# Investigating the effects of psychopathic traits on pain perception and empathy in non-clinical samples

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## Abstract

While there exists research examining psychopathic traits and their impact on empathy for others and pain responses in the self, there are gaps in the literature that need to be addressed. The present thesis aimed to address these gaps by conducting four research studies examining how psychopathic traits affect responses to pain perception for the self, pain empathy for others, and cognitive and affective empathy.

Firstly, to consolidate the research that exists within the field, a systematic review was conducted examining eight papers that studied pain experience and empathy for others' pain in psychopathic traits non-clinical samples. Next, a two-part study is presented. As there is very little research investigating triarchic psychopathy in relation to facets of empathy in men, women, and age, an online study using self-report measures was conducted in Study 1. Utilising the same dataset, Study 2 explored an insensitivity to pain when controlling for empathy in those with psychopathic traits within a non-clinical population. Lastly, a laboratory-based study was conducted using objective skin conductance responses (SCR) and self-report measures to assess pain perception and empathy for other people's pain.

In summary, the results of this thesis demonstrated differences in facets of triarchic psychopathy between men, women and age in non-clinical participants. Additionally, findings showed that those higher in psychopathic traits process pain stimuli differently, and this difference may depend upon the pain stimulus and data collection method. Further, the present thesis was able to extend findings suggesting that a deficit in empathy may have a physiological basis within psychopathic traits in the general population. Future research should investigate a psychophysiological basis for a lack of empathy in psychopathy, expand pain research using multiple stimuli and methods, and increase research conducted on females with psychopathic traits.

# Declaration

No portion of the work referred to in the thesis has been submitted in support of an application for another degree or qualification of this or any other university or other institute of learning.

**Publications relating to the work presented in this thesis:**

**Alshukri, S**., Lyons, M., Blinkhorn, V., Munoz, L., & Fallon, N. (2024). Psychopathy, pain, and pain empathy: A psychophysiological study. *Plos One*, *19*(7), e0306461. https://doi.org/https://doi.org/10.1371/journal. pone.0306461

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**List of other publications completed during the PhD but not directly related to this thesis:**

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Warsaw, R. E., Jones, A., Rose, A. K., Newton-Fenner, A., **Alshukri, S**., & Gage, S. H. (2021). Mobile technology use and its association with executive functioning in healthy young adults: A systematic review. *Frontiers in Psychology, 1*, 643542-643542. https://doi.org/10.3389/fpsyg.2021.643542

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# Chapter 1: General Introduction

Psychopathic traits have been widely researched in the context of how they affect responses to empathic and pain experiences. Despite the information that has been gained through these investigations, there are still gaps in the knowledge regarding empathic responses to other people's pain, and responses to directly experienced nociceptive stimuli in those with lower and higher levels of psychopathic traits. Due to this, the current thesis will address these gaps to deepen the understanding of how psychopathic traits effect pain and empathy experiences in non-clinical samples.

## Psychopathy Construct

Psychopathy describes a constellation of personality traits that encompasses affective and interpersonal deficits in addition to lifestyle and antisocial traits (Hare et al., 2009). As a predictor of violence and aggression (Garofalo et al., 2021a; Gillespie et al., 2023), as well as showing associations with intimate partner violence and bullying (Baroncelli et al., 2022; Robertson et al., 2020), psychopathic traits are an important construct to study due to their impact on others and the wider society (Garofalo et al., 2022).

While psychopathic traits are typically associated with individuals from clinical and institutionalised populations, these traits are also found within non-clinical groups within the general population (Boduszek et al., 2021; Sanz-García et al., 2021). That being the case, research has shown differences in psychopathy levels between different populations. For instance, prisoners have shown increased deficits in cognitive responsiveness compared to university students and community samples (Boduszek et al., 2021). However, students possessed higher levels of manipulative abilities than prisoners (Boduszek et al., 2021). Additionally, the prevalence of psychopathic traits was higher in forensic and prison samples compared to the general population (Boduszek et al., 2022; Sanz-García et al., 2021). This

evidence helps to show the fluctuations in psychopathic traits that need to be further investigated in non-clinical samples in the general population.

In addition to variations in psychopathic traits between populations, it has also been suggested that physiological similarities and differences exist in individuals with psychopathic traits. Findings propose that while criminal and non-criminals with psychopathic traits exhibited similar structural and functional brain characteristics, offenders showed increased arousal to violent scenes (Nummenmaa et al., 2021). Additionally, research found disrupted brain connections in male offenders with higher levels of psychopathic traits (Vermeij et al., 2018). These findings propose that differences in extreme impulsivity and offending between the two groups may have a neurological underpinning. Furthermore, incarcerated males higher in psychopathic traits exhibited lower skin conductance responses (SCR) to affective stimuli compared to a healthy control group (Pfabigan et al., 2015). These findings may indicate a physiological basis to the characteristics shown by those with higher psychopathic traits. However, as there has been a focus on research looking at psychopathic traits within clinical and institutionalised populations, by comparison, there exists a lack of examination of these traits within non-clinical samples. As such, psychopathic traits within non-clinical samples warrant further exploration as evidence points to a possible physiological basis for individuals' behaviours.

**Psychopathy Measures**

First described in Hervey Cleckley's seminal work 'The Mask of Sanity' (Cleckley, 1941), psychopathy was established as a distinct construct separate from other personality subtypes. This rudimentary work helped to lay the foundation for the development of numerous measurement tools to assess psychopathic traits in both clinical and non-clinical populations.

Psychopathy has been conceptualised in many ways, with two and three factor models providing distinct and overlapping features (De Brito et al., 2021). The Triarchic Psychopathy Measure (TriPm; Patrick, 2010) adopts a three-factor model of psychopathic traits comprising of boldness, meanness, and disinhibition. The facets of the TriPm represent three separate constructs with interrelated components (Patrick et al., 2012) and was developed as a means of combining existing models into one unitary construct (Patrick et al., 2012; Patrick et al., 2009). Boldness describes high social dominance, low anxiousness, and venturesomeness, meanness describes callousness, cruelty, aggression, and excitement seeking, and disinhibition describes impulsiveness, irresponsibility, and anger and hostility (Patrick, 2010). The TriPm incorporates both adaptive and maladaptive features of psychopathy, with each component representing positive and negative characteristics such as fearlessness, emotional resilience, and spontaneity (Bronchain et al., 2020; Patrick, 2022; Segarra et al., 2022; see General Methodology for further details). In addition, the TriPm has been used in both clinical and non-clinical samples, thus showing it can capture a wide range of psychopathic traits (Somma et al., 2019; van Dongen et al., 2017). As a result, the three-factor structure of the TriPm offers a nuanced approach to assessing psychopathic traits.

The triarchic structure of psychopathy (Patrick, 2010) was developed to encompass the diverse representations of psychopathy, including criminal and non-criminal samples, primary and secondary characteristics, and successful and unsuccessful definitions (see Patrick et al., 2009), as well as combining historical and modern perspectives (Evans et al., 2016). It was argued that existing measures did not capture the distinct constructs of psychopathy, thus the TriPm was established (Patrick et al., 2012).

The TriPm incorporates personality traits, behavioural tendencies, and emotional responses that aim to capture the complexities of psychopathic personality within its three facets (Patrick et al., 2009). Compared to other models (e.g., Psychopathy Checklist-Revised;

PCL-R; Hare, 2003; Psychopathic Personality Inventory-Revised; PPI-R; Lilienfeld et al., 2005), the TriPm aims to provide a more balanced representation of boldness and meanness characteristics, rather than a heavy focus on meanness (Patrick et al., 2012; van Dongen et al., 2017). Focusing primarily on meanness would provide an unbalanced emphasis on affective traits such as a lack of empathy while neglecting other critical and potentially adaptive aspects of boldness such as resilience to stress and fearlessness (Evans et al., 2016; Segarra et al., 2022; van Dongen et al., 2017; for further details on adaptive and maladaptive features of psychopathy, see General Methods). Thus, incorporating balance in the presentation of traits allows for a holistic evaluation of the personality. Nevertheless, understanding two-factor models, such as the PCL-R (Hare, 1991, 2003), remains essential as they that have been instrumental in assessing psychopathic traits.

In comparison to Patrick's (2010) three factor triarchic model, two factor models provide a different perspective of psychopathic traits. The PCL-R (Hare, 1991, 2003) was developed for use in criminal and offender samples, and is divided into two elements. Factor 1 comprises of interpersonal-affective traits such as manipulation and a lack of empathy, whereas Factor 2 consists of lifestyle-antisocial traits such as impulsivity and behavioural problems (Hare et al., 2005). To administer the PCL-R, a clinician or researcher needs to be trained and qualified and will use questionnaire responses in conjunction with details such as court and criminal records to determine a diagnosis (De Brito et al., 2021). As a result, it makes the PCL-R time consuming to use, and can be impractical in some situations, such as for data collection rather than diagnosis (van Dongen et al., 2017). However, when compared to one another, the TriPm showed associations with the PCL-R; meanness correlated with interpersonal, lifestyle and antisocial facets of the PCL-R, while boldness demonstrated associations with interpersonal and antisocial facets, and disinhibition related to lifestyle traits (Venables et al., 2014). This helps to provide validity and reliability to the triarchic

measure. Yet, while the two-pronged approach of the PCL-R is useful to measure personality traits that may help to identify risk factors related to psychopathic traits (Hare et al., 2020), the TriPm, in comparison, has less of a focus on criminality which may be more applicable to those in non-clinical populations (e.g., general population; Evans et al., 2016). However, the TriPm's conceptual framework also aligns with other three-factor models, such as Psychopathic Personality Inventory-Revised (PPI-R; Lilienfeld et al., 2005).

The TriPm has demonstrated alignment with similar three-factor models such as the PPI-R (Lilienfeld et al., 2005). The PPI-R is a 154 item self-report measure designed to assess psychopathy in non-clinical populations using three distinct components; fearless dominance (i.e., stress immunity, fearlessness), self-centred impulsivity (i.e., Machiavellianism, blame externalisation), and cold-heartedness (i.e., empathic concern; Lilienfeld et al., 2005). While the PPI-R has shown little convergence with tools such as the PCL-R (Hughes et al., 2013), it has shown good internal consistency with measures such as the TriPm (Drislane et al., 2017; Hall et al., 2014). For example, meanness of the TriPm loaded onto the cold-heartedness dimension of the PPI, suggesting the two constructs distinguish empathic concern in similar ways (Drislane et al., 2017). Additionally, some argue that the PPI is not as comprehensive in its representation of psychopathy as the TriPm due to exhibiting a large focus of criminality (Drislane et al., 2017), thus limiting the breadth of characteristics that should be captured when assessing this construct. As a result, the three-factor model of triarchic psychopathy (Patrick, 2010) was adopted to measure psychopathic traits due to capturing a range traits in non-clinical samples (Somma et al., 2019; van Dongen et al., 2017), incorporating adaptive and maladaptive features (Patrick, 2022; Segarra et al., 2022; for further details on adaptive and maladaptive features of psychopathy, see General Methods), and providing three distinct but interrelated facets to assess characteristics associated with psychopathy (De Brito et al., 2021).

**Prevalence of Psychopathic Traits**

As psychopathic traits were initially observed in men (Sica et al., 2021), research has heavily focused on this population. However, psychopathic traits also exist in women (Verona et al., 2018) but remain a largely unexplored sample (Tully et al., 2023). Yet, investigations into psychopathic traits between men and women have typically found that men tend to score higher on all three facets of psychopathy compared to women (Aluja et al., 2022). Despite that, individual differences have been found between aspects of psychopathy in both sexes. For example, while male offenders scored higher on lifestyle-antisocial traits, female offenders scored higher on interpersonal-affective traits (Carabellese et al., 2020). These variations were attributed to the different types of crimes committed; men tended to commit to rule-breaking, whereas women were involved in intrafamilial offences. Moreover, research demonstrated that men who displayed higher levels of interpersonal traits were less prone to experience negative emotions (i.e., depression, anxiety, stress), while women high in interpersonal traits were more likely to experience such emotions (Međedović et al., 2018). This suggests that for men in this circumstance, psychopathic traits could be beneficial. However, as a lot of the existing research has explored psychopathy in clinical and incarcerated samples in men, there has been limited exploration of the differences in psychopathic traits in women in non-clinical samples (Tully et al., 2023). This is important as dimensions of psychopathy may differ amongst these demographics (see Boduszek et al., 2021; Sanz-García et al., 2021), highlighting the need for further research to fully understand how psychopathic traits manifest in both men and women in non-clinical sample and to ensure a more comprehensive and gender-inclusive perspective on psychopathy. However, in addition to sex differences, age differences have also been found in psychopathic traits.

Age-related differences in psychopathic traits have highlighted important distinctions. Firstly, research has shown younger incarcerated women and men scored higher in antisocial

and impulsive traits compared to older inmates (Huchzermeier et al., 2008; Maurer et al., 2022). In addition, affective and interpersonal traits were more prominent in younger adults (Baglole et al., 2022), whilst psychopathic traits generally tended to decrease as people aged (Hartung et al., 2022). These findings help to show the complex interplay of age and sex on psychopathic traits, and that there may be generational differences. Considering this, what then are the reasons for these differences in psychopathic traits?

Several possible explanations for differences in psychopathic traits between men and women have been posited. Firstly, research has shown that, compared to men, women may rely on manipulation more than physical aggression to achieve their goals (Nicholls et al., 2005). This could be attributed to women typically being smaller in stature compared to men (Efferson et al., 2018). Supporting this notion, research on forensic psychiatric patients has found that women tend to appear less physically violent when presenting to treatment, and instead used more subtle manipulative strategies (de Vogel et al., 2016). Furthermore, women higher in psychopathic traits did not display the same level of emotional processing deficits compared to men (Efferson et al., 2018). In fact, women scored higher on emotional intelligence (EI; the ability to process and understand emotions; Mayer et al., 2016) compared to men (Edwards et al., 2019). This may help to explain the higher levels of affective traits that women with psychopathic traits tend to display (Carabellese et al., 2020). Lastly, research has shown that there may be physiological differences in psychopathic traits between men and women. For instance, lower heart rate changes related to greater levels of meanness and antisocial behaviours in female university students (Delk et al., 2020). Further, fearless dominance scores were associated with lower heart rate changes in female but not male students (Branchadell et al., 2023). However, men showed greater cardiac reactivity to a physiological indicator of fearlessness compared to women (Segarra et al., 2022), which may indicate an underlying biological difference in psychopathic traits. Another non-invasive

method of physiological measurement is skin conductance response (SCR). SCR is part of the sympathetic nervous system (SNS) and has been largely unexplored within psychopathic traits. Thus, conducting experiments using SCR could help to uncover physiological differences within psychopathy to deepen knowledge and understanding.

**Sympathetic Nervous System**

Research has indicated that individuals with psychopathic traits may show altered SNS activity to emotional triggers (e.g. Thomson, 2022; Thomson et al., 2019a; Wagner et al., 2020). As a branch of the autonomic nervous system (ANS; Lovallo et al., 2016), the SNS acts as a response system during 'fight or flight', or stress states (Lovallo et al., 2016). For example, heart rate increases, blood flow redirects to vital muscles, and pupils dilate (Lovallo et al., 2016; Peate, 2017; for further information, see General Methods). Yet, physiological responses from those with psychopathic traits are shown to be distorted (e.g. Thomson, 2022; Thomson et al., 2019a; Wagner et al., 2020). For instance, in a sample of undergraduate students, the co-inhibition of respiration rates and SCRs related to interpersonal traits of psychopathy, whereas lower SCRs alone related to higher levels of psychopathic traits (Thomson, 2022). Due to this, using an objective measure of SNS activity is important as it will help to highlight possible underlying explanations for psychopathic traits and their associated behaviours.

Responses to stimuli in individuals with psychopathic traits can be objectively measured using an indirect effect of the SNS such as electrodermal activity (EDA; Dawson et al., 2016). EDA is a biomarker for arousal (Christopoulos et al., 2019) and describes autonomic changes in the electrical properties of the skin; this can take the form of SCRs (Bari et al., 2018). Evidence for the use of SCR in psychological research has come from associations with anxiety, and responses to threat and fear (Abend et al., 2020; Christopoulos et al., 2019). However, research has uncovered differences in SCR in individuals with certain

traits, such as psychopathy. For instance, youth high in callousness showed lower SCRs when presented with threatening stimuli such as a rollercoaster drop (Centifanti et al., 2022). Furthermore, findings from incarcerated offenders with psychopathy propose a disconnect between SCR and self-report responses to other people's pain (Pfabigan et al., 2015). While offenders higher in psychopathic traits self-reported empathy for other people's pain, their physiological responses remained reduced (Pfabigan et al., 2015). This has been further supported by evidence showing that when presented with a social stressor, participants with higher levels of psychopathy were unable to report body sensations that were objectively identified through SCR and heart rate activity (Gao et al., 2012). This helps to show there may be a discrepancy between the self-reporting of physical body sensations and the body's autonomic responses in individuals higher in psychopathic traits. Therefore, using SCRs to measure physiological responses in psychopathy is valuable for identifying differences in reactions to stimuli.

There are many advantages to using SCR in psychological research. Firstly, using an objective measure such as SCR negates issues such as social desirability bias found in self-report measures like questionnaires, and instead captures unconscious physiological responses (Hibbing et al., 2019). This is an especially important feature when testing a population known for its manipulative and deceptive characteristics (i.e., psychopathy; Patrick et al., 2009; Ray et al., 2013). In addition, SCR offers a non-invasive way to capture physiological activity that helps to better understand emotional experiences (Novak, 2019). This means that discomfort and risk of harm to participants is kept at a minimum. Lastly, SCR is a sensitive measure that helps to index physiological arousal (Rosebrock et al., 2017). As such, SCR may detect subtle changes in arousal that self-report measures may not capture. Together, this makes SCR a useful objective resource for individuals with psychopathic traits

as this can help to uncover objective discrepancies or differences to emotional, fearful or painful events.

**Pain**

Responses to painful nociceptive stimuli in those with psychopathic traits has become an increasingly important topic to study for several reasons. To start, findings have indicated that individuals exhibiting psychopathic traits responded to nociceptive stimuli differently. For example, those on the higher end of the psychopathy spectrum displayed higher tolerances to painful nociceptive stimuli compared to those lower in psychopathy (Brislin et al., 2016; Brislin et al., 2022). Further, research suggests that a lack of understanding of pain in individuals higher in psychopathic traits may influence the lack of empathy for others (Brazil et al., 2022). This was demonstrated by diminished self-reported and physiological responses to others' pain. As a result, individuals higher in psychopathic traits may display aggressive and violent behaviours towards others (Mayer et al., 2018; Rijnders et al., 2021). Consequently, investigating the perception of pain in psychopathic traits will offer valuable information needed to untangle this complex relationship.

Pain is a subjective experience that involves the risk of actual or impending harm (IASP, 1994b). The experience of pain is generated from a nociceptive stimulus that creates or threatens to create injury, such as heat, pressure, or electrical stimulation (Mischkowski et al., 2018; Walters et al., 2019). Due to this, pain may be an evolutionarily adaptive feature that helps one to produce defensive responses, such as 'fight or flight', to avoid harm (Himmel et al., 2019; Woolf, 2010). When experiencing pain, distress is typically communicated through vocalisations and facial expressions to attract the help of others (Dawel et al., 2012). However, those with higher levels of psychopathic traits have shown associations with reduced attention to distress (Anestis et al., 2022; Kaseweter et al., 2019), as well as blunted responses in pain perception, and higher tolerances to pain generated by

nociceptive stimuli (Brislin et al., 2016; Brislin et al., 2022). These findings suggest that individuals higher in psychopathy may process pain stimuli differently than others.

**Psychopathy and Pain Tolerance**

Psychopathy has long been associated with a higher tolerance of pain (e.g. Fedora et al., 1993; Lykken, 1957). An early piece of research in the field examined physiological responses to pain stimuli and their relation to fear and anxiety (Lykken, 1957). When using SCRs to measure arousal to electrical shocks, findings revealed those higher in psychopathy had lower SCRs to shock stimuli compared to those lower in psychopathy. In addition, psychopathic traits were related to less avoidance of electric shocks. Furthermore, as lower SCRs in those higher in psychopathic traits could be interpreted as lower levels of anxiety to fearful stimuli, this reduction in anxiety may underlie antisocial and risk-taking behaviours seen in psychopathic personality (e.g. Book et al., 2022; Cardinale et al., 2021). Consequently, early work such as the study above helped to lay the foundation that future studies built upon.

Since Lykken's (1957) study, further research has been conducted looking into the explanations underlying psychopathic personality and pain experience, albeit limited in its quantity. Findings have generally showed that individuals higher in psychopathic traits experience nociceptive pain differently to others (Brislin et al., 2016; Brislin et al., 2022; Durand et al., 2017; Seara-Cardoso et al., 2015). For instance, neuroimaging indicates atypical and blunted neural responses to pain (Brislin et al., 2022; Seara-Cardoso et al., 2015) while self-report data has demonstrated lower levels of fear and anxiety to pain (Brislin et al., 2016; Durand et al., 2017). These lower levels of fear and anxiety in higher levels of psychopathic traits could help to explain reduced responsiveness to distressing stimuli. For instance, evidence shows blunted SNS activity related to higher affective and antisocial traits within psychopathy during an interactive horror game (Thomson, 2022). Additionally, when

watching footage of a video designed to either induce excitement or fear, those higher in psychopathic traits used more positive adjectives to describe the experience of fear (Book et al., 2020). Consequently, blunted responses to distressing, fearful, and anxiety-inducing stimuli may extend to pain experiences since pain is a form of distress (Rogers et al., 2018).

A general tolerance for higher levels of nociceptive pain stimuli has been demonstrated in individuals with higher levels of psychopathic traits, although there have been discrepancies in findings (e.g. Berluti et al., 2020; Miller et al., 2013). A tolerance of pain describes the level of a physical nociceptive stimulus that an individual is willing to withstand before it becomes unbearable (IASP, 1994a). In individuals with psychopathic traits, a higher tolerance of pressure and electric shock stimuli has been found, but this was not the case with cold temperatures (Miller et al., 2013). However, evidence has also demonstrated no associations between psychopathy and nociceptive pain experience when applying pressure between the knuckles of fingers and measuring neurological activity (Berluti et al., 2020), challenging the notion of reduced perception of pain in psychopathic traits when exposed to certain experimental conditions. Further, a higher tolerance of pressure has been related to a history of antisocial and aggressive behaviours in community samples (Miller et al., 2013), whereas higher scores of meanness negatively correlated with pressure tolerance in undergraduate students (Brislin et al., 2016; Brislin et al., 2022). The differences in the limited number of findings may be explained by different methods of measurement (e.g. self-report, behavioural measures, physiological measures), as well as different modalities of nociceptive stimuli (e.g., pressure, electric shock, cold temperatures). Therefore, there is a need to explore responses to pain using both self-report and objective measures to address the discrepancies in findings.

Next, differences in the perception of pain in individuals with psychopathic traits have also been noted. It has been suggested that painful nociceptive stimuli may not be salient for

individuals high in psychopathic traits, leading to less attentional prioritisation (van Heck et al., 2017). Research has found that traits of boldness and disinhibition were negatively related to a fear of pain, meaning as levels of traits increased, a fear of pain decreased (Brislin et al., 2016), whereas higher levels of meanness were not associated with lower ratings of self-perceived pain (Brislin et al., 2022). Furthermore, elevated scores on the lifestyle, affective, and interpersonal facets of psychopathy were associated with lower estimates of own pain distress when assessed using a moral dilemma task (Brazil et al., 2022). In contrast to this, in a two-part follow-up experiment, disinhibition was negatively associated with pressure ratings, suggesting that pain experiences were remembered as being less intense and pain perception may be diminished (Brislin et al., 2016). Moreover, female prisoners higher on psychopathic traits showed reduced brain connectivity in emotional processing areas when completing a pain perception task (Yoder et al., 2022). Together, these findings provide a mixed and unclear understanding of pain perception in psychopathic traits, indicating a necessity for further exploration.

**Why Study Pain Perception in Psychopathy?**

There is a critical need to investigate the relationship between psychopathy and pain perception to address key gaps in the literature. Firstly, some of the existing research on nociceptive pain experience in psychopathic traits has been conducted in criminal or incarcerated samples (e.g. Pfabigan et al., 2015; Yoder et al., 2022). While these findings are valuable, they may not be generalisable to non-clinical samples within the general population, which limits understanding of how psychopathic traits influence pain perception in the broader population. Investigating pain responses in relation to psychopathic traits in non-clinical samples could help to determine whether these findings expand to such populations or differ significantly.

Second, adopting a valid pain stimulation method is important to ensure valid and reliable results. Pressure stimulations are reported as a valid and reliable method of inducing pain, activating regions of the brain associated with pain processing (Jackson et al., 2020; Lacourt et al., 2012). Unlike other forms of pain stimulation (e.g., electrical stimulation), pressure-based methods may better mimic the types of pain experienced in everyday life, thus enhancing ecological validity and the generalisability of findings.

Lastly, recent research has suggested that the ability to estimate the distress of others is linked to the capacity to rate one's own pain distress (Brazil et al., 2022). Given that empathy deficits are a core feature of psychopathy, understanding how individuals higher in psychopathic traits perceive and interpret their own pain could provide an insight into the underlying reasons for their reduced levels of empathy for others. If individuals higher in psychopathy experience lower levels of nociceptive pain, this could contribute to diminished sensitivity to others' pain, which could impact emotional and social functioning.

Taken together, these concerns highlight the importance of exploring pain perception in psychopathic traits in non-clinical samples. By addressing these research gaps, this thesis can provide a more comprehensive understanding of how psychopathy influences pain perception, and its broader implications for processes such as empathy.

**Empathy**

Empathy is an important skill that is used to help navigate day-to-day life by facilitating our ability to understand and communicate with others (Fallon et al., 2020; Lockwood, 2016). However, empathic processes in those with higher levels of psychopathic traits significantly differ from those with lower levels of psychopathic traits (e.g. Burghart et al., 2022; Campos et al., 2022). Further, while the capacity to resonate with another's emotions facilitates social bonding and prosocial behaviours (Decety et al., 2012; Decety et al., 2011; Riess, 2017), individuals with higher levels of psychopathy display poorer levels of

these behaviours which may impact empathy for others (Viding et al., 2019; Waller et al., 2020; White, 2014). In fact, research suggests that adopting empathy helps to inhibit harmful behaviours and encourages altruism (Ferguson et al., 2021; Stevens et al., 2021; Trivedi-Bateman et al., 2022). Due to this, exploring empathy within psychopathic traits is crucial to further understand this complex topic.

Empathy is a continuous construct broadly defined as an affective state caused by the sharing of emotions (Seara-Cardoso et al., 2012), yet, this capacity is hampered in those with psychopathic traits (Luckhurst et al., 2017). Empathy can be divided into two facets: cognitive and affective. Cognitive empathy describes the ability to understand what others are feeling or taking their perspective (Singer et al., 2009), whereas affective empathy describes being able to experience and feel what others are feeling (Singer et al., 2009). These facets have been operationalised and transformed into assessment tools that have been used in samples such as those with psychopathic traits.

While numerous tools have been developed to measure empathy, the present thesis adopted the Interpersonal Reactivity Index (IRI; Davis, 1980). The IRI is a 28-item self-report measure and is divided into 4 subscales: perspective taking, fantasy, empathic concern, and personal distress. Perspective taking describes the ability to adopt others' points of view, whereas the fantasy scale relates to imagining oneself in fictional situations and relating to those characters. Both measures are designed to measure cognitive empathy. On the other hand, empathic concern assesses the feelings of concern for others, and personal distress measures experiences of unpleasant feelings when observing another's negative situations. These two facets measure affective empathy levels. However, empathic processes appear different in some populations, such as those with higher levels of psychopathy (Burghart et al., 2022; Campos et al., 2022). For example, individuals higher in psychopathy have shown lower levels of reactions to, and recognition of, other people's emotions (Fanti et al., 2017b;

Gillespie et al., 2019). Furthermore, variations in empathy levels are also seen between sex and age (e.g., Gilet et al., 2013; Pang et al., 2023; Proverbio, 2023; Sun et al., 2018). For instance, women tend to show higher levels of empathy compared to men (Pang et al., 2023; Proverbio, 2023), whereas aspects of cognitive empathy showed a decline in older participants compared to their younger counterparts (Gilet et al., 2013). As a result, investigating empathy and its facets in these populations is vital to uncover distinctions that may exist.

**Psychopathy and Empathy**

Individuals exhibiting higher levels of psychopathic traits typically display lower levels of empathy compared to those with lower levels of psychopathy (e.g. Campos et al., 2022). This typically manifests as relatively intact cognitive empathy skills compared to a deficit in affective empathy (Campos et al., 2022). Consequently, a lack of empathy in those with higher psychopathic traits can result in broader implications. For example, an outcome of a lack of empathy within psychopathic traits can be a strain on the capacity to develop meaningful and deep social connections (Kyranides et al., 2023). This is evidenced by fleeting relationships in those with psychopathy (Golmaryami et al., 2021). In addition, lower levels of empathy are also seen to relate to increased instances of aggressive and antisocial behaviours (Garofalo et al., 2021a; Gillespie et al., 2023). Given that empathy deficits are a core feature of psychopathy (Hare et al., 2009; Viding et al., 2014), it is important to investigate their impact using objective and rigorous methods, such as physiology.

Using assessment methods such as physiology to investigate a lack of empathy within psychopathic traits provides an objective evaluation of responses and can help to combat limitations of self-report methods (Hibbing et al., 2019; Rosebrock et al., 2017). As a result, researchers have used a variety of physiological methods within emotion recognition studies to help to offer insights into emotional arousal. Firstly, using pupillometry techniques to

measure arousal to affective stimuli, male prisoners with a history of sexual or violent offences viewed a range of facial expressions. Results found that callous features were related to impaired recognition of fearful faces, as well as reduced pupil dilation to fearful, happy and sad expressions (Gillespie et al., 2019). These findings suggest that callous traits may underlie deficits in emotional responsiveness. In contrast to this, when assessing criminal and non-criminal's facial muscle responses to positive (i.e., happy) and negative (i.e., angry, sad) emotional expressions of others, no significant findings emerged (Künecke et al., 2018). Yet, individuals higher in psychopathic traits did not have difficulty reflecting the positive emotions of others, such as happiness and joy (Khvatskaya et al., 2016). However, when viewing negative emotions such as anger, fear, and sadness, those higher in psychopathic traits showed less facial muscle activity (Khvatskaya et al., 2016). While results are mixed, physiological research helps to detect reduced arousal and attention in response to others' negative emotions. Consequently, these findings for reduced physiological arousal to negative emotional stimuli may transfer to a lack of empathy in psychopathic traits.

Research suggests there may be a physiological foundation for reduced levels of empathy in individuals with high levels of psychopathic traits (Fanti et al., 2017b; Fanti et al., 2016). Specifically, individuals high in callous-unemotional (CU; the affective dimension of psychopathy; Pisano et al., 2017) traits showed reduced facial reactions of fear and disgust when viewing violent films, suggesting low levels of empathic concern to others' distress (Fanti et al., 2017b). Similarly, when measuring involuntary defensive eye-blink startle reflexes to acoustic probes during violent, comedy, or neutral films, higher CU traits were associated with diminished startle potentiation to violent films, whereas impulsive aggression was associated with increases in startle potentiation (Fanti et al., 2016). This implies that CU traits are related to low arousal and defensive reactions to negative stimuli, whereas impulsive aggression is associated with levels of increased arousal to such stimuli.

Accordingly, such features may underlie fearlessness and unemotionality in psychopathic traits (Branchadell et al., 2023; Thomson et al., 2019a), as well as negative emotionality and anxiety (Fanti et al., 2016). Moreover, in a sample of young adults, CU traits were associated with lower levels of sympathy toward victims as well as lower ratings of fear and sadness during violent scenes (Fanti et al., 2017a). This was demonstrated via low startle potentiation and self-reported affective ratings. As well as this, grandiose-manipulative traits were associated with low arousal, which was indicated by low heart-rate activity in response to violent films (Fanti et al., 2017a). Collectively, these findings indicate that individuals with high levels of psychopathic traits, and particularly elevated affective traits, demonstrate reduced physiological responses to affective and empathic stimuli. Given psychopathy has shown a relationship with a lack of empathy to other's emotions and distress, it is important to assess whether a lack of empathy also applies to other circumstances, such as pain.

Since pain is an extension of distress (Rogers et al., 2018), questions have been raised as to whether those with higher levels of psychopathic traits experience a lack of empathy to other's pain. A review revealed that there may be an extensive overlap in brain regions associated with empathy for pain and the direct experience of pain (Fallon et al., 2020). Findings suggests that empathising with someone else's pain may activate the same neural regions as when experiencing pain. This significant finding proposes that directly experienced pain and empathy for others' pain may be interconnected; this may explain pain perception and empathy deficits seen in those with higher levels of psychopathic traits. Moreover, one's experience and knowledge of pain experiences may modulate arousal to other people's pain (Decety, 2011). For instance, a higher tolerance of pain in those with higher levels of psychopathic traits may act as an underlying influence, leading to the underestimation of other people's pain experience (Branchadell et al., 2024). As a result,

others' pain experience may not be perceived as painful in those with higher levels of psychopathy.

**Psychopathy, Empathy, and Pain Tolerance**

Researchers have strived to investigate the relationship between empathy for others' pain in psychopathic traits. To start, evidence has found higher psychopathic traits in incarcerated females related to atypical brain activity when trying to understand another's pain experience (Yoder et al., 2022). When watching images of hands and feet in painful and matching non-painful situations, participants showed unusual functional connectivity in the salience network (Yoder et al., 2022). In other words, when trying to understand someone else's feelings, parts of the brain associated with emotional responses communicated differently with each other, leading to a reduced ability to understand other people's distress. Furthermore, in a sample of violent incarcerated offenders, those with low and high levels of psychopathic traits showed reduced SCRs when viewing video clips of other people in pain, compared to healthy age-and-intelligence-matched controls (Pfabigan et al., 2015). However, inmates higher in psychopathic traits were able to provide empathy ratings that were comparable to the healthy control group, making them appear empathetic while not physiologically *feeling* the emotion. This helps to demonstrate that inmates with higher psychopathic traits displayed intact cognitive empathy but ineffective affective empathy abilities when viewing the pain of others. In addition, when adopting an electroencephalogram (EEG) to access facial processing in a sample of undergraduate students, those higher in callousness displayed reduced reactivity to fearful faces as well as reduced accuracy in identifying them (Brislin et al., 2019). Consequently, evidence helps to show that individuals with higher levels of psychopathic traits display a clear deficit in empathic abilities that self-report measures and physiological data may be able to uncover.

This is crucial as psychopathic traits and a lack of empathy for others relate to risk-factors such as harm and aggression (Shafti et al., 2021).

As psychopathic traits are simultaneously associated with aggression towards others (i.e., a lack of empathy) and behaviours that may cause harm to oneself (i.e., a higher tolerance of pain), the theory of dual-harm has been postulated (Shafti et al., 2021). The concept of dual-harm suggests that the co-morbidity of both self-harm and aggressive behaviours towards other people relate to shared risk-factors such as impulsivity, a lack of behavioural control, and emotional dysregulation (Boxer, 2010; Garofalo et al., 2021a; Sahlin et al., 2017). Despite the misconception that those with higher levels of psychopathic traits do not experience emotions (e.g. Garofalo et al., 2019), individuals with these traits do feel emotions, but may have trouble with emotion regulation (i.e., emotion dysregulation; Baskin-Sommers et al., 2016; Garofalo et al., 2020). As a result, in addition to dual harm, the concept of emotional dysregulation has been affiliated with individuals with higher psychopathic traits.

