

ASSESSING GENUINE AND POSED FACIAL EXPRESSIONS AND RESPONSE
INHIBITION IN PSYCHOPATHY

by

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Abstract

Trait psychopathy can be characterized by several features, including manipulativeness, low empathy, and impulsivity. Traditionally, psychopathy has been assessed on two dimensions, clustered around callous/unemotional (Factor 1) and emotionally reactive (Factor 2) traits. There is a dearth of research concerning psychopathy traits in community populations in relation to face processing, including the ability to distinguish genuine emotional faces, and attention to emotional faces. The present study measured psychopathy traits in a sample of undergraduate students at Cape Breton University between the ages of 18-25 years. The first aim was to evaluate the influence of psychopathy traits on the ability to identify genuine/posed facial expressions. Preliminary results indicate that anger authenticity is more challenging to classify than fear ($t(13) = 3.21, p < .006$), though the genuineness accuracy of these emotions did not yield significant results. The second aim was to evaluate the influence of these traits on response inhibition both at the behavioural and neural levels using emotional Go/No-Go face tasks. Factor 1 was related to reaction times in angry ($r = -.688, p = .007$) and fearful ($r = -.598, p = .024$) conditions, but not in the non-emotional condition. A psychopathy subscale, cognitive responsiveness, was also correlated with commission errors to angry No-Go faces ($r = -.603, p = .022$). The current behavioural findings, paired with the pending neural results, have implications for understanding psychopathic traits and social cognition, as well as the potential mechanisms involved in the development and maintenance of psychopathy traits.

CHAPTER 1: INTRODUCTION

Psychopathic traits may be broadly divided into two trait groupings: affective/interpersonal (Factor 1 psychopathy) and behavioural/antisocial (Factor 2 psychopathy). These two Factors are paired with deficits in recognizing and interpreting facial expressions, and disinhibition, respectively. Disinhibition is a pattern of behaviour where an individual lacks the cognitive control required to withhold or prevent a response, which generally leads to poorly planned actions, leaving them to the risk of developing behavioural problems such as aggression, improper social acts, and elevated anxiety (Benning et al., 2003; Wright et al., 2014; Yildirim & Derksen, 2015). In Factor 2 psychopathy, disinhibition is a hallmark of the Factor's classification, with research supporting deficits in inhibitory control at both the behavioural and neural levels (Clark et al., 2019; Patrick, 1994). Regarding the interpretation of facial expressions, emotion processing is a vital component of effective communication and social behaviour. Failing to interpret fearful expressions, for example, may lead to costly miscommunications, or, in the other extreme, highly manipulative behaviours. Individuals high in Factor 1 psychopathy have been found to have decreased neural responses to, and difficulty recognizing genuine fearful faces, causing them to ignore distress cues and callously manipulate others without remorse (Brislin & Patrick, 2019; Dawel et al., 2019). For those with deficits in emotion processing or behavioural regulation, there is an increased risk for consequences such as social exclusion or incarceration (Hare et al., 1994). The commission of inappropriate social behaviours and the misunderstanding of basic, yet important emotional cues are likely to prove maladaptive to the individual (Harpur et al., 1989). Therefore, it is beneficial to investigate emotion identification and the influence of emotion on inhibitory response of those high in both Factors of psychopathy.

Psychopathic Traits

When it was first conceptualized, psychopathy was broadly characterized by 16 personality and behavioural traits, including untruthfulness, superficial charm, antisocial behaviour, and failure to follow any life plan (Cleckley, 1941). Over the next 80 years, this model has been restructured and refined by dozens of researchers to fit forensic and diagnostic contexts, some of which characterized psychopathy as a personality disorder (such as in the DSM-II), while others sought to gain a more robust understanding of its potential neurological or physiological basis (Blair, 2007, 2010). Since the publication of the DSM-III, psychopathy has been removed as a diagnosis, and replaced with antisocial personality disorder, which is a clinical forensic term describing a behavioural disorder, including facets such as violating social norms and stealing (American Psychiatric Association, 1980). During the 1990s, while psychopathy was no longer a clinical term, its primary use shifted to describing offender populations (Hare et al., 1990; Hart et al., 1995), though researchers began broadening the applicability to include non-forensic populations, such as communities or university students (Hare et al., 1990; Hart et al., 1994, 1995).

There are several perspectives available to assess psychopathy in non-clinical settings. One of the most common methods divides psychopathy into two trait clusters: Factor 1 (primary psychopathy) and Factor 2 (secondary psychopathy). Each Factor is composed of distinct personality traits, with separate responses to social situations and emotional stimuli, as well as divergent behavioural responsiveness, such as a lack of self-control (Patrick et al., 2009). Primary psychopathy captures affective traits of callous unemotionality, fearlessness, superficial charm, and social manipulateness (Hare et al., 1990; Hart et al., 1994; Ross et al., 2009). Later researchers emphasized the lack of anxiety experienced in those high in Factor 1 traits (Ross et

al., 2007; Yildirim & Derksen, 2015). In contrast, secondary psychopathy is centered in socially deviant behaviour, poor emotion regulation, disinhibition, boldness, anxiety, and poor sociality (Hart, 1994; Marsh, 2013; Yildirim & Derksen, 2015). The variations between those with predominantly affective or behavioural traits are numerous; failing to take them into account disallows researchers to draw accurate conclusions when studying their behaviour or cognition.

Considering the importance of excluding clinically relevant behaviours, a recent approach has gained attention for its applicability to community populations. The Psychopathy Personality Traits Scale - Revised (PPTS-R) divides psychopathy into four domains: affective responsiveness, cognitive responsiveness, interpersonal manipulation, and egocentricity (Boduszek et al., 2021). The first two domains concentrate on reduced emotional reactivity and understanding the emotional state of others, while the latter two focus on the ability to gain control of social situations and interactions with a focus on egoistic pursuits. In keeping with previous non-clinical perspectives, the PPTS-R retains key personality aspects of past structures (e.g., manipulateness, egocentricity) while reducing the impact of the behavioural/antisocial traits. The PPTS-R additionally reduces the focus on unlawful conduct and antisociality, which enables researchers to set aside forensic or clinical aspects, as psychopathic traits and behaviours do not inexorably lead to criminal activity (Benning et al., 2018; Boduszek et al., 2021; Corrado et al., 2012). While the PPTS-R provides a robust model for assessing psychopathy in community populations, it does not hone the distinction between the affective and antisocial traits. Nevertheless, this questionnaire measures vital aspects of interpersonal dimensions, most of which are present in each Factor (e.g., cognitive responsiveness, which is typically impaired for both Factors). Intuitively, such a wide variety of alterations to typical functioning will have a

distorting impact on emotion perception and social behaviours. Before properly considering these relational factors, it is important to delve into the individual level of behavioural control.

Inhibitory Control

A vital aspect of one's ability to maintain self-control is inhibition, the capability of an individual to cease action, or resist responding to an impulse or stimulus (Anestis et al., 2007). Inhibitory control is an essential cognitive operation for daily functioning, as the ability to refrain from impulsive behaviours is a requirement to delay gratification, plan, and avoid committing socially inappropriate behaviours. For individuals with poor inhibitory control, externalizing behaviours such as aggression, hyperactivity, and frequent risky behaviour may develop, leading to troubles with peers or even with law enforcement (Kooijmans et al., 2000; Verona et al., 2012). While one may instinctively associate disinhibition with reward-seeking behaviour, disinhibition additionally fuels impulsive responses where the individual does not consider the potential consequences of action, and therefore, undesired consequences occur as frequently as self-serving outcomes. The process of continuously acting impulsively and suffering negative consequences may lead to anxiety, as the individual may be aware of the lack of control they have over their behaviour (Quay, 1988). Therefore, it is worth exploring the specifics of response inhibition—the ability to withhold or prevent a specified motor response to a given stimulus.

Response inhibition is a higher-order cognitive process, critically important to executive function (Barkley, 1999; Cummings, 1985). Withholding or preventing a response requires sufficient motor control to physically stop acting, alongside the cognitive ability to process the stimuli, realise action is unwarranted, and cease or redirect behaviour (Barkley, 1999). Particularly weak inhibitory control at the response level is strongly related to behavioural impulsivity, where researchers have found low inhibition and impulsivity to be related to

disordered behaviour patterns, such as poor planning, low self-control, and antisociality (Benning et al., 2003; Levenson et al., 1995; Wright et al., 2014; Yildirim & Derksen, 2015). The inability to restrict behaviours that serve positive emotions or impulses is considerably damaging to the individual as well, as the actions could have negative consequences for the individual, reinforcing their compulsion to act on impulse if this instinctual behaviour pattern typically leads to desired outcomes (Cyders & Smith, 2008, Fournier et al., 2021). Secondary psychopathy is conceptually grounded in low inhibitory control and antisocial behaviours. These characteristics are based on several components such as impulsivity, a lack of focused attention, poor planning skills, and a low boredom threshold (Benning et al., 2003; Levenson et al., 1995; Yildirim & Derksen, 2015). Recent studies have investigated the inhibitory control of individuals with elevated Factor 1 and Factor 2 traits using behavioural tasks such as the Go/No-Go and the flanker task, unearthing further evidence of poor inhibitory control in the absence of rewarding stimuli (Clark et al., 2019; Friedman et al., 2021).

