeem & Cooke, 2010).

In response to these practical and conceptual limitations, the Psychopathic Personality Inventory (PPI; Lilienfeld & Andrews, 1996) was developed as a self-report measure that could be administered efficiently in non-criminal populations with a return to the personality-based approach as opposed to the behavior-based approach. Thus, the conceptualization driving the PPI was increased emphasis on personality traits suggested by Cleckley and others (Karpman, 1948; McCord & McCord, 1964) and decreased emphasis on violent, antisocial behaviors in Hare's model (Lilienfeld & Andrews, 1996). The PPI generates eight subscales (Stress Immunity, Fearlessness, Social Potency, Machiavelian Egocentricity, Carefree Nonplanfulness, Impulsive Nonconformity, Blame Externalization, and Coldheartedness) which load onto two broad higher-order dimensions which have been supported by factor analysis (Benning et al., 2003; Patrick et al., 2006) and labeled Fearless Dominance (bold and dominant interpersonal style) and Impulsive Antisociality (disinhibited, self-centered, ruthless; Benning et al., 2005).

Patrick, Fowles, and Krueger (2009) reviewed the wide ranging theories and debates surrounding the construct of psychopathy. One issue has been the varying emphasis placed upon externalizing characteristics such as impulsivity, explosive violence, and antisocial acts. While most scholars agree on the importance of dysregulated behavior, some researchers have questioned criminal behavior as a requisite characteristic of psychopathy (Skeem & Cooke, 2010), whereas others defend the inclusion of antisocial behavior as an important component in the assessment of criminal psychopathy (Hare & Neumann, 2008). A second issue is varying emphasis on traits such as interpersonal dominance, superficial charm, and narcissistic or egocentric perspective. Measurement modalities exemplify divergent emphasis on these traits as the Fearless Dominance factor of the PPI captures these traits well, but Factor 1 of the PCL-R captures them to a lesser degree (Patrick, 2010). Third, a number of prior accounts illustrated cruelty and coldheartedness related to callous exploitation. Such traits have also gained varying prominence in assessments but have been captured well in the PCL-R Factor 1 (Patrick, 2010). Thus, conceptual variability has impacted not only the content of measurement but also the structure as two, three, and four factor models of psychopathy have been proposed (Cooke & Michie, 2001; Hare & Neumann, 2006; Lilienfeld & Andrews, 1996; Patrick, Fowles, & Krueger, 2009)

As a result, Patrick, Fowles, and Krueger (2009) proposed the Triarchic model which integrates historical perspectives with sound assessment instruments. The authors were influenced by a variety of perspectives generating the concept of psychopaths exhibiting externalizing behaviors in the context of emotional detachment, or lack of social relatedness, to others. The proposed domains were developed to capture recurring themes in the various theories and manifestations of psychopathy. The authors argue for three, distinct phenotypic constructs comprising the Triarchic model of psychopathy: disinhibition, boldness, and meanness. Within the Triarchic model, meanness is related to disaffiliation, low empathy, exploitativeness, and rebelliousness. Boldness phenotypically describes traits such as social dominance, calmness under pressure, and bravery. Disinhibition most strongly encapsulates the antisocial and impulsive traits of most social deviance measurement factors (Patrick, Fowles, & Krueger, 2009). In relation to other prominent models, the construct of disinhibition appears across most measurement modalities while meanness is indexed in the PCL-R Factor 1 and boldness is captured by PPI Fearless Dominance. The Triarchic model has been shown to capture proposed facets of psychopathy in offender and university samples (Patrick, 2010; Sellbom & Phillips, 2013; Stanley, Wygant, & Sellbom, 2013).

Emotion Deficits

Researchers have sought to study the etiology of this personality construct to better understand the links to destructive and sometimes violent behavior. Emotion processing deficits in adult psychopathy include decreased reactivity to unpleasant stimuli (Osumi, Shimazaki, Imai, Sugiura, & Ohira, 2007) and negative emotion words (Verona, Sprague, & Sadeh, 2012; Williamson, Harpur, & Hare, 1991). Cleckley (1941) described traits such as absence of "nervousness," lack of remorse, and general poverty in major affective reactions that begin to describe underlying detached emotionality. Lykken (1957) showed that inmates rated as low-anxiety psychopaths[1] were defective in avoidance learning. Replications of Lykken's study in conjunction with findings of low arousal in punishment conditioning (Fowles, 1980) have produced what is now referred to as the low-fear hypothesis of psychopathy (Fowles & Dindo, 2006). Subsequent research showed decreased startle response to unpleasant stimuli in psychopathic sex offenders compared to normal controls (Patrick, Bradley, & Lang, 1993) supporting the selective fear deficit hypothesis (see Fowles & Dindo, 2006). Additionally, poor fear conditioning has been reported in individuals high on psychopathy. For example, Flor and colleagues (2002) used classical conditioning to pair an unpleasant odor (US) with neutral faces (CS). Non-criminal psychopathic males showed normal, aversive reactions to the odor but failed to show aversion to the conditioned stimulus to the extent of the healthy controls. Taken

[1] At the time of Lykken's 1957 paper, the term sociopathy was used to identify individuals with personality traits related to impulsivity and failure to learn from consequences. Furthermore, sociopathy was divided into etiologically distinct subcategories. His so-called "primary sociopath" reflected a personality type that closely resembled Cleckley's description.

together, these avenues of research suggest that emotional processing deficits may be considered at the core of the psychopathic personality.

A number of studies have shown biological correlates of affective-emotional processing deficiencies in psychopathic individuals, particularly abnormalities in brain regions such as the amygdala (see Dawel, O'Kearney, McKone, & Palermo, 2012 for a review; Marsh & Blair, 2008) and orbitofrontal/ventromedial regions of the prefrontal cortex (Yang & Raine, 2009). While the amygdala has traditionally been conceptualized as a center for fear/threat processing (Blair, et al., 2004), more recent evidence suggests that it is involved to some extent in the processing of a variety of affective expressions (Dawel et al., 2012; Fitzgerald, Angstadt, Jelsone, Nathan, & Phan, 2006). Case studies of individuals with damage to the ventromedial prefrontal cortex before the age of 16 months show an inability to access knowledge of socially and morally appropriate behavior and thus exhibit psychopathy-like traits such as impulsivity, irresponsibility, and lack of remorse or guilt (Anderson, Bechara, Damasio, Tranel, & Damasio, 1999). Biological deficiencies may underlie the inability to recognize and respond to emotional cues in others and may contribute to callous or aggressive actions toward others.

Developmental studies suggest that affective processing deficits exist in youth high on Callous Unemotional (CU) traits (Frick & White, 2008), which are often precursors to a psychopathic personality (see Frick, 2009). These deficits occur in response to a number of stimuli including emotional words with delinquent adolescent boys (Loney, Frick, Clements, Ellis, & Kerlin, 2003) and vocal tones with boys with psychopathic tendencies (Blair, Budhani, Colledge, & Scott, 2005). Evidence suggests that affective processing deficits stem from amygdala dysfunction in psychopathy in early stages of information processing (Viding et al., 2012). Understanding developmental origins of emotion deficits have implications for adult emotional detachment. Specifically, early deficits in distress cue responsiveness related to poor eye contact in young children diagnosed with oppositional defiant disorder are a precursor to shallow empathy development (Dadds et al., 2012).

Emotion Recognition.

Emotion recognition in others has important implications for understanding social cues (Dadds et al., 2012). Happiness, surprise, anger, fear, contempt, sadness, and disgust have generally been considered the seven basic, universal expressions (Russell, 1994). Boys high on psychopathic traits (Dadds et al., 2008) and adults (Marsh & Blair, 2008) have been noted to show deficits in recognizing emotions in a number of presentation modes (Dawel et al., 2012). Dawel, O'Kearney, McKone, and Palermo (2012) produced a meta-analysis of emotion recognition studies related to psychopathy across facial, vocal, and postural modalities. The researchers found impaired overall emotion recognition deficits for all basic emotions in facial and vocal displays. Further analyses showed deficits in recognition of fear, happiness, and surprise when presented facially or vocally and poor sadness identification when presented facially. Divergent results across expression modalities suggest broad affective deficits that include visual and auditory perception.

Studies with adolescents have consistently shown that deficits do not occur in the identification of positive emotions but rather are circumscribed to negative emotions and fear in particular (Blair et al., 2001; Frick & White, 2008). Furthermore, numerous studies in children indicate that those high on callous unemotional traits have fear-processing deficits (Blair & Coles, 2000; Blair, Colledge, Murray, & Mitchell, 2001; Dadds et al., 2006; Stevens, Charman, & Blair, 2001) including preattentive, automatic processing of fearful emotions in others (Sylvers, Brennan, & Lilienfeld, 2011; Viding et al., 2012). Emotion recognition deficits, particularly for negative emotions and distress cues, may have implications for the ability of people high on psychopathy to commit violent acts with little regard for the victim. However, specific affective recognition deficits are less clear in adult research (Dawel et al., 2012; Dolan & Fullam, 2006; Glass & Newman, 2006; Marsh & Blair, 2008).

Research studies often show fear recognition deficits associated with psychopathy, but results are mixed with regard to other emotions in adults. Blair and his colleagues (2004) showed that male inmates high on psychopathy had impairments in the ability to recognize emotions, specifically fearful faces, as well as disgust but not sadness. Another study of male inmates showed deficits in the identification of disgust while relying on the right-hemisphere resources, but not fear or sadness (Kosson, Suchy, Mayer, & Libby, 2002). On the contrary, other studies showed more general deficits across a number of emotions including happiness, surprise, and sadness (see Dawel et al., 2012 for a review). In a sample of male inmates, Dolan and Fullam (2006) found deficits for recognition of sad and happy expressions but not for any other emotions. Furthermore, Glass and Newman (2006) found no differences between psychopathic and non-psychopathic offenders on emotion recognition tasks. A test of theory of mind presented male inmates with the eye region only and asked participants to select the correctly portrayed complex mental state from four choices (Richell et al., 2003). Contrary to expectations, individuals rated as psychopathic and those rated as non-psychopathic performed equally well on this task of mental state identification. A more general role of emotion processing in the amygdala may explain conflicting results in specific emotion recognition deficits associated with psychopathy (Dawel et al., 2012).

Marsh and Blair (2008) questioned whether fear recognition deficits in the literature could be accounted for by task difficulty. Their meta-analysis included 20 articles that assessed facial affect in the context of antisocial traits or behaviors. The authors found deficits in fear recognition, and to a lesser extent sadness and surprise, to be more significant than in any other emotion. These deficits could not be better explained by task difficulty or moderator variable such as age and gender and were greater in antisocial compared to control populations. However, the authors qualify that fear is the most difficult of the basic emotions even for healthy subjects cross-culturally to identify correctly (Russell, 1994).

Most investigations into the relationship between emotion recognition and psychopathy have reported psychopathy as a unitary construct, but important differences may exist among conceptual psychopathy factors. In two meta-analyses, emotion recognition deficits were especially associated with affective-interpersonal traits (Dawel et al., 2012); although, individuals with antisocial traits also show deficits in emotion recognition (see Marsh & Blair, 2008). In a sample of mainstream classroom school children assessed using the Antisocial Psychopathy Screening Device (APSD; Frick & Hare, 2002), higher psychopathy total scores were associated with decreased ability to recognize fear, sadness, and anger (Blair & Coles, 2000). Additionally, when a two-factor structure similar to the PCL-R was applied, Factor 1 traits were associated with poorer ability to recognize fear and sadness, whereas Factor 2 traits were associated with poorer recognition of fearful expressions only. Given contradictory findings in previous studies and little delineation between psychopathy facets, additional research is needed to compare emotion recognition deficits with conceptually relevant models of psychopathy. Moreover, further research in non-incarcerated samples is needed to increase the generalizability of these findings.

Emotional Features Detection.

In real-world scenarios, individuals must gather information necessary for social interactions by attending to the faces, and more specifically the eyes, of other individuals. This ability is measured in lab tasks of emotion recognition where participants must visually attend to areas of an image that provide essential information about the emotions portrayed to correctly identify the expression. Researchers have examined emotion recognition in relation to specific facial feature detection mostly in samples of children and adolescents. Emotions are expressed through muscle movements of the face with some emotions (i.e. fear) being more reliant on the eye region and others (i.e. disgust) reliant on the mouth region (Ekman, Friesen, & Tomkins, 1971). In one study, adolescents from the community who display conduct problems as measured by the Strengths and Difficulties Questionnaire (Goodman, 2001) performed poorly on tasks of emotion recognition even when they were only shown the most salient feature of emotion, the eyes (Sharp, 2008).

Other evidence suggests that explicitly instructing adolescent participants to attend to the eye region of the facial expression increases correct emotion recognition (Dadds et al., 2006). Dadds and colleagues (2008) assessed private school boys using the APSD and affective images that they were asked to label under three conditions: free-gaze, eye-directed, and mouth-directed. Compared to boys rated low on CU traits, those high on CU traits performed significantly worse at fear recognition during the free-gaze condition. When participants were instructed to look at the eyes, both groups showed comparable performance on fear recognition. However, deficits returned in a mouth-directed gaze condition in boys high on CU traits. Furthermore, eye tracking data showed that even in the eye-directed condition, boys higher on CU traits had fewer fixations to and spent less time looking at the eye region than the boys low on CU traits. These results indicate that explicitly directing individuals with CU traits to look at the eye region of a face increases accuracy of fear detection even when quantitative visual attention to the area is less than their low CU trait counterparts.

Adolphs and colleagues (2005) report on the case of SM, a woman with localized, bilateral amygdala damage. While SM was able to recognize some affective expressions such as happiness, she was unable to recognize fear. Free-gaze eye tracking tests showed that she had deficits in fixating on the eye region of images compared to normal peers. However, when she was directed to look at the eye region, her recognition of fearful affect improved, but only while she was explicitly directed to look at the eyes. This preliminary evidence suggests that the amygdala is related to orientation to emotional features, which in turn impacts fear recognition.

Another element in feature detection besides salient aspects of the face is attending to an emotional face in the context of a more complex background. Sadeh and Verona (2012) incorporated emotional and attentional systems to investigate physiological reactions to emotionally salient images in an adult sample recruited from the community and criminal justice agencies assessed on the Psychopathy Checklist: Screening Version (PCL:SV; Hart, Cox, & Hare, 1995). They found that picture complexity moderated emotion processing in two factors of psychopathy. Specifically, affective-interpersonal traits were associated with more allocation of attention to emotional stimuli within more complex visual display, as measured by EEG technology. On the other hand, individuals higher on impulsive-antisociality traits did not allocate much attention to emotional stimuli presented in a complex image. Complexity of the visual stimuli without a clear figure and ground may have important implications for orientation towards emotionally salient aspects of the image (Sadeh & Verona, 2012). However, the researchers in this study used a variety of emotion-invoking images, not only emotional faces.

Further adult research on the detection of specific affective facial features imbedded in complex visual stimuli is warranted.

Eye Tracking

One method of measuring visual attention to specific regions of an image is eye tracking technology. Studies using eye-tracking methodologies have historically been used most often to investigate eye movements during reading tasks (Anson & Schwegler, 2012). Additional applications such as advertising, driving, disabilities, and some mental illnesses (i.e. schizophrenia) have appeared in recent years. Eye trackers typically provide data based upon fixation points, or the pause of eye movement to look at a specific part of the stimuli. The combinations of fixation points may yield a number of results including a “gaze plots” (pathway of fixations), “bee swarm” (aggregate of many individuals’ eye movements), “heat maps” (areas that draw the most attention), and “clusters” (individual’s areas of interest; Anson & Schwegler, 2012; Grinbath.com).

A number of studies have used eye tracking in autism and attention to social stimuli research. Autism is associated with reduced attention to faces and thus may have an impact on social learning abilities that are notably reduced in individuals with autism (Ribby & Hancock, 2009). Another study revealed that high-functioning adolescents with autism fixated on the eye region of the face for the same portion of time as normally developing adolescents (Freeth, Chapman, Ropar, & Mitchell, 2010). However, the individuals with autism did not focus on this area immediately and spread out the facial fixation time throughout the five second display. Individuals high on psychopathy may show similar patterns of insufficient attention to facial features which result in low emotional processing.

Research on psychopathic traits using eye tracking is limited. In a sample of adolescent boys previously described, an eye tracker recorded number of fixations, duration of fixations, and order of fixations within pre-defined areas around the eyes and mouth in images of affective expressions (Dadds et al., 2008). Averages for number, duration, and first fixations to the eyes or mouth were generated for each participant in each condition for each emotion. High CU traits were associated with decreased scores on all fixation indices to the eye region for all emotions compared to boys with low CU traits. Additionally, there were no significant differences between CU trait groups in the free-gaze condition, but those high on CU traits showed a smaller increase in visual attention to the eyes and mouth when directed to do so. Taken together, these results indicate less attention to the eye region of an image across all emotions even when instructed to look at that region. Further research is needed to elucidate these findings in adult populations with both genders. While deficits in attention to the eyes and mouth in directed conditions exist in facial images, these results need to be expanded to more real-world images showing a full body to examine orientation to an expressive face. The precision of measurement gained with eye tracking will add significantly to the understanding of emotion recognition due to feature detection. Specific implications for psychopathy include better understanding of emotional processing beginning with detailed stimulus perception above and beyond previous studies using self-report and affect labeling tasks.

Attention

In addition to specific emotional features detection, attention deficits have been hypothesized to moderate fear deficits in psychopathy (Baskin-Sommers, Curtin, & Newman, 2011a). The response modulation theory suggests that fear conditioning, emotional, and behavioral deficits associated with psychopathy indicate a failure to process salient information when it is peripheral to goal-directed behavior (Newman, Curtin, Bertsch, & Baskin-Sommers, 2010). The theorists argue that this response modulation predicts situation-specific fear deficits and attention problems broader than fear only deficits. In one study, eye blink following startle probe (white-noise burst) was measured in male inmates at a maximum-security prison (Baskin-Sommers et al., 2011a). Participants were administered a task in which threatening stimuli (a red box) predicted the startle probes and attention to the threatening stimuli was measured. Psychopathy was related to deficits in fear potentiated startle when the threatening stimuli was peripheral, but not when it was the central feature of attention. Additionally, attention moderated the relationships between fear potentiated startle and psychopathy total, Factor 1, and Factor 2 scores as measured by the PCL-R indicating broad importance of attention selection to psychopathy. The researchers conclude in the context of existing literature that global psychopathy may be related to attention biases that once established are difficult to redistribute to peripheral cues.

Given the potential for attentional biases to affect emotion recognition, perhaps manipulations that direct focus to relevant stimuli are important for affective features detection and, in turn, emotion recognition. Selective attention is the ability to focus and shift attention to relevant stimuli and is related to cognitive control, a mechanism showing deficits in Factor 2 but not Factor 1 of psychopathy (Baskin-Sommers, Zeier, and Newman, 2009). In a study with male offenders, Baskin-Sommers, Zeier, and Newman (2009) found superior attentional control associated with affective-interpersonal traits of psychopathy and inferior attentional control associated with social deviance traits across a variety of psychopathy measurement modalities (i.e., PCL-R, PPI, and Multidimensional Personality Questionnaire-Brief; MPQ-B; Patrick, Curtin, and Tellegen, 2002). However, the researchers used a self-report measure of attentional control, a methodology that could be influenced by response bias and individual subjective experiences.