A disregard of the emotions of others in those with high psychopathy traits may stem from emotional dysregulation (Burghart et al., 2024). Emotional dysregulation describes the decrease in emotional awareness, inadequate emotional reactivity, emotional rigidity, and intense experiences and expressions of emotions (D'Agostino et al., 2017). In recent studies, emotional dysregulation has shown negative associations with higher psychopathic traits (Garofalo et al., 2020; Garofalo et al., 2018, 2021a). In fact, literature has demonstrated that a failure to contain emotions (i.e., under-regulation) or the suppression of emotions (i.e., over-regulation) resulting from emotion dysregulation (Garofalo et al., 2018; Roberton et al., 2012) may lead to a disregard of the pain of others (Burghart et al., 2024). This is due to the combination of a lack of empathy for others and deficient emotional control stemming from emotional dysregulation; this could result in emotions being misdirected towards others

(Burghart et al., 2024; Preston et al., 2020; Shafti et al., 2021). As a result, those who engage in dual-harm behaviours may represent a group that is prone to harmful behaviours both towards others and themselves (Shafti et al., 2021). However, while the idea of dual harm is still in its infancy, adding to this theory is beneficial as it can help to provide a deeper understanding of the behaviours displayed and inform more effective treatment and intervention plans.

**Thesis Aims**

This thesis aims to investigate the relationship between triarchic psychopathy, pain perception for the self, pain empathy for others, and cognitive and affective empathy. Higher levels of psychopathy are associated with increased levels of antisocial behaviours, aggression and violent crimes (Garofalo et al., 2021a; Gillespie et al., 2023; Robertson et al., 2020), which may be driven by deficits in empathy and differences in pain processing. Individuals higher in psychopathic traits often display higher tolerances for nociceptive pain (Brislin et al., 2016; Brislin et al., 2022; Miller et al., 2013) and lower levels of empathy for others (Fanti et al., 2017b; Gillespie et al., 2019; Khvatskaya et al., 2016). Due to this, investigating these relationships in non-clinical samples is essential to aid understanding of how pain perception and empathy deficits contribute to negative outcomes associated with psychopathic traits.

Previous research has shown that individuals higher in psychopathic traits demonstrated higher tolerances for pain, including pressure and electric shock stimuli (Brislin et al., 2016; Brislin et al., 2022; Miller et al., 2013). This heightened pain tolerance may be linked to a diminished capacity for empathy for others since a reduced capacity for pain may impair the ability to relate to others' pain, hence impacting the understanding of others' experiences (Branchadell et al., 2024). Key studies have indicated a relationship between psychopathic traits and a tolerance for pressure and electric shock stimuli (Brislin et al., 2016;

Brislin et al., 2022; Miller et al., 2013). In addition, neuroimaging indicates atypical responses to pain in those with psychopathic traits (Seara-Cardoso et al., 2015), further suggesting that higher levels of psychopathic traits are associated with diminished sensitivity to pain. However, there is a lack of research looking at empathy for other people's pain experiences.

The relationship between pain tolerance and empathy for others' pain experiences remained unexplored. While psychopathy is characterised by a lack of empathy for others (Patrick et al., 2009), empirical studies have mainly focused on reduced empathy for emotions such as anger, fear, and sadness, with higher levels of psychopathy showing associations with lower physiological responses to these emotions (Fanti et al., 2017b; Gillespie et al., 2019; Khvatskaya et al., 2016). Further, this lack of empathy demonstrated in the literature may have a possible neurological basis; review evidence has highlighted possible neural networks involved in empathy processing (Fallon et al., 2020). Interestingly, these networks are shown to share pathways with experiencing pain (Fallon et al., 2020). Therefore, a lack of empathy for others as well as higher tolerances for pain may be interrelated and needs to be explored further.

However, despite these interesting and pivotal connections in the field, there is a significant gap in the literature regarding how psychopathy relates to empathising with others' pain experiences, and how this may relate to perceptions of pain in oneself. Although the shared neural pathways between empathy and pain processing have been highlighted (Fallon et al., 2020), the relationship between empathy for other people's pain and an individual's perception of pain has not been fully explored within psychopathic traits. This gap in the literature provides an opportunity for the present thesis to explore and could yield new insights into both the nature of psychopathic traits and the implications on pain perception and empathy for other people, especially other people's pain.

**Thesis Chapters Outline**

Chapter 2 consists of an overview of the methods used in this thesis. Specifically, this chapter details the self-report and experimental measures that were adopted, and the reasons for why each method was used.

Chapter 3 contains a systematic review that consolidates research investigating a tolerance for nociceptive pain, and empathy for other people's pain, in individuals with low and high levels of psychopathic traits within non-clinical samples following PRISMA guidelines (Alshukri et al., 2025). This review allowed for the exploration of existing literature to identify trends within the field.

Chapter 4 explored triarchic psychopathy and their effects on empathy and sensitivity to pain. Two studies were conducted; Study 1 investigated triarchic psychopathy, and cognitive and effective empathy in males and females and between age groups, while Study 2 explored psychopathic traits and sensitivity to pain when controlling for self-reported empathy. As previous research has shown differences in empathy levels in those with higher psychopathic traits (van Dongen et al., 2018), as well as between men, women, and age groups (e.g., Aluja et al., 2022; Baglole et al., 2022; Maurer et al., 2022; Sun et al., 2018), an online, non-clinical sample was recruited to complete both psychopathy and empathy measures to look for similarities and differences between men and women and age. This was especially important as women are underrepresented in psychopathy research. Study 2 utilised the same sample as Study 1, and investigated how the perception of pain sensitivity may be altered in those with psychopathic traits (namely boldness, meanness and disinhibition of the TriPm) when controlling for empathy levels. As individuals with psychopathic traits are known to lack empathy for others (see Campos et al., 2022), empathy was controlled for as a possible confounding factor so the effects of psychopathy on pain sensitivity could be reliably tested.

Lastly, Chapter 5 comprises of a laboratory-based study. This study objectively assessed physical nociceptive pain perception and empathy for other people's pain in individuals from a non-clinical sample with low-and-high psychopathic traits (Alshukri et al., 2024). This involved applying pneumatic pressure to the finger bed of the non-dominant hand and measuring SCRs and self-report responses to pain stimuli. Following this, participants' empathy for other people's pain was assessed. Participants were shown images of feet and hands in painful situations, such as a hand trapped in a car door or a foot standing on a fractured piece of glass, and graphically matched non-painful scenes. SCRs and self-report responses to empathy stimuli were also recorded. Self-reported psychopathic traits (Patrick, 2010) and empathy levels (Davis, 1980) were also measured (Alshukri et al., 2024).

# Chapter 2: General Methods

## Psychometric Measurement

### *Psychopathy Assessment*

**Triarchic Psychopathy Measure.** The Triarchic Psychopathy Measure (TriPm; Patrick, 2010) is comprised of 58-items that were developed from a triarchic perspective of psychopathy by Christopher Patrick (Patrick, 2010; see Appendix 1). This measure was designed to integrate previous conceptualisations of psychopathy into three distinct but interconnected facets (Patrick, 2010). Additionally, as criminal behaviours may not be a central component of psychopathic personality, studying psychopathy outside of forensic samples helps to yield crucial information about non-clinical samples (van Baardewijk et al., 2008).

The assessment tool relies upon self-reported information and requires the individual to state how much a statement applies to them, with responses ranging from 'true', 'somewhat true', 'somewhat false', and 'false'. While psychopathy is stereotyped as a negative attribute, the personality construct also shows adaptive qualities (e.g. Patrick, 2022; Segarra et al., 2022) within its facets.

The model consists of three distinct facets: boldness, meanness, and disinhibition. Boldness describes social dominance, venturesomeness, courageousness, and emotional stability, and has been related to adaptive traits such as an immunity to stressful events and emotional resilience (Patrick, 2022; Segarra et al., 2022). However, the trait has also been linked to maladaptive features such as fearless risk-taking, and a failure to learn from punishment (Segarra et al., 2022). Boldness was developed from the 'fearless dominance' segment of the Psychopathic Personality Inventory (PPI; Lilienfeld et al., 2006; Lilienfeld et al., 2005), which helped to map out the core features associated with this trait.

Meanness, on the other hand, refers to the callous-unemotional dimension of psychopathy, and consists of low empathy, excitement seeking, callousness, and manipulative behaviours (Patrick, 2022; Viding et al., 2018). This facet has been associated with a lack of close attachments and exploitative behaviours towards others (Frick et al., 2014). While this trait has maladaptive features (i.e. emotional deattachment; Brewer et al., 2018), shallow emotions and manipulation can also be considered adaptive in certain circumstances, such as situations that require emotional detachment (Međedović et al., 2018). Meanness was developed from the Externalising Spectrum Inventory (ESI; Krueger et al., 2007) using the 'callous-aggressive' factor to form the TriPm's meanness scale.

Lastly, disinhibition describes boredom proneness, impulsiveness, lack of stability, and irritability (Patrick, 2022), and has been linked to criminal behaviours and aggression (Garofalo et al., 2021a; Gray et al., 2021). This facet was also derived from the ESI (Krueger et al., 2007), pulling from numerous scales to produce disinhibition of the TriPm. Disinhibition has been associated with maladaptive effects such as poorer executive functioning and counterproductive work behaviours but also adaptive features such as spontaneity and flexibility (Bronchain et al., 2020; Kranefeld et al., 2022; Pasion et al., 2018). Additionally, this scale in conjunction with meanness has shown negative associations with antisocial outcomes (Gatner et al., 2016).

The TriPm is a well-established tool for use in general and non-clinical populations for several reasons (Somma et al., 2019). Firstly, the TriPm can discriminate between non-clinical/community and forensic samples, showing good construct validity in these two populations (Hall et al., 2014; Stanley et al., 2013; van Dongen et al., 2017). This is significant as it demonstrates that the measure is sensitive enough to validly capture a full range of psychopathic traits that may exist. The measure has also demonstrated good construct validity with other assessment tools such as the PPI-R (Lilienfeld et al., 2005) and

aggression questionnaires (van Dongen et al., 2017). This ensures that the TriPm accurately measures constructs that are related to psychopathy and helps to show that there is a relationship between psychopathic traits and aggression. Further, the TriPm has been successfully adapted for different cultural contexts, effectively assessing the concepts of the triarchic model in different populations (Fanti et al., 2015). Lastly, the model provides three distinct constructs that other tools, such as the PCL-R, lack (Patrick et al., 2012). This helps to arguably assess a broader spectrum of psychopathic characteristics, going beyond criminality and exploring potentially adaptive traits (e.g. Međedović et al., 2018; Patrick, 2022; Segarra et al., 2022) within this measure.

Together, the three facets of the TriPm help to capture the complex interplay of psychopathy characteristics in non-clinical samples into one succinct measure. In this thesis, the TriPm was employed to assess psychopathic traits beyond clinical and forensic contexts and in non-clinical samples, offering a more nuanced perspective of their expression in this population. By utilising this measure, the present thesis aims to enhance the understanding of psychopathic traits in non-clinical samples, thus contributing to the body of literature of subclinical psychopathy and its implications.

**Youth Psychopathy Inventory.** The Youth Psychopathic Inventory (YPI; Andershed et al., 2002) is a 50-item self-report measure designed to assess 10-core concepts related to psychopathy (see Appendix 4). First developed to measure psychopathic traits in non-referred children and adolescents (i.e., from the general population who have not been identified or directed to psychological, behavioural, or legal services for intervention; Andershed et al., 2002; van Baardewijk et al., 2008), the YPI has since shown validity in adult samples (Campbell et al., 2009; Neumann et al., 2014), and displayed convergence with other psychopathy assessment tools such as the Self-Report Psychopathy Scale (Paulhus et al.,

2016) and Psychopathic Personality Inventory-Revised (Campbell et al., 2009; Lilienfeld et al., 2005; Neumann et al., 2014).

The YPI assesses core concepts related to psychopathy, with each concept containing 5 questions; dishonest charm (e.g., "Pretty often I act charming and nice, even with people I don't like, in order to get what I want"); grandiosity (e.g., "I'm better than everyone on almost everything"); lying (e.g., "Sometimes I lie for no reason, other than because it's fun"); manipulation (e.g., "I'm good at getting people to believe in me when I make something up"); remorselessness (e.g., "To feel guilty and remorseful about things you have done that have hurt other people is a sign of weakness"); unemotionality (e.g., "what usually scares others usually doesn't scare me"); callousness (e.g., "I think that crying is a sign of weakness, even if no one sees you"); thrill-seeking (e.g., "I like to do things just for the thrill of it"); impulsiveness (e.g., "I prefer to spend my money right away rather than save it") and irresponsibility (e.g., "If I won a lot of money in the lottery I would quit school or work and just do things that are fun"). Items are scored on a 4-point Likert scale from "does not apply at all" (1) to "applies very well" (4).

The YPI was developed to measure the core personality traits of psychopathy, with a focus on traits identified through prior research and developmental frameworks (Andershed et al., 2002; Lynam et al., 2005). Yet, characteristics such as marital relationships and promiscuous sexual behaviour were excluded as they may not have applied to youths (Andershed et al., 2002). Further, questions were developed to help those who may struggle with self-insight, which may pose an issue when assessing some of the core traits of psychopathy. For instance, questions were worded in a positive and admirable manner so that one's traits were seen as strengths and others' qualities were posed as weaknesses (Andershed et al., 2002).

The YPI has shown good alignment and internal consistency with the facets of the TriPm (Drislane et al., 2015). Specifically, the components of the YPI that assess traits relating to boldness, meanness, and disinhibition show good convergence with the corresponding facets of the TriPm (Drislane et al., 2015). This congruence provides strong evidence that the YPI captures essential psychopathic traits that aligns with existing theoretical models of psychopathy, making it a reliable and valid tool for psychopathy assessment.

Considering the alignment with the TriPm (Drislane et al., 2015), the YPI was adopted as a screening measure in Chapter 5 to identify individuals exhibiting high and low levels of psychopathic traits. This approach allowed for the stratified selection of participants, identifying a clear distinction between low and high levels of psychopathic traits, prior to the laboratory experiment and administration of the TriPm. This method of using the YPI as a preliminary tool ensures that the sample used for experimental assessment includes individuals exhibiting low and high psychopathic traits, thus allowing the comparison of the two groups.

### *Empathy Assessment*

**Interpersonal Reactivity Index.** The Interpersonal Reactivity Index (IRI; Davis, 1980) is a 28-item assessment tool developed by Mark Davis in 1980 (Davis, 1980) to assess self-reported empathy (see Appendix 2). Empathy can be divided into two dimensions: cognitive and affective (Singer et al., 2009). Subsequently, the IRI assesses subcomponents that make up both dimensions.

Within the IRI, cognitive empathy is made up of two components. The perspective taking subscale assesses the ability to adopt another person's point of view, which is essential for understanding someone else's perspective and acting with social awareness and sensitivity. The empathic concern subscale measures feelings of compassion and concern for

others in distress. This is important as concern for others promotes kindness and co-operation. Affective empathy is also assessed using two subscales: personal distress and fantasy. The personal distress component measures self-oriented feelings of discomfort and anxiety in response to others' suffering, which is critical for recognising emotional reactions in interactions with others. Lastly, the fantasy scale captures the tendency to imaginatively identify with fictional characters in books, movies, or stories. This is an important component when understanding empathy as it allows individuals to explore other people's perspectives. The IRI is scored from 'does not describe me well', '0', to 'describes me very well', 4, with participants exhibiting higher levels of empathy when scoring higher on the measure.

Previous research has supported the validity of the IRI as an effective measure of self-reported empathy across a range of populations (e.g., Gilet et al., 2013; Hawk et al., 2013). Studies have also confirmed its four-factor structure, demonstrating that the subscales reliably reflect distinct aspects of empathy, that being cognitive and affective (e.g., De Corte et al., 2007; Gilet et al., 2013).

Given the support for the measure, the IRI was adopted in the present thesis as a method of assessing empathy. Its comprehensive structure and reliability make it an ideal tool for investigating empathy in relation to psychopathic traits. By incorporating the IRI, the dimensions of empathy (i.e., cognitive and affective) can be examined in the context of psychopathy, offering a deeper understanding of how psychopathy affects emotional processing. Understanding such associations on a greater level can help to shed light on the impact that psychopathic traits may have in relation to the components of empathy.

### *Pain Assessment*

**Pain Sensitivity Questionnaire**. The Pain Sensitivity Questionnaire (PSQ; Ruscheweyh et al., 2009a) is a 17-item self-report measure used to assess ones' sensitivity to everyday pain scenarios (see Appendix 3). This measure was designed as an alternative to

experimental pain assessment methods due to the time, equipment, and labour required to conduct such experiments, in addition to the potential aversive nature of experimental methods on participants (Ruscheweyh et al., 2009b).

The development of the PSQ involved listing a range of daily situations, such as clinical pain or painful scenarios that can occur in everyday life (e.g., hot cold, sharp, and blunt pain situations), alongside non-painful situations (e.g., taking a warm shower) to act as non-painful reference points (Ruscheweyh et al., 2009b). Three hundred and fifty-four participants rated the pain intensity they would expect to feel in those situations. Following this, experimental pain intensities were tested in 47 participants using a variety of noxious stimuli, such as heat, cold, pressure, and pinpricks. Correlations were then performed to between initial PSQ scores and experimental pain ratings and demonstrated good reliability between the two types of assessment methods (Ruscheweyh et al., 2009b), supporting the PSQ's validity as a self-assessment tool for pain sensitivity.

The final version of the PSQ comprises of 17 items, for which participants self-report their perceived pain intensity to each scenario, such as "imagine you bump your shin badly on a hard edge, for example, on the edge of a glass coffee table. How painful would that be for you?", "imagine you trap your finger in a drawer", and "imagine you grazed your knee falling off your bicycle". Items are scored on an 11-point Likert scale from "no pain" (0) to "most severe pain that you can imagine or consider possible" (10). The self-report measure yielded excellent internal consistency ($\alpha = .92$; Kiliç, 2016).

The present thesis used the PSQ as a measure of pain sensitivity in Study 2 of Chapter 4 to provide a comprehensive assessment of pain experiences across a variety of everyday scenarios. Unlike single nociceptive stimuli, which are limited in what they can assess, the PSQ captures differences in pain perception across a range of real-life situations, enhancing the ecological validity of measuring the perception of pain in Chapter 4.

**Self-Assessment Manikin** The self-assessment manikin (SAM; Bradley et al., 1994) is a pictorial assessment technique that uses graphical figures to help participants in identifying their emotional responses to stimuli (see Appendix 6). The SAM is useful in experimental settings as it enables participants to categorise their responses to stimuli via a visual format, thus reducing reliance of verbal descriptions and making it accessible to a diverse range of individuals, including those with language barriers or difficulties in articulating emotions.

The SAM uses a series of images to represent varying emotional states. The measure spans from no pain, or '0', to the most pain imaginable, or '10', with images starting with a happy/neural expression and ending with a face expressing the most distress. As participants progress up the scale, the figures' facial expressions become increasingly distressed, providing an intuitive and easily interpretable representation of pain-related emotions. The effectiveness of SAM in assessing pain experiences has been demonstrated in previous research (Fallon et al., 2015a; Fallon et al., 2015b).

In this thesis, the SAM was utilised in Chapter 5 to assist participants with identifying and reporting their emotional states in response to experiencing pressure. This visual approach of self-reporting to physical stimuli enhances the accuracy of participants' responses, particularly in cases where verbal articulation of pain and distress may be challenging. By offering a standardised, non-verbal method for capturing emotional responses to pain, the SAM contributes to the robustness and accessibility of pain assessment in experimental research (Bradley et al., 1994).

## Physiological Measurement

### *Skin Conductance Response*

The sympathetic nervous system (SNS) represents a branch of the autonomic nervous system (ANS), and is responsible for initiating the body's stress response, commonly known

as ‘fight or flight’ response (Lovallo et al., 2016). During stress episodes, the body activates protective systems that help mitigate threats by redistributing blood flow to vital muscles and increasing heart rate amongst other physiological changes (Lovallo et al., 2016; Peate, 2017). One measurable and indirect effect of SNS activation is electrodermal activity (EDA; Dawson et al., 2016), which serves as a biomarker of physiological arousal in the body (Christopoulos et al., 2019). EDA reflects autonomic changes in the skin’s electrical properties and can manifest itself as skin conductance responses (SCR; Bari et al., 2018).

The human body contains two main types of sweat glands on the body: apocrine and eccrine. Apocrine sweat glands remain inactive until puberty and are concentrated in specific areas such as the armpits (Chen et al., 2020). In contrast, eccrine sweat glands, which are present from birth, cover the entire body and assist with thermoregulatory functions (Chen et al., 2020; Edelberg, 1972). Specifically, eccrine sweat glands on the palms of the hands are more responsive to psychological stimuli such as emotion, attention, and arousal rather than temperature regulation (Dawson et al., 2016; Edelberg, 1972). When SNS activation increases, such as in response to a perceived threat, sweat rises within the ducts that open onto the skin’s surface, and temporarily increases the skin’s electrical conductivity, resulting in measurable SCRs (Christopoulos et al., 2019; Dawson et al., 2011; Dawson et al., 2016).

For the most reliable and accurate measurement of electrodermal activity, SCR is typically recorded using electrodes placed on the palmar surfaces of the index and middle fingers or the lower palm, as these areas contain a high density of eccrine sweat glands (Dawson et al., 2011; Dawson et al., 2016; Freedman et al., 1994). Once data has been collected and cleaned, specialist software detects peaks or troughs in SCR, indicating physiological responses to specific stimuli.

SCR is a valuable method for assessing physiological arousal in experimental settings due to its non-invasive nature, hence minimising discomfort to participants (Novak, 2019).

Additionally, its use in non-clinical populations can help to identify discrepancies between self-report and physiological responses in psychopathic traits, as evidence has been found in incarcerated samples (e.g., Pfabigan et al., 2015). As a result, SCR was used in the present thesis to assess arousal to pressure stimuli and other people's pain images in Chapter 5.

## Nociceptive Stimulation

### *Pressure*

Nociceptive pressure describes mechanical stimuli used to activate pain receptors in the body (Treede et al., 2002). To induce controlled pressure pain, a custom-built pressure stimulator designed by Dancer Designs (St. Helens, UK) was used. This device, described in previous research (e.g., Watkinson et al., 2013), operates by employing a pneumatic force controller that uses compressed air to lower a 1$cm^2$ circular rubber probe onto the target area with precise and adjustable force.

The use of pressure stimulation in the present thesis aimed to emulate pain that could be experienced every day, such as the pain felt when trapping a finger in a door. To achieve this, the circular probe was lowered onto the finger of the non-dominant hand, covering the lunula (i.e., the visible, crescent-shaped part of the fingernail) and adjacent skin to create pressure (see Watkinson et al., 2013). Each stimulus was administered by delivering a controlled voltage into the pressure stimulator, translating to pressure in a range from 0.00 kg/cm2 (generated from 0.00 v input) to a maximum of 3.5 bar (11.55 kg/cm2, generated from 3.5 v input). This range was carefully chosen to induce pain without risking tissue damage. Voltages were generated via a custom PsychoPy script written in Python (LabJack Corp., Lakewood, CO, USA).

The validity of pressure stimulation as a pain-induction method is well supported in the literature. Research has demonstrated that pressure pain reliably activates brain regions associated with nociceptive processing (Jackson et al., 2020; Lacourt et al., 2012). Given its

ecological validity and reliability of stimulating pain, pressure stimulations were used in Chapter 5 to emulate real-world pain experiences.

# Chapter 3: A systematic review investigating a tolerance for pain, and empathy for other people's pain in psychopathic traits within non-clinical samples

## Introduction to Manuscript

This study entitled, 'a systematic review investigating a tolerance for pain, and empathy for other people's pain in psychopathic traits within non-clinical samples' aimed to summarise the findings that previously examined nociceptive pain experience and empathy for other people's pain within non-clinical samples (Alshukri et al., 2025). This review was essential as findings showed disparities and mixed results. In addition, the reviewed allowed for the exploration of existing literature to identify trends.

This paper was published at Personality and Individual Differences. The presentation of the article in this thesis may be different to that of the published piece.

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**Abstract**

Higher psychopathic traits have been related to a higher tolerance for nociceptive pain and a deficit in empathy for others' pain. However, results are varied and inconsistent. As a result, this systematic review aimed to consolidate the current evidence on the relationship between psychopathic traits, the perception of nociceptive pain, and empathy for other people's pain in non-clinical samples.

Reported in accordance with the PRISMA statement, a comprehensive literature search used five databases to identify articles published between 2000-2022. The inclusion criteria focused on studies examining the experience of nociceptive pain and/or empathy for other people's pain in relation to individuals assessed for psychopathic traits in non-clinical populations. The systematic review protocol was registered with PROSPERO (CRD42023426112). From a total of 9522 articles, eight papers were identified as eligible for inclusion. A total of 573 participants were included across eight studies.

The review found differences in pain tolerance to pressure and electric shocks in those higher in psychopathic traits, but not when using cold temperatures. In addition, higher levels of psychopathic traits related to less brain activity in response to others' pain, thus impacting empathy. Accordingly, relationships between psychopathy, pain, and empathy varied depending on the pain stimulus or data collection method used.

This review highlights that within psychopathic traits, pain tolerance findings may be dependent upon the type of nociceptive pain stimulus and data collection method used to assess responses. Additionally, a lack of empathy for others may have a neurological basis, as evidence in brain imaging findings. Lastly, boldness and meanness traits may play a specific role in tolerating more nociceptive pain and lacking empathy for others.

## Introduction

Psychopathic traits reflect a personality construct comprising of behavioural, affective, and interpersonal features such as shallow affect, impulse control problems, and callousness (Hare, 2003; Patrick et al., 2009). Higher levels of psychopathy have been associated with a higher tolerance for physical nociceptive pain (e.g. Brislin et al., 2016; Miller et al., 2013) and a lack of empathy for others (van Dongen et al., 2018); however, results are varied and inconsistent. This systematic review aimed to compile research looking at nociceptive pain experienced by the self and empathy for others' pain in psychopathic traits in non-clinical samples and summarises findings.

Over the years, many psychopathy measures have been devised for use in adult clinical and community samples, however, only those relevant to this review (i.e., general/ non-clinical populations) are discussed. While these self-report psychopathy tools share a common goal of measuring these traits, they vary in their approach. To start, the Triarchic Psychopathy Measure (TriPm; Patrick, 2010) uses a 3-dimensional approach to measure psychopathic traits: boldness (i.e., social dominance, emotional resiliency), meanness (i.e., low empathy, exploitativeness), and disinhibition (i.e., low impulse control; Patrick et al., 2009). The Levenson Self-Report Psychopathy Scale (LSRP; Levenson et al., 1995), on the other hand, is grouped into primary and secondary characteristics. The primary facet encompasses affective and interpersonal traits (i.e., lack of empathy, superficial charm) whereas the secondary facet consists of lifestyle and antisocial traits (i.e., impulsivity, poor behavioural control; Levenson et al., 1995). Next, the Elemental Psychopathy Assessment (EPA; Lynam et al., 2011) is designed to assess psychopathy on 4 higher-order dimensions: antagonism (i.e., aggression, hostility), emotional stability (i.e., anxiety, shallow emotions), disinhibition (i.e., risk-taking, irresponsibility), and narcissism (i.e., grandiosity, superficial charm). In contrast, the Self-Report Psychopathy Scale (SRP-4; Paulhus et al., 2016)

examines interpersonal (i.e., superficial charm, manipulation), affective (i.e., shallow emotions, lack of remorse or guilt), lifestyle (i.e., irresponsibility, impulsivity), and antisocial (i.e., behavioural problems, criminality) traits. Lastly, the Minnesota Multiphasic Personality Inventory-2-Restructured Form (MMPI-2-RF; Ben-Porath et al., 2008) is a 9-scale measure designed to assess a broad range of variables related to psychological functioning. Rather than providing a distinct psychopathy score, the measure assesses personality dimensions associated with psychopathic traits. While there is conceptual overlap, these psychopathy measures offer structured and rigorous frameworks to help identify psychopathic traits, allowing researchers to explore how traits affect the experience of nociceptive pain and empathy for other people's pain.

Research investigating how psychopathy affects experiencing nociceptive pain and empathising with others' pain is mixed. Firstly, studies examining nociceptive pain in psychopathy tend to assess pain tolerance, which refers to the amount of subjective pain one can withstand (Kanner, 2009). Studies have looked at a variety of pain stimuli to measure tolerance, including electric shocks, pressure, and cold temperatures (Brislin et al., 2016; Miller et al., 2013). For instance, research has found correlations between the meanness facet of psychopathy and a greater tolerance of pressure stimuli placed between the knuckles of the dominant hand (Brislin et al., 2016). Similarly, when delivering pressure to the upper arm, electric shock stimuli fingers, and submerging hands into cold temperatures, positive relationships were found between psychopathy and pressure and electric shock stimuli, but not cold temperatures (Miller et al., 2013). Together, these studies suggest modality-specific effects. However, given the limited body of evidence on the topic, it is important to collate all the relevant literature in the field to help identify trends between nociceptive pain experience and psychopathic traits as research suggests that higher tolerances of pain may be linked to a lack of empathy for others (Fallon et al., 2020).

Emerging research proposes that a deficit in pain perception in the self is associated with a lack of empathy for others (e.g. Berluti et al., 2020; Branchadell et al., 2024). Findings have suggested that the heightened tolerance to nociceptive pain found in those with higher psychopathic traits may underpin the underestimation of others' experience of pain (Branchadell et al., 2024; Brislin et al., 2022). For instance, undergraduate students experienced pressure stimuli, viewed the pain of others via images, and were asked to rate the pain that was perceived in both conditions. Results found that lower ratings of pain intensity under both self and other perspectives were related to elevated scores of boldness and meanness of the TriPm. This suggests that higher levels of these traits are linked to diminished responses to the pain of others, which may be underpinned by increased tolerances of pressure stimuli. As a result, individuals higher in psychopathy may be less sensitive to the distress of others (Kaseweter et al., 2022; Waller et al., 2020).

Moreover, brain imaging research has highlighted that the same neural networks may be activated when experiencing pain and when observing others in pain (see Fallon et al., 2020 for meta-analysis). Specifically, a meta-analysis synthesised functional magnetic resonance imaging (fMRI) studies that investigated pain and empathy experiences and found the anterior insula (AI) and anterior mid-cingulate cortex (aMCC) were activated when individuals either experienced nociceptive pain themselves or observed another person in pain (Fallon et al., 2020). This suggests shared neural networks underlie both first-hand pain experiences and empathic responses to the pain of others. However, as lower levels of neural activity have been found in response to nociceptive pain stimuli in individuals with higher psychopathic traits (e.g., Brislin et al., 2022), this may influence the lower levels of brain activation observed for other people's pain and distress (e.g., Berluti et al., 2020; Branchadell et al., 2024; Brislin et al., 2022; Seara-Cardoso et al., 2015). Given the implications of this body of work, such as potentially distinct or shared emotional networks, it is essential to

examine how psychopathy influences responses to nociceptive stimuli and the possible underlying impact on empathy for others.

Compared to studies on experiencing physical nociceptive pain, research looking at empathy for pain in psychopathic traits is more abundant (e.g. Penagos-Corzo et al., 2022; Burghart & Mier, 2022). Empathy plays a crucial role in daily functioning and social interactions (Singer et al., 2009), yet, a lack of empathy is a hallmark characteristic of psychopathic personality (Hare, 2003; Patrick et al., 2009). Research demonstrates that individuals higher in psychopathic traits fail to recognise the distress cues of others (e.g. Dawel et al., 2019; Kaseweter et al., 2022), and pain is an extension of distress (Rogers et al., 2018). Various methods have been used to collect data on empathic responses to others' pain such as skin conductance responses (SCR), electroencephalography (EEG), fMRI, and self-report responses (e.g. Berluti et al., 2020; Decety et al., 2015; Pfabigan et al., 2015). For instance, when using fMRI to examine neural responses to images of others' pain, female participants higher in psychopathic traits exhibited lower activation in empathy-related brain regions such as the AI (Seara-Cardoso et al., 2015). Further, when using EEG to measure event-related potentials (ERPs) to images of others in painful situations, findings indicated reduced neural activity to other people's suffering in those with higher levels of psychopathic traits (Berluti et al., 2020). Existing research offers valuable insights into empathy experiences in psychopathic traits however, findings lack consolidation. Therefore, this highlights the need for a systematic review comparing similarities and differences between data modalities.

Previous reviews have synthesised some aspects of psychopathy and empathy. For example, a previous meta-analysis explored how psychopathy is associated with alexithymia (i.e., difficulty describing and identifying feelings; Bagby et al., 1994) and empathy (Burghart et al., 2022). By looking at research from the past 30 years in a variety of populations (e.g.,

clinical, community, correctional), reviewers found the most pronounced empathy deficit was the lack of ability to feel empathic concern for others. This could be explained by a sole focus on goal-relevant information and disregarding irrelevant information such as a victim's pain. The meta-analysis also unearthed a positive association between psychopathy and alexithymia, which has been further linked to aggressive behaviour in people with higher levels of psychopathy (Velotti et al., 2016). Another meta-analysis looked at the association between psychopathy, antisocial behaviour (e.g., acts of aggression and rule breaking; Burt, 2012) and empathy (Campos et al., 2022). People higher in psychopathic traits have long been associated with antisocial acts, with debates as to whether it is a core component or an outcome of the personality trait (see Campos et al., 2022). The meta-analysis revealed interpersonal-affective traits within psychopathy were strongly linked to deficits in affective empathy, while those with antisocial traits (ranging in offenders, conduct disorders, antisocial personality disorders) had greater cognitive empathy impairments. Building on these insights into the complex relationships between psychopathic traits and empathy, further reviews have explored other areas affected by psychopathic traits, such as the processing of affective stimuli.

Beyond empathy, other systematic reviews have examined affective processing within psychopathic traits. For instance, individuals with co-morbid anti-social personality disorder and psychopathy showed atypical patterns of affective reactivity and difficulty processing negative and aversive stimuli (Marsden et al., 2019). However, this review was conducted in prison populations and may not be generalisable to other groups. Next, a recent systematic review looking at facial affect processing found incarcerated males with medium to high levels of psychopathy had impairments in recognising disgust and fearful facial expressions (Chapman et al., 2018). Collectively, these findings suggest an issue with the processing of affective information, such as negative stimuli and facial expressions in those higher in

psychopathic traits, which leads to a lack of empathy. However, while the above reviews are useful, there lacks systematic consolidation of evidence examining how psychopathy affects empathy for others' pain and the direct experience of nociceptive pain within non-clinical samples alone.

Despite the contributions of research in the area, there is a lack of consistency and consolidation of findings relating to experiencing nociceptive pain in oneself and empathy for others' pain within non-clinical samples assessed for psychopathic traits. Due to this, the present review aimed to synthesise studies looking at physical nociceptive pain experience and empathy for the pain of others. To achieve this, this review consolidated and examined peer-reviewed literature on nociceptive pain and pain empathy in healthy individuals from non-clinical populations, whose psychopathic traits were assessed using validated measures.

## Methodology

The present systematic review is reported in accordance with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) statement (see Page et al., 2021). A priori protocol was published on the PROSPERO international register of systematic reviews (CRD42023426112; https://www.crd.york.ac.uk/prospero/).

### *Eligibility Criteria*

To qualify as eligible for inclusion, studies were required to examine responses to receiving physical nociceptive pain stimuli and/or observing others receiving physical nociceptive pain stimuli between 2000-2022. These dates were chosen as preliminary scoping searches identified relevant studies from the year 2000 up until the year that the systematic review was conducted. The studies had to include within participant comparisons (e.g. recordings taken at multiple time points) or between participant comparisons (e.g. high and low psychopathy scores). Participants had to be healthy adults with no physical or mental

health afflictions, aged over 18 years of age and recruited from the general population/non-clinical samples. Participants also had to be screened for psychopathic personality traits using a validated psychopathy measure suitable for non-clinical use. Unpublished data was not sourced for the present systematic review as these studies lacked the critical evaluation of the peer-review process, thus possibly resulting in a lack of quality and scientific rigour. Overall, studies could not include participants from clinical, incarcerated or forensic settings or use psychopathy measurement tools designed solely for clinical use.