Considering the emphasis on each Factor's social deficits (e.g., callousness, antisociality), several studies in recent years have focused on the effects of emotion modulation on tasks of behavioural inhibition. While the literature is somewhat mixed, Factor 2 has been associated with poor executive functioning in tasks assessing response inhibition (e.g., stop-signal, flanker), displaying greater response times, and a tendency to commit more errors on incongruent trials than individuals with low psychopathy traits (Feilhauer et al., 2012; Friedman et al., 2021; Zeier et al., 2012). Factor 1 does not share these problems; rather, they have been found to demonstrate better performance on tasks assessing cognitive control than individuals low on psychopathic traits, even when the stimuli are emotionally distracting (Haïtt et al., 2004; Newman & Lorenz, 2003; Zeier et al., 2009). Using an emotional-linguistic Go/No-Go task,

Sprague and Verona (2010) found individuals high in antisocial traits (i.e., Factor 2 traits) displayed behavioural control deficits (i.e., slower reaction times) when the stimuli consisted of negative words (e.g., poison) or diagnostically relevant words (e.g., abandon, hate) compared to individuals scoring low on these traits. In stark contrast, Factor 1 has been repeatedly shown to be unaffected by negative linguistic stimuli, which is likely due to their deficits in emotional arousal (Patrick et al., 1994; Sellbom & Verona, 2006). To gain perspective on the mechanisms behind each Factor's divergences from non-psychopathic populations, researchers progressed to the neural level.

To explore the response inhibition at the neural level, researchers will commonly utilize electroencephalography (EEG) and event-related potentials (ERPs) to examine the temporal aspects of responses, and the intensity of the experience. Considering the Go/No-Go task, infrequent No-Go trials (assessing the ability to withhold a response) typically induce larger amplitudes of electrical activity in participants, compared to the frequently displayed Go trials (response trials), as withholding a response for an infrequent trial requires greater cognitive control and interrupts the individual's expectations (Falkenstein et al., 1999; Polich, 2007). Alongside measuring response inhibition, the use of emotionally potent stimuli, such as facial expressions, may be used to gain insight into the influence of emotion modulation on response inhibition.

Previous researchers have isolated the N2 and the P3 components of the EEG waveform when studying inhibitory control using Go/No-Go experiments (with and without emotional face stimuli; Lewis et al., 2006). The N2 wave is a negative-going wave, which peaks at approximately 250-350ms, recorded at the frontal site (Lewis et al., 2006; Luck, 2014; Verona, 2012). Located over the anterior scalp area, this wave is enhanced after the presentation of a

deviant stimulus (after the presentation of repetitive stimuli which elicit standard N2 waves), reflecting processes such as performance monitoring, response inhibition, and shifts of attention (Clark et al., 2019; Luck, 2006). In nonclinical psychopathic populations (i.e., individuals with either high Factor 1 or Factor 2 traits), mixed results were found when researchers failed to account for the discrepancies between the two Factors of psychopathy. More commonly, researchers found the N2 wave generally tends to be enlarged in persons with higher psychopathic traits using Go/No-Go tasks (of either Factor; Kim & Jung, 2014). Forensic populations (typically higher Factor 1 scores) have been found to have superior performance on Go/No-Go tasks compared to community populations, signaled by a near-significant N200 amplitude (Munro et al., 2007). In contrast, Factor 2 was associated with poor performance on conceptually similar tasks (e.g., the flanker task), as reflected in their reduced N2 waves in the majority of affective face/linguistic response inhibition tasks (Anderson & Stanford, 2012; Eisenbarth et al., 2013).

The P3 wave is a key component used to observe an individual's working memory and decision to respond (Clark et al., 2019). Additionally, this wave relates to experimental manipulation (e.g., categorization of a stimulus), and is not connected to the specific attributes of a given stimulus (Luck, 2006). Typically, the frontal P3 wave is prominent during Go/No-Go tasks when a respondent displays inhibitory control (Smith et al., 2008) and when reacting to emotionally salient stimuli (Metzger et al., 1997). In those with elevated Factor 2 traits, several studies found this population displays larger P3 waves (N2 waves not assessed) during linguistic Oddball and Go/No-Go tasks (Brazil et al., 2012; Verona et al., 2012). Researchers have found individuals with elevated Factor 1 traits to display low P3 waves during similar affective picture

inhibition tasks (Drislane et al., 2013). The deficits found in this population's inhibitory control extend to their ability to process emotion and regulate emotional responses.

Emotion regulation may be defined as the degree to which a person controls their emotion's intensity, duration, and expression, both prior to, and in response to an inciting event (Walker et al., 2022). One's ability to properly regulate their emotions may be affected by a variety of interacting personality traits and cognitive processes, such as impulsivity and neuroticism (Dapprich et al., 2021; de Ribera et al., 2019; Patrick et al., 2009). Similarly, salient emotional stimuli (i.e., faces or words reflecting strong emotions which typically elicit physiological responses) may disrupt one's response inhibition (Verona & Bresin, 2015). In secondary psychopathy, disinhibition interacts with poor emotion regulation, resulting in underregulated emotional responses, inclining the individual to outbursts, approach behaviours, and a low threshold for reactivity (Levenson et al., 1995; Ross et al., 2007). Importantly, one's emotional response to a given stimulus is heavily impacted by their ability to properly interpret the emotions of those around them, as frequent misinterpretations may intuitively lead to frustration during communication events.

Emotion Identification in Psychopathy

Recent publications report conflicting results in studies examining the relationship between psychopathy and emotion identification. According to an experimental dissertation by Book (2004) which investigated several variables simultaneously, individuals high in psychopathy do not display deficits in perceiving fearful facial expressions. The author concluded that psychopathic persons may be social predators who may be more accurate in recognizing fear than those who do not have high psychopathic traits, using this skill to target potential victims of robbery. However, Book's (2004) study, and similar studies do not

consistently differentiate between primary and secondary psychopathy (using more than one questionnaire and generalizing the results), which is a vital distinction, as the two groups display high variation in their behavioural and cognitive structures (Espinoza et al., 2019; Hart et al., 1995). Moreover, the faces in the images are posed, which impairs the validity of the experiment. Conversely, a more direct approach uses isolated images of facial expressions to avoid distortion of the research question, where participants simply label expressions based on their emotion (e.g., fearful, angry, happy; Gao et al., 2014). Two meta-analyses concluded primary/affective psychopathy was strongly associated with deficits in the identification of distress emotions (fear and sadness), though other emotions (e.g., happiness, surprise, anger) were not associated with such impairments (Dawel et al., 2012; Marsh & Blair, 2008). Recently, researchers have taken emotion identification in psychopathy a step further by requesting participants label the expressions as genuine or posed, and thereby examining this population's perception of the authenticity of facial expressions (Dawel et al., 2019).

Genuine Versus Posed Emotional Facial Expressions

Facial expressions of emotion project an innumerable amount of social and behavioural cues, which, in the best of conditions, convey the emotional experience of a multitude of feelings and meanings. Faces speak volumes to those who view them, signaling not only general mood, but also social cues, which provide vital signals to interpreters, informing their responses. Traditionally, researchers have concluded that women identify facial emotions—particularly negative emotions—more accurately than men (McClure, 2000; Miura, 1993; Rotter & Rotter, 1988). For most meaningful interactions, people wish to convey whichever emotion they are feeling to their audience as accurately as possible. It is to all parties' benefit that the person interpreting the emotion is correct in their summation of the expression, particularly when

conveying an important message, such as distress or anger. If one interprets an expression to be posed or faked, essential indications as to the mental or emotional state of the expressor may be lost (e.g., an interpreter believing a genuine expression of fear is posed could induce discomfort during communication or escalate an argument). Therefore, the ability to accurately process emotional facial expressions is critical to all interactions between individuals where facial expressions are relevant.

An important caveat to consider when discussing facial genuineness is the potential benefits of falsifying an emotion for the purpose of manipulation (excluding scenarios where one feigns emotion for humor or other playful endeavors). Within social interactions, one may manipulate others, simulating sadness to garner sympathy, or happiness to subvert boredom, all to ensure the other party is unaware of one's true feelings or intentions. One of the primary features of Factor 1 psychopathy is manipulateness, where the individual typically uses superficial charm to entice a desired behaviour or favour from another person (Cleckley, 1941). Researchers have only recently begun investigating psychopaths' perceptions of the genuineness of others' emotions. According to Dawel and colleagues (2019), Factor 1 individuals display a diminished ability to differentiate between posed or genuine faces of emotional distress, while Factor 2 did not share this deficit. This finding may follow from the callous unemotionality and low emotional arousal of Factor 1 (Ross et al., 2007).

The reduced emotional arousal and lack of fear experienced by Factor 1 has inspired dozens of studies researching potential physical neurological abnormalities in this population. Two neural structures, the amygdala, and the ventromedial prefrontal cortex (vmPFC) have been established as dysfunctional in individuals high in psychopathy (more consistently in Factor 1), affecting their emotional and inhibitory regulation (Blair, 2007, 2010). Damage to, or

underactivity of the amygdala (Blair, 2007) suggests such individuals have decreased responsivity to typically distressing (i.e., fear-inducing) stimuli, such as snakes or images of people in pain (Oxford et al., 2003). Individuals with lesions to the vmPFC have been shown to have trouble with response reversal (changing behaviour to contradict a previously established rule; Blair, 2006; Izquierdo et al., 2004). In facing challenges with both structures, individuals are likely to experience difficulty in social contexts, where the ability to withhold a response and empathize with another person is extremely important. Thus far, there are no studies combining inhibitory responsiveness using EEG methods with tasks assessing the ability to differentiate between expressions of dubious authenticity.