Samples of adult, male inmates (Baskin-Sommers et al., 2011a) and boys high on CU traits (Sylvers et al., 2011) both show early-stage or preattentive deficits in emotion recognition, particularly to threat or fear cues. These results indicate that not only are attentional control deficits present in individuals high on psychopathic traits, but these modulation difficulties are present early in the cognitive processing. Response modulation related to poor attentional control and disinhibition has implications for understanding whether the impairments observed in psychopaths are attributable to deficits in affective processing or deficits in attention. Thus, it is important for future studies to account for attention in the modulation of psychopathy and emotional processing (Baskin-Sommers, Curtin, Li & Newman, 2011b; Newman et al., 2010). Specifically, deficits in the ability to direct attention to emotionally salient features that are not designated as central to the task may be apparent in individuals with psychopathic traits, particularly social deviance traits (Dadds et al., 2008; Zeier, Maxwell, & Newman, 2009).

Objectives

The current study examined both emotion recognition (ability to identify emotional expressions) and emotional features detection (attending to emotionally salient aspects of an image such as the eyes/mouth or face in images of faces or the full-body, respectively). While there is evidence for the presence of emotion recognition deficits in psychopathy, the extent of specific affective expression deficits is unclear. Compared to emotion recognition, less is known about the underlying mechanisms of this emotion processing, including visual attention to salient social clues. In images of faces, I measured attention to the eye and mouth regions in a free-gaze condition and subsequently in an emotion recognition task. Thus, I investigated whether visual attention differs between individuals low on psychopathy versus those higher on psychopathy and if the gaze patterns change when emotion recognition is required. Furthermore, accuracy of emotion recognition was assessed as well as patterns of errors in those high on psychopathy to clarify mixed findings in the literature. As just reviewed, emotion recognition deficits, especially with regard to fear detection (Marsh & Blair, 2008), have been shown with global psychopathy and affective-interpersonal factors more specifically (Dawel et al., 2012; Sylvers et al., 2011). The current study aimed to replicate these findings in both a university sample and a community sample of individuals oversampled for subclinical psychopathy traits. Additionally, emphasis was placed on investigation into psychopathy factors of various theoretical models.

Furthermore, there is little adult psychopathy research on detection of emotional features in a complex image (e.g. attending to an emotional face in a full-body image containing many foils; Sadeh & Verona, 2012). The current study extended emotional features detection of the face to full-body images to investigate attention to the face. Specifically, I examined attention to the face when there were few background distractors compared to images with more complex backgrounds. I investigated differences in attention to the face in calm versus fearful expressions to examine the degree to which affectively salient cues draw visual attention. The full-body image condition extended emotional features detection to more real-world scenarios of encounters with others.

To my knowledge, no research on adult psychopathy has used eye tracking technology to examine visual attention to facial affect. This methodology is superior in the exact measurement of eye gaze compared to self-report measures of selective attention (Baskin-Sommers et al., 2009) or simply directed attention (Dadds et al., 2006). Eye gaze is indicative of visual perception; where people are looking is what they see. Eye tracking is a useful tool to measure visual attention to relevant stimuli that may inform on the emotional processing abilities of individuals higher in psychopathy. The present study measured emotional features detection using eye tracking to assess visual attention to both emotionally salient aspects of a facial expression and detection of an emotional face imbedded in a complex background. The utilization of this behavioral, in-lab measure of visual perception adds significantly to the understanding of emotional processing in psychopathy.

Finally, this study accounted for differences in selective attention (Newman et al., 2010) and examined the results in terms of general psychopathy as well as psychopathy facets. It is important to note that the prior research cited in regard to controlling for attention in emotional processing has been conducted in forensic samples and was important to replicate these results in community and university participants.

Hypotheses

1. I hypothesized that individuals higher on psychopathy in both an adult, community sample and a university sample would show deficits in emotion recognition tasks and would show the greatest deficits for fearful stimuli (Dawel et al., 2012; Marsh & Blair, 2008).
2. I hypothesized that eye tracking data would show that individuals higher on psychopathy allocate less visual attention to the eye region than individuals lower on psychopathy (Dadds et al., 2008).
3. I hypothesized that attention to emotionally salient aspects of the face would increase when individuals high on psychopathy were asked to label the emotion compared to free-gaze conditions (Dadds et al., 2008).
4. I hypothesized that eye tracking technology would show that individuals high on psychopathy compared to those lower on psychopathy measures would pay more attention

to peripheral aspects of a complex, full-body image rather than the face (Sadeh & Verona, 2012).

5. I hypothesized that eye tracking technology would show that individuals high on psychopathy would show increased attention to the face in full-body images when the background is simple rather than complex (Sadeh & Verona, 2012)

6. I hypothesized that overall, affective-interpersonal traits of psychopathy, particularly those associated with meanness (Patrick et al., 2009), would be more strongly associated with emotion recognition deficits than disinhibitory traits (Sylver et al., 2011).

7. I hypothesized that disinhibitory traits would be more strongly associated with poor selective attention than meanness or boldness traits (Baskin-Sommers et al., 2009; Sadeh & Verona, 2012).

8. I hypothesized that attention would partially account for the variance in the relationship between psychopathy and emotion recognition such that increased attention would account for better emotion recognition (Baskin-Sommers et al., 2009).

9. I hypothesized that attention would partially account for the relationship between psychopathy and emotional features detection such that increased attention would account for more gaze fixations and duration to emotionally salient features (Sadeh & Verona, 2012).

CHAPTER 2

METHODOLOGY

Study 1

Study 1 was derived from a larger project conducted at the University of Alabama with community participants.

Participants.

The sample included 240 participants (140 male and 100 female) who were 58.5% Caucasian, 32.5% African-American, and roughly 9% of other or mixed ethnicity. The mean age was 26.91 (SD=10.07) and ranged from 18 to 75 with 78% having never been married, 10% currently married, and 8% divorced. The average years of education was 14.45 (SD = 2.24). Almost 14% reported a juvenile arrest record and 25% of the sample reported at least one previous adult arrest.

Measures.

Psychopathy measures.

Triarchic Psychopathy Measure (TriPM; Patrick, 2010; 58 items): Participants provide self-report responds to each item on a 4-point Likert scale, ranging from 1 to 4 (1 = *true*, 2 = *mostly true*, 3 = *mostly false*, 4 = *false*). Although a total score can be computed for the TriPM, the primary focus of the inventory is on assessing psychopathy in terms of three distinguishable, albeit modestly correlated, dimensions of psychopathy: Boldness, Meanness, and Disinhibition. Patrick (2010) provides data regarding the differential correlates of these scales. The TriPM has exhibited good construct validity in both college (Sellbom & Phillips, 2013) and correctional (Sellbom & Phillips, 2013; Stanley et al., 2013) samples. Each of the three scales meet the cut-off for acceptable internal consistencies (αs = .79 - .86) across both samples.

Psychopathic Personality Inventory (PPI; Lilienfeld & Andrews, 1996; 187 items). The PPI measures psychopathic personality traits in non-incarcerated populations. It yields a total score and eight subscales which load onto the two factor scores of Fearless-Dominance (Stress Immunity, Fearlessness, Social Potency) and Impulsive-Antisociality (Machiavelian Egocentricity, Carefree Nonplanfulness, Impulsive Nonconformity, Blame Externalization) except for the Coldheartedness subscale which does not load onto either factor. The PPI has demonstrated promising convergent and discriminant validity in forensic and non-forensic settings (see Lilienfeld & Fowler, 2006 for a review).

Levenson's Self-Report Psychopathy Scale. The LSRP (Levenson, Kiehl, & Fitzpatrick, 1995) is a 26-item self-report inventory of psychopathic personality traits designed for use in non-institutionalized populations. In addition to a Total Score, investigations (e.g., Brinkley, Diamond, Magaletta, & Heigel, 2008; Sellbom, 2011) have indicated that the LSRP yields three factor scores (Egocentricity, Callous, and Antisocial). Brinkley and colleagues (2008) showed that the LSRP correlates moderately with the PCL-R, and other studies have shown more general support for its construct validity (Levenson et al., 1995; Sellbom, 2011).

Attention task.

Go-No-Go Flanker Task (Eriksen & Eriksen, 1974) is used to gauge selective attention. This computer task consisted of 4 blocks of 40 trials, and each trial consisted of a string of 5 letters (i.e., HHHHH; SSHSS; SSSSS; HHSHH) presented for 500ms in black script on a white background (the inter-trial interval varies from 1500-2500ms). Participants are instructed to press a button when the middle letter is the target (H) and to not press the button if the middle letter is a non-target (S). A dominant response (e.g., respond to target) is required in 80% of the trials. The frequency of target variables (H) varies across blocks with block 1 having more targets than the others. The participants are further instructed to ignore the flanker (surrounding) letters. Across the whole task, a greater number of commission errors (i.e., pressing the button to non-targets) are typically reflective of deficits in response inhibition (LaPierre et al., 1995). Results yield variables for accuracy, reaction times, and congruence or incongruence of flankers for each of the four blocks. The current study used an index of reaction times to target responses with higher scores indicative of better attention.

Emotion recognition task.

The Diagnostic Analysis of Nonverbal Accuracy Scale 2 (DANVA2; Nowicki & Carton, 1993; Nowicki & Duke, 1994) is a computerized affective processing task that uses facial stimuli. This series contains examples of four different emotional expressions (happy, sad, angry, or fearful [scared]) in differing degrees of intensity across 24 images. Total completion of this task takes approximately 5 minutes. The scale developers report in college student raters Cronbach coefficient alphas were .77 and test-retest reliability was .84 (Nowicki & Carton, 1993). The participants are instructed that they will see facial expressions and are to choose which of the four emotions best describes each example. In the current study, I assessed accuracy ratings as well as error patterns (e.g. confusing anger for fear). Each emotion received a total score which was the sum of all times that emotion was confused for another (e.g. the Happy errors variable was the sum of all instances where happy was labeled as sad, angry, or fearful).

Procedures.

Participants for Study 1 were recruited from the Tuscaloosa, AL area by advertising the study via a flyer that calls for "*adventurous, fearless, charming, and carefree people who've led exciting lives*." Participants were required to be 19 years or older and visually capable of viewing a computer screen. Participants were administered a range of experimental cognitive and affective tasks along with several self-report questionnaires and interviews. All cognitive tasks were completed prior to self-report questionnaires in order to reduce the possibility of fatigue.

Study 2

Participants.

Participants were recruited from the University of Alabama through the Department of Psychology's subject pool. A total of 264 students participated in the study, which was equivalent to the estimated sample size needed for the analyses. The sample size was determined based upon a power analysis using the following parameters: an alpha level of .05, a power of .80, and an effect size of .03 = F^2 for the entire regression equation. Participants were required to have visual abilities at a level that allows them to use a computer screen without eye-glasses.

Various technical errors prevented 27 participants from completing the demographic survey. Of the 237 participants who completed demographic information, 86 (36.3%) were men and 151 (63.7%) were women. The sample ranged in age from 18 to 25 years (M = 19.03, SD = 1.21). In terms of ethnic background, most were Caucasian (78.9%), with about 13% African-American, 4% Asian, and the remaining 4% of various other backgrounds. Participants were also asked about Attention-Deficit/Hyperactivity Disorder (ADHD) treatment and diagnosis to screen for alternative attention difficulties. Of the 35 (14.8%) participants who reported having a prior diagnosis of ADHD, 29 had been prescribed medication and 11 had taken it that day. Among the

18 participants who had not taken their medication that day, 15 reported that they thought that they still experienced symptoms of ADHD. Only seven participants who responded that they had been diagnosed with ADHD produced useable eye tracking data, so no further analyses were conducted with this demographic variable due to the small sample size.

Apparatus.

Grinbath Eye-Tracker.

The eye-tracker uses an infrared camera and LED light in front of the participant's eye to illuminate and capture movement of the pupil. Utilization of the head-mounted eye tracker began with focusing the camera and LED light on the participant's eye so that it was in line with the cross-hairs displayed on the computer screen. The initial test that the eye tracker was "locked" on the pupil was to have the participant look at the four corners of the screen to ensure that the pupil was highlighted throughout the movement. Then, a nine-point calibration began and the participants were instructed to look at each dot until it disappeared completely before looking at the next dot. Calibration was repeated as needed until all targets showed satisfactory accuracy. Eye movement data was sent directly to the program's software. The equipment recorded a variety of data including task time, areas of interest, gaze path, heat maps, and clustering. Raw data output generated x and y pixel coordinates at a rate of 20 frames per second (50Hz).

Fixation points within each image were defined by both spatial (15 pixel radius) and temporal (60ms) parameters. Saccadic movements were defined as a linear velocity of 15 or more pixels per frame ($d \geq 15$ pixels) where $d = \sqrt{}(x^2) + (y^2)$ for each 20ms frame (Klin et al., 2002). Thus, saccadic movements of 15 pixels or more from one frame to the next were excluded from defined fixation points. Finally, fixations required a 3 frame (60ms) minimum with no upper limit. At least half of the x/y coordinates per fixation were required to categorize a fixation point as falling within the areas of interest.

The current study used pre-defined areas indexed by pixel coordinates to designate areas of interest (AOI). For Tasks 1 and 4, the AOI was the face defined as the area extending between the shoulders to just above the top of the head. Tasks 2 and 3 showed images of the face only and two AOIs were defined – one around the eyes and the other around the mouth. Variables included in the analyses consisted of a ratio of number of fixations in and out of the AOI, a ratio of time spent fixating in and out of the AOI, as well as the average fixation duration in the AOI. Since Tasks 2 and 3 had two AOIs for each image, the two areas were collapsed to generate the two overall ratio scores (number and duration of fixations). Finally, I also measured the number of fixations before the first fixation in the AOI and the time before the first fixation in the AOI.

Microsoft Windows Computer.

Data was collected on a 32-bit Windows 7 desktop computer. The monitor size was 38 X 30.5 cm, and images were displayed on a 1280 X 1024 screen resolution. Participants sat in a stationary chair approximately 62cm from the screen.

Measures.

Selective attention.

Continuous Performance Test (CPT). Continuous performance tests have been utilized since the 1950s when they were first introduced by Rosvold and colleagues to study brain damage (Rosvold et al., 1956). Today, the Conner's Continuous Performance Test (CPT-II; Conners, 2000) is a common neuropsychological measure used to assess attention. The measure is based on a database of 2,686 subjects ages 6 years and older. Letters appear on the screen one at a time for 250 milliseconds with 1, 2, and 4 second inter-stimulus intervals (ISI) that vary between blocks of letters. Participants are to press the response button immediately after each letter except “X.” The measure lasts approximately 14 minutes. The results produce scores for vigilance (sustained attention), inattentiveness (selective attention), and impulsivity.

In the current study, five subscales of selective attention were used: omissions, commissions, hit reaction time, hit reaction time standard error, and attentiveness (d’) (Conners, 2000). Omissions are the number of targets to which the individual did not respond whereas commissions are the number of responses to a non-target “X.” An elevated number of omissions and commissions combined with slow reaction time (high T-scores on hit reaction time) indicates inattention. Hit reaction time standard error is the consistency of response times across the measure with high T-scores indicating variable reactions related to inattentiveness over the course of performance. Finally, attentiveness (d’) is a discriminability measure between targets and non-targets calculated as corrected hit rate minus corrected false alarm rate. The PEBL Continuous Performance Test (PCPT; Mueller, 2011) is a free, downloadable version of the CPT-II that was used in the current study.

Demographics questionnaire.

Participants completed a brief demographics questionnaire (Appendix A) electronically. The questionnaire included items regarding the diagnosis and treatment of ADHD, which could have an impact on performance on the PCPT. While other disorders such as autism and schizophrenia that have been associated with poor emotional features detection could have been assessed, I chose not to ask about them because psychopathic traits were the focus of this study regardless of additional diagnoses.

Psychopathy measures.

Triarchic Psychopathy Measure (TriPM) was used to compare samples on the same psychopathy measure.

Hare Self-Report Psychopathy Scale – 3rd Edition (SRP-III). The SRP-III (Paulhus, Neumann, & Hare, in press) is a 64-item self-report measure of psychopathy for which participants respond to questions on a 5-point Likert scale ranging from Strongly Agree to Strongly Disagree. The scale has four subscales: Interpersonal Manipulation (IPM; conning, manipulation, lying, blaming others), Callous Affect (CA; low empathy and remorse, lack of concern for others' feelings), Erratic Life Style (ELS; impulsivity, recklessness, thrill-seeking, boredom proneness), and Criminal Tendencies (CT; criminal activity, drug problems; Neal & Sellbom, 2012). The ELS and CT subscales both describe behavioral components of psychopathy with ELS describing tendencies to engage in highly external behavior while CT is a more specific measure of actual illicit behavior. Overall, the SRP-III captures many of the characteristic traits of psychopathy and shows good construct validity (Neal & Sellbom, 2012). Subscale alpha reliabilities from a student sample ranging from .74 to .82 with the overall scale reliability of .81 were reported (Paulhus, Neumann, & Hare, in press).

Eye tracking tasks.

Eye tracking tasks were presented in the following order such that stimuli presentations moved from free-gaze to recognition tasks. The task order was established so the free-gaze tasks would not be contaminated by later instructions to label emotions. The eye tracker was worn for the following four tasks, and participants were told to keep their head still and eyes on the screen at all times. Before Tasks 1 and 2, participants saw the instructions "You will see some images. Please keep your eyes on the screen at all times." At the beginning of Task 3, participants read the following instructions: “You will see the last set of images again. Then, you will be asked to label the emotion you just saw. Please keep your eyes on the screen at all times.” This task assessed recognition of seven basic emotions to clarify discrepancies in the literature regarding which emotions are associated with psychopathy deficits. Before Task 4, the DANVA program, they read: “You are going to see you some people’s faces, and I want you to tell me how they feel. I want you to tell me if they are happy, sad, angry, or fearful (scared). Please use the mouse to click on the emotion you think is best.”

Task 1. Participants were shown full-body images of six Caucasian models (three male, three female) each showing a calm (neutral) and fearful expression in a simple condition (plain background) and complex condition (background with a number of objects; see Freeth et al., 2010) for a total of 24 images (Appendix B). Images were displayed in random order (Dadds et al., 2008) such that not more than two images of the same model were shown consecutively. The images appeared for 2.5 seconds each (Nowicki & Duke, 1994) with an interstimulus interval (ISI) of 0.5 seconds (Freeth et al., 2010). Due to unreliability of the presentation software, occasionally images and ISIs were displayed for slightly longer or shorter durations (most frequently ±0.5 seconds). Although images that were not shown for the full 2.5 seconds could not be corrected, data was truncated for those shown for longer durations.

