

UNIVERSITY OF CENTRAL OKLAHOMA

Edmond, OK

Jackson College of Graduate Studies

Physiological Measures of Anti-Social Behavior within Psychopathy

A THESIS

SUBMITTED TO THE GRADUATE FACULTY

in partial fulfillment of requirements for

the degree of

MASTERS OF ARTS IN FORENSIC PSYCHOLOGY

By

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Edmond, OK

2016

PHYSIOLOGICAL MEASURES OF ANTI-SOCIAL BEHAVIOR WITHIN
PSYCHOPATHY

A THESIS

APPROVED FOR THE DEPARTMENT OF PSYCHOLOGY

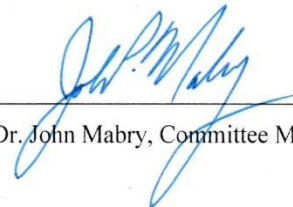
November 30, 2016



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Abstract

The purpose of the current study was to utilize new physiological measures associated with psychopathy and criminal behavior. Research has demonstrated a link between psychopathy and criminal behavior (Douglas, Vincent, & Edens, 2006; Porter & Woodworth, 2007). There is also a link between psychopathy and physiological responses (Rose, 2011). However, previous research focused on resting heart rate, skin conductance, and affective responses. However, heart rate variability, measured on a continuum, has not been explored. When examining variability, it was hypothesized that while examining criminal behavior, those with higher psychopathy scores would show less variability to crime images than neutral images. In the present study, participants completed the Dark Triad and the CMI to assess general criminal behavior. Participants then saw crime depicting images and neutral (non-crime depicting) images. Heart rate variability was monitored. Results indicated that participants who were higher in the psychopathic trait demonstrated lower heart rate variability to crime depicting images than neutral images. Those who scored low in psychopathy had higher heart rate variability to crime depicting image than neutral images. The results demonstrate a link between psychopathic traits and antisocial behavior in a nonclinical population. Thus, criminal behavior and psychopathic traits are related to physiological responses.

Keywords: psychopathy, antisocial behavior, heart rate variability, criminality.

Acknowledgments

I would first like to thank my thesis advisor Dr. Nora Gayzur of the Department of Psychology at the University of Central Oklahoma. The door to Dr. Gayzur office was always open whenever I ran into a trouble spot or had a question about my research or writing. She consistently allowed this paper to be my work but steered me in the right direction whenever she thought I needed it. Additionally, I would like to thank Dr. Alicia Limke of Department of Psychology and Dr. John P. Mabry of Institute of Forensic Science at the University of Central Oklahoma. Dr. Limke and Dr. Mabry served on my thesis committee and had always helped get through my thesis.

I would also like to thank the Office of Research and Grants. Their funding allowed me to complete this thesis timely and affordably. I would also like to thank the College of Education and Professional Studies and the Department of Psychology for their acceptance and dedication to aid in completing this project.

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Physiological Measures of Anti-Social Behavior within Psychopathy

In research, there is a differentiation within psychopathy. Research showed that psychopathy is both a clinical disorder (i.e., antisocial personality disorder) and a personality trait seen in a nonclinical sample (Allport, 1937; Paulhus & Williams, 2002). A clinical population is those who have been diagnosed or under some forensic supervision, while a nonclinical population is the distribution of the personality characteristics of a community sample (Furnham, Richards, & Paulhus, 2013). Within popular culture, there is an idea that psychopathy and criminality are one in the same. While research clearly demonstrates a link between criminality and psychopathy, the relationship is correlational and not causal (Douglas, Vincent, & Edens, 2006; Porter & Woodworth, 2007). Therefore, not all psychopaths are criminals, and not all criminals are psychopaths.

A common portrayal of psychopaths in popular media is that of an unfeeling, cold-blooded serial killer. In clinical psychopaths, there is a lessened emotional and physiological response to criminal behavior. In fact, many clinical, criminal psychopaths report escalating the severity and/or the frequency of their criminal behavior (Storey, Hart, Melroy, & Reavis, 2008). The reason for the escalation in criminal psychopaths is that they will need to commit more severe criminal behaviors in order to feel the same physiological arousal. However, the misconception in popular culture is overgeneralized. The misconception is tied to the idea that criminality and psychopathy are the same.

What is lacking is research along the idea of the personality trait in a nonclinical sample. While research has focused on the affective and interpersonal aspects of psychopathy (Rose, 2011), less is known about the physiological response associated with criminal behavior in a nonclinical sample. The purpose of this study is two-fold. I

examined the link between criminal behavior and psychopathy in a nonclinical sample. Second, I examined a different physiological measure (heart rate variability) to demonstrate the link between physiological responding and psychopathy in a nonclinical sample.

