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THREAT DETECTION FROM PHENOTYPIC FACIAL FEATURES

A Dissertation

Submitted to the Graduate Faculty of the
University of South Alabama
in partial fulfillment of the
requirements for the degree of

Doctor of Philosophy

in

Combined-Integrated Clinical & Counseling Psychology

by

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LIST OF ABBREVIATIONS

fMRI	=	Functional Magnetic Resonance Imaging
PCL-R	=	Psychopathy Checklist-Revised
ADI	=	Arrogant and Deceitful Interpersonal style
DAE	=	Deficient Affective Experience
IIL	=	Impulsive and Irresponsible Behavioral style
ANT	=	Antisocial Behavior
CFA	=	Confirmatory Factor Analysis
vmPFC	=	Ventromedial Prefrontal Cortex
OFC	=	Orbital Frontal Cortex
HVA	=	Homovanillic Acid
5-HIAA	=	5-Hydroxyindoleacetic Acid
FWHR	=	Facial Width-to-Height Ratio
LSRP	=	Facial Width-to-Height Ratio
ITS	=	Interpersonal Trust Scale
NPP/OoC	=	Nobel Peace Prize/Order of Canada Recipients
FBI	=	FBI's Ten Most Wanted Fugitives

ABSTRACT

Kern, Melissa L., M.S., University of South Alabama, August 2022. Threat Detection from Phenotypic Facial Features. Chair of Committee: James R. Stefurak, Ph.D. & John F. Shelley-Tremblay, Ph.D.

Previous research has demonstrated people's ability to accurately and quickly make snap judgments of trustworthiness from viewing individuals' faces (Todorov, Pakrashi, & Oosterhof, 2009; Willis & Todorov, 2006). The study of how human beings make meaningful predictions from phenotypic facial features about trustworthiness, among other traits, warrants additional scrutiny and investigation. Further, other research suggests the facial width to height ratio (fWHR) is a more specific indicator used by human beings to gauge, often accurately gauge, trustworthiness with some accuracy. As such, past research found participants rated people with larger fWHRs as less trustworthy and more aggressive (Carré & McCormick, 2008; Stirrat & Perrett, 2010).

The present study had four major aims. The study's first aim was to extend the current literature to explore whether faces of the FBI's Ten Most Wanted Fugitives (FBI) would have larger fWHRs than faces of Nobel Peace Prize or Order of Canada (NPP/OoC) recipients. The study's second aim was to replicate previous research exhibiting participants' ability to accurately discern less trustworthy individuals (i.e., the FBI's Ten Most Wanted Fugitives) from more trustworthy individuals (i.e., Nobel Peace Prize or Order of Canada recipients). The third aim of the study was to replicate fWHR

findings to test the inverse relationship between fWHR and trustworthiness ratings. Finally, the fourth aim of the study entailed investigating whether participants endorsing psychopathic traits were more attracted to individuals who, arguably, have greater psychopathic traits (i.e., FBI's Ten Most Wanted Fugitives).

Results yielded mixed support for the above aims. The present study did not uncover a significant difference in fWHRs between the FBI's Ten Most Wanted Fugitives and Nobel Peace Prize or Order of Canada recipients. Additionally, results did not indicate an inverse relationship between fWHR and trustworthiness ratings. However, results supported participants' ability to accurately and reliably discern the FBI's group from NPP/OoC recipients. Further, results revealed differences among psychopathy groups. Participants with the highest psychopathy scores endorsed significantly higher attractiveness and truthfulness ratings than participants with the lowest psychopathy scores, regardless of picture type.

CHAPTER I

INTRODUCTION

Psychopathy was not formally defined until 1941, when Hervey Cleckley established its most modern-day definition. Cleckley described the key features of psychopathy to be glibness, superficial charm, lack of remorse and guilt, and emotional detachment. Contrasting most with previous definitions, Cleckley suggested psychopaths could be anyone functioning well within society while simultaneously masking their psychopathic traits (Arrigo & Shipley, 2001). Following Cleckley, Robert Hare began to scientifically study psychopathy and created the first standardized psychopathy measure, The Psychopathy Checklist-Revised (PCL-R). The PCL-R measures two dominant factors of psychopathy. The first factor examines the unemotional and callous traits typical of many psychopaths, whereas the second factor focuses on antisocial and reckless behavior (Hare, 2003). While scores on both traits contribute to overall psychopathy, the implications of each factor differ significantly.

Research suggests two distinct types of psychopaths: Fundamental Psychopaths (FD) and Secondary Psychopaths (SP). Fundamental Psychopathy is the product of a hereditary emotional deficit consistent with Factor 1 traits, whereas Secondary Psychopathy results from environmental factors consistent with the expression of Factor 2 traits (Porter, 1996). Researchers believe Fundamental Psychopaths are born with

callous-unemotional traits, whereas Secondary Psychopaths are the product of an early adverse environment that disrupts successful socialization (Yildirim & Derksen, 2013). Individuals with high Factor 1 traits appear to be more planned, strategic, and goal-oriented in expressing their antisocial behavior, whereas individuals with high Factor 2 traits are impulse-driven. As such, individuals with elevated Factor 1 traits exhibit instrumental aggression, and individuals with elevated Factor 2 traits exhibit reactive aggression (Yildirim & Derksen, 2013). While the two-factor psychopathy model is the most well-known psychopathy model, other researchers have suggested three and four-factor models of psychopathy.

Factor analytic research has found support for a three-factor model which divided Factor 1 into arrogant and deceitful interpersonal style (ADI) and deficient affective experience (DAE), and a third factor of impulsive and irresponsible behavior (IIL) (Cooke & Michie, 2001). Later a fourth factor consisting of prior antisocial behavior (ANT) was added. Statistical evidence suggests this four-factor model was a superior fit to the data (Vitacco, Rogers, Neumann, Harrison, & Vincent, 2005). However, regardless of the structure, there are certain biological and environmental contributors to the development of psychopathy.

The development of psychopathy can be attributed to biological factors such as genetics, neurology, and endocrinology, and environmental factors such as poor parental bonding and an early aversive home life. For instance, studies examining the heritability of psychopathic traits among identical twins reared together and apart has demonstrated a potential genetic link for psychopathy, specifically as it pertains to the paternal line (Beaver, Rowland, Schwartz, & Nedelec, 2011; Blonigen, Carlson, Krueger,

& Patrick, 2003). Additionally, anatomical brain differences in the amygdala and ventromedial prefrontal cortex (vmPFC) were found among psychopathic individuals. These differences are imperative as defects in these structures reduce fear and impair moral reasoning, which are key characteristics of psychopaths. Turning to the endocrinology of psychopathy, testosterone and cortisol appear to play a crucial role, separately and jointly. Elevated testosterone levels result in increased social aggression and reward sensitivity and decreased sensitivity to punishment (Dabbs, Frady, & Carr, 1995; Dabbs, Jurkovic, Frady, 1991; Van Honk et al., 2004), whereas elevated cortisol levels result in less reactivity to stress (Glenn & Raine, 2008). To examine the joint impact of testosterone and cortisol, some researchers have applied the "Dual Hormone Hypothesis" to psychopathy, which suggests the aggressive behavior of psychopaths is the product of increased testosterone to cortisol ratio (Glenn, Kurzban, & Raine, 2011; Mehta & Josephs, 2010). These results have been echoed in studies using forensic populations but not among community populations (Glenn et al., 2011).

Along with biological contributors, the early environment is another key factor in the development of psychopathy. Of particular importance, poor early parental and overall familial bonding is linked to psychopathy (Bowlby, 1969; Kosson, Cyterski, Steuerwald, Neumann, & Walker-Matthews, 2002). Additionally, childhood abuse and neglect are related to creating psychopathic traits (Craparo, Schimmenti, & Caretti, 2013; Lang, Klintnerberg, & Alm, 2002; Weiler & Widom, 1996). Yet, so far, psychopathy has been discussed in depth without a clear rationale for the importance of studying it.

Research on psychopathy is imperative as these traits are linked to antisocial behavior that impacts the larger community within which the psychopath resides. For

instance, studies have found psychopathy scores positively correlated to risk for violence, number of violent acts committed, general criminal behavior, and violent crime (Fix & Fix, 2015; Grettton et al., 2004; Reidy, Shelley-Tremblay, & Lilienfeld, 2011; Serin, 1991; Vaughn, Howard, & DeLisi, 2008). Thus, the psychopath poses a significant risk to public safety, and therefore, poses a significant financial burden to society, costing the judicial system approximately \$460 billion per year (Reidy, Shelley-Tremblay, & Lilienfeld, 2011).

Given the damaging impact of psychopathic individuals, there is a question of whether people who harbor such traits can be detected by others and the threat they posed mitigated through such detection. Various theories offer explanations of how such threat detection may operate, one which the present study applies is the possibility that underlying genetic, neurobiological, and endocrinological etiological factors give rise to phenotypic markers within the facial structures of such individuals, structures which others can visually perceive (Anderl, Hahn, Schmidt, Moldenhauer, Notebaert, Clement, Windmann, 2016; Geniole et al., 2014). One suspected endocrinological factor is testosterone. ability to detect the facial features and what meaning do they make of them?

Testosterone maps onto physical characteristics such as jaw width and cheekbone size (Tanner & Tanner, 1990). Accordingly, pubertal testosterone shapes the structure of males' faces, resulting in an increased width. One way to measure these features is to calculate the facial width-to-height ratio (fWHR). The fWHR is the ratio between the face's bizygomatic width, which is the farthest left and right facial boundaries, and the height of the face, which is the distance from the highest points on the upper lip and eyelids (Carre & McCormick, 2008). While it would logically seem fWHR is associated

with increased testosterone (Lefevre et al., 2013), little research has uncovered such findings (Bird et al., 2016; Hodges-Simeon et al., 2016; Kordsmeyer et al., 2019). Although it is unclear if fWHRs correlate to increased testosterone, research indicates fWHRs are positively correlated to self-reported dominance and reactive aggression scores and expressed aggression (Carré & McCormick, 2008). In addition, various studies have yielded a positive association between fWHRs and aggressive behavior (Haselhuhn, Ormiston, & Wong, 2015). While multiple studies have supported the connection between fWHRs and aggression, this same relationship has not been found in every study examining the impact of the fWHR on aggression (Deaner et al., 2012; Kosinski, 2017). Despite these mixed findings, fWHRs significantly impact perceptions of trustworthiness. Research demonstrates that fWHR impacts threat detection so that the larger the ratio, the greater the perceived threat. Simply by manipulating the fWHRs, researchers could change the trustworthiness rating so that the wider the fWHR, the less trustworthy the face was perceived (Ormiston et al., 2017; Stirrat & Perret, 2010). Further, fWHRs have been used to predict psychopathy scores, including fearless dominance and self-centered impulsivity (Anderl, 2016; Geniole et al., 2014). These results suggest fWHR may be an evolved cue of aggression in men. However, these findings do not determine whether people can reliably and accurately detect and differentiate such facial features.

Research examining the impact of facial structure on trustworthiness judgments indicates certain facial features influence perceptions of trust. Accordingly, people with various facial structures are consistently rated differently. For instance, individuals with rounder faces or “baby faces” are perceived as warmer than more defined or mature faces (Montepare & Zebrowitz, 1998; Zebrowitz, Franklin, & Boshyan, 2015). These findings

suggest people with rounder or baby-like faces are regarded as less threatening and more trustworthy than people with sharper, more mature faces. In addition, the notion that individuals use facial cues to form trustworthiness judgments is supported by research that shows people make trustworthiness judgments in as little as 33 milliseconds after viewing an individual's face (Todorov, Pakrashi, & Oosterhof, 2009). More specifically, research suggests people may focus on facial testosterone markers when making trustworthiness judgments.