Images for Task 1 were created for the current study. Individuals unaffiliated with the University of Alabama Department of Psychology were recruited and volunteered their time. Models were instructed to take a deep breath in order to create a calm expression. They were then instructed to make a fearful face by raising their eyebrows, opening their mouth, and gasping. A total of 82 images were collected and used in a pilot study for interrater reliability. Ten volunteers were given the following instructions: “You are about to see a number of images.

After each image you will be asked to choose a label for the expression you just saw. Just say out loud what emotion you think it is. Some emotions may be displayed more than once and some may not be displayed at all." The raters were shown each image followed by a list of seven emotions (angry, calm, disgust, fear, happy, sad, and surprise), and their verbal responses were recorded by the researcher. The results showed frequent labeling of intended fearful expressions as surprise. Tottenham and her colleagues (2009) also reported fairly consistent errors of confusing fear for surprise. Therefore, either ratings of surprise or fearful were categorized as correct responses for fearful faces. The proportion of correct responses for each image was calculated and images were selected that were roughly in the 0.7 to 0.9 range. This target range was established to provide consistency with Task 2. Interrater reliability was moderate for the whole sample with an intraclass correlation (kappa) of .827.

Task 2. Participants were shown six Caucasian faces (three male, three female) from the NimStim Set of Facial Expressions (Tottenham et al., 2009) each showing a happy, surprised, angry, sad, fearful, disgusted, and calm expression for a total of 42 images (Appendix C). Six actors were chosen from the database whose proportion correct ratings for each expression were roughly in the 0.7 to 0.9 range with the exception of "calm" which had low validity across all actors, likely because it is difficult to distinguish from "neutral" expressions. This target range was established in order to identify faces that were representative of the desired emotions but were not so obvious that they would not produce any variability in our findings. As in Task 1, images were displayed in random order for 2.5 seconds each with an ISI of 0.5 seconds, with similar random error in display time.

The NimStim Set of Facial Expressions offer a number of advantages over other established affect sets including updated appearance of actors, color images, and young-adult models while maintaining comparable labeling accuracy ratings (see Glass & Newman, 2006; Tottenham et al., 2009). Thus, the NimStim are considered more realistic representations of modern, real-world scenarios and have been used in several recent studies (Glass & Newman, 2006; Viding et al., 2012). The authors report the mean proportion of correct scores ranging from 0.67 to 0.84. Test-retest reliability scores show a mean agreement of ratings of 0.84 between testing sessions.

Task 3. Task 3 was a replication of the stimuli in Task 2. However, at the beginning of the task, participants were told that they would be asked to label the emotion after each image and selected one emotion from the list of seven expressions.

Task 4. DANVA2 was replicated in the university student sample with the additional use of the eye tracking device (Appendix D). Data showed both emotion recognition based on labeling of responses and attention to the emotional features gathered through gaze patterns. Similar to Study 1, results from Tasks 3 and 4 for emotion recognition resulted in both specific error types as well as total error scores defined as the sum of all times that emotion was confused for another.

Procedures.

Participants came to the lab for individual sessions with a research assistant. The participants were given the opportunity to review and ask questions about the informed consent for the study titled "Personality and Visual Attention." Participants first completed the PCPT measure of sustained attention to minimize fatigue effects. The instructions for the PCPT appeared on the screen and research assistants ensured participants' understanding before allowing them to begin. Then, the research assistants helped calibrate the participants' eye gaze to the eye tracking device using their dominant eye. Participants then completed the emotion recognition and emotional features detection tasks (Tasks 1 through 4) on the computer using the eye tracker. Next, participants completed a brief demographics questionnaire. Finally, they completed the TriPM and SRP-III psychopathy measures on the computer. These measures were programed so they would run sequentially in the same program with instructions in between them.

CHAPTER 3

RESULTS

Data Screening.

Eye tracking data quality was evaluated on three criteria: initial calibration, amount of missing data, and gaze plots. At least eight of the nine calibration points were required to be within 2° visual angle from the center of the target (V. Beanland, personal communication, June 3, 2014). All cases that had more than 20% missing data were excluded. Finally, the recorded gaze plot videos were subjectively reviewed to determine quality of the recording throughout the study. Only videos with “high average” quality were included, either in their entirety or partially with some tasks excluded.

Due to technical errors with the recordings, only 218 participants had recorded eye tracking data. Of those with recorded data, 69 were excluded because of poor initial calibration. An additional 23 participants were excluded because they had missing data in excess of the 20% limit. Finally, 95 participants were excluded because their video recordings showed poor quality. These evaluations resulted in a total of 31 (11.74% of the total sample) usable eye tracking cases. Most, 27, of those with useable cases showed high quality throughout all four tasks, while the other four showed high quality on one or two tasks, thus only tasks for which they showed acceptable data were used.

Descriptive Statistics Study 1, Community Sample.

Descriptive statistics and internal consistency reliability estimates for all variables used in the final analyses of Study 1 are reported in Table 1. I examined all variables for normality of their distributions. All psychopathy measures showed skewness and kurtosis within the acceptable range (+/- 1) as well as good internal consistency measured by Cronbach's alpha. Although numerous DANVA and GNG measures were not normally distributed, these were clearly count distributions and proportions, thus transformations were not warranted. I retained them as count variables and used procedures, namely non-parametric Spearman correlations, to account for their distributions in the appropriate analyses.

Table 1.
Descriptive statistics of all variables used in Study 1

Scales	*n*	Min	Max	Mean	SD	Skewness	Kurtosis	Cronbach's alpha
Age	240	18	75	26.91	10.07	1.88	.15	N/A
PY Total	231	-2.03	3.39	0	.91	.35	.46	.73
Meanness	231	-1.71	3.19	0	.81	.43	.69	.93
Disinhibition	231	-1.59	1.87	0	.71	.04	-.34	.93
Boldness	231	-2.08	1.7	0	.77	-.02	-.41	.90
DANVA								
Total errors	240	0	17	5.07	3.37	.25	.05	N/A
Happy errors	240	0	5	.51	.76	1.69	4.30	N/A
Angry errors	240	0	6	1.82	1.42	.40	-.49	N/A
Sad errors	240	0	6	1.23	1.28	1.14	1.20	N/A
Fear errors	240	0	6	1.50	1.40	1.03	.77	N/A
Happy as angry	240	0	1	.04	.20	4.37	17.24	N/A
Happy as sad	240	0	2	.26	.51	1.81	2.47	N/A
Happy as fear	240	0	5	.20	.52	4.25	29.65	N/A
Angry as happy	240	0	4	.80	.85	.75	-.15	N/A
Angry as sad	240	0	4	.65	.92	1.49	1.97	N/A
Angry as fear	240	0	6	.37	.75	3.13	15.05	N/A
Sad as happy	240	0	2	.10	.35	3.64	13.58	N/A
Sad as angry	240	0	5	.61	.86	1.90	5.27	N/A
Sad as fear	240	0	6	.51	.74	2.35	11.65	N/A

Fear as happy	240	0	4	.71	.88	1.21	1.05	N/A
Fear as angry	240	0	3	.43	.70	1.75	2.93	N/A
Fear as sad	240	0	5	.35	.69	2.5	9.02	N/A
Go/No-Go								
Go accuracy index	164	-.41	.15	-.01	.04	-3.41	29.18	N/A
Nogo accuracy index	164	-.38	.46	-.01	.13	-.07	.71	N/A
Go reaction time index	164	-.08	.13	.02	.03	-.09	-.18	N/A

Note: PY Total = psychopathy total score; TriPM = Triarchic Psychopathy Measure; DANVA = Diagnostic Analysis of Nonverbal Accuracy Scale

Exploratory Factor Analysis.

The first step in analyzing the community sample data was to conduct exploratory factor analysis (EFA) with maximum likelihood estimation to extract optimal number of psychopathy factors. After standardization using a z-score transformation, all of the subscales from the different psychopathy measures were included: the three factors of the LSRP, the three domain scales of the Triarchic Inventory, and eight PPI subscales. To extract the optimal number of factors, I entered all subscales into the factor analysis with maximum likelihood extraction, examining factor solutions in which all factors meet the Kaiser (1960) criterion of an eigenvalue of 1.00 or greater. In addition, I applied parallel analysis utilizing randomly generated data to indicate a viable factor structure.

The first set of analyses (Table 2) generated a three-factor model with no clear conceptual consistency within each factor. Of note, the PPI Coldheartedness subscale was the primary indicator loading on Factor 3. Due to a lack of a clear theoretical application, this model was not considered optimal and therefore other models were tested.

Table 2.
Percent variance explained and factor loadings for exploratory factor analysis of psychopathy scales (three-factor)

	Factor 1 (31.02%)	Factor 2 (17.98%)	Factor 3 (9.77%)
TriPM Disinhibition	.835		
TriPM Meanness	.789		.351
PPI Machiavelian Egocentricity	.786		
LSRP Antisocial	.766		
PPI Carefree Nonplanfulness	.639		
LSRP Egocentricity	.621		
PPI Blame Externalization	.598		
LSRP Callous	.545		.315
PPI Impulsive Nonconformity	.496	.291	-.304
TriPM Boldness		.930	
PPI Social Potency		.709	
PPI Stress Immunity	-.329	.640	.270
PPI Fearlessness	.367	.594	
PPI Coldheartedness			.895

Note: Only loadings of |.25| or greater are shown for enhanced clarity. TriPM = Triarchic Psychopathy Measure; LSRP = Levenson Self-Report Psychopathy Scale; PPI = Psychopathic Personality Inventory.

A maximum of four factors of psychopathy have been supported in the literature, so I next generated a model which included the above fourteen subscales and extracted four factors. As shown in Table 3, Factor 4 was primarily explained by Coldheartedness, as was Factor 3 in Table 2. While the other three factors began to make more theoretical sense, several subscales still did not show multiple cross-loadings. For example, TriPM Meanness loaded most highly on Factor 2, but also loaded equally well on Factor 1 and Factor 4. Additionally, LSRP Callous loaded nearly equally across Factors 1, 2, and 4. These issues lead me to consider an alternative solution that would optimize conceptual and actuarial sense.

Table 3.
Percent variance explained and factor loadings for exploratory factor analysis of psychopathy scales (four-factor)

	Factor 1 (32.36%)	Factor 2 (17.21%)	Factor 3 (9.77%)	Factor 4 (3.93%)
PPI Carefree Nonplanfulness	.952	-.266		
TriPM Disinhibition	.728			
PPI Impulsive Nonconformity	.616		.322	-.254
LSRP Antisocial	.472	.346		
PPI Blame Externalization	.353	.274		
LSRP Egocentricity		.888		
PPI Machiavelian Egocentricity		.792		
TriPM Meanness	.345	.506		.345
TriPM Boldness			.916	
PPI Social Potency			.677	
PPI Stress Immunity		-.267	.669	.296
PPI Fearlessness	.307		.592	
PPI Coldheartedness				.886
LSRP Callous	.316	.268		.323

Note: Only loadings of |.25| or greater are shown for enhanced clarity. TriPM = Triarchic Psychopathy Measure; LSRP = Levenson Self-Report Psychopathy Scale; PPI = Psychopathic Personality Inventory.

In my third round of EFA, I excluded PPI Coldheartedness to test the factor structure without the strong influence of this subscale on a single factor. A three-factor model (Table 4) emerged that illustrated a conceptual structure that resembled Patrick's (2010) Triarchic model of Disinhibition, Meanness, and Boldness, and the factors were therefore labeled accordingly. For scales that significantly loaded onto more than one factor, the scale was included in the factor on which it had the higher loading. Although PPI Fearlessness cross-loaded onto both the Boldness and Disinhibition factors, others (e.g. Edens & McDermott, 2010) have proposed that this subscale is comprised of aspects of both of these factors. Thus, PPI Fearlessness was maintained on both the Boldness and Disinhibition factors. The finding that PPI Coldheartedness did not load onto other factors may not be surprising given findings that it is generally not included in either of the two factors of the PPI (see Benning, Patrick, Hicks, Blonigen, and

Krueger, 2003 for a review). This analytic step reduced the data to an optimal number of facets that are theoretically supported and parsimonious. To create a total psychopathy score, I standardized the total scores of each of the three psychopathy measures (TriPM, LSRP, and PPI) and averaged the values. In subsequent analyses, psychopathy was examined globally as well as across the resulting factors.

Table 4.
Percent variance explained and factor loadings for exploratory factor analysis of psychopathy (excluding Coldheartedness)

	Meanness (33.19%)	Boldness (19.24%)	Disinhibition (5.17%)
LSRP Egocentricity	.863		
TriPM Meanness	.810		
PPI Machiavelian Egocentricity	.746		
LSRP Callous	.632		
TriPM Boldness		.921	
PPI Social Potency		.690	
PPI Stress Immunity		.677	-.255
PPI Fearlessness		.524	.505
PPI Impulsive Nonconformity	-.260		.909
LSRP Antisocial	.283		.538
TriPM Disinhibition	.442		.450
PPI Carefree Nonplanfulness			.440
PPI Blame Externalization			.439

Note: Only loadings of |.25| or greater are shown for enhanced clarity. TriPM = Triarchic Psychopathy Measure; LSRP = Levenson Self-Report Psychopathy Scale; PPI = Psychopathic Personality Inventory.

Descriptive Statistics Study 2, University Sample.

For Study 2, descriptive statistics and internal consistency reliability estimates for all variables used in the final analyses are reported in Table 5. Similar to Study 1, all psychopathy measures showed skewness and kurtosis within the acceptable range (+/- 1) and acceptable internal consistency. Tasks 3 and 4 had numerous count variables that were not normally distributed, thus procedures were used in subsequent analyses to account for these non-parametric variables. Commission and sensitivity d' were normally distributed, but the omission, correct RT mean, and correct RT standard deviation variables showed skewness and kurtosis beyond the acceptable range.

Eye tracking variables tend to be non-normally distributed for most measures of performance. Those that show significant amounts of skewness and kurtosis tend to be those variables measuring ratios of fixations and time spent looking in the AOI. These findings are reasonable and thus no transformations were conducted. Non-normal distributions were accounted for in all following analyses by using Spearman correlations.

Table 5.
Descriptive statistics of all variables used in Study 2

Scales	*n*	Min	Max	Mean	SD	Skewness	Kurtosis	Cronbach's alpha
TriPM Total	237	92	170	118.82	15.55	.719	.442	.85
TriPM Meanness	237	20	56	31.29	7.75	.80	.20	.85
TriPM Disinhibition	237	22	58	34.99	6.83	.76	.73	.79
TriPM Boldness	237	28	73	52.53	7.87	-.092	-.128	.80
SRP Total	237	89	213	145.36	28.20	.45	-.30	.79
Interpersonal Manipulativeness	237	21	66	40.08	9.44	.44	-.31	.83
Callous Affect	237	22	62	37.44	8.86	.35	-.342	.78
Erratic Lifestyles	237	20	72	43.52	10.09	.23	-.22	.81
Criminal Tendencies	237	16	48	24.31	7.02	.97	.59	.68
Task 3								
Total errors	264	0	36	10.56	4.70	.27	3.32	N/A
Sad errors	264	0	6	1.93	1.31	.29	-.40	N/A
Happy errors	264	0	6	1.37	1.08	.58	.38	N/A
Angry errors	264	0	6	1.79	1.17	.26	-.24	N/A
Disgust errors	264	0	6	1.41	1.19	.85	.90	N/A
Surprise errors	264	0	6	.67	.92	1.95	5.88	N/A
Calm errors	264	0	6	1.09	1.22	1.13	.90	N/A
Fear errors	264	0	6	2.27	1.68	.34	-.81	N/A
Sad as happy	264	0	1	.01	.10	9.27	84.62	N/A
Sad as angry	264	0	2	.09	.31	3.58	13.21	N/A
Sad as disgust	264	0	5	1.10	.97	.95	1.13	N/A
Sad as surprise	264	0	2	.16	.42	2.67	6.74	N/A
Sad as calm	264	0	6	.24	.61	4.32	29.75	N/A
Sad as fear	264	0	3	.32	.57	1.86	3.59	N/A
Happy as sad	264	0	1	.02	.14	6.44	39.79	N/A

Happy as angry	264	0	1	.01	.12	7.98	62.21	N/A
Happy as disgust	264	0	1	.09	.28	2.86	6.24	N/A
Happy as surprise	264	0	3	.92	.91	.66	-.46	N/A
Happy as calm	264	0	6	.30	.58	4.05	32.89	N/A
Happy as fear	264	0	1	.01	.10	9.27	84.62	N/A
Angry as sad	264	0	3	.42	.60	1.24	1.01	N/A
Angry as happy	264	0	1	.00	.08	11.42	129.46	N/A
Angry as disgust	264	0	4	1.00	.85	.56	-.12	N/A
Angry as surprise	264	0	2	.09	.31	3.58	13.21	N/A
Angry as calm	264	0	6	.12	.48	7.56	80.65	N/A
Angry as fear	264	0	2	.14	.36	2.22	3.76	N/A
Disgust as sad	264	0	5	.73	.84	1.35	2.95	N/A
Disgust as happy	264	0	1	.00	.06	16.24	264	N/A
Disgust as angry	264	0	3	.48	.62	1.02	.43	N/A
Disgust as surprise	264	0	1	.03	.17	5.51	28.59	N/A
Disgust as calm	264	0	6	.04	.42	11.65	150.33	N/A
Disgust as fear	264	0	2	.11	.32	2.76	6.83	N/A
Surprise as sad	264	0	1	.02	.14	6.44	39.79	N/A
Surprise as happy	264	0	3	.10	.36	4.14	20.93	N/A
Surprise as angry	264	0	1	.00	.06	16.24	264.00	N/A
Surprise as disgust	264	0	1	.11	.31	2.44	4.02	N/A
Surprise as calm	264	0	6	.04	.41	12.30	170.96	N/A
Surprise as fear	264	0	5	.38	.69	2.41	8.45	N/A
Calm as sad	264	0	3	.39	.70	1.93	3.61	N/A
Calm as happy	264	0	2	.07	.31	4.20	18.59	N/A
Calm as angry	264	0	3	.30	.59	2.01	3.80	N/A
Calm as disgust	264	0	3	.21	.50	2.91	10.19	N/A
Calm as surprise	264	0	1	.00	.08	11.42	129.46	N/A
Calm as fear	264	0	2	.08	.32	3.93	16.15	N/A
Fear as sad	264	0	2	.29	.50	1.45	1.15	N/A