Theories of Psychopathy

The inclusion of criminality in psychopathy is controversial in research. For instance, Vaillancourt and Suderani (2011) speculated that psychopathy was subdivided into two distinct facets: primary psychopathy and secondary psychopathy. Primary psychopathy is an inherent interpersonal, affective facet marked by an absence of fear, lowered level of empathy, and lowered levels of anxiety. Secondary psychopathy is an antisocial lifestyle facet that includes impulsivity, higher levels of anxiety, and greater empathy due to external factors, like situational or affective turmoil. In this theory, there is little mention of criminality, specifically. This theory focuses on the emotional disturbances seen in psychopathy. Also, this theory is in reference specifically to clinical psychopathy but does not speak to nonclinical samples.

While many theories focus in on the affective and interpersonal, a current theory states that psychopathy incorporates the affective (reduced empathy and remorse/guilt), interpersonal (manipulation of others for personal gain), and antisocial (aggressive and impulsive behavior) aspects (Hare, 2003; Hare, Hart, & Harpur, 1991). This theory explains the behavior and thought patterns of both clinical and nonclinical samples. Thus, this theory has broader and clearer implications for both disorder individuals and individuals that demonstrate personality traits on a continuum.

Criminality and Anti-Social Behavior within Psychopathy

Early research categorized psychopathy as a disorder strictly associated with criminal behavior (Cleckley, 1941). Clinical psychopathy has been shown to affect 1-2 % of the population in its extreme form and as many as 50% of violent offenders (Hare, 1993; Rutter, 2012). While there is a controversy over the inclusion of antisocial behavior (ASB) within psychopathy (Hare & Neumann, 2010; Skeem & Cooke, 2010), there is a reliably strong link between psychopathy and violence and general criminality (Douglas et al., 2006; Porter & Woodworth, 2007). ASB includes poor control of anger, impulsiveness, irresponsibility, and a parasitic orientation towards others (Frick & Ellis, 1999, Guay, Ruscio, Knight, & Hare, 2007). These factors are positively related such as high level of callous and unemotional personality traits that predicts an increase in ASB (Viding et al., 2007; Kahn et al., 2013). Thus, the link between psychopathy and criminal behavior has been demonstrated for clinical samples.

Within forensic psychology, researchers have examined the different predictors of why clinical psychopaths are attracted to and commit higher amounts of criminal behavior. Researchers postulated that markers of psychopathy may emerge early in childhood (Glenn et. al., 2007; Wang et. al., 2012). These markers are moderately reliable predictors of adult psychopathy (Lynam et.al., 2008), while core affective features of psychopathy appear to be highly heritable (Larsson et.al., 2006). An individual's risk of engaging in ASB during childhood or adulthood can be increased by any number of life changing events, such as trauma exposure, low socio-economic status, or criminal peer groups. In fact, in studies with antisocial youth, psychopathic traits were strongly associated with dysfunctional parenting , low intelligence, preference for thrill and adventure seeking activities, a reward

dominant response style, and deficits in processing negative emotional stimuli (Blair, 1999; Blair, 2001; Barry, Bradley, Britten, Stevenson, & Barber, 2000; Frick et al., 2003b; Frick, Lilienfeld, Ellis, Loney, Frick, Clements, Ellis, & Kerlin, 2003; Loney, & Silverthorn, 1999; Wootton, Frick, Shelton & Silverthorn, 1997).

Psychopathic traits are increasingly used as a predictor of dangerousness, which is defined as danger to society or themselves in the criminal justice system (DeMatteo & Edens, 2006; Walsh & Walsh, 2006). ASB and psychopathy are increasingly viewed as major public concerns, insofar as it imposes substantial financial costs and negative impacts to society, such as wrongful convictions or misdiagnoses (Mercy, Rosenberg, Powell, Broome, & Roper, 1993; Piquero, Shepherd, Shepherd, & Farrington, 2011; Shepherd & Farrington, 1993; Scott, Knapp, Henderson, & Maughan, 2001).

Aggression and Psychopathy

Research has shown that psychopathy is related to various traits that constitute ASB. Psychopathy primarily consists of interpersonal antagonism and disinhibition which are both considered as prominent factors in ASB and aggression (Jones, Miller, & Lynam, 2011; Miller, Lynam, Widiger, & Leukefeld, 2001). Aggression has led to criticisms over the diagnosis of APD. For example, many researchers concluded that in nonclinical cases, psychosocial impairment usually misleads clinicians to incorrect diagnoses of APD (Judd et al., 1996; Skoog & Skoog, 1999).

The presence of psychopathic traits is a strong predictor of aggression that serves an instrumental goal such as bullying, sexual violence, or assault during a robbery (Blair, 2001; Woodworth & Porter, 2002). According to Coyne and Thomas (2008), primary psychopathy is associated with indirect aggression (non-verbal behavior and manipulation

of social situations), whereas secondary psychopathy is related to direct aggression (physical harm). The link between psychopathy and aggression has focused on direct aggression, but research has also shown that indirect aggression is also found in individuals with high psychopathic traits (Archer & Coyne, 2005; Archer, 2001; Bjorkqvist, Lagerspetz, & Kaukianen, 1992; Crick & Grotpeter, 1995; Galen & Underwood, 1997). In addition to behavioral changes that are due to aggression, physiological changes have also been observed in individuals with high psychopathic traits.