### *Information Sources and Searches*

The main literature search took place between May to June 2023 using five databases: MedLine, PsychInfo, PubMed, Scopus, and Web of Science. These databases were chosen for use as pre-screening demonstrated that they represented a comprehensive and balanced coverage of research fields relevant to the search criteria. Search terms were devised via scoping searches and included key words for physical pain and pain empathy. Key words were: ("psychopathy" OR "psychopathic" OR "psychopath" OR "psychopath*" AND "empathy for pain" OR "pain empathy" OR "pain empath*" OR "pain empathy" OR "directly experienced pain" OR "experienced pain" OR "pain" OR "pain perception" AND "human").

### *Study Selection*

Two authors were responsible for the evaluation of articles suitable for inclusion. SA (PhD researcher) screened titles and abstracts, with a random sample of 20% of titles crossed-screened by RW; no disagreements arose. SA screened full texts of articles to identify those eligible for inclusion.

### *Data Collection*

Data was extracted by SA and cross-checked by RW. In cases where data was unclear, or multiple versions of a paper were located, corresponding authors were contacted for clarification. Data extracted included participants, pain and empathy exposure, comparison groups, outcomes, and outcome collection method (see Table 1).

### *Quality Assessment*

The quality of the papers included in the present systematic review were assessed using the Newcastle-Ottawa Scale (NOS; Wells et al., 2000) modified for cross-sectional studies. NOS was created to assess the quality of non-randomised studies for inclusion in meta-analyses and systematic reviews using a star-based system. Studies were evaluated using three criteria: sample selection, group comparability, and the outcome being investigated. A total score was calculated, and a rating was assigned to each study (see Table 2).

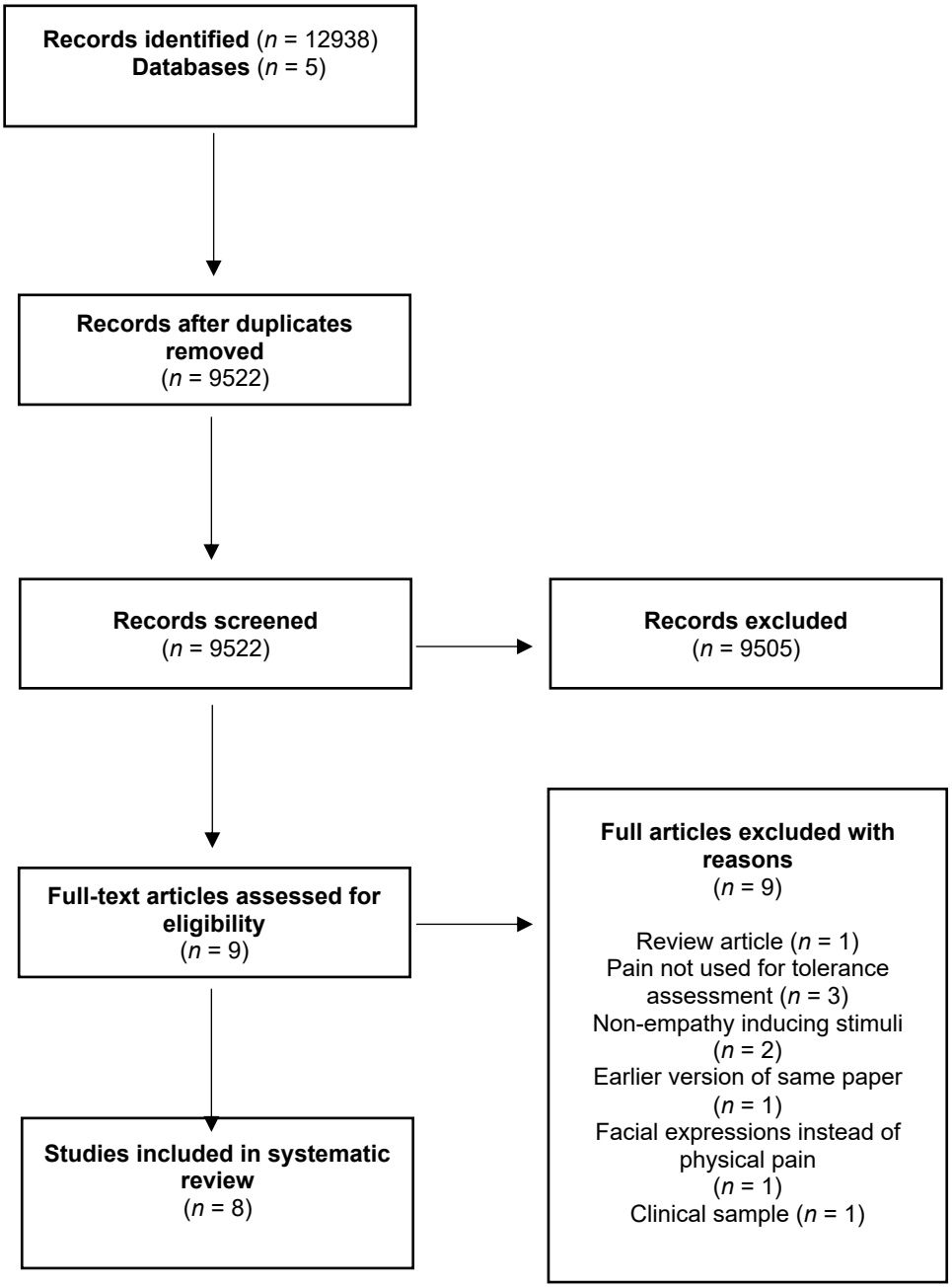
## Results

### *Study Selection*

Once duplicates were removed, a total of 9522 articles were identified from literature searches. After screening, nine articles were identified as meeting eligibility criteria. However, one author was contacted to confirm that an earlier version of their paper existed as the full text could not be located. Therefore, eight articles met the criteria. The process of study selection is shown in Figure 1.

**Figure 1**

*PRISMA flowchart of the selection of studies*



## Table 1

*Summary of study characteristics*

| References | Title | Country | Participants | Psychopathy Measure | Empathy Measure | Comparison | Pain Assessment | Empathy Assessment | Data Collection Method |
|---|---|---|---|---|---|---|---|---|---|
| Anestis et al. (2022) | Assessing physical pain perception and psychological distress tolerance through the MMPI-2-RF: A comparison of multimethod measures | USA | 115<br>Female (*n* = 87)<br>Male (*n* = 19)<br>Gender unknown (*n* = 9)<br>Age: *M* = 21.14, *SD* = 5.81 | Minnesota multiphasic personality inventory-2-restructured form (MMPI-2-RF; Ben-Porath et al., 2008) | N/A | | Physical pain tolerance using pressure algometer below first knuckle on second finger of right hand | N/A | Self-report pain tolerance on 5-point scale |
| Brislin et al. (2016) | "Do unto others"? Distinct psychopathy facets predict reduced perception and tolerance of pain | USA | 100<br>Female (*n* = 58)<br>Male (*n* = 42)<br>Age: *M* = 19.4 | Triarchic Psychopathy Measure (TriPm; Patrick, 2010) | N/A | | Physical pain tolerance using pressure algometer on dorsal side, medial placement between knuckles of pointer and middle finger on dominant hand | N/A | Self-report 10-point pain appraisal visual analogue scale (pain VAS) |
| Miller et al. (2013) | Examining the relations among pain tolerance, psychopathic traits, and violent and nonviolent antisocial behaviour | USA | 104<br>Female (*n* = 30)<br>Male (*n* = 74)<br>Age: *M* = 36.8, *SD* = 17.3 | Self-Report Psychopathy scale (SRP-III; Paulhus et al., 2016)<br><br>The Elemental Psychopathy Assessment (EPA; Lynam et al., 2011) | N/A | | Pain tolerance to pain algometer, cold pressor and electric stimulation | N/A | Self-report pain tolerance |

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|---|---|---|---|---|---|---|---|---|---|
| Marcoux et al. (2013) | The modulation of somatosensory resonance by psychopathic traits and empathy | Canada | 30<br>Males (*n* = 30)<br>Low psychopathy (*n* = 15)<br>Age: *M* = 23.7, *SD* = 2.9<br>High psychopathy (*n* = 15)<br>Age: *M* = 22.3, *SD* = 1.44 | Levenson Self-Report Psychopathy Scale (LSRP; Levenson et al., 1995) | Interpersonal Reactivity Index (IRI; Davis, 1980) | Participants in the upper third (*n* = 15) and participants in the lower third (*n* = 15) of the Levenson Self-Report Psychopathy Scale | N/A | 30-colour pseudo-dynamic pictures depicting hands of male and female adults in three different conditions: painful, non-painful, and neutral situations | EEG<br><br>Self-report visual rating scale and verbally evaluate level of pain recorded by researcher |
| Seara-Cardoso et al. (2015) | Neural responses to others' pain vary with psychopathic traits in healthy adult males | United Kingdom | 46<br>Male (*n* = 46)<br>Age range 19-40, *M* = 27.93 | Self-Report Psychopathy Scale, Short Form (SRP-SF; Paulhus et al., 2016) | N/A | Pain versus no pain stimuli and levels of psychopathic traits | N/A | 192 digital photographs showing another person's hand or foot in painful or non-painful situations | MRI |
| Brislin et al. (2022) | Pain processing and antisocial behaviour: A multimodal investigation of the roles of boldness and meanness | USA | 118<br>Female (*n* = 58)<br>Male (*n* = 60)<br>Age: *M* = 19.5, *SD* = 3.8 | Triarchic Psychopathy Measure (TriPm; Patrick, 2010) | N/A | TriPm scales (boldness, meanness, disinhibition) | Hand operated and automatic pain algometer on dorsal side of dominant hand (medial placement between knuckles of pointer finger and middle finger) | 128 colour pictures, each depicting either the right hand or right foot of people in various painful and nonpainful situations | EEG<br><br>Self-report pain severity on 4-point Likert scale |
| Berluti et al. (2020) | Reduced multivoxel pattern similarity of vicarious neural pain responses in psychopathy | USA | 21<br>Females (*n* = 9)<br>Males (*n* = 12) | Psychopathy Personality Inventory—Revised Short Form (PPI-R SF; Lilienfeld et al., 2005) | N/A | Total psychopathy scores | Pneumatic pressure pain on thumbnail | Observed a stranger (confederate) receive painful pressure stimulation | fMRI<br><br>Self-report 7-point Likert scale rating perceived pain intensity |
| Decety et al. (2015) | Specific electrophysiological components disentangle affective sharing and empathic concern in psychopathy | USA | 39<br>Female (*n* = 20)<br>Male (*n* = 19)<br>Age: *M* = 19.4, *SD* = 1.9 | Levenson Self-Report Psychopathy Scale (LSRP; Levenson et al., 1995) | Interpersonal Reactivity Index (IRI; Davis, 1980) | Total psychopathy scores, primary psychopathy scores, secondary psychopathy scores | N/A | 100 pictures of hands and feet in painful or neutral situations | EEG<br><br>Self-report visual analogue scale rating empathic concern or pain intensity (VAS) |

## Table 2

*Summary of Newcastle-Ottawa Scale ratings and findings by article.*

| References | Newcastle-Ottawa Scale Rating | Findings |
|---|---|---|
| Anestis et al. (2022) | Satisfactory | Positive weak correlation between boldness and self-reported pain tolerance ($r$ = .37, $p$ <.005)<br><br>No significant correlations between meanness, disinhibition and self-reported or behavioural pain tolerance, or boldness and behavioural pain tolerance |
| Brislin et al. (2016) | Satisfactory | Meanness significantly associated with pain tolerance via both correlation ($r$ = .30, $p$ <.005) and regression ($\beta$ = .33, $p$ <.005)<br><br>Meanness sole predictor when predicting pain tolerance when TriPm entered, but not in follow up tests<br><br>Disinhibition negative associations with pain vas in follow-up tests ($r$ = -.23, $p$ <.05)<br><br>TriPm scales not significantly associated with pain vas ratings |
| Miller et al. (2013) | Satisfactory | Both self-reported ($r$ = .30, $p$ <.001) callous affect, self-reported ($r$ = .28, $p$ <001) antisocial behaviour, and self-report ($r$ = .27, $p$ <.001) and total psychopathy score showed weak positive correlations with algometer pressure pain<br><br>Callous affect ($r$ = .27, $p$ <.001), erratic lifestyle ($r$ = .29, $p$ <.001) and total psychopathy score ($r$ = .23, $p$ <.05) showed weak positive correlations with electric shock pain<br><br>Psychopathic traits showed no correlations with pain tolerance via cold temperatures |
| Marcoux et al. (2013) | Satisfactory | Empathic concern was inversely related to total psychopathy score ($r$ = -.561, $p$ = .001)<br><br>No significant difference on behavioural ratings of painful scenarios between high and low psychopathy groups<br><br>No significant main effects found for pain gating for condition (pain, no pain) or group (low psychopathy or high psychopathy), nor it's interaction<br><br>When mean energy ratios were compared, no significant main effects of condition (pain, no pain) or group (low psychopathy or high psychopathy). Interaction between condition and group was significant [$F$ (1, 28) = 4.8, $p$ = .042], with post hoc tests showing a significant difference between pain and no pain condition for high psychopathy only ($p$ = .014)<br><br>No significant main effect found for (1300:1500 ms) period for condition or group. Post hoc tests showed significant different between pain and no pain conditions in high psychopathy group only ($p$ = .001; low psychopathy group: $p$ = .086). |

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| Seara-Cardoso et al. (2015) | Good | After controlling for lifestyle-antisocial traits, unique variance associated with affective-interpersonal traits were negatively related to bold response in AI [$t$ (43) = 1.87, $p$ = .03], IFG [$t$ (43) = 2.68, $p$ < .01], and midCC [$t$ (43) = 2.38, $p$ = .01], and was at trend in ACC [$t$ (43) = 1.24, $p$ = .11]<br><br>- That is, when holding levels of lifestyle-antisocial behaviour constant, increased levels of affective-interpersonal traits were associated with a decrease in neural responses to others' pain in these regions.<br><br>After controlling for affective interpersonal traits, unique variance associated with lifestyle antisocial traits were positively related to differential bold response in AI [$t$ (43) = 2.51, $p$ < .01], IFG [$t$ (43) = 3.16, $p$ < .01], midCC [$t$ (43) = 2.64, $p$ < .01], and ACC [$t$ (43) = 1.92, $p$ = .03]<br><br>- That is, when holding levels of affective-interpersonal traits constant, increased levels of lifestyle-antisocial behaviour traits were associated with an increase in neural responses to others' pain in these regions. |
| Brislin et al. (2022) | Good | Boldness ($r$ = .32, $p$ <.001) and meanness ($r$ = .25, $p$ <.05) positively associated with algometer pain tolerance<br><br>Boldness and meanness not associated with either perspective ratings of non-painful scenes<br><br>Meanness negatively associated with ratings of self-perspective painful scenes ($r$ = -.27, $p$ = .01) and other perspective scenes ($r$ = -.20, $p$ = .04)<br><br>Unique negative association with meanness for ratings of both self ($\beta$ = -.24, $p$ = .02) and other ($\beta$ = -.23, $p$ = .03) perspective painful situations<br><br>Boldness positively associated with N110 and N240 for painful scenes and negatively associated with boldness for non-painful scenes<br><br>Meanness negatively related to LPP for painful scenes ($r$ = -.21, $p$<.05) and showed unique association in LPP response model ($\beta$ = -.15, $p$ <.05)<br><br>The change in $r^2$ at step 2 was not significant for any of the models, indicating that the addition of TriPm boldness and meanness scales did not contribute significantly to pain-scene ERP response |
| Berluti et al. (2020) | Satisfactory | Ratings of partners' experiences of pressure pain was not significantly different from own reported pain, $t$ (20) = 1.67, $p$ = .11, $d$ = .37<br><br>Total psychopathy scores not associated with objective level of pain, $r$ (19) = .02, $p$ = .93 selected as slightly intense, or subjective reports of experienced pain during pain epochs during neuroimaging, $r$ (19) = -.08, $p$ = .74<br><br>When observing partner in pain, psychopathy not associated with perceptions of pain, $r$ (19) = -.31, $p$ = .17 or following empathy prompt, $r$ (19) = -.29, $p$ = .21 |
| Decety et al. (2015) | Satisfactory | Total empathy score positively predicted modulations in LPP response over central and parietal midline locations for painful vs neutral stimuli in empathic concern, (Cz/CPz/Pz/POz cluster, $r$ = 0.355, $p$ < .05 but not affective sharing, $p$ > .23)<br><br>Total psychopathy score negatively related to differences in LPP in empathic concern but not in affective sharing ($p$ > .35)<br><br>Psychopathy (total LSRP and primary psychopathy) negatively associated with LPP differences in empathic concern condition, POz (total score: $r$ =- .388, $p$ < .05; LSRP primary psychopathy subscale: $r$ = - .340, $p$ < .05)<br><br>LSRP secondary psychopathy scores negatively predicted LPP effect, (Cz/CPz/Pz/POz cluster, $r$ = -.344, $p$ < .05) |

LSRP primary psychopathy subscale scores negatively predicted left frontal to right parietal coherence ($r$ = -.383, $p$ < .05) and left frontal to right temporal coherence ($r$ = -.370, $p$ < .05)

LSRP total score also predicted coherence between left frontal and right temporal regions ($r$ = -.333, $p$ < .05)

Psychopathy positively related to degree of mu suppression when perceiving pain versus neutral stimuli in affective sharing condition, with lower mu predicted by LSRP total score ($r$ = -.472, $p$ < 0.01), primary psychopathy score ($r$ = -.441, $p$ <.01), and secondary psychopathy score ($r$ = .336, $p$ < .05)

### *Study Characteristics*

The number of participants in each study ranged from 21 (Berluti et al., 2020) to 115 (Anestis et al., 2022), with a total of 573 participants and an average of 72. Participants were largely sampled from student and community populations, with ages ranging between 17-56. Four studies used a pressure algometer or pneumatic stimulator to apply pressure to stimulate pain, and one study used cold temperatures, electrical stimulation and a pressure algometer to stimulate pain. Stimuli were either applied to hands, fingers or fingernails, or arms.

Four studies used images of other people's hands and feet in painful and matching non-painful situations to measure empathy responses, whereas one study used a confederate receiving pressure stimulations. Seven out of the eight studies collected self-report responses to either pain intensity or empathy for others, while three studies used electroencephalography (EEG), and two studies used functional magnetic resonance imaging **(**fMRI) (see Table 1 for full study characteristics).

### *Quality Assessment in Included Studies*

The cross-sectional adaptation of the NOS was used to screen included studies for risk of methodological bias (Wells et al., 2000). Of the eight studies included, two were rated as "good" and six were rated as "satisfactory" based upon three assessment criteria (see Table 2 for details).

### *Experiencing Nociceptive Pain*

**Pressure Stimuli.** Pressure pain, involving algometer and pneumatic stimulations, were examined in five studies (Anestis et al., 2022; Berluti et al., 2020; Brislin et al., 2016; Brislin et al., 2022; Miller et al., 2013). All studies collected self-report data relating to pain experience or tolerance, one study collected EEG data, and one study collected fMRI data (see Table 1). Anestis et al. (2022), Brislin et al. (2016), Brislin et al. (2022) applied pressure

to the finger or thumbnail and collected self-report data on pain tolerance (see Table 1 for specific measures). While Anestis et al. (2022) found positive correlations between boldness and self-reported pain tolerance, Brislin et al. (2016) found only meanness to be positively associated with pain tolerance, whereas Brislin et al. (2022) found positive associations for both boldness, meanness and pain tolerance (see Table 2). However, Berluti et al. (2020) found no associations between psychopathy and ratings of pain experience during neuroimaging when pressure was administered between knuckles of two fingers. Meanwhile, when pressure was administered to the supinator muscle of the non-dominant upper arm, callous affect and total psychopathy scores showed positive correlations with pain tolerance in the form of pressure (Miller et al., 2013). In summary, the studies suggest that higher psychopathic traits, but especially boldness and meanness, may underlie the differences seen in experiencing pressure stimuli. In addition, significant pain findings may be dependent upon how data is collected, as there were significant findings for self-report responses and EEG, but not when using fMRI.

**Temperature and Electric Stimuli.** Miller et al. (2013) assessed temperature and electrical stimulation in a sample of 104 participants. For temperature assessment, participants were asked to submerge their non-dominant hand in cold water of 3°C. For electric stimulations, participants were administered brief shocks via electrodes attached to the index and middle fingers of non-dominant hands. Cold temperatures showed no correlations with psychopathic traits, whereas electric shock stimuli were positively correlated with callous affect, erratic lifestyle, and total psychopathy score. These findings suggest that electric shock stimulations produce significant pain responses, whereas cold temperatures do not.

### *Empathy for Pain*

Empathy for pain was assessed in five studies (Berluti et al., 2020; Brislin et al., 2022; Decety et al., 2015; Marcoux et al., 2013; Seara-Cardoso et al., 2015). Four of the five studies assessed empathy for pain via images depicting hands and feet in painful and non-painful situations (Brislin et al., 2022; Decety et al., 2015; Marcoux et al., 2013; Seara-Cardoso et al., 2015), while one used a confederate paradigm (Berluti et al., 2020). Three of the studies collected EEG data, while the remaining two used fMRI (see Table 1).

When comparing mean energy ratios during EEG, Marcoux et al. (2013) did not find significant effects of pain or no pain conditions, or psychopathy levels. However, there was a significant interaction between pain condition and psychopathy group, showing that the high psychopathy group interpreted pain and no-pain conditions significantly differently compared to the low psychopathy group, who did not show a significant difference. In addition, Brislin et al. (2022) found boldness positively associated with early sensory processing (N100 component of event-related potential; ERP) and later-stage sensory processing (N240 component of ERP) for both painful and non-painful scenes, while meanness negatively related to later-stage cognitive and emotional processing (late positive potential; LPP) for painful scenes. Meanness was also negatively associated with ratings of others' pain scenes. This suggests higher levels of boldness and meanness contributed to pain processing in different ways, such as deficient responses to other's pain. Decety et al. (2015), on the other hand, found total psychopathy score positively predicted modulations in LPP response for painful versus neutral scenes in empathic concern. In addition, total psychopathy score was negatively associated with LPP differences in empathic concern conditions. This means that those with psychopathy showed less brain activity in areas associated with empathic concern, suggesting it may influence responses to other people's distress.

Meanwhile, in fMRI studies, Seara-Cardoso et al. (2015) found increased levels of affective-interpersonal traits were associated with a decrease in neural responses to others' pain in anterior insula (AI), inferior frontal gyrus (IFG), midcingulate cortex (midCC) and anterior cingulate cortex (ACC) when controlling for lifestyle-antisocial traits. In addition, when controlling for affective-interpersonal traits, increased levels of lifestyle-antisocial traits were associated with an increase in neural responses to others' pain in the same regions as above. This shows that the differing levels of psychopathic traits in males may influence how they respond to the pain of others. Moreover, when observing a partner in pain, Berluti et al. (2020) found psychopathy was not significantly associated with how much pain they believed their partner may be experiencing, even after an empathy prompt. However, evidence was found showing diminished self-other mapping of others' pain. This was demonstrated by less patterns of activity in brain regions associated with empathy for pain.

## Discussion

This systematic review synthesised the existing literature on experiencing nociceptive pain and empathy for pain in individuals with psychopathic traits in non-clinical samples. Eight papers met the inclusion criteria; three assessed nociceptive pain, three examined empathy for pain, and two examined both topics. Findings are discussed below.

### *Experiencing Nociceptive Pain*

The reviewed papers looked at how those with psychopathic traits experienced and responded to nociceptive pain stimuli using various methodologies such as self-report measures, EEG, and fMRI (Anestis et al., 2022; Berluti et al., 2020; Brislin et al., 2016; Brislin et al., 2022; Miller et al., 2013). Together, the results suggest that psychopathic traits affected experiencing nociceptive pain. Specifically, boldness (i.e., risk-taking and fearlessness) and meanness (i.e., a lack of empathy; Patrick, 2022) showed to underlie the

differences in a higher tolerance for nociceptive pain. For instance, Brislin et al. (2016) found that boldness was negatively associated with a fear of pain, suggesting that individuals with higher levels of these traits are less responsive to pain stimuli. Meanwhile, meanness was related to antisocial behaviours and diminished emotional responses to distressing stimuli (Brislin et al., 2022). Consequently, these findings suggest that a higher tolerance for nociceptive pain in those with higher traits of boldness and meanness could explain violent and antisocial behaviours observed in such individuals (Brislin et al., 2016; Brislin et al., 2022). However, the extent to which a heightened tolerance for pain contributes to aggression remains unclear as this was not a variable investigated in the present review. As a result, future work should explore these traits further to disentangle the relationship between psychopathic traits and violent and antisocial behaviours to better understand the complexities.

In addition to specific traits of psychopathy impacting pain processing, experiencing nociceptive pain may be dependent upon the type of stimulus delivered. Synthesised findings showed significant effects of pain tolerance when using pressure and electric shocks (Anestis et al., 2022; Berluti et al., 2020; Brislin et al., 2016; Brislin et al., 2022; Miller et al., 2013) but not cold temperatures (Miller et al., 2013). These distinctions suggest that cold temperatures are not as salient as pressure and electrical stimuli when stimulating pain in those with higher psychopathic traits. However, due to the limited amount of research directly comparing different pain modalities in individuals with varying levels of psychopathic traits (e.g., low vs high), these findings should be considered with caution as responses of those with lower levels of psychopathy is underexplored. Additionally, while pressure and electric shocks are commonly used to induce nociceptive pain in psychopathy research (e.g., Alshukri et al., 2024; Atanassova et al., 2024), in comparison, cold temperatures remain largely unexplored. Given that higher psychopathic traits are associated with lower levels of fear to

pain (Brazil et al., 2022; Durand et al., 2017), it is possible that cold temperatures may have less of a punishing effect than pressure or electric shocks in those with higher psychopathic traits. However, as this possibility is yet to be investigated, future research should examine the variations in tolerances for different modes of nociceptive pain stimulations and investigate potential underlying reasons for why this may be.

Going beyond the type of pain stimulus used, differences in pain processing may be subject to data collection methods. Findings showed significant effects between psychopathy and pain when collecting data via self-report measures and EEG (Brislin et al., 2016; Brislin et al., 2022), but not between psychopathy and pain experience when collecting data via fMRI (Berluti et al., 2020). These discrepancies may be attributed to the differences between EEG and fMRI when capturing brain activity. For instance, EEG records electrical signals from the scalp, allowing researchers to track brain activity in real time (Cohen, 2017; Michalopoulos et al., 2015). In contrast, fMRI captures blood oxygenation (BOLD signal) activity within the brain which provides greater spatial resolution but in a slower manner than EEG (Logothetis, 2008; Michalopoulos et al., 2015). Given these methodological distinctions, the data that is captured by both approaches is very different from one another and may lead to a significant difference in results. Due to this, researchers have proposed combining EEG with fMRI to help balance out each other's strengths and limitations (see Huster et al., 2012 for review), which could enhance the understanding of pain processing in psychopathic traits.

### *Empathy for Pain*

In addition to examining pain perception, the studies in this review also examined how psychopathic traits influence empathy for other people's pain. EEG research demonstrated that individuals with higher psychopathic traits interpreted the pain of others differently compared to those with lower levels of psychopathic traits. This was demonstrated

by reduced brain activity and diminished neural responses in the areas associated with empathy (Brislin et al., 2022; Decety et al., 2015; Marcoux et al., 2013). Specifically, boldness and meanness traits played a significant role in diminished responses to others' pain, further suggesting that these facets may underlie the deficiencies in empathy. While there is limited research investigating empathy for pain, these findings can be corroborated by physiological studies showing impaired facial muscle activity to the negative emotions of others (Khvatskaya et al., 2016) and reduced startle potentiation to violent films (Fanti et al., 2016). These findings suggest that deficits in empathy may have a biological basis, which highlights the need for further research into the underpinnings of a lack of empathy in psychopathic traits.

Next, although EEG research has provided valuable insights into the topic at hand, there is relatively little research looking at empathy for other people's pain using fMRI (Berluti et al., 2020; Seara-Cardoso et al., 2015). However, existing evidence indicates a reduction in brain activity in the regions associated with empathy in those with higher levels of psychopathic traits (Berluti et al., 2020; Seara-Cardoso et al., 2015). Additionally, Berluti et al. (2020) found weaker brain mirroring effects when observing someone else in pain, suggesting that those higher in psychopathy are less able to empathise with others in distress. Since fMRI research on empathy for pain in non-clinical samples is limited, findings in incarcerated offenders and youths can offer valuable insights. For instance, when incarcerated individuals high in psychopathic traits were asked to imagine another person in pain, the corresponding neural regions were not activated (Decety et al., 2013a). Further, 14 adolescents with psychopathic traits and associated disorders showed less responsiveness in brain regions implicated in affectively responding to another's pain, even as pain intensity increased (Marsh et al., 2013). Together, these findings from EEG and fMRI research propose that those higher in psychopathic traits have diminished neural responses to the pain of

others, thus leading to a reduction in empathy. This may indicate that individuals higher in psychopathic traits demonstrate a neurological basis for empathy deficits. Due to this, future research should investigate the potential neurological differences in empathy in those with higher psychopathic traits as it could help develop treatment and interventions to aid those struggling with deficits in empathy for others.

### *Strengths and Limitations of the Systematic Review Process*

Overall, the methodological quality of the evidence base was rated "satisfactory" to "good", with most of the studies not including a representative sample. Participants were recruited from undergraduate communities, primarily from a white background and some male-only samples. This limits the generalisability of findings as samples are unlikely to represent a full range of psychopathic traits. Therefore, future work should be extended to include more diverse samples in terms of age, gender, ethnicity, cultural background, and education level to make findings more generalisable (Roberts et al., 2020). Most studies also lacked an adequate sample size or had low statistical power which may have hindered the findings from the present studies, and larger replication studies should be conducted to validate results. In addition, some studies did not allow for a comparison group as psychopathy scores were used to group subjects. This can be problematic as arbitrary grouping can lead to homogeneity of groups if there is a cross-over in psychopathy scores. Nevertheless, a strength of this review is that all studies used objective and validated laboratory techniques and validated psychopathic traits measures. Additionally, each study clearly and appropriately used statistical tests to analyse its data.

### *Limitations of Eligible Research*

Most studies used pressure as a method to assess pain tolerance. While this is a validated method of pain stimulation (Jackson et al., 2020; Lacourt et al., 2012), physical

pain is multifaceted and should be assessed through multiple modalities such as temperature (e.g., heat and cold), pressure and electric shocks as each stimulus can be interpreted differently (e.g. Miller et al., 2013). In addition, although associations were found between psychopathy, pain tolerance and empathy, research is still lacking about the possible mechanisms behind such findings. The neurological studies used in the current review (Berluti et al., 2020; Brislin et al., 2022; Decety et al., 2015; Marcoux et al., 2013; Seara-Cardoso et al., 2015) did show potential areas in the brain that may be affected during nociceptive pain and pain empathy stimuli, however, more research is needed to understand the complex relationship between them. Moreover, some studies used a male-only sample (Marcoux et al., 2013; Seara-Cardoso et al., 2015), which limits the generalisability of the findings, thus populations should be diversified to include more groups such as females. Lastly, the presence of a researcher in pain tolerance assessments may have an influence on willingness to withstand pain, which could potentially affect the validity of findings (Kállai et al., 2004). Research has suggested that factors such as social desirability bias and the need to appear tough or resilient in front of an observer can alter pain perception and endurance (Kállai et al., 2004). Due to this, future research should consider controlling for the effects of a researcher being present and being absent to account for them as potential influences on results.

### *Conclusions and Implications*

The systematic review highlights that a tolerance for nociceptive pain may be modality specific. This was demonstrated via significant differences for pressure and electric shock stimuli, but not cold temperatures. Additionally, significant pain findings may be dependent upon the method used to collect data; there were significant pain tolerance findings in psychopathic traits when data was collected via self-report and EEG, but there were no significant findings when pain data was collected via fMRI. Furthermore, neural

findings indicate that a reduction in empathy for the pain of others may stem from a neurological basis. Lastly, boldness and meanness traits may play a specific role in experiencing pain as well as in empathy for other people's pain. As a result, future research should aim to explore a variety of nociceptive pain and data collection methods in individuals with low and high levels of psychopathic traits and investigate how facets of psychopathy influence responses. In addition, more neural research should be conducted in those assessed for higher levels of psychopathic traits to further investigate a potential neurological basis for a lack of empathy.

**Conclusion to Manuscript**

This systematic review aimed to consolidate findings that investigated nociceptive pain experience and empathy for other people's pain in non-clinical samples (Alshukri et al., 2025). The results indicated that a tolerance of nociceptive pain within higher psychopathic traits may be modality dependent. In addition, the review highlighted that a lack of empathy for others may stem from a neurological basis. Lastly, specific traits of boldness and meanness were found to play a role in tolerating nociceptive pain and lacking empathy for others.

These findings are important as they suggest a tolerance for nociceptive pain may not apply for all modes of nociceptive pain stimuli in those with higher levels of psychopathic traits, and results differ between methods of data collection. This may represent a complex relationship between nociceptive pain experience and traits such as psychopathy. In addition, if empathy is rooted in neurological and physiological differences, this knowledge can help to inform and develop treatments and interventions. Subsequently, Chapter 4 aimed to explore the effects of psychopathic traits on cognitive and affective empathy and investigated how psychopathic traits affect sensitivity to pain when controlling for self-reported empathy, as empathy is affected in those higher in psychopathic traits.

# Chapter 4: A two-part online study investigating psychopathic traits and their effect on empathy and sensitivity to pain in a non-clinical sample

## Introduction to Manuscript

This chapter entitled, “a two-part online study investigating psychopathic traits and their effect on empathy and sensitivity to pain in a non-clinical sample”, explored the effects of triarchic psychopathy on empathy in men and women, and the effects of triarchic psychopathy on pain sensitivity when controlling for the effects of empathy using an online non-clinical sample. Men and women are known to show differences in both psychopathy and empathy levels (e.g., Aluja et al., 2022; Baglole et al., 2022; Maurer et al., 2022; Sun et al., 2018), however, there are limited studies examining how triarchic psychopathy relates to empathy, and research in women has been scarce. In addition, evidence has also shown differences in psychopathy and empathy levels between age (Huchzermeier et al., 2008; Maurer et al., 2022). Moreover, as previous research has shown higher tolerances for pain in individuals with higher levels of psychopathic traits (Brislin et al., 2016; Brislin et al., 2022), it was important to control for the effects of empathy when assessing this using a self-report pain questionnaire. This ensured that the effects of psychopathic traits could be isolated. As a result, the present research utilised the same sample of participants to assess psychopathy and empathy in Study 1, and psychopathy, pain sensitivity and empathy in Study 2.

**Abstract**

Psychopathic traits have shown associations with lower levels of empathy and higher tolerances to pain. Yet, the effects of triarchic psychopathy (Patrick, 2010) on facets of empathy (i.e., cognitive and affective; Davis, 1980) between men and women remains largely unexplored. Further, as empathy is affected in individuals with higher psychopathic traits (see Campos et al., 2022), it is important to control for such effects when exploring sensitivity to pain.

Two studies were conducted to explore the effects of empathy between men and women, and to control for the effects of empathy on sensitivity to pain in a non-clinical sample. Seven-hundred and fifty-seven participants (18-80 years; $M = 25.24$, $SD = 10.90$, 71.7% female) completed self-report psychopathy, empathy, and pain sensitivity measures. For Study 1, a one-way MANOVA and correlations were run to test the relationships between psychopathic traits, empathy, and age between women and men. Two hierarchical multiple regressions were used to examine the effects of sex, age and psychopathy on cognitive and affective empathy. For Study 2, in addition to correlations, a hierarchical multiple regression was used to examine the effects of psychopathy facets (boldness, meanness, disinhibition) on predicting pain sensitivity after controlling for the influence of empathy (perspective taking, fantasy, empathic concern, personal distress; Davis, 1980).

The present study showed facets of psychopathic traits related to empathy in different ways, particularly amongst men and women. For instance, women showed a negative relationship between cognitive empathy and disinhibition, whereas men showed a positive relationship between affective empathy and disinhibition. Additionally, and contrasting previous findings (Alshukri et al., 2024; Kaseweter et al., 2022)., there was not a significant relationship between psychopathy and a sensitivity to pain except when controlling for empathy levels, for which boldness emerged as a significant predictor. Findings indicate there

may be discrepancies between self-report data versus experimental studies, which should be explored further.