Fear as happy	264	0	2	.12	.35	2.78	7.36	N/A
Fear as angry	264	0	2	.03	.21	7.67	62.44	N/A
Fear as disgust	264	0	3	.32	.62	1.90	3.09	N/A
Fear as surprise	264	0	5	1.44	1.25	.62	-.39	N/A
Fear as calm	264	0	6	.05	.41	11.95	163.79	N/A
DANVA/Task 4								
Total errors	264	0	15	5.02	2.47	.19	.96	N/A
Happy errors	264	0	3	.15	.45	3.50	14.19	N/A
Angry errors	264	0	6	1.98	1.26	.34	-.10	N/A
Sad errors	264	0	6	1.04	1.03	.90	1.10	N/A
Fear errors	264	0	6	1.83	1.19	.35	-.12	N/A
Happy as angry	264	0	2	.01	.15	10.98	129.70	N/A
Happy as sad	264	0	3	.08	.33	4.96	29.47	N/A
Happy as fear	264	0	1	.05	.23	3.85	12.92	N/A
Angry as happy	264	0	5	1.29	1.02	.38	-.35	N/A
Angry as sad	264	0	5	.51	.78	1.86	4.90	N/A
Angry as fear	264	0	3	.18	.47	2.86	8.73	N/A
Sad as happy	264	0	6	.17	.56	5.74	47.15	N/A
Sad as angry	264	0	3	.62	.77	1.00	.20	N/A
Sad as fear	264	0	2	.25	.49	1.87	2.71	N/A
Fear as happy	264	0	5	1.08	.96	.77	.36	N/A
Fear as angry	264	0	2	.21	.47	2.15	3.98	N/A
Fear as sad	264	0	6	.53	.77	2.25	9.57	N/A
CPT								
Commission errors	262	1	38	15.19	7.36	.55	-.03	N/A
Omission errors	262	0	327	8.25	38.56	7.19	53.21	N/A
Correct RT mean	262	238.67	1069	351.57	80.20	5.41	44	N/A
Correct RT SD	262	0	904.11	103.73	87.96	6.36	51.33	N/A
Sensitivity d’	262	-4.42	4.11	-1.62	1.41	.31	-.64	N/A
Eye tracking Task 1								

Calm ratio fixations	30	.30	27.00	5.66	6.30	1.72	3.15	N/A
Calm ratio time	30	.42	131.91	23.06	36.32	2.04	3.04	N/A
Calm average duration AOI	30	13.82	121.75	45.37	24.70	1.49	2.46	N/A
Calm fix first AOI	31	0	30	14.58	5.18	.84	4.47	N/A
Calm time first AOI	31	0	475	96.39	117.46	1.87	3.49	N/A
Fear ratio fixations	27	.21	32.00	4.76	6.62	3.05	10.94	N/A
Fear ratio time	28	.27	72.21	14.69	19.03	1.92	3.31	N/A
Fear average duration AOI	30	11.59	124	48.37	25.69	.87	.99	N/A
Fear fix first AOI	31	0	32	14.19	5.12	1.04	5.59	N/A
Fear time first AOI	31	0	492	74.26	121.10	2.24	4.81	N/A
Simple ratio fixations	28	.22	32.00	6.58	9.23	1.86	2.28	N/A
Simple ratio time	28	.19	342.00	24.19	64.28	4.81	24.28	N/A
Simple average duration AOI	30	10.27	124	49.03	25.91	1.07	1.15	N/A
Simple fix first AOI	31	0	35	14.42	5.33	1.57	8.34	N/A
Simple time first AOI	31	0	599	91.23	125.50	2.57	8.34	N/A
Complex ratio fixations	30	.29	24.00	5.20	6.12	1.94	3.14	N/A
Complex ratio time	30	.35	131.82	18.08	29.29	2.78	8.16	N/A
Complex average duration AOI	30	9.78	121.75	44.90	23.99	1.28	2.57	N/A
Complex fix first AOI	31	0	28	14.35	4.99	.56	3.59	N/A
Complex time first AOI	31	0	450	79.42	111.46	1.93	3.83	N/A
Eye tracking Task 2								
Sad ratio fixations	29	.00	13.00	1.58	2.48	3.79	16.59	N/A
Sad ratio time	29	.00	2.76	.89	.76	.67	-.60	N/A
Sad average duration AOI	28	9.55	58.33	29.96	13.95	.41	-.73	N/A
Sad fix first AOI	31	0	19	9.19	4.21	.01	.70	N/A
Sad time first AOI	31	0	450	117.77	96.56	1.48	3.24	N/A
Happy ratio fixations	29	.09	3.50	1.05	.75	1.28	2.46	N/A
Happy ratio time	29	.08	4.63	.97	.99	2.18	5.66	N/A
Happy average duration AOI	29	9.92	74	31.44	16.96	.95	.36	N/A
Happy fix first AOI	31	0	19	9.10	3.69	-.17	2.17	N/A

Happy time first AOI	31	0	232	99.52	71.75	.31	-1.06	N/A
Angry ratio fixations	28	.06	3.50	1.12	.92	1.11	.51	N/A
Angry ratio time	29	.04	21.39	1.65	3.88	4.99	26.04	N/A
Angry average duration AOI	29	7.47	110.50	36.54	23.88	1.49	2.54	N/A
Angry fix first AOI	31	0	19	9	4.12	-.02	.77	N/A
Angry time first AOI	31	0	362	115.06	91.40	.72	.44	N/A
Disgust ratio fixations	27	.00	8.00	1.48	1.68	2.43	7.83	N/A
Disgust ratio time	29	.00	23.00	1.90	4.21	4.77	24.37	N/A
Disgust average duration AOI	28	7.96	66.13	31.79	15.21	.37	-.62	N/A
Disgust fix first AOI	31	0	19	8.32	3.75	-.04	2.15	N/A
Disgust time first AOI	31	0	384	101	93.55	1.23	1.62	N/A
Surprise ratio fixations	28	.11	3.67	1.15	.86	1.45	1.84	N/A
Surprise ratio time	29	.01	10.43	1.26	1.92	4.15	19.41	N/A
Surprise average duration AOI	29	5.00	96.86	33.20	23.22	1.38	1.87	N/A
Surprise fix first AOI	31	0	16	8.03	3.24	-.37	1.77	N/A
Surprise time first AOI	31	0	237	79.35	75.71	.86	-.53	N/A
Calm ratio fixations	29	.07	4.33	1.20	1.02	1.41	2.12	N/A
Calm ratio time	29	.05	3.54	.86	.83	1.71	3.03	N/A
Calm average duration AOI	29	8.06	67.75	30.74	14.91	.63	-.00	N/A
Calm fix first AOI	31	0	18	8.71	3.60	-.04	2.13	N/A
Calm time first AOI	31	0	307	114.90	97.36	.65	-.49	N/A
Fear ratio fixations	28	.00	7.00	1.20	1.57	2.52	7.17	N/A
Fear ratio time	28	.00	3.46	.93	.94	1.12	.78	N/A
Fear average duration AOI	26	8.78	82	36.23	22.49	.71	-.65	N/A
Fear fix first AOI	31	0	15	8.16	3.85	-.44	.28	N/A
Fear time first AOI	31	0	288	90.58	89.41	.77	-.37	N/A
Eye tracking Task 3								
Sad ratio fixations	27	.00	2.67	.61	.60	1.97	4.92	N/A
Sad ratio time	28	.00	230.67	8.60	43.52	5.29	27.99	N/A
Sad average duration AOI	25	5.50	62.91	21.58	14.65	1.34	1.46	N/A

Sad fix first AOI	31	0	34	10.68	6.73	1.47	4.29	N/A
Sad time first AOI	31	0	440	141.61	121.00	1.16	1.00	N/A
Happy ratio fixations	29	-29.00	12.00	.29	6.12	-3.88	20.39	N/A
Happy ratio time	28	.00	4.72	.76	1.04	2.31	6.66	N/A
Happy average duration AOI	24	5.00	73.13	24.32	18.94	1.45	1.23	N/A
Happy fix first AOI	31	0	19	9.29	4.36	-.29	.76	N/A
Happy time first AOI	31	0	432	110.06	102.50	1.34	1.94	N/A
Angry ratio fixations	28	.00	3.50	.91	.92	1.19	.90	N/A
Angry ratio time	28	.00	10.36	1.01	1.99	4.10	18.90	N/A
Angry average duration AOI	26	4.00	76.38	26.95	19.99	1.45	1.22	N/A
Angry fix first AOI	31	0	21	9.29	4.87	.11	.37	N/A
Angry time first AOI	31	0	432	103.26	116.00	1.22	.75	N/A
Disgust ratio fixations	28	.00	5.50	.82	1.25	2.56	7.04	N/A
Disgust ratio time	28	.00	9.68	.85	1.86	4.27	20.07	N/A
Disgust average duration AOI	24	5.90	70.50	26.68	17.24	1.00	.37	N/A
Disgust fix first AOI	31	0	35	10.19	6.78	1.76	5.48	N/A
Disgust time first AOI	31	0	562	125.06	146.76	1.67	2.39	N/A
Surprise ratio fixations	28	.00	2.25	.62	.66	1.32	.91	N/A
Surprise ratio time	28	.00	6.33	.76	1.33	3.13	11.15	N/A
Surprise average duration AOI	23	5.68	64.00	19.80	14.24	1.55	2.89	N/A
Surprise fix first AOI	31	0	23	10.45	5.69	.22	.13	N/A
Surprise time first AOI	31	0	580	136.71	135.66	1.59	2.87	N/A
Calm ratio fixations	28	.00	2.14	.65	.65	.78	-.58	N/A
Calm ratio time	28	.00	10.41	.85	1.97	4.52	22.25	N/A
Calm average duration AOI	22	4.00	79.38	22.20	18.03	1.89	3.91	N/A
Calm fix first AOI	31	0	22	9.74	5.11	.05	.36	N/A
Calm time first AOI	31	0	432	136.87	137.30	.68	-.85	N/A
Fear ratio fixations	27	.00	3.33	.60	.87	2.44	5.83	N/A
Fear ratio time	28	.00	10.03	.69	1.89	4.78	24.12	N/A
Fear average duration AOI	21	4.00	66.20	21.63	15.41	1.49	2.16	N/A

Fear fix first AOI	31	0	48	11.90	9.06	2.43	8.55	N/A
Fear time first AOI	31	0	660	159.81	181.89	1.70	2.32	N/A
Eye tracking Task 4								
Happy ratio fixations	22	.00	.43	.07	.10	2.34	6.88	N/A
Happy ratio time	22	.00	.55	.08	.13	2.44	6.50	N/A
Happy average duration AOI	12	4.50	64	17.82	17.20	2.03	4.43	N/A
Happy fix first AOI	25	0	48	14.24	10.33	1.47	3.93	N/A
Happy time first AOI	25	0	684	234.48	197.87	.68	-.02	N/A
Sad ratio fixations	22	.00	.62	.09	.17	2.43	5.22	N/A
Sad ratio time	22	.00	.83	.10	.22	2.47	5.41	N/A
Sad average duration AOI	11	3	40.83	15.29	10.24	1.56	3.53	N/A
Sad fix first AOI	25	0	48	14.76	10.74	1.26	2.68	N/A
Sad time first AOI	25	0	684	253.00	205.40	.45	-.53	N/A
Angry ratio fixations	22	.00	.58	.08	.14	2.67	7.46	N/A
Angry ratio time	22	.00	.89	.09	.20	3.40	12.54	N/A
Angry average duration AOI	14	3	34.50	14.46	8.67	1.00	1.04	N/A
Angry fix first AOI	25	0	48	14.52	10.31	1.46	3.94	N/A
Angry time first AOI	25	0	684	250.60	198.11	.55	-.16	N/A
Fear ratio fixations	22	.00	.64	.09	.13	3.07	11.50	N/A
Fear ratio time	22	.00	33.00	12.10	9.74	1.01	.27	N/A
Fear average duration AOI	14	0	33	12.10	9.74	1.01	.27	N/A
Fear fix first AOI	25	0	88	22.60	23.57	1.75	2.58	N/A
Fear time first AOI	25	0	572	215.44	167.86	.46	-.36	N/A

Note: TriPM = Triarchic Psychopathy Measure; SRP = Hare Self-Report Psychopathy Scale; DANVA = Diagnostic Analysis of Nonverbal Accuracy Scale; CPT = Continuous Performance Test; Correct RT mean = mean reaction time of correct responses on the CPT; Correct RT SD = standard deviation of reaction time for correct responses on the CPT

Hypothesis 1.

The first hypothesis was that individuals higher on psychopathy would show deficits in emotion recognition tasks and would show the greatest deficits for fearful stimuli (Dawel et al., 2012; Marsh & Blair, 2008). To assess this hypothesis in the community sample, I correlated the EFA psychopathy factors with emotion recognition errors on the DANVA task. Emotion recognition errors are reported in Table 6 for both specific mistakes (e.g., mistaking a happy face as an angry face) and total errors (e.g., happy errors is the sum of incorrectly labeling a happy face as another emotion). Given the large age range in the community sample, I tested to see whether age was correlated with any of the variables of interest. Age was associated with more errors in identifying happy (r = -.208, p < .01) and sad (r = -.132, p < .05) faces as well as lower ratings on Meanness (r = -.156, p < .05). Therefore, I controlled for variability due to age by conducting partial correlations. Contrary to the hypothesis, the only significant errors were labeling happy faces as angry, which was mirrored by high rates of mislabeling angry faces as happy. These errors existed primarily for those individuals high on Disinhibition.

Table 6.
Community Study correlations between psychopathy and emotion recognition errors for the DANVA task controlling for age

	Boldness	Meanness	Disinhibition	Psychopathy Total
Total errors	.054	-.027	.058	.031
Happy errors	.032	-.045	-.024	-.020
Angry errors	.013	.018	.060	.051
Sad errors	.072	-.059	.004	-.009
Fear errors	.010	.012	.075	.038
Happy as angry	.044	.119	.170*	.163*
Happy as sad	.039	-.105	-.021	-.060
Happy as fear	-.009	-.012	-.081	-.036
Angry as happy	.047	.094	.156*	.125
Angry as sad	-.085	-.124	-.057	-.112
Angry as fear	.071	.075	-.003	.079
Sad as happy	.048	-.026	.023	.001

Sad as angry	-.014	-.087	-.021	-.049
Sad as fear	.079	.017	.018	.043
Fear as happy	.057	-.041	.022	-.009
Fear as angry	-.021	-.032	.012	-.016
Fear as sad	-.035	.118	.107	.106

Note: Factors listed were those generated by final EFA analyses. (*df* = 189).
**p*<.05 ***p*<.01

Next, I examined the university students' performance on emotion recognition by correlating psychopathy scores on the SRP-III and TriPM with Task 3 and Task 4 errors separately. In Task 3, individuals higher on affective-interpersonal traits made the most errors by confusing surprised expressions as disgust (see Table 7). The second most frequent affect recognition errors for those high on affective-interpersonal traits were mistaking disgusted expressions for calm. With regard to total errors, those individuals scoring higher on affective-interpersonal traits (i.e., IPM, CA, Boldness, and Meanness) made fewer errors in identifying happy expressions. The Total score on the TriPM was also associated with fewer errors in recognizing anger. Individuals scoring higher on the SRP-III Total score made more errors in identifying disgust, whereas those scoring high on Callous Affect made more errors in identifying surprise. Of note, Boldness was not significantly correlated with any emotion recognition error types.

Table 7.
University sample correlations between psychopathy measures and emotion recognition errors for Task 3

	IPM	CA	ELS	CT	SRP Total	TriPM Boldness	TriPM Meanness	TriPM Disinhibition	TriPM Total
Total errors	-.003	.005	.036	-.013	.035	-.044	-.049	-.001	-.053
Sad errors	.112	.000	.108	.108	.113	.001	.008	.023	.001
Happy errors	-.139*	-.076	-.077	-.090	-.113	-.048	-.167*	-.031	-.150*
Angry errors	-.066	-.100	-.090	-.117	-.098	-.124	-.118	-.043	-.149*
Disgust errors	.096	.121	.057	.118	.129*	.036	.086	.123	.104
Surprise errors	.055	.155*	.009	.075	.093	.037	.060	-.041	.035
Calm errors	-.034	-.044	.073	-.057	.001	.039	-.047	.062	.035
Fear errors	.036	.051	.012	-.072	.035	-.088	.049	-.104	-.048
Sad as happy	-.107	-.136*	-.072	-.072	-.129	-.066	-.125	.040	-.083
Sad as angry	.080	.046	.026	.151*	.100	.056	.066	.072	.104
Sad as disgust	.050	-.001	.082	.083	.077	.031	.083	.038	.064
Sad as surprise	-.026	-.056	.000	-.027	-.034	.039	-.089	-.055	-.079
Sad as calm	.041	.012	-.013	.022	.027	-.030	-.084	-.110	-.097
Sad as fear	.038	.034	.092	.005	.048	-.014	.055	.065	.036
Happy as sad	-.001	.083	.085	-.012	.057	.010	.043	.052	.050
Happy as angry	.069	.085	.049	-.035	.053	.014	.064	.001	.036
Happy as disgust	.029	.022	.026	.039	.039	.017	.033	-.020	.010
Happy as surprise	-.119	-.050	-.061	-.047	-.088	-.018	-.144*	-.034	-.111
Happy as calm	-.086	-.115	-.067	-.107	-.108	-.055	-.112	.029	-.078
Happy as fear	-.128	-.057	-.112	.006	-.089	-.055	-.042	-.004	-.061
Angry as sad	-.086	-.018	-.044	-.048	-.057	-.100	-.003	.047	-.034
Angry as happy	-.002	.006	.054	-.052	.002	.027	.022	.022	.013
Angry as disgust	.006	-.094	-.061	-.093	-.070	-.021	-.100	-.073	-.101
Angry as surprise	-.057	-.092	-.057	-.012	-.066	-.068	-.084	-.128	-.125
Angry as calm	.016	.031	-.021	-.077	-.001	-.032	-.082	-.002	-.050
Angry as fear	-.104	-.042	-.001	.016	-.030	.003	-.059	.014	-.036

Disgust as sad	.020	.045	-.014	.047	.025	.106	.029	.044	.065
Disgust as happy	.071	.098	.088	.046	.083	.055	.097	-.059	.075
Disgust as angry	.053	.018	-.006	.049	.048	-.023	.023	.108	.063
Disgust as surprise	.032	-.018	-.005	-.081	-.020	.057	.005	.041	.041
Disgust as calm	.051	.138*	.081	.109	.131*	-.037	.155*	.067	.096
Disgust as fear	.064	.122	.136*	.072	.123	.025	.043	.020	.041
Surprise as sad	.044	-.011	-.028	.033	.016	.027	-.099	-.108	-.081
Surprise as happy	.068	.173**	.022	.039	.098	.066	.113	-.064	.058
Surprise as angry	.086	-.030	.037	.039	.053	.092	.030	-.089	.037
Surprise as disgust	.225**	.224**	.163*	.089	.234**	.088	.252**	.168*	.258**
Surprise as calm	.088	-.013	-.075	.004	.008	-.111	-.002	-.021	-.083
Surprise as fear	-.122	.006	-.033	.016	-.046	.006	-.086	-.074	-.069
Calm as sad	-.019	-.074	.052	-.101	-.022	.033	-.015	.009	.022
Calm as happy	-.017	.032	-.020	.097	.034	-.034	-.125	-.008	-.079
Calm as angry	-.149*	-.088	-.029	-.075	-.103	.019	-.129*	-.073	-.067
Calm as disgust	.026	.023	.034	-.050	.023	.065	.058	.068	.077
Calm as surprise	.086	.077	.116	.026	.099	-.028	.102	.133*	.121
Calm as fear	-.037	-.016	.000	.034	-.001	-.090	-.028	.068	-.029
Fear as sad	.001	.015	.011	-.008	.001	.001	.003	-.033	-.013
Fear as happy	.151*	.080	.071	.007	.113	.035	.035	.011	.033
Fear as angry	.001	.037	-.055	.078	.028	-.016	-.003	-.074	-.045
Fear as disgust	.038	.006	.003	-.009	.027	-.014	.086	-.078	.021
Fear as surprise	-.030	-.001	.018	-.116	-.022	-.097	-.010	-.056	-.056
Fear as calm	.102	.081	-.007	.057	.101	.017	.054	-.031	.011

Note: IPM = Interpersonal Manipulativeness; CA = Callous Affect; ELS = Erratic Lifestyles; CT = Criminal Tendencies; SRP = Hare Self-Report Psychopathy Scale; TriPM = Triarchic Psychopathy Measure (n = 231)
$^*p<.05$ $^{**}p<.01$

Finally, correlations between psychopathy measures and emotion recognition errors for Task 4 (i.e. DANVA) were evaluated (Table 8). The strongest relationships identified were that individuals primarily elevated on affective-interpersonal traits confused fearful expressions for happy ones, which in turn resulted in significant total errors for fear. Several negative correlations with specific labeling of happy emotions suggested that individuals scoring higher in psychopathy may be less likely to confuse happiness with another emotion than individuals scoring lower in psychopathy. However, individuals scoring high on Criminal Tendencies were more likely to make the error of labeling happy as angry. On this task, Disinhibition was not significantly correlated with any error types.