To date, no research has tested the ability of individuals with psychopathic traits to detect other individuals with such traits. Despite this, evolutionary theorists suggest psychopathic traits represent adaptability and fitness, specifically as it pertains to reproductivity. According to an evolutionary theory, psychopathic individuals should be perceived as more attractive because they signify reproductive success (Jonason et al., 2009; Jonason, Valentine, Li, & Harbeson, 2011). While this theory is promoted, little to no evidence suggests that to be the case with psychopathic individuals. For instance, psychopathy has not correlated to the number of offspring. When examining the impact of psychopathy on mate selection for short-term and long-term dating, individuals low in psychopathy were not attracted to individuals with high psychopathy; however, this was not the case with individuals high in psychopathy. Results with individuals elevated on psychopathy are mixed. Some studies suggest that male and female individuals with elevated psychopathy scores were more attracted to one another (Blanchard, Lyons, & Centifanti; Jonason, Lyons, and Blanchard, 2015; Watts et al. 2018), whereas others have not (Lyons & Blanchard, 2016). While no research indicates psychopathic individuals are better at identifying one another, most current research suggests an attraction between

psychopathic individuals. The factors that underlie the mutual attraction between psychopaths are unknown, and further research is needed to understand this attraction.

As previously mentioned, people make trustworthiness judgments rapidly, but are they accurate? Research examining the ability to discern untrustworthy faces from trustworthy faces would suggest people can accurately distinguish between such faces. For example, various studies demonstrate the ability of participants to accurately discern between the following groups: criminals and non-criminals (Valla, Ceci, & Williams, 2011); Nobel Peace Prize or Order of Canada recipients and the FBI's Ten Most Wanted Fugitives (Porter et al., 2008); Non-violent sex offender and violent sex offenders (Maner & Baumeister, 2010). The studies mentioned above support the hypothesis that people can reliably and accurately discern trustworthy faces from untrustworthy faces.

The current study replicated previous research that exhibited participants' ability to accurately discern pictures of trustworthy individuals (i.e., the FBI's Ten Most Wanted Fugitives) from images of untrustworthy individuals (i.e., Nobel Peace Prize/Order of Canada recipients) (Stillman, Maner, & Baumeister, 2010; Porter et al., 2008; Valla et al., 2011), and to replicate the smaller number of prior studies that have linked fWHR with ratings of trustworthiness.

The study attempted to extend the existing literature by testing whether the FBI's Ten Most Wanted Fugitives faces had larger fWHRs than Nobel Peace Prize/Order of Canada recipients, who arguably have lower psychopathy scores. Additionally, the current study sought to extend the literature by testing whether the self-reported psychopathy orientation traits of the participant correlate with their attractiveness ratings of the faces of those high and low in psychopathy (i.e., do those with psychopathic

tendencies detect something in faces that cue for them that the target individual is like-minded and potentially attractive). Prior research suggests that psychopaths find other psychopaths attractive, but the mechanism of action is unclear in these relationships (Blanchard, Lyons, & Centifanti, 2015; Jonason, Lyons, & Blanchard, 2015; Watts et al., 2019).

CHAPTER II

LITERATURE REVIEW

2.1 History of Psychopathy

Psychopathy has a long history, dating as far back as Biblical times. It appears there have always been people throughout the ages that demonstrated psychopathic characteristics (Arrigo & Shipley, 2001; Smith 1978). Despite its long history, psychopathy was not formally defined until 1941. It appears the lag in establishing a clinical definition may be in part due to the nature of psychopathic individuals. In the 1700 & the 1800s, people assumed that lower intelligence was associated with mental illness; however, many people with psychopathic features did not exhibit any cognitive impairments (Arrigo & Shipley, 2001). The first person to note this difference was Philippe Pinel, in 1801, who described psychopathic individuals as having "manie sans delire" or insanity without delirium (Arrigo & Shipley, 2001; Dinges et al., 1998; Millon, Simonsen, & Birket-Smith, 1998). He acknowledged the impulsive and sometimes violent behavior exhibited by these individuals but believed they were rational and understood their behavior as abnormal (Dinges et al., 1998; Millon et al., 1998). Pinel advocated for the moral treatment of psychopathic individuals rather than more aversive treatments such as bloodletting and cold baths (Arrigo & Shipley, 2001; Smith, 1978). In the early 1800s, following Pinel, Benjamin Rush (1812) modified the public's

conceptualization of psychopathy. He argued that these individuals exhibited "moral alienation of the mind" or a total disregard for moral behavior.

Additionally, he regarded this moral inability as a hereditary defect, which optimally developed in poor environmental conditions. The definition was further evolved by J. C. Prichard (1835) to "moral insanity," in which he argued psychopathic individuals exhibited a "deplorable defect in personality" (Arrigo & Shipley, 2001; Porter 1996). He suggested that these individuals understood right from wrong but intentionally chose to act immorally (Arrigo & Shipley, 2001). Prichard advised ostracizing these individuals from the larger society. As such, he created a negative view and long-standing stigma for psychopathic individuals. Over 50 years later, Koch (1891) changed the definition to "psychopathic inferiority." He argued that psychopathic individuals behaved immorally due to genetic factors that were not within their control. He suggested psychopathic individuals were rational and sane but demonstrated moral deficits that were not intentionally malicious. After Koch, Maudsley (1897) posited that psychopaths demonstrated "moral imbecility," which suggests that psychopathic individuals acted immorally due to "cerebral deficits" (Arrigo & Shipley, 2001, p 332). He believed their actions were not within their control. Due to their deficits and lack of control, he did not agree with punishing psychopathic individuals (Toch, 1998). Transitioning to a much darker conceptualization of psychopathy, Krafft-Ebing (1904) regarded psychopaths as "savages" that could not be rehabilitated and believed they "must be kept in asylums for their own [good] and [for] the safety of society" (Toch, 1998, p. 148). Consistent with Krafft-Ebing's understanding of psychopathic individuals, Kraepelin further defined and categorized them by their specific maladaptive traits into seven types of psychopaths

(Arrigo & Shipley, 2001; Porter, 1996). He described psychopathic individuals as "enemies of society" who are "characterized by a blunting of the moral elements" and lacking a "deep emotional reaction." (Millon et al., 1998, p. 10). Kraepelin and Krafft-Ebing's bleak conceptualization of psychopathic individuals stood until 1941, when Hervey Cleckley established the modern definition of psychopathy.

Cleckley laid out the key features of psychopathy, which he described as glibness, superficial charm, lack of remorse and guilt, and emotional detachment. Additionally, he noted the lack of anxiety experienced by psychopaths. While previous researchers viewed psychopaths as easy to detect and incapable of functioning within society, Cleckley argued for a different type of conceptualization. He suggested some psychopaths could easily function and pass in society. He conveyed his ideas in his text, *The Mask of Insanity* (1941), where he wrote: "The true difference between them and the psychopaths who continually go to jails or psychiatric hospitals is that they [i.e., the nonoffenders] keep up a far better and more consistent outward appearance of being normal" (p. 198-199). As suggested in his text, many psychopaths are incarcerated; however, certain psychopaths are capable of successful socialization, which provides them the understanding to abide by societal norms and, therefore, "mask" their maladaptive traits. Due to this ability, these types of psychopaths can blend within society and go undetected, making them even more socially effective in carrying out psychopathic behavior (Arrigo & Shipley, 2001). Following Cleckley decades later, the next major researcher and contributor to psychopathy theory is Robert Hare. Robert Hare created the first standardized measure for psychopathy, titled The Psychopathy Checklist-Revised (PCL-R). The PCL-R contains 20 items, each rated on a 0 to 2-point Likert scale with a

max score of 40. To qualify as a psychopath, an individual must score 30 or higher. The PCL-R measures two major factors of psychopathy. The first factor encompasses the unemotional and callous traits typical of many psychopaths. The second factor reflects the antisocial and reckless behavior common among psychopaths (Hare, 2003). Although these two factors are strongly related, they vary in their implications.

2.2 Two Types of Psychopaths

Congruent with Hare's 2-factor model of psychopathy, researchers suggest two types of psychopaths: Fundamental Psychopaths (FD) and Secondary Psychopaths (SP). Fundamental Psychopaths have a hereditary emotional deficit characterized by Factor 1 (emotional detachment) traits such as glibness, superficial charm, callousness, lack of empathy, and manipulative behavior. Conversely, Secondary Psychopaths demonstrate Factor 2 (impulsive-antisocial lifestyle) traits such as impulsivity, irresponsibility, parasitic behavior, and need for stimulation (Porter, 1996). Additionally, Secondary Psychopaths engage in "de-activation of dissociation" (Porter, 1996). While Fundamental Psychopaths are the product of genetic factors, Secondary Psychopaths are the product of environmental factors. In other words, people regarded as fundamental psychopaths have an innate deficit, whereas secondary psychopaths are the result of an adverse environment (Porter, 1996). People with Secondary Psychopathy learn to cope with their adverse experiences by relocating their attention to other less-threatening stimuli in their environment (Harpur & Hare, 1990; Porter, 1996). Another proposed way to cope as children is by turning off their emotions, resulting in a "strong/tough demeanor" as an

adult (Everstine & Everstine, 1989; Porter, 1996). Raised in a dysfunctional environment, Secondary psychopaths do not complete the socialization process, which prevents them from learning and understanding moral and social norms. This contrasts with Fundamental Psychopaths, who researchers believe to be born with callous-unemotional traits regardless of their developmental environment (Yildirim & Derksen, 2013). Because secondary psychopathy is associated with environmental forces disrupting the normal socialization process, it is often referred to as sociopathy and primary psychopathy as psychopathy (Yildirim & Derksen, 2013). In addition to etiological differences, there are personality differences between Fundamental Psychopaths and Secondary Psychopaths or between individuals scoring high on Factor 1 or Factor 2 traits.

Factor 1 and Factor 2 traits are correlated to different behavior, especially as it pertains to achievement and aggression. Concerning achievement behavior, Factor 1 traits positively correlate to achievement-oriented behavior; conversely, Factor 2 traits do not. People scoring high on Factor 1 traits are more planned, strategic, and goal-oriented in expressing their antisocial behavior, whereas people scoring high in Factor 2 traits are impulse-driven. Accordingly, people high on Factor 1 traits demonstrate instrumental aggression, but people high on Factor 2 traits demonstrate reactive aggression (Yildirim & Derksen, 2013). Given the different manifestations of antisocial behavior, each factor is linked to different symptoms of other disorders. In line with Factor 2's association with impulsivity and reactive aggression, it is comorbid with ADHD and Conduct Disorder. Factor 1 traits are tied to callous-unemotional (CU) traits, congruent with the previously proposed innate inability to demonstrate empathy among people high on Factor 1 features

(Frick & Morris, 2004). While Factor 1 and Factor 2 traits seem somewhat contradictory to each other, in combination, these two core components define psychopathy.

2.3 Three and Four Factor Models of Psychopathy

While the two-factor model is the most prevalent, it is not the only suggested way to define psychopathy. To better understand the critical components of psychopathy, Cooke and Michie (2001) created a three-factor model. Contrasting with the two-factor model, the three-factor model places less emphasis on criminal behavior and emphasizes more on the essential personality traits that encompass psychopathy. Along with this modification, the three-factor model separates Factor 1 into two characteristics: arrogant and deceitful interpersonal style (ADI), deficient affective experience (DAE). The third factor is an impulsive and irresponsible behavioral style (IIL). In sum, the three-factor model includes an arrogant and deceitful interpersonal style (ADI), deficient affective experience (DAE), and impulsive and irresponsible behavioral style (IIL). Like the two-factor model, each factor of the three-factor model correlates to categorically different characteristics and behavior (Cooke & Michie, 2001).