## Introduction

Psychopathy is a cluster of personality traits that relate to inter-personal (i.e., empathy for others) and intra-personal (i.e., pain tolerance) functioning (Berkout et al., 2013; Miller et al., 2013) which could relate to one another (e.g. Fallon et al., 2020; van Dongen et al., 2018). Using the triarchic model of psychopathy, traits can be assessed via three facets: boldness (i.e., social dominance, emotional stability, and risk-taking), meanness (i.e. low empathy, exploitativeness, manipulation), and disinhibition (i.e., irritability, boredom proneness, and lack of stability; Patrick, 2022). A higher tolerance for experiencing pain has been found in those higher in psychopathy, but especially within the meanness facet of the TriPm (Brislin et al., 2016; Brislin et al., 2022). As such, lacking sensitivity to pain may influence reduced empathy for others that is often found in those with higher levels of psychopathic traits (Branchadell et al., 2024). Such behaviours can present themselves as aggression and dangerousness (Garofalo et al., 2021a; Gillespie et al., 2023), rape-supportive attitudes (Lyons et al., 2022), intimate partner violence perpetration (Robertson et al., 2020), and school bullying (Baroncelli et al., 2022). Examining the relationships between psychopathy, empathy, and pain sensitivity may provide insights into the forces underlying aggressive and antisocial behaviours. While previous studies have examined aspects of the relationships between psychopathy, empathy, and pain sensitivity (e.g., Brislin et al., 2016; Brislin et al., 2022; Burghart et al., 2024; Campos et al., 2023), research specifically investigating how triarchic psychopathy facets relate to dimensions of empathy and a range of pain experiences in a non-clinical sample is limited. As a result, the present study aimed to further the knowledge of psychopathy, empathy, and sensitivity to pain.

Although psychopathy has been conceptualised in different ways (see De Brito et al., 2021), this study chose to investigate it as a dimensional construct of three traits: boldness, meanness, and disinhibition. These facets of psychopathy have been related to reduced attention and blunted responses to the emotions of others (Burley et al., 2019; Kimonis et al., 2020). For instance, individuals scoring higher on interpersonal-affective (i.e., boldness and meanness) traits displayed blunted pupil dilation in response to negative facial expressions (Burley et al., 2019). Further, higher psychopathic traits were associated with reduced attention to emotional stimuli assessed via a dot probe and emotion-induced blindness tasks (Kimonis et al., 2020). Such atypical emotional patterns may contribute to the emotional deficits observed in psychopathic traits. Due to this, it is important to investigate the impact that psychopathic traits may have on empathy for others.

Empathy can be divided into two continuous traits: affective (i.e., the ability to feel what others are feeling) and cognitive (i.e., the ability to understand what others are feeling; Singer et al., 2009). Psychopathy is generally associated with deficits in affective empathy, while cognitive empathy remains relatively intact (Maguire et al., 2024). However, only a few studies have investigated how triarchic psychopathy relates to empathy subtypes. For instance, while meanness is associated with a broad empathy impairment, boldness has been linked to enhanced cognitive empathy but reduced affective empathy, and disinhibition has been connected to diminished cognitive empathy (Campos et al., 2023). Moreover, all three psychopathy facets showed a negative association with all dimensions of the Interpersonal Reactivity Index (IRI; Davis, 1980) in a community sample, but these effects were less pronounced in a forensic comparison group (Burghart et al., 2024; Campos et al., 2023). On the other hand, violent offenders with high levels of psychopathic traits were found with reduced cognitive and affective empathy levels when asked to rate the feelings of others (Mayer et al., 2018). While these findings illustrate the varied impact of psychopathic traits

on empathy, other factors such as sex and age also play a crucial role in these relationships, influencing both psychopathy levels and empathy.

Factors such as sex and age may also play a role in the differences in psychopathy and empathy. While research in women is limited (e.g., Tully et al., 2023), studies have shown that men tend to score higher than women in psychopathic traits overall (Aluja et al., 2022), while women show higher levels of empathy than men (Gilet et al., 2013), which could be attributed to differences in patterns of brain connectivity (Rodríguez-Nieto et al., 2022). Further, levels of antisocial and impulsive traits varied across age in both male and female prison samples, with younger men and women scoring significantly higher than their older counterparts (Baglole et al., 2022; Huchzermeier et al., 2008; Maurer et al., 2022). Due to these influences on findings, sex and age will be controlled for when investigating psychopathic traits and empathy in Study 1.

Moreover, lower levels of empathy, which are considered a core trait of psychopathy (Hare et al., 2008), may lead to an insensitivity to others' distress and result in aggression. Research has shown lower levels of empathy in individuals with higher psychopathic traits (Alshukri et al., 2024; Burghart et al., 2022). Consequently, diminished levels of empathy seen in those with higher levels of psychopathy may lead to a greater chance of aggressive behaviours towards others since there is less emotional conflict involved (Blair, 2018). This, coupled with a deficit in processing nociceptive stimuli such as pain in oneself has been proposed to influence the lack of understanding of others' pain in psychopathy (Branchadell et al., 2024; Brislin et al., 2022). Consequently, differences (i.e., varying scores on facets of the TriPm) in pain perception may underlie lower empathic abilities in those higher in psychopathic traits, thus causing an insensitivity towards others in distress.

As psychopathic traits are shown to relate to both altered empathy (Maguire et al., 2024) and pain perception (Alshukri et al., 2024; Burghart et al., 2022), both aspects were

explored in two separate studies. Study 1 examined facets of psychopathic traits and their relationships with cognitive and affective empathy and explored differences in men and women, and age. Previous research has shown variations in results relating to psychopathy and empathy (e.g. Burghart et al., 2022; Burghart et al., 2024; Campos et al., 2023), but there is a lack of research investigating the sub-types of triarchic psychopathy in relation to facets of empathy. In addition, as previous research has shown significant results in relation to age and gender in both psychopathy and empathy research (e.g., Aluja et al., 2022; Burghart et al., 2022; Gilet et al., 2013; Sun et al., 2018), these variables will be controlled for.

Next, Study 2 investigated how self-reported psychopathy relates to pain sensitivity and empathy. Previous findings have shown an association between psychopathy and a higher tolerance for pain, as well as lower perceptions of pain (Alshukri et al., 2024; Brislin et al., 2016; Brislin et al., 2022). Furthermore, research has suggested that reduced empathy for other people may be related to lower levels of distress experienced in oneself (Brazil et al., 2022; van Dongen, 2020). Given the negative relationships between psychopathy and empathy (see Burghart et al., 2022 for meta-analysis), it is important to control for the influence that empathy may have when assessing pain in oneself. This means that the relationship between psychopathic traits on pain sensitivity can be more accurately assessed. In addition, previous research fails to explore a range of pain scenarios in relation to psychopathy to test whether this impacts findings (see Brislin et al., 2022), but instead use a single repeated pain stimulation method such as pressure (e.g. Brislin et al., 2016; Brislin et al., 2022). Due to this, the present study adopted a pain sensitivity questionnaire investigating an array of everyday pain situations to assess a more broad range of pain scenarios (Pain Sensitivity Questionnaire; Ruscheweyh et al., 2009a). Together, the present study aimed to assess the effects of triarchic psychopathy on empathy and pain sensitivity in a non-clinical sample.

## Study 1

Study 1 employed two questionnaires to assess psychopathic traits and empathy levels between men, women, and age groups using an online non-clinical sample.

### Methodology

#### *Participants*

Participants ($n$ = 1168) submitted online responses between September 2022 and February 2024. The estimation of the sample size was derived from previous research which conducted online studies investigating personality traits and two related variables (e.g., Foulkes et al., 2014; Sest et al., 2017). The study was advertised through mailing lists at Liverpool John Moores University and submitted to Psychological Research on the Net (Krantz, 2022). After cleaning the data for incomplete responses (i.e., not responding to all psychometric questions; $n$ = 385) and violations of eligibility criteria (i.e., below 18 years of age; $n$ = 26), 757 complete responses remained (18-80 years; $M$ = 25.24, $SD$ = 10.90, 71.7% women, 26.6% men, .8% other; 567 from the United Kingdom; 159 from the United States of America and Canada; 31 from mainland European countries; 75.83% identified as students).

#### *Procedure*

Ethical approval was granted by Liverpool John Moores University's ethics committee (reference number: 22/PSY/055; see Appendix 8). Participants were instructed to read a participant information sheet prior to completing the online questionnaire (see Appendix 6). Once consent was given, participants provided demographic information and then completed questionnaires on the topics on psychopathy and empathy (see Materials). A further pain sensitivity questionnaire was administered and utilised in Study 2 of this chapter. Participants were directed to a debriefing page (see Appendix 7) upon completion and could enter a prize draw to win a £25 online shopping voucher.

### *Materials*

The Triarchic Psychopathy Measure (TriPm; Patrick, 2010) is a 58-item self-report measure used to assess psychopathic traits (see Appendix 1). The TriPm has a 4-point Likert scale ranging from "'true"' (3) to "'false"' (0) and assesses three distinct constructs; boldness (e.g., "I am well-equipped to deal with stress"), meanness (e.g., "I enjoy a good physical fight"), and disinhibition (e.g., "I jump into things without thinking"). The self-report measure yielded good internal consistency using Cronbach's alpha coefficient ($\alpha = .89$) overall as well as for each of the constructs ($\alpha = .85$; $\alpha = .88$; $\alpha = .84$, respectively; Kiliç, 2016).

The Interpersonal Reactivity Index (IRI), developed by Davis (1980), is a 28-item self-report questionnaire devised to measure empathy using 4 subscales, each containing 7 questions (see Appendix 2); perspective taking (e.g., "I try to look at everybody's side of a disagreement before I make a decision") and fantasy (e.g., "I really get involved with the feelings of the characters in a novel") assess cognitive empathy, and empathic concern (e.g., "I am often quite touched by things that I see happen"), and personal distress (e.g., "In emergency situations, I feel apprehensive and ill-at-ease") assess affective empathy. Items are scored on a 5-point Likert scale from "does not describe me well" (0) to "describes me very well" (4). The overall self-report measure yielded good internal consistency ($\alpha = .86$), as did each of the constructs ($\alpha = .78$; $\alpha = .80$; $\alpha = .81$; $\alpha = .83$, respectively; Kiliç, 2016).

### *Data Analysis Strategy*

Study 1 employed a within-participants study design. Firstly, a one-way MANOVA was run to compare psychopathy (i.e., boldness, meanness, disinhibition) and empathy (cognitive and affective) scores between men and women as the primary objectives were to evaluate differences in each variable. Using a MANOVA helped to control for multiple comparisons being run and reduced the risk of Type 1 error (Cole et al., 1994; Pallant, 2010).

Next, Pearson's correlations were performed between the facets of psychopathy, cognitive and affective empathy, and age to look for significant correlations between the variables. Lastly, two separate hierarchical multiple regressions were conducted to examine the effects of psychopathy on cognitive and affective empathy when controlling for sex and age. For the first regression, cognitive empathy was entered as the dependent variable, age and sex were entered into step 1 of the model, and psychopathy facets were entered into step 2 of the model. Similarly for the second regression, affective empathy was entered as the dependent variable, age and sex were entered into step 1 of the model, and psychopathy facets were entered into step 2 of the model. The MANOVA was conducted in SPSS (version 29.0.1.0, IBM SPSS Statistics). The correlation analyses were conducted in JASP (version 0.18.3, JASP Team, 2024) and the hierarchical multiple regressions were run in SPSS (version 29.0.1.0, IBM SPSS Statistics).

## Results

### *Assumptions and Descriptive Statistics*

Preliminary analyses were conducted to ensure no violation of the assumptions of normality, linearity, multicollinearity, singularity, and homoscedasticity (Fidell et al., 2003). Skewness and kurtosis of the data were within the normal range for all variables (Hair et al., 2010; see Table 3).

A one-way MANOVA was run to compare psychopathy and empathy scores between males and females (see Table 4). Results showed that gender had a significant effect on each of the psychopathy and empathy variables, $F$ (5, 763) = 18.75, $p < .001$, Wilks' Lambda = .891, partial $\eta^2 = .109$. Post hoc comparisons revealed that men scored significantly higher ($M$ = 28.9, $SE$ = .318) than women ($M$ = 28.1, $SE$ = .194) on boldness, $F$ (1, 767) = 4.71, $p$ = .03, partial $\eta^2 = .006$. Men also scored significantly higher ($M$ = 25.1, $SE$ = .508) than women ($M$ = 22.5, $SE$ = .309) on meanness, $F$ (1, 767) = 20.47, $p <.001$, partial $\eta^2 = .026$. Additionally,

men scored significantly higher on disinhibition ($M$ = 22.8, $SE$ = .506) than women ($M$ = 21.1, $SE$ = .308), $F$ (1, 767) = 8.85, $p$ = .003, partial $\eta^2$ = .011. In contrast, women scored significantly higher on cognitive empathy ($M$ = 35.8, $SE$ = .349) compared to men ($M$ = 32.5, $SE$ = .573), $F$ (1, 767) = 18.10, $p$ <.001, partial $\eta^2$ = .023. Additionally, women also scored significantly higher on affective empathy ($M$ = 34.2, $SE$ = .330) compared to men ($M$ = 28.45, $SE$ = .542), $F$ (1, 767) = 81.18, $p$ <.001, partial $\eta^2$ = .096.

***Correlations***

Pearson's correlations are shown in Table 5. For women, significant correlations were as follows. Cognitive empathy showed a significant negative correlation with meanness ($r$ = -.20, $p$ < .001) and disinhibition ($r$ = -.09, $p$ < .05), while affective empathy significantly negatively correlated with meanness ($r$ = -.35, $p$ < .01). Age negatively correlated with meanness ($r$ = -.11, $p$ <.01) and disinhibition ($r$ = -11, $p$ <.01).

For men, significant correlations were as follows. Cognitive empathy negatively correlated with meanness ($r$ = -.17, $p$ <.05), whereas affective empathy negatively correlated with meanness ($r$ = -.18, $p$ <.05) and positively correlated with disinhibition ($r$ = .17, $p$ <.05). Age negatively correlated with meanness ($r$ = -.23, $p$ <.01).

***Main Study Question***

Does triarchic psychopathy predict cognitive and affective empathy when controlling for sex and age?

Two hierarchical multiple regressions were conducted to examine the effects of psychopathy on cognitive and affective empathy when controlling for sex and age. For the first regression for cognitive empathy, sex and age were entered into step 1 of the model, and explained 2.8% of the variance in cognitive empathy, $F$ (2, 768) = 12.08, $p$ < .001, adjusted $R^2$ = .028; however, sex was the only significant control variable ($B$ = 2.81, $p$ <.001). After

entering psychopathy facets into step 2 of the model, the total variance explained by the model was 6.6%, $F$ (5, 768) = 11.78, $p$ <.001, adjusted $R^2$ = .066. The psychopathy facets explained an additional 3.8% of the variance, *F change* (3, 763) = 11.25, $p$ <.001. The addition of meanness was the only statistically significant predictor variable of cognitive empathy ($B$ = -.25, $p$ <.001). The model indicates that women have greater cognitive empathy than men, whereas age does not have a statistically significant impact. In addition, higher levels of cognitive empathy were associated with lower levels of meanness (see Table 6).

For the second regression for affective empathy, sex and age were entered into step 1 of the model, and explained 9.1% of the variance in affective empathy, $F$ (2, 768) = 39.56, $p$ <.001, adjusted $R^2$ = .091. Sex was the only significant control variable ($B$ = 5.42, $p$ <.001). After entering psychopathy facets into step 2 of the model, the total variance explained by the model was 20.4%, $F$ (5, 768) = 40.44, $p$ <.001, adjusted $R^2$ = .204. The psychopathy facets explained an additional 11.3% of the variance, $F$ change (3, 763) = 37.28, $p$ <.001. Both meanness ($B$ = -.435, $p$ <.001) and disinhibition ($B$ = .20, $p$ <.001) were significant predictors of affective empathy. This model indicates that women have greater levels of affective empathy than men, whereas age does not have a statistically significant impact. In addition, higher levels of affective empathy are associated with higher levels of disinhibition but lower levels of meanness (see Table 7).

**Table 3**

*Descriptive statistics and distribution data for each of the study variables split by males (n = 208) and females (n = 561).*

| | Female (*n* = 561) | | | | | Male (*n* = 208) | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | **Boldness** | **Meanness** | **Disinhibition** | **Cog total** | **Aff total** | **Boldness** | **Meanness** | **Disinhibition** | **Cog total** | **Aff total** |
| *M* | 28.07 | 22.49 | 21.08 | 35.80 | 34.17 | 28.88 | 25.18 | 22.84 | 32.94 | 28.45 |
| *SD* | 4.73 | 7.42 | 7.21 | 8.39 | 8.00 | 4.19 | 7.07 | 7.53 | 7.92 | 7.31 |
| Minimum | 11 | 8 | 7 | 8 | 5 | 19 | 6 | 5 | 14 | 1 |
| Maximum | 42 | 48 | 45 | 55 | 54 | 39 | 48 | 46 | 50 | 49 |
| Skewness | -.08 | .29 | .33 | -.52 | .46 | .04 | .14 | .13 | -.08 | -.37 |
| Skewness *SE* | .10 | .10 | .10 | .10 | .10 | .17 | .17 | .17 | .17 | .17 |
| Kurtosis | .10 | -.49 | -.32 | .23 | .30 | -.34 | .36 | .06 | -.42 | 1.19 |
| Kurtosis *SE* | .21 | .21 | .21 | .21 | .21 | .34 | .34 | .34 | .34 | .34 |

*Note*. Cog total = total cognitive empathy score. Aff total = total affective empathy score. Mean (*M*); standard deviation (*SD*); standard error (*SE*).

**Table 4**

*One-way MANOVA for each of the variables for males (n = 208) and females (n = 561).*

| | **Male (*n* = 208)** | | **Female (*n* = 561)** | | | |
|---|---|---|---|---|---|---|
| | *M* | *SE* | *M* | *SE* | *F* (1, 767) | $\eta^2$ |
| Boldness | 28.9 | .318 | 28.1 | .194 | 4.71 * | .006 |
| Meanness | 25.2 | .508 | 22.5 | .309 | 20.42*** | .026 |
| Disinhibition | 22.8 | .506 | 21.1 | .308 | 8.85** | .001 |
| Cognitive empathy | 32.9 | .573 | 35.8 | .349 | 18.10* | .023 |
| Affective empathy | 28.5 | .542 | 34.2 | .330 | -81.18* | .096 |

*Note. Mean (M); standard error (SE); F-statistic, degrees of freedom, and degrees of freedom error, F (degrees of freedom, degrees of freedom error); Partial eta squared of effect size,* $\eta^2$.

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

**Table 5**

*Pearson's (r) correlation table for each of the study variables for both men (n = 208) and women (n = 561).*

| | Female (*n* = 561) | | | | | | Male (*n* = 208) | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **1** | **2** | **3** | **4** | **5** | **6** | **1** | **2** | **3** | **4** | **5** | **6** |
| 1. Boldness | — | | | | | | — | | | | | |
| 2. Meanness | .04 | — | | | | | -.11 | — | | | | |
| 3. Disinhibition | -.05 | .47** | — | | | | -.13 | .51** | — | | | |
| 4. Cog total | .010 | -.20** | -.09* | — | | | -.001 | -.17* | -.05 | — | | |
| 5. Aff total | -.06 | -.35** | -.06 | .42** | — | | -.008 | -.18* | .17* | .30** | — | |
| 6. Age | .04 | -.16** | -.11** | -.07 | -.04 | — | .14 | -.23** | -.13 | -.06 | .02 | — |

*Note.* Cog total = total cognitive empathy score. Aff total = total affective empathy score.

**Table 6**

*Hierarchical regression table for cognitive empathy.*

| Predictor | Unstandardised *B* | *SE* | *95% CI* | Adjusted $R^2$ |
|---|---|---|---|---|
| Step 1 | | | | .03 |
| Sex | 2.81*** | .67 | 1.51, 4.12 | |
| Age | -.05 | .03 | -.102, .008 | |
| Step 2 | | | | .07 |
| Boldness | .03 | .06 | -.097, .154 | |
| Meanness | -.25*** | .05 | -.34, -.15 | |
| Disinhibition | .02 | .05 | -.07, .11 | |

*Note*. Unstandardised regression coefficient (Unstandardised *B*); standard error *(SE);* 95% confidence interval (*95% CI);* adjusted R squared (*adjusted* $R^2$).

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

**Table 7**

*Hierarchical regression table for affective empathy.*

| Predictor | Unstandardised *B* | *SE* | *95% CI* | Adjusted $R^2$ |
|---|---|---|---|---|
| Step 1 | | | | .09 |
| Sex | 5.42*** | .63 | 4.19, 6.65 | |
| Age | -.02 | .03 | -.067, .037 | |
| Step 2 | | | | .21 |
| Boldness | -.05 | .06 | -.16, .06 | |
| Meanness | -.44*** | .04 | -.52, -.35 | |
| Disinhibition | .20*** | .04 | .12, .28 | |

*Note*. Unstandardised regression coefficient (Unstandardised *B*); standard error *(SE);* 95% confidence interval (*95% CI);* adjusted R squared (*adjusted* $R^2$).

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

**Study 1 Discussion**

Study 1 examined the effects of triarchic psychopathy and age on cognitive and affective empathy between men and women. The results corroborated previous research showing differences between psychopathy and empathy levels between men and women (Aluja et al., 2022; Pang et al., 2023). Specifically, the present study showed men scored higher on psychopathy than women, whereas women scored higher in empathy than men. This finding highlights important differences between the two sexes, and signals for future investigations to take these differences into account when conducting research.

While gender differences were found between psychopathy and empathy levels in men and women, meanness was negatively associated with cognitive and affective empathy overall, but also in both women and men. This suggests that meanness may be a core component of empathy deficits in both men and women.

Next, nuanced findings were unearthed between men and women. Firstly, women showed a negative association with cognitive empathy and disinhibition that men did not. Secondly, in men, there was a positive relationship between affective empathy and disinhibition, meaning that as levels of disinhibition increased, so did levels of affective empathy. These findings indicate distinctiveness in how psychopathic traits and empathy facets manifest themselves between men and women.

Lastly, although age did not emerge as a statistically significant control variable for empathy, there were significant relationships between age and psychopathy in women and men. Firstly, both men and women showed negative relationships between age and meanness scores. Yet only women showed a negative association between age and disinhibition scores. This could indicate that psychopathic traits vary with age between men and women. Findings are discussed in more detail in the General Discussion of this chapter.

## Study 2

As Study 1 identified differences in empathy levels in relation to psychopathic traits, Study 2 expanded on this by controlling for the effects of empathy when investigating psychopathic traits and sensitivity to pain. This was achieved by using an additional questionnaire assessing pain sensitivity in the sample utilised in Study 1.

### Methodology

#### *Participants*

Study 2 utilised the same sample of participants as Study 1 (see Study 1 Participants).

#### *Procedure*

Study 2 followed the same procedure as Study 1 but employed an additional questionnaire assessing sensitivity to pain (see Materials below).

#### *Materials*

Study 2 utilised both the TriPm and IRI from Study 1, but also included the Pain Sensitivity Questionnaire (PSQ; Ruscheweyh et al., 2009a). The PSQ is a 17-item self-report measure used to assess ones' sensitivity to painful scenarios such as, "imagine you burn your tongue on a very hot drink" and "imagine you trap your finger in a drawer" (see Appendix 3). Items are scored on an 11-point Likert scale from "no pain" (0) to "most severe pain that you can imagine or consider possible" (10). The self-report measure yielded excellent internal consistency ($\alpha$ = .92; Kiliç, 2016).

#### *Data Analysis Strategy*

Study 2 employed a within-participants study design. Pearson's correlations were performed between empathy facets (perspective taking, fantasy, empathic concern, personal distress, IRI total score), psychopathy facets (boldness, meanness, disinhibition, TriPm total), and pain sensitivity to look for significant associations amongst variables. Next, a

hierarchical multiple regression was conducted to examine the effects of psychopathy facets (boldness, meanness, disinhibition) on predicting pain sensitivity after controlling for the influence of empathy (perspective taking, fantasy, empathic concern, personal distress). As there was high multicollinearity with IRI total and TriPm total, these variables were excluded from the regression (Fidell et al., 2003; Kim, 2019). Pain sensitivity total score was entered as the dependent variable, empathy facets were entered into step 1 of the model, and psychopathy facets were entered into step 2 of the model. Correlation analyses were conducted in JASP (version 0.18.3, JASP Team, 2024) and the hierarchical multiple regression was run in SPSS (version 29.0.1.0, IBM SPSS Statistics).

## Results

### *Assumptions and Descriptive Statistics*

Preliminary analyses were conducted to ensure no violation of the assumptions of normality, linearity, multicollinearity, and homoscedasticity (Fidell et al., 2003). Skewness and kurtosis of the data were considered to be within the normal range for all variables (Hair et al., 2010; see Table 8). Descriptive statistics are listed in Table 8.

### *Correlations*

Pearson's correlations are shown in Table 9. Pain sensitivity total score showed significant positive correlations with empathic concern ($r$ = .58, $p$ <.001), personal distress ($r$ = .23, $p$ <.001), and empathy total score ($r$ = .69, $p$ <.001). Meanness displayed significant negative correlations with perspective taking ($r$ = -.30, $p$ <.001), empathic concern ($r$ = .58, $p$ <.001), personal distress ($r$ = -.11, $p$ <.01), and empathy total score ($r$ = -.33, $p$ <.001). Disinhibition revealed significant negative correlations with perspective taking ($r$ = -.12, $p$ <.01), empathic concern ($r$ = -.11, $p$ <.01), empathy total score ($r$ = -.73, $p$ <.05), and positively correlated with meanness ($r$ = .49, $p$ <.001). Total psychopathy score demonstrated

negative correlations with perspective taking ($r$ = -.23, $p$ <.001), empathic concern ($r$ = -.32, $p$ <.001), and empathy total score ($r$ = -.24, $p$ <.001).

**Table 8**

*Descriptive statistics and distribution data of each of the study variables.*

| | Perspective taking | Fantasy | Empathic concern | Personal distress | IRI total | Boldness | Meanness | Disinhibition | TriPm total | Pain q total |
|---|---|---|---|---|---|---|---|---|---|---|
| *M* | 18.05 | 17.04 | 19.86 | 12.78 | 67.73 | 28.27 | 23.21 | 21.57 | 73.05 | 70.34 |
| *SD* | 4.76 | 5.70 | 4.81 | 5.50 | 13.93 | 4.60 | 7.41 | 7.31 | 13.41 | 22.02 |
| Minimum | 2.00 | 1.00 | .00 | .00 | 19.00 | 11.00 | 6.00 | 5.00 | 39.00 | 30.00 |
| Maximum | 28.00 | 28.00 | 28.00 | 27.00 | 102.00 | 42.00 | 48.00 | 46.00 | 113.00 | 167.00 |
| Skewness | -.45 | -.31 | -.63 | -.02 | -.37 | -.07 | .23 | .27 | .12 | .74 |
| Skewness *SE* | .09 | .09 | .09 | .09 | .09 | .09 | .09 | .09 | .09 | .09 |
| Kurtosis | .01 | -.50 | .46 | -.31 | .16 | .04 | -.33 | -.23 | -.32 | .73 |
| Kurtosis *SE* | .18 | .18 | .18 | .18 | .18 | .18 | .18 | .18 | .18 | .18 |

*Note*. IRI total = total empathy score; TriPm total = total psychopathy score; Pain q total = total pain sensitivity score; Mean (*M*); standard deviation (*SD*); standard error (*SE*).

**Table 9**

*Pearson's (r) correlation table for each of the study variables.*

| | 1 | | 2 | | 3 | | 4 | | 5 | | 6 | | 7 | | 8 | | 9 | 10 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1. Perspective taking | — | | | | | | | | | | | | | | | | | |
| 2. Fantasy | .27 | *** | — | | | | | | | | | | | | | | | |
| 3. Empathic concern | .58 | *** | .34 | *** | — | | | | | | | | | | | | | |
| 4. Personal distress | -.027 | | .24 | *** | .26 | *** | — | | | | | | | | | | | |
| 5. IRI total | .69 | *** | .72 | *** | .77 | *** | .57 | *** | — | | | | | | | | | |
| 6. Boldness | .01 | | -.018 | | -.046 | | -.07 | | -.047 | | — | | | | | | | |
| 7.. Meanness | -.30 | *** | -.067 | | -.45 | *** | -.11 | ** | -.33 | *** | .018 | | — | | | | | |
| 8. Disinhibition | -.12 | ** | -.035 | | -.11 | ** | .047 | | -.073 | * | -.057 | | .49 | *** | — | | | |
| 9. TriPm total | -.23 | *** | -.062 | | -.32 | *** | -.061 | | -.24 | *** | .32 | *** | .82 | *** | .80 | *** | — | |
| 10. Pain q total | .008 | | .037 | | .14 | *** | .23 | *** | .16 | *** | .055 | | -.027 | | .038 | | .025 | — |

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

***Main Study Question***

When controlling for empathy, does boldness, meanness, or disinhibition predict pain sensitivity?

A hierarchical multiple regression was conducted to examine the effects of the facets of the TriPm (boldness, meanness, disinhibition) on predicting pain sensitivity after controlling for the influence of empathy levels (perspective taking, fantasy, empathic concern, personal distress).

Empathy facets (fantasy, perspective taking, empathic concern, personal distress) were entered at step 1, explaining 5.8% of the variance in pain sensitivity, $F$ (4, 774) = 12.94, $p$<.001, adjusted $R^2$ = .058. After entry of the TriPm facets, (boldness, meanness, disinhibition) at step 2, the total variance explained by the model was 6.2%, $F$ (7, 774) = 8.37, $p$<.001, adjusted $R^2$ = .062. The psychopathy facets explained an additional .4% after controlling for empathy; however, this did not significantly improve the power of the model, *R squared change* = .008, *F change* (3, 767) = 2.19, $p$ = .088. In the final model, only boldness led to a statistically significant increase in adjusted $R^2$ = .062, $F$ (7, 774) = 8.37, $p$<.001. Overall, while boldness showed a significant relationship with pain sensitivity, the combined effect of the psychopathy predictors in step 2 did not significantly explain variance in pain sensitivity nor enhance the power of the model (see Table 10).

**Table 10**

*Multiple regression table for affective empathy.*

| **Predictor** | **Unstandardised *B*** | ***SE*** | ***95% CI*** | **Adjusted $R^2$** |
|---|---|---|---|---|
| Step 1 | | | | .058 |
| Perspective taking | -.2 | .198 | -.588, .188 | |
| Fantasy | -.17 | .147 | -.459, .119 | |
| Empathic concern | .591* | .203 | .192, .99 | |
| Personal distress | .816*** | .151 | .52, 1.112 | |
| Step 2 | | | | .062 |
| Perspective taking | -.188 | .198 | -.577, .201 | |
| Fantasy | -.186 | .148 | -.477, .104 | |
| Empathic concern | .688* | .218 | .259, 1.117 | |
| Personal distress | .83*** | .151 | .533, 1.128 | |
| Boldness | .365* | .167 | .037, .694 | |
| Meanness | .105 | .135 | -.16, .369 | |
| Disinhibition | .076 | .122 | -.164, .316 | |

*Note*. Unstandardised regression coefficient (Unstandardised *B*); standard error *(SE);* 95% confidence interval (*95% CI);* adjusted R squared (*adjusted* $R^2$).

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

## Study 2 Discussion

Study 2 aimed to investigate the relationship between psychopathy and pain sensitivity when controlling for empathy levels in non-clinical samples. In contrast to previous experimental research (Alshukri et al., 2024; Kaseweter et al., 2022), the present study did not find a significant relationship between the facets of psychopathy and a sensitivity to pain when using self-report measures alone. This key finding helps to highlight potential differences in assessment methods (i.e., self-report vs experimental) and how they may affect results. It also helps to corroborate potential discrepancies in self-report responses to body sensations that have been found in those with psychopathic traits, known as somatic aphasia (Gao et al., 2012).

Further, the present findings showed that out of the three facets of psychopathy, boldness was the sole significant predictor of pain sensitivity, however, the overall model was not statistically significant. This may suggest that boldness traits play a key role in pain perception due to adaptive traits such as a better ability to manage stress (Yancey et al., 2022). This may result in the perception of less pain, thus reduced sensitivity to pain.

Diving deeper than Study 1, Study 2 unveiled that meanness was negatively related to facets of cognitive (i.e., perspective taking) and affective (i.e., empathic concern, personal distress) empathy. Moreover, disinhibition related to lower levels of cognitive empathy, specifically perspective taking. Findings are discussed in more detail in the General Discussion below.

## General Discussion

The aim of the two studies was to investigate cognitive and affective empathy between men and women and age groups and investigate the effects of psychopathic traits on sensitivity when controlling for the effects of empathy in non-clinical samples. Study 1 found an array of similarities and differences in the relationships between psychopathy and empathy

in women and men, which both support and contrast previous research (Aluja et al., 2022; Burghart et al., 2022; Pang et al., 2023). Age was found to only have a small effect on psychopathy. Study 2 did not reveal a significant relationship between psychopathic traits and sensitivity to pain when using self-report measures alone, contrasting previous experimental research (e.g., Alshukri et al., 2024; Kaseweter et al., 2022). Whereas boldness traits emerged as the sole significant predictor of pain sensitivity when controlling for empathy. A deeper understanding of the relationships between facets of psychopathy and empathy were also uncovered in Study 2. Findings are discussed below.

The present study was able to confirm previous findings highlighting sex differences in psychopathy and empathy between men and women in Study 1 (Aluja et al., 2022; Burghart et al., 2022; Pang et al., 2023). Firstly, women displayed higher levels of cognitive and affective empathy compared to men. One of the potential underlying reasons for this has been attributed to differences in brain activity when viewing emotionally salient stimuli; compared to men, women have shown different patterns of connectivity within the brain when viewing compassionate images (Rodríguez-Nieto et al., 2022). This may help to show a possible explanation for differences in empathy between the sexes. Additionally, a recent meta-analysis investigated whether empathy in psychopathic traits were related to emotional intelligence (EI; Megías et al., 2018). EI is the ability to perceive, process, understand and regulate emotions (Mayer et al., 2016). While findings showed psychopathy was related to lower levels of EI more broadly (see Megías et al., 2018 for meta analysis), more specific research has showed female offenders with psychopathic traits tended to score higher on measures of emotional intelligence compared to males (Edwards et al., 2019). While higher levels of EI may not directly link to higher levels of empathy (as this was not explicitly measured), it raises the question as to whether higher EI is an underlying factor for higher empathic abilities in women with psychopathic traits in non-clinical samples. As such, future

research should employ EI measures in similar research in non-clinical samples to assess its influence of empathy levels in both women and men within psychopathic traits.

Secondly, men displayed higher levels of psychopathic traits compared to women, which is consistent with previous research (Aluja et al., 2022). While both men and women higher in psychopathic traits have shown similar emotional modulation abilities, women do not display the same emotional processing deficits as men (Efferson et al., 2018). This can also be further supported by the present finding from Study 1 showing that women have higher empathic abilities than men. Moreover, research looking into differences in aggression between men and women may also underpin differences found in psychopathic traits (Thomson et al., 2019b). While affective traits (i.e., shallow affect, callousness) related to physical aggression in women, antisocial facets (i.e., impulsivity, criminal behaviour) were related to indirect aggression in men (Thomson et al., 2019b). Due to this, men may be more likely to engage in different acts of aggression such as rule breaking (Garofalo et al., 2021a). Consequently, understanding sex-based differences is important as a 'one size fits all' approach may not be applicable in terms of treatments and interventions.