Similarly to Task 3, the results from Task 4 showed the most frequent positive correlations with affective-interpersonal traits rather than the disinhibitory traits (i.e. ELS, CT, and Disinhibition), and these findings were somewhat more robust. In contrast to Task 3, Task 4 showed a clear relationship between fear errors and psychopathy, particularly the affective-interpersonal traits. Compared to the community sample's performance on the DANVA, the university students higher on psychopathy showed more errors in emotion recognition on the same task, particularly for fearful faces. However, the latter sample also showed a pattern of confusion for happy and angry faces.

Table 8.
University sample correlations between psychopathy measures and emotion recognition errors for Task 4

	IPM	CA	ELS	CT	SRP Total	TriPM Boldness	TriPM Meanness	TriPM Disinhibition	TriPM Total
Total errors	.164*	.059	.069	.096	.139*	.084	.016	.078	.067
Happy errors	.000	-.081	-.093	-.062	-.067	-.011	-.110	.014	-.067
Angry errors	.076	-.051	-.008	.037	.033	.099	-.063	-.024	.007
Sad errors	-.031	-.001	-.023	.104	.010	-.051	.003	.039	-.032
Fear errors	.220**	.188**	.162*	.023	.203**	.092	.151*	.124	.177**
Happy as angry	.085	.051	-.027	.157*	.080	.032	.040	.085	.060
Happy as sad	-.067	-.124	-.140*	-.009	-.099	-.039	-.161*	-.023	-.113
Happy as fear	-.001	-.057	-.013	-.138*	-.057	-.035	-.067	-.019	-.068
Angry as happy	.067	-.016	.080	-.021	.053	.144*	.006	.046	.099
Angry as sad	.056	.047	-.026	.055	.037	.060	-.019	-.085	-.020
Angry as fear	-.050	-.142*	-.102	.010	-.081	-.065	-.107	-.031	-.086
Sad as happy	.035	.065	.003	.102	.060	.003	.075	.129	.070
Sad as angry	-.009	-.024	.023	.081	.022	-.056	-.004	-.030	-.056
Sad as fear	-.112	-.086	-.110	-.016	-.116	-.053	-.113	.011	-.082
Fear as happy	.215**	.162*	.153*	.016	.188**	.190**	.156*	.023	.199**
Fear as angry	.062	-.035	.074	.064	.043	-.059	.014	.086	.019
Fear as sad	-.020	.042	-.037	-.043	-.011	-.095	-.004	.105	-.013

Note: IPM = Interpersonal Manipulativeness; CA = Callous Affect; ELS = Erratic Lifestyles; CT = Criminal Tendencies; SRP = Hare Self-Report Psychopathy Scale; TriPM = Triarchic Psychopathy Measure (n = 230)
$^*p$<.05 $^{**}p$<.01

Hypothesis 2.

Second, I hypothesized that eye tracking data would show that individuals higher on psychopathy allocate less visual attention to areas with socially relevant information (e.g., the face in a whole body image or eyes in a face image) than individuals lower on psychopathy (Dadds et al., 2008). In the next set of analyses, correlations between psychopathy measures and eye tracking variables for each task were conducted. Again, non-parametric Spearman correlations were used to account for the violation of normality.

Contrary to hypothesis, for Task 1 in which full-body images were shown, there were no relationships between psychopathy and the ratios of fixations or time spent in the face area of the images. The ratio scores were the primary indications of overall number and duration of fixations to the area of interest. The Criminal Tendencies subscale of the SRP and the Disinhibition subscale of the TriPM were the only psychopathy facets significantly associated with the eye tracking variables, with the addition of one significant correlation with the SRP Total score (Table 9). Disinhibitory traits were negatively correlated with average duration of fixation to the face area across all four conditions (i.e. calm, fear, simple, complex), meaning that individuals high on disinhibition had shorter average length of fixations in the area of interest than those lower on the trait. In other words, disinhibited individuals seemed to shift focus within the face area rather than "stare" at one part of it.

Table 9.
Task 1 correlations between psychopathy measures and eye tracking variables

	IPM	CA	ELS	CT	SRP Total	TriPM Boldness	TriPM Meanness	TriPM Disinhibition	TriPM Total
Calm ratio fixations	-.131	-.072	.010	-.015	-.039	-.022	-.078	-.002	-.039
Calm ratio time	.019	-.019	.022	-.108	-.010	.103	.015	-.013	.063
Calm average duration AOI	.063	-.272	-.144	-.467*	-.310	.032	-.108	-.380*	-.210
Calm fix first AOI	.019	.092	-.110	.226	.015	-.211	.189	.053	-.025
Calm time first AOI	.012	.125	-.086	.439*	.108	-.183	.186	.034	-.025
Fear ratio fixations	-.169	-.005	-.226	-.248	-.210	.089	-.036	-.152	-.017
Fear ratio time	-.168	-.094	-.219	-.207	-.238	.006	-.066	-.086	-.104
Fear average duration AOI	-.102	-.253	-.250	-.540**	-.409*	.105	-.133	-.513**	-.261
Fear fix first AOI	.207	.158	.210	.271	.292	-.171	.244	.155	.119
Fear time first AOI	.265	.178	.205	.202	.298	-.057	.276	.094	.171
Simple ratio fixations	-.231	.050	-.065	.021	-.043	.015	.040	-.075	.012
Simple ratio time	-.122	-.101	-.123	-.181	-.179	-.005	-.022	-.027	-.045
Simple average duration AOI	-.086	-.225	-.201	-.453*	-.358	.069	-.116	-.470*	-.250
Simple fix first AOI	.141	.162	.044	.200	.138	-.076	.202	.116	.106
Simple time first AOI	.179	.245	.108	.358	.260	.021	.241	.090	.153
Complex ratio fixations	-.185	-.104	-.181	-.245	-.234	.040	-.126	-.083	-.080
Complex ratio time	-.029	-.092	-.086	-.110	-.105	.036	-.083	-.042	-.051
Complex average duration AOI	.037	-.254	-.196	-.472*	-.325	.095	-.093	-.463*	-.215
Complex fix first AOI	.010	.039	-.046	.429*	.128	-.342	.202	.075	-.024
Complex time first AOI	.073	.105	-.038	.497**	.198	-.286	.295	.008	.018

Note: IPM = Interpersonal Manipulativeness; CA = Callous Affect; ELS = Erratic Lifestyle; CT = Criminal Tendencies; SRP = Hare Self-Report Psychopathy Scale; TriPM = Triarchic Psychopathy Measure; AOI = area of interest
For all analyses n = 29 except average duration scores where n = 28.
**p*<.05 ***p*<.01

For Task 2 as well as Task 3, the AOI included both the mouth and eye regions. A different pattern emerged for correlations between psychopathy and eye tracking variables in Task 2 (Table 10). In this case, primarily affective-interpersonal subscales of psychopathy were significantly associated with eye tracking variables as well as the total scores for each measure. A general trend of high scores on Interpersonal Manipulativeness, Callous Affect, and Meanness associated with positive ratios of number of fixations in versus out of the AOI for all emotions (except Surprise) indicated that individuals with these psychopathy traits looked at the eyes and mouths more than those who scored lower on those scales. The same pattern held for the ratio of duration of fixations in versus out of the AOI.

Average duration of fixations in the AOI, which gives a more descriptive account of the focus within the eye and mouth regions, showed only minimal results. Interpersonal Manipulative traits were associated with longer fixations to the eye/mouth areas of sad faces. Similarly, individuals higher on Callous Affect traits had on average longer fixations to the eyes and mouth of faces portraying fearful expressions.

Initial allocation of visual attention to the areas of interest was measured by the number of fixations before the first fixation in the eye/mouth areas as well as by how long it took before making the first fixation in the AOI. Across all emotions, affective-interpersonal traits such as Interpersonal Manipulativeness, Callous Affect, Meanness, and the total scores of both measures, and to a lesser extent Erratic Lifestyles and Boldness, formed a pattern of having fewer fixations before the first look in the eye/mouth area and less time before the first fixation in the AOI. Combined with the previously described trends, it appears that individuals high on affective-interpersonal traits looked at AOIs first, and then spent more time looking in the AOI than outside of it.

Table 10.
Task 2 correlations between psychopathy measures and eye tracking variables

	IPM	CA	ELS	CT	SRP Total	TriPM Boldness	TriPM Meanness	TriPM Disinhibition	TriPM Total
Sad ratio fixations	.284	.501**	.255	.216	.478*	.172	.481*	.177	.508**
Sad ratio time	.255	.558**	.207	.247	.465*	.257	.480*	.137	.535**
Sad average duration AOI[a]	.418*	.224	.066	.183	.294	.125	.315	-.185	.078
Sad fix first AOI	-.247	-.422*	-.089	.154	-.221	-.055	-.465*	.163	-.214
Sad time first AOI	-.231	-.406*	-.009	-.246	-.269	-.034	-.391*	.042	-.191
Happy ratio fixations	.328	.562**	.226	.259	.491**	.208	.539**	-.010	.434*
Happy ratio time	.327	.526**	.302	.184	.500**	.164	.480*	.144	.500**
Happy average duration AOI[b]	.177	.253	.086	-.077	.170	.147	.250	-.168	.093
Happy fix first AOI	-.486**	-.310	-.209	-.043	-.324	-.316	-.323	-.095	-.371*
Happy time first AOI	-.518**	-.455*	-.369*	.011	-.440*	-.553**	-.423*	-.104	-.600**
Angry ratio fixations	.312	.621**	.299	.248	.583**	.253	.547**	.218	.625**
Angry ratio time	.398*	.625**	.293	.261	.570**	.193	.573**	.236	.595**
Angry average duration AOI[b]	.288	.122	-.049	-.157	.041	-.188	.279	-.252	-.112
Angry fix first AOI	-.414*	-.602**	-.383*	.082	-.464*	-.174	-.575**	-.229	-.545**
Angry time first AOI	-.422*	-.637**	-.449*	.098	-.505**	-.280	-.555**	-.345	-.657**
Disgust ratio fixations	.351	.477*	.228	.266	.462*	.169	.396*	.304	.471*
Disgust ratio time	.284	.571**	.151	.117	.425*	.176	.503**	.179	.509**
Disgust average duration AOI[a]	.289	.194	.053	-.234	.115	.273	.104	-.311	.078
Disgust fix first AOI	-.492**	-.654**	-.356	.138	-.510**	-.389*	-.660**	-.110	-.684**
Disgust time first AOI	-.454*	-.606**	-.283	.126	-.430*	-.379*	-.583**	-.085	-.628**
Surprise ratio fixations	.166	.308	.079	.292	.307	.257	.244	-.077	.263
Surprise ratio time	.264	.259	.061	.260	.270	.170	.212	.104	.278
Surprise average duration AOI[b]	.347	.116	.091	.185	.233	.160	.116	-.126	.057
Surprise fix first AOI	-.306	-.470*	-.134	.143	-.265	-.324	-.548**	.287	-.351
Surprise time first AOI	-.320	-.463*	-.145	.095	-.298	-.256	-.541**	.153	-.386*
Calm ratio fixations	.376	.495**	.347	.269	.565**	.355	.415*	.091	.517**

Calm ratio time	.451*	.395*	.336	.281	.545**	.179	.297	.271	.452*
Calm average duration AOI[b]	.127	.089	-.028	-.157	.022	.096	.060	-.301	-.097
Calm fix first AOI	-.448*	-.422*	-.259	-.014	-.347	-.192	-.458*	.123	-.292
Calm time first AOI	-.576**	-.331	-.274	-.185	-.425*	-.123	-.406*	-.040	-.275
Fear ratio fixations	.385	.555**	.338	.309	.549**	.163	.492*	.228	.497**
Fear ratio time	.295	.544**	.252	.295	.476*	.215	.398*	.172	.453*
Fear average duration AOI[c]	.337	.432*	.324	-.005	.382	.188	.357	-.067	.235
Fear fix first AOI	-.485**	-.606**	-.315	.148	-.457*	-.179	-.630**	-.080	-.455*
Fear time first AOI	-.637**	-.692**	-.431*	-.119	-.679**	-.238	-.674**	-.204	-.597**

Note: IPM = Interpersonal Manipulativeness; CA = Callous Affect; ELS = Erratic Lifestyles; CT = Criminal Tendencies; SRP = Hare Self-Report Psychopathy Scale; TriPM = Triarchic Psychopathy Measure; AOI = area of interest
For all analyses n = 29 except the following: [a]n = 26. [b]n = 27. [c]n = *24.*
*p<.05 **p<.01

Compared to Task 2, Task 3 showed a similar pattern of results (Table 11). For all measured emotions, affective-interpersonal traits, and to a lesser extent Erratic Lifestyles and Disinhibition, were faster to fixate in the eye/mouth areas. Thus, Task 3 replicated the finding that primarily individuals high on affective-interpersonal traits tended to look at the AOI sooner and with fewer looks elsewhere before fixating on the eyes or mouth. Also similar to Task 2 was the finding that few of the average duration of fixations in the AOI were significant. Interpersonal Manipulativeness, Callous Affect, and Meanness traits were positively correlated with average duration of fixations for some emotions, furthering support for affective-interpersonal traits associated with longer gazes at the socially relevant information.

Table 11.
Task 3 correlations between psychopathy measures and eye tracking variables

	IPM	CA	ELS	CT	SRP Total	TriPM Boldness	TriPM Meanness	TriPM Disinhibition	TriPM Total
Sad ratio fixations	.272	.251	.228	.524**	.417*	-.024	.229	.156	.189
Sad ratio time	.400*	.367	.335	.519**	.517**	-.022	.329	.261	.310
Sad average duration AOI[a]	.459*	.467*	.344	-.020	.346	.384	.427*	-.192	.293
Sad fix first AOI	-.488**	-.451*	-.210	.031	-.335	-.246	-.421*	.087	-.350
Sad time first AOI	-.659**	-.361	-.473**	-.020	-.486**	-.233	-.386*	-.287	-.574**
Happy ratio fixations	.276	.017	-.006	.516**	.253	.103	.099	.115	.148
Happy ratio time	.350	.371	.183	.636**	.470*	-.149	.329	.323	.254
Happy average duration AOI[a]	.337	.239	.170	.198	.213	.112	.104	-.155	-.044
Happy fix first AOI	-.613**	-.725**	-.429*	-.033	-.609**	-.078	-.699**	-.210	-.547**
Happy time first AOI	-.625**	-.654**	-.500**	-.043	-.620**	-.063	-.589**	-.419*	-.604**
Angry ratio fixations	.365	.488*	.345	.536**	.592**	.054	.496**	.312	.471*
Angry ratio time	.386	.348	.393*	.595**	.586**	-.048	.331	.415*	.371
Angry average duration AOI[b]	.499*	-.005	.119	.026	.196	-.077	-.021	-.070	-.127
Angry fix first AOI	-.708**	-.655**	-.540**	-.198	-.733**	-.224	-.618**	-.368*	-.646**
Angry time first AOI	-.729**	-.577**	-.618**	-.215	-.746**	-.170	-.564**	-.553**	-.703**
Disgust ratio fixations	.338	.337	.182	.611**	.447*	-.193	.309	.257	.179
Disgust ratio time	.337	.351	.247	.570**	.463*	-.150	.301	.298	.232
Disgust average duration AOI[c]	.478*	.288	.209	-.089	.217	.196	.258	-.149	.103
Disgust fix first AOI	-.580**	-.663**	-.368*	-.251	-.628**	-.200	-.595**	-.133	-.496**
Disgust time first AOI	-.616**	-.626**	-.429*	-.350	-.677**	-.129	-.550**	-.308	-.516**
Surprise ratio fixations	.410*	.411*	.265	.663**	.575**	-.152	.370	.448*	.355
Surprise ratio time	.457*	.379	.311	.578**	.551**	-.124	.349	.427*	.345
Surprise average duration AOI[d]	.232	.210	-.001	-.024	.066	-.042	.125	.015	-.033
Surprise fix first AOI	-.499**	-.460*	-.326	-.040	-.429*	-.029	-.478**	-.155	-.402*
Surprise time first AOI	-.536**	-.355	-.313	-.138	-.436*	.138	-.408*	-.335	-.357
Calm ratio fixations	.289	.202	.094	.600**	.368	-.281	.277	.339	.185

Calm ratio time	.313	.279	.182	.643**	.438*	-.309	.299	.388	.200
Calm average duration AOI[d]	.255	.220	-.167	.371	.209	-.177	.217	-.237	-.188
Calm fix first AOI	-.591**	-.540**	-.372*	-.111	-.534**	-.141	-.551**	-.231	-.512**
Calm time first AOI	-.597**	-.495**	-.445*	-.165	-.566**	-.137	-.453*	-.387*	-.544**
Fear ratio fixations	.309	.300	.139	.659**	.450*	-.057	.187	.314	.193
Fear ratio time	.375	.354	.264	.614**	.512**	-.161	.288	.380	.254
Fear average duration AOI[e]	.287	.168	-.019	-.129	.056	-.006	.102	-.212	-.146
Fear fix first AOI	-.472**	-.564**	-.309	-.035	-.454*	-.431*	-.451*	.056	-.495**
Fear time first AOI	-.446*	-.445*	-.350	-.203	-.469*	-.222	-.332	-.264	-.475**

Note: IPM = Interpersonal Manipulativeness; CA = Callous Affect; ELS = Erratic Lifestyles; CT = Criminal Tendencies; SRP = Hare Self-Report Psychopathy Scale; TriPM = Triarchic Psychopathy Measure; AOI = area of interest

For all n = 29 except the following: [a]n = 23. [b]n = 24. [c]n = 22. [d]n = 21. [e]n = 19.