Present Study

Inhibitory control is a vital aspect of behaviour regulation, influencing one's ability to delay reward, restrain maladaptive behaviours, and inhibit inappropriate behaviours (Barkley, 1999). For individuals high in Factor 2 traits, disinhibition has a large impact on several aspects of their social skills, including emotional reactivity and the commission of socially inappropriate behaviours (Dawel et al., 2019; Miller & Lynam, 2012). Studies reporting deficits in the response inhibition of Factor 2 (e.g., increased response times, commission errors; Friedman et al., 2021; Feilhauer et al., 2012; Sprague & Verona, 2010), have not utilized emotional face stimuli and measures at the neural level. Factor 1 does not share similar disinhibition or antisocial traits (Hart, 1995; Levenson et al., 1995; Ross et al., 2007); however, their inability to recognize the emotion of fear impairs their comprehension of a valued subset of interpersonal communications, while lending them the advantage of manipulating social situations for their own gain (Hare, 1995; Levenson et al., 1995; Wheeler et al., 2009). Recent research has found that individuals high in primary psychopathy display a reduced ability to differentiate between

genuine and posed expressions of distress (Dawel et al., 2019). Previous studies investigating emotional face identification have commonly neglected to separate the two Factors of psychopathy, leading to mixed results (Brook & Kosson, 2013; Dolan & Fullam, 2006; Hastings et al., 2008). Presently, there are no known studies investigating these personality traits in relation to the influence of attention to emotional faces on response inhibition at the neural level, nor have there been any connections between these capacities and the ability to differentiate between genuine and posed facial expressions.

Research Questions

1. Do people high on Factor 1 or Factor 2 psychopathy show reduced accuracy in judging genuine versus posed emotional faces?
2. Do people high on Factor 1 or Factor 2 psychopathy show differences in the emotion modulation of response inhibition at the behavioral level?
3. Do people high on Factor 1 or Factor 2 psychopathy show differences in the emotion modulation of response inhibition at the neural level?

CHAPTER 2: METHODOLOGY

Participants

Upon receiving permission from the Cape Breton University Research Ethics Board (# 2019091), phase 1 of recruitment began. The population of interest included Cape Breton University students of any ethnicity or gender aged 18-25 years. Participants were restricted to ages 18-25, as the population of interest is “emerging adulthood,” where brain maturation is not yet complete, as it requires the first 25 years of life (Jetha & Segalowitz, 2012). All participants were required to have normal or corrected vision, with no reported cases of major neurological disorders (where prescription medications could have an influence on their EEG responses).

Students recruited for the present study had been pre-screened for a larger EEG study, entitled “An ERP Study of Attention Biases in Young Adults: Associations with Behavioral Inhibition and Activation Systems.” This larger study identifies personality traits (i.e., shyness/boldness/sociability/impulsivity) that are centred on Gray’s (1981) two motivational systems (behavioural inhibition/activation). The study uses EEG methodology to study attention, emotion processing, and regulatory response in individuals who have been identified as high or low on these traits. Shyness, for example, is associated with the behavioral inhibition system and the motivation to avoid aversive outcomes, while boldness is associated with the behavioural activation system and the motivation to approach goal-oriented outcomes.

To recruit participants high or low on these traits, the pre-screening for the larger study used public posters, as well as PowerPoint slides presented in classrooms across various academic disciplines in the university. Posters were displayed in various places around Cape Breton University’s campus, with particular care taken to bringing the boldness poster to areas of

the departments of Engineering, Mathematics, and Business. These departments, particularly the latter, have been found to have elevated levels of psychopathic traits (Litten et al., 2018). Students who participated were pre-screened for shyness, sociability, boldness, and impulse control using a 16-item questionnaire. Of the 16-item pre-screening survey, 3 items measured boldness. Previous research on psychopathy has used similar recruitment posters to enlist individuals higher on boldness traits; however, for previous studies, a full-itemized boldness questionnaire was used for pre-screening procedures (Dawel, 2019). Individuals who scored higher on sociability and boldness, and lower on impulse control were chosen for the behavioural activation group for the larger study. Individuals who score higher on shyness and impulse control, and lower on boldness were chosen for the behavioural inhibition group for the larger study.

While research has established it is inaccurate to use Carver and White's (1994) BIS/BAS scales to denote psychopathy types (Poythress et al., 2008), there is much conceptual overlap with behavioural activation traits and psychopathy traits. For instance, boldness and poor impulse control are fundamental attributes of Factor 2 psychopathy (Hart, 1994; Marsh, 2013; Yildirim & Derksen 2015). In addition, those high on shyness may share Factor 1's inability to accurately classify genuine or posed fearful faces, albeit for different reasons (Dawel et al., 2019; Gao et al., 2014). The students who agree to take part in the larger study were invited from this pre-screening pool to take part in the current study, receiving \$30 compensation for their participation in the larger study, and \$5 for their participation in the current study. Due to the conceptual links in the pre-screening questionnaires to various aspects of psychopathy, the recruitment procedures provide a range of participants that displayed varying degrees of

psychopathic traits (i.e., potentially a greater number of participants scoring highly on Factor 2, and fewer for Factor 1).

In total, the pre-screening process yielded a final sample of 166 respondents. Of these, 126 agreed to be contacted to participate in the full laboratory study. Participants scoring highly in Factor 1, Factor 2, or shyness characteristics were approached first, though the entire pool was contacted. Although the 126 participants were contacted, 41 agreed to come to the lab to participate in the study (eight participants were unable to be scheduled, and thus could not participate). The reduced willingness to participate in the study emerged after the Cape Breton University faculty strike and may have been due to the workload and time constraints placed on students upon their return to campus, among other factors associated with the disruption. The recruitment of students will continue after the academic year has ended and the present document has been submitted. A total of 33 participants have completed the questionnaires and EEG tasks, and 32 participants have completed the full study (due to an equipment malfunction). Here, 32 participants are included in the demographics. Ethnicity information was collected for this study, as they may influence the interpretation of face processing tasks (Wong et al., 2020). Most participants were Caucasian or Asian (). Participants scoring highly in Factor 1, Factor 2, or shyness characteristics were approached first, though the entire pool was contacted. Most participants were Asian (). The majority of the participants were (female). Most commonly, the participants were recruited from psychology classes. The mean age of participants was (19.9) years ($SD = 1.63$). Full participant demographics are found in Table 1.

Table 1.

Demographic Information (N = 32)

Variables	Participant Characteristics % (N)
Race/Ethnicity	
Asian	% ()
African Canadian	% ()
Caucasian	% ()
Sex	
Female	65.63% (21)
Male	34.37% (11)
Age	
18	15.63% (5)
19	25.00% (8)
20	28.13% (9)
21	12.5% (4)
22	9.37% (3)
23	6.25% (2)
24	0.00% (0)
25	3.13% (1)

Procedure

Upon participants' arrival to the laboratory, they were first briefed on the research purpose, procedure, potential harms and benefits, and confidentiality. After signing the consent form (see Appendix A) and asking any questions about the study or their participation, the participants completed the self-report questionnaires (see Appendix B and Appendix C for the full questionnaires). Following this, participants completed the Genuine Versus Posed Emotion Identification Task (GVP), where they were seated in a comfortable chair, and viewed a computer screen which displayed emotionally salient facial expressions (fearful and angry). Participants were directed to press keyboard keys based on whether they believed the expressions appearing before them were genuine (photographed during natural experiences) or

posed (actors pretending to experience emotion) (key 1 = genuine; key 2 = posed). The images appeared in a randomized order for two seconds each, formatted within a single trial. The duration of the GVP behavioural task is approximately four minutes.

Upon the completion of the questionnaires and the behavioural task, participants completed the EEG portion of the study. Each participant was seated in front of a computer monitor and keyboard, fitted with a 128-channel HydroCel Geodesic Sensor Net. These nets were first soaked in a saline solution to improve the conductivity of the very weak electrical brain signals that were measured from the scalp (with the saline solution, abrasion of the scalp is unnecessary). A high-impedance NetStation NA400 amplifier (Electrical Geodesics, Inc.) and a 128 Ag/AgCl electrode Hydrocel Geodesic sensor net were used to record EEG signals. The EEG signals were recorded at 1000 Hz while referenced to the midline vertex electrode (Cz). Impedances were kept below 100 k Ω where possible. During net application, participants filled out a 10-item questionnaire concerning their current state of arousal, medication use, and substance intake that would affect EEG interpretation, arousal level, or their ability to concentrate. Breaks were taken between tasks as needed to avoid fatigue. The duration of the larger study was approximately 90 minutes.

Self-Report Questionnaires

Levenson Self-Report Psychopathy Scale (LSRPS; Levenson et al., 1995): This 26-item questionnaire assesses primary and secondary psychopathic traits in nonclinical, non-forensic populations (e.g., undergraduate students). This questionnaire has been validated for use in community populations (Garofalo et al., 2019; Wissenburg et al., 2022). This scale is highly useful for distinguishing between Factor 1 (primary psychopathy; items 1-16) and Factor 2 (secondary psychopathy, items 17-26) traits. Factor 1 traits encapsulate individuals who typically

are low in anxiety and emotionality, and high in callousness, whereas Factor 2 traits are centered in disinhibition, boldness, anxiety, poor sociality, and impulsivity. The characterization of these traits further distinguished aspects that influence attention to emotional faces and have the potential to modulate response inhibition. Cronbach's alpha for this scale is .84 for the primary subscale, and .74 for the secondary subscale. See Appendix B for the complete questionnaire.

Psychopathic Personality Traits Scale - Revised (PPTS-R; Boduszek et al., 2021): This 28-item questionnaire assesses psychopathic traits in non-clinical, non-forensic populations (e.g., undergraduate students) using four domains (affective responsiveness, cognitive responsiveness, interpersonal manipulation, and egocentricity). This questionnaire has been validated for use in community populations (Boduszek et al., 2022). Previous research has shown that participants who score highly on this scale have deficits in processing certain facial emotions (particularly fearful expressions) in both behavioural and physiological tasks (Boduszek et al., 2018; Dawel et al., 2019). The PPTS-R aids in refining the characterization of the extroverted/disinhibited personality type. In the event that the sample of participants recruited does not yield a sufficient number of people scoring high on each Factor (e.g., approximately 10 participants scoring high on Factor 1, and 10 scoring high on Factor 2), this scale measures psychopathy more broadly than the LSRPS, without differentiating between the two Factors. Therefore, this questionnaire provided an overall score of psychopathic traits. Cronbach's alpha ranged from .76 to .95 in community populations. See Appendix C for the complete questionnaire.