Next, Study 1 was able to show that meanness was negatively associated with cognitive and affective empathy overall, but also in both men and women. Even though women tend to show more empathic behaviours as a whole (Pang et al., 2023), higher levels of meanness may negate this as meanness describes callousness and a disregard for the feelings of others (Patrick, 2022). Since cognitive and affective empathy involves emotional understanding and resonance, respectively (Decety et al., 2008), possessing higher meanness levels conflicts with the idea of understanding and sharing the emotions of others. Further, recent neuroimaging research has found those higher in traits of meanness show reduced electrophysiological responses to aggressive, painful, and unpleasant images (Brislin et al., 2022; Ruchensky et al., 2023; van Dongen et al., 2018). This suggests that, neurologically,

less arousal may be produced in response to negative stimili, which may be interpreted as less of an attempt to empathise with others. Due to this, these findings may offer an explanation as to why individuals with higher levels of psychopathic traits are less responsive to others' distress cues (Blair, 2015). However, as the above research did not explicitly investigate brain responses between women and men, future research should focus on exploring these potential gender differences.

More specifically, Study 2 was able to show negative correlations between meanness and the facets of empathy, namely perspective taking (i.e., cognitive empathy), empathic concern, and personal distress (i.e., affective empathy). While psychopathic traits are generally related to relatively intact cognitive empathy skills (Campos et al., 2022), the findings help to highlight individual differences that may be overlooked. For instance, recent research supported the present findings by diving deeper into the intricacies of perspective taking in psychopathy and found a negative association with cold-heartedness (Lanciano et al., 2021). As well as cold-heartedness, individuals higher in meanness traits may also exhibit callousness and exploitative behaviours (Patrick et al., 2009). Such traits may conflict with the ability to take another's perspective, which could help to explain why these behaviours are prevalent in such individuals (Camara et al., 2025). Moreover, higher levels of meanness were also associated with less affective empathy in the form of empathic concern and personal distress. This is consistent with previous findings reporting lower levels of personal distress and responsiveness to others' emotions (see Burghart et al., 2022 for meta-analysis). Furthermore, lower levels of empathic concern may be attributed to the callous behaviours seen in these individuals, which may contribute to a decrease in the likelihood of prosocial behaviours that may help a person in need (Rijnders et al., 2021). Together, this shows that it is important to consider the individual differences that may contribute to empathy findings as psychopathy sits on a spectrum rather than being a linear construct. This way of thinking will

aid in creating a deeper understanding of those with lower levels of empathy. For instance, this will help to firstly avoid an overgeneralisation of a lack of empathy within psychopathic traits and instead identify potential risk factors for lower levels of empathy. Secondly, the field can gain a deeper understanding of *why* certain traits of psychopathy result in lower levels of empathy, and potential root causes.

Further, Study 2 found higher levels of disinhibition were related to lower levels of cognitive empathy, specifically perspective taking, which supports recent review findings (Campos et al., 2023). Trait disinhibition describes impulsivity and sensation-seeking behaviours (Patrick et al., 2009), and has shown negative associations with fear of pain stimuli and punishment (Brislin et al., 2016; van Dongen, 2020). A lack of cognitive empathy in conjunction with high levels of disinhibition could reinforce antisocial behaviour as there is difficulty in accurately inferring another's emotions (Branchadell et al., 2024; Brazil et al., 2022). This is supported by research showing disinhibition correlated with past violence and criminal behaviour (Gray et al., 2021; Seigfried-Spellar et al., 2017). Yet, as the present study did not assess antisocial behaviours, this idea must be considered with caution but presents an interesting line of inquiry for future research.

Moreover, Study 1 uncovered differences in disinhibition between men and women. To start, women showed a negative association with cognitive empathy and disinhibition that men did not. As cognitive empathy requires understanding others' perspectives, disinhibited behaviours may not fit in with this idea as they describe impulsivity and acting without thinking about consequences (Gottfried et al., 2019). Furthermore, impulsive traits like disinhibition have been linked to reduced emotional attention to negative stimuli (Kimonis et al., 2020), which may indicate that such individuals may not possess the attention and focus that is needed to attend to the emotions of others. Yet this sample consisted solely of men (Kimonis et al., 2020). However, women with higher levels of disinhibition have been

associated with symptoms such as depression, anxiety, and stress (Falkenbach et al., 2017; Sica et al., 2015; Sica et al., 2021), as well as difficulties in regulating and processing negative emotions (Falkenbach et al., 2017; Pinheiro et al., 2023). As a result, such emotional difficulties in oneself may hinder being able to understand the emotions of others. Together, this may help to explain reduced levels of cognitive empathy in women. However, as there is a lack of psychopathy and empathy research in women, more needs to be conducted to further explore this relationship.

In contrast, in Study 1, there was a positive relationship between affective empathy and disinhibition in men, meaning that as levels of disinhibition increased, so did levels of affective empathy. Although this relationship was weak, these findings contrast with previous studies which found lifestyle and antisocial facets were related to intimate partner violence and bullying (Baroncelli et al., 2022; Robertson et al., 2020) rather than empathic behaviours. However, elevated levels of disinhibition have been linked to emotion dysregulation (i.e., difficulties managing emotions) and aggression (Garofalo et al., 2020; Garofalo et al., 2021a). As such, emotional instability and impulsivity may translate into experiencing intense emotions such as reactive aggression (i.e., hostile and anger-laden reactions; Dodge et al., 1987) that may lead to irregular emotional responses (Garofalo et al., 2017). Moreover, possessing high levels of affective empathy may also be a tool for manipulation; being able to *appear* as though one is feeling the emotions of others. This can be supported by findings showing individuals higher in psychopathic traits were able to self-report as though they were empathetic, but physiologically, empathy was absent (Pfabigan et al., 2015). Although the findings seem counterintuitive in relation to previous research (e.g. Baroncelli et al., 2022; Robertson et al., 2020), and the effect size was small, future research should consider replicating the study to ensure these findings are robust.

Next, although age did not emerge as a statistically significant control variable for empathy in Study 1, there were significant relationships between age and psychopathy in men and women. Firstly, both men and women showed negative relationships between age and meanness scores. Age-related differences in psychopathy scores have generally shown that traits tend to drop as age increases (Huchzermeier et al., 2008; Makim et al., 2018). However, inconsistencies have been found in women (Maurer et al., 2022). For instance, in a sample of incarcerated women, interpersonal and affective traits were comparable across age groups (Maurer et al., 2022). Moreover, meanness traits in particular were better identifiers of psychopathic traits in young males compared to their older counterparts (Baglole et al., 2022). Yet, such traits were comparable across age groups in women (Maurer et al., 2022). In contrast, only women showed a negative association between age and disinhibition scores in the present study. This is supported by previous findings in female offenders which showed younger women scored higher on traits of impulsivity (Maurer et al., 2022). However, the same has also been found in violent male offenders (Huchzermeier et al., 2008). Whether these results relate to aging or generational differences in unknown. Nevertheless, the present findings call for more research looking at age and generational differences in psychopathic traits, as this could help to strengthen knowledge and understanding.

Next, previous research has shown those with higher levels of psychopathic traits are less sensitive to pain (Alshukri et al., 2024; Kaseweter et al., 2022). This has been demonstrated by individuals higher in psychopathy reporting less nociceptive pressure compared to those lower in psychopathy (Alshukri et al., 2024). However, Study 2 did not find a significant relationship between the facets of psychopathy and a sensitivity to pain when using self-report measures alone. One reason for this may be that the self-report measure describing pain scenarios may not have generated enough arousal to create a significant response in participants. What is more, findings may reflect previous research

which has demonstrated a disparity between self-report and experimental measures (Gao et al., 2012; Pfabigan et al., 2015). For instance, research has demonstrated individuals with psychopathic traits were unable to self-report bodily sensations that were identified through an objective measure of heart rate activity (Gao et al., 2012). Further, inconsistencies between self-report and skin conductance responses were found in a sample of male inmates when responding to the pain of others (Pfabigan et al., 2015). Such discrepancies, also termed somatic aphasia (Gao et al., 2012), may help to explain the difference between self-report responses and objective measures in psychopathic traits. As a result, future research may wish to further explore the discrepancies that exist between subjective and objective methods of measurement.

Lastly, Study 2 showed that out of the three facets of psychopathy, boldness was the sole significant predictor of pain sensitivity, however, the overall model was not statistically significant. Boldness is associated with traits like fearlessness, venturesomeness, and social dominance (Patrick et al., 2009), and has been related to accepting higher levels of pressure (Brislin et al., 2022). Moreover, research has found boldness was associated with lower levels of self-reported pain anxiety and catastrophising (Brislin et al., 2016; Durand et al., 2017). This may suggest that individuals higher in boldness may experience pain differently to others, perhaps due to the ability to better manage stress (Yancey et al., 2022). However, while boldness was a significant predictor, the overall model was not significant. Since the present study did not find any significant correlations between psychopathy facets and pain sensitivity, the self-report measure capturing sensitivity to pain may have been insufficient to generate significant responses. Furthermore, as psychopathy is a complex personality trait, additional investigations are needed to explore the nuances of how psychopathic traits may affect pain perception. As a result, future research should consider adopting a laboratory-

based study using nociceptive stimuli to assess pain sensitivity and investigating the potential influence of psychopathy when controlling for the effects of empathy.

### *Limitations and Strengths*

Despite the findings of this research, the limitations of the present studies must be considered. Firstly, as this study was dependent upon self-report measures, there may be a possibility of social desirability bias or demand characteristics which could affect the responses given (Mortel, 2008). Additionally, as individuals with psychopathic traits are known for their manipulative abilities or wanting to appear tough, this may have affected responses (Ray et al., 2013). Future research may wish to mitigate these effects by adopting physiological techniques to accompany self-report responses and identify any discrepancies. Moreover, as demonstrated by Study 2's findings, a questionnaire asking people to imagine themselves in painful situations may not be able to fully capture how that person feels. This can be corroborated by prior research showing associations between psychopathic traits and self-reported pain perceptions when using nociceptive stimuli in laboratory-based studies (Alshukri et al., 2025; Alshukri et al., 2024). Therefore, this discrepancy in findings should be addressed in future research by comparing self-report responses to pain questionnaires and exposure to similar experimental stimuli. Lastly, as the online questionnaire was advertised in mostly university-based settings, 75% of participants reported themselves as being students. This may be problematic as a student sample may lack generalisability to other populations, and have previously shown different responses in experimental research compared to non-student samples (Hooghe et al., 2010). Due to this, future research should aim to diversify their samples to include a range of education levels as well as races, ethnicities, and socioeconomic levels.

However, this research also has its strengths. Firstly, the study was able to recruit a large sample size ($n$ = 757), which helps to increase the reliability and validity of the

findings. The sample size was based on previous studies measuring personality traits and two related variables in an online setting (e.g., Foulkes et al., 2014; Sest et al., 2017). To confirm this, a post hoc power analysis (similar to Schönthaler et al., 2023) was conducted to ensure the sample size was adequate to sufficiently power the findings, and showed that this study was highly powered, $(1 - \beta) = 1$ (Faul et al., 2009). Next, the present study was able to recruit a wide age-range, meaning research can be added to the limited findings exploring age, psychopathic traits, and empathy. In addition, the present study used validated assessment methods that enabled the creation of high-quality and reliable research. Lastly, as self-report measures present issues with participants being honest in their responses (Mortel, 2008), the anonymity of questionnaires completed in an online environment helps to lower levels of social desirability bias (Kreuter et al., 2008). This ensures responses are more reliable.

### *Conclusions*

In conclusion, the present study helped to show that psychopathic traits and empathy levels relate to each other in different ways, and especially between men and women. For instance, women showed a negative relationship with cognitive empathy and disinhibition while men showed a positive relationship between affective empathy and disinhibition. Additionally, there were age differences in psychopathy traits, such as negative relationships between age and meanness scores in both men and women. Next, and in contrast to previous findings, there was not a significant relationship between psychopathy and a sensitivity to pain except when controlling for empathy levels, for which boldness emerged as a significant predictor. These findings contradict previous results on psychopathic traits and pain perception as there were discrepancies in self-report data versus previous experimental studies. Due to this, future research may wish to develop the methods by which self-reported pain sensitivity is measured. In addition, the present study highlights the need for further research of psychopathic traits and empathy in women and amongst varying age groups.

## Conclusion to Manuscript

The present body of research aimed to explore the relationships between triarchic psychopathy on facets of empathy between men and women. Further, as psychopathic traits have shown associations with lower levels of empathy (Campos et al., 2022) but higher tolerances to pain (Brislin et al., 2016; Miller et al., 2013), it was important to control for the effects of empathy when exploring pain sensitivity in psychopathic traits.

These results are significant as there is limited research exploring psychopathy and empathy from a triarchic perspective in both men and women. Furthermore, these findings are interesting as they suggest that a self-report measure assessing sensitivity to pain may not be able to fully capture this complex matter in psychopathic traits, as findings contradict previous experimental research (e.g., Alshukri et al., 2024; Kaseweter et al., 2022). Subsequently, Chapter 5 adopted an experimental method of pain (i.e., pressure) and assessed empathy to other people's pain images. Responses were recorded using self-report and skin conductance responses to offer both a subjective and objective method of assessment.

# Chapter 5: Psychopathy, pain, and pain empathy: A psychophysiological study

## Introduction to Manuscript

This study titled, 'psychopathy, pain, and pain empathy: A psychophysiological study' (Alshukri et al., 2024) is a laboratory-based study. This study aimed to examine whether individuals higher in psychopathic traits self-reported less pressure and showed lower physiological responses to pressure compared to those lower in psychopathic traits. The study also examined whether psychopathy affected empathy for others' pain via self-reported and physiological measures. It was important to investigate whether any differences in physical pain perception in psychopathic traits existed as previous research has uncovered differences in incarcerated samples (Pfabigan et al., 2015). In addition, literature has revealed lower levels of empathy in those higher in psychopathic traits (see Campos et al., 2023). Due to this, it was important to explore whether these differences existed when viewing other people's pain via images as pain is an extension of distress but is under-explored. This paper was published in Plos One in 2024, and the format of the text has been altered to match the style of this thesis.

Alshukri, S., Lyons, M., Blinkhorn, V., Munoz, L., & Fallon, N. (2024). Psychopathy, pain, and pain empathy: A psychophysiological study. *Plos One*, *19*(7), e0306461. https://doi.org/https://doi.org/10.1371/journal. pone.0306461

**Abstract**

Higher psychopathic traits are related to lower levels of empathy as well as higher tolerances of nociceptive pain. While previous research has explored the relationship between psychopathy and empathy, and deficits in empathy and pain perception are noted, there is limited understanding of how psychopathic traits relate to perceiving pressure and empathising with the pain of others, and their physiological responses to such stimuli, in non-clinical samples. Thus, the present study examined whether people higher in psychopathy experienced less self-reported nociceptive pressure and exhibited lower psychophysiological responses to pressure compared to those lower in psychopathy. This research also examined whether psychopathy affected empathy for others' pain via self-reported and psychophysiological measures.

Three hundred and sixty-nine students (18-78 years; $M = 26$, $SD = 9.34$) were screened for psychopathic traits using the Youth Psychopathy Inventory (YPI). Stratified sampling was used to recruit 49 adults residing in the highest ($n = 23$) and lowest ($n = 26$) 20% of the psychopathy spectrum. Using skin conductance response (SCR) and self-report responses, participants responded to individually adjusted intensities of pneumatic pressure and others' pain images and completed self-reported psychopathy and empathy measures (Triarchic Psychopathy Measure, TriPm; Interpersonal Reactivity Index, IRI).

People higher in psychopathy self-reported feeling less nociceptive pressure compared to people lower in psychopathy, yet the present study did not find any differences in SCR to nociceptive pressure. However, when viewing other people in pain, the high psychopathy group displayed lower SCR and lower self-reported empathy compared to those lower in psychopathy.

The results suggest that psychopathic traits relate to problems empathising with others' pain in the form of pain images, as well as issues with perceiving nociceptive

pressure, which were assessed using an experimental paradigm. The present study also showed support for the theory of dual harm which has been receiving increasing attention, thus indicating that individuals higher in psychopathic traits may have impairments in both experiencing nociceptive pain and empathising with the pain of others. Consequently, psychopathy interventions should focus both on recognising and empathising with the pain of others which may help with empathic responses and prosocial behaviours.

## Introduction

Psychopathy is a personality trait that has been related to multiple adverse outcomes, including aggression towards others (e.g. Gillespie et al., 2023) as well as aggression towards oneself (Greitemeyer et al., 2021). The triarchic model of psychopathy divides it into three factors: boldness (i.e. social dominance, emotional resiliency), meanness (i.e. low empathy, exploitativeness), and disinhibition (i.e. low impulse control; Patrick et al., 2009). People at the higher end of the psychopathy spectrum typically have trouble recognising their own emotions as well as the emotions of others (Burghart et al., 2022). Indeed, it is possible that the inability to recognise one's own emotions stems from a poor recognition of others' emotions, contributing to low empathy (Valdespino et al., 2017). Interestingly, psychopathy (especially meanness) has also been associated with low empathy for the pain of others (van Dongen et al., 2018) as well as increased nociceptive pain tolerance (Brislin et al., 2016; Brislin et al., 2022). As a result, the present study aimed to further the knowledge of a link between psychopathy, experiencing nociceptive pressure, and empathy for others' pain.

Investigating pain perception in the context of psychopathy is important for several reasons. Firstly, pain and distress are typically communicated through facial expressions and vocalisations to attract help from others (Dawel et al., 2012). However, individuals with higher levels of psychopathy exhibited a reduced ability to recognise distress and pain in others, as well as lower levels of prosocial behaviours needed to help those individuals (Blair, 2019; Kaseweter et al., 2019). Yet, when offenders higher in psychopathy were asked to empathise with others' pain observed through videos, they showed relatively normal levels of empathy (Meffert et al., 2013). In addition, findings indicate deficits in brain regions associated with processing distress cues in individuals higher in psychopathy, which may impact empathic responses to others' pain (Decety et al., 2013b). For instance, brain activation patterns showed impairments when observing facial expressions of pain and

individuals being harmed. Furthermore, ones' own pain distress was found to influence views about how much pain another person experienced, with higher scores on the lifestyle (or disinhibition) facet of psychopathy predicting lower estimates of other's distress levels (Brazil et al., 2022). This relationship was underpinned by the extent to which participants themselves could experience distress, which then impacted the understanding of distress experienced by others. Since recognising others in pain and prosocial responses are related, it is important to investigate psychopathy and empathy for others' pain.

Second, psychopathy shares co-morbidity and risk factors with both self-harm and aggression towards others (Shafti et al., 2023). In the case of the present study, self-harm behaviours relate to accepting higher levels of pressure, whereas aggressive behaviours refer to lower levels of empathy when others are experiencing pain. According to the dual harm model, the co-occurrence of self-harm and aggression could relate to emotional dysregulation (Shafti et al., 2023), which could also link to diminished perception of pain (Franklin et al., 2012). Emotional dysregulation refers to difficulties in managing and responding to emotional experiences via decreases in emotional awareness, inadequate emotional reactivity, emotional rigidity, and intense experiences and expressions of emotions (D'Agostino et al., 2017). The emotional challenges that co-occurring dual-harm behaviours present may lead to individuals using self-harm and aggression as a coping mechanism to manage any distress (Shafti et al., 2021), for which links have consistently been found in a range of populations (see O'Donnell et al., 2015 for review). Further, 15% of individuals that were in contact with health services for self-harm behaviours had also committed a violent crime (Sahlin et al., 2017). Together, while research on dual harm is in its early stages, the idea that psychopathy could relate to both reduced empathy for the pain of others and impaired perception of pain for the self is an important avenue to explore, as gaining insight into such risk factors could enhance understanding.

Third, observing and experiencing nociceptive pain relies on affective empathy (Singer et al., 2004), which could have neural bases in the mirror neuron system[1] (Di Pellegrino et al., 1992; Gallese et al., 1996; Penagos-Corzo et al., 2022). Indeed, research using functional magnetic resonance imaging (fMRI) has demonstrated that similar neural networks such as the anterior cingulate cortex (ACC), insula, and somatosensory cortices are activated when observing others in pain and when experiencing nociceptive pain in typically developing individuals (see Bird et al., 2014). This overlap in neural activation suggests shared mechanisms in experiencing pain and empathic responses to other people's pain. However, higher psychopathic traits are associated with deficits in both affective empathy and responses to others' distress (e.g. Campos et al., 2022; Lishner et al., 2012; Penagos-Corzo et al., 2022). For instance, studies using self-report and behavioural measures demonstrated individuals higher in psychopathy showed diminished responses to others' pain experiences (Campos et al., 2022; Lishner et al., 2012), while neuroimaging revealed hypoactivation of the mirror neuron system in those with higher levels of psychopathy when observing others in pain (Penagos-Corzo et al., 2022). These findings suggest that psychopathy may disrupt both pain perception and empathy for pain. As a result, higher psychopathic traits may affect how individuals process their own pain experiences and disturb their ability to recognise and respond to the pain of others.

Fourth, current literature suggests mixed findings on psychopathy, nociceptive pain, and pain empathy for others depending on the methods used (e.g. self-report vs behavioural measures). For instance, studies using nociceptive pain have found certain aspects of psychopathy are related to a higher tolerance of pressure stimuli and electric shocks (Brislin et al., 2022; Miller et al., 2013). However, other studies did not replicate such findings, and

[1]This refers to a group of neurons in the brain that activate when performing an action and when observing somebody else performing the same action.

showed no significant relationships between psychopathy and pain tolerance (Anestis et al., 2022). Yet, research using self-report measures have demonstrated that individuals with higher psychopathic traits showed positive correlations with increased nociceptive pain tolerance (Anestis et al., 2022; Durand et al., 2017). In addition, higher psychopathic traits were associated with blunted neural responses to the pain of others (Branchadell et al., 2024; Decety et al., 2013a), but not when imagining pain in the self (Decety et al., 2013a), which suggests a dissociation between experiencing pain and processing the pain of others. Yet, one study found that although psychopathy had a link with a decreased ability to assess pain expressions, it did not relate to self-reported pain attributions of others (van Heck et al., 2017). These discrepancies in findings suggest that higher psychopathic traits may explain the differences in the perception of pain in the self and to empathising with the pain of others. Due to this, utilising both an objective measure (skin conductance response, or SCR) and a self-report measure, the current study can look at the differences when administering nociceptive stimuli and empathy images in psychopathy.

SCR, an indirect measure of sympathetic nervous activity, can measure emotional arousal which may be related to nociceptive pain experience (Dawson et al., 2016; Laine et al., 2009). Research has found increased psychopathy and callous-unemotional traits (CU; the affective dimension of psychopathy; Pisano et al., 2017) are associated with lower SCR to fear-inducing stimuli, suggesting diminished physiological responses to threatening and emotional conditions (Centifanti et al., 2022; Fanti et al., 2017a; Kyranides et al., 2017). Moreover, violent incarcerated offenders had reduced SCR when viewing others in pain (Pfabigan et al., 2015), supporting the notion that individuals higher in psychopathy may have deficits in autonomic responses to the distress of others. These findings stress the importance of incorporating psychophysiological assessments to better understand how psychopathic traits affect responses to pain stimuli. Individuals higher in psychopathic traits

may be unable to respond to emotionally salient and arousing stimuli, thus leading to diminished responses to the emotions of others.

In addition, psychopathy could be associated with a discrepancy in physiological and self-reported responses to directly experienced nociceptive pain and the pain of others. It has been suggested that psychopathy is linked to somatic aphasia; the inaccuracy in identifying and recognising somatic states of the self (Gao et al., 2012). Indeed, research in incarcerated men (Pfabigan et al., 2015) and children at high-risk of criminal behaviour (van Zonneveld et al., 2017) suggests that increased levels of psychopathy are associated with blunted physiological (e.g., SCR), but not self-reported responses of empathy to others' pain. For instance, when children higher in psychopathic traits were shown images of others in distress, their SCRs were lower than children with lower levels of psychopathic traits, but their self-report responses were not significantly different (van Zonneveld et al., 2017). This indicates a potential disconnect between subjective perception and physiological experiences. Despite these findings, to the best of the authors knowledge from scoping the existing literature from five databases (MedLine, PsychInfo, PubMed, Scopus, and Web of Science), no studies have used adult, non-clinical samples that have simultaneously looked at both self-reported and psychophysiological responses to directly experienced nociceptive pressure stimuli, and pain empathy for other people. Based on somatic aphasia, it would be expected that individuals with high levels of psychopathy may differ in their responses to nociceptive pressure and the pain of others when arousal is measured with SCR, and self-reported measures.

The present study sought to investigate psychopathy and its relationship to self-report measures and SCR to directly experienced nociceptive pressure stimuli, and how it relates to recognising the pain of others. Although psychopathy and empathy are well studied, and deficits in both self-report measures and physiology are seen (e.g. Branchadell et al., 2024; Pfabigan et al., 2015), pain perception is not fully explored, with little research investigating

physiological aspects. By understanding this aspect more, and incorporating the dual harm model (Shafti et al., 2023), the current study aims to assess whether individuals higher in psychopathy scores show differences in their responses to nociceptive pain and empathy to others' pain when measured via SCR and self-report. As a result, the field may understand more about why and how individuals with psychopathy show a reduction in empathy, which can help to develop educational strategies, advance pain management systems, and improve interventions. The following research questions were addressed:

1. Do people higher in psychopathy experience less intense nociceptive pain to pressure stimuli than people lower in psychopathy via self-report responses and SCR?
2. Do people higher in psychopathy feel less empathy for other people's pain via self-report responses and SCR?

## Methods

### *Participants*

Three-hundred and sixty-nine students (18-87 years; $M = 26$, $SD = 9.34$) were recruited between June 2018 and March 2019 via advertisements located around the University of Liverpool campus such as on notice boards and in communal areas. Those interested were asked to read the participant information sheet (see Appendix 9), give informed consent (see Appendix 10), and were screened for psychopathic traits using an online version of the Youth Psychopathic Inventory (see Appendix 4; YPI; Andershed et al., 2002). A stratified sampling technique was used to invite potential participants who scored in the highest and lowest 20% of the psychopathy spectrum to a research study in the laboratory. One hundred and thirty-one participants (low psychopathy $n = 63$; YPI $M = 73$, $SD = 6.08$; high psychopathy $n = 68$; YPI $M = 132$, $SD = 10.05$) were contacted to take part in the laboratory experiment; a total of 49 adults (female $n = 26$; male $n = 23$), aged between 18-55

years old ($M$ = 25, $SD$ = 7.03) accepted the invitation to take part (low psychopathy $n$ = 26, min YPI score = 71, max YPI score = 90, $M$ = 80, $SD$ = 5.02; high psychopathy $n$ = 23, min YPI score = 120, max YPI score = 149, $M$ = 133, $SD$ = 8.13). Participants' data were anonymised by assigning a number to each dataset and keeping all identifying paperwork in a locked storage space that only the supervising investigator (NF) had access to.

***Procedure***

Ethical approval was granted by the University of Liverpool's Ethics Committee (Reference: 2954; see Appendix 11). Participants invited into the laboratory were seated in a chair positioned approximately 80cm from a 48.2cm (19-inch) Dell OptiPlex 780 computer monitor (Figure 2). Following consent, participants were fitted with electrodes to measure SCR. An individual mould was made of dental putty to ensure the finger remained consistent throughout the task. Prior to the experiment, participants were given two self-report questionnaires (IRI and TriPm; Davis, 1980; Patrick, 2010) to complete to accommodate a 10-minute stabilisation period for SCR.

Participants were given a demonstration of the pressure stimulator which created nociceptive pressure before the experimental program began. For the experiment, participants positioned the index finger of their dominant hand in the mould under the circular probe while they rested their non-dominant hand on the table. The probe covered the lunular of the fingernail and adjacent skin and was lowered onto this area to create pressure (Watkinson et al., 2013). Participants received training to select an individualised appropriate level of pressure to evoke a moderate self-reported pain response for the task (adapted staircase procedure; Gracely et al., 1988). The intensity of each pressure stimulus, measured in volts (v), was rated on a 0-100 numerical rating scale (NRS; 0 representing no pain or sensation at all, 100 representing the most pain imaginable). This was verbally explained and presented in visual form (self-assessment manikin or SAM; see Appendix 6; Bradley et al., 1994). The

pressure level was gradually increased in small increments (0.1- 0.2 v) until pain threshold (3 on pain scale) and moderate pain (6/7 on pain scale) was reached for each participant.

Participants experienced 10 touch stimulations (also referred to as no pressure since it was a touch sensation, attained by calculating 1/3 of moderate pressure level), 10 threshold pressure stimulations, and 10 moderate pressure (also referred to as high pressure) stimulations in a pseudorandom order. Each trial began with a 3-second rest interval period where participants viewed a white fixation cross on a grey background, followed by a grey screen which signalled pressure stimulation. Full pressure lasted for 1 second, followed by an immediate release (Watkinson et al., 2013). Participants then rated physical pressure intensity ranging from "no pain/sensation" (0) to "worst pain imaginable" (100) using a NRS on the screen. Participants were instructed to keep their finger in the mould until the NRS appeared, remove it to rate their self-reported pain, then place it back in the mould. A grey screen would appear to prompt participants to place their finger under the probe and prepare for the next stimulation. Participants were made aware of the safety features of the stimulator and could abort the process at any time by removing their finger from the machine. The task lasted approximately 15 minutes.

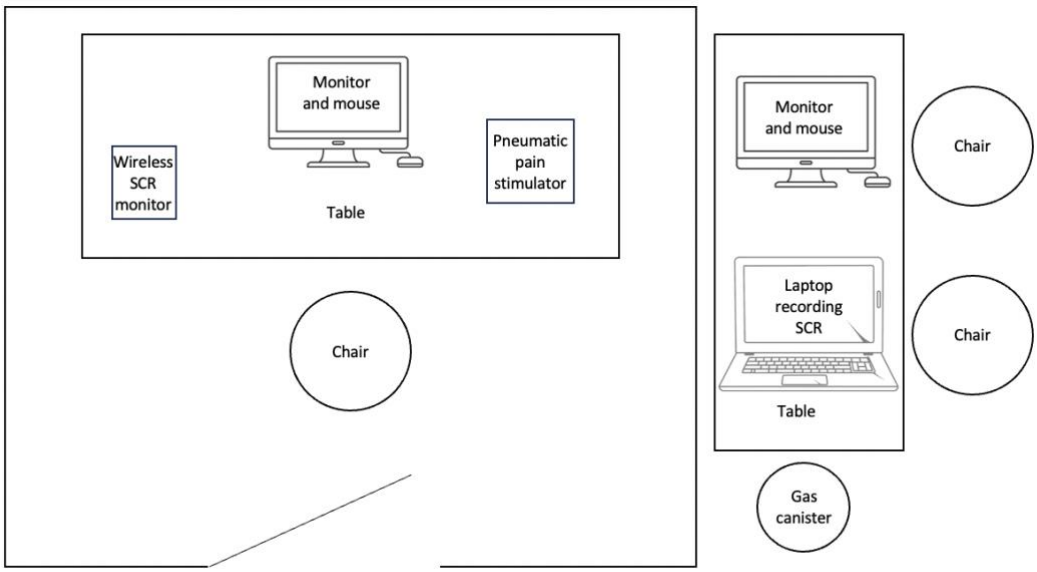
The empathy task was similar to previous studies (see Fallon et al., 2015a; Fan et al., 2008). Each trial began with a white fixation cross on a grey background. Participants had a single viewing of 30 images. The images, originally developed for Fallon et al. (2015b), consisted of 15 pictures containing feet or hands depicting painful situations, such as a hand trapped in a car door, or a foot standing on a fractured piece of glass, and 15 images depicting non-painful scenes graphically matched but contained no pain, for example, a hand next to a car door rather than trapped in it, and a foot placed safely on the ground with no signs of broken debris. Each image was presented for 5 seconds. After each image, a 5 second computerised response period followed. Participants were asked to rate how much pain they

perceived using a NRS ranging from “no pain” (0) to “worst possible pain” (100). The images were presented in a pseudo-randomised order, and the task lasted approximately 10 minutes. Cronbach’s alpha ($\alpha$) coefficient for self-report responses to non-pain ($\alpha$ = .79) were rendered acceptable, whereas self-report responses to pain images ($\alpha$ = .96) had excellent internal consistency (Kiliç, 2016)

Participant data such as demographic information, questionnaire responses and SCRs were anonymised by assigning a number to each dataset making it unidentifiable, and all identifying paperwork was kept in a locked storage space that only the supervising investigator (NF) had access to.

**Figure 2**

*Diagram representing the layout of the experimental setup in the laboratory.*

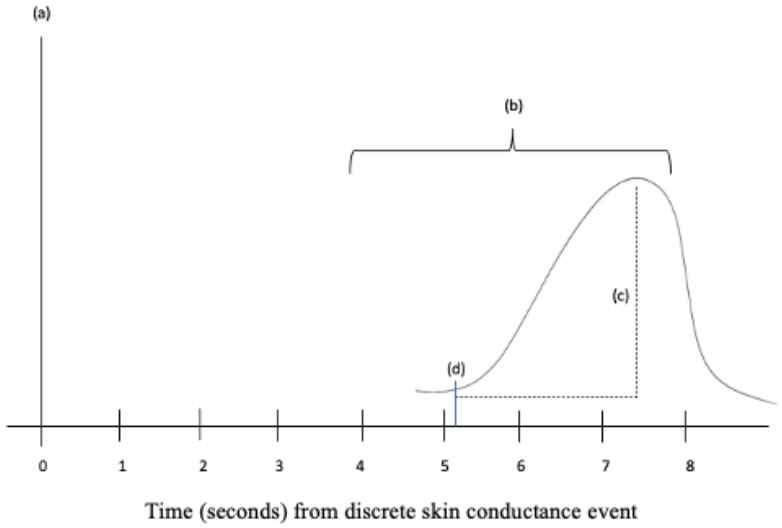



**Skin Conductance Response.** To measure skin conductance, two Ag-AgCl electrodermal conductance electrodes containing 0.5% chloride gel concentration were attached to the volar surface of the index and middle distal phalanges (finger pads of the

index and middle finger) for the most reliable electrodermal activity measurement (Dawson et al., 2016), and secured with surgical tape. Data were recorded using a MindWare Mobile Impedance device (Mindware Technologies Ltd., Gahanna, Ohio, USA). The device transmitted physiological signals wirelessly and remotely via Billion BiPAC 5200G router (Billion Electric Co., Ltd., London) to a HP Notebook laptop running Biolab Acquisition software (Mindware Technologies Ltd.). SCR was recorded using a low-pass filter of 1 hertz (Hz) and a gain of 5 μS/V. The waveform was smoothed at 500 samples. Data were analysed offline using Mindware Technologies' Electrodermal Activity (EDA) analysis software application. Event-related SCR was used to identify discrete responses following a pressure/pain (or non-pressure/pain) event. SCR for the self-reported pain to pressure task was calculated by identifying the peak of skin conductance within the latency window of 1 to 4 seconds after the release of the pressure probe (see Figure 3). SCR for the empathy task was calculated in a similar way but by identifying the peak of skin conductance within the latency window of 1 to 4 seconds after the presentation of the image (see Figure 4). There was no missing data in the sample. Cronbach's alpha coefficient for SCR to low pressure ($\alpha$ = .62) and high pressure ($\alpha$ = .17) showed acceptable and poor internal consistency respectively, whereas SCR to pain images ($\alpha$ = .66) and non-pain images ($\alpha$ = .63) were rendered acceptable (Kiliç, 2016).