*p<.05 **p<.01

Relative to the first three tasks, patterns of performance on Task 4 were less clear because there were fewer significant results (Table 12). For the first time, individuals high on Boldness looked at the facial region quickly across all emotions. Those higher on Interpersonal Manipulativeness were also faster to look at the eyes/mouth for both happy and angry images. While there were a few additional significant relationships, no other discernable patterns were noted.

Table 12.
Task 4 correlations between psychopathy measures and eye tracking variables

	IPM	CA	ELS	CT	SRP Total	TriPM Boldness	TriPM Meanness	TriPM Disinhibition	TriPM Total
Happy ratio fixations	.409	.297	.380	-.102	.335	.120	.189	.542*	.442*
Happy ratio time	.432	.440*	.379	-.018	.415	.186	.299	.443*	.447*
Happy average duration AOI[a]	.198	.621*	-.014	.286	.323	.239	.494	-.425	-.068
Happy fix first AOI	-.209	-.377	-.115	-.003	-.157	-.482*	-.307	.292	-.249
Happy time first AOI	-.470*	-.308	-.292	.006	-.285	-.446*	-.166	-.042	-.330
Sad ratio fixations	-.085	-.091	-.206	-.230	-.265	.204	.001	-.072	.133
Sad ratio time	-.095	-.107	-.205	-.211	-.256	.128	.018	-.021	.117
Sad average duration AOI[b]	-.086	-.249	-.445	-.220	-.243	-.377	-.085	-.195	-.511
Sad fix first AOI	-.251	-.303	-.163	.128	-.106	-.416*	-.265	.187	-.214
Sad time first AOI	-.396	-.189	-.204	.173	-.147	-.295	-.134	-.009	-.215
Angry ratio fixations	.052	.280	-.070	.379	.204	.015	.162	.014	.029
Angry ratio time	.008	.135	-.069	.346	.167	-.039	.050	.075	.002
Angry average duration AOI[c]	.008	-.077	.141	.000	.129	.017	-.055	-.094	-.143
Angry fix first AOI	-.190	-.377	-.133	-.003	-.155	-.457*	-.306	.321	-.201
Angry time first AOI	-.491*	-.328	-.337	.096	-.287	-.487*	-.191	-.017	-.374
Fear ratio fixations	.029	.224	-.011	.050	.080	.188	.169	.070	.143
Fear ratio time	-.085	.064	-.119	.048	-.050	.069	.077	-.020	.034
Fear average duration AOI[c]	.085	.061	.025	-.018	.095	.130	.169	-.297	.052
Fear fix first AOI	-.125	-.299	.031	.238	.013	-.434*	-.327	.272	-.165
Fear time first AOI	-.335	-.228	-.222	.200	-.150	-.420*	-.134	-.026	-.338

Note: IPM = Interpersonal Manipulativeness; CA = Callous Affect; ELS = Erratic Lifestyles; CT = Criminal Tendencies; SRP = Hare Self-Report Psychopathy Scale; TriPM = Triarchic Psychopathy Measure; AOI = area of interest
For all n = 24 except the following: [a]n = 11. [b]n = 10. [c]n = 13.
*p<.05 **p<.01

Hypothesis 3.

My third hypothesis was that visual attention to emotionally salient aspects of the face would increase when individuals high on psychopathy were asked to label the emotion compared to free-gaze conditions (Dadds et al., 2008). To assess this change, Tasks 2 and 3 were designed using the same images but with free-gaze and emotion labeling instructions, respectively. I first created difference variables for the ratio scores between Tasks 2 and 3 by subtracting scores on Task 2 from the same ones on Task 3. Only the ratio scores were used because this hypothesis refers specifically to amount of visual attention directed at the eye and mouth regions.

Next, the difference scores for each emotion were correlated with psychopathy variables. There were no significant results with the SRP-III measure of psychopathy, but the TriPM results are shown in Table 13. Boldness traits were negatively associated with several of the emotional features detection difference scores. The TriPM Total score was also associated with looking at the eyes and mouth more in Task 2 than Task 3. The opposite was true for Disinhibition which was correlated with more fixations in the areas of interest for surprised faces in the labeling rather than the free-gaze condition.

Table 13.
Task 2 and Task 3 difference scores correlated with psychopathy

	TriPM Boldness	TriPM Meanness	TriPM Disinhibition	TriPM Total
Sad ratio fixations difference	-.175	-.191	-.113	-.313
Sad ratio time difference	-.316	-.177	.056	-.284
Happy ratio fixations difference	-.125	-.225	.179	-.129
Happy ratio time difference	-.574**	-.055	.183	-.353
Angry ratio fixations difference	-.325	-.149	.076	-.296
Angry ratio time difference	-.382	-.223	.011	-.406*
Disgust ratio fixations difference	-.140	.074	-.105	-.133
Disgust ratio time difference	-.262	.066	-.045	-.162
Surprise ratio fixations difference	-.530**	-.055	.504*	-.121
Surprise ratio time difference	-.470*	-.075	.254	-.255
Calm ratio fixations difference	-.689**	-.178	.252	-.397*
Calm ratio time difference	-.570**	.022	.208	-.248
Fear ratio fixations difference	-.252	-.337	.058	-.343
Fear ratio time difference	-.450*	-.159	.090	-.303

Note: TriPM = Triarchic Psychopathy Measure
$n = 26$
*p<.05 **p<.01

To better understand these correlations, I examined whether there was a significant difference in time spent looking at the eyes and mouth between Task 2 and Task 3 for individuals scoring high in psychopathy. Paired samples t-tests were performed for the variables that were found to be significant in the correlations above. For those individuals scoring above the mean on Boldness, there was a statistically significant decrease in time spent looking at happy faces from Task 2 (M = 1.12, SD = .90) to Task 3 (M = .64, SD = .79), t = 2.523, p <.05. There was also a decrease between Task 2 (M = 1.64, SD = 1.14) and Task 3 (M = .49, SD = .47), t = 4.03, p < .05 for the ratio of fixations to surprised faces as well as for time spent fixating on surprised faces (Task 2 M =1.33, SD = 1.07; Task 3 M = .44, SD = .45), t = 2.67, p < .05. The same was also true for the number of fixations to calm faces between Task 2 (M = 1.70, SD = 1.29) and Task 3 (M = .44, SD = .46), t = 4.59, p < .01 and also for the duration of fixations in eye/mouth areas for calm faces (Task 2 M = 1.01, SD = .82; Task 3 M = .24, SD = .30), t = 3.78,

$p < .05$. Overall, individuals high on Boldness allocated more visual attention to salient features in the free-gaze condition than the labeling condition for some expressions.

Individuals with above average scores on TriPM Total had more fixations to the eyes and mouths of calm faces in Task 2 ($M = 1.70$, $SD = 1.29$) than Task 3 ($M = .44$, $SD = .46$), $t = 4.59$, $p < .01$. However, there was no significant change in time spent looking at the eyes and mouth of angry faces in Task 2 ($M = 1.32$, $SD = 1.14$) than Task 3 ($M = .67$, $SD = .64$), $t = 1.80$, $p = .10$. This finding suggests that individuals scoring low on the TriPM are what drive the significant correlation with the difference scores. Finally, individuals scoring highly on Disinhibition did not have significantly more fixations to surprised faces in either task (Task 2 $M = .855$, $SD = .59$; Task 3 $M = .78$, $SD = .80$), $t = .29$, $p = .77$. These results indicate that being higher on some psychopathy traits did not guarantee significant changes in visual attention between tasks and that low scoring individuals may account for this change.

Hypothesis 4.

Next, I hypothesized that eye tracking technology would show that individuals high on psychopathy compared to those lower on psychopathy measures would pay more attention to peripheral aspects of a complex, full-body image rather than the face (Sadeh & Verona, 2012). Complexity of the background was manipulated in Task 1 to evaluate this hypothesis, and results are displayed in Table 9. The ratio variables are the primary measures of visual attention in versus out of the face area. However, there were no significant correlations between psychopathy and these ratio variables, meaning that psychopathy was not meaningfully related to how many or how long individuals fixated in the face area of the images. Criminal Tendencies was positively correlated with both number of fixations before first fixation to the area of interest and time to first fixation in the face for Complex images. These results indicate individuals scoring high on Criminal Tendencies took longer and they had more fixations before fixating on the face for Complex images than their lower scoring counterparts.

Hypothesis 5.

In my fifth hypothesis, I predicted that eye tracking technology would show that individuals higher on psychopathy would show increased attention to the face in full-body images when the background was simple rather than complex (Sadeh & Verona, 2012). To evaluate this hypothesis, I compared the ratios of number of fixations and duration of fixations for Simple background images versus Complex background images in Task 1 relative to psychopathy (see Table 9). There were no significant correlations with psychopathy for ratio variables of either image type.

Another way to investigate changes in visual attention allocated to the images was to investigate the average duration of fixations which shows dwell time for each gaze point within the face area. Average duration of fixation measures for Simple and Complex images were negatively correlated with both Criminal Tendencies and Disinhibition. This finding suggests that disinhibited individuals had shorter gazes within the face area in both Simple and Complex images. Steiger's (1980) t-test, which tests the statistical significance of the difference between dependent correlations, showed no difference between average durations for Simple and Complex images for individuals high on either Criminal Tendencies t (30) = .22, p = .829, Cohen's q = .024 or Disinhibition t (30) = -0.08, p = .936, Cohen's q = .009. Thus, there was no significant difference between average duration on Simple images versus Complex images. Because of the issue of low power, I also graphed the relationships between the Simple and Complex images with Criminal Tendencies (Figure 1) and Disinhibition (Figure 2), and there did not seem to be descriptive differences between the image types.

Figure 1.
Duration of fixations for Simple and Complex images correlated with Criminal Tendencies

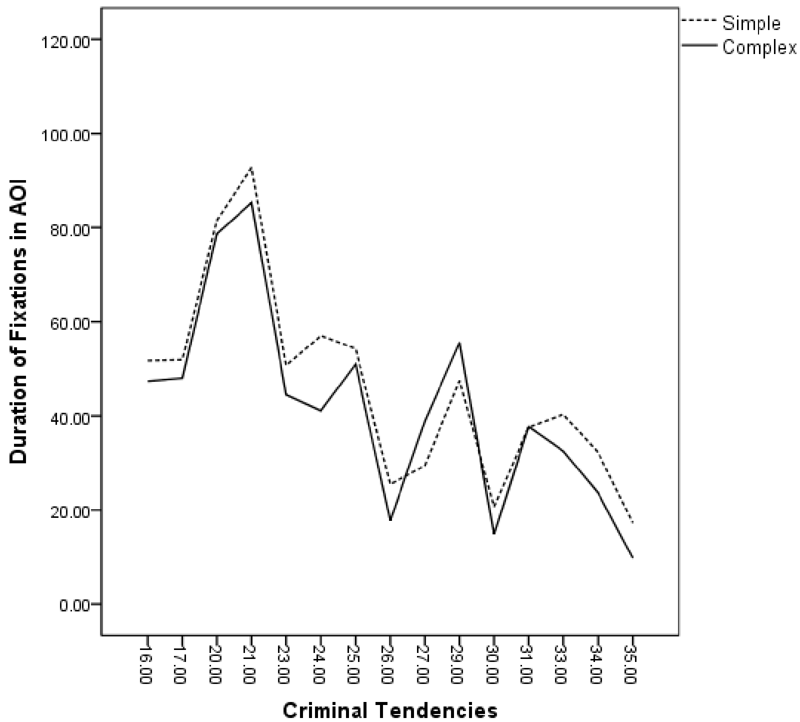
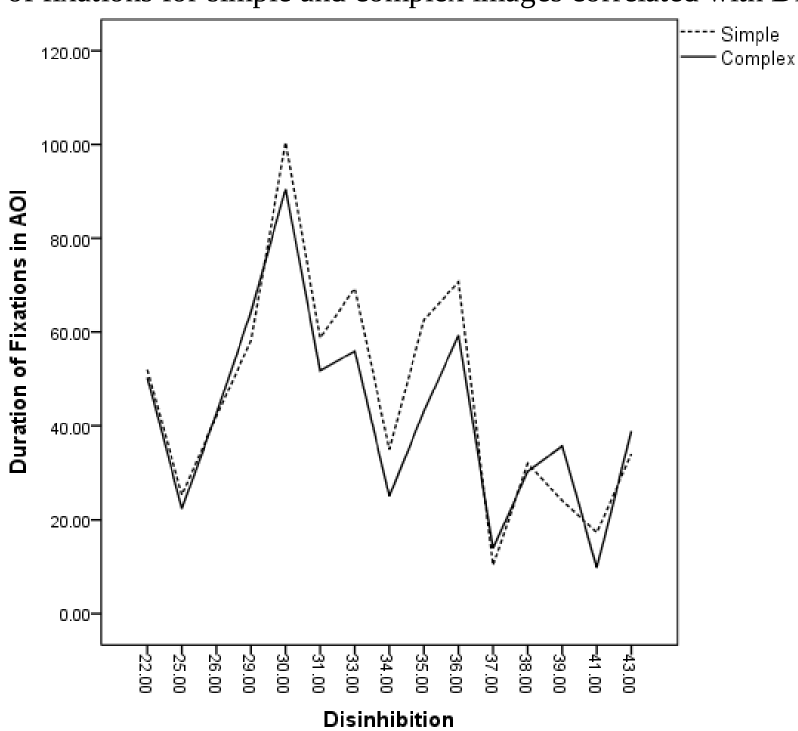


Figure 2.
Duration of fixations for simple and complex images correlated with Disinhibition



Hypothesis 6.

Sixth, I hypothesized that overall, affective-interpersonal traits of psychopathy, particularly those traits reflective of meanness (Patrick et al., 2009), would be more strongly associated with emotion recognition deficits than disinhibitory traits (Sylvers et al., 2011). This prediction was assessed using data from the community sample (Table 6) and university sample (Tables 7 and 8). In the community sample, individuals high on Disinhibition made errors in confusing happy and angry emotions.

A similar pattern occurred with the university sample on Task 3 wherein individuals high on disinhibition showed increased errors in confusing some specific emotions (e.g., sad as angry, disgust as fear, surprise as disgust, calm as surprise). At the same time, the individuals higher on affective-interpersonal traits showed a combination of accurate (e.g., sad as happy, calm as angry) and inaccurate (e.g., disgust as calm, surprise as happy, fear as happy) identification between some emotion pairs. There was a clear pattern for affective-interpersonal traits to be associated with labeling surprise as disgust. In Task 4, performance on both factors of psychopathy were mixed, but a distinct trend of affective-interpersonal traits associated with errors in labeling fearful emotions as happy appeared and subsequently total errors for fear recognition was high for this group.

Hypothesis 7.

For my seventh hypothesis, I stated that disinhibitory traits would be more strongly associated with poor selective attention than meanness or boldness traits (Baskin-Sommers et al., 2009; Sadeh & Verona, 2012). Selective attention was measured in the community study sample using the Go-No-Go task which yielded several measures of accuracy and reaction time across the four blocks of varying inter-stimulus time. A one-way repeated measures ANOVA was conducted to compare accuracy scores on the GNG across blocks with psychopathy scores as a covariate. There was a significant effect for Psychopathy Total, Wilks' Lambda = .946, F (5, 153) = 2.906, $p < .05$, Meanness, Wilks' Lambda = .934, F (5,153) = 3.594, $p < .015$, and Boldness, Wilks' Lambda = .946, F (5,153) = 2.912, $p < .036$. Pairwise comparisons indicated that block 1 was significantly different from block 2 (M = -.021, SE = .004) and from block 3 (M = -.022, SE = .004), but block 1 was not different from block 4 (M = -.012, SE = .006).

Based upon these results and the prediction that reaction time would also be an important metric, index scores were created from the average of blocks 2, 3, and 4 for go accuracy, no-go accuracy, and go reaction time variable. Then, those averaged values were subtracted from block 1 of the respective variable type. Correlations between attention and psychopathy are reported here in relation to the current hypothesis, and associations between attention and emotion recognition tasks are also included in reference to the next hypothesis.

When correlated with psychopathy and the DANVA tasks, the index for reaction time was significant (see Table 14). This finding suggests that those individuals scoring high on Boldness had improvement in reaction times across blocks and, in turn, better sustained attention. On the contrary, Disinhibition was associated with slower performance over time, thus worse sustained attention. Furthermore, faster responding over time was associated with more sad errors as well as more errors overall.

Table 14.
Go-No-Go scores correlation with psychopathy and DANVA scores

	Go accuracy index[a]	No-go accuracy index[a]	Go reaction time index[b]
Boldness	.096	.018	.187*
Meanness	.029	.030	-.117
Disinhibition	-.020	.015	-.191*
Psychopathy Total	.009	.017	-.096
Total errors	-.007	-.133	.176*
Happy errors	.006	.053	.050
Angry errors	-.009	-.100	.100
Sad errors	-.004	-.098	.202*
Fearful errors	.045	-.085	.131

[a]*n* = 160. [b]*n* = 157.

Next, in the university sample, the SRP-III and TriPM measures of psychopathy and the emotion recognition tasks were correlated with outcome measures of the CPT measure of attention (Table 15). People who made more commission errors indicative of impulsivity were higher on the TriPM Disinhibition subscale and made more Surprise errors on Task 3. Individuals scoring higher on Erratic Lifestyles, Meanness, and Triarchic Total had slower reaction times. There was also a negative relationship between Total emotion recognition errors and Reaction Time Mean as well as Reaction Time Standard Deviation suggesting that those with faster reaction times had fewer emotion recognition errors. There were no significant correlations between Task 4 emotion recognition errors and attention variables.

Table 15.
Correlations between psychopathy measures, emotion recognition errors, and the CPT measure of attention

	Commission errors	Omission errors	Correct RT mean	Correct RT SD	Sensitivity d'
Interpersonal Manipulativenes	.050	.055	-.078	.015	-.036
Callous Affect	-.038	.015	-.103	-.023	-.052
Erratic Lifestyles	.087	-.089	-.152*	-.105	.001
Criminal Tendencies	.081	.124	-.054	.119	.049
SRP Total	.056	.022	-.127	-.010	-.016
TriPM Boldness	.043	-.055	-.088	-.002	.010
TriPM Meanness	.026	.024	-.139*	-.075	-.068
TriPM Disinhibition	.130*	.011	-.083	-.041	.014
TriPM Total	.091	-.011	-.150*	-.056	-.023
Task 3					
Total errors	.068	-.067	-.126*	-.153*	-.025
Sad errors	.008	-.004	-.071	-.099	.017
Happy errors	.030	-.058	-.049	-.081	-.042
Angry errors	.043	-.049	-.091	-.105	-.058
Disgust errors	-.009	-.016	-.078	-.115	.042
Surprise errors	.154*	-.021	-.089	-.012	-.017
Calm errors	.075	-.034	-.057	-.080	-.003
Fear errors	.003	-.065	-.057	-.077	-.035
Task 4					
Total errors	.087	-.012	-.063	-.048	.063
Happy errors	.004	-.019	.036	-.005	.103
Sad errors	.002	-.005	-.042	-.046	.040
Angry errors	.092	-.036	-.054	-.042	.036
Fear errors	.079	.026	-.051	-.013	.018

Note: RT = Reaction Time; SD = Standard Deviation; SRP = Hare Self-Report Psychopathy Scale; TriPM = Triarchic Psychopathy Measure. For correlations between psychopathy variables and CPT n = 235, and for correlations between emotion recognition errors and CPT n = 262.
*p<.05 **p<.01

Hypothesis 8.