The first factor, an arrogant and deceitful interpersonal style (ADI), is associated with the following: higher adaptive functioning, social dominance, low-stress reactivity. As its title suggests, the second factor, a deficient affective experience (DAE), entails low social closeness and violent offending. The third factor, an impulsive and irresponsible behavioral style (IIL), includes poor adaptive functioning, disinhibition, reactive aggression, and negative emotionality (Hall, Benning, & Patrick, 2004).

Other researchers have validated Cooke and Mitchie's three-factor model. For instance, when researchers administered the PCL-R to a sample of psychiatric patients, the same three factors emerged (Skeem, Mulvey, & Grisso 2003). Additionally, within this study, the impulsive and irresponsible behavioral style (IIL) component was significantly associated with alcohol and drug usage, property crimes, and the frequency and severity of arrests (Skeem et al., 2003). Further, the deficient affective experience (DAE) correlated with interpersonal crime and past and future violence (Skeem et al., 2003). Consistent with results from the previous study by Skeem et al. 2003, a study administering the PCL-R to 300 incarcerated offenders replicated the three-factor psychopathy model. The studies mentioned above utilized Caucasian and African American male samples; however, the three-factor model has been validated among more diverse samples as well. For instance, samples of Hispanic federal inmates (Tubb, 2002) and incarcerated females replicated the three-factor model (Jackson, Rogers, Neumann, & Lambert, 2002). Although the three-factor model better distinguishes the different factors that compose psychopathy, it is criticized for minimizing the importance of antisocial behavior.

Due to the three-factor model's limitations, a four-factor model of psychopathy has been proposed, including antisocial behavior (ANT) as the fourth factor (Vitacco, Rogers, Neumann, Harrison, & Vincent, 2005). A four-factor model was supported when a confirmatory factor analysis (CFA) compared the three different factor models of psychopathy to evaluate which best captured the construct of psychopathy. Vitacco et al., (2005) conducted a CFA using the PCL-R scores of 96 criminal offenders. Further, the four-factor model is the superior fit, even when considering the effects of ethnicity,

gender, and intelligence (Vitacco, Neumann, & Jackson, 2005). The four-factor model appears to encapsulate the entire construct of psychopathy comprehensively. Despite its demonstrated superiority to the two and three-factor models of psychopathy, the four-factor model has yet to gain its predecessors' popularity.

2.4 Etiology of Psychopathy

2.4.1 Biological Contributors

2.4.1.1 Genetics.

Much of the compelling evidence for a genetic basis of psychopathy lies within twin studies. Data from the Minnesota Twin Registry supports the notion that the variance in psychopathic traits is significantly explained by genetic factors, even after accounting for other relevant factors (Blonigen et al., 2003). Another study utilizing genetic data from the Minnesota Twin Family Study explored the extent genetics contributed to the variance of psychopathic traits. This analysis uncovered that genetics explained 40% of the variance of psychopathic traits related to antisocial behavior and attachment. Similarly, results from a meta-analysis of 10 studies found that genetics accounted for roughly 49% of the variance of psychopathic traits (Waldman & Rhee, 2006). To account for environmental differences, other researchers have turned to adoption studies. In one study, there appeared to be a paternal link to psychopathy. For instance, the father's criminal behavior significantly correlated to the psychopathy scores of their male offspring. In other words, the more criminal behavior of the biological

father, the higher the psychopathy score of his male children. Contrastingly, results did not demonstrate this relationship between fathers and daughters. Further, the mother's criminal behavior was not significantly correlated to either male or female offspring (Beaver et al., 2011). Considering the presented results, there appears to be a genetic link, possibly along the paternal line, that significantly contributes to the variance of psychopathic traits.

2.4.1.2 Neurology.

Psychopathic individuals demonstrate anatomical brain differences when compared to non-psychopathic individuals. The brain region with the most significant difference and overall impairment is the amygdala. The amygdala's actual anatomical structure and its ability to operate effectively are different among psychopathic individuals than non-psychopathic controls. Specifically, the amygdala appears to have a size reduction. The amygdala's impairment is crucial because it is implicated in threat detection and fear conditioning (Blair et al., 2006). This is important because a deficit in fear conditioning results in less responsiveness to threat, meaning psychopathic individuals can act without fear in stress-inducing and dangerous situations. A similar pattern of impaired fear conditioning has been found among individuals with amygdala lesions, further supporting the amygdala's biological specificity in the development of psychopathy (Blair et al., 2006; Blair, 2007; Blair, 2008).

Along with the amygdala, images show impairments in the ventromedial prefrontal cortex (vmPFC) among psychopathic individuals. The abnormal functioning of the amygdala and vmPFC is imperative to understanding psychopathy's neurobiology, as neuroimaging studies show they work together for moral decision-making. This suggests

that if the communication between the amygdala and vmPFC is disrupted, then the ability to appropriately respond to stressful or threatening situations and engage in moral behavior is impaired (Blair et al., 2006; Blair, 2007; Blair, 2008). This can explain why psychopathic individuals can calmly respond in stressful situations and why they do not have difficulty making immoral choices. Supporting this notion, individuals who have experienced injuries to the vmPFC have developed "acquired sociopathy," resulting in the development of psychopathic traits following the injury (Blair et al., 2006). Other research suggests neurotransmitters as another neurological contributor to psychopathy.

Due to psychopathic individuals' impulsive nature, researchers speculate that there may be an imbalance of neurotransmitters (Fallon, 2006). An increased ratio between the dopamine metabolite homovanillic acid (HVA) and the serotonin metabolic 5-hydroxyindoleacetic acid (5-HIAA) has been found among individuals with psychopathic traits (Soderstrom, Blennow, Manhem, & Forsman, 2001; Soderstrom, Blennow, Sjodin, & Forsman, 2003). In addition to neurotransmitters, hormone levels may be another biological contributor to the development of psychopathic traits.

2.4.1.3 Endocrinology.

Testosterone and cortisol appear to be the most influential hormones contributing to the expression of psychopathic traits. For instance, providing a single dosage of testosterone to participants engaging in the Iowa Gambling Task yielded a similar behavioral pattern expressed by psychopathic individuals. As a result of testosterone administration, participants demonstrated increased reward sensitivity and decreased sensitivity to punishment (Van Honk et al., 2004). This study suggests that testosterone may be a driving force for psychopathic behavior. Congruently, testosterone levels

correlate with higher Factor 2 scores. This indicates that individuals with higher Factor 2 scores will have higher testosterone levels than individuals with lower Factor 2 scores. Another hormone of interest is cortisol. Cortisol is a hormone released in response to stress to calm the immune response and return the body to homeostasis (Clow & Hucklebridge, 2003; Harbuz, 2002). Higher cortisol levels have been found among violent offenders (Holi, Auvinen-Lintunen, Lindberg, Tani, & Virkkunen, 2006). Contrastingly, cortisol levels were less reactive during a social stress test among a sample of undergraduate males with elevated psychopathy scores (Glenn & Raine, 2008). There are mixed results on the exact connection between psychopathy and cortisol; however, research implicates its impact on the expression of psychopathic traits.

Instead of conceptualizing testosterone and cortisol's impact on psychopathic traits individually, researchers suggest it may be the ratio of these two hormones that determine such characteristics. In reference to primary and secondary psychopathy, primary psychopathy or individuals scoring high on Factor 1 traits may be the product of decreased cortisol, whereas secondary psychopathy or individuals scoring high on Factor 2 traits may be due to increased testosterone levels (Van Honk et al., 2004). To conceptualize the combined effect of testosterone and cortisol on psychopathy, some have applied the "Dual Hormone Hypothesis," which suggests the aggression exhibited by psychopathic individuals is the product of an increased testosterone to cortisol ratio. As such, individuals are more aggressive (i.e., testosterone) but do have the means to inhibit (cortisol) such behavior (Glenn et al., 2011; Mehta & Josephs, 2010). Research applying the Dual Hormone Hypothesis to psychopathy has yielded mixed results. In favor of the Dual Hormone Hypothesis, Glenn et al. (2011) investigated the influence of testosterone

and cortisol on psychopathy when examining the stress response among a sample of 178 adult males varying in psychopathy levels. Results from the study uncovered an increased testosterone to cortisol ratio among participants with higher psychopathy scores. Also, higher psychopathy scores only correlated to the interaction of high testosterone and low cortisol levels (Glenn et al., 2011). Conversely, results from a community sample of 237 participants did not uncover psychopathy to be associated with an interaction between testosterone and cortisol levels (Welker, Lozoya, Campbell, Neumann, & Carre, 2014). While it is uncertain if an interaction between testosterone and cortisol underlies psychopathy, it seems the majority of research would suggest these hormones play a role in the expression of aggression commonly demonstrated among psychopathic individuals.

2.4.1.4 Testosterone and Aggression.

Research with animals has demonstrated a relationship between testosterone and aggressive behavior (Boissy & Bouissou, 1994; Von Honk et al., 2004). Due to animal research's successful results, researchers have investigated the potential link between testosterone and aggression among humans. As hypothesized, studies employing human participants uncovered a positive association between testosterone and social aggression. As discussed previously with the Iowa Gambling Task, a single testosterone dose was correlated to increased reward sensitivity and decreased sensitivity to punishment among average college students (Von Honk et al., 2004). Supporting the connection between testosterone and aggressive behavior, research found young and adult offenders exhibited elevated testosterone levels (Dabbs, Carr, & Frady, 1995; Dabbs et al., 1991). For example, among adult inmates, higher testosterone was associated with inmates who committed personal crimes, which include interpersonal violent and sexual offenses,

when compared to inmates who had committed property crimes such as theft, burglary, and drug offenses (Dabbs et al., 1995). Testosterone appears to contribute to the expression of aggressive behavior among both younger and older offenders.

Although research suggests testosterone is associated with aggression, cortisol is another integral hormone regulating aggressive behavior expression. Cortisol appears to act as a mediator to aggressive behavior. Higher cortisol levels counter aggressive behavior by eliciting inhibition and psychological distress, whereas lower cortisol levels elicit relaxation (Terburg, Morgan, & Van Honk, 2009). For instance, when presented with a social stress test, individuals with lower cortisol demonstrate less reactivity (O'Leary et al., 2007). Not surprisingly, psychopathic offenders with histories of violence exhibit lower cortisol levels (Cima et al., 2008). Without enough cortisol, individuals do not respond to stress or threat appropriately, leaving them uninhibited to engage in risky or dangerous behavior without distress.

Connecting the collective impact of testosterone and cortisol, researchers have suggested aggressive behavior is the product of an imbalanced testosterone to cortisol ratio (Glenn et al., 2011; Mehta & Josephs, 2010; Terburg et al., 2009; Welker et al., 2014; Zilioli et al., 2015). To express this hypothesis, Mehta & Josephs (2010) coined the "Dual Hormone Hypothesis," which posits that aggression is the product of high testosterone levels and low cortisol levels. The Dual-Hormone Hypothesis suggests that low cortisol levels are insufficient in yielding an adequate stress response to inhibit aggressive and dominant behavior associated with high testosterone (Mehta & Josephs, 2010). With higher testosterone levels and lower cortisol levels, there is little to inhibit aggressive behavior expression.