Nonclinical samples can express psychopathic traits (Markon et.al, 2011). The study of a nonclinical sample follows closely with clinically diagnosed samples (Malterer et.al, 2010). Psychopathic traits are continuously distributed in a nonclinical population that can reliably and validly assessed (Edens et al., 2006; Guay et al., 2007). Krueger, Caspi, Moffitt, and Silva (1998) conducted a longitudinal study on a nonclinical sample. The researchers found that even in a nonclinical sample, people exhibited factors seen in those diagnosed with APD. Therefore, nonclinical samples showed aspects of behavior and thought patterns observed in clinical samples. For instance, Rose (2011) examined the affective component of psychopathy in a nonclinical sample. Those that score higher in psychopathy showed a similar pattern of responding as a clinical sample.

Physiological Response in Psychopathy

One type of physiological response associated with psychopathy is the activation of the sympathetic nervous system (i.e., the fight or flight response) in the autonomic nervous system. This response engages in response to real or perceived threats (Cannon, 1929). When this pathway is activated, the pupils dilate to let more light into the retina, digestion

slows, heart rate and blood pressure increases, breathing become shallower, and so forth. Typically, when humans are exposed to a stressor, this pathway activates. In general, this response is evolutionary adaptive and aids in survival. Without this response,

Researchers have investigated how the activation of this pathway differs between a clinical and nonclinical population. In sum, psychopathy impairs skin conductance, potentiated startle responses (lessened fear), and contraction of corrugator muscle under the eyebrows responses (Aniskiewicz, 1979; Birbaumer et al., 2005; Herpertz et al., 2001; Levenston et al., 2000; Lykken, 1957; Patrick et al., 1993; Rothmund et al., 2012). Psychopathy has been shown to impair aversive classical conditioning, which leads to delinquent behavior, as well as impairment in recognition of fear through the face, body, and voice in a stressful situation (Dawel et al., 2012; Flor et al., 2002; Marsh & Blair, 2008). In an aggressive task, clinically diagnosed individuals show little to no changes in their skin conductance level compared to a non-clinical sample (Dengerink & Bertilson, 1975). In sum, various physiological responses have been used to examine clinical and nonclinical populations of psychopathy.

An avenue of research that has examined heart rate and psychopathy is fear. Fear has been shown to activate the fight or flight response. Evolutionarily, humans use fear as a way to protect themselves from predators (Cannon, 1929). Studies have shown consistently that individuals with psychopathic traits lack this response towards a fearful situation and have difficulties being conditioned to fear (Birbaumer, Hermann, Ziegler, & Patrick, 2002; Birbaumer et al., 2005; Flor et al., 2002). These studies provided evidence that the deficiency of fear response reflected impairments on affective aspects (individuals with psychopathic traits lack emotional association between the cue and the noxious

event). However, psychopaths display no physiological response to aversive stimuli (Lopez et.al., 2013). This effect has been shown to be due to a lack of fear, which, in turn, facilitated the ASB within psychopathy. This hypothesis has been used to explain the increasingly arousing nature in criminal conduct.

A specific physiological response examined with psychopathy is resting heart rate (how fast the heart pumps while at rest). In general, there is significant variability in resting heart rate across individuals and is highly correlated with fitness. For instance, athletes have a lower resting heart rate than non-athletes (Maciel, Gallo, Marine, Lima, Terra, & Manco, 1985; Stein, Rosito, Zimmerman, & Riberio, 2002). Researchers do not fully understand the underlying mechanism behind low heart rate and ASB in clinical psychopaths. Some researchers have hypothesized that low resting heart rate in individuals with psychopathy and ASB comes from the low arousal of autonomic nervous system (Buss, 1961; Dengerink & Bertilson, 1975). Various studies have detected a significant relationship between low resting heart rate and psychopathic traits (Baker et al., 2009; Hansen, Johnsen, Thornton, Waage, & Thayer, 2007). Individuals with low resting heart rates were hypothesized to engage in stimulating behavior to increase their arousal level to a more optimal level (Quay, 1965; Raine 1993, 2002a). Individuals would escalate their criminal behavior to incur higher arousal levels. In a series of narrative reviews, Raine (1993, 2002a) suggested that: 1). low resting heart rate characterizes ASB in any gender, 2). different variables, such as body size, IQ, physical activity, and socioeconomic status need to be controlled in order to find relationship between ASB and low resting heart rate, 3). low resting heart rate is more typical in young antisocial individuals, and 4). the

relationship between low resting heart rate and ASB is confirmed through many cross-sectional, as well as longitudinal studies.