My eighth hypothesis was that attention would partially account for the variance in the relationship between psychopathy and emotion recognition such that increased attention would account for better emotion recognition (Baskin-Sommers et al., 2009). In the community sample, planned hierarchical multiple regression analyses to assess the ability of psychopathy to predict emotion recognition after controlling for the influences of attention and age could not be performed. The Go-No-Go reaction time index score was significantly correlated with total sad errors and total errors overall as well as with psychopathy traits of Boldness and Disinhibition (Table 14). However, none of the psychopathy scores were significantly correlated with either of the above mentioned error types (Table 6). Thus, there was no relationship between psychopathy and error type from which attention could be partialed.

The first step in evaluating Hypothesis 8 in the university sample was to identify an attention variable for the university sample. Correct Reaction Time Mean was significantly correlated with several of the psychopathy variables in Table 15 as well as Total emotion recognition errors in Task 3. Unfortunately, none of the psychopathy scores were related to Total emotion recognition errors (Table 7), so no further analyses were necessary.

Hypothesis 9.

Finally, my ninth hypothesis stated that attention would partially account for the relationship between psychopathy and emotional features detection such that increased attention would account for more gaze fixations and duration to emotionally salient features (Sadeh & Verona, 2012). The final hypothesis was evaluated in the college sample by controlling for the attention variable, Correct Reaction Time Mean, in significant Spearman's correlations between psychopathy variables and emotional features detection variables from the eye tracking measure. Partial correlations were only performed for those psychopathy and emotional features detection variables that were both correlated with each other as well as with Correct Reaction Time Mean, and only those that were significant are reported.

The attention variable was not correlated with any of the emotional features detection variables in Tasks 1 or 4, so no partial correlations were conducted.   The partial correlations for Task 2 are reported in Table 16. Although the strength of the correlation coefficients decreased somewhat for some comparisons, most of the coefficients were similar to those reported for the Spearman correlations (Table 10). For example, the change in correlation coefficients was largest for the relationship between Meanness and the ratio of angry fixations, but the effect size for this change was small (Cohen's q = .296). All of the other effect sizes were descriptively classified as either small or having no effect.

Table 16.
Task 2 partial correlations between psychopathy and emotional features detection

	df	ELS	TriPM Meanness	TriPM Total
Happy ratio fixations	24	-	.534**	-
Happy ratio time	24	-	.520**	.420*
Angry ratio fixations	23	-	.721**	.580**
Angry ratio time	24	-	.449*	-
Angry fix first AOI	26	-.435*	-.632**	-.595**
Disgust fix first AOI	26	-	-.664**	-.630**
Calm ratio fixations	24	-	.523**	.455*
Calm ratio time	24	-	-	.431*
Calm fix first AOI	26	-	-.521*	-

Note: ELS = Erratic Lifestyles; TriPM = Triarchic Psychopathy Measure; AOI = area of interest.
*p<.05 **p<.01

There were some slight shifts in Task 3 from those reported in Table 11; for example, the correlation coefficients for fixations before the first fixation in the AOI and affective-interpersonal traits became stronger. However, even the correlation with the biggest change (i.e., Meanness and surprise fixations to first fixation in AOI) showed only a small effect size (Cohen's q = .195) with many changes having no significant effect. This finding suggests that attention may have acted as a suppressor in some cases masking the true association between psychopathy traits and the number of fixations before first looks in the eye/mouth area.

Table 17.
Task 3 partial correlations between psychopathy measures and eye tracking variables

	df	ELS	TriPM Meanness	TriPM Total
Sad fix first AOI	26	-	-.431*	-
Happy fix first AOI	26	-.408*	-.729**	-.598**
Happy time first AOI	26	-.428**	-.488**	-.472*
Angry ratio fixations	23	-	.543**	-
Angry fix first AOI	26	-.563**	-.659**	-.701**
Angry time first AOI	26	-.523**	-.472*	-.575**
Surprise fix first AOI	26	-	-.614**	-.479*
Surprise time first AOI	26	-	-.378*	-
Calm fix first AOI	26	-	-.612**	-.524**
Calm time first AOI	26	-.392*	-.411*	-.457*
Fear fix first AOI	26	-	-.483**	-.514**
Fear time first AOI	26	-	-	-.462**

Note: ELS = Erratic Lifestyles; TriPM = Triarchic Psychopathy Measure; AOI = area of interest.
*p<.05 **p<.01

CHAPTER 4

DISCUSSION

The aim of the current study was to examine emotion recognition and emotional features detection abilities in relation to psychopathy. There is evidence that psychopathy is associated with emotion recognition deficits in both adults (Dawel, O'Kearney, McKone, & Palermo, 2012) and children (Frick & White, 2008) who are high on psychopathic traits. Less is known about the visual attention processes involved in the identification of these emotions, particularly for adults high on psychopathy (Dadds et al., 2008). The present study simultaneously assessed specific emotion recognition deficits and social cues processing through recordings of eye gaze to emotionally salient areas of facial images. Results were analyzed in the context of various psychopathy models to elaborate on the specific deficits associated with conceptualized factors.

The current study demonstrated that psychopathic traits were generally not associated with errors in recognizing emotional expressions. Depending upon the sample, task, and psychopathy trait, some significant correlations were identified while other analyses were inconclusive. The intricacies of the results reported here confirm and refute previous findings in the literature, and they beg further examination of psychopathy factors in relation to emotional deficits and mechanisms for the effects.

Previous research has indicated that those higher on psychopathy show the greatest deficits for fear recognition (Blair et al., 2001; Frick & White, 2008); however, these results did not fully confirm that finding. By in large, psychopathy was not associated with emotion recognition errors. The community participants did not show any significant deficits in fear recognition. On the contrary, in the university sample individuals high on overall psychopathy as well as affective-interpersonal traits showed significant errors in fear recognition on the DANVA task (Task 4). Although these tasks were identical, the difference in results may be attributed to the methodology within the context of the study. For the community participants, the DANVA was the first emotion recognition task they performed, whereas for the college students, it was the last. It is possible that the students became fatigued or disinterested by the time they reached the final task and put forth less effort in identifying fear. Supposing that fear is the most challenging emotion for psychopaths to identify, declining performance over time in recognizing this emotion may be driven by difficulty maintaining mental effort. These effects may be explained by the concept of ego depletion, or the reduction in the self-regulation to engage in a task caused by the consumption of limited resources during a prior task (Baumeister et al., 2006). Although no literature could be found on the associations between ego depletion and psychopathy, one could argue that executive functioning resources required to maintain self-regulation may be impacted by known deficits in the prefrontal cortex of individuals high on psychopathy (Yang & Raine, 2009).

Additionally, during Task 3 college students high on psychopathy also showed frequent mistaking of fearful expressions as happy. These examples of fear deficits need to be considered in the context of various other emotion recognition deficits such as the confusing of happy and angry faces by community participants and the frequent labeling of surprised faces as disgusted by the university students. Compared to Task 4, Task 3 had several additional emotions from which to choose which may have weakened the overall results. In sum, psychopathy was indeed associated with fear recognition deficits, but these traits were also related to deficits in recognizing other emotions.

Dadds and colleagues (2008) showed that adolescents higher on callous-unemotional traits allocated less visual attention to the eye region of a facial image, even when explicitly directed to look there, than their peers lower on this trait. On the contrary, the current study found that on Tasks 2, 3, and 4 psychopathic traits were associated with looking at the socially relevant area sooner and spending more time gazing within that area than outside of it. These gaze patterns oriented toward the socially relevant stimuli appeared without explicit directions to look at these areas. It is important to note that on Task 4 psychopathic traits were associated with few discernable gaze patterns which was likely due to a lack of power and accuracy to detect more relationships.

Dadds and colleagues reported no significant findings between emotional features detection and antisocial behavior traits. In contrast, on Task 1 disinhibitory traits (rather than affective-interpersonal traits which are similar to callous-unemotional traits) were associated with shorter average duration of fixations in the face area of the image. It is unsurprising that individuals with traits reflective of impulsivity had shorter looks within the face region, but they were looking at the salient features nonetheless. Again, it is important to note that the majority of correlations between psychopathy and the eye tracking variables for all tasks were not significant. While a lack of power likely accounts for these findings, it may also be that individuals looked somewhat randomly at the images and therefore did not gaze at points long enough to meet the criteria of measureable fixations. Thus, my hypothesis that individuals higher on psychopathy overall would focus less visual attention to emotionally salient areas of the images was only partially confirmed.

I was also interested in comparing changes in visual attention when participants moved from a free-gaze condition to a requirement to label the emotions they viewed based upon related findings reported by Dadds and colleagues (2008). Comparisons between free-gaze and labeling conditions happened primarily between Tasks 2 and 3 where the same images were presented but participants were asked to identify the emotion in the latter task. In general, there was not a noticeable difference in amount of visual attention directed to the eye and mouth regions across these two tasks. The pervasive null findings could be an artifact of the repetition of the same images which may have made participants less inclined to re-examine them closely. Individuals high on Boldness looked at the area of interest less and for shorter time for some emotions (e.g., surprise and calm) than their lower scoring counterparts. Perhaps the social dominance aspect of this trait made individuals less concerned about detecting features, and underlying feelings, unique to these expressions.

The findings are in contrast to those of Dadds who reported distinct increases in gaze to the eye regions of images when participants were instructed to look there before labeling emotions. The differences between the studies lie in the fact that in the current study participants were not explicitly instructed to look at the eye region, which produces more naturalistic responding. The conclusion drawn from these differences may be that most of the time simply asking individuals high on psychopathy to label emotions does not cue them to look at the emotionally salient aspects of the images.

I hypothesized that individuals high on psychopathy compared to those lower on psychopathy measures would pay more attention to peripheral aspects of a complex, full-body image rather than the face (Sadeh & Verona, 2012). This hypothesis was evaluated using data from Task 1 in which the complexity of the background was manipulated. The average duration of fixations in the face region was roughly the same between complex and simple images for individuals high on disinhibitory traits, but these negative associations indicated that these traits were associated with shorter length of fixations to the face regardless of background. Of note, those participants higher on SRP-III Criminal Tendencies took longer to make their initial look in the AOI than those lower on this trait. This finding suggests that those with more disinhibitory traits may be initially more distracted by peripheral stimuli before finding the facial region of an image. These findings somewhat replicate those of Sadeh and Verona (2012) where those higher on affective-interpersonal traits allocated more visual attention to emotional stimuli in complex images than those higher on impulsive traits.

Unfortunately, I was unable to confirm or disconfirm increased attention to the face area when the background was simple because there were not significant correlations between psychopathy variables and number or duration of fixations in the face area. Negative correlations were observed between Criminal Tendencies and average dwell time of looks to the face for simple and complex backgrounds; however, the coefficients were not significantly different from each other. The lack of findings for this research question may again potentially be attributed to a small sample size.

For my sixth hypothesis, I wanted to evaluate differences between individuals' scores on psychopathy factors and their emotion recognition abilities. In the community sample, only disinhibition traits were associated with confusing angry and happy. The university sample showed a variety of mixed findings, but there was a clear trend for affective-interpersonal traits to be associated with mislabeling surprise as disgust in Task 3. This specific error was unexpected given the seemingly unique differences between these two expressions. Disgust has been described as distinguishable by "a wrinkling of the nose" (Eckman & Friesen, 1986) whereas surprise is associated with "wide eyes" (Russell, 1994). Both of these features can be seen in the stimuli used for the current study (Appendix C), so this confusion was not likely due to poorly portrayed expressions. Similarly, frequent errors in mislabeling disgust as calm also appeared in Task 3, which taken in combination may be indicative of a more general misperception of disgust.

Task 4 showed affective-interpersonal traits associated with overall fear errors, which was accounted for by the rate of confusing fear as happy. In this case, five of the six fearful images show teeth which could be confused for teeth showing in a smile (happy). The mislabeling of disgust and fear by individuals high on affective-interpersonal traits is qualified by few errors in identifying happiness in Task 3. Taken together, these findings suggest that community members high on disinhibition are more likely to make emotion recognition errors than those high on affective-interpersonal traits, but the inverse is true for university students. The university sample results are in support of the hypothesis that traits associated with meanness would be related to more emotion recognition errors but only for negative emotions such as disgust and fear. Dawel and colleagues (2012) suggest that there may be a general emotion recognition deficit for psychopathy that may be more severe for individuals with affective-interpersonal traits when they are asked to identify fear. The combination of results reported here may lend support to their proposition.

Various studies have identified selective attention, the ability to focus and shift attention to relevant stimuli, as a deficit associated with psychopathy in general and with disinhibitory traits more specifically (Baskin-Sommers et al., 2011a; Baskin-Sommers, Zeier, & Newman, 2009). Thus, I predicted that disinhibitory traits would be more strongly associated with poor selective attention than affective-interpersonal traits. For the community sample, Disinhibition was associated with slower reaction time while Boldness was associated with faster reaction time on a task requiring attention to target stimuli while ignoring distracting flankers. Thus, this hypothesis was confirmed for this sample.

The university sample participants high on Erratic Lifestyles, Meanness, and the Triarchic measure of psychopathy overall showed slowed reaction times on a similar task of responding to target stimuli while inhibiting responses to non-target stimuli. Simultaneously, participants high on Disinhibition showed increased commission errors, or responses to non-target stimuli indicative of impulsivity. Although it was not a direct assessment of selective attention, traits of disinhibition were negatively associated with average duration of fixations in the face area for Task 1, perhaps suggesting difficulty sustaining attention to that region. The results of the university sample are less clear than the community sample, but seem to point to poor selective attention performance overall for individuals higher on psychopathy.

The moderation effects of attention on psychopathy and fear detection reported by Baskin-Sommers, Zeier, and Newman (2009) suggested that attention would at least partially account for the variance between psychopathy and emotion recognition abilities. The veracity of this prediction was not able to be evaluated in either sample due to the lack of overlapping correlations on all measures. A strength of the current study compared to the study by Baskin-Sommers was the use of a performance measure of attention rather than a self-report questionnaire. On the other hand, performance on the CPT could have been influenced by any number of factors that we were unable to account for such as an attention disorder, distractions in the testing environment, or participant fatigue to name a few

Of additional interest was the finding that faster responding to the attention measure over time was associated with more total errors in emotion recognition. This result is noteworthy because faster reaction time over different blocks is indicative of better attention, so it is curious that those with better attention performed more poorly on emotion recognition. This finding at least in part invalidates the hypothesis that better selective attention would account for better emotion recognition. Although I was unable to assess the impact of attention on the association between psychopathy and emotion recognition, it is possible that selective attention would have had little effect and that psychopathy is in fact the greatest predictor of emotion recognition deficits. Other factors such as carelessness, poor moral socialization, or disinterest cannot be ruled out as covariates of the relationship between psychopathy and emotion recognition deficits.

Finally, I investigated the impact of attention on psychopathy and emotional features detection in the university sample. Partialling the reaction time index from the relationships between psychopathy and emotional features detection was not evaluated for most of these associations. On Task 2, effect sizes for the change between Spearman correlations and partial correlations were either not significant or small, thus yielding the conclusion that the observed relationship between psychopathy and emotional features detection is not merely due to the influence of attention. On Task 3, attention appeared to be suppressing the relationship between psychopathy and emotional features detection. Although my final hypothesis could not fully be explored, the eye tracking tasks themselves were inherently functions of controlled visual attention and show an overlap in construct with the explicit measure of attention.

In general, the current study is consistent with the child and adolescent literature indicating abnormalities in the processing of emotional stimuli, particularly in university students (Frick & White, 2008). While clear negative emotion processing deficits have been noted in child and adolescent samples (Blair & Coles, 2000; Blair, Colledge, Murray, & Mitchell, 2001; Dadds et al., 2006; Stevens, Charman, & Blair, 2001), studies in the adult psychopathy literature have been less consistent in identifying specific emotion recognition deficits (Dawel et al., 2012; Dolan

& Fullam, 2006; Glass & Newman, 2006; Marsh & Blair, 2008). It is important to note that concerns have been raised about extending the construct of psychopathy to adolescents for a number of reasons (see Frick, 2009) and that the traits in adolescents and adults are not always conceptualized in the same way. Callous-unemotional traits tend to encapsulate a lack of guilt or empathy whereas affective-interpersonal traits also include poverty of emotion, grandiosity, and manipulativeness. Differences in the measures of these traits could account for some of the discrepancies in results between the present study and the adolescent research.

Unlike the study by Glass and Newman (2006) which resulted in no effect for emotion recognition deficits in psychopathy, the current study found modest effects for rates of errors in recognizing fear, surprise, and disgust, but less difficulty identifying happiness. Notably missing from this set of negative emotions is sadness which did not show any significant association with psychopathy either for better or worse emotion recognition, so no conclusions can be drawn. Marsh and Blair (2008) reported deficits in recognition of fearful expressions, but they also noted deficits in identifying sadness which did not appear in the present study. The current study replicated findings by Dadds and colleagues (2008) of deficits in the recognition of fear and disgust, although their findings were with adolescents. Dadds also reported that neutral faces received rates of errors similar to other emotions, and the same was found for the current study with calm faces. Prior studies (Dawel et al., 2012; Dolan & Fullam, 2006) reported deficits in the recognition of happiness, but the opposite result appeared in the current study where psychopathy was generally associated with fewer errors in labeling happy expressions among university student.

With regard to emotion recognition deficits, the current study also attempted to clarify conflicting results in the adult literature as to psychopathy factors related to these deficits (Dawel et al., 2012; Marsh & Blair, 2008). Fear and surprise deficits in the university sample were distinctly related to affective-interpersonal traits. It is unsurprising that traits related to disaffiliation and low empathy would be related to these deficits in surprise/fear and further bolsters the proposal that inability to perceive these emotions in others may perpetuate victimization. Conversely, accuracy in identifying happiness was also associated with affective-interpersonal traits. Perhaps heightened awareness of happiness helps perpetuate the charismatic and social dominance qualities of psychopathy in that happy expressions reinforce manipulative behaviors. It may also be the case that those individuals lower on psychopathy observe subtleties in happy faces, especially in posed images, that make them question their genuineness and therefore rate it as another emotion.

In the university sample, good performance in recognizing anger was related to psychopathy overall. However, in the community sample deficits in anger recognition were related to disinhibition. Across studies anger recognition has not been associated with psychopathic traits (Dawel et al., 2012; Dolan & Fullam, 2006; Marsh & Blair, 2008). Even though psychopathy is nearly synonymous with aggression toward others (Patrick & Zempolich, 1998) and psychopaths tend to have a bias toward perceiving hostility in others' ambiguous actions (Kastner & Sellbom, unpublished manuscript), they are not necessarily more sensitive to identifying overtly angry facial expressions than individuals lower on these traits.