Supporting the Dual Hormone Hypothesis, an imbalanced testosterone and cortisol ratio influences status-seeking and dominant leadership behavior among undergraduates and athletes (Edwards & Casto, 2013; Mehta & Josephs, 2010; Mehta, Welker, Zilioli, & Carré, 2015). Additionally, an imbalanced testosterone to cortisol ratio has predicted aggressive and violent behavior among adolescent offenders (Dabbs et al., 1991; Popma et al., 2007). Overall, the imbalanced testosterone to cortisol ratio has been associated with status-seeking, risk-taking, dominance, aggression, delinquency, antisocial punishment, and decreased empathy (Dabbs et al., 1991; Edwards & Casto, 2013; Mehta & Josephs, 2010; Mehta et al., 2015; Pfattheicher et al., 2013; Popma et al., 2007; Van Den Bos, Golka, Effelsberg, McClure, 2013; Zilioli, Ponzi, Henry, & Maestriperi, 2015; Zillioli & Watson, 2012).

The imbalance of testosterone and cortisol appears to be associated with status-seeking behavior. This is consistent with animal and human research that revealed testosterone activates the brain's reward system (Dekkers et al., 2019; Mehta et al., 2015). Cortisol and testosterone influence the reward systems of animals and humans (Dekkers et al., 2019; Hermans, Boss, Ossewaarde, Ramsey, Fernandez, & Van Honk, 2010; Shemisa, Kunnathur, Liu, Salvaterra, & Dluzen 2006; Lombardo et al., 2012; Ope de Macks et al., 2011; Zhang et al., 2016). To examine the combined effect of testosterone and cortisol on status-relevant behavior, Dekkers et al. (2019) conducted a meta-analysis of 33 studies that examined the influence of hormones on status, dominance, risk-taking, aggression, and psychopathy. There was a small yet significant interaction between both hormones and the status-relevant behavior tested ($p = .026$). The studies above appear to provide sufficient evidence in support of the Dual-Hormone Hypothesis in explaining

aggression and status-relevant behavior; however, not all studies have gleamed such results.

Despite the previously mentioned studies in favor of the Dual-Hormone Hypothesis, other studies have not found an association between testosterone and cortisol and aggression or status-relevant behavior (Geniole, Carré, & McCormick, 2011; Mazur & Booth, 2014). For instance, Geniole et al. (2011) found higher cortisol levels and testosterone to individually, and not jointly, predicted aggressive behavior while playing an online game (Cyberball). Contradictory to the Dual-Hormone Hypothesis, Denson et al. (2013) discovered reactive aggression was only correlated to testosterone when cortisol levels were elevated. This finding is a complete reversal of the hypothesis, which suggests aggression is the product of an imbalanced ratio of testosterone and cortisol rather than an elevation of both hormones (Denson, Mehta, & Tan, 2013). Due to the presented research, the Dual Hormone Hypothesis has mixed findings for explaining aggression among humans.

2.4.2 Environmental Contributors

John Bowlby (1969), a prominent attachment researcher, examined the impact of unsuccessful early attachment and bonding with parental figures on psychopathic traits. Upon examining 44 male juvenile offenders, Bowlby uncovered that most offenders had poor relationships with their mothers. He argued that a weak maternal bond could create "affectionless psychopathy" (Bowlby, 1969). Parental and general familial negatively correlates with psychopathy scores. A study of male adolescents found that self and individual familial bonding reports related to psychopathy scores (Kosson et al., 2002).

Results from this study seem to suggest that weak familial bonding negatively correlates to psychopathy. As such, the weaker the familial bonding, the higher the psychopathy score. Additionally, a sample of adolescent psychopaths indicated an increased likelihood of foster care placement, thus providing further support for the importance of early parental attachment to the development of psychopathy (Campbell et al., 2004). Along with familial bonding, trauma may play a role in the development of psychopathy.

Setting the stage for this research, Weiler & Widom (1996) compared the psychopathy scores between a sample of 652 abused and neglected individuals and a control group of 489 individuals. Results from this study uncovered significantly higher psychopathy scores among participants who had been abused or neglected. A longitudinal study, including 199 Swedish males, found similar results. Elevated psychopathy scores and increased violent behavior were discovered among males with histories of trauma compared to those without a history of victimization (Lang et al., 2002). Additionally, a study of 2,260 Italian violent offenders found increased childhood neglect and abuse (Craparo et al., 2013). Along with abuse and neglect, other variables such as inadequate supervision, parental rejection, coldness, and inconsistent discipline contributed to the development of psychopathy (da Silva, Rijo, Salekin, 2012). Interestingly, different types of maltreatment map onto the development of Factor 1 and Factor 2 scores.

As previously mentioned, when outlining the differences between Factor 1 and Factor 2 traits, research suggests abuse and neglect contribute more to the development of Factor 2 traits than Factor 1 traits. Congruently, elevated Factor 2, but not Factor 1 traits, were discovered among a sample of 615 male offenders who had experienced childhood victimization. These males exhibited more impulsive and irresponsible behavior (e.g.,

Factor 2 traits); however, their ability to interpersonally connect and demonstrate empathy (e.g., Factor 1) was not disrupted (Poythress, Lilienfeld, & Skeem, 2006). In studies examining victimized youth with psychopathic traits, abuse has only been linked to Factor 2 traits and not Factor 1 traits (Kimbrel, Nelson-Gray, & Mitchell, 2007; Gao, Raine, Chan, Venables, & Mednick, 2010). Contrastingly, O'Neil, Lidz, & Heilbrun (2003) discovered abuse and neglect associated with Factor 1 and Factor 2 traits. While abuse and neglect may be related to both factors, it seems the type of trauma yields differential effects for each factor. Put differently, the kind of trauma impacts the sort of psychopathic traits expressed. For instance, sexual abuse was tied to Factor 2 and neglect to Factor 1 traits among a diverse sample of 117 detained male youth. Further, youth who scored higher on Factor 2 traits were more likely to have been convicted of sexual offenses than those who scored high on Factor 1 or low on psychopathy overall (Kimonis et al., 2013). Further, increased psychopathy scores of the youth, irrespective of which factor, predicted histories of victimization compared to youth scoring lower on psychopathy (Kimonis et al., 2013). As mentioned above, the research supports a connection between trauma and psychopathy with the type of trauma impacting the expression of Factor 1 and Factor 2 traits.

Along with trauma, parental bonding connects to both psychopathy factors. Specifically, maternal bonding appears to be of considerable significance to the development of psychopathic traits. Utilizing a sample of 333 individuals, Gao et al. (2010) examined the individual impact of maternal and paternal care on Factor 1 and Factor 2 traits. Both factors correlated with low maternal care. Interestingly, paternal overprotection was primarily associated with Factor 1 traits and not Factor 2 traits.

Inconsistent with this finding, Kimbrel et al. (2007) discovered that the degree of maternal care was predictive of Factor 2 traits but not Factor 1 traits (Kimbrel et al., 2007). Further, parental separation before the age of 10 influenced Factor 2 traits but not Factor 1 traits (Farrington, 2006), whereas inadequate paternal monitoring and supervision influenced Factor 1 traits but not Factor 2 traits (Wootton et al., 1997). The discrepancy between psychopathy factors demonstrates the complexity and many heterogeneous paths to developing a psychopathic personality.

2.5 Importance of Studying Psychopathy

Psychopathy is one of many personality types; however, its study benefits beyond the individual with the disorder and extends to society's overall safety. The studying of psychopathy serves public safety, as research suggests psychopathy is associated with committing violent acts. For instance, using a sample of 87 incarcerated males, Serin (1991) found higher psychopathy was related to aggressive and impulsive behavior. Further, individuals with high psychopathy committed more serious offenses and used lethal weapons when committing their crimes. In addition to examining the histories and PCL scores of the incarcerated men, the study presented participants with hypothetical scenarios with frustrating outcomes and measured their level of anger and hostility in response. As expected, individuals with higher psychopathy scores reported more anger and hostility to others in response to the hypothetical scenarios than did individuals with lower psychopathy (Serin, 1991). This violent and aggressive disposition has proven to remain stable over time. Employing a sample of 157 boys, Gretton et al. (2004)

monitored males' psychopathy levels for ten years. Boys were first administered the PCL between the ages of twelve and eighteen and again administered the PCL ten years later. Even when considering factors such as the age of the first offense, conduct disorder, and history of violent and non-violent behavior, those who scored high as youths were more at risk for violence later (Gretton et al., 2004). Further, psychopathy predicted life-long criminal behavior with 70-88% accuracy (Vaughn et al., 2008). Psychopathic traits link to violent behavior outside of forensic populations too. For instance, researchers could predict violent and illegal behavior using the psychopathy scores of 111 college students (Fix & Fix, 2015). It appears that regardless of the population, psychopathic traits are predictive of violent criminal behavior.

Along with committing violent acts, individuals with psychopathic characteristics account for a disproportional amount of the violent crimes committed. Considering the relationship between psychopathy and violent criminal behavior, psychopathic individuals pose a significant financial burden to society. Psychopathic individuals cost the judicial system approximately \$460 billion per year (Reidy et al., 2011). Overall, psychopathy poses a threat to public safety and a financial risk to society at large.

2.6 Interpersonal Attraction and Psychopathy

While no research to date has tested if people endorsing psychopathic traits are better adept at detecting others with these traits, there is evidence regarding the attractiveness of psychopathic individuals. Evolutionary psychologists have suggested psychopathic characteristics indicate adaptability and fitness, specifically as it pertains to

reproductivity. Under this theory, psychopaths are attractive because they signify reproductive success (Jonason et al., 2009; Jonason et al., 2011). Studies by Visser, Pozzebon, Bogaert, & Ashton (2010) and Borráz-León & Rantala (2021) yielded support for this evolutionary theory, finding that psychopathy was positively associated with number of sexual partners. Other evidence does not support the evolutionary theory of reproductive success for psychopathic traits. For instance, Marcinkowska, Lyons, & Helle (2016) did not find a correlation between men's psychopathy scores and their number of offspring produced, whereas results from Carter, Lyons, & Brewer (2018) yielded psychopathy as a negative predictor of offspring. Other research has teased apart the components of psychopathy and tested the reproductive success of each. Using the four-factor model of psychopathy, Mededovic, Petrovic, Zeleskov-Doric, & Savic (2017) found interpersonal style positively predicted reproductive success. Alternatively, the affect and lifestyle components negatively predicted reproductive success. This research seems to suggest the different traits of psychopathy vary in their overall adaptability and reproductive success.

Aside from reproductive success, individuals may be drawn to people with elevated self-reported psychopathy scores due to their association with increased social dominance (Cichocka, Khont, & Makwana, 2017; Glenn, Efferson, Iyer, & Graham, 2017; Hodson, Hogg, & MacInnis, 2009; Ho et al., 2015). Self-reported psychopathic traits have correlated to the dominance subdimension of social dominance orientation, which demonstrates a bias towards group-based dominance in which more powerful groups maintain the power and oppress less powerful groups (Ho et al., 2015). As such, psychopathic individuals are more concerned with their social hierarchy status than their

income or education levels (Glenn, Efferson, Iyer, & Graham, 2017). In reviewing the trait preferences of their current long-term partners, women, but not men, rated social dominance as an important trait in relationship satisfaction (Bryan, Webster, Mahaffey, 2011). Due to these findings, psychopathic individuals' emphasis on social status may make them more appealing to mates.