**Figure 3**

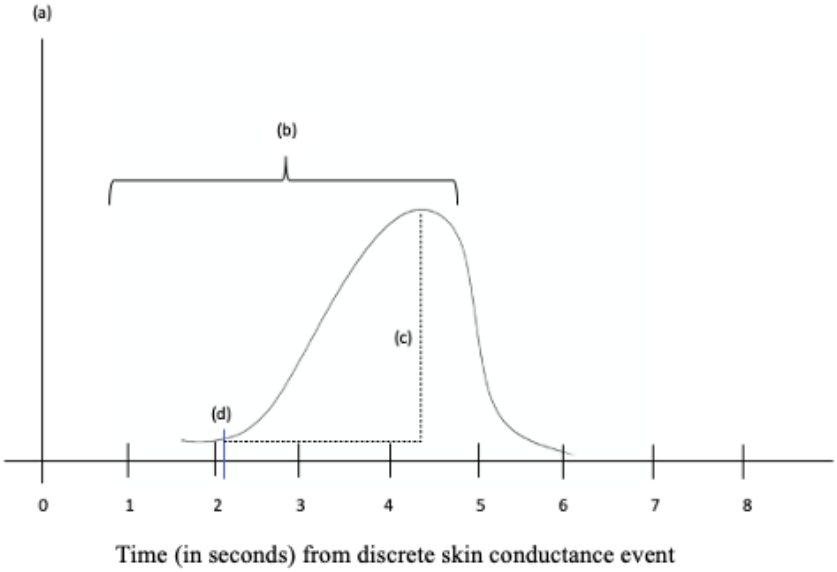
*Timeline for event related (ER) analysis for pain task*




*Note*. (*a)* – onset of pressure probe event which lasts up to 4 seconds; (*b)* – 1-4 second time window when any increase (over 0.1 microsiemens) in SC was taken as onset (*d*) of an ER SCR; (*c)* – amplitude of ER SCR.

**Figure 4**

*Timeline for event-related (ER) analysis for empathy task*




*Note. (a)* – presentation of image; (*b)* – 1-4 second time window when any increase (over 0.1 microsiemens) in SC was (*d*) of an ER SCR; (*c)* – amplitude of ER SCR.

**Pneumatic Pressure Stimulator.** Nociceptive pressure was delivered using a pneumatic pressure stimulator designed by Dancer Design (St. Helens, UK). The system included a pneumatic force controller which used compressed air from a 11.1 litre aluminium cylinder to lower a 1 $cm^2$ circular probe with variable force. Each stimulus was delivered by passing a specific voltage into the pressure stimulator, which translates into pressure in a range from 0.00 $kg/cm^2$ (generated from 0.00 v input) to a maximum of 3.5 bar (11.55 $kg/cm^2$, generated from 3.5 v input) to avoid injury. Voltages were generated by a computer program written in PsychoPy in Python programming language (LabJack Corp., Lakewood, CO, USA). Cronbach's alpha coefficient for self-report responses to touch/no pressure ($\alpha$ = .91) and high ($\alpha$ = .93) pressure showed excellent internal consistency (Kiliç, 2016).

**Psychopathic Traits.** The Youth Psychopathic Inventory (YPI; Andershed et al., 2002) was used to screen participants for psychopathy traits (see Appendix 4). The YPI is a 50-item self-report measure designed to assess 10-core concepts related to psychopathy, each containing 5 items; dishonest charm (e.g., "It's easy for me to charm and seduce others to get what I want from them"; $\alpha$ = .90); grandiosity (e.g., "I'm better than everyone on almost everything"; $\alpha$ = .85); lying (e.g., "Sometimes I find myself lying without any particular reason"; $\alpha$ = .89); manipulation (e.g., "I can make people believe almost anything"; $\alpha$ = .93); remorselessness (e.g., "I seldom regret things I do, even if other people feel that they are wrong"; $\alpha$ = .90); unemotionality (e.g., "what usually scares others usually doesn't scare me"; $\alpha$ = .78); callousness (e.g., "I think that crying is a sign of weakness, even if no one sees you"; $\alpha$ = .80); thrill-seeking (e.g., "I like to be where exciting things happen"; $\alpha$ = .75); impulsiveness (e.g., "I prefer to spend my money right away rather than save it"; $\alpha$ = .76) and irresponsibility (e.g., "I have often been late to work or classes in school"; $\alpha$ = .75). Items were scored on a 4-point Likert scale from "does not apply at all" (1) to "applies very well" (4). Cronbach's alpha score for the YPI ($\alpha$ = .95) and its subscales showed adequate

reliability (Kiliç, 2016), similar to previous research (Centifanti et al., 2022; Essau et al., 2006).

The Triarchic Psychopathy Measure (TriPm; Patrick, 2010) was used to assess and confirm psychopathy scores once in the laboratory (see Appendix 1). The TriPm is a 58-item self-report measure designed to assess psychopathy using three distinct constructs; boldness (e.g., "I am well-equipped to deal with stress"), meanness (e.g., "I enjoy a good physical fight"), and disinhibition (e.g., "I jump into things without thinking"). Items are scored on a 4-point Likert scale from "true" (3) to "false" (0). Cronbach's alpha coefficient was strong for TriPm total score ($\alpha$ = .94) as well as for each of the constructs ($\alpha$ = .88, $\alpha$ = .94, $\alpha$ = .87, respectively; Kiliç, 2016)

**Empathic Traits.** The Interpersonal Reactivity Index (IRI; Davis, 1980) was used to assess self-reported empathy (see Appendix 2). The 28-item self-report measure assesses empathy using 4 subscales; perspective taking (e.g., "I try to look at everybody's side of a disagreement before I make a decision"), fantasy (e.g., "I really get involved with the feelings of the characters in a novel"), empathic concern (e.g., "I am often quite touched by things that I see happen"), and personal distress (e.g., "In emergency situations, I feel apprehensive and ill-at-ease"). Items are scored on a 5-point Likert scale from "does not describe me well" (0) to "describes me very well" (4). The self-report measure yielded a good internal consistency using Cronbach's alpha coefficient ($\alpha$ = .85) overall as well as for each of the constructs ($\alpha$ = .76, $\alpha$ = .71, $\alpha$ = .85, $\alpha$ =.80, respectively; Kiliç, 2016). Fantasy was not used for data analysis as the study was not looking at participants' ability to adopt the thoughts and feelings of fictitious characters from books, movies or plays.

### *Data Analysis Plan*

To test whether people higher in psychopathy experienced less intense nociceptive pain than people lower in psychopathy when given individually adjusted pressure intensities

to report the same subjective pain intensity (i.e. moderate pain), a 2-way mixed ANOVA was performed with pressure intensity (touch/no pressure, high pressure) as a repeated measures factor (dependent variable; DV) and psychopathy group (low, high) as a between subject's factor (independent variable; IV). This was performed for both NRS self-report and SCR data. To test whether people higher in psychopathy felt less empathy for other people's pain, another 2-way mixed ANOVA was performed with empathy images (no pain, pain) as a repeated measures factor (DV) and psychopathy group (low, high) as a between subject's factor (IV). This was again performed for both NRS self-report and SCR data.

To test whether people higher in psychopathy required objectively more intense pressure stimuli (measured in volts) to report the same subjective pain intensity (i.e., moderate pain) as the low psychopathy group, an independent sample's t-test was performed with psychopathy group (low, high) as the IV and pressure stimuli level (moderate pressure) as the DV. Hedge's g correction for effect sizes and 95% confidence intervals (CI) were used as it uses a correction factor for small sample sizes (Lakens, 2013).

Manipulation checks were run to ensure the effectiveness of the study. To test whether the high psychopathy group scored significantly higher on psychopathy facets and lower on empathy facets compared to the low psychopathy group, an independent sample's t-test was conducted using Hedge's g correction. Psychopathy group (low, high) was used as IV, and the subscales of the TriPm and IRI as DVs. Analysis was conducted in JASP (version 0.18.3, JASP Team, 2024).

## Results

### *Tests of Normality*

The distribution of SCR to touch/no pressure ($Z = 5.79$) and high nociceptive pressure ($Z = 1.94$) as well as observing others' pain images ($Z = 3.18$) and observing other's non-pain images ($Z = 4.00$) were positively skewed. Due to this, a square root transformation was

conducted to ensure that the data follow approximately normal distribution for each of the SCR variables; touch/no pressure (skewness = 1.75, *SE* = .340, Z-skewness = 5.15), high pressure (skewness = .573, *SE* = .340, Z-skewness = 1.69), observing others' pain images (skewness = -.611, *SE* = .340, Z-skewness = -1.80), observing other's non-pain images (skewness = 1.28, *SE* = .340, Z-skewness = 3.76).

### *Main Study Questions*

**Do people higher in psychopathy experience less intense nociceptive pain to pressure stimuli than people lower in psychopathy?**

The current study examined whether people higher on psychopathy would report less intense subjective (NRS) nociceptive pain when given individually adjusted pressure intensities to report the same subjective pain intensity (i.e. moderate pain), and whether that would also be reflected in their SCR. For NRS self-report data, the repeated measures ANOVA showed a significant effect of pressure intensity, $F$ (1, 45) = 228.54, $p$<.001, $\eta_p^2$ = .84, a significant between-subjects effect of psychopathy group, $F$ (1, 45) = 7.58, $p$=.008, $\eta_p^2$ = .144, and a non-significant interaction effect between pressure intensity and psychopathy group, $F$ (1, 45) = .71, $p$ = .40, $\eta_p^2$ = .02. Post hoc tests showed high levels of pressure were rated as significantly higher ($M$ = 58.20, $SE$ = 2.00) than lower levels of pressure ($M$ = 16.1, $SE$ = 1.61), $t$ (45) = 2.79, $p$ = .008, 95% CI [ 2.55, 4.23], Cohen's $d$ = 3.40. In addition, the high psychopathy group reported experiencing significantly less pain ($M$ = 33.96, $SD$ = 1.70) compared to the low psychopathy group ($M$ = 40.40, $SE$ = 1.60), $t$ (47) = 2.75, $p$ <.01, 95% CI [.12, .91], Cohen's $d$ = .52.

For SCR, there was a significant effect of pressure intensity, $F$ (1, 47) = 4.45, $p$ = .04, $\eta_p^2$ = .09, a non-significant between subjects effect of psychopathy group, $F$ (1, 47) = .22, $p$ = .64, $\eta_p^2$ = .005, and a non-significant interaction effect between pressure intensity and psychopathy group, $F$ (1, 47) = 3.04, $p$ = .09, $\eta_p^2$ = .06. Post hoc comparisons showed high

levels of nociceptive pressure produced greater SCR ($M$ = 1.07, $SE$ = .01) compared to lower levels of nociceptive pressure ($M$ = 1.05, $SE$ = .01), $t$ (47) = 2.11, $p$ = .04, 95% CI [.01, .62], Cohen's $d$ = .31.

The present study tested whether people higher in psychopathy ($M$ = 2.61, $SD$ = .74) required objectively more intense pressure stimuli (measured in volts) to report the same subjective pain intensity (moderate pain) as the low psychopathy group ($M$ = 2.30, $SD$ = .52), however this was non-significant, $t$ (47) = -1.70, $p$ = .1, 95% CI [-1.05, .09], Hedge's $g$ = -.48.

**Do people higher in psychopathy feel less empathy for other people's pain?**

Using the images of other's experiencing pain, the present study tested if those higher in psychopathy would rate the images as less painful than those lower in psychopathy. SCR was also tested to assess whether SCR would be lower for those higher in psychopathy when viewing images of others' pain. The repeated measures ANOVA showed a significant effect of pain intensity (pain images, non-pain images), $F$ (1, 47) = 188.48, $p$ <.001, $\eta_p^2$ = .56, a significant between-subjects effect of psychopathy group, $F$ (1, 47) = 10.21, $p$ = .002, $\eta_p^2$ = .18, and a significant interaction effect between pain intensity and psychopathy group, $F$ (1, 47) = 12.73, $p$ <.001, $\eta_p^2$ = .04. Post hoc tests showed overall, pain images were rated as more painful ($M$ = 45.60, $SE$ = 3.14) compared to non-pain images ($M$ = 5.61, $SE$ = .91), $t$ (47) = -.13.7, $p$<.001, 95% CI [1.85, 3.04], Cohen's $d$ = 2.47. In addition, the low psychopathy group had more empathy for other's pain images ($M$ = 31.4, $SE$ = 2.48) compared to the high psychopathy group ($M$ = 19.8, $SE$ = 2.63), $t$ (47) = 3.20, $p$ = .002, 95% CI [.24, 1.20], Cohen's $d$ = .71. Lastly, the interaction effect showed that the high psychopathy group self-reported less empathy to pain images ($M$ = 34.61, $SE$ = 4.57) compared to the low psychopathy group ($M$ = 56.56, $SE$ = 4.30), $t$ (47) = 4.64, $p$ <.001, 95% CI = [.49, 2.21], Cohen's $d$ = 1.35. However, the high psychopathy group did not self-report significantly less

empathy to non-pain images ($M$ = 5.03, $SE$ = 1.41) compared to the low psychopathy group ($M$ = 6.19, $SE$ = 1.33), $t$ (47) = .25, $p$<.060, 95% CI [-.70, .85], Cohen's $d$ = .07.

For SCR, there was a significant effect of pain intensity (pain images, non-pain images), $F$ (1, 47) = 453.63, $p$<.001, $\eta_p^2$ = .91, a significant between-subjects effect of psychopathy group, $F$ (1, 47) = 12.83, $p$<.001, $\eta_p^2$ = .21, and a significant interaction effect between pain intensity and psychopathy group, $F$ (1, 47) = 13.13, $p$<.001, $\eta_p^2$ = .22. Post hoc tests showed that pain images produced greater SCR ($M$ = 6.53, $SE$ = .26) than non-pain images ($M$ = 1.04, $SE$ = .01), $t$ (47) = -21.3, $p$<.001, 95% CI [3.35, 5.30] Cohen's $d$ = 4.32. Overall, the low psychopathy group produced greater SCRs ($M$ = 4.24, $SE$ = .18) compared to the high psychopathy group ($M$ = 3.33, $SE$ = .19), $t$ (47) = -21.3, $p$<.001, 95% CI [3.35, 5.30] Cohen's $d$ = 4.32. Lastly, the high psychopathy group produced significantly lower SCRs to pain images (M = 5.60, SD = .37) compared to the low psychopathy group ($M$ = 7.45, $SE$ = .35), $t$ (47) = 5.10, $p$<.001, 95% CI [.59, 2.33], Cohen's $d$ = 1.46. However, non-pain images did not produce a significant effect between low ($M$ = 1.03, $SE$ = .01) and high psychopathy groups ($M$ = 1.05, $SE$ = .01), $t$ (47) = -.05, $p$ = .170, 95% CI [-.80, .76], Cohen's $d$ = -.01.

### *Manipulation Checks*

The present study tested if the high psychopathy group scored higher in psychopathy than the low psychopathy group using a separate psychopathy measure (TriPm; Patrick, 2010). Results found the high psychopathy group scored significantly higher on all subscales of boldness, meanness, and disinhibition when compared to the low psychopathy group. The high psychopathy group also reported significantly lower empathic concern, personal distress, and perspective taking when compared to the low psychopathy group (Table 11).

**Table 11**

*Independent sample's t-tests for psychopathy and empathy subscales.*

| In-lab measures | Low | | High | | *t* (47) | *p* | 95% CI | | Hedge's *g* |
|---|---|---|---|---|---|---|---|---|---|
| | *M* | *SD* | *M* | *SD* | | | Lower | Upper | |
| Boldness | 24.9 | 8.16 | 36.3 | 8.67 | -4.75 | <.001 | -2.00 | -.71 | -1.34 |
| Meanness | 13.9 | 13.97 | 28.0 | 7.86 | -4.28 | <.001 | -1.81 | -.60 | -1.21 |
| Disinhibition | 13.5 | 10.87 | 21.3 | 8.02 | -2.83 | .007 | -1.40 | -.21 | -.80 |
| Empathic Concern | 22.0 | 3.18 | 15.8 | 4.47 | 5.59 | <.001 | .92 | 2.21 | 1.60 |
| Perspective Taking | 20.2 | 4.60 | 17.5 | 4.82 | 2.04 | .047 | -2.06 | 1.15 | .58 |
| Personal Distress | 15.3 | 5.46 | 11.6 | 5.53 | 2.40 | .021 | .10 | 1.25 | .68 |

*Note*. Low psychopathy and high psychopathy groups' respective mean (*M*); standard deviation (*SD*); t-statistic and degrees of freedom t (*df*); p value (*p*); lower and upper 95% confidence intervals (95% CI); Hedge's *g* of effect size for each subscale.

**Discussion**

The present study aimed to investigate psychopathic traits, their relationship to SCR and NRS self-reported responses to directly experienced pressure in oneself, and how it may relate to empathising with the pain of others. Findings revealed that individuals in the high psychopathy group exhibited less self-reported empathy and lower SCR for other people's pain. Additionally, people in the high psychopathy group self-reported experiencing less intense nociceptive pressure compared to people in the low psychopathy group. However, SCR to pressure was similar in both groups. The results suggest high psychopathic traits relate to problems with empathising with others' pain, as well as to reporting lower pressure intensities. Findings are also discussed in the context of the dual harm model.

Building on the idea of somatic aphasia, the present study expected to find significant differences in response to nociceptive pressure in both self-report measures and SCRs. To

ensure comparable pressure levels across participants, a standardised procedure was implemented to select individualised moderate pressure stimulation levels prior to testing. This was to account for any variability in pain threshold levels. After undergoing the same matched procedure to select pressure levels, higher levels of nociceptive pressure were rated as more intense than touch/no pressure overall. Additionally, differences were noted between psychopathy groups; those higher in psychopathy self-reported experiencing less nociceptive pressure than those lower in psychopathy. Conversely, there was a significant difference in SCR to high levels of nociceptive pressure, but not between psychopathy groups. Contrary to the present findings, previous research has shown those with higher levels of psychopathy may feel their own physical nociceptive pain experiences in a similar way as those lower in psychopathy, but their evaluations of the experience could be disconnected with their objective sensations; this is known as somatic aphasia (Gao et al., 2012). As a result, nociceptive pain is self-reported as less intense. This discrepancy between physiological and self-reported responses supports the idea that people higher in psychopathic traits may have altered processing of internal states (Gao et al., 2012), which warrants further investigation.

Yet, people higher in psychopathy did not choose significantly higher levels of pressure when selecting their individualised pressure thresholds; the high psychopathy group self-reported lower levels of nociceptive pressure overall which indicates a difference in NRS self-reported pressure, but not necessarily a difference in nociceptive pressure perception itself. In other words, there was a difference in how pressure was self-reported but not in how pressure was perceived as there were no significant differences in SCR to pressure between groups. Existing literature has found inconsistencies between physiological and self-reported data. For instance, previous research indicates that people higher in psychopathy reported similar scores to those lower in psychopathy when viewing negative images, but showed reduced physiological activity to those images (Ellis et al., 2017; Pfabigan et al., 2015). A

potential brain-body disconnect could be at play (e.g. Gao et al., 2012), or deception may have been used since it is a central feature of a psychopathic personality (Patrick et al., 2009). Taken together, the present findings did not support previous research suggesting that a lack of awareness or sensitivity to one's' own body sensations could underlie impairments in emotion in people with high psychopathic traits (Gao et al., 2012; Nentjes et al., 2013). Future research should examine this link more closely.

Contrary to previous research demonstrating reduced physiological responses to pain or fear in those with higher levels of psychopathic traits (Centifanti et al., 2022; Pfabigan et al., 2015; Thomson et al., 2019a), the present study did not find differences in SCRs to mechanical pneumatic pressure. Although research is somewhat limited (Berluti et al., 2020), this finding is surprising. Typically, fear of a stimuli develops from past negative experiences (Olsson et al., 2007), including pain experiences, which reinforce behaviours that help to avoid pain-inducing stimuli. Yet, people with higher levels of psychopathy usually do not associate pain with fear or punishment (Umbach et al., 2015), which could contribute to experiencing lower physiological arousal (Deming et al., 2020; Lykken, 1995). For instance, reduced levels of neural activation were found in response to processing fearful facial expressions in those with higher levels of psychopathic traits (Deming et al., 2020), therefore contributing to impairments in processing fear stimuli and subsequent responses. Additionally, people with higher levels of psychopathy may not interpret their body signals correctly. Research has found a relationship between psychopathy and difficulty in identifying and describing feelings (see Burghart et al., 2022 for meta-analysis) such as shame and aggression (Burghart et al., 2022; Garofalo et al., 2021b). This is known as alexithymia (Taylor et al., 1991). Being unable to correctly identify feelings could lead to misinterpretation, and a different emotion is perceived (Elison et al., 2014). Although this finding was non-significant in the present study, the link between alexithymia and

psychopathic traits should be explored further, as previous research (e.g. Burghart et al., 2022) has found strong support for this relationship.

The present study found that people in the high psychopathy group had different pain empathy reactions compared to people in the low psychopathy group. Firstly, participants in the high psychopathy group self-reported feeling less empathy to images of other people's pain compared to the low psychopathy group. This finding aligns with previous research that found people with high levels of psychopathy struggled to empathise with the moods and feelings of others (Mayer et al., 2018), as well as a prison population's poor recognition of fear and disgust in others (Igoumenou et al., 2017), and poor recognition of pain in young males with CU traits (Wolf et al., 2014). Given that recognising and responding to the emotions of others is important for social interactions (Frischen et al., 2008; Kraaijenvanger et al., 2017), an absence of empathy for other people's pain could offer an explanation to why psychopathy relates to acts of violence that are carried out on others (Mayer et al., 2018; Rijnders et al., 2021). Targeting empathy deficits in psychopathy, and in particular deficits for other people's pain could be an important strategy when creating interventions. For example, treatment programs should include teaching people to recognise painful situations and empathising with the pain of others.

Secondly, participants in the high psychopathy group experienced less SCR to other people's pain images compared to the low psychopathy group, demonstrating less emotional arousal when observing others in pain. These results are partially in line with previous findings showing that inmates higher in psychopathy exhibited lower SCRs to the pain of others (Pfabigan et al., 2015), demonstrating that a lack of arousal to empathy exists outside of incarcerated samples and can apply to non-clinical samples, too. This is important as it shows criminal samples in previous findings and non-criminal psychopaths in the current sample may share similar psychophysiological characteristics (Mahmut et al., 2008). On the

other hand, participants may have also experienced faster habituation to pain images which could have led to reduced SCRs (see Kothgassner et al., 2017; and Seeger et al., 2024). Habituation occurs when repeated exposure to a stimuli leads to diminished physiological responses over time (Seeger et al., 2024). In the case of the present study, participants may have become desensitised to pain images, thus leading to lower emotional arousal and consequently, lower SCRs. As such, pain habituation should be a key area for exploration within psychopathy research. Additionally, further research should be conducted comparing criminal and non-criminal psychopaths to find similarities and differences between the two samples; this would help to disentangle why some people with psychopathy are imprisoned while others are not.

The present study provides further support for the dual harm model, which suggests that individuals with higher levels of psychopathy exhibit a strong disposition for aggression towards themselves and others (Shafti et al., 2023). Due to this, it was predicted that individuals higher in psychopathy would have reduced empathy for others' pain as well as require objectively more intense pressure stimuli to report the same subjective pain intensity. Specifically, those higher in psychopathy demonstrated lower SCRs and self-report responses when observing the pain images of others, which suggests blunted affective responses to others' distress. Additionally, individuals higher in psychopathy self-reported experiencing less pain in response to matched nociceptive pressure stimuli, although there were no significant differences in pressure levels. These findings contribute to the growing body of evidence suggesting that emotional dysregulation, which is a potential explanation for dual harm, is higher in individuals with higher levels of psychopathic traits (Garofalo et al., 2018). Emotional dysregulation describes the under- and over-regulation of emotions that may lead to either a failure to contain emotions, or avoiding or suppressing emotional experiences, respectively (Garofalo et al., 2018; Roberton et al., 2012). As such, emotional dysregulation

may generate a disregard for others' pain. While this study provides insight into the relationship between psychopathy and dual-harm behaviours, more research is needed as this exciting concept is in its infancy.

### *Strengths and Limitations*

The limitations of the study must be considered. The stimuli used depicted hands and feet in painful or matching non-painful situations and may not generalise to other painful or distressing situations. Therefore, a variety of painful and distressing situations should be explored in future studies, e.g., dental scenarios, thermal pain. In addition, empathy has a contextual component; people empathise better with same sex and same race individuals (Contreras-Huerta et al., 2013). For instance, research has indicated group-based segregation when empathising with others, demonstrating a lack of empathy for other-race individuals (Azevedo et al., 2013). Due to this, future research should aim to make stimuli more diverse and representative to assess empathic responses more comprehensively, such as including a broad spectrum of race and ethnicities. Further, it is difficult to know whether an increase or decrease in SCR is because of arousal or not. For example, an increase in SCR to images may indicate interest (Kyle et al., 2014) as opposed to feeling empathy. As SCR can be an ambiguous physiological measure, indicating emotions such as happiness, sadness, or embarrassment (Howell et al., 2018), it may be difficult to interpret emotional responses without qualitative self-report measures allowing participants to describe the emotions experienced. Due to this, future research should consider adopting qualitative self-report responses to help reduce the obscurity in SCRs.

Moreover, due to the nature of psychopathic traits, those higher in psychopathy may experience pain but may mask it to appear tough (e.g., Watts et al., 2016), rather than experiencing a dissociation with bodily sensations. As such, future research should focus on

unpicking this problem. For instance, studies could employ physiological measures such as SCR or brain imaging techniques to assess brain activation in response to pain stimuli to fully understand the experiences that may be masked. In addition, since prior research has used a range of pain delivery methods (Anestis et al., 2022; Brislin et al., 2016; Miller et al., 2013), future research should consider using different modes of pain stimuli as differences in pain reporting could be modality specific (see Alshukri et al., 2025). Next, the internal consistency of some measures was not satisfactory, for instance SCRs. This may impede the results by reducing the reliability or validity of findings as the quality of the data may be lower than data exhibiting higher Cronbach's alpha scores (Tavakol et al., 2011). Yet, lower internal consistency scores may reflect individual differences in SCRs (see Jang et al., 2019). Nonetheless, future research should aim to improve the internal consistency of SCRs to ensure reliability of data. For instance, pilot trials can test the effects of shorter or longer intervals between trials to allow SCR to return to baseline, or repeat stimuli to average out responses from those trials to increase the consistency of responses. Lastly, although appropriate statistical tests were used to balance the small sample size, this study proposes conducting an a priori power analysis and testing psychopathy groups within larger samples to increase statistical power. When conducting a post hoc power analysis using G*Power (Faul et al., 2007), a sample size of 54 participants was needed to achieve 80% statistical power (Cohen, 1988). However, as the actual sample size of this study was 49, it would suggest that the study was underpowered. Due to this, researchers should aim to meet or exceed the predicted sample size to enhance the robustness of findings.

However, the current study also has its strengths. Firstly, SCR is an ecologically valid physiological measure with coherence found in both laboratory and real-life settings (Van Doren et al., 2021). This means that the emotions captured in laboratory settings are like those in every-day situations. Additionally, the current thesis used pneumatic mechanical

pressure which, arguably, better emulates nociceptive pain experienced every day, e.g. a finger trapped in a door, than other experimental modalities (e.g. laser, electrical, cold pressor). This is an important ecologically valid method as opposed to pain research using modalities which are not commonly experienced day-to-day. The present thesis also used a non-clinical sample which helped to show psychopathy exists within this population and adds to literature heavily based on clinical/incarcerated samples. This is of high clinical importance and practical relevance since interventions cannot be created on prison samples alone as people in non-clinical samples also exhibit psychopathic traits.

### *Conclusions and Future Directions*

In conclusion, this study provides support for the dual harm model by demonstrating that individuals higher in psychopathic traits showed diminished perception of pain and lower levels of empathy for others. Such findings also help to reinforce the link between psychopathic traits and deficits in pain processing and empathy for others. Additionally, the present study contributes to current literature by showing that high psychopathic traits related to problems in empathising with others' pain which may stem from a physiological basis. Together, these findings highlight the importance of future research examining pain experiences and empathy for other people's pain from a physiological perspective, and future psychopathy interventions should thus focus on recognising and empathising with pain in the self and the pain of others.

## Conclusion to Manuscript

This study aimed to test perceptions of physical pain experience and empathy for other people's pain in those with low and high psychopathic traits within a laboratory setting (Alshukri et al., 2024).

The findings were interesting as they helped to confirm that higher psychopathic traits related to issues with empathising with the pain of others, which was also demonstrated in the previous chapters of this thesis. However, this study helped to show this in an objective manner by using SCR. This may allude to a physiological basis for a lack of empathy in those with psychopathic traits. Additionally, this study helped to show that individuals higher in psychopathic traits perceive pressure differently to those lower in psychopathic traits. This suggests that pressure is a significant pain stimulus in psychopathic traits, and pain stimuli may be processed differently in those higher in psychopathic traits compared to those lower in psychopathic traits. Findings from this and previous chapters are discussed more broadly in the general discussion below.

# General Discussion

## Summary of Key Findings

The purpose of the present research was to assess the relationship between psychopathic traits, pain experience, and empathy within non-clinical samples. Taken together, this thesis revealed several important findings. One key theme that emerged from all four studies is that psychopathic traits were related to lower levels of empathy processing. This was evidenced in the laboratory-based study (Chapter 5; Alshukri et al., 2024), as well as in the systematic review (Chapter 3; Alshukri et al., 2025) and in both online-based studies (Study 1 and Study 2 of Chapter 4). Next, the present thesis also helped to show that psychopathic traits affected pain perception. This was demonstrated by evidence from the systematic review (Chapter 3; Alshukri et al., 2025), the online-based findings in Study 2 of Chapter 4, and the laboratory-based study (Chapter 5; Alshukri et al., 2024). Findings are discussed below.

## Psychopathic Traits are Related to Pain Perception

The results of the present thesis both compliment and contrast previous findings on psychopathic traits and pain perception. Chapter 5 showed individuals higher in psychopathic traits reported feeling less pressure pain compared to those lower in psychopathy (Alshukri et al., 2024). These findings are corroborated by previous research showing those with psychopathic traits exhibit a higher tolerance for pain (Brislin et al., 2016; Brislin et al., 2022; Miller et al., 2013). Additionally, systematic review evidence in Chapter 3 further supports these findings by demonstrating that a tolerance for pain may be modality dependent (Alshukri et al., 2025). Particularly, pressure was a significant method of pain stimulation which was also confirmed in Chapter 5 (Alshukri et al., 2025; Alshukri et al., 2024). Several ideas (e.g., a failure to learn from negative outcomes; Atanassova et al., 2024; motivation for

rewards; Groat et al., 2020) have been proposed to help explain a tolerance for pain in psychopathic traits. One of those is somatic aphasia; the inaccuracy in identifying and recognising somatic states of the self (Gao et al., 2012). If one's own perception of pain is dampened, self-report responses will reflect this. As a result, when the high trait sample reported less pain to moderate pressure stimulations, the disconnect between experiencing pain and understanding the sensation would result in an inaccurate interpretation of the pain. This could result in lower self-reported responses to pressure.

Surprisingly, the present thesis did not uncover a significant relationship between pain sensitivity and facets of psychopathy when solely relying on self-report measures in Study 2 of Chapter 4. This finding is incongruent with existing experimental literature which shows those with higher levels of psychopathic traits self-reported experiencing lower levels of pressure stimuli (Brislin et al., 2022). While the results from Chapter 4 lack significance, they help to highlight an interesting finding in the field of psychopathy: a disparity between self-report versus experimental measures. Again, this inconsistency in findings may relate to a lack of awareness to one's own pain experience (Gao et al., 2012). Research has demonstrated that individuals with psychopathic traits were unable to report bodily sensations that were identified through objective measures (Gao et al., 2012). Furthermore, a discrepancy was noted between self-reports and SCRs in high psychopathy incarcerated offenders in response to other people's pain experiences; while they demonstrated less physiological arousal, their self-report responses reflected the opposite (Pfabigan et al., 2015). This suggests that individuals did not exhibit emotional arousal but reported that they did. Taking this information into account, the ability to detect nociceptive pain stimuli in those with higher psychopathic traits may be compromised. Consequently, self-report responses could be tainted whereas objective measures may offer a more accurate reflection of experiences. This is because individuals may alter their behavioural self-reported

responses, but it is less likely that they can change their biological or physiological responses (Hibbing et al., 2019). This disconnect in higher psychopathic traits may translate to lower self-perceptions of pain experiences. As a result, future work should aim to investigate this discrepancy at a much deeper level to help understand the complexities of this personality trait (see paragraph 2 in Future Directions for further discussion).

Building upon this, the systematic review in Chapter 3 revealed specific traits of psychopathy affected pain perception. Through the consolidation of existing literature, boldness and meanness emerged as playing a significant role in tolerating a greater level of pain (Alshukri et al., 2025). In partial support of these results, boldness was a significant predictor of pain sensitivity when controlling for empathy levels in Chapter 4. Mirroring these collective findings, a recent study explored the role that psychopathic traits played in pain processing (Brislin et al., 2022). Results found boldness was associated with blunted neural responses to painful stimuli and an increased tolerance to nociceptive pressure, while meanness was associated with a reduced perception of pain as well as an increased tolerance to nociceptive pressure. Further, research has shown boldness traits negatively related to a fear of pain (Brislin et al., 2016), which may stem from a failure to learn from adverse experiences (Atanassova et al., 2024). The combination of boldness (i.e., risk-taking and fearlessness) and meanness (i.e., a lack of empathy; Patrick, 2022) traits in addition to higher tolerances of pain may lead to antisocial behaviours due to the disregard of consequences (Brislin et al., 2022). As a result of this, future research should take a closer look at how elements of psychopathy such as boldness and meanness interact with pain processing and its associated behaviours to help disentangle the roles these traits may play (see paragraph 7 of Future Directions for further discussion).

In contrast to the systematic review findings of this thesis, the results in Chapter 5 did not reveal significant SCRs to mechanical pneumatic pressure in those with psychopathic

traits (Alshukri et al., 2024). While there exists limited work investigating SCRs to nociception, prior research has demonstrated lower levels of SCRs to fearful and violent stimuli (Centifanti et al., 2022; Fanti et al., 2017a) and when viewing others' pain experiences (Pfabigan et al., 2015). As a result, it was hypothesised that these findings would translate to lower levels of SCRs to pain stimuli, but this was not found (Alshukri et al., 2024). With that being said, boldness and meanness have emerged as playing a significant role in pain processing in this thesis' systematic review findings (Alshukri et al., 2025). Yet, Chapter 5 did not analyse the effects of boldness and meanness independently, which could be an explanation for the lack of significance in findings. Due to this, future research needs to assess the effects that facets of psychopathy have on SCRs to pneumatic pressure stimuli.

Taken together, these findings investigated pain perception in psychopathic traits and suggest those individuals on the higher end of the spectrum may process and interpret pain differently. This was demonstrated by individuals higher in psychopathy reporting to experience less pain to moderate pressure stimulations (Alshukri et al., 2024). Further, a subjective tolerance of pain in those with psychopathic traits may be dependent upon the type of stimulus delivered and the method in which data is collected. For example, pressure was a significant pain method when collecting data via self-reports and EEG, however, there were no associations between psychopathy and ratings of pressure experience via fMRI (Alshukri et al., 2025). Further, while a tolerance of pressure and electric shock stimuli were related to psychopathic traits, a tolerance of cold temperatures were not (Alshukri et al., 2025). Lastly, facets of psychopathy may play distinct roles in the processing and perception of pain. For instance, boldness and meanness showed significant associations with pain perception, while disinhibition showed no associations (Alshukri et al., 2025). Thus, these findings not only enhance the understanding of how psychopathic traits affect pain processing but also highlight specific facets that may have a more profound effect on pain experience. As a result,

future research should aim to investigate these important findings further to strengthen the collective knowledge (see Further Research & Future Directions for further detail).