The Genuine Versus Posed Emotion Identification Task

The Genuine Versus Posed Emotion Identification Task (GVP), created using E-Prime (2.0) software for the present study, was designed to assess participants' ability to differentiate between genuine and posed expressions of fearful and angry faces. The emotional face stimuli

were taken from two validated sets: the Karolinska Directed Emotional Faces (KDEF) (Lundqvist et al., 1998), and the GUR stimuli (Gur et al., 2002). Both stimuli sets were received from Dr. Amy Dawel, the primary researcher who validated these images (Dawel et al., 2017). The GUR images of genuine emotion were method-evoked—that is, the individuals in the photographs responded naturally to emotionally salient events (e.g., watching a frightening film to evoke a fear response). These images were then assessed in a research study to determine whether the “average observer” would perceive them as genuine (Dawel et al., 2017). Contrariwise, Lundqvist and colleagues (1998) created the posed KDEF stimuli by asking actors to mimic facial expressions, without truly experiencing the requested emotions. The aforementioned study by Dawel and colleagues (2017) also tested these images, with findings suggesting the average observer rates them as nongenuine or posed. Of the range of faces available in the packages, only the fearful (distress) and angry (non-distress) images were used in the behavioural task.

The GVP task used a total of 60 images, where 30 display fear and 30 display anger. Of each emotion, 15 of each belong to the KDEF, and 15 to the GUR set. The images were standardized using GIMP 2.10.32 and Photoshop software. The images were cropped such that only the faces themselves (i.e., no hair, neck, or clothing) were visible. All faces were looking directly into the camera lens. These greyscale images were displayed in a portrait frame with a black background, at a viewing distance of approximately 50cm (as per Dawel et al., 2019). The KDEF images are exclusively Caucasian persons, with an equal number of male faces and female faces. The GUR images are ethnically diverse (including American participants of African, European, and Asian descent), with an equal number of male faces and female faces.

EEG Data Acquisition

Measures

Emotional Face Go/No-Go Task: This task assessed the interference of emotion on inhibitory control. The stimuli for the task included faces that vary in ethnicity, gender, and emotional expression (e.g., fearful, angry, and calm). The participants were asked to respond as quickly as possible to the stimuli that appear on the computer screen by pressing a button on the response box. In these blocks, errors of commission provided an index of response inhibition. In two separate blocks (i.e., fear and anger conditions), participants were asked to press a button when a calm face appears on the screen and to withhold responding when an emotional face (No-Go stimulus) appears on the screen. In these blocks, errors of commission provide an index of emotional regulation processes. Additionally, there was a control condition of male (No-Go) and female (Go) faces. These tasks used 108 Go trials and 42 No-Go trials. The duration of each task is approximately 4.5 minutes.

The electroencephalogram (EEG) was used to investigate the participants' neural activity during the completion of the Go/No-Go tasks. Behaviourally, response accuracy and reaction time were measured to assess response inhibition and emotion modulation. At the neural level, ERP enables the observation of brain activity at the millisecond level in response to stimuli in relation to correct and incorrect responses. A person scoring high on Factor 2 traits may be particularly sensitive to a face displaying anger, which could delay their response time during the Go/No-Go task. Moreover, the ERP may show enhanced voltage, suggesting elevated neural activity during the processing of an emotional stimulus. Moreover, a person with elevated psychopathic traits (particularly Factor 2) may be disinhibited in their responses during a Go/No-Go task. There exists an intriguing discrepancy between the Factors' EEG responses—Factor 1

displays a low or blunted electrical response (reduced arousal) to a highly emotional face, whereas Factor 2 exhibits an elevated response.

The NimStim set of validated facial expressions was used as stimuli for the Go/No-Go tasks (Tottenham et al., 2009). The NimStim stimuli consist of 672 images of 43 actors, who were instructed to pose eight different facial expressions (happy, sad, angry, fearful, neutral, disgusted, surprised, and calm), with open and closed mouth versions of each expression. The images are commonly used in EEG tasks (Hinvest et al., 2022; Perizzolo et al., 2019). Cui et al. (2021) found that images of faces with open mouths have been found to be perceived as more intense than faces with closed mouths, as reflected in their EEG responses, most notably in their Late Posterior Potentials. To control for variations in neural responsiveness, six actors were chosen, and only open-mouthed expressions were used for the tasks.

CHAPTER 3: DATA ANALYSIS

Participants were first divided into two groups of approximately equal size based on their scores on the LSRPS questionnaire, where scoring highly on primary/secondary psychopathy, disinhibition, thrill and adventure seeking, and antisocial action are considered the key descriptives. It was expected that more males than females would score high on the two psychopathy questionnaires. With the addition of data in the future, depending on the available participant pool, participants may be separated into three groups: high Factor 1 traits, high Factor 2 traits, and a control group (low psychopathy scores). If the sample does not allow for approximately 10 participants scoring high on each Factor, two or three groups will be formed depending on the results using the PPTS-R (high and low psychopathic traits, or high, medium, and low psychopathic traits). The data was analyzed both individually (without grouping the participants), and after dividing participants into two small groups (Factor 1 and Factor 2). Intercorrelations between each psychopathy subscale were assessed.

Concerning the first research question, the analysis for the behavioural task will be subjected to a multivariate ANOVA (MANOVA) with emotion (angry, fearful) and authenticity (genuine, posed) as within-subjects variables, and group (high F. 1, high F. 2, low on F. and F. 2), and sex (male, female) as between-subjects variables, with the dependent variable percent correct. Until this time, paired samples *t*-tests analyses were conducted to determine whether there were significant differences between the percent correct genuine and posed responses, as well as angry and fearful responses.

For the second research question, at the behavioural level, the data will be subjected to a MANOVA, with emotion (fearful, angry) as the within-subjects variable, and group (Factor 1,

Factor 2) and sex (male, female) as the between-subjects variables. Data will be run separately for the following dependent variables: reaction time (RT) to emotional Go targets, RT to non-emotional Go targets, commission errors (CE) to emotional No-Go targets, and CE to calm No-Go targets. Until this time, correlational tests were run to observe the relationships between psychopathy subscales and No-Go stimuli (angry, fearful, and the male control faces), and between the subscales and the reaction times.

Finally, for the third research question, at the neural level, a MANOVA will be conducted with trial type (Go, No-Go), emotion (fearful, angry) and electrode site (Fz, FCz, Cz) as within-subjects variables, psychopathy (Factor 1, Factor 2) and sex (male, female) as between-subjects variables. Data will be run separately for the following dependent variables: N2 amplitude, N2 latency, P3 amplitude, and P3 latency. Follow up tests in the form of ANOVAs may be run for significant results. Further, post hoc comparisons with *t*-tests will be conducted using the Bonferroni correction. EEG results are pending at this time.

Expected Results

Concerning the first research question, “do people high on Factor 1 or Factor 2 psychopathy show reduced accuracy in judging genuine versus posed emotional faces?”, it is predicted that individuals scoring high on Factor 1 traits may show reduced accuracy on the GVP task, while Factor 2 and the control group are likely to achieve higher scores (e.g., a low score being approximately 50% correct, and an high score being approximately 80-100% correct, though these estimates will likely be different in practice depending on the data, as this is a novel task). Moreover, individuals with elevated Factor 1 traits may be more likely to incorrectly classify fearful faces than angry faces. Regarding the second research question, “do people high

on Factor 1 or Factor 2 psychopathy show differences in the emotion modulation of response inhibition at the behavioral level?" it is predicted that the response inhibition of individuals scoring high on Factor 2 traits may be especially affected by emotional faces (e.g., delayed responses, increased number of commission errors), while Factor 1 may be relatively unaffected by varying emotion conditions, and the control group results would likely fall between those of the other two groups. For the final research question, "do people high on Factor 1 or Factor 2 psychopathy show differences in the emotion modulation of response inhibition at the neural level?" it is anticipated that the response inhibition of individuals scoring high on Factor 2 traits may be especially influenced by emotional faces (e.g., elevated neural responses, increased latency, reduced N2 waves, larger P3 waves), while Factor 1 may be less affected by such stimuli (e.g., increased N2 waves, reduced P3 waves) though they may display reduced neural responses to emotional faces. The results of the control group are predicted to fall between those of the two aforementioned groups.

CHAPTER 4: RESULTS

Prior to evaluating the hypotheses, first, the questionnaire data was analyzed to determine whether the participants could be divided into groups based on their psychopathy scores. The LSRPS assessed participants' traits on Factor 1 and Factor 2 psychopathy. The mean Factor 1 score was 29.54 ($SD = 6.33$), and the mean Factor 2 score was 22.03 ($SD = 3.97$), indicating that on average, participants had middling-low psychopathy scores, with a higher percentage displaying higher Factor 2 than Factor 1 scores (range of possible scores for Factor 1 and Factor 2 were 0-64 and 0-40, respectively).

Concerning the PPTS-R, the average psychopathy scores across the four subscales were low, with the highest subscale mean belonging to interpersonal manipulation, and the lowest mean belonging to affective responsiveness. The descriptive statistics of each subscale can be found in Table 2. Significant correlations were found between Factor 1 and affective responsiveness ($r = .844, p < .001$), Factor 1 and interpersonal manipulation ($r = .625, p = .013$), and Factor 1 and egocentricity ($r = .550, p < .001$). There was additionally a moderate correlation between Factor 2 and cognitive responsiveness ($r = .415, p < .016$). Affective responsiveness was weakly correlated with interpersonal manipulation ($r = .364, p < .037$) and egocentricity ($r = .408, p < .018$). Finally, egocentricity and interpersonal manipulation were also weakly correlated ($r = .354, p < .044$). See Table 3 for these results.

Table 2.