An issue with resting heart rate is that heart rate can fluctuate for various reasons aside from psychopathy. As stated in relation to fitness, those with low resting heart rate could be considered physically fit and not psychopathic. One area of research to examine is heart rate variability (HRV). Variability can be measured as time or frequency. There is a connection between HRV and the fight of flight response (Berntson et al., 1997). When stressed, the frequency of heart beat increases. In other words, the heart beats faster in response to a stressful stimulus. When not stressed, HRV frequency decreases, which means that heart rate is slowed. In psychopathy, the results are not conclusive. Hansen, Johnsen, Thorton, Waage, and Thayer (2007) examine HRV in a prison population. They found that HRV was related to the interpersonal aspect of psychopathy (manipulating people for personal gain). The authors explored the antisocial aspect but found only a weak relationship (about 10% of the variance was explained).

Instruments Used to Measure Psychopathy

The main clinical measure of psychopathy is the Psychopathy Checklist-Revised (PCL-R) scale. The PCL-R is used for psycho-diagnostic purposes, but researchers have found that the PCL-R can be used to predict violence, criminality, and recidivism. Healthy individuals tend to mobilize defensive action when exposed to threatening or aversive cues (Davis, 1989; Lang et al., 1990; Patrick et al., 1996). However, in the case of clinically psychopathic individuals, they lack the capacity to form associations between a cue and an aversive or fear evoking event (Birbaumer et al., 2005; Flor et al., 2002; Hare et al., 1978; Patrick et al., 1994). Researchers who use psychopathy measures, that do not include

anxiety or fear-relevant items, often supplement the measurement scale for anxiety or clinical assessments of anxiety disorders (Finger et al., 2008; Malterer et al., 2008; Marsh et al., 2008; Kimonis et al., 2012; Koenigs et al., 2012; Sutton et al., 2002;).

The issue with using the PCL-R is that it is used to examine a clinical population. However, it does not examine the personality trait seen in a nonclinical population. Psychopathy as a personality trait is correlated to other Big Five personality traits, such as low agreeableness and low conscientiousness (Eysenck & Eysenck, 1985; Miller, Lynam, Widiger, & Leukefeld, 2001). One of the main measures of psychopathy as a personality trait is the Dark Triad (Paulhus & Williams, 2002). The Dark Triad comprises of three distinct socially aversive constructs of personality (Paulhus & Williams, 2002). They are psychopathy, machiavellianism, and narcissism. Within psychopathy, this measure examines the impulsivity, thrill-seeking, and lack of empathy associated with psychopathy. What this measure does not assess is the link with criminality, which has been shown to be a part of psychopathy in a clinical population. Various studies have used the Dark Triad to explore the relationship between the three subscales and aggression. These studies suggested that aggression was a strategy used to physically or verbally dominate an opponent or a rival. The concepts of machiavellianism, narcissism, and psychopathy help focus on the antisocial factor within psychopathy. At the same time, they differentiated between the thought processes and the behavioral outcomes of aggression (Anderson & Bushman, 2002; Baughman, Dearing, Giammarco, & Vernon, 2012; Chabrol, Leeuwen, Rodgers, & Sejourne, 2009; Furnham, Richards, & Paulhus, 2013; Jones & Paulhus, 2010; Paulhus & Williams, 2002).

While studies have focused on aggression, what is lacking in research is the link between the thought (e.g., psychopathy) and the behavior (e.g., general criminality). While the Dark Triad examines personality traits, other measures have been used to assess the manifestations of misconduct in a broad spectrum, specifically criminal behaviors. Paulhus and Williams (2002) developed a Comprehensive Misconduct Inventory (CMI), which assessed ASB from high school behavior to current behavior. The CMI measures seven main dimensions of antisocial behavior: soft drug abuse (e.g., drunk driving, buying alcohol underage), hard drug abuse (e.g., using hallucinogens, selling heroin and cocaine), minor criminality (e.g., stealing from a store, paying for sex), serious criminality (e.g., breaking into a vehicle, damaging a property), driving misbehavior (e.g., receiving a speed ticket, participating in a street car race), bullying/harassing (e.g., assaulting someone, using physical force to get money), and anti-authority misbehavior (e.g., stealing money from parents, sneaking out at night without parents' permission).

Present Study

The goal of this study is two-fold. Firstly, I examined the relationship between the psychopathic personality traits and criminality. Nathanson and colleagues (2006) demonstrated a link between the Dark Triad and the CMI. Specifically, the authors showed a significant relationship between psychopathy and all of the subscales of CMI in a nonclinical sample. For the purpose of this study, the subscales minor criminality, serious criminality, and current misbehavior were infused as general criminality scale to analyze the general ASB of an individual. Thus, the current study hypothesized to replicate previous findings in a nonclinical sample. Specifically, I predicted to find a significant positive relationship between general criminality, as assessed by the CMI, and

psychopathy scores, as assessed on the Short Dark Triad (a condensed version of the Dark Triad). While it is hypothesized that there is a relationship between psychopathy and criminality, it is important to note that the link between the two is correlational.