**Psychopathic Traits Affected Empathy for Others' Pain**

Throughout this thesis, psychopathic traits were shown to affect empathy, especially empathy for other people's pain. To start, Chapter 5 showed people higher in psychopathy self-reported less empathy for other people's pain images (Alshukri et al., 2024). While pain empathy literature is somewhat scarce, the present findings can be corroborated by previous research investigating empathy for other people's emotions (e.g., Igoumenou et al., 2017; Mayer et al., 2018). For instance, violent offenders higher in psychopathic traits displayed lower self-reported empathy levels to empathy-inducing videos when asked to focus on the moods and feelings of the characters (Mayer et al., 2018). Further, male offenders high in psychopathic traits with a history of violent or sexual offences had difficulty recognising others' fearful and disgusted facial expressions. (Igoumenou et al., 2017). Yet, the present results help to expand literature by showing that a lack of emotional recognition for others also extends to pain experiences. Exploring a lack of empathy for the pain of others is crucial as it may begin to help in understanding the violence or cruelty perpetrated by those with higher psychopathic traits (van Dongen, 2020). What is more, the present thesis enhances current findings by demonstrating that a lack of empathy for other people's pain exists in psychopathic traits within non-clinical samples. This is important as there has been a large focus on research on clinical and incarcerated samples and such findings may not apply to other populations. For example, research has identified differences in facets of psychopathic traits between prison samples and non-prison samples (i.e., university students, community adults; Boduszek et al., 2021). Prisoners exhibited higher levels of antisocial behaviours while university students demonstrated higher levels of interpersonal manipulation. In view

of this, it is important to understand how psychopathic traits may manifest themselves and impact empathy for others outside of incarcerated and clinical populations.

Further, the present thesis consolidated findings on pain empathy in psychopathic traits through a systematic review. Findings indicated that a lack of empathy for other people may stem from neurological basis (Alshukri et al., 2025). The results from Chapter 5 help to corroborate these findings by showing individuals high in psychopathic traits displayed lower SCRs to other people's pain images, demonstrating a potential physiological foundation for these differences (Alshukri et al., 2024). Although there is limited research using SCR to other people's pain, the present findings align with previous evidence which demonstrated that incarcerated violent offenders high in psychopathic traits had reduced SCR to other people's painful expressions (Pfabigan et al., 2015). Moreover, these findings can be substantiated by complementary physiological evidence showing individuals high in psychopathic traits had blunted neurological responses when viewing other people in painful situations (Seara-Cardoso et al., 2015) and when viewing others' facial emotions (Seara-Cardoso et al., 2016). Further, male prisoners and university students high in psychopathic traits showed reduced pupil dilation and less facial muscle activity to negative facial expressions such as fear and sadness (Gillespie et al., 2019; Khvatskaya et al., 2016). Together, the present findings help to advance literature further by indicating there may be a physiological basis to differences in empathy in those with psychopathic traits. Additionally, these findings are of particular significance as, while most research has been conducted in criminal samples, the present thesis highlights a potential physiological basis for empathy deficits in non-clinical samples. Whether this physiological difference mirrors that of criminal or clinical populations warrants further investigations.

Moreover, the present thesis uncovered specific facets of psychopathy which affected empathy and have been reinforced and contradicted by previous findings. In Chapter 3,

boldness and meanness showed negative associations with empathy for others (Alshukri et al., 2025). Boldness describes emotional stability, social dominance, and courage, whereas meanness is defined by a lack of empathy and callousness (Patrick, 2022; Patrick et al., 2009). Specifically, when previous research has assessed levels of empathic concern, boldness and meanness levels negatively correlated with neural responses to other people's pain (Brislin et al., 2022). This finding is consistent with existing findings demonstrating affective and interpersonal features of psychopathic traits related to affective empathy (Seara-Cardoso et al., 2012). As such, boldness and meanness appear to be key factors in lower levels of empathy.

Meanness, however, exhibited further negative relationships with aspects of cognitive (i.e., perspective taking) and affective (i.e., personal distress, empathic concern) empathy in Chapter 4. Previous findings have demonstrated that individuals with elevated meanness levels showed diminished neural responses to empathy-eliciting stimuli, such as aggressive situations (van Dongen et al., 2018). Further, a recent meta-analysis found meanness was related to diminished brain amplitudes to fearful faces (Spivey et al., 2024). As a result, findings suggest if one cannot understand aggressive and fearful situations, it may lead to a lack of understanding of others' circumstances that require empathic responses. In turn, this results in less prosocial and altruistic behaviours seen in those with higher psychopathic traits (Lin et al., 2023; Mayer et al., 2018). Thus, these findings helped to show the impact that boldness and meanness can have on empathy for others, and the potential outcomes of these traits.

Next, in Study 2 of Chapter 4, disinhibition negatively related to aspects of cognitive and affective empathy; perspective taking and empathic concern. Typically, disinhibition is the strongest predictor of antisocial behaviours, such as violence and aggression (Garofalo et al., 2021a; Gray et al., 2021). Acts of violence and aggression towards others may stem from

an insensitivity to negative outcomes, such as a lack of fear to punishment and pain (Brislin et al., 2016; van Dongen, 2020). Consequently, a lack of fear to negative stimuli may result in a lack of understanding of others' fearful and distressing experiences since negative stimuli may lack salience in those with higher levels of psychopathy (Brazil et al., 2022; Marsh, 2016). For instance, a systematic review found reduced amygdala activity in response to fear which may impact the difficulties individuals higher in psychopathic traits have in identifying and empathising with fear in other people (Marsh, 2016). Additionally, findings suggest that ones' own pain distress mediates how much pain distress others may feel (Brazil et al., 2022). For example, if an individual with increased levels of psychopathic traits experiences less distress in response to their own pain, they will underestimate the pain distress of others. Consequently, a difficulty in interpreting others' emotions leads to lower empathic responses. Therefore, an insensitivity to fear and punishment not only leads to a lack of empathy for other people but may also lead to aggressive and violent behaviours towards others.

Further, this work helped to uncover individual differences in psychopathy and empathy. Firstly, in line with recent research (e.g. Aluja et al., 2022; Pang et al., 2023; Proverbio, 2023), Study 1 of Chapter 4 found women had higher levels of empathy and lower levels of psychopathy compared to men. Sex differences in empathy have been attributed to distinctions in brain connectivity patterns, which were observed when men and women viewed compassionate images (Rodríguez-Nieto et al., 2022). Meanwhile, lower levels of psychopathic traits in women have been credited to potential differences in emotional processing (Efferson et al., 2018). For instance, women scored higher on emotional intelligence measures and fear reactivity compared to males (Edwards et al., 2019; Efferson et al., 2018). This may act as an underlying factor that influences affective aspects of psychopathic personality, such as empathy.

Secondly, Study 1 of Chapter 4 demonstrated negative relationships between cognitive empathy and meanness in both men and women. Although research proposes that cognitive empathy remains relatively intact in those with psychopathic traits (see Campos et al., 2022 for meta-analysis), variances across sex and psychopathic traits exist (Campos et al., 2023; Sica et al., 2021). Yet, meanness levels appear to be consistent across men and women (Sica et al., 2021), while meanness traits are also associated with more broad empathy deficits in both cognitive and affective facets (Campos et al., 2023). As meanness describes callousness and a lack of regard for others (Patrick, 2010), this finding seems fitting. Nonetheless, such findings highlight wider implications. Recently, traits of meanness have shown negative associations with expressions of love, such as intimacy, passion, and commitment (Mejia et al., 2020), which are essential components of successful relationships (Sternberg, 1986, 1997). As individuals higher in meanness can have difficulties with empathy, this may impact a lack of commitment and stability, and emotional detachment seen in those with higher psychopathic traits (Golmaryami et al., 2021). As a result, those with increased levels of psychopathy tend to rely upon short-term relationship strategies which helps to meet their needs (Jonason et al., 2012) while simultaneously being compatible with a detached emotional style (Mejia et al., 2020). Further, work has demonstrated that lower levels of empathy affected attachment styles, which can also impact interpersonal relationships (Christian et al., 2017). What is more, research has identified differences in romantic attachment between men and women with higher psychopathic traits; women were related to anxious attachment styles whereas men were associated with avoidant attachment styles (Mayer et al., 2020). This may impact the emotional dynamics within relationships. Although possessing higher levels of psychopathic traits does not exclude an individual from forming relationships, the consequences of possessing lower levels of empathy may impact the quality of relationships (Christian et al., 2017). However, as there is limited literature

looking into sex differences in both psychopathic traits and empathy, these findings help to offer a deeper insight into the components of psychopathy that affect cognitive empathy. Due to this, further research needs to be conducted looking at psychopathic traits, empathy, and the potential implications they may have between men and women.

Thirdly, only women showed a negative relationship with cognitive empathy and disinhibition scores in Study 1 of Chapter 4. This gender-specific finding is interesting as it raises the question of why this occurred in women and not men. Yet, research investigating the relationships between psychopathy and empathy in females is limited. The existing literature indicates that females who possess higher levels of disinhibition do so due to internalising symptoms such as depression, anxiety, and stress (Falkenbach et al., 2017; Sica et al., 2015; Sica et al., 2021). Additionally, individuals with traits such as impulsivity and anxiousness struggled with regulating (i.e., dysregulation) and processing negative emotions such as sadness and depression (Falkenbach et al., 2017; Pinheiro et al., 2023). Behaviours that indicate difficulties in managing emotions may contribute to behavioural dysregulation such as impulsiveness, which may escalate to antisocial behaviours (Patrick et al., 2005; Pinheiro et al., 2023). While these findings are significant, what is equally important is highlighting the lack of literature examining psychopathic traits in women. As demonstrated, psychopathic traits manifest themselves differently in women compared to men. By building a stronger knowledge base, researchers can gain a clearer understanding of the distinctions that exist between men and women and develop more specific strategies to help those individuals.

Lastly, men showed a surprising positive relationship between disinhibition scores and affective empathy, contrasting with previous research (Baroncelli et al., 2022; Robertson et al., 2020). Affective empathy relates to being able to *feel* the emotions of others (Singer et al., 2009), while disinhibition describes impulsivity and poor emotional and behavioural

regulation (Patrick, 2010). Recently, research has revealed disinhibition is strongly associated with poorer life satisfaction as well as impairments in interpersonal (i.e., social skills, communicating with others) and personal (i.e., self-regulation, coping strategies) functioning (Davis et al., 2024; Morey, 2017). It may be the case that being able to increasingly feel other's emotions leads to impairments in social functioning (e.g., becoming overwhelmed; Riess, 2017). Interestingly, similar characteristics have been found in individuals with autistic spectrum disorder (ASD); that being intact affective empathy and impulsivity (Maguire et al., 2024). While this by no means implies that those with psychopathy present with ASD or vice versa, it may be that simply, these two traits share similar characteristics in some populations (Maguire et al., 2024). Identifying potential overlaps within these two traits may help to enhance the lives of those individuals, especially if there are strong associations with lower life satisfaction in those with higher psychopathic traits (Davis et al., 2024).

Moreover, age-related differences within psychopathic traits were found to be limited in the present thesis. While age did not act as a significant control variable for cognitive or affective empathy, both men and women showed negative relationships between age and meanness scores. Furthermore, only women showed a negative association between age and disinhibition scores. Age-related research has generally agreed that psychopathic traits in both men and women typically decrease with age (Hartung et al., 2022), although some disparities have been found (e.g. Maurer et al., 2022). As demonstrated in this thesis, and corroborated by previous research (Maurer et al., 2022), older women showed a decrease in impulsive traits (i.e., disinhibition) compared to their younger counterparts. In contrast, although the present research did not find this in men, research has supported this finding in violent male offenders (Huchzermeier et al., 2008). One reason for this discrepancy may be the different measurement tools used in the present study (i.e., TriPm) versus contrasting research (Psychopathy Checklist: Screening Version; PCL:SV; Hart et al., 1995), as this may present

variability in definitions and constructs of psychopathic traits (Evans et al., 2016). In addition, men in non-clinical samples versus those violent offenders may display different behaviours and characteristics, leading to differences in findings (see Boduszek et al., 2021). Thus, future work could adopt cross-validation of psychopathy tools to enhance comparability and investigate both criminal and non-criminal samples. Together, while age-related findings in psychopathic traits appear minimal, evidence for sex differences in psychopathic traits and empathy warrants further investigation and may be able to enhance explanations for these differences.

Lastly, the results of Chapter 5 helped to add literature to the growing theory of dual harm. Dual harm describes a distinct construct of the co-occurrence of aggression and self-harm (Shafti et al., 2021). The findings in the present thesis demonstrated that individuals with higher levels of psychopathic traits exhibit reduced empathy for others (i.e., aggression) in conjunction with a reduced perception of pressure stimuli (i.e., self-harm) (Alshukri et al., 2024). As psychopathy is a strong predictor of aggressive and self-harm behaviours (O'Donnell et al., 2015), it is suggested that those engaging in dual harm may possess distinct characteristics such as impulse control and emotional dysregulation (Boxer, 2010; Garofalo et al., 2021a; Sahlin et al., 2017). The results from Chapter 5 align with dual harm by suggesting that these behaviours in conjunction with emotional dysregulation can lead to a disregard for the pain of others. This can be due to either the suppression of emotions (i.e., over-regulation) or a failure to contain emotions (i.e., under-regulation; Garofalo et al., 2018; Roberton et al., 2012) and a lack of empathy in higher levels of psychopathic traits (Burghart et al., 2024). These findings are important as they help to show individuals engaging in these co-occurring behaviours may display distinctive characteristics. As such, this could improve the understanding of the complex behaviours in those with psychopathic traits, which could

lead to more effective interventions. However, more research needs to be conducted in this preliminary idea.

Together, these findings propose that individuals higher in psychopathic traits have difficulty processing empathy stimuli, which also takes the form of pain empathy. This is crucial as it may begin to explain aggressive and violent behaviours seen in those with increased levels of psychopathic traits (Garofalo et al., 2021a; Gillespie et al., 2023). In addition, this thesis helped to add to literature indicating that a lack of empathy for other people's pain may have a physiological basis. This is evidenced through laboratory-based findings examining empathy for other people's pain via SCRs (Alshukri et al., 2024) and systematic review results demonstrating reduced levels of neural activity to empathy stimuli (Alshukri et al., 2025). Furthermore, results from Study 1 of Chapter 4 help to highlight sex differences in empathy, too. For example, men and women demonstrated different levels of psychopathic traits and empathy, which may have broader implications such as relationship difficulties and emotional dysregulation (Christian et al., 2017; Garofalo et al., 2021a). However, findings also helped to highlight the lack of research into psychopathic traits and empathy in females in non-clinical samples, thus calling for more investigations in this area. Lastly, findings contributed to the growing theory of dual harm in which individuals with psychopathic traits present aggressive (i.e., a lack of empathy for others' pain) and self-harm (i.e., a higher acceptance of pain stimuli) behaviours (Shafti et al., 2021). However, as this theory is in its infancy, more research is needed to better establish this concept.

**Limitations, Strengths, and Further Research**

While this thesis helps to add considerable knowledge to the field of psychopathic traits, pain perception, and empathy, the studies also have their limitations which could be addressed in upcoming research. Firstly, self-report measures were used to capture psychopathic traits in each of the participant samples. Due to the nature of psychopathic

traits, there is no way of knowing if the responses to pain, empathy, and in fact psychopathic traits themselves, were truthful. While concerns have been raised regarding biases in the self-reporting of psychopathic traits (see Watts et al., 2016), there have been mixed findings when reassuring researchers of this effect (Ray et al., 2013; Verschuere et al., 2014; Watts et al., 2016). For instance, a meta-analysis of 45 studies revealed that as psychopathic traits increased, individuals engaging in "faking good" (i.e., giving socially desirable responses) decreased (Ray et al., 2013). Conversely, the tendency to "fake bad" (i.e., portraying oneself in a worse light) increased as psychopathic traits increased (Ray et al., 2013). This suggests that individuals with psychopathic traits either try to make themselves look better or worse depending on the situation. In contrast to this, other researchers argue that individuals with psychopathic traits are more honest in their responses, and socially desirable answers simply reflect variances in those responses rather than a bias (Verschuere et al., 2014). Furthermore, socially desirable responses are reduced when questionnaires are completed anonymously, and it also helps when they are completed in an online environment, such as in Chapter 4 (Kreuter et al., 2008). Although the evidence presents a complex picture, issues such as self-report biases should continue to be monitored in contemporary psychopathy studies to ensure data is accurate and reliable.

Next, the populations sampled in all 3 chapters may lack external validity. This is because some of the samples are limited in their characteristics such as their sex, age, ethnicity, socioeconomic status, and cultural background. While Study 1 of Chapter 4 demonstrated that there are differences in psychopathic traits and empathy between men, women, and age, the general lack of diversity in psychological research represents a wider problem. For instance, participants taking part in psychological research typically represent Western, educated, industrialised, rich, and democratic (WEIRD) samples that are conveniently located where researchers are based, such as universities (Pitesa et al., 2023;

Roberts et al., 2020). Furthermore, analysis of research ranging from 1970's to 2018 found discussions relating to females and gender were scarce, while empirical research was typically conducted on white samples (Rao et al., 2015; Roberts et al., 2020). This would imply that only a limited range of participant perspectives were collected, resulting in a lack of generalisability to other populations. As a result, the full spectrum of human experiences is not represented, and research is limited in its understanding of human behaviours. Due to this, future research should expand the diversity of their samples, including sex and age, so that results are inclusive and can be applied to people beyond the study context.

Lastly, due to the time-demanding and labour-intensive nature of laboratory experiments, sample sizes tend to be relatively smaller than online questionnaire studies, for example. A smaller sample size results in several issues such as low statistical power (Cohen, 1992) or an overestimation of effect sizes (Gelman et al., 2014). Therefore, the field more broadly needs to develop viable and sustainable methods that could enhance sample sizes, such as collaborative research projects between institutions in which data on the same topic is collated and analysed.

However, this thesis also presents many strengths. To start, Chapter 5 boasts multiple experimental methods (Alshukri et al., 2024). Firstly, the study adopted an objective physiological measure to assess perceptions of pain in the self and empathy for other people's pain. SCR is an ecologically valid tool that has shown consistency between emotional experiences and their accompanying physiological responses (Van Doren et al., 2021). Due to this, SCR may better emulate emotions from both real-life and laboratory settings. Further, SCR offers a non-invasive technique to measure physiological activity to emotional experiences (Novak, 2019). This is important as it means that the risk of harm and discomfort to participants is kept minimal. In addition, using SCR helps to circumvent any social desirability issues that may present themselves when using methods such as self-report

questionnaires (Hibbing et al., 2019). This is equally important when testing a population that is known for its deceptive and manipulative capabilities (Patrick et al., 2009). As a result, future studies should consider adopting multiple experimental methods to enhance the validity of research.

Next, the method of nociceptive pressure used in Chapter 5 is a valid method of pain stimulation (Lacourt et al., 2012). As pressure stimulations have been found to activate regions of the brain associated with pain processing (Jackson et al., 2020; Lacourt et al., 2012), this may help to better imitate pain experienced day-to-day. This helps to improve the ecological validity of the research by increasing its real-world applicability.

Further, Chapter 4 has the advantage of recruiting a large sample size ($n$ = 757). This is important as it helps to increase the reliability of the findings in the study by improving the statistical power and reducing type I and II errors (Shreffler et al., 2023). By providing reliable and credible results, such findings can help to advance the knowledge in the field of psychopathic traits, pain perception, and empathy.

Lastly, this thesis enriches contributions to open science. The concept of open science describes the practice of making data and knowledge replicable and transparent (Nosek et al., 2022). For the present thesis, this was achieved by pre-registering the systematic review procedure for Chapter 3 (see Alshukri et al., 2025), and providing transparency in the availability of data in Chapter 5 during the peer-review and publishing process (Alshukri et al., 2024). Such practices help to deter dishonest research practices such as creating hypotheses after the results are revealed (HARKing), or running analysis until a significant p-value is reached (p-hacking; Allen et al., 2019). By continuing open science practices, replicability can be enhanced which will help to advance knowledge and scientific rigor (Nosek et al., 2022).

**Practical and Theoretical Implications**

The present research offers several practical and theoretical implications. Firstly, the results in Chapter 3 highlight that a tolerance of pain may be dependent upon the type of stimulus that is delivered (Alshukri et al., 2025). This was evidenced by significant findings for a higher tolerance of pressure and electrical stimuli but not cold temperatures in individuals with higher psychopathic traits. Yet, as there was a lack of a control group (e.g., low psychopathic traits) to offer a comparison with how high psychopathic-trait individuals respond to such stimuli, these results should be considered with caution. Nevertheless, as pain is multidimensional experience encompassing not just nociception but emotional and cognitive components (see Fabbro et al., 2014 for further details), physical pain should be assessed through a range of methods such as pressure, heat, and electrical stimulations. As shown by Chapter 3, regardless of a lack of a comparison group, cold temperatures were perceived differently than pressure and electric stimuli (Alshukri et al., 2025). By testing an assortment of stimuli, researchers can ensure they are capturing a broad spectrum of nociceptive pain which will help to distinguish pain perception and help to commence the understanding of why some pain stimuli are tolerated while others are not.

Furthermore, Chapters 3 (Alshukri et al., 2025) and 4 also revealed the variations in pain findings based on the methods used for data collection. The systematic review demonstrated significant findings in pain tolerances when data was collected via EEG and self-reports, but not when collecting data using fMRI. EEG and fMRI collect brain activity in different ways; EEG records the electrical activity of the brain through electrodes placed on the scalp (Cohen, 2017) whereas fMRI measures changes in blood oxygen (BOLD) levels using magnetic fields and radio waves (Logothetis, 2008). Furthermore, EEG is better at recording brain activity in real time, while fMRI can more accurately identify the brain regions involved in specific tasks or functions (Michalopoulos et al., 2015). As a result, the

data that is collected by both methods differs greatly, which may help to explain the difference in findings. For this reason, suggestions have been made to combine both methods in order to create a more balanced data collection method (Huster et al., 2012). By doing so, researchers could gain a more comprehensive picture of pain perception in psychopathic traits. Moreover, Chapter 4 did not uncover a significant relationship between pain sensitivity and facets of psychopathy when solely relying on a self-report measure, which contrasts previous experimental literature (Brislin et al., 2016; Brislin et al., 2022). While these findings may suggest a discrepancy in self-report responses versus physiological responses in those with psychopathic traits (see Gao et al., 2012), they stress the importance of future research adopting a range of data collection methods, such as EEG, fMRI, and self-report responses. By doing so, each method will offer unique insights. Yet, when combined, they will provide a more comprehensive understanding of psychopathic personality traits and pain perception.

Furthermore, the findings described in the two paragraphs above could offer insights into pain management interventions. For instance, in Study 2 of Chapter 4, boldness was the only significant predictor of pain sensitivity. Additionally, from the synthesis of findings in Chapter 3 (Alshukri et al., 2025), boldness and meanness played specific roles in the tolerance of pain. Based on what we know about boldness and meanness traits, they encompass fearlessness, resilience, and reduced emotional interference in decision making (Patrick, 2022). By utilising the adaptive features of these traits (see Segarra et al., 2022), pain management programs can be tailored to better improve patient outcomes, rather than using the typically uniform approach to treatments which are determined based on severity of pain, for instance (Kumar et al., 2024). Clinicians have suggested screening patients for protective factors of psychological distress that may result in resilience in chronic pain patients (Ibrahim et al., 2020); traits like boldness and meanness could be among these

protective factors (Patrick, 2022). While implementing such approaches poses challenges as pain is a complex phenomenon affected by numerous factors (e.g., biological, psychological, social, and cultural; Kumar et al., 2024), exploring such strategies could significantly enhance patients' quality of life.

Next, results throughout the entire thesis have broader applications that can span to developing guidance and support in non-clinical populations, such as students. A review of interventions that help to treat those with psychopathic traits highlights the lack of treatments specifically developed for these traits (Lewis, 2018). Instead, results highlighted a focus on reducing criminal recidivism as opposed to challenging the underlying causes of psychopathic traits such as cognitive and affective differences (Lewis, 2018). The findings of the present thesis emphasise that higher psychopathic traits disrupt empathy processing, especially empathy for other people's pain experience. Additionally, Chapter 5 highlighted that individuals higher in psychopathy perceive pressure differently to those lower in psychopathy (Alshukri et al., 2024), which may impact the perception of others' pain (Brazil et al., 2022). By extrapolating from the information learned from the review of interventions (Lewis, 2018), support can be put in place for the underlying causes of empathy and pain perception deficits for the individuals studied in the present thesis, i.e., the student population. For instance, by identifying students with lower levels of empathy for others' pain, those individuals can be offered tailored support in the form of emotional intelligence workshops (Castillo et al., 2013; Kuk et al., 2021), or role-playing exercises (Hu et al., 2024). By doing so, those individuals may have less of a difficulty in relating to their peers' emotions, while overall, by acknowledging the diversity in empathy and pain processing associated with psychopathic traits, educational institutions can adopt proactive, evidence-based measures to foster a supportive and inclusive environment. Yet, further research into the efficacy of such support needs to be explored in students in the United Kingdom.

Moreover, the present thesis helped to show distinctions between psychopathic traits and empathy between men, women, and age. For example, women exhibited negative relationships between cognitive empathy and disinhibition that men did not, whereas men exhibited a positive relationship between affective empathy and disinhibition that women did not. While this evidence is important as it helps to show differences and similarities exist between these samples, the findings also highlighted a lack of research looking into psychopathic traits and empathy solely in women. As psychopathic traits were initially reported in men (Sica et al., 2021), there has been a focus on research in this population. However, psychopathic traits also exist in women (Verona et al., 2018), but this sample is greatly underreported and results in a series of issues. Firstly, only studying psychopathic traits in men results in a gender bias in findings. Due to this, findings can be skewed in favour of men and lack generalisability to women, which means results cannot be applied to women. As seen in Study 1 of Chapter 4, differences were found in both psychopathic traits and empathy in men and women, stressing the importance of studying both samples individually. Secondly, due to the lack of research regarding psychopathic traits in women (Tully et al., 2023), there are limited insights and therefore gaps in knowledge. Research may focus on men due to links with violent crime and criminal behaviours, yet psychopathic traits in women could also result in violent and non-violent behaviours (Eisenbarth et al., 2012; Tully et al., 2023). Furthermore, two of the eight studies eligible for the systematic review in Chapter 3 used male-only samples (see Alshukri et al., 2025) which poses the question: do these findings also apply to women? As a result, research should aim to include women in their participant samples as psychopathic traits may manifest themselves differently. Not only will this help to address the gaps in the literature, but it will ultimately benefit those individuals, too.

Furthermore, findings from Chapter 5 (Alshukri et al., 2024) contributed to the developing theory of dual harm (Shafti et al., 2021). The theory of dual harm suggests a group of individuals that present a unique set of characteristics such as causing harm to oneself and harm towards others (Shafti et al., 2021). These results were identified in Chapter 5; individuals with psychopathic traits demonstrated a lack of empathy for others' pain (i.e., harm towards others) and accepted higher levels of pressure stimuli (i.e., self-harm; Alshukri et al., 2024; Shafti et al., 2023). Identifying individuals who may engage in dual harm behaviours will provide a more nuanced understanding of their actions, however, a lot more research is needed in this area to better establish this theory.

Additionally, Chapter 5 highlighted that individuals higher in psychopathy displayed lower SCRs to other people's pain images (Alshukri et al., 2024). When this result is combined with findings from Chapter 3 (Alshukri et al., 2025), they suggest that a lack of empathy for other people's pain may have a physiological basis. This has significant clinical importance as future research may be able to develop physiological tests to assess psychopathic traits more accurately. Moreover, this helps to deepen the understanding of psychopathic traits by showing particular behaviours may not be a conscious choice. Likewise, researchers have argued that early childhood maltreatment and trauma may lead to the development of higher psychopathic traits (see de Ruiter et al., 2022; Moreira et al., 2022 for reviews). For instance, links have been found between physical and emotional child abuse and developing increased levels of psychopathic traits (de Ruiter et al., 2022). Although trauma is beyond the scope of the present thesis, it is an important avenue to also consider when examining reasons for a lack of empathy related to psychopathic traits. By considering possible explanations for psychopathy that are beyond the control of the individual, it may help to reshape the negative and harmful stereotypes that are formed about those with high levels of psychopathic traits (e.g. Skeem et al., 2011).

Lastly, findings from all 3 chapters demonstrated that facets of psychopathy interact with dimensions of empathy in different ways. For example, boldness and meanness played a specific role in pain and empathy experiences in Chapter 3 and 4. This helps to highlight the nuances in psychopathic traits, how they may relate to empathy processing, and how this is reflected in interactions with others. As such, recommendations have been made to explore the subdimensions of psychopathic traits rather than relying on a total psychopathy score; simply relying on a total score may lead to misleading or obscure conclusions since facets describe different aspects of the personality trait (Lilienfeld, 2018). For instance, when examining the total scores of youth psychopathy, results showed that psychopathic traits are unrelated to processing fearful faces (Gillen et al., 2018). However, on closer examination, sub-facets associated with shallow affect and a lack of empathy related to the processing of fearful faces (Gillen et al., 2018), thus, highlighting the importance of exploring dimensions of psychopathy in addition to total scores. Using a more comprehensive approach to researching psychopathic traits will help the field to gain a better understanding and appreciation of how facets of psychopathy associate, or disassociate, with one another within the broader construct. Theoretically, this knowledge can advance models of personality traits like psychopathy, while practically, it can help to improve the support given to the populations sampled in this thesis, such as students.

## Conclusion

The current thesis advances the understanding of psychopathic traits and their effect on pain processing and empathy for other people's pain, and cognitive and affective empathy. Gaps in the literature were addressed in relation to pain perception and empathy in those with psychopathic traits by using objective SCRs combined with self-report measures and systematic review evidence.

Despite previous research investigating psychopathic traits and how they may relate to pain perception and empathy, a lot of this research has been conducted in incarcerated and criminal samples and lacks objectivity. This leads to an absence of generalisability and increased chances of self-report biases in findings. Consequently, the results in the present thesis enhance understanding by showing a tolerance of pain may be dependent upon the modality of the stimulus, and how data is collected, within non-clinical samples. Additionally, specific traits of psychopathy may have a more profound effect on empathy than others, with findings pointing towards boldness and meanness playing a substantial role. Further, a lack of empathy for others' distress was extended to empathy for pain, which is under researched. This was evidenced through objective laboratory-based examinations and questionnaire-based research. What is more, a lack of empathy is those with higher psychopathic traits may stem from a physiological basis as substantiated by laboratory and systematic review findings.

The findings reported in this thesis add crucial contributions to the field of psychopathic traits, pain perception, and empathy. Firstly, future research should consider adopting multiple nociceptive pain stimuli and data collection methods to discriminate the differences in pain perception and tolerances in those higher in psychopathic traits and gain a more comprehensive understanding of pain processing. Additionally, the present thesis underscores the need to assess the facets of psychopathic traits as boldness and meanness

were found to play a specific role in pain and empathy processing. Subsequently, such personality traits may aid in the development of personalised pain management strategies in the future. Further, by targeting the underlying causes of a lack of empathy for others' pain in the populations sampled in this thesis, better guidance and support could be developed for tailored interventions in populations such as students. Lastly, the preset thesis highlights the need for further research in women as they are underrepresented in the literature but show significant differences in results compared to men. Additionally, as differences in age were found, this should also be an avenue for future exploration.

In conclusion, this thesis advances the understanding of psychopathic traits and their impact on pain perception and empathy by addressing key gaps in the literature. By incorporating both objective physiological measures and self-report data, the present research enhances findings beyond incarcerated and clinical samples and provides clear and robust research in non-clinical populations. This thesis also emphasises the need to move beyond a one-dimensional view of psychopathy, while also bridging the gap between physiological and psychological mechanisms to form a more holistic understanding of human behaviour. Through this process, scientific knowledge will be enriched while individuals will have the option to seek better support through tailored interventions.

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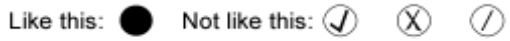
# Appendices

Appendix 1. Triarchic Psychopathy Measure

**Directions:** This questionnaire contains statements that different people might use to describe themselves. Each statement is followed by four choices: τ T Φ ϕ. The meaning of these four different choices is as follows:

τ = True T = somewhat true Φ = somewhat false ϕ = False

For each statement, fill in the bubble for the choice that describes you best. There are no right or wrong answers; just choose the answer that best describes you.




**Remember: Fill only one bubble per item.** If you make a mistake cross out the incorrect answer with an X and fill in the correct option. Answer all of the items. Please work rapidly and do not spend too much time on any one statement.

| | | | | | |
|---|---|---|---|---|---|
| 1. | I'm optimistic more often than not. | τ | T | Φ | ϕ |
| 2. | How other people feel is important to me. | τ | T | Φ | ϕ |
| 3. | I often act on immediate needs. | τ | T | Φ | ϕ |
| 4. | I have no strong desire to parachute out of an airplane. | τ | T | Φ | ϕ |
| 5. | I've often missed things I promised to attend. | τ | T | Φ | ϕ |
| 6. | I would enjoy being in a high-speed chase. | τ | T | Φ | ϕ |
| 7. | I am well-equipped to deal with stress. | τ | T | Φ | ϕ |
| 8. | I don't mind if someone I dislike gets hurt. | τ | T | Φ | ϕ |
| 9. | My impulsive decisions have caused problems with loved ones. | τ | T | Φ | ϕ |
| 10. | I get scared easily. | τ | T | Φ | ϕ |
| 11. | I sympathize with others' problems. | τ | T | Φ | ϕ |
| 12. | I have missed work without bothering to call in. | τ | T | Φ | ϕ |
| 13. | I'm a born leader. | τ | T | Φ | ϕ |
| 14. | I enjoy a good physical fight. | τ | T | Φ | ϕ |
| 15. | I jump into things without thinking. | τ | T | Φ | ϕ |
| 16. | I have a hard time making things turn out the way I want. | τ | T | Φ | ϕ |

| | | | | | |
|---|---|---|---|---|---|
| 17. | I return insults. | τ | T | Φ | ϕ |
| 18. | I've gotten in trouble because I missed too much school. | τ | T | Φ | ϕ |
| 19. | I have a knack for influencing people. | τ | T | Φ | ϕ |
| 20. | It doesn’t bother me to see someone else in pain. | τ | T | Φ | ϕ |
| 21. | I have good control over myself. | τ | T | Φ | ϕ |
| 22. | I function well in new situations, even when unprepared. | τ | T | Φ | ϕ |
| 23. | I enjoy pushing people around sometimes. | τ | T | Φ | ϕ |
| 24. | I have taken money from someone's purse or wallet without asking. | τ | T | Φ | ϕ |
| 25. | I don't think of myself as talented. | τ | T | Φ | ϕ |
| 26. | I taunt people just to stir things up. | τ | T | Φ | ϕ |
| 27. | People often abuse my trust. | τ | T | Φ | ϕ |
| 28. | I'm afraid of far fewer things than most people. | τ | T | Φ | ϕ |
| 29. | I don't see any point in worrying if what I do hurts someone else. | τ | T | Φ | ϕ |
| 30. | I keep appointments I make. | τ | T | Φ | ϕ |
| 31. | I often get bored quickly and lose interest. | τ | T | Φ | ϕ |
| 32. | I can get over things that would traumatize others. | τ | T | Φ | ϕ |
| 33. | I am sensitive to the feelings of others. | τ | T | Φ | ϕ |
| 34. | I have conned people to get money from them. | τ | T | Φ | ϕ |
| 35. | It worries me to go into an unfamiliar situation without knowing all the details. | τ | T | Φ | ϕ |
| 36. | I don't have much sympathy for people. | τ | T | Φ | ϕ |
| 37. | I get in trouble for not considering the consequences of my actions. | τ | T | Φ | ϕ |
| 38. | I can convince people to do what I want. | τ | T | Φ | ϕ |
| 39. | For me, honesty really is the best policy. | τ | T | Φ | ϕ |
| 40. | I've injured people to see them in pain. | τ | T | Φ | ϕ |
| 41. | I don’t like to take the lead in groups. | τ | T | Φ | ϕ |
| 42. | I sometimes insult people on purpose to get a reaction from them. | τ | T | Φ | ϕ |
| 43. | I have taken items from a store without paying for them. | τ | T | Φ | ϕ |
| 44. | It's easy to embarrass me. | τ | T | Φ | ϕ |
| 45. | Things are more fun if a little danger is involved. | τ | T | Φ | ϕ |

| | | | | | |
|---|---|---|---|---|---|
| 46. | I have a hard time waiting patiently for things I want. | τ | T | Φ | ϕ |
| 47. | I stay away from physical danger as much as I can. | τ | T | Φ | ϕ |
| 48. | I don't care much if what I do hurts others. | τ | T | Φ | ϕ |
| 49. | I have lost a friend because of irresponsible things I've done. | τ | T | Φ | ϕ |
| 50. | I don't stack up well against most others. | τ | T | Φ | ϕ |
| 51. | Others have told me they are concerned about my lack of self-control. | τ | T | Φ | ϕ |
| 52. | It's easy for me to relate to other people's emotions. | τ | T | Φ | ϕ |
| 53. | I have robbed someone. | τ | T | Φ | ϕ |
| 54. | I never worry about making a fool of myself with others. | τ | T | Φ | ϕ |
| 55. | It doesn't bother me when people around me are hurting. | τ | T | Φ | ϕ |
| 56. | I have had problems at work because I was irresponsible. | τ | T | Φ | ϕ |
| 57. | I'm not very good at influencing people. | τ | T | Φ | ϕ |
| 58. | I have stolen something out of a vehicle. | τ | T | Φ | ϕ |

Appendix 2. Interpersonal Reactivity Index

**INTERPERSONAL REACTIVITY INDEX**

The following statements inquire about your thoughts and feelings in a variety of situations. For each item, indicate how well it describes you by choosing the appropriate letter on the scale at the top of the page: A, B, C, D, or E. When you have decided on your answer, fill in the letter next to the item number. READ EACH ITEM CAREFULLY BEFORE RESPONDING. Answer as honestly as you can. Thank you.