Descriptive Statistics: LSRPS and PPTS-R

	N	Range	Minimum	Maximum	Mean	SD
Factor 1	14	26.00	20.00	46.00	29.54	6.33
Factor 2	14	17.00	13.00	31.00	22.03	3.96
Affective Responsiveness	14	17.00	0.00	17.00	4.82	3.93

Descriptive Statistics: LSRPS and PPTS-R

Cognitive Responsiveness	14	15.00	2.00	17.00	7.61	2.75
Interpersonal Manipulation	14	19.00	1.00	20.00	10.55	4.26
Egocentricity	14	13.00	2.00	15.00	8.42	3.16

Table 3.*Pearson's Correlations: Psychopathy Subscales*

		Factor 1	Factor 2	AR	CR	IM	E
1. Factor 1	Pearson's r	—					
2. Factor 2	Pearson's r	0.189	—				
3. AR	Pearson's r	0.704 ***	-0.072	—			
4. CR	Pearson's r	0.207	0.415 *	0.115	—		
5. IM	Pearson's r	0.582 ***	0.144	0.364 *	0.120	—	
6. E	Pearson's r	0.550 ***	-0.014	0.408 *	0.023	0.354 *	—

* $p < .05$, ** $p < .01$, *** $p < .001$

While the resulting scores of the LSRPS allowed for the division of participants into Factor 1 and Factor 2, the lack of participants does not often allow for meaningful results. Therefore, the analyses were completed with and without grouping depending on the hypotheses and the available data. Specifically, the GVP task results utilized both the individual responses, and the Factor groupings, whereas results associated with the Go/No-Go tasks did not include the groupings. Rather, the total individual scores for all participants were incorporated.

Factor 1 and Factor 2: Genuine/Posed Classification Accuracy

To address the first research question, paired samples t -tests were conducted comparing percent correct responses on genuine versus posed faces to determine whether these scores were

significantly different. Omissions of responses were removed from the data analyses and scores were calculated as a percentage of the participant's total number of responses. When running all of the participants regardless of their grouping (higher scores in Factor 1 or Factor 2), the mean of the correct responses to genuine faces was not found to be significantly different from the correct responses to posed expressions ($t(14) = -1.06, p = .305$). However, a second paired samples t -test found the mean percent correct fearful faces to be significantly different from the mean percent correct angry faces ($t(14) = 3.21, p < .006$). The descriptives of these tests can be found in Table 4.

Table 4.

Genuineness and Emotion Correct: Descriptives (N = 15)

Condition	Mean	SD
Genuine Correct	54.566	15.911
Posed Correct	60.896	15.556
Anger Correct	53.906	13.634
Fear Correct	61.646	9.502

Note: Values presented as a percentage of possible correct scores.

Next, participants were divided based on their psychopathy scores.

To determine whether the tasks garnered significant results when participants were divided into groups based on their LSRPS scores, two groups were created in accordance with the participants' Factor scores. If a participant scored higher on Factor 1 than Factor 2, they were assigned to the Factor 1 group ($N = 10$). If they scored higher on Factor 2, or if they scored equally on the two Factors, they were assigned to the Factor 2 group ($N = 5$). In running the paired samples t -tests under these conditions, there were trends for each of the tests, though only

the percent emotion correct for Factor 2 was found to be significant. See Table 5 for these results.

First, the percent genuine correct and the percent posed correct results were analyzed using paired samples *t*-tests. The Factor 2 group displayed slightly higher means than the Factor 1 group ($t(4) = -.617, p = .571$); ($t(9) = -.817, p = .435$), though neither group yielded significant results. Second, the emotion percent correct aspect of the task was analyzed. Similarly, for this test, the Factor 2 group showed marginally higher means than the Factor 1 group. However, in this case, Factor 2 displayed significant results, whereas Factor 1 displays a small trend ($t(4) = -2.74, p < .05$); ($t(9) = -2.08, p = .067$). Further additions of participants will allow for increased power. See Table 5 for the descriptives. The non-significant results of these tests are most likely due to the small sample sizes of each group, as trends are still apparent in many cases.

Table 5.

Genuineness and Emotion Correct: Factor 1 and Factor 2.

	N	Mean	SD
Genuine Correct (Factor 2)	5	54.722	23.292
Posed Correct (Factor 2)	5	62.473	20.355
Genuine Correct (Factor 1)	10	54.488	12.356
Posed Correct (Factor 1)	10	60.108	13.792
Anger Correct	5	54.074	19.368
Fear Correct	5	63.933	14.553
Anger Correct	10	53.823	11.064
Fear Correct	10	60.502	6.478

Note: Values presented as a percentage of possible correct scores

Emotion Modulation of Response Inhibition: Behavioural Level

Percent Correct No-Go Responses

When analyzing the data for the Go/No-Go tasks, there are 14 participants included rather than 15, as there was an equipment malfunction during one of the trials. To determine whether

emotion modulation would influence the response inhibition of participants scoring highly on psychopathic traits, correlational analysis was utilized. When assessing participants' ability to withhold their responses, commission errors were employed as the inhibition variable.

Commission errors occur when the individual responds to a No-Go stimulus, when they should have withheld their response. Commission errors were calculated as a percentage of the total No-Go trials. A correlational analysis was conducted including both the LSRPS and the PPTS-R psychopathy scales, and the percent angry, fearful, and male (control) commission errors. The results determined neither Factor was significantly correlated with commission errors. Cognitive responsiveness was significantly negatively correlated with commission errors of Angry No-Go faces ($r = -.603, p = .022$), and Male faces ($r = -.565, p = .035$), but not with fearful faces ($r = -.370, p = .193$). See Figures 1 and 2 for scatterplots of these results. The other subscales of the PPTS-R were not significantly correlated with these commission errors. Accuracy for the No-Go tasks was very strong. Descriptives of the Go trials can be found in Table 7.

Table 6.

Correlations: Psychopathy Questionnaires, Face Stimuli, Commission Errors

	Percent Correct Angry CE	Percent Correct Fear CE	Percent Correct Male CE
Factor 1	-.054	.028	-.187
Factor 2	-.372	-.466	-.113
Affective Responsiveness	.075	.219	-.053
Cognitive Responsiveness	-.603*	-.370	-.565*
Interpersonal Manipulativeness	-.069	.028	-.018
Egocentricity	.157	.332	.094

*. Correlation is significant at the 0.05 level (2-tailed).

Table 7.

Descriptive Statistics: Percentage of Go Correct Responses, Percentage Commission Errors (CE) and Reaction Times (RT) to Go trials in milliseconds.

	N	Minimum	Maximum	Mean	Std. Deviation
Go Correct					
Angry	14	75.93	100.00	97.0238	6.30277
Fear	14	75.93	100.00	93.3201	8.31494
Male	14	96.30	100.00	99.0741	1.20453
No-Go CE					
Angry	14	7.14	54.76	20.9184	13.27888
Fear	14	11.90	69.05	27.7211	15.47569
Male	14	2.38	50.00	18.5374	13.08036
RT to Go (ms)					
Angry	14	241.81	512.45	396.6707	61.11739
Fear	14	275.08	532.13	431.5790	59.51378
Male	14	316.94	482.69	395.6352	39.19285

Figure 1.

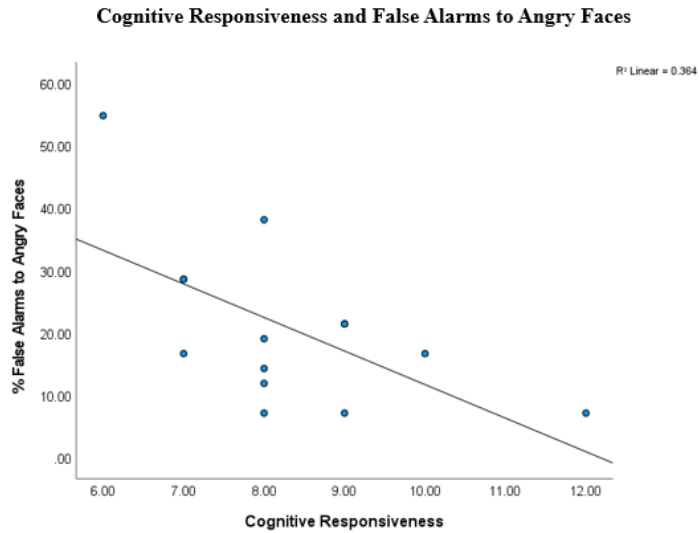


Figure 1: Correlation matrix ($r = -.603$) for cognitive responsiveness and false alarms/commission errors to angry faces.

Figure 2.

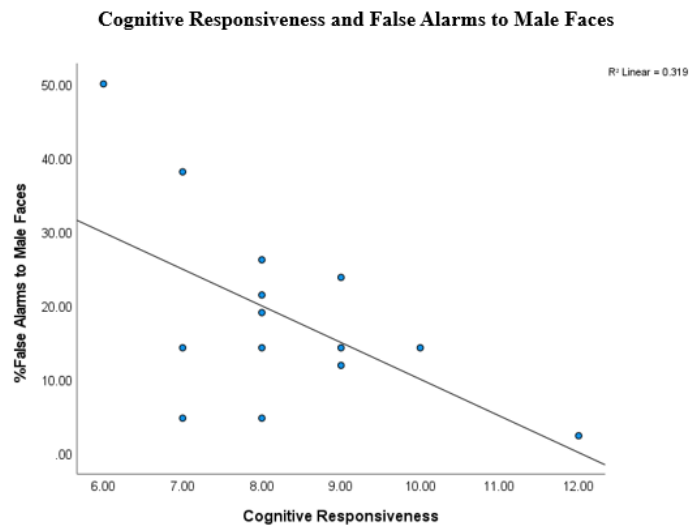


Figure 2: Correlation matrix ($r = -.565$) for cognitive responsiveness and false alarms/commission errors to male faces.