In line with this research, Jonason, Lyons, and Blanchard (2015) examined how Dark Triad traits impact mate selection. They proposed that individuals with higher levels of Dark Triad traits would be desired for short-term dating, such as one-night stands, while individuals with lower levels would be desired for long-term mating. Additionally, they tested the impact the Dark Triad traits of each participant had on mate selection. Consistent with their hypothesis, Jonason et al. (2015) found individuals higher in Dark Triad traits were more desirable for short-term dating, and individuals lower in Dark Triad traits were desirable for long-term dating. Participants high in psychopathy were the exception to this pattern. Both male and female participants with elevated psychopathy chose individuals high in psychopathy for both short and long-term dating. These results were replicated by Blanchard, Lyons, & Centifanti (2015), who congruently found participants deemed psychopathic traits unattractive except for participants that were high in psychopathy, who found psychopathic traits attractive. This research suggests psychopaths may be more attracted to one another. Providing additional support, Watts et al. (2018) tested the attractiveness of psychopathic traits among a sample of male and female community members and female undergraduates. Researchers constructed a list of 70 characteristics depicting traits of various personality disorders (e.g., Borderline, Schizotypal, Borderline, Histrionic, Narcissistic, & Dependent) and instructed

participants to use this list to create their ideal mate for dating and short and long-term relationships. Among the personality disorders, psychopathic traits were rated as the most attractive but still low on average. Interestingly, psychopathy's affective component was most desired for dating compared to the other facets of psychopathy. Additionally, people with elevated psychopathic traits consistent with Factor 2 were more likely to construct an ideal mate with psychopathic traits. These results reveal an increased attraction to psychopathic individuals among men and women who exhibit Factor 2 psychopathic traits (Watts et al., 2018). This suggests that a heterosexual woman with elevated psychopathy scores would be attracted to men with elevated psychopathy scores and vice versa for men.

On the contrary, Lyons & Blanchard (2016) did not find women with elevated psychopathy to be attracted to men with similar psychopathic tendencies after viewing men's facial stimuli varying in Dark Triad Traits. Within this study, stimuli demonstrating Dark Triad traits were regarded as less attractive, even among high psychopathy participants. Research has found some support that individuals with psychopathic traits may be attractive to potential mates and that this degree of attraction may be enhanced when both individuals harbor such traits. The underlying mechanisms for this are only vaguely identified, and further research is needed to pinpoint what features and behaviors of the psychopathic individual promote this attractiveness, and specifically why psychopaths are attracted to one another

2.7 Using Facial Features to Make Trustworthiness Judgments

The notion that facial features impact the formation of others' judgments was first noted in 1872 by Charles Darwin. Darwin established the inhibition hypothesis, which posits genuine emotion uncontrollably "leak[s]" onto the face in the form of microexpressions (Darwin, 1872). Other researchers have contributed to this idea by suggesting that these leaked emotions appear in either the upper or lower part of the face (Ekman, 1992; Porter and ten Brinke, 2008). The assumption that individuals utilize facial cues to make judgments is supported by research that shows people make trustworthiness judgments in as little as 33 milliseconds after viewing an individual's face (Todorov, Pakrashi, & Oosterhof, 2009).

Turning to research on judgments of trustworthiness, it seems certain facial features influence perceptions of trust. Facial dynamics dictated participants' partner selections and overall cooperation in a two-person trust game (Krumbhuber et al., 2007). Notably, studies discovered people with rounder faces or "baby faces" were viewed as warmer than mature or defined faces (Montepare & Zebrowitz, 1998; Zebrowitz, Franklin, & Boshyan, 2015). Similarly, participants regard faces resembling Labrador Retrievers as less dominant than faces resembling lions. From these findings, the researchers speculate that people attribute the behavioral characteristics of a lion to those with faces resembling lions and the same pattern for those with faces resembling Labrador Retrievers (Zebrowtiz et al., 2011). It would seem people with softer, baby-like facial features are viewed as less threatening and, therefore, more trustworthy than people with mature or defined faces.

Along with facial features, face typicality influences perceptions of trustworthiness. Research examining the impact of face typicality create typical faces by calculating the average of multiple morphed faces. Importantly, the faces used in the morphing process are all from the participants' environment, thus creating a typical effect. Participants scored more typical faces as more familiar and trustworthy than atypical faces (Dotsch, Hassin & Todorov, 2016; Rhodes, Jeffery, Watson, Clifford, & Nakayama, 2003; Sofer, Dotsch, Wigboldus, & Todorov, 2015; Sofer, Dotsch, Oikawa, Oikawa, & Wigboldus, 2017; Todorov et al., 2015). This result has been replicated across cultures. For example, Israeli and Japanese female students rated individuals sharing their culture as more trustworthy than those from another culture (Sofer et al., 2017). It seems people, even across different cultures, regard other people with more familiar facial characteristics, as determined by their environment, as more trustworthy than unfamiliar faces.

2.8 Facial Testosterone Markers in Making Trustworthiness Judgments

Testosterone contributes to the development of certain physical characteristics such as jaw width and cheekbone size (Tanner, 1990). The increase of testosterone during puberty modifies the face's shape, increasing the width (Marečková et al., 2011). Pubertal testosterone appears to influence the facial structure among males. Congruently, larger facial width-to-height ratios (fWHRs) exhibit increased testosterone levels (Lefevre et al., 2013). The fWHR is the ratio between the face's bizygomatic width, which is the farthest left and right facial boundaries, and the height of the face, which is the distance from the

highest points on the upper lip and eyelids (Carre & McCormick, 2008). Despite Lefevre's study results, which tied testosterone to fWHRs, there is scant research that demonstrates this relationship. For example, among a sample of 91 Tsimane male adolescents, testosterone levels were not associated with fWHRs (Hodges-Simeon et al., 2016). In addition to male youth, the fWHR of adult men was not related to testosterone levels (Bird et al., 2016; Kormsmeier et al., 2018). In sum, it seems little research supports the theory that testosterone impacts fWHRs in males.

While it is uncertain if fWHRs correlate to increased testosterone, research suggests fWHRs are associated with aggression among men. Employing a sample of male hockey players, Carré & McCormick (2008) discovered that elevated self-reported dominance and reactive aggression were positively associated with fWHRs. As fWHRs increased, so did the dominance scores and reactive aggression. In addition to self-report scores, the fWHRs of the hockey players correlated to their expressed aggression. With this in mind, Carré, McCormick, & Mondloch (2009) suggested that WHR may be "an honest signal of propensity for aggressive behavior." Similarly, a meta-analysis reviewing the effect sizes of fourteen articles uncovered a positive association between fWHRs and aggressive behavior (Haselhuhn et al., 2015). Additionally, across two separate studies, men with wider faces were more likely to deceive or cheat to increase personal gain (Haselhuhn & Wong, 2011). Moreover, researchers have predicted psychopathy scores, including fearless dominance and self-centered impulsivity, using fWHRs (Anderl, 2016; Geniole et al., 2014). Given this research, the fWHR appears to be an indicator of aggressive behavior for men.

Although the aforementioned research suggests fWHR is associated with aggressive behavior, other research has not found this connection. Utilizing a large sample of 137,163 participants, Kosinski (2017) tested the link between fWHR and self-reported antisocial or violent behaviors. His results did not find fWHR to be related to self-reports of antisocial or violent behavior. This research suggests previous findings may be a product of small sample sizes and laboratory-based experiments (Kosinski, 2017). Additionally, when examining the relationship between aggression and fWHR among NHL players, Deaner et al. (2012) found bodyweight but not fWHR to predict aggressiveness. From this, current research appears mixed regarding fWHR's connection to aggressive behavior.

Despite the mixed results regarding the relationship between fWHRs and aggression, individuals' fWHRs impact others' perceptions of their trustworthiness. Threat detection fluctuates depending on the size of the fWHR. The level of threat positively correlates with fWHR (Stirrat & Perrett, 2010). Participants perceive people with larger jawlines and brow bones as less trustworthy and more aggressive (Macapagal, Rupp, & Heimann, 2011). In line with this perception, Stirrat & Perret (2010) found that they could change the same face's trustworthiness ratings by merely manipulating the facial widths of each picture. Moreover, another experiment by Ormiston et al. (2017) manipulated the width of the same twelve photos from Stirrat & Perrett's (2010) study to examine judgments of integrity. As expected, participants viewed wider faces as exhibiting less integrity than their narrower counterparts (Ormiston et al., 2017). These results suggest it is not the face but rather the width that influences perceptions of threat. Additionally, across three studies, fWHRs were associated with self and other perceived

dominance, providing support for the influence of fWHRs on threat detection (Mileva et al., 2014). Irrespective of the actual threat of the individual portrayed, perceived threat appears to be determined by facial width. In consideration of these findings, fWHR may be an evolved cue of aggression in men.

2.9 Accuracy of Detecting Trustworthiness

As previously mentioned, trustworthiness judgments are established in as little as 33 milliseconds (Todorov, Pakrashi, & Oosterhof, 2009). While people make trustworthiness judgments quickly, there lies the concern of their accuracy. Research with young infants would suggest using facial cues to accurately determine trustworthiness begins at a young age. As young as seven months old, babies will orient their gaze towards trustworthy faces but not untrustworthy faces (Jessen & Grossman, 2016). Exhibited early, the ability to utilize facial cues to determine trustworthiness remains stable over the lifespan. Research with adults has demonstrated their ability to accurately discriminate between untrustworthy and trustworthy people (Porter et al., 2008; Stillman, Maner, & Baumeister, 2010; Valla et al., 2011).

Testing the ability to discern trustworthy from untrustworthy individuals, Porter et al. (2008) conducted an experiment in which participants rated the trustworthiness between pictures of recipients of the Nobel Peace Prize or the Order of Canada (i.e., trustworthy group) and the FBI's Ten Most Wanted Fugitives (i.e., untrustworthy group). During the study, participants were exposed to 34 black-and-white pictures of the Nobel Peace Prize recipients or the Order of Canada and the FBI's Ten Most Wanted Fugitives

twice. Across both trials, participants were able to detect trustworthy (recipients) from untrustworthy (criminals) individuals above 50% accuracy, precisely 55.8% and 57.9% for trials 1 and 2, respectively (Porter et al., 2008). In congruence, utilizing the mugshots of sex offenders convicted of either violent or non-violent sex offenses, Stillman et al., (2010) found participants could accurately distinguish between the violent vs. non-violent offenders. Additionally, Gordon & Platek (2009) investigated the amygdala's activation, as indicated by increased blood flow, when participants viewed faces of individuals varying in Dark Triad Traits. Of particular interest was if there would be a difference in amygdala activation, which detects threat, between viewing participants lower and higher on Dark Triad traits. Results uncovered increased activation of the amygdala when participants examined pictures of individuals with elevated psychopathy and Machiavellianism traits. This increased activation pattern suggests the automatic and subconscious threat detection abilities of the amygdala when presented with untrustworthy faces. Further, among another sample, participants could accurately and reliably discern pictures of criminals and non-criminals, even when controlling for factors such as gender, race, age, attractiveness, emotional display, and picture quality (Valla et al., 2011).

2.10 Statement of the Problem

Past research has demonstrated people's ability to accurately and reliably detect untrustworthy individuals from trustworthy individuals (Porter et al., 2008; Stillman et al., 2010; Valla et al., 2011). The purpose of the present study was to replicate previous

research demonstrating people's ability to accurately discern untrustworthy individuals from trustworthy individuals using pictures of the FBI's Ten Most Wanted Fugitives (hereafter FBI) as the untrustworthy group and recipients of the Nobel Peace Prize or Order of Canada (hereafter NPP/OoC) as the trustworthy group. The hypotheses for this study were based upon the assumption that the FBI group exhibits more aggressive and psychopathic traits than the NPP/OoC group. The following study held two assumptions. It assumed that the FBI group would have larger fWHRs and be rated as less trustworthy than NPP/OoC recipients.