The second purpose of the study was to examine how a nonclinical sample physiologically responds to criminal behavior. I used crime depicting images and neutral images (non-crime depicting) to measure HRV when exposed specifically to criminal behavior. Hansen and colleagues (2007) found only a weak relationship between HRV and antisocial aspects of psychopathy. However, their study was a recollection of previous criminal behaviors. Many times, clinical psychopaths reminisce on their previous crimes in order to relive the arousal from that event. Another potential issue could be that psychopathy was measured in a continuous manner. When examining the continuum of psychopathy, there may be too much variability in the both psychopathy and HRV to see reliable changes. Thus, in this study I split groups into low and high psychopathy (median split of psychopathy scores) to examine differences in HRV between groups. I also included general criminality (median split of CMI scores) to assess if recollection of criminal events would affect HRV.

The images used from this study were from the International Affective Picture System (IAPS), which are normed for valence (positive, negative, and neutral emotionality) and arousal (Bradley & Lang, 2000). As described previously, psychopathic individuals show little physiological response to arousing situations (Aniskiewicz, 1979; Birbaumer et al., 2005; Herpertz et al., 2001; Levenston et al., 2000; Lykken, 1957; Patrick et al., 1993; Rothmund et al., 2012). Psychopathic individuals have been known to show decreased heart rate. The decreased response creates an escalation effect, in which

psychopathic individuals need to escalate their criminal behavior to feel the physiological arousal. This effect has been seen with heart rate. In the present study, I examined HRV to crime-depicting images and neutral images. I predicted that individuals who were higher in psychopathy would have lower heart rate to crime-depicting images than neutral images.

Method

Participants

Participants were recruited from the general psychology pool at the University of Central Oklahoma. One hundred sixteen participants (92 F, 24 M) completed the study. Of those 116 participants, 76 were freshman, 26 were sophomores, 3 were juniors, 4 were seniors, and 7 were “other” (other meaning either the participants did not disclose their current standing or were graduate students). The age range of the participants varied from 18 - 45 years old. Participants completed the task for course credit.

Materials

The Comprehensive Misconduct Inventory (CMI). The CMI is a 50-item measure that examines past (high school) and current criminal misconduct (Paulhus & Williams, 2002). Participants report the frequency of the behaviors. The CMI measures seven main dimensions of antisocial behavior: soft drug abuse (e.g., “During your high school years, how many times did you: drive while impaired by alcohol or drugs.”), hard drug abuse (e.g., “During your high school years, how many times did you: sell hard drugs, such as heroin, cocaine, meth, or LSD.”), minor criminality (e.g., “During your high school years, how many times did you: throw objects such as rocks, snowballs, or bottles at cars or people.”), serious criminality (e.g., “During your high school years, how many times did you: purposely damage or destroy property that did not belong to you.”), driving

misbehavior (e.g., “During your high school years, how many times did you: take a vehicle for a ride without the owner's permission.”), bullying/harassing (e.g., “During your high school years, how many times did you: use physical force to get money or things from someone.”), and anti-authority misbehavior [e.g., “During your high school years, how many times did you: swear at adults (e.g. parents, salesclerks, telephone solicitors, teachers).”]. The current misbehavior subscale included questions such as: “These days, in average month, how often do you ridicule someone who is helpless?”.

The Short Dark Triad. The Short Dark Triad (SD3) is a 28 item questionnaire that measured negative personality traits (Jones & Paulhus, 2011). Participants rated responses on a 5 point Likert scale (1 = strongly disagree to 5 = strongly agree). The higher scores indicated an increased tendency toward the personality construct. The three subscales of the dark triad were: machiavellianism, psychopathy, and narcissism. Each sub-scale comprises of 9 items. Machiavellianism comprises of a selfish, manipulative propensity motivated by instrumentality (e.g., “Generally speaking, people won’t work hard unless they have to.”). Psychopathy is associated with reckless, impulsive behavior (e.g., “Payback needs to be quick and nasty.”). Narcissism has vulnerable and grandiose dimensions (e.g., “People see me as a natural leader.”).

International Affective Picture System (IAPS). Crime depicting and neutral images were selected from the IAPS (Lang, Bradley, & Cuthbert, 2008). For the purpose of this study, 20 images were selected for crime depiction condition and 20 images were selected for neutral condition (40 images total). Crime-depicting images [valence ($M = 2.49$; $SD = .50$); arousal ($M = 6.41$; $SD = .65$)] depicted criminal behavior (e.g., attacks or holding a gun), while and neutral images [valence ($M = 5.07$; $SD = 1.15$);

arousal ($M = 3.67$; $SD = .80$)] were depictions of faces (e.g., expressionless face) or objects (e.g., tissue box). Sample images are shown in Figure 1. Images were presented using DirectRT (Empirisoft, New York, NY).