The current study did not produce definitive clarity on the specific emotion recognition deficits associated with psychopathy factors, and additional work may be needed in this area to generate more conclusive findings. However, in the context of the already developed literature on this topic, I tend to agree with Dawel and colleagues (2012) that psychopathy may be associated with general emotion recognition deficits with fearful stimuli posing a particular challenge. Varying results may be a function of factors such as task design, sample, or intensity of the stimuli rather than psychopathy. One such factor may be the number of emotions from which to choose in labeling an image. Perhaps having more options obscures results because of the greater number of possible false responses. An interesting comparison in a future study may be for participants to generate their own labels to fill-in-the-blank type responses.

Emotional features detection has primarily been studied in child and adolescent samples (Dadds et al., 2006; Dadds et al., 2008; Sharp, 2008). The current study results are somewhat contrary to the findings of Dadds and colleagues (2008) that visual attention differences occur in free-gaze versus directed attention tasks. In fact, there were very few significant changes between gaze patterns in the free-gaze and the labeling conditions, and the significant results that did exist showed more visual attention to the areas of interest during the free-gaze condition. This result may be explained by not caring to re-examine the images in order to identify the emotion, or perhaps those high on affective-interpersonal traits do not know to look at the salient regions of the face to gather essential information. These findings also raise the question of motivation versus inability to attend to salient information.

This study has significant theoretical implications for understanding and treating psychopathy. Emotion deficits have long been associated with psychopathy, but the current study provides more knowledge of the factors of both constructs and how they inter-relate. Specifically, community participants high on disinhibition tended to have the most errors in emotion recognition, whereas university students higher on affective-interpersonal traits showed more errors. Interestingly, those same affective-interpersonal traits in students were also associated with quicker, longer, and more visual attention to emotionally salient aspects of the face. At least for university students, there seems to be something about affective-interpersonal traits such that information garnered from gazing at the emotionally salient aspects of the images does not necessarily translate to correct identification of those images. The implication is that traits related to social dominance such as callousness and meanness may be related to a failure in appropriately process the social cues, particularly distressed expressions, which may lead to the perpetuation of harm or manipulation of others. Furthermore, deficits in comprehending the portrayed emotions likely interfere with empathy development that may perpetuate deviant behavior associated with psychopathy.

Moreover, the generalizability of this study extends to adults in non-incarcerated samples. Even though both samples used adults, some important differences emerged in the results between the two groups. Some of these varying results may be explained by the oversampling for externalizing traits in the community sample. The lack of findings among individuals with affective-interpersonal traits in the community sample may be due to the inherently higher disinhibition traits sought for that study, and which were associated with emotion recognition deficits. The results for the community study maintain generalizability to other adults, but may be distinctly different from the university sample, which also may include individuals who are less likely to have overtly antisocial behaviors.

Interpersonal violence is one of the most significant concerns with people high on psychopathy (Serin, 1991; Woodworth & Porter, 2002) and finding mechanisms of this behavior is likely to be most effective in decreasing it. By understanding the information-processing of social cues by individuals high on psychopathic traits, we can better structure interventions that intercept these maladaptive behaviors. For example, treatment approaches that teach individuals, particularly those high on affective-interpersonal traits, to direct their visual attention to the salient facial regions would likely improve recognition of emotions, particularly negative emotions such as fear, in others. Victim empathy is a concept widely used in the treatment of sexual offenders to increase the cognitive and emotional awareness for the perpetrator of the victim's experience (Stinson & Becker, 2012). The concept could be applied to psychopathic offenders and visual manipulations could also be used to teach expressive cues associated with victim distress. However, treatment implications should be approached cautiously as directing attention may not significantly alter underlying brain abnormalities (see Han et al., 2012).

Several limitations of this study must be considered. Most importantly, the final sample size for the eye tracking portion of Study 2 was roughly 11% of the proposed number. Various technical difficulties with the eye tracking device primarily account for this drastic reduction. Although a sample size of 31 is not uncommon in eye-tracking studies, conceptualizing psychopathy as a continuous variable requires a larger sample, particularly in a university population where psychopathy is already restricted in range. By the nature of their student status, many of the individuals in the university sample most likely do not exemplify high levels of psychopathic traits, particularly antisocial or impulsive behaviors. This limitation in sampling may extend to bias in attention abilities as well. Because of the limited sample size, many of the analyses lost power; this could have obscured results that otherwise would have been apparent and reduces generalizability. A related limitation was the inability to control for ADHD as a proxy of inattention due to the small sample size in the university sample, which may have introduced measurement error into the CPT.

Another important limitation is the risk of type I errors due to performing multiple hypotheses tests. I did not control for multiple comparisons by using family-wise error rate procedures because I needed to maintain power. However, without applying corrections, there is a chance that the findings produced false positives. Finally, the software program used to present the stimuli used in Study 2 was unreliable for many participants; occasionally images were shown for slightly more or less than the 2.5 second designated interval, and the inter-stimulus interval was sometimes skipped. Although longer presentations of the image presentations were corrected by truncating the data to the 2.5 second mark, nothing could be done to correct for the shortened presentation intervals which could have affected results due to what was essentially missing data.

The findings presented here raise several additional questions which will guide future research. Further clarification with a larger sample size to assess factors of psychopathy related to visual attention is warranted. Although the number of participants in the university sample was not unusual for physiological studies such as eye tracking, the dimensional conceptualization of psychopathy warrants a larger sample to avoid attenuation due to range restriction. A larger study may show replication or additional differences within psychopathy with regard to allocation of emotional features detection. Other covariates such as gender or empathy may also be investigated. Gender is rarely directly assessed in the psychopathy literature, and the current topics have primarily been studied in boys. To date, there continues a debate as to whether poor empathy drives gaze avoidance to emotional features, or whether deficits in emotion detection inhibit empathy development (see Dawel et al. for review). Direct evaluation of empathy in relation to these variables may help elucidate the directionality issue. Finally, future studies may wish to investigate neurological functioning concurrent with emotional features detection with methods such as fMRI. Numerous studies have posited underlying brain dysfunctions associated with emotion deficits, but to my knowledge none have incorporated emotional features detection.

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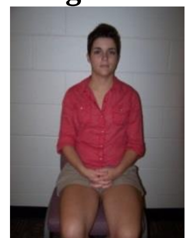
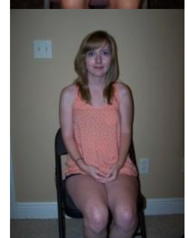
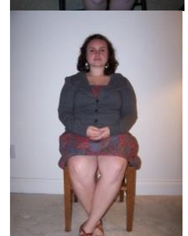
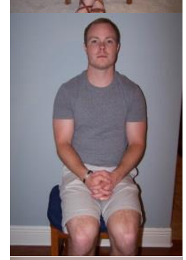
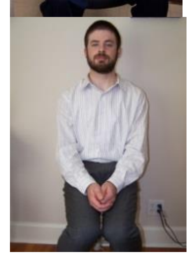
APPENDIX A

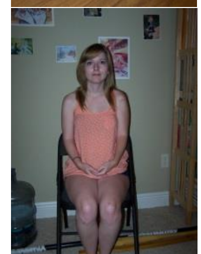
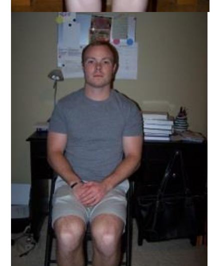
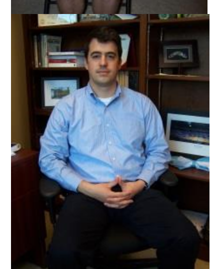
Brief Demographic Survey

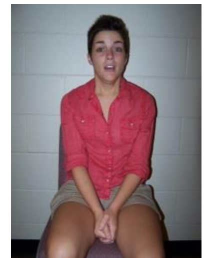
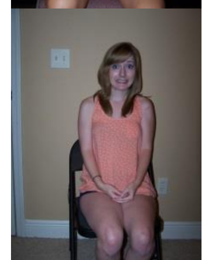
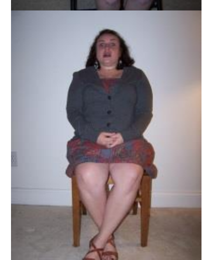
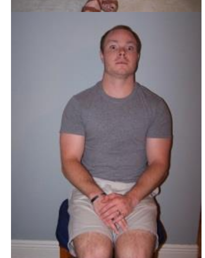
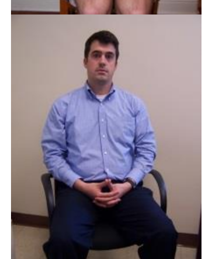
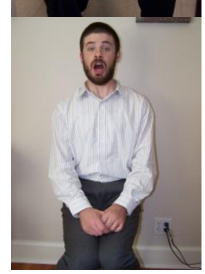
1) Age ____________
2) Gender (Pick one)
    a. Male
    b. Female
    c. Other
3) Ethnicity (Pick one)
    a. African-American
    b. Asian
    c. Caucasian
    d. Hispanic
    e. Native American
    f. Other/Mixed/Prefer not to disclose
4) Have you received a prior diagnosis of ADD or ADHD?
    a. Yes
    b. No
5) If yes, have you been prescribed medication for these symptoms?
    a. Yes
    b. No
6) If yes, did you take your medication today?
    a. Yes
    b. No
7) If no, do you think you still experience symptoms of ADD or ADHD when you are not on your medication?
    a. Yes
    b. No

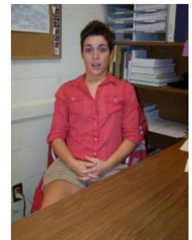
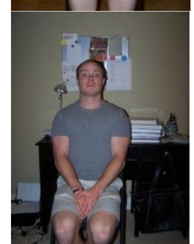
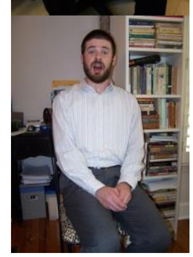
APPENDIX B

Task 1 Stimuli

Emotion	**Background**	**Rating**	**Code**	**Image**
Calm	Simple	0.9	01f_ca_si	
Calm	Simple	0.7	02f_ca_si	
Calm	Simple	1.0	03f_ca_si	
Calm	Simple	0.8	01m_ca_si	
Calm	Simple	0.6	02m_ca_si	
Calm	Simple	0.9	03m_ca_si	

Calm	Complex	0.8	01f_ca_co	
Calm	Complex	0.8	02f_ca_co	
Calm	Complex	0.7	03f_ca_co	
Calm	Complex	0.9	01m_ca_co	
Calm	Complex	0.8	02m_ca_co	
Calm	Complex	0.8	03m_ca_co	

Fear	Simple	0.8	01f_fe_si	
Fear	Simple	0.9	02f_fe_si	
Fear	Simple	1.0	03f_fe_si	
Fear	Simple	0.9	01m_fe_si	
Fear	Simple	0.9	02m_fe_si	
Fear	Simple	0.8	03m_fe_si	

Fear	Complex	0.7	01f_fe_co	
Fear	Complex	0.8	02f_fe_co	
Fear	Complex	0.8	03f_fe_co	
Fear	Complex	1.0	01m_fe_co	
Fear	Complex	0.9	02m_fe_co	
Fear	Complex	1.0	03m_fe_co	

APPENDIX C

NimStim (Tasks 2 and 3)

Emotion	Rating	Code	Image
Angry	.68	02f_an_c.pict	
	.67	06f_an_c.pict	
	.91	10f_an_o.pict	
	.89	29M_AN_O.pict	
	.80	24m_an_o.pict	
	.70	33m_an_c.pict	

Calm	.23	02f_ca_c.pict	
	.37	06F_CA_C.pict	
	.36	10f_ca_c.pict	
	.34	29M_CA_C.pict	
	.49	24m_ca_c.pict	
	.30	33m_ca_c.pict	

Disgust	.68	02F_DI_C.pict	
	.96	06F_DI_C.pict	
	.87	10f_di_o.pict	
	.80	29M_DI_O.pict	
	.49	24M_DI_C.pict	
	.68	33m_di_c.pict	

Fear	.41	02F_FE_O.pict	
	.78	06f_fe_o.pict	
	.72	10F_FE_C.pict	
	.55	29m_fe_o.pict	
	.66	24m_fe_o.pict	
	.72	33m_fe_o.pict	

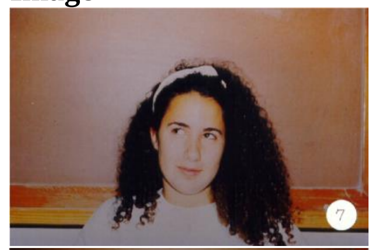
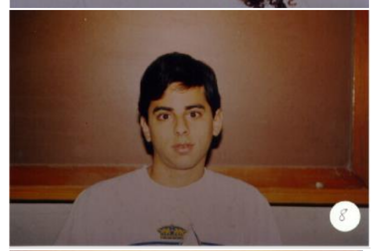
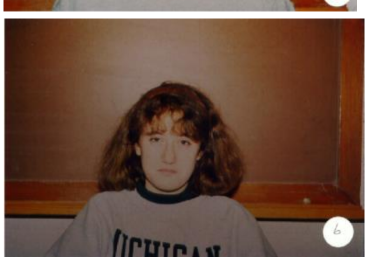
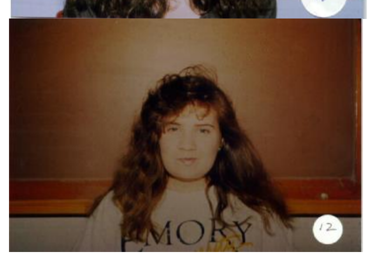
Happy	.81	02f_ha_x.pict	
	.66	06f_ha_x.pict	
	.96	10f_ha_c.pict	
	.74	29M_HA_C.pict	
	.94	24m_ha_c.pict	
	.55	33m_ha_x.pict	

Sad	.39	02f_sa_o.pict	
	.74	06F_SA_C.pict	
	.87	10F_SA_O.pict	
	.87	29m_sa_c.pict	
	.83	24M_SA_O.pict	
	.72	33m_sa_c.pict	

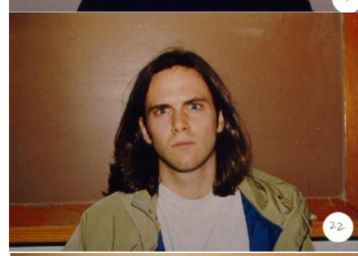
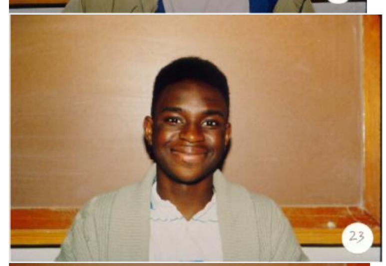
Surprise	.96	02F_SP_O.pict	
	.74	06f_sp_o.pict	
	.95	10f_sp_o.pict	
	.89	29m_sp_o.pict	
	.70	24m_sp_o.pict	
	.89	33M_SP_O.pict	

APPENDIX D

DANVA/Task 4 Stimuli

Emotion	**Image**	**Emotion**	**Image**
Happy		Happy	
Fearful		Fearful	
Angry		Fearful	
Happy		Happy	
Angry		Sad	
Sad		Angry	

Emotion	Image
Sad	
Sad	
Angry	
Fearful	
Sad	
Sad	

Emotion	Image
Fearful	
Angry	
Fearful	
Angry	
Happy	
Happy	

APPENDIX E

Office for Research

Institutional Review Board for the Protection of Human Subjects

THE UNIVERSITY OF ALABAMA RESEARCH

October 30, 2013

Rebecca Kastner
Department of Psychology
College of Arts & Sciences
Box 870348

Re: IRB#: 13-OR-327 "Personality and Visual Attention"

Dear Ms. Kastner:

The University of Alabama Institutional Review Board has granted approval for your proposed research.

Your application has been given expedited approval according to 45 CFR part 46. You have also been granted the requested waiver. Approval has been given under expedited review category 7 as outlined below:

(7) Research on individual or group characteristics or behavior (including, but not limited to, research on perception, cognition, motivation, identity, language, communication, cultural beliefs or practices, and social behavior) or research employing survey, interview, oral history, focus group, program evaluation, human factors evaluation, or quality assurance methodologies

Your application will expire on October 28, 2014. If your research will continue beyond this date, complete the relevant portions of the IRB Renewal Application. If you wish to modify the application, complete the Modification of an Approved Protocol Form. Changes in this study cannot be initiated without IRB approval, except when necessary to eliminate apparent immediate hazards to participants. When the study closes, complete the appropriate portions of the IRB Request for Study Closure Form.

Please use reproductions of the IRB approved stamped information sheets to obtain consent from your participants.

Should you need to submit any further correspondence regarding this proposal, please include the above application number.

Good luck with your research.

Sincerely,

Carpantato T. Myles, MSM, CIM
Director & Research Compliance Officer
Office of Research Compliance
The University of Alabama

358 Rose Administration Building
Box 870127
Tuscaloosa, Alabama 35487-0127
(205) 348-8461
FAX (205) 348-7189
TOLL FREE (877) 820-3066

IRB# 13-OR-327

UNIVERSITY OF ALABAMA INSTITUTIONAL REVIEW BOARD FOR THE PROTECTION OF HUMAN SUBJECTS
REQUEST FOR APPROVAL OF RESEARCH INVOLVING HUMAN SUBJECTS

I. Identifying information

	Principal Investigator	Second Investigator
Name:	Rebecca Kastner, M.A.	Andrea Glenn, Ph.D.
Department:	Psychology	Psychology
College:	Arts and Sciences	Arts and Sciences
University:	University of Alabama	University of Alabama
Address:	Box 870348, Tuscaloosa, AL	Box 870348, Tuscaloosa, AL
Telephone:	(812) 344-8824	(205) 348-4340
FAX:		(205) 348-8648
E-mail:	rmkastner@crimson.ua.edu	andrea.l.glenn@ua.edu

Title of Research Project: Personality and Visual Attention

Date Printed: Funding Source: None

Type of Proposal: _x_New ___Revision ___Renewal ___Completed ___Exempt

Attach a renewal application

Attach a continuing review of studies form

Please enter the original IRB # at the top of the page

UA faculty or staff member signature: ______________________

II. NOTIFICATION OF IRB ACTION (to be completed by IRB):

Type of Review: ______ Full board X Expedited

IRB Action:

___Rejected Date:________

___Tabled Pending Revisions Date:________

___Approved Pending Revisions Date:________

X Approved—this proposal complies with University and federal regulations for the protection of human subjects.

Approval is effective until the following date: 10/28/2014

Items approved:

X Research protocol: dated

__ Informed consent: dated

__ Recruitment materials: dated

X Other: Info sheet dated

Future contact sheet

Approval signature _Date 10/31/2013