Additionally, the present study planned to replicate the inverse relationship between fWHRs and trustworthiness ratings (Macapagal et al., 2011; Ormiston et al., 2017; Stirrat & Perret, 2010). Further, the study intended to extend previous findings by exploring whether the psychopathy levels of the raters impacted their judgments of attractiveness. More specifically, it tested whether participants with higher psychopathy scores were more likely to rate pictures of the FBI group as more attractive than participants with lower psychopathy scores.

2.11 Hypotheses

2.11.1 Hypothesis 1

Research suggests individuals with larger fWHRs exhibit more aggressive behavior than individuals with smaller fWHRs (Anderl, 2016; Carré & McCormick, 2008; Carré et al., 2010; Geniole et al., 2014; Haselhuhn & Wong, 2012; Haselhuhn et

al., 2015). Due to these findings, the present study posited that the FBI group would have larger fWHRs than the NPP/OoC group. A positive correlation between fWHR and Psychopathy was expected.

2.11.2 Hypothesis 2

Research has demonstrated people's ability to accurately discern untrustworthy individuals from trustworthy individuals (Porter et al., 2008; Stillman et al., 2010; Valla, et al., 2011). The present study intended to replicate this relationship using pictures of the FBI as the untrustworthy group and pictures of NPP/OoC group recipients as the trustworthy group. It was predicted that pictures of the FBI would be rated as less trustworthy than pictures of NPP/OoC recipients.

2.11.3 Hypothesis 3

Previous studies have demonstrated the negative association between facial width-to-height ratios (fWHRs) and judgments of trustworthiness (Mileva et al., 2014; Ormiston et al., 2017; Stirrat & Perrett, 2010). This study planned to replicate this relationship by comparing the trustworthiness ratings of faces with larger and smaller fWHRs. It was hypothesized that faces with larger fWHRs would be rated as less trustworthy than faces with smaller fWHRs.

2.11.4 Hypothesis 4

Previous research has demonstrated an increased attraction between psychopathic individuals. As such, individuals with elevated psychopathy scores find other individuals with psychopathic traits as more attractive than individuals with lower psychopathy scores (Blanchard et al., 2015; Jonason et al., 2015; Watts et al., 2019). While scant research exists that explores the increased attraction between individuals with higher

psychopathy, the previous research would suggest they are somehow able to differentiate between pictures of individuals low and high on psychopathy. Due to this, the present experiment planned to extend previous findings and proposed that participants with elevated LSRP scores would rate pictures of the FBI's Ten Most Wanted Fugitives as more attractive than participants with lower LSRP scores.

CHAPTER III

METHODS

3.1 Participants

Participants consisted of 372 individuals recruited from Amazon Mechanical Turk (MTurk) and paid \$.50 for taking part in the study. Of the participants, 61.5% identified as female, 35.8% as male, 1.9% as non-conforming, and 0.8% preferred not to answer (See Table 1). Additionally, 72.1% of participants identified as Caucasian, 15.2% as African American, 5.6% as Asian, 4.4% as Hispanic or Latino, and 2.5% as Biracial (See Table 2). All participants willingly participated and provided consent by signing an informed consent form before the start of the study. Prior to data collection, the study was approved by the Institutional Review Board (IRB) (See Appendix A).

Table 1. Gender of Participants

Gender	Frequency	Percent (%)
Female	227	61.0
Male	132	35.5
Non-conforming	7	1.9
Prefer not to answer	3	0.8
Missing	3	0.8

Table 2. Race/Ethnicity of Participants

Race	Frequency	Percent (%)
Caucasian	261	70.2
African American	55	14.8
Asian	21	5.6
Hispanic or Latino	16	4.3
Biracial	9	2.4
Missing	10	2.7

3.2 Procedure and Materials

Participants answered a series of questionnaires before beginning the experimental task, including the Faith in People Scale (Rosenberg, 1957), the Interpersonal Trust Scale (ITS; Rotter, 196777), the State-Trait Anxiety Inventory (STAI; Spielberger, Gorsuch, Lushene, Vagg, & Jacobs, 1983), Levenson Self Report Psychopathy (LSRP; Levenson, Kiehl, & Fitzpatrick, 1995), The Short Dark Triad (SD3; Paulhus & Jones, 2011), and Social Dominance Orientation (SDO7; Ho et al., 2015). They answered basic demographic questions regarding age, race, and gender. Additionally, they were asked if they have ever been diagnosed with an anxiety disorder or autism.

Next, using stimuli from Porter et al.'s (2008) study (See Appendix B), participants viewed 38 standardized pictures of the FBI's Ten Most Wanted Fugitives (hereafter FBI) and Nobel Peace Prize or Order of Canada (hereafter NPP/OoC) recipients. Of the 38 pictures, half were from each facial group. The picture order was randomized for each participant. As the image was displayed, participants rated the

individual portrayed in the picture on the personality characteristics of trustworthiness, likeability, intelligence, attractiveness, and happiness. Trustworthiness was rated on a 4-point Likert scale (1 = Very Untrustworthy, 4 = Very Trustworthy), whereas likeability, attractiveness, intelligence, and happiness were rated on a 5-point Likert scale (1= Very Unlikeable, 5 = Very Likeable; 1 = Very Unattractive, 5 = Very Attractive; 1 = Very Unintelligent, 5 = Very Intelligent; 1 = Very Unhappy, 5 = Very Happy). A 4-point scale was used for trustworthiness ratings to force participants to choose if the individuals portrayed in the pictures were either trustworthy or untrustworthy by eliminating a neutral rating option. By eliminating a neutral option, participants were forced to make a decision on the trustworthiness of the individual. The other personality variables used a 5-point scale because the purpose of collecting data on these variables was to account for their variance in the data analysis stage. This process was repeated for all 38 photos. Lastly, participants were thanked and paid for their participation.

3.2.1 Personality Measures

3.2.1.1 Levenson Self Report Psychopathy (LSRP)

The LSRP (Levenson et al., 1995) is a 26-item self-report measure designed to measure psychopathy. More specifically, the LSRP measures two scales of psychopathy: primary psychopathy and secondary psychopathy. The primary psychopathy scale measures the callous traits, whereas the secondary psychopathy measures related to lifestyle. Participants were asked to respond using a 5-point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree). Some of the items include “I enjoy manipulating other people’s feelings,” “I often admire a really clever scam,” and “I find myself in the same kinds of trouble, time after time.”

CHAPTER IV

RESULTS

4.1 Hypothesis 1: fWHRs and Face Group

The initial step in the analysis entailed calculating the Facial Width-to-Height Ratios (fWHRs) for all 38 pictures. FWHRs were calculated in accordance with Stirrat & Perrett's (2010) method in which width is defined as the distance between the farthest left and right facial boundaries (e.g., distance between left and right jaw or between left and right cheekbones) and height is defined as the distance from the highest points on the upper lip and eyelids (See Figure 1 for facial boundary examples).

Employing an independent samples t-test for hypothesis 1, the FBI's Ten Most Wanted Fugitives (hereafter FBI) group was not found to have significantly larger fWHRs than recipients of the Nobel Peace Prize or Order of Canada (hereafter NPP/OoC) $t(34) = .89, p = .19$ (See Table 3 for the means and standard deviations of the FBI and NPP/OoC recipients).



Figure 1. Facial Boundary Example

Table 3. Mean FWHRs (inches) by Facial Group

Facial Group	M	SD	n
FBI's 10 Most Wanted	2.19	.20	18
Nobel Peace/Order of Canada	2.26	.28	18

Next, in order to evaluate the responses of the participants, the initial step in the analysis entailed matching trial numbers with specific pictures, as picture order was randomized. Once completed, a quality analysis of the data was conducted. This analysis scanned for outliers and found that there were no outliers in regard to the picture items and participants.

After the quality analysis, the average response for each face on each personality item was calculated. Grand means for both facial groups (i.e., FBI vs. NPP/OoC) were calculated for the ratings of the following personality variables: trustworthiness, attractiveness, likeability, intelligence, and happiness.

4.2 Hypothesis 2: Facial Group & Trustworthiness Ratings

In order to test Hypothesis 2, which posits that facial group will have a significant relationship with ratings of trustworthiness, a paired samples t-test was computed using participant mean ratings for each personality variable (trustworthiness, attractiveness, likeability, intelligence, happiness) as the dependent variable and facial group (FBI vs. NPP/OoC) as the independent variable. The analysis yielded a significant main effect for facial group, $t = -4.73$, $p < .001$. The mean trustworthiness rating for the NPP/OoC facial group ($M = 1.78$) was higher than that of the FBI's most wanted facial group ($M = 1.73$).

Beyond the study's focus on ratings of face trustworthiness, additional paired-samples t-tests found that FBI faces were rated significantly lower across all personality variables when compared to the NPP/OoC faces (See Table 4). Additional analysis confirmed that there were no significant differences between males or females regarding the personality ratings. Overall, the FBI group faces were rated as significantly less trustworthy, attractive, likeable, intelligent, and happy than NPP/OoC faces.

Table 4. Mean Personality Ratings for the FBI's Ten Most Wanted Fugitives

Measure	M	SD	SE	n
Trustworthy	1.73	.45	.023	372
Attractive	1.74	.86	.045	372
Likable	2.38	.51	.026	372
Intelligent	2.30	.60	.031	372
Happy	2.27	.58	.030	372

Table 5. Mean Personality Ratings for Nobel Peace Prize/Order of Canada Recipients

Measure	M	SD	SE	n
Trustworthy	1.78	.42	.030	371
Attractive	1.80	.85	.044	372
Likable	2.49	.32	.066	372
Intelligent	2.48	.58	.030	372
Happy	2.48	.54	.030	372

Table 6. Comparison of Mean Personality Ratings by Picture Type

	Picture Type			
	NPP/OoC		FBI	
	Mean	SD	Mean	SD
Trustworthy	1.78	.42	1.73	.45
Attractive	1.80	.85	1.74	.86
Likable	2.49	.32	2.38	.51
Intelligent	2.48	.58	2.30	.60
Happy	2.48	.54	2.27	.58

Note. NPP = Nobel Peace Prize recipient, OoC = Order of Canada recipient; FBI = FBI's Ten Most Wanted Fugitives

4.3 Hypothesis 3: fWHR & Trustworthiness Ratings

To examine the relationship between fWHR and participant ratings of faces' trustworthiness, a Pearson r correlation coefficient was calculated between each face's fWHR and the average trustworthiness rating of each face by the participants. FWHR and trustworthiness were not statistically significantly correlated ($r = .087$, $p > .05$); however, participants still accurately distinguished between facial groups (See Figure 2). The same pattern was observed for the other personality ratings of faces, with no significant correlations between fWHR and attractiveness, intelligence, likeability, and happiness. These findings suggest that participants were able to differentiate between facial groups, but they did not use fWHR to make this distinction.