Reaction Time

To determine whether emotion modulation influenced the response speed of participants, reaction time was correlated with each Factor. The results found Factor 1 to be significantly related to decreased reaction times of Angry faces, ($r = -.688, p = .007$), and Fearful No-Go faces ($r = -.598, p = .024$), though it was not significantly correlated with the control condition (Male faces, ($r = -.036, p = .904$)). Factor 2, and all subscales of the PPTS-R were not significantly correlated with reaction times to any of the stimuli. The correlations for these results can be found in Table 8. The scatterplots of these results are found in Figures 3 and 4.

Table 8.

Correlations: LSRPS and Emotional Face Reaction Time

Psychopathy	Anger Reaction Time	Fear Reaction Time	Male Reaction Time
Factor 1	-.688**	-.598*	-.036
Factor 2	-.147	.082	-.257

** . Correlation is significant at the 0.01 level (2-tailed).

* . Correlation is significant at the 0.05 level (2-tailed).

Figure 3.

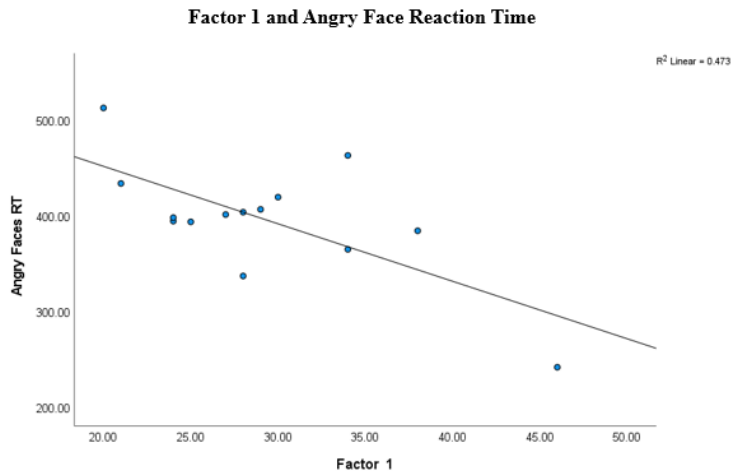


Figure 3: Correlation matrix ($r = -.688$) for Factor 1 and angry face reaction times.

Figure 4.

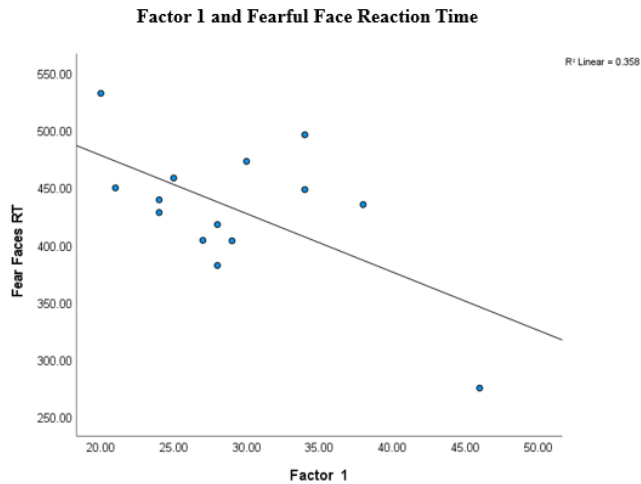


Figure 3: Correlation matrix ($r = -.598$) for Factor 1 and angry face reaction times.

Emotion Modulation of Response Inhibition: Neural Level

The third research question will investigate neural responsiveness in conjunction with the behavioural Go/No-Go tasks. Specifically, the N2 and the P3 waves will be analyzed, which will provide information about performance monitoring, and inhibitory control, respectively.

CHAPTER 5: DISCUSSION

The current study had two broad aims. The first was to provide clarity into the relations between Factor 1 and Factor 2 psychopathy, and explore these groups' genuine and posed identification abilities at the behavioural level. The second was to investigate these personality or trait dimensions in relation to response inhibition at the behavioural and neural levels. This exploration is the first known study to examine the perception of genuine and posed faces, and the influence of emotion on response inhibition in the same study, and the first to use EEG methods in conjunction with these combined topics. Moreover, it is one of the few to examine these collective variables in a community sample. Due to the low sample size ($N = 14$), dividing participants into groups based on their Factor scores resulted in minimal statistical power. Consequently, the proposed data analyses were slightly modified. With the addition of more data, there is potential to return to the previous hypotheses and proposal. Preliminary analyses in the form of t -tests and correlations have been completed, yielding a mixture of significant and non-significant results, as well as early trends. Broadly speaking, the GVP task has found a significant differences between angry and fearful percent correct responses, particularly for Factor 2. However, the genuine and posed classification analysis did not yield significant results, nor did Factor 1 display any notable deficits in completing the task. The Go/No-Go results displayed mixed findings in the correlational analyses, with most of the significant results occurring among Factor 1 and cognitive responsiveness.

Psychopathy and Emotion Identification

Factor 1 has been associated with a lack of understanding of, and emotional response to, emotionally potent facial expressions, notably fearful expressions (Blair & Coles, 1999; Brislin & Patrick, 2019; Dawel et al., 2019). Theoretically, if an individual is unable to experience an

emotion, such as fear, they may have difficulty recognizing and understanding fear in others. Moreover, if they cannot recognize the emotion itself, it would be possible that they may not be able to understand when someone is genuinely feeling such an emotion, and thus, they may commit more errors when attempting to classify the authenticity of a fearful face. The research in this area is extremely brief within the realm of psychopathy, as there this topic is generally unexplored. However, considering psychopathy is distinctly connected to difficulties identifying distress emotions, and grounded in traits such as emotional reactivity and callousness, it would be beneficial to understand the mechanisms behind their perception of emotion, and whether they have similar emotion authenticity differentiation abilities as the general population. Such knowledge could be valuable for clinical treatment in antisocial populations (particularly in forensic settings), who are known for elevated psychopathy traits.

The first research question investigated whether participants with elevated Factor 1 or Factor 2 psychopathy scores can accurately classify genuine and posed fearful and angry faces. The hypotheses stated that Factor 1 individuals would experience greater difficulty differentiating between genuine and posed faces, and moreover, they would display particular difficulty with fearful faces. Factor 2 was hypothesized to have little difficulty with this task. In both the individual and the grouped results, the current study found that the participants did not show differences in the correct identification of genuine over posed faces. However, when considering the overall correct scores (i.e., correctly identifying genuine versus posed faces), participants fared better at making these discriminations for fearful than angry faces.

The nonsignificant results of the genuineness aspect could be due to a number of potential glitches with the task, and the small sample size. Theoretically, it is possible that scoring highly on psychopathic traits is not related to ones' ability to differentiate the

authenticity of the facial emotions fear and anger. While some researchers posit that Factor 1's association with an inability to express, comprehend, or interpret fear should therefore lead to an inability to recognize genuine fear over posed in others (Hare et al., 1990; Hart et al., 1994; Ross et al., 2009), other researchers suggest Factor 1's high interpersonal manipulation would lead to an enhanced ability to make this distinction (Book, 2004). Further, Factor 1 individuals may not necessarily lack the ability to differentiate or process emotions; rather, they may not make their abilities obvious until they are sufficiently motivated to do so (Groat & Shane, 2020). In Factor 2, the literature suggests that although such individuals may be emotionally volatile, highly reactive, and socially inappropriate (Hart, 1994; Marsh, 2013; Yildirim & Derksen, 2015), they do not necessarily experience and difficulty differentiating the authenticity of others' emotions (Dawel et al., 2019).

The finding that fearful faces were easier than angry faces to classify regardless of psychopathy grouping aligns with the study by Dawel et al. (2019), as Angry faces were the least accurately classified. For Factor 1, the emotion correct results were similar (though not significant) to those of Factor 2: more fearful faces were classified correctly than angry faces. This finding runs contrary to the hypotheses, though there are a few possible intuitive suggestions that could explain this result. First, fearful faces may be more transparent in their authenticity (e.g., posed fearful faces could be greatly exaggerated by the actors) due to their emotional significance. For example, it is vital to understand when others are experiencing genuine fear due to a threatening stimulus (e.g., a predator); however, it is beneficial to know when others are feigning fear (e.g., joking with friends), to avoid excessive threat vigilance. Alternatively, since angry faces may be a valuable cue to imminent danger, the ability to recognize and understand this emotion could prevent people from accurately classifying the

expression's authenticity. For this reason, angry faces could be interpreted as genuine more broadly than fearful faces to ensure one steers clear of direct or immediate threats. Considering our sample's lower number of Factor 2 individuals, it is intriguing that their results are significant, while the results of Factor 1 were only trending. However, this could suggest that Factor 2 would be more adept at this task, which aligns with our hypotheses, as Factor 2 was predicted to experience little difficulty with this task due to their sensitivity to emotions and lack of issues interpreting and recognizing fear.

Though the participant sample is currently low, there may be other potential explanations for the non-significant findings. Firstly, the GVP task is the first of its kind to divide the facial stimuli into genuine and posed categories, rather than using a Likert scale of authenticity. The literature on this topic is scarce. As previous studies have noted (Bothwell et al., 1989; Meissner & Brigham, 2001), participant familiarity with a variety of ethnicities may have influenced their results. After testing, it was noted that several participants of Asian descent, who were international students, lacked experience with the ethnicities of the primary models used for the task stimuli (Caucasian and African American). The lack of familiarity with non-Asian faces may have influenced task performance.

Secondly, the amount of time allotted for participants to make their classifications was extremely limited (two seconds), which did not allow for deep emotion processing. Had participants been allowed to make purposeful decisions, they may have potentially made different judgements. While the task was designed with the intent of only allowing participants to make rapid, automatic decisions, they could have still benefitted from slightly longer trials. Further, the briefness may have resulted in many missed stimuli, particularly in early trials as participants were adjusting to the task. Additionally, the task was not equipped with a practice

round for participants to become familiar with their assignment. Due to time constraints, there was no proper pilot of the task, and thus, these factors were not considered.