ANSWER SCALE:

| A | B | C | D | E |
|---|---|---|---|---|
| DOES NOT DESCRIBE ME VERY WELL | | | | DESCRIBES VERY WELL |

1. I daydream and fantasize, with some regularity, about things that might happen to me. (FS)

2. I often have tender, concerned feelings for people less fortunate than me. (EC)
3. I sometimes find it difficult to see things from the "other guy's" point of view. (PT) (-)
4. Sometimes I don't feel very sorry for other people when they are having problems. (EC) (-)
5. I really get involved with the feelings of the characters in a novel. (FS)
6. In emergency situations, I feel apprehensive and ill-at-ease. (PD)
7. I am usually objective when I watch a movie or play, and I don't often get completely caught up in it. (FS) (-)
8. I try to look at everybody's side of a disagreement before I make a decision. (PT)
9. When I see someone being taken advantage of, I feel kind of protective towards them. (EC)
10. I sometimes feel helpless when I am in the middle of a very emotional situation. (PD)
11. I sometimes try to understand my friends better by imagining how things look from their perspective. (PT)

12. Becoming extremely involved in a good book or movie is somewhat rare for me. (FS) (-)
13. When I see someone get hurt, I tend to remain calm. (PD) (-)
14. Other people's misfortunes do not usually disturb me a great deal. (EC) (-)
15. If I'm sure I'm right about something, I don't waste much time listening to other people's arguments. (PT) (-)
16. After seeing a play or movie, I have felt as though I were one of the characters. (FS)
17. Being in a tense emotional situation scares me. (PD)
18. When I see someone being treated unfairly, I sometimes don't feel very much pity for them. (EC) (-)
19. I am usually pretty effective in dealing with emergencies. (PD) (-)
20. I am often quite touched by things that I see happen. (EC)
21. I believe that there are two sides to every question and try to look at them both. (PT)
22. I would describe myself as a pretty soft-hearted person. (EC)
23. When I watch a good movie, I can very easily put myself in the place of a leading

character. (FS)
24. I tend to lose control during emergencies. (PD)
25. When I'm upset at someone, I usually try to "put myself in his shoes" for a while. (PT)
26. When I am reading an interesting story or novel, I imagine how I would feel if the events in the story were happening to me. (FS)
27. When I see someone who badly needs help in an emergency, I go to pieces. (PD)
28. Before criticizing somebody, I try to imagine how I would feel if I were i

Appendix 3. Pain Sensitivity Questionnaire

This questionnaire contains a series of questions in which you should imagine yourself in certain situations. You should then decide if these situations would be painful for you and if yes, how painful they would be. Let 0 stand for no pain; 1 is an only just noticeable pain and l0 the most severe pain that you can imagine or consider possible. Please mark the scale with a cross on the number that is most true for you. Keep in mind that there are no "right" or "wrong" answers; only your personal assessment of the situation counts. Please try as much as possible not to allow your fear or aversion of the imagined situations affect your assessment of painfulness.

1. Imagine you bump your shin badly on a hard edge, for example, on the edge of a glass coffee table. How painful would that be for you?

   0= not at all painful, 10 = most severe pain imaginable

   1---2---3---4---5---6---7---8---9---10

2. Imagine you burn your tongue on a very hot drink.

   0= not at all painful, 10 = most severe pain imaginable

   1---2---3---4---5---6---7---8---9---10

3. Imagine your muscles are slightly sore as the result of physical activity.

   0= not at all painful, 10 = most severe pain imaginable

   1---2---3---4---5---6---7---8---9---10

4. Imagine you trap your finger in a drawer.

   0= not at all painful, 10 = most severe pain imaginable

   1---2---3---4---5---6---7---8---9---10

5. Imagine you take a shower with lukewarm water.

   0= not at all painful, 10 = most severe pain imaginable

   1---2---3---4---5---6---7---8---9---10

6. Imagine you have mild sunburn on your shoulders.

   0= not at all painful, 10 = most severe pain imaginable

   1---2---3---4---5---6---7---8---9---10

7. Imagine you grazed your knee falling off your bicycle:

   0= not at all painful, 10 = most severe pain imaginable

   1---2---3---4---5---6---7---8---9---10

8. Imagine you accidentally bite your tongue or cheek badly while eating.

   0= not at all painful, 10 = most severe pain imaginable

   1---2---3---4---5---6---7---8---9---10

9. Imagine walking across a cool tiled floor with bare feet.

   0= not at all painful, 10 = most severe pain imaginable

   1---2---3---4---5---6---7---8---9---10

10. Imagine you have a minor cut on your finger and inadvertently get lemon juice in the wound.

    0= not at all painful, 10 = most severe pain imaginable

    1---2---3---4---5---6---7---8---9---10

11. Imagine you prick your fingertip on the thorn of a rose.

    0= not at all painful, 10 = most severe pain imaginable

    1---2---3---4---5---6---7---8---9---10

12. Imagine you stick your bare hands in the snow for a couple of minutes or bring your hands in contact with snow for some time, for example, while making snowballs.

    0= not at all painful, 10 = most severe pain imaginable

    1---2---3---4---5---6---7---8---9---10

13. Imagine you shake hands with someone who has a normal grip.

    0= not at all painful, 10 = most severe pain imaginable

    1---2---3---4---5---6---7---8---9---10

14. Imagine you shake hands with someone who has a very strong grip.

    0= not at all painful, 10 = most severe pain imaginable

1---2---3---4---5---6---7---8---9---10

15. Imagine you pick up a hot pot by inadvertently grabbing its equally hot handles.

0= not at all painful, 10 = most severe pain imaginable

1---2---3---4---5---6---7---8---9---10

16. Imagine you are wearing sandals and someone with heavy boots steps on your foot.

0= not at all painful, 10 = most severe pain imaginable

1---2---3---4---5---6---7---8---9---10

17. lmagine you bump your elbow on the edge of a table ("funny bone").

0= not at all painful, 10 = most severe pain imaginable

1---2---3---4---5---6---7---8---9---10

Appendix 4. Youth Psychopathic Inventory

**Instructions**

This sheet consists of a number of statements that deal with what you think and feel about different things. Read each statement carefully and decide how well the particular statement applies to you. You can choose between four different alternatives on each statement.

**Answer each statement as you most often feel and think, not only how you feel right now.**

Example:

I like reading books.

| Does not apply at all | Does not apply well | Applies fairly well | Applies very well |
|---|---|---|---|
| ☐ | ☐ | ☐ | ☐ |

• Put a mark in the box that corresponds to how you feel.
• Do not think too long on each statement.

REMEMBER:

• **Answer ALL statements.**
• **Do not put a mark between the alternatives.**
• **Only one answer per statement.**

**IMPORTANT!!!** There are no answers that are ”Right” or ”Wrong”. You cannot score worse or better than anyone else. We are interested in what you think and feel, not in what is ”Right” or ”Wrong”.

1. I like to be where exciting things happen.

| Does not apply at all | Does not apply well | Applies fairly well | Applies very well |
|---|---|---|---|
| ☐ | ☐ | ☐ | ☐ |

2. I usually feel calm when other people are scared.

| Does not apply at all | Does not apply well | Applies fairly well | Applies very well |
|---|---|---|---|
| ☐ | ☐ | ☐ | ☐ |

3. I prefer to spend my money right away rather than save it.

| Does not apply at all | Does not apply well | Applies fairly well | Applies very well |
|---|---|---|---|
| ☐ | ☐ | ☐ | ☐ |

4. I get bored quickly when there is too little change.

| Does not apply at all | Does not apply well | Applies fairly well | Applies very well |
|---|---|---|---|
| ☐ | ☐ | ☐ | ☐ |

5. I have probably skipped school or work more than most other people.

| Does not apply at all | Does not apply well | Applies fairly well | Applies very well |
|---|---|---|---|
| ☐ | ☐ | ☐ | ☐ |

6. It's easy for me to charm and seduce others to get what I want from them.

| Does not apply at all | Does not apply well | Applies fairly well | Applies very well |
|---|---|---|---|
| ☐ | ☐ | ☐ | ☐ |

7. It's fun to make up stories and try to get people to believe them.

| Does not apply at all | Does not apply well | Applies fairly well | Applies very well |
|---|---|---|---|
| ☐ | ☐ | ☐ | ☐ |

8. I have the ability not to feel guilt and regret about things that I think other people would feel guilty about.

| Does not apply at all | Does not apply well | Applies fairly well | Applies very well |
|---|---|---|---|
| ☐ | ☐ | ☐ | ☐ |

9. I consider myself as a pretty impulsive person.

| Does not apply at all | Does not apply well | Applies fairly well | Applies very well |
|---|---|---|---|
| ☐ | ☐ | ☐ | ☐ |

10. I'm better than everyone on almost everything.

| Does not apply at all | Does not apply well | Applies fairly well | Applies very well |
|---|---|---|---|
| ☐ | ☐ | ☐ | ☐ |

11. I can make people believe almost anything.

| Does not apply at all | Does not apply well | Applies fairly well | Applies very well |
|---|---|---|---|
| ☐ | ☐ | ☐ | ☐ |

12. I think that crying is a sign of weakness, even if no one sees you.

| Does not apply at all | Does not apply well | Applies fairly well | Applies very well |
|---|---|---|---|
| ☐ | ☐ | ☐ | ☐ |

13. If I won a lot of money in the lottery, I would quit school or work and just do things that are fun.

| Does not apply at all | Does not apply well | Applies fairly well | Applies very well |
|---|---|---|---|
| ☐ | ☐ | ☐ | ☐ |

14. I have the ability to con people by using my charm and smile.

| Does not apply at all | Does not apply well | Applies fairly well | Applies very well |
|---|---|---|---|
| ☐ | ☐ | ☐ | ☐ |

15. I am good at getting people to believe in me when I make something up.

| Does not apply at all | Does not apply well | Applies fairly well | Applies very well |
|---|---|---|---|
| ☐ | ☐ | ☐ | ☐ |

16. I have often been late to work or classes in school.

| Does not apply at all | Does not apply well | Applies fairly well | Applies very well |
|---|---|---|---|
| ☐ | ☐ | ☐ | ☐ |

17. When other people have problems, it is often their own fault, therefore, one should not help them.

| Does not apply at all | Does not apply well | Applies fairly well | Applies very well |
|---|---|---|---|
| ☐ | ☐ | ☐ | ☐ |

18. It often happens that I talk first and think later.

| Does not apply at all | Does not apply well | Applies fairly well | Applies very well |
|---|---|---|---|
| ☐ | ☐ | ☐ | ☐ |

19. I have talents that go far beyond other people's.

| Does not apply at all | Does not apply well | Applies fairly well | Applies very well |
|---|---|---|---|
| ☐ | ☐ | ☐ | ☐ |

20. It’s easy for me to manipulate people.

| Does not apply at all | Does not apply well | Applies fairly well | Applies very well |
|---|---|---|---|
| ☐ | ☐ | ☐ | ☐ |

21. I seldom regret things I do, even if other people feel that they are wrong.

| Does not apply at all | Does not apply well | Applies fairly well | Applies very well |
|---|---|---|---|
| ☐ | ☐ | ☐ | ☐ |

22. I like to do things just for the thrill of it.

| Does not apply at all | Does not apply well | Applies fairly well | Applies very well |
|---|---|---|---|
| ☐ | ☐ | ☐ | ☐ |

23. It’s important to me not to hurt other people’s feelings.

| Does not apply at all | Does not apply well | Applies fairly well | Applies very well |
|---|---|---|---|
| ☐ | ☐ | ☐ | ☐ |

24. Sometimes I lie for no reason, other than because it's fun.

| Does not apply at all | Does not apply well | Applies fairly well | Applies very well |
|---|---|---|---|
| ☐ | ☐ | ☐ | ☐ |

25. To be nervous and worried is a sign of weakness.

| Does not apply at all | Does not apply well | Applies fairly well | Applies very well |
|---|---|---|---|
| ☐ | ☐ | ☐ | ☐ |

26. If I get the chance to do something fun, I do it no matter what I had been doing before.

| Does not apply at all | Does not apply well | Applies fairly well | Applies very well |
|---|---|---|---|
| ☐ | ☐ | ☐ | ☐ |

27. When someone asks me something, I usually have a quick answer that sounds believable, even if I've just made it up.

| Does not apply at all | Does not apply well | Applies fairly well | Applies very well |
|---|---|---|---|
| ☐ | ☐ | ☐ | ☐ |

28. When someone finds out about something that I've done wrong, I feel more angry than guilty.

| Does not apply at all | Does not apply well | Applies fairly well | Applies very well |
|---|---|---|---|
| ☐ | ☐ | ☐ | ☐ |

29. I get bored quickly by doing the same thing over and over.

| Does not apply at all | Does not apply well | Applies fairly well | Applies very well |
|---|---|---|---|
| ☐ | ☐ | ☐ | ☐ |

30. The world would be a better place if I were in charge.

| Does not apply at all | Does not apply well | Applies fairly well | Applies very well |
|---|---|---|---|
| ☐ | ☐ | ☐ | ☐ |

31. To get people to do what I want, I often find it efficient to con them.

| Does not apply at all | Does not apply well | Applies fairly well | Applies very well |
|---|---|---|---|
| ☐ | ☐ | ☐ | ☐ |

32. It often happens that I do things without thinking ahead.

| Does not apply at all | Does not apply well | Applies fairly well | Applies very well |
|---|---|---|---|
| ☐ | ☐ | ☐ | ☐ |

33. Pretty often I act charming and nice, even with people I don't like, in order to get what I want.

| Does not apply at all | Does not apply well | Applies fairly well | Applies very well |
|---|---|---|---|
| ☐ | ☐ | ☐ | ☐ |

34. It has happened several times that I've borrowed something and then lost it.

| Does not apply at all | Does not apply well | Applies fairly well | Applies very well |
|---|---|---|---|
| ☐ | ☐ | ☐ | ☐ |

35. I often become sad or moved by watching sad things on TV or film.

| Does not apply at all | Does not apply well | Applies fairly well | Applies very well |
|---|---|---|---|
| ☐ | ☐ | ☐ | ☐ |

36. What scares others usually doesn’t scare me.

| Does not apply at all | Does not apply well | Applies fairly well | Applies very well |
|---|---|---|---|
| ☐ | ☐ | ☐ | ☐ |

37. I'm more important and valuable than other people.

| Does not apply at all | Does not apply well | Applies fairly well | Applies very well |
|---|---|---|---|
| ☐ | ☐ | ☐ | ☐ |

38. When I need to, I use my smile and my charm to use others.

| Does not apply at all | Does not apply well | Applies fairly well | Applies very well |
|---|---|---|---|
| ☐ | ☐ | ☐ | ☐ |

39. I don’t understand how people can be touched enough to cry by looking at things on TV or movie.

| Does not apply at all | Does not apply well | Applies fairly well | Applies very well |
|---|---|---|---|
| ☐ | ☐ | ☐ | ☐ |

40. I often don't/didn’t have my school or work assignments done on time.

| Does not apply at all | Does not apply well | Applies fairly well | Applies very well |
|---|---|---|---|
| ☐ | ☐ | ☐ | ☐ |

41. I am destined to become a well-known, important and influential person.

| Does not apply at all | Does not apply well | Applies fairly well | Applies very well |
|---|---|---|---|
| ☐ | ☐ | ☐ | ☐ |

42. I like to do exciting and dangerous things, even if it is forbidden or illegal.

| Does not apply at all | Does not apply well | Applies fairly well | Applies very well |
|---|---|---|---|
| ☐ | ☐ | ☐ | ☐ |

43. Sometimes I find myself lying without any particular reason.

| Does not apply at all | Does not apply well | Applies fairly well | Applies very well |
|---|---|---|---|
| ☐ | ☐ | ☐ | ☐ |

44. 44. To feel guilty and remorseful about things you have done that have hurt other people is a sign of weakness.

| Does not apply at all | Does not apply well | Applies fairly well | Applies very well |
|---|---|---|---|
| ☐ | ☐ | ☐ | ☐ |

45. I don't let my feelings affect me as much as other people's feelings seem to affect them.

| Does not apply at all | Does not apply well | Applies fairly well | Applies very well |
|---|---|---|---|
| ☐ | ☐ | ☐ | ☐ |

46. It has happened that I've taken advantage of (used) someone in order to get what I want.

| Does not apply at all | Does not apply well | Applies fairly well | Applies very well |
|---|---|---|---|
| ☐ | ☐ | ☐ | ☐ |

47. I like to spice up and exaggerate when I tell about something.

| Does not apply at all | Does not apply well | Applies fairly well | Applies very well |
|---|---|---|---|
| ☐ | ☐ | ☐ | ☐ |

48. To feel guilt and regret when you have done something wrong is a waste of time.

| Does not apply at all | Does not apply well | Applies fairly well | Applies very well |
|---|---|---|---|
| ☐ | ☐ | ☐ | ☐ |

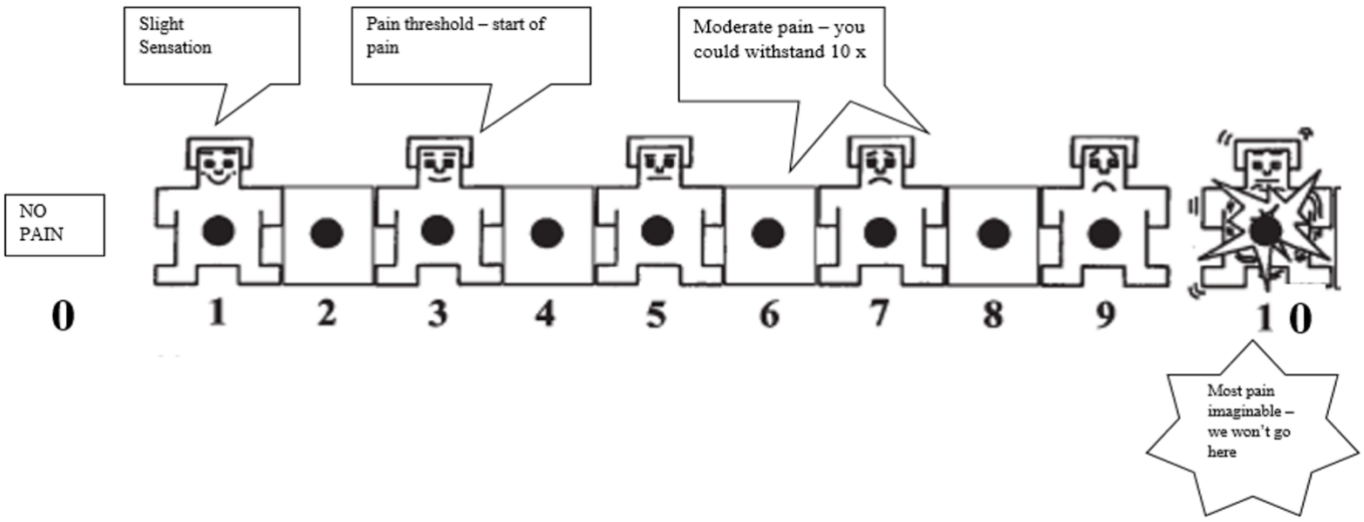
49. I usually become sad when I see other people crying or being sad.

| Does not apply at all | Does not apply well | Applies fairly well | Applies very well |
|---|---|---|---|
| ☐ | ☐ | ☐ | ☐ |

50. I've often gotten into trouble because I've lied too much.

| Does not apply at all | Does not apply well | Applies fairly well | Applies very well |
|---|---|---|---|
| ☐ | ☐ | ☐ | ☐ |

Appendix 5. Self-Assessment Manikin



Appendix 6. Chapter 4 Study 1 & 2 Participant Information Sheet

**PARTICIPANT INFORMATION SHEET**

**Research Ethics Committee Reference Number**: **22/PSY/055**

**Title of Study:** Investigating the relationship of personality traits on sensitivity to pain and empathy

You are being invited to take part in a research study. You do not have to take part if you do not want to. Please read this information, which will help you decide.

1. **What is the purpose of the study?**
   The purpose of the study is to investigate personality trait psychopathy on sensitivity to pain and empathy. We want to understand more about individual differences in psychopathic personality, and if these personality traits affect self-reported sensitivity to painful scenarios and empathy to other people. The study will be included in a PhD thesis and will be published in a scientific journal. This study hopes to answer which personality traits affect sensitivity to pain and empathy towards others.

2. **Why have I been invited to participate?**
   You have been chosen to take part because you meet the inclusion criteria and have indicated your interest by replying to the study advertisement. You must be a minimum of 18 years of age. You must not take part if you suffer from current acute pain or have a history of chronic pain. This is because we will be assessing self-reported pain tolerance.

3. **Do I have to take part?**
   No. You can ask questions about the research before deciding whether to take part. If you do not want to take part that is OK. We will ask you to sign a consent form and will give you a copy for you to keep. Submitting the questionnaire implies your consent to participate in this study.

   You can stop being part of the study at any time, without giving a reason, but we will keep information about you that we already have. You may withdraw from the study by contacting the lead investigator, Sophie Alshukri.

4. **What will happen to me if I take part?**
   You will be asked to complete 3 brief online questionnaires. The questionnaires will take no longer than 15 minutes to complete. You will then be presented with debrief information and asked to submit your details into a prize draw with a chance to win 1 of 19 amazon vouchers worth £25 each. Your responses to the questionnaires cannot be linked to the personal contact details that you submit for the prize draw.

5. **Are there any potential risks in taking part?**

Participating in the research is not anticipated to cause you any disadvantages or discomfort. The potential psychological harm will be the same as any experienced in everyday life. The questionnaires include questions that will ask you about various aspects of personality that can be perceived as positive or negative (e.g., callousness or empathy). During these validated questionnaires you are required to respond to statements with how much you think they apply to you, e.g., '*it often happens that I take first and think later*' or '*sometimes I don't feel very sorry for other people when they are having problems*.' Very occasionally people may find this kind of introspection about their own personality sensitive or mildly distressing. If you think this may be the case, then you should not take part in the study.

6. **Are there any benefits in taking part?**
   There are no perceived benefits in taking part however you might find the study interesting.

7. **Payments, reimbursements of expenses or any other benefit or incentive for taking part**
   Once you have submitted the questionnaires, you will be entered into a prize draw with the chance to win one of nineteen amazon vouchers worth £25. Prize draw submissions will close once data has been collected which will be 2 months from when the questionnaires go live. (We will state a date once ethics has been approved, and we have an official start date).

8. **What will happen to information/data provided?**
   The information you provide as part of the study is the **study data**. Any study data from which you can be identified (e.g., from identifiers such as your name, date of birth, audio recording etc.), is known as **personal data.** Your participation in this study will involve the collection/use of personal data.

   We will keep personal data safe and secure. People who do not need to know who you are will not be able to see your name or contact details. The personal data collected will include:
   - A record of consent (which will include your name)
   - Study data. We will use a code/pseudonym so that you cannot be directly identified from the data.

   Study data and records of consent will be kept for three years after the study has finished. We will write our reports in a way that no-one can work out that you took part in the study.

9. **Who is organising the study?**
   This study is organised by Liverpool John Moores University.

10. **Whom do I contact if I have a concern about the study or I wish to complain?**
    If you have a concern about any aspect of this study, please contact Sophie Alshukri or Minna Lyons and they will do their best to answer your query. You should expect a reply within 10 working days. If you remain unhappy or wish to make a formal complaint, please contact the Chair of the Research Ethics Committee at Liverpool John Moores University who will seek to resolve the matter as soon as possible:
    Chair, Liverpool John Moores University Research Ethics Committee; Email: FullReviewUREC@ljmu.ac.uk; Tel: 0151 231 2121; Research Innovation Services, Liverpool John Moores University, Exchange Station, Liverpool L2 2QP

**11. Data Protection**

Liverpool John Moores University is the data controller with respect to your personal data. Information about your rights with respect to your personal data is available from:

- https://www.ljmu.ac.uk/legal/privacy-and-cookies/external-stakeholders-privacy-policy/research-participants-privacy-notice
- by asking one of the study team or contacting us using the information below

**12. Contact details**

Principle investigator: Sophie Alshukri (LJMU postgraduate research student)
LJMU email address: s.alshukri@2022.ljmu.ac.uk
LJMU school: School of psychology
LJMU Central telephone number: 0151 231 2121

Supervisor name: Minna Lyons
LJMU email address: m.t.lyons@ljmu.ac.uk

Please note that you may only participate in this survey if you are 18 years of age or over.

☐ I certify that I am 18 years of age or over

If you have read the information above and agree to participate with the understanding that the data (including any personal data) you submit will be processed accordingly, please tick the box below to start.

☐ Yes, I agree to take part

Appendix 7. Chapter 4 Study 1 & 2 Debrief

**DEBRIEF FORM**

**Study title:** *Investigating the relationship of personality traits on sensitivity to pain and empathy*

**Research Ethics Committee Reference Number**: 22/PSY/055

Thank you for taking part in the experiment.

The purpose of the study was to assess your personal sensitivity to painful situations, empathy for others, and how much both relate to the personality trait of psychopathy. We are looking to see if psychopathic personality traits improve or worsen people's ability to assess painful situations or empathise with other people. Psychopathy is not a negative trait and is in fact a spectrum of traits and there a lot of successful people who exhibit these traits.

If you would like to find out more about the study, or if you are unhappy or have a problem, please feel free to let us know by contacting Sophie Alshukri or Minna Lyons, and we will try to help in any way possible.

If you would like to be entered into a prize draw with the chance to win 1 of 19 amazon vouchers worth £25, please click the link below. The contact details that you enter for the prize draw cannot be linked back to the questionnaire responses that you gave in any way.

**Principal Investigator**: Sophie Alshukri
LJMU Email address: S.Alshukri@2022.ljmu.ac.uk
LJMU School/Faculty: School of Psychology
LJMU Central telephone number: 0151 231 2121

**Supervisor Name**: Minna Lyons
LJMU Email address: M.T.Lyons@ljmu.ac.uk

**Thanks again for taking part!**

Appendix 8. Chapter 4 Ethical Approval Letter

Dear Sophie,

Thank you for registering your study as minimal risk.

**Sophie Alshukri, PGR - Investigating the relationship of personality traits on sensitivity to pain and empathy (Minna Lyons/Victoria Blinkhorn)**

**UREC opinion: Favourable ethical opinion**
**UREC reference: 22/PSY/055**
**Research Governance Assessment: Approved – the study may commence.**

Conditions of the favourable opinion
Prior to the start of the study.

- Covid-19. Studies that involve in-person activity – The extent of any in-person contact and the measures taken by the study team to reduce the risk of transmission of COVID-19 must be explained to participants in advance in order to inform decisions about participating – update the participant information sheet as required

After ethical review.

- The study is conducted in accordance with the Minimal Ethical Risk Guiding Principles
- You must ensure the information included in the participant facing documents are always current and informed by ongoing risk assessments and any changes to current practices.
- Where any substantive amendments are proposed to the protocol or study procedures further ethical opinion must be sought (https://www.ljmu.ac.uk/ris/research-ethics-and-governance/research-ethics/university-research-ethics-committee-urec/amendments)
- Any adverse reactions/events which take place during the course of the project are reported to the Committee immediately by emailingFullReviewUREC@ljmu.ac.uk
- Any unforeseen ethical issues arising during the course of the project will be reported to the Committee immediately emailingFullReviewUREC@ljmu.ac.uk

Please note that favourable ethics opinion is given for a period of five years. An application for extension of the ethical opinion must be submitted if the project continues after this date.

**Research Governance Approval.**
This email also constitutes LJMU Research Governance Approval of the above referenced study on the basis described in the minimal risk registration form, supporting documentation and any clarifications received, subject to the conditions specified below.
Conditions of Approval

- Compliance with LJMU Health and Safety Codes of practice and risk assessment policy and procedures and LJMU Code of Practice for Research
- Ensure the study is covered by UMAL
- Covid-19. Compliance with LJMU updates detailed in the moving forward together webpages
- Covid-19. Studies that involve in-person activity meet Covid-19 practices which are current at the time the research activity takes place – see here for guidance (https://www.ljmu.ac.uk/microsites/moving-forward/on-campus/research)
- Where relevant, appropriate gatekeeper / management permission is obtained at the study site concerned.
- The LJMU logo is used for all documentation relating to participant recruitment and participation e.g. poster, information sheets, consent forms, questionnaires.

- The study consent forms, study data/information, all documents related to the study etc. will be accessible on request to a student's supervisory team and/or to responsible members of Liverpool John Moores University for monitoring, auditing and data authenticity purposes.

Yours sincerely

**Mandy Williams, Research Support Officer**
**(Research Ethics and Governance)**
**Research and Innovation Services**
**Exchange Station, Tithebarn Street, L2 2QP**
**t: 01519046467 e: a.f.williams@ljmu.ac.uk**
**https://www2.ljmu.ac.uk/RGSO/93042.htm**
**https://twitter.com/LJMUEthics**

Appendix 9. Chapter 5 Participant Information Sheet

**Participant Information sheet**

**Effect of personality traits and pain processing.**

You are being invited to participate in a research study. Before you decide whether to participate, it is important for you to understand why the research is being done and what it will involve. Please take your time to read the following information, and feel free to ask us if you would like more information or if there is anything that you do not understand. We stress that you do not have to accept this invitation and should only agree to take part if you want to.

**What is the purpose of the study?**

The purpose of this study is to investigate the effect of different personality traits on pain processing.

**Why have I been chosen to take part?**

You have been chosen to take part as you meet the inclusion criteria and have indicated your interest by replying to the study advertisement. You are suitable to take part if you do not suffer from current acute pain or history of chronic pain and are a minimum of 18 years of age.

**Do I have to take part?**

You are under no obligation to take part; participation is voluntary, and you are free to withdraw at any time without explanation and without incurring any disadvantage.

**What will happen if I take part?**

Firstly, you will be invited to complete a brief online screening session. This will involve a short online questionnaire. Depending on your score you may be asked to attend the full experiment, which may last up to 1 hour. During the full session, you will first be asked to fill in three questionnaires. Then there will be some equipment applied to monitor your experience whilst a pressure stimulator applies brief (up to 3 second) pulses of pressure to the nail bed of your thumb. The maximum amount of force applied is decided in consultancy with you at the beginning of the experiment. To do this we utilise a validated 'staircase procedure' when we will start with a very low pressure and build up to something that you find mildly painful, but which is also suitable for repeated exposures required during the experiment. During the experiments, the maximum force applied will never exceed the maximal pressure agreed at the beginning of the session. Following each stimulus, you will be asked to rate the characteristics

of the pain experience. Throughout the experiment some sensors will be attached (e.g., to the fingers of the non-stimulated hand) so that we can monitor physiological activity. None of these devices will cause any pain or discomfort. After this you will be asked to rate your perceived intensity of pain experience in a selection of forty photographs of either 'neutral' or 'painful' situations on a computer program. The experimenter will discuss the experience with you between blocks and ensure that you are happy to continue. The whole study will last approximately 1 hour.

**Expenses**

Everyone who takes part in the screening process will be entered into a draw to win a £20 amazon voucher. Those who are invited to attend the full experimental session will be eligible to receive EPR course credit (for Year 1 Psychology Students) at a rate of 6 points. Alternatively, you will receive £10 in return for your participation in the study as reasonable compensation for your time and expense in taking part.

**Are there any risks in taking part?**

There are minimal risks anticipated for taking part in either the screening or the full version of the study described above. The questionnaires required for both the initial screening and full experiment measure various aspects of personality that can be perceived as negative or positive (e.g., callousness or empathy). During these validated questionnaires you are required to respond to statements with how much you think they apply to you, e.g., '*it often happens that I talk first and think later'* or '*sometimes I don't feel very sorry for other people when they are having problems'*. Very occasionally, people may find this kind of introspection about their own personality sensitive or mildly distressing. If you think this may be the case, then you should not take part in the study.

If you are selected for the full experiment from the initial online screening questionnaire, the risks associated with mild-moderate pressure pain stimuli are minimal and the stimulator is validated equipment for research purposes including providing pressure-pain. At the beginning of each study, you will have the opportunity to influence your preferred level of stimuli and we will never exceed this level in the study.

Finally, as described we will also require you to rate some painful and non-painful images which could (similar to the questionnaires) and very occasionally viewing images depicting pain could cause mild distress. We would stress that the images will only contain mild, everyday pain scenarios (e.g., 'hands cutting bread in a manner that would risk a cut to the finger' OR 'hands cutting bread safely'), there will be no images displaying blood or injury occurring.

If you feel this may cause you any distress, we would recommend that you should not take part in this experiment. If you should experience any discomfort or disadvantage during any part of the research, you can cease participation by simply withdrawing you hand from the stimulator to prevent any further stimulation. If this occurs during screening please notify us by email, or

in the event of the full experiment you should make this known to the researcher immediately and we will cease the study immediately.

**Are there any benefits to taking part?**

There are no perceived benefits in taking part; however, you might find the process interesting and receive some insight into the psychology of pain.

**What if I am unhappy or if there is a problem?**

If you are unhappy, or if there is a problem, please feel free to let us know by contacting Dr Nick Fallon, Dr Luna Centifanti or Sophie Alshukri and we will try to help. Details are at the bottom of this form  If you remain unhappy, or have a complaint which you feel you cannot come to us with, then you should contact the Research Governance Officer on 0151 794 8290 (ethics@liv.ac.uk). When contacting the Research Governance Officer, please provide details of the name or description of the study (so that it can be identified), the researcher involved, and the details of the complaint you wish to make.

**Will my participation be kept confidential?**

All of the data collected from you will remain confidential. Digital data will be coded for anonymity during all analysis and in any report. Data will be made anonymous through numerically coding each participant's dataset and only the lead researcher and the research team will have access to the data, and this will be stored for up to 10 years as required by scientific journals. Likewise, all identifying paperwork from each participant will be stored securely in locked storage space and destroyed after a period of 10 years. Following this period all electronic and manual files storing participant details will be deleted. Some academic journals require summary data to be uploaded to online servers for other scientists to critique. In this instance the data uploaded will be entirely anonymous and participants will not be identifiable in any way.

**What will happen to the results of the study?**

The results will form part of a report and potentially be published as part of a scientific publication in peer-reviewed journals. However, participants will not be identifiable from the published data in either format, only anonymous data will be utilised.

**What will happen if I want to stop taking part?**

You will be free to withdraw from the study at any time, without explanation. Results up to the period of withdrawal may be used, if you are happy for this to be done. Otherwise you may request that they are destroyed and no further use is made of them.

**Who can I contact if I have further questions?**

**Researchers:**
Sophie Alshukri
s.alshukri@liverpool.ac.uk

Dr Nick Fallon
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Appendix 10. Chapter 5 Consent Form

## Committee on Research Ethics

### PARTICIPANT CONSENT FORM

**Title of Research Project:** **Effects of personality traits on pain processing**

**Researcher(s):** Nicholas Fallon, Sophie Alshukri, Luna Centifanti and