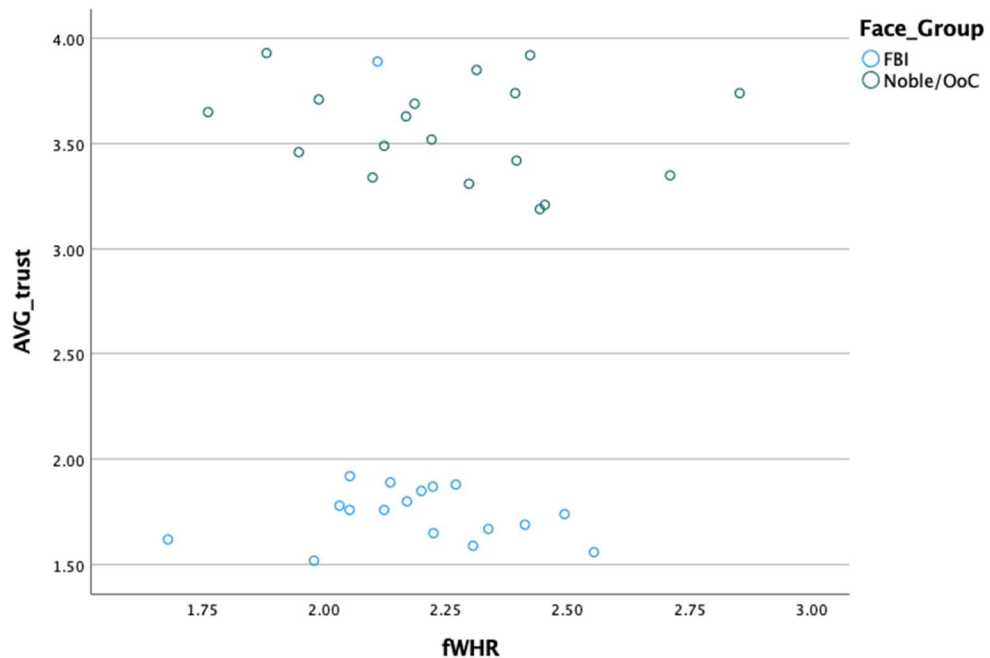


Figure 2. Relationship between fWHR and Trustworthiness

4.4 Hypothesis 4: Participant Psychopathy Levels and Ratings of Face Attractiveness

Hypothesis 4 focused on evaluating whether the self-reported psychopathy levels of participants had a relationship with the attractiveness ratings that these participants gave to the two facial groups. More specifically, hypothesis four suggested that people with higher LSRP scores and not lower scores would rate the FBI group as more attractive than the NPP/OoC group (e.g., an interaction between LSRP levels and facial group would occur).

Bivariate correlations were conducted to examine the relationship between the participants' psychopathy scores and their attractiveness ratings for each facial group. Pearson r correlation coefficients revealed weak positive correlations between LSRP scores and both FBI group ($r = .365, p < .01$) and NPP/OoC group ($r = .385, p < .01$). A Fisher's z test was employed to evaluate if the correlation coefficients were significantly different in size. Results did not find significant differences between correlation coefficients ($z = -.31; p > .05$). These results indicate that the psychopathy score of participants was a mild predictor of attractiveness ratings regardless of picture type. The higher the psychopathy score of the participants, the higher the attractiveness rating regardless of picture type.

As an additional analysis, the same correlations between respondent psychopathy and ratings of trustworthiness of faces was conducted. A moderately positive and statistically significant correlation was observed between respondent psychopathy and trustworthiness ratings of faces from the NPP/OoC faces ($r = .313, p < .01$), and the FBI faces ($r = .308, p < .01$). Another Fisher's z test was performed to test whether these

correlations were significantly different from one another. Again, there was no significant difference between the two correlations ($z = .08, p < .05$).

Table 7. Summary of Principal Component Factor Analysis of Personality Items

Component	Total	% of Variance	Cumulative %
1	3.587	71.730	71.730
2	.577	11.547	83.277
3	.360	7.192	90.468
4	.253	5.056	95.525
5	.224	4.475	100.000

]

CHAPTER V

DISCUSSION

5.1 Evaluation of Hypotheses

The current study was designed to replicate and extend previous findings demonstrating people's ability to accurately and reliably detect faces of untrustworthy individuals. Additionally, the study intended to replicate previous research examining the inverse relationship between fWHR and ratings of trustworthiness. Further, the study also sought to explore if individuals reporting elevated levels of psychopathy would rate the faces of individuals known to have committed serious crimes as more attractive.

5.1.1 Do Violent Faces Exhibit Larger fWHR?

The present findings did not yield support for hypothesis one which sought to demonstrate that the FBI's Ten Most Wanted Fugitives (FBI) had significantly greater fWHRs than Nobel Peace Prize or the Order of Canada (NPP/OoC) recipients. The rationale for this hypothesis stemmed from previous research, which focused on the relationship between fWHRs, testosterone, and aggression such that faces of individuals with a record of significant violence (i.e., FBI) would theoretically yield a larger average fWHR than do faces of individuals noted for their non-violent and humanitarian efforts (i.e., NPP/OoC). This research suggests that testosterone is linked to fWHRs because of

its impactful role on the facial structure during puberty (Marečková et al., 2011; Tanner & Tanner, 1990). Pubertal testosterone modifies the shape of males' faces, making them wider (Marečková et al., 2011). While there is scant research other than Lefevre et al., (2013) that revealed a direct link between testosterone and fWHRs (Lefevre et al., 2013), the present study's design was conducted under the assumption that fWHR (jaw width and cheekbone size) is determined by testosterone-linked facial features (Tanner, 1990). Given previous research demonstrating the positive relationship between testosterone and aggression, it is reasonable to hypothesize that fWHR and aggression are indirectly and positively related, with testosterone as the moderating factor (Dabbs et al., 1995; Dabbs et al., 1991; Van Honk et al., 2004). Given this moderated relationship between fWHR and aggression, the present study proposed that more aggressive individuals, such as the FBI facial group, would have larger fWHRs than less aggressive individuals (NPP/OoC). This was not found to be true.

At present, there are mixed findings on the relationship between fWHR and aggression. While most previous studies uncovered a significant positive relationship between facial width and aggression, violence, and untrustworthy behavior (Carré & McCormick, 2008; Carré et al., 2009, Haselhuhn & Wong, 2012; Haselhuhn et al., 2015), there still remains research that contradict these results (Deaner et al., 2012; Kosinki, 2017). Consistent with Deaner et al. (2012) and Kosinki (2017), this study did not find an association between fWHRs and aggression history. People with documented aggression histories (FBI) did not have larger fWHRs as predicted. While the present results conflict with most previous research findings, they may shed light on the complexity of the relationship between fWHR, testosterone, and aggression.

The current study may capitalize on another factor underlying the relationship between elevated testosterone and aggression, cortisol. Cortisol is a hormone released in response to stress to calm the body; however, elevated cortisol can inhibit a stress response (Clow & Hucklebridge, 2003; Harbuz, 2002). Coined by Mehta & Josephs (2010), the “Dual Hormone Hypothesis” suggests that it is the ratio between testosterone and cortisol that determines the expression of aggressive behavior. When testosterone is elevated and cortisol is low, an individual exhibits a greater propensity for aggression without the adequate means to inhibit it due to insufficient cortisol. With this information, it is possible that individuals with elevated testosterone and low cortisol levels can present with pronounced testosterone-linked facial features and larger fWHRs but do not express aggression due to cortisol’s inhibitory role. Ultimately, an individual may phenotypically appear aggressive (e.g., larger fWHR), but not demonstrate such behavior, possibly due to the buffering impact of chronically elevated cortisol levels during development. This may explain why fWHR did not differ between the faces of known criminals in the FBI face group and known prosocial individuals in the NPP/OoC group.

In consideration of the present study, cortisol may have impacted fWHRs. Given the heightened aggression of the FBI group, it would be expected that this group have higher testosterone levels and, therefore, larger fWHRs than the NPP/OoC group; however, this was not found in the present study. As cortisol was not a variable of interest in the present study and, therefore, not within its the scope, it is uncertain if it was an underlying factor contributing to the lack of differences in fWHRs; however, it is a potential explanation, which could be further investigated in subsequent studies.

5.1.2 Are the Faces of Violent Individuals Rated as Less Trustworthy?

Turning to hypothesis two, the present study yielded results congruent with the proposed hypothesis that the FBI group would be rated as less trustworthy than the NPP/OoC recipients. The initial research question examined if participants would be able to distinguish individuals with histories of violence (i.e., the FBI's Ten Most Wanted) from individuals with histories of prosocial behavior (i.e., Nobel Peace Prize or the Order of Canada recipients). These findings replicated previous research that has demonstrated the ability of individuals to quickly detect untrustworthy faces. (Gordon & Platek, 2009; Porter et al., 2008; Stillman et al., 2010; Valla et al., 2011). For example, prior research supports participants' ability to discern between those varying in Dark Triad Traits (Gordon & Platek, 2009), the FBI's Ten Most Wanted Fugitives and Nobel Peace Prize or the Order of Canada recipients (Porter et al., 2008), violent and non-violent offenders (Stillman et al., 2010), and criminals and non-criminals (Valla et al., 2011).

Specifically, the present findings replicated those from Porter et al.'s (2008) study from which the pictures used in this study were derived. Porter et al. (2008) revealed participants' ability to accurately detect the FBI's Ten Most Wanted Fugitives (i.e., untrustworthy group) from Nobel Peace Prize or the Order of Canada recipients (i.e., trustworthy group) via trustworthiness ratings. In the present study, in addition to being rated as less trustworthy, the FBI's Ten Most Wanted Fugitives were regarded as significantly less likable, intelligent, attractive, and happy. Additionally, regardless of the gender of the participant, the FBI's Ten Most Wanted Fugitives were rated as less appealing on all personality variables (e.g., gender did not moderate these results).

Regardless of their actual expressed behavior, people with stronger jawlines, brow bones, wider faces, and overall larger fWHRs have been rated as less trustworthy and more aggressive (Carré, et al., 2009; Macapagal et al., 2011; Stirrat & Perrett, 2010). Previous research supports the notion that testosterone-linked phenotypic facial features are used as markers for threat detection. Despite previous support for this theory, the present study did not find a significant association between fWHR and trustworthiness ratings. While participants were able to accurately and reliably detect faces of the FBI from NPP/OoC recipients, results indicate that participants did not use fWHRs as a cue in making decisions of trustworthiness. Overall, the present study did not find fWHRs impacted trustworthiness ratings. Rather than using fWHRs as a gauge of aggression participants must have used something else to determine trustworthiness.

Previous studies have found perceived emotions, familiarity, and personality characteristics impact trustworthiness judgments. Even when shown pictures of neutral faces, participants rate faces that they perceive to be aggressive or dominant as less trustworthy than perceived submissive or happy faces (Montepare & Dobish 2003; Oosterhof & Todorov 2009; Said, Sebe, & Todorov, 2009; Todorov & Duchaine 2008; Zebrowitz et al. 2010). In addition to perceived emotion, people use the familiarity of faces to determine trustworthiness, so that more familiar or average-looking faces are regarded as more trustworthy (Dotsch et al., 2016; Rhodes et al., 2003; Sofer et al., 2015; Sofer et al., 2017; Todorov, Olivola, Dotsch, & Mende-Siedlecki, 2015).

Further, individuals visually perceived to be attractive are rated as more trustworthy, intelligent, and competent than those less attractive (Eagly, Ashmore, Makhijana, & Longo, 1991). These findings support results from the present study as

NPP/OoC faces were rated as more trustworthy, attractive, likeable, intelligent, and happier. Rather than using fWHR as a proxy for trustworthiness, participants may have determined ratings by the perceived emotion or personality characteristics of each face.

5.1.3 Do Those High in Psychopathy Rate Violent Faces as More Attractive?

Hypothesis four, which posited that participants with elevated LSRP scores would rate pictures from the FBI group as more attractive than would participants with lower LSRP scores, was rejected. Results uncovered weak associations between psychopathy scores and attractiveness ratings for both facial groups; however, differences were not found in attractiveness ratings between groups. Overall, participants with elevated psychopathy were more likely to rate faces as more attractive and trustworthy regardless of facial group. Moreover, post hoc factor analysis suggested that participants didn't discriminate significantly between the different facets of personality measured, as evidenced by all personality items loading onto a single factor.

The underlying theory for hypothesis four was that psychopathic individuals may exhibit desirable characteristics such as reproductive success and social dominance (Hodson 2009; Ho et al., 2015; Jonason et al., 2009; Jonason, Valentine, Efferson, Iyer, & Graham, 2017) making them attractive to potential mates; however, that was not supported by the present study's results.