Psychopathy and Percent Correct No-Go Responses

Response inhibition is an important component of social communication and behavioural regulation, as the ability to withhold a response may prevent making an inappropriate response, and aid in smooth and enjoyable communication. For instance, restricting the urge to interrupt when someone is speaking ensures all members of a conversation are respecting each other's time and listening to what the others have to say. Factor 1 is not associated with issues in response inhibition when completing behavioural inhibition tasks – rather, they may even display superior performance, though researchers are not certain of the reason (Haitt et al., 2004; Newman & Lorenz, 2003; Zeier et al., 2009). In contrast, Factor 2 individuals are known to be highly impulsive (Hare et al., 1994; Yildirim & Derksen, 2015), and have been shown to make greater errors in inhibition tasks (Feilhauer et al., 2012; Friedman et al., 2021; Zeier et al., 2012). Further, their emotional reactivity and regulation issues has been shown to further complicate their issues in emotional linguistic response inhibition tasks (Sprague & Verona, 2010). The literature did not extend these studies to emotional face response inhibition tasks, and thus, the present study will aid in filling the gap in the literature.

Based on previous literature, it was predicted that Factor 1 would have an average performance on the Go/No-Go tasks, with fewer commission errors due to their lack of response to distress emotions or sensitivity to emotional faces, as well as average levels of self-control. In contrast, Factor 2 was predicted to perform poorly on this task due to their low response inhibition, and emotional reactivity to emotive stimuli.

Neither Factor was significantly associated with commission errors (i.e., responding with a button press when they should have withheld their response), and therefore, the hypotheses were not supported. Interestingly, cognitive responsiveness was the only psychopathy subcategory of the PPTS-R to be significantly negatively correlated with commission errors. Cognitive responsiveness concerns the ability to understand the emotions of others and how to interact with them (Boduszek et al., 2018) – though in this questionnaire, scoring highly on this subscale indicates a decreased ability to do so. Therefore, the present findings show that as the ability to understand and react to others’ emotional states decreases, the percent of commission errors follows likewise decreases.

Cognitive responsiveness aligns theoretically with Factor 2 (social misunderstandings, lack of understanding others’ emotions, feeling misunderstood by others), though currently, there is no significant correlation between Factor 2 and cognitive responsiveness. Thus, perhaps cognitive responsiveness may be associated with the impulsive social behaviours of Factor 2, rooted in a lack of emotional stability and social inhibition skills. The lack of a significant relationship between Factor 2 and greater commission errors is a striking divergence with the literature, and thus, perhaps with the addition of participants, significant results may be found between these traits. If this were to occur, it would be surprising if commission errors continued to be negatively correlated with cognitive responsiveness.

Psychopathy and No-Go Response Times

As described above, Factor 1 has been associated with strong performance during Go/No-Go (and related) tasks, including average or reduced response times (Patrick et al., 1994; Sellbom & Verona, 2006). Due to their noted lack of hesitation when confronted with a distressing stimulus, it would be unlikely that they would display prolonged reaction times to

emotional face stimuli. Further, Factor 1 is under-aroused in presence of emotional stimuli may allow for higher task focus (Patrick et al., 1994). In contrast, while Factor 2 is high in disinhibition, their deficient social skills and emotion regulation challenges have been linked with increased reaction times in the presence of emotionally threatening words during response inhibition tasks (Sprague & Verona, 2010).

The second research question hypothesized Factor 1 would not be associated with increased reaction times to emotional stimuli, as their lack of emotional response to fear intuitively suggests they would not be inclined to hesitate to respond. Due to the lack of disruption induced by fearful or angry faces, Factor 1 should show decreased or average reaction times during the presentation of emotional faces (particularly fearful faces) and non-emotional faces. In opposition, Factor 2 was estimated to be associated with increased response times for fearful faces.

The former hypothesis was supported, as the findings reported decreased response times for Factor 1. In the presence of emotionally distressing or captivating stimuli, Factor 1 was able to respond rapidly, while the non-emotional condition was not associated with rapid responding. This result suggests Factor 1 was not phased or taken aback by the emotional faces – on the contrary, they had faster average response times to such stimuli than to the non-emotional faces. A recent study suggests that a low empathetic response to emotionally salient stimuli may result in superior performance when the stimuli meet a threshold of interest (Groat & Shane, 2020). [Note – the payment participants received to complete the tasks would not qualify as sufficient extra motivation, as they would receive compensation regardless of their performance.] In accordance with this hypothesis, perhaps the significance fearful and angry stimuli enabled individuals with higher Factor 1 traits to respond rapidly, while the non-emotional faces did not

provoke enough interest to elicit quick responses. Future neural results may enhance the theoretical background of these findings. Factor 1 is associated with a low neural response to fearful faces, while Factor 2 displays an elevated response (as seen in their waveforms, Brislin & Patrick, 2019). It will be intriguing to observe whether the present study's participants follow suit, as this could be indicative of the hallmarks of each Factor (callous unemotionality and emotion reactivity, respectively). However, if the findings diverge, and Factor 1 displays waveforms similar to those of Factor 2 or the general population, the hypothesis that motivation may be at play, as signaled by a higher response to emotional faces opposed to non-emotional faces.

Concerning Factor 2, there are two competing systems at play which could strongly influence their reaction time: disinhibition and emotion reactivity. Scoring highly on traits surrounding disinhibition, such as poor planning, impulsivity, and an inability to delay gratification would lead one to believe an individual with these traits has low self-control. Thus, poor regulation in many facets in one's life may be strongly associated with rapid responding, when given a task which encourages a series of quick decisions (e.g., a Go/No-Go task). The literature surrounding Factor 2 emphasizes each of the aforementioned traits of disinhibition (Clark et al., 2019; Patrick, 1994), leading to a prediction that Factor 2 individuals may display decreased response times in a Go/No-Go task. However, Factor 2 is almost equally centered in greater negative responses to distress, inappropriate social behaviours, and antagonistic emotions (Hart, 1994; Marsh, 2013). These sorts of traits and actions fuel an individual's reactivity, though they may also cause an emotional response which gives pause to action, as they are preoccupied with their internal reaction. A demanding emotional response could cause hesitation in emotional Go/No-Go tasks and thus increase reaction times in response to emotional stimuli. The

nonsignificant findings of the current study lean towards the latter explanation, though the expectation that the disinhibition would win out was not supported. However, future additions of participants may alter these results, so long as a full range of scores is acquired.

Future Directions and Limitations

The novel Genuine Versus Posed task was the first known task where participants differentiate between real and fake instances of angry and fearful faces, rather than using a Likert scale of genuineness. In the interests of scope, simplicity, and time, the study employed a simple binary classification method with a brief time limit (two seconds). Considering the results were only slightly greater than chance, there are likely flaws in the task's design. While this method may have provided the opportunity to gather data on rapid decision-making and classification skills (in conjunction with the later tests of response inhibition), it may be prudent for future studies to adhere to the prevailing scale method and allow participants ample time to complete the task. The use of a scale could also provide information on the degree to which certain stimuli are perceived to be genuine, rather than pure classification. Additionally, it would reduce the potential for a participant to have made an error pressing a button with the intention of responding to one face, but missing the opportunity, and therefore missing one stimulus and incorrectly responding to the next.

The stimuli used may have played a role in the non-significant findings. The KDEF package includes Caucasian faces only, while the GUR package incorporates faces of several ethnicities. It would be beneficial for future studies to have a single stimulus package with a mixture of genuine and posed faces of all ethnicities; however, currently there is no known set in existence. The GUR package used a variety of ages as well (not specified by the creators), including children and elderly individuals. As previously discussed, there may be a race/ethnicity

bias when participants experience difficulty recognizing or interpreting the emotions of ethnicities unlike their own (Wong et al., 2020). Future studies could delve into these effects in connection to genuine and posed facial expressions. There may be age biases (i.e., elderly faces incorrectly judged as posed more commonly than other age groups) which will be explored with the addition of more data. Until this time, it may be a limitation to have an unequal distribution of the age of the faces in the stimuli set, as the majority (especially after including the KDEF set) are approximately 30 years of age.

The current study has a few limitations. First, a substantial portion (50%) of the participants were international students (specifically, from India), which may have influenced their ability to classify the genuineness and the emotions of faces of unfamiliar ethnicities. While the facial stimuli of the No-Go tasks used a variety of ethnicities, none of these include persons of Indian descent. Second, while the Emotion Identification task was designed to capture participants' ability to rapidly assess the genuineness of fearful and angry faces, they were limited to a response time of two seconds. While many participants were able to respond within this timeframe, future studies could consider extending the limit to four or five seconds, to allow for more accurate and relaxed (yet rapid and instinctual) classifications. Finally, the total psychopathy scores of the sample population were low, which may contribute to the lack of significant results, and the lack of differences between the Factors. For a more robust examination of this studies research questions, a full range of scores from a community population is required.

Conclusion

In sum, the preliminary results of the current study have found mixed support for the hypotheses, though there is budding potential for each task to yield further significant results in

the future. The significant findings present were not uniformly predicted, as there was greater emphasis on the potential for Factor 1 to experience difficulty with the Genuine Versus Posed task, and Factor 2 to display greater commission errors and disruptions to their reaction time. However, psychopathy has been shown related to differences in reaction time, emotion modulation of response inhibition, and the ability to classify the genuineness of certain emotions, and the results of the current study may become more significant with a full range of psychopathy scores. The ability of all participants to accurately classify genuine and posed fear and anger is still a novel research topic, and thus, there are several avenues for exploration. While the GVP task did not conclusively suggest ease or challenge in genuineness assessment, it is clear there are differences in the ease of classifying emotion types. The question remains on whether each Factor will display the predicted neural responses to the emotion stimuli, and further data will likely round out the initial results.