BIOPAC. The BIOPAC was used to record HRV (Biopac Systems, Inc.). A pulse monitor was attached to the nondominant middle finger. was used to measure the heart rate while the participants were being exposed to the pictures. The sampling rate for the BIOPAC was 200 Hz.

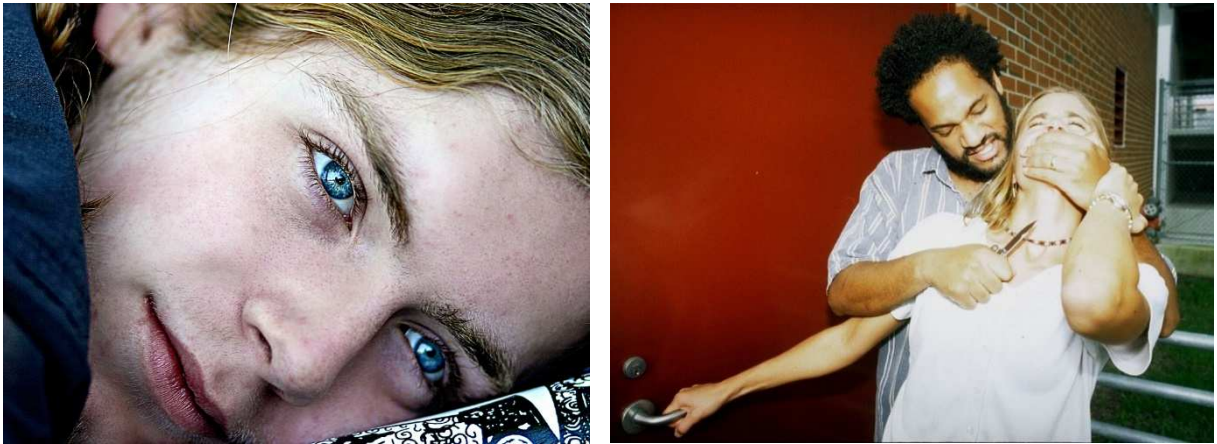


Figure 1. Neutral and Crime Depicting Images. The left image is a neutral picture from the IAPS and has a low normed arousal score (Lang, Bradley & Cuthbert, 2008). The right image is a crime depicting image and has a high normed arousal rating (Lang, Bradley & Cuthbert, 2008). The normed scores are for a typical population, and not a psychopathic population.

Procedure

After informed consent, participants anonymously completed the Dark Triad and CMI on Qualtrics (Provo, UT). After the completion of the survey, a pulse monitor was attached to the index finger of a non-dominant hand of the participants. After attaching the pulse monitor, participants were instructed to rest for two minutes. Recording began during

the rest period in order to obtain a baseline. After the rest period, participants began the task. The participants were then asked to study the IAPS images and rate each image for arousal using the number pad on the keyboard (Figure 2). The arousal scale was a Likert scale from 1-7 (1 = not arousing at all, 7= extremely arousing). The arousal task was only used to assess if participants were examining the images.

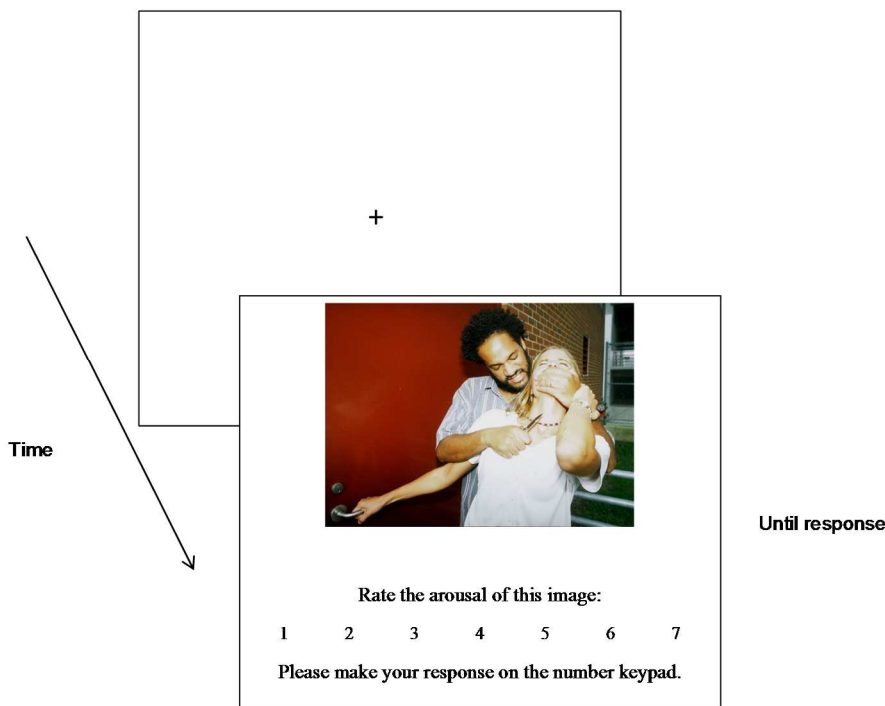


Figure 2. Sample Trial Sequence for the Crime Depicting Block. Participants saw a fixation cross to demonstrate where to look. Participants were then shown an image and instructed to make an arousal rating. The image appeared on the screen until participants make an arousal rating response. The trial sequence was identical for the neutral images.