The significant positive relationships between psychopathy and ratings of trustworthiness and attractiveness may stem from a basic characteristic of psychopathy: impaired threat detection. When confronted with adverse stimuli, individuals with elevated psychopathy do not elicit an electrodermal response (Arnett, 1997; Lorber, 2004). Further, psychopaths do not express a startle reflex response when presented with

aversive stimuli (Flor, Birbaumer, Hermann, Ziegler, & Patrick, 2002; Patrick, 1994; Patrick et al., 1993). People with elevated psychopathy have been found to lack a stress response; therefore, making it difficult for them to distinguish safety from danger (Arnett, 1997; Flor et al., 2004; Patrick, 1994; Patrick et al., 1993). Due to their insensitivity to dangerous and aversive stimuli, participants with greater psychopathy would not pick up on threat detection cues such as the previously discussed testosterone-linked phenotypic facial features. Their higher attractiveness and trustworthiness scores would be congruent with the lack of stress response commonly found among psychopathic individuals.

Uninhibited sexual behavior may be another psychopathic trait contributing to the higher trustworthy and attractiveness ratings for individuals with psychopathic traits (Borráz-León & Rantala, 2021; Cleckley 1941; Hare 1993; Harris, Rice, Hilton, Lalumi, Quinsey, 2007; Jonason, et al., 2011; Jonason et al., 2009; Seto, Khatter, Lalumière, & Quinsey, 1997; Visser, Pozzebon, Bogaert, & Ashton, 2010). Those with psychopathic traits, including adults within the community (Seto et al. 1997), male students (Visser et al. 2010), offenders with and without serious mental illness (Cleckley 1941; Hare 1993), and sex offenders (Harris et al. 2007) have been documented as experiencing sexual encounters at a younger age. In addition, researchers uncovered that men with psychopathic traits view themselves and others as more attractive than those who do not possess such traits (Visser et al. 2010). This is consistent with research by Borráz-León & Rantala (2021) in which psychopathy positively predicted the number of sexual partners regardless of gender. Research suggests that psychopathic individuals intentionally pursue short-term sexual relationships (Jonason et al. 2009), which require little time knowing the sexual partner beforehand (Seto et al. 1997), and no attachment (Jonason et

al. 2010). Further, Jonason et al., (2009) uncovered that individuals with Dark Triad traits, which include psychopathy, were associated with characteristics of short-term mating. This evidence provides support for the theory that Dark Triad traits have an evolutionary purpose regarding sexual reproduction (Jonason et al., 2009; Jonason et al., 2011). In consideration of these findings, it is reasonable to speculate that individuals with psychopathic traits rate other individuals as more attractive due to their impaired threat detection and uninhibited sexuality.

5.2 Summary

In review of the major findings, the present study did not yield evidence that the FBI's Ten Most Wanted Fugitives had larger fWHRs than the Nobel Peace Prize or Order of Canada recipients or an inverse relationship between fWHRs and trustworthiness ratings. The FBI's Ten Most Wanted Fugitives were rated as less trustworthy, likable, intelligent, attractive, and happy than Nobel Peace Prize or Order of Canada recipients. Finally, participants with the highest psychopathy scores rated all the pictures as more attractive and trustworthy when compared to participants with the lowest psychopathy scores. This pattern was present regardless of picture type.

5.3 Limitations

The present study encountered many obstacles. The methodology had to be modified twice due to difficulties obtaining participants. The study originally proposed obtaining a novel set of photos gathered through the USA psychology department subject

pool to students enrolled in psychology courses at the University of South Alabama. These pictures would include the psychopathy scores of those pictured. Unfortunately, there were not enough subjects to meet the picture requirements, and there was a historically low participation rate among students for all psychological experiments. Next, MTurk was employed to obtain pictures of eligible individuals; however, this method also proved to be an unsuccessful means of obtaining pictures. Participants uploaded inviable pictures such as random pictures. This led to the present protocol of using stimuli from Porter et al.'s (2008) study. Due to these methodological modifications, the present study had some significant limitations.

The most significant limitation of this study was the lack of psychopathy scores for those photographed. Because there were no psychopathy scores, past behavior was utilized as a proxy for psychopathy; therefore, the present study cannot say with certainty that the non-trustworthy group (i.e., FBI's Ten Most Wanted Fugitives) had higher psychopathy scores than the trustworthy group (i.e., Nobel Peace Prize/Order of Canada recipients). Without having the psychopathy scores for all individuals in the photographs, the present study may have individuals in each group that do not fit the respected criteria. Another limitation was the means by which data was gathered. MTurk provides the benefit of a diverse sample of participants; however, it is also vulnerable to scammers. While the study employed validity checks and IP addresses to filter out bots, it still poses a risk to the quality of the data

5.4 Future Research

Future research should employ a similar methodology but use pictures in which the psychopathy scores of the individuals in the photographs are known. This will ensure the pictures of individuals are in the correct group according to validated psychopathy measures. Additionally, using those pictures, subsequent studies should calculate the fWHRs of those high and low in psychopathy. Conducting the same experiment but using pictures of individuals with known psychopathy scores would significantly improve internal validity and advance the understanding of the relationships between threat detection, psychopathy, and fWHRs.

Further, another future direction is to focus on the sensitivity in threat detection. Previous studies have examined the ability to detect individuals on the extreme ends of antisocial or psychopathic behavior and prosocial behavior. The present study utilized a sample of two groups of individuals exemplifying the extreme ends of psychopathy (very low psychopathy levels vs. very high psychopathy levels). Future studies could examine people's ability to detect individuals with average psychopathy scores rather than those with the highest or lowest scores. Pictures of average people scoring high in psychopathy that have no previous offenses or significant aggression history could be utilized rather than convicted murders. Additionally, rather than the Nobel Peace Prize or the Order of Canada recipients, pictures of people scoring low in psychopathy that do not have documented prosocial histories could be utilized. This would allow researchers to test the ability to detect normal, everyday people scoring high in psychopathy.

Future research could conduct a similar experiment as the current study but incorporate pictures of women varying in psychopathy level. This could uncover differences in detection ability depending on the gender of the individual being rated.

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APPENDICES

Appendix A: Institutional Review Board Approval Letter

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INSTITUTIONAL REVIEW BOARD June 18, 2021

Principal Investigator: Melissa Kern, MS
IRB # and Title: IRB PROTOCOL: 20-390
[1670113-4] Threat Detection from Phenotypic Facial Features
Status: APPROVED Review Type: Expedited Review
Approval Date: June 18, 2021 Submission Type: Amendment/Modification
Initial Approval: November 2, 2020 Expiration Date:
Review Category: Category: 45 CFR 46.110 (7):
Research on individual or group characteristics or behavior

This panel, operating under the authority of the DHHS Office for Human Research and Protection, assurance number FWA 00001602, and IRB Database #00000286 or #00011574, has reviewed the submitted materials for the following:

- 1. Protection of the rights and the welfare of human subjects involved.*
- 2. The methods used to secure and the appropriateness of informed consent.*
- 3. The risk and potential benefits to the subject.*



















The regulations require that the investigator not initiate any changes in the research without prior IRB approval, except where necessary to eliminate immediate hazards to the human subjects, and that **all problems involving risks and adverse events be reported to the IRB immediately!**

Subsequent supporting documents that have been approved will be stamped with an IRB approval and expiration date (if applicable) on every page. Copies of the supporting documents must be utilized with the current IRB approval stamp unless consent has been waived.

Notes:

Appendix B

Appendix B: Pictures for Study

FBI's Ten Most Wanted Fugitives	Nobel Peace Prize/Order of Canada Recipients
	
	
	
	
	
	
	
	
	
	

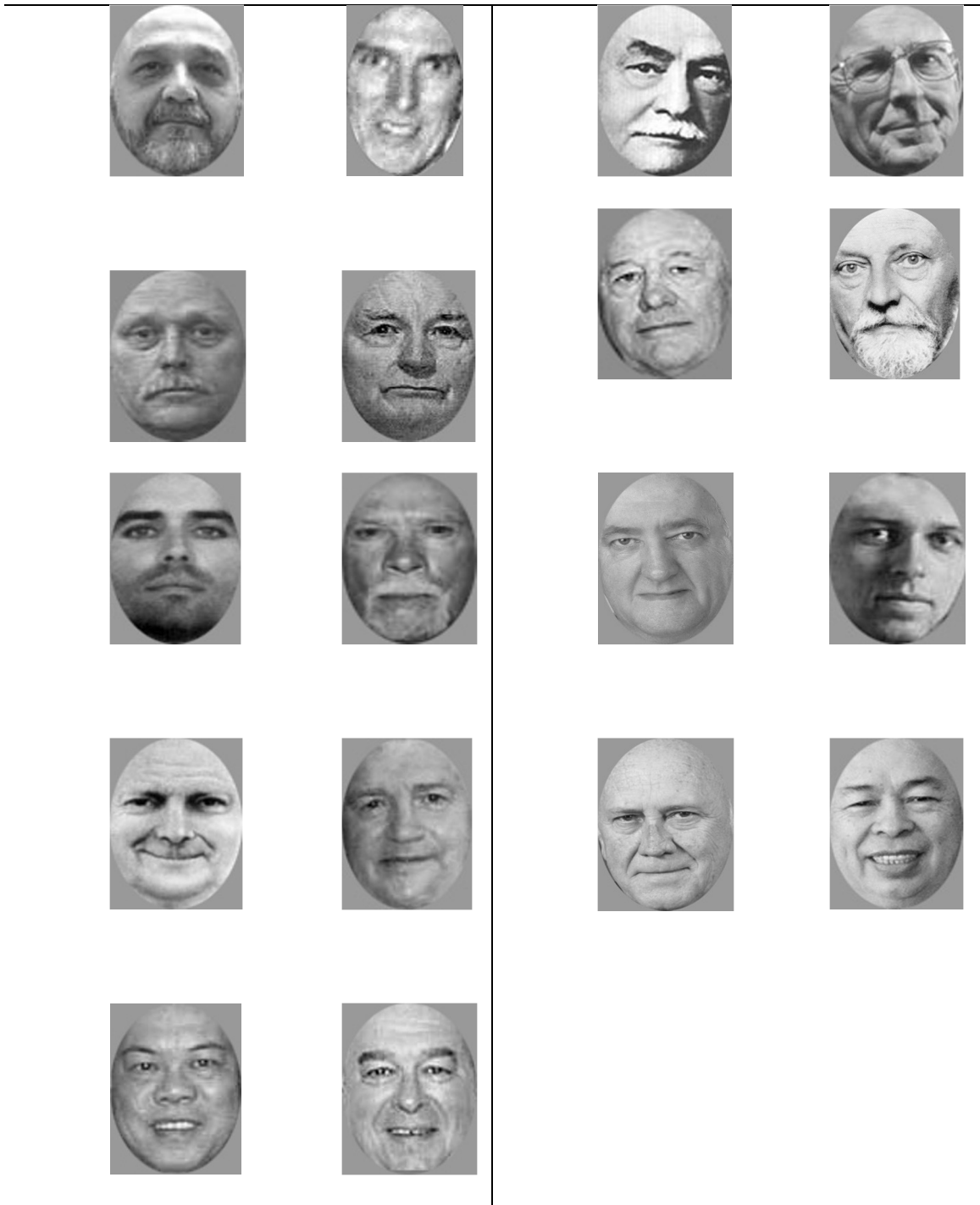


Figure 3. 38 Pictures for Study

BIOGRAPHICAL SKETCH

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