Psychopathy is an extremely complex collection of traits, and it is evident that there are divergences between each Factor. In delving into the ability to recognize and comprehend the authenticity of facial emotion, we are learning how these trait groupings influence ones' ability to perceive emotion, and how this affects their behaviours and cognitions in social settings, and even predicts potential strengths and weaknesses that may help or hinder people throughout life. Investigating psychopathy, emotion understanding, and response inhibition at the behavioural and neural levels can improve the lives of those who are impacted by these traits, and enrich the greater literature in discovering the mechanics of these fundamental aspects of behaviour, perception, and personality.

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APPENDIX A:
INFORMED CONSENT AND FEEDBACK FORMS

INFORMED CONSENT FORM

Project Title: Assessing Response Inhibition and Face Processing in Relation to Personality Traits

Principle Investigator: Molly McGillivray

Research Purpose:

Individual differences in personality have been related to how quickly and intensely people process emotion. It is thought that these differences are driven in part by attentional biases to emotional stimuli, such as faces expressing emotion. For example, some individuals, depending on their personality style, may have tendencies to attend more rapidly to, and devote more attention to specific emotions displayed on faces (e.g., anger or fear). In this study, we will combine self-report and behavioural measurements to investigate how personality may influence how individuals attend to and discriminate facial emotions.

Research Description and Procedures

If you agree to participate in this study, you will first be asked to complete a short computerized behavioural task that will take approximately 5 minutes to complete. For this computerized task, you will view photos of faces on the computer screen, and you will be asked to press a button to designate whether you think the face is expressing genuine emotion or a posed facial expression. This task will take approximately 5 minutes. Next, you will complete 2 short paper and pencil questionnaires that will ask you about how you typically think and behave in certain situations (e.g., aversive, boring, or rewarding events). The questionnaires will take approximately 5-7 minutes each to complete.

Next, you will have a 5-minute break, and if you agree to continue with your participation in the next study, a researcher will begin to go over the consent form with you for the EEG study, “An ERP Study of Attention Biases in Young Adults: Associations with Behavioral Inhibition and Activation Systems”.

This information from this study will also be linked with the EEG tasks that you will complete in the next study. This additional information will help us to learn about how personality is related to the neural processing of emotion and behavioral control.

Potential Harm, Injuries, Discomforts, or Inconvenience:

There is no known harm associated with participating in this study. Risks are few and minor. Some questions may potentially touch on a few sensitive issues (e.g., issues surrounding grief or empathy), and so some mild emotional discomfort could be experienced by some participants. If you feel any discomfort, you are free to discontinue the questionnaire at any time. You can also refuse to answer certain questions if you feel that they make you uncomfortable.

There is no pressure to participate in this research and you may choose to cease your participation at any time. If you choose to withdraw and do not complete the experiment, your data will be discarded. Declining to participate or withdrawing from the study will in no way negatively impact your grade or status in your courses.

Potential Benefits:

You will not benefit directly from being in this study. However, your participation and completion of this study will contribute to our understanding of face processing in people who differ in personality styles and their ability to identify real and fake facial expressions of emotion.

Will my taking part in this project be kept confidential?

All information collected is confidential and will only be used as part of research work being carried out by the primary researcher/research assistants working directly for the primary researcher at Cape Breton University. Your contact details (i.e., name and email) will be stored separately from other data that is collected. To ensure that you cannot be recognised from the data, we assign each participant with a coded number for identification purposes. Data, when reported, will be in aggregate form. No personally identifiable information will be given out at any time. No personally identifiable information will be included in published findings from this study or in any data reports associated with this study.

The cash compensation that you will receive for this study will be handled through the finance department at Cape Breton University. The names of study participants will be submitted to the finance office for cash reimbursement to the project supervisor. When your name is submitted to the finance office, it will be submitted separately from all other data collected during the lab visit.

Who will have access to this research information?

Any information which you provide, including the questionnaires and behavioural data that is collected will be entered into a secure filing system or database in a locked laboratory. The information and data will only be accessed by authorized researchers involved in the project. The researchers are closely supervised by the faculty advisor, Dr. Michelle Jetha. Information will be kept indefinitely in the secure location.

Withdrawal by the participant

Participation in research is completely voluntary. If you choose to participate in this study, you may withdraw at any time without giving a reason. If you wish to withdraw after completing the questionnaires, completed questionnaires without your name will be kept for statistical purposes only.

Reimbursement:

For completing this study, you will receive a compensation of \$5.00.

What will happen to the study results?

The responses we collect during the experiment will be used to advance understanding of the brain mechanisms involved in the maintenance of personality styles, as well as facial emotion processing. The results from this study will be linked to the data from the EEG study. To maximise the value of this study and to ensure an open scientific process, it is our duty to share the results from this study with other researchers. We will present the results at conferences and publish it in appropriate outlets (e.g., academic journals). When we do this, we typically present the average result from a group of participants. The data will be presented anonymously so that no one would be able to identify you from the data. We will provide simple summary information about our participants (e.g., “40 individuals participated; their average age was 22 years”).

Feedback about the results of this study will be available by contacting the project supervisor through email after September 2023.

Ethical review of the study

The project has received ethical approval from the Cape Breton University Research Ethics Board.

Informed Consent

I _____ have been informed of the purpose of this research and agree to participate in this study.

Further information

If you have any questions or concerns about the study, please contact the Project Supervisor:

ResearchersProject Supervisor:

Dr. Michelle Jetha
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Cape Breton University
902-563-2814
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If you have any questions that have not been answered satisfactorily by the researchers named above, please contact one of the Board Co-Chairs, Tracey Harris (Tracey_Harris@cbu.ca), (902) 563-1328, or Bishakha Mazumdar (Bishakha_Mazumdar@cbu.ca) (902) 563-1132, or the Research Ethics Board Administrator, Jared Walters (Jarad_Walters@cbu.ca) at (902) 563-1107.

Appendix B

Levenson Self Report Psychopathy Scale

Instructions and Items

This 26-item questionnaire assesses primary and secondary traits in healthy, nonclinical, non-forensic populations (commonly used in university studies, e.g., Lynam et al., 1999). This scale is highly useful for distinguishing between factor 1 (items 1-16) and factor 2 (items 17-26) traits.

Directions: For each of the items below, please indicate how characteristic or atypical the statement is of you, using the following scale:

Strongly agree = 4

Agree = 3

Disagree = 2

Strongly disagree = 1

1. Success is based on survival of the fittest; I am not concerned about the losers.
2. For me, what's right is whatever I can get away with.
3. In today's world, I feel justified in doing anything I can get away with to succeed.
4. My main purpose in life is getting as many goodies as I can.
5. Making a lot of money is my most important goal.
6. I let others worry about higher values; my main concern is with the bottom line.
7. People who get ripped off usually deserve it.
8. Looking out for myself is my top priority.
9. I tell other people what they want to hear so that they will do what I want them to do.
10. I would be upset if my success came at someone else's expense.
11. I often admire a really clever scam.
12. I make a point of trying not to hurt others in pursuit of my goals.
13. I enjoy manipulating other people's feelings.
14. I feel bad if my words or actions cause someone else to feel emotional pain.
15. Even if I were trying very hard to sell something, I wouldn't lie about it.
16. Cheating is not justified because it is unfair to others

17. I find myself in the same kinds of trouble, time after time.
18. I am often bored.
19. I find that I am able to pursue one goal for a long time.
20. I don't plan anything very far in advance.
21. I quickly lose interest in tasks I start.
22. Most of my problems are due to the fact that other people just don't understand me.
23. Before I do anything, I carefully consider the possible consequences.
24. I have been in a lot of shouting matches with other people.
25. When I get frustrated, I often "let off steam" by blowing my top.
26. Love is overrated.

Appendix C

Psychopathic Personality Traits Scale - Revised

Instructions and Items

This 28-item questionnaire assesses psychopathy in healthy, non-clinical, non-forensic populations (most commonly, in undergraduate students) using four domains: affective responsiveness (7 items), cognitive responsiveness (7 items), interpersonal manipulation (7 items), egocentricity (7 items).

Directions: For each of the items below, please indicate how characteristic or atypical the statement is of you, using the following scale:

Strongly agree = 4

Agree = 3

Sometimes Agree = 2

Disagree = 1

Strongly disagree = 0.

1. Before slagging someone off (insulting them), I don't try to imagine and understand how it would make them feel.
2. I don't care if I upset someone to get what I want.
3. I know what to say or do to make another person feel guilty.
4. I tend to focus on my own thoughts and ideas rather than on what others might be thinking.
5. What other people feel doesn't concern me.
6. I don't take into account the other person's feelings before I do or say something, even if they may be affected by my behavior.
7. I'm good at saying nice things to people, to get what I want out of them.
8. I don't try to understand another person's opinion if I don't agree with it.
9. Seeing people cry doesn't really upset me.
10. I can guess how people will feel in different situations.
11. I know how to fake emotions like pain and hurt to make other people feel sorry for me.
12. No matter what happens and what people say, I'm usually the one who is right.

13. I don't feel bad when a friend is going through a tough time.
14. I can't really tell when someone is feeling awkward or uncomfortable.
15. I sometimes provoke people on purpose to see how they react in certain situations.
16. I'm happy to help somebody as long as I get something in return.
17. I don't really feel compassion when people talk about the death of their loved ones.
18. I find it difficult to understand what other people feel.
19. I'm good at pretending that I like someone if this will get me what I want.
20. Something has to benefit me, otherwise, I'm not willing to do it.
21. Seeing somebody suffer doesn't distress me.
22. I can see when someone is hiding what they really feel.
23. I would lie to someone if this gets me what I want.
24. I like it when people do as I say, regardless of whether I'm right or wrong.
25. It doesn't really bother me to see somebody in pain.
26. I find it hard to understand why some people get very upset when they lose someone close to them.
27. I'm good at getting people to do what I want, even if they don't want to at first.
28. How others feel is irrelevant to me, as long as I feel good.