All crime depicting images were shown in one block, and all neutral images were shown in a separate block. Blocks were counterbalanced across participants. Also, the images within the blocks were randomized. After one block of images was presented, the participants were asked to relax for 2 minutes to avoid overlapping of the accelerated heart

rate. After completing both the block of images, the participants were detached from the pulse monitor.

A 2×2 between subjects design was used. Median split psychopathy (high or low psychopathy) and general criminality (high or low criminality) were the between subjects variables. Psychopathy scores ($Mdn = 2$) were median split. Participants below the median were considered low in psychopathy ($N = 65$), while those above that number were considered high in psychopathy ($N = 51$). The same median split was done from criminality ($Mdn = -3.2948$). Participants below the median were considered low criminality ($N = 58$), while those above were considered high criminality ($N = 58$). Mean HRV difference (crime-depicting image HRV minus neutral image HRV) was the dependent variable.

Results

Correlation

A Pearson's correlation was conducted on the subscales of the CMI and the Short Dark Triad. A significant positive correlation between psychopathy and general criminality (minor criminality, major criminality, and current misbehavior), $r(114) = 0.49, p < .001$ was observed. Table 1 illustrated the correlation matrix between all the subscales of the Short Dark Triad and the CMI. Psychopathy was significantly related to all subscales of the CMI, as well as machavelianism but not narcissism.

A Pearson's correlation was also conducted on each of the subscales with mean HRV difference (crime depicting image HRV minus neutral image HRV). None of the subscales were related to mean HRV difference scores, $p > .05$

Table 1

Correlation Matrix between Variables of the CMI and the Dark Triad

Variables	1	2	3	4	5	6	7	8	9	10	11
1 Soft drugs use	-										
2 Hard drugs use	.283**	-									
3 Driving Misbehavior	.489***	.229*	-								
4 Bullying	.289**	.167	.503***	-							
5 Anti-Authority	.376***	.356***	.483***	.598***	-						
6 Minor Criminality	.452***	.460***	.652***	.586***	.735***	-					
7 Serious Criminality	.338***	.591***	.352***	.484***	.562***	.620***	-				
8 Current Misbehavior	.397***	.053	.745***	.716***	.674***	.698***	.339***	-			
9 Psychopathy	.272**	.276**	.314**	.363***	.471***	.389***	.493***	.277**	-		
10 Narcissism	.028	.033	.143	.177	.049	.129	.007	.150	.106	-	
11 Machiavellianism	.112	.253**	.236*	.299**	.412***	.323***	.405***	.310**	.588***	.089	-

Note: Correlation where * denotes significance at $p < 0.05$, ** denotes significance at $p < 0.01$, *** denotes significance at $p < 0.001$

Analysis of Variance (ANOVA)

The dependent variable (heart rate variability difference) was submitted to a 2 (High psychopathy, Low psychopathy) \times 2 (High criminality, Low criminality) between-subjects ANOVA. The independent variables were the median split of psychopathy score (high or low) and median split of criminality scores (high or low). The dependent variable was the mean HRV difference. A main effect of psychopathy, $F(1, 112) = 3.80, p = .05$, was observed. HRV difference was greater for those who scored low in psychopathy ($M = 0.33, SD = 2.32$) than those who scored high in psychopathy ($M = -0.40, SD = 2.19$). For those low in psychopathy, HRV was greater in response to criminal images than neutral images. Alternatively, for those who scored high in psychopathy, HRV was lower in response to criminal images than neutral images. The main effect of criminality, $F(1, 112) = 1.28, p = .26$, and the Psychopathy \times Criminality, $F(1, 112) = 1.97, p = .16$, were not significant.

Discussion

The purpose of the study was two-fold. First, the study aimed to confirm the link between psychopathy and criminality in a nonclinical population. The current study confirmed the relationship between psychopathy, as assessed by the Short Dark Triad, and criminality, as assessed by all of the subscales of the CMI. The positive relationship demonstrated that as psychopathy increases, criminality also increases. Numerous studies examined the relationship between psychopathy and criminal behavior and demonstrated the link (Hare & Neumann, 2008; Skeem & Coke, 2010). Extensive research has shown that psychopathy is related to various behaviors that constitute ASB. These traits include aggression, violence, recidivism, and sexual coercion towards women (Kennealy, Skeem,

Walters, & Camp, 2010; Knight & Guay, 2006; Walters, Knight, Grann, & Dahle, 2008; Woodworth & Porter, 2002). This study also supports the findings of Nathanson et al. (2006), which found similar links between criminality and psychopathy in a nonclinical sample. From a personality point of view, psychopathy primarily consists of interpersonal antagonism, and disinhibition which are both considered as prominent factors in ASB and aggression (Jones, Miller, & Lynam, 2011; Miller, Lynam, Widiger, & Leukefeld, 2001). One caveat to this finding is that it is correlative. Those who score higher in psychopathy tend to show a greater frequency of criminality. However, it is important to remember that is not causal. Thus, criminality is related to psychopathy, but this does not mean it is a fundamental component to psychopathy.

In addition to relationships between criminality and psychopathy, the current study found that HRV differs with psychopathy. Individuals who are score higher in psychopathy demonstrate lower HRV to crime-depicting images than neutral images. Alternatively, individuals who are lower in psychopathy show lower HRV to neutral images than crime-depicting images. The findings extend to varying studies that have shown that those in clinical and nonclinical samples demonstrate differences in response to aversive stimuli. Bradley and colleagues (2000) found that non-clinical samples showed greater heart responses to aversive stimuli (such as those in the crime depicting images in this study) than neutral images. Various studies have detected a significant relationship between low resting heart rate and psychopathic traits in a nonclinical sample (Baker et al., 2009; Hansen, Johnsen, Thornton, Waage, & Thayer, 2007). The current study extends the findings to HRV, a different physiological measure.

Implications

This study extends the physiological evidence and its relation to psychopathy. Research within psychopathy and physiological responses has focused on galvanic skin response, pupil dilation, resting heart rate, etc. There are confounding issues with resting heart rate, mostly due to its relationship with fitness. Athletes demonstrate lower resting heart rates compared to non-athletes. The same finding applies to psychopaths. Clinical psychopaths demonstrate lower resting heart rates compared to nonpsychopaths. The question remains is the individual more physically and cardiovascularly fit than another or is the person psychopathic. There could also be a possibility that an individual could be both. HRV examines the variability in the time and frequency of heart rate continuously. This can show differences or changes over time in response to stimuli. Resting heart rate can only evaluate what happens at rest and not in response to stimuli. This study demonstrates the use of HRV as a variable that may not be as confounded as resting heart rate.

Current theories of psychopathy examine the affective, interpersonal, and antisocial components that are a part of psychopathy. Rose (2011) examined a subclinical population was used to examine if those with higher psychopathic traits would alter skin conductance. Using positively and negatively valenced stimuli (IAPS images), it was found that those higher in psychopathy showed delayed skin responses to threatening (negative) stimuli than positive (empathetic) or neutral stimuli. While this study examined the physiological responses to affective stimuli, the present study examined antisocial behavior. From a forensic perspective, knowledge of the underlying criminal behavior can help law enforcement and recidivism rates.

While controversial, the inclusion of criminality in psychopathy is clearly demonstrated. However, it is important to note that other factors contribute to psychopathy. The interpersonal, affective, and physiological aspects of psychopathy should also be examined. Each of these factors may contribute differently to each individual. For instance, within an individual, different factors may contribute more or less to psychopathy. Psychopathy may manifest in thought and behavior patterns as an affective component for one person, but the interpersonal aspect may contribute to thought and behavior patterns for a different individual. Individual differences in personality traits is what makes humans unique. Thus, criminality may affect the behavior of one individual more than another. The link between criminality and psychopathy is correlative and not causal.

Limitations and Future Directions

One aspect of this study that did not find significance is connection between criminality and HRV. With clinical psychopaths, remembrance of a previous criminal behavior affects physiological arousal. In the current study, participants reacted to watching (“witnessing”) another person’s criminal behavior. Since the images did not depict a criminal activity that the person engaged in, it may not have had an effect. While for those that score low in psychopathy did show HRV to seeing others engage in criminal behavior, those that score high in psychopathy may need to experience a personally relevant stimulus in order to see the link with their criminal behavior and HRV. In order to address this, future research could attempt to include a personally relevant behavior. This inclusion would be more ecologically valid to what clinical psychopaths who relive their criminal activity to increase physiological arousal.

In the present study, static images were used to present aversive stimuli. The static images are normed for valence and arousal, which is the reason they were chosen. However, reactions to stimuli in a real world stimuli are not static but dynamic. The use of video could impact how participants respond. When watching (or witnessing) an aversive situation, participants heart rate responses could be affected more by a dynamic stimulus than a static image.

Conclusion

The understanding of psychopathy has been a source of fascination within popular culture. Many misconceptions in the general population affect how psychopathy is viewed. This study demonstrates the link between psychopathy, criminality, and physiological responding. While this may have an impact on forensic psychology, in terms of treatment programs, the results need to be interpreted with caution. Psychopathy is a multi-faceted disorder and personality trait. All facets of psychopathy should be taken into account when determining a course of action. Criminality alone is not the sole contributor. It is important to keep this in mind when examining psychopathic individuals in a clinical and nonclinical population. Not all psychopaths are criminals, and not all criminals are psychopaths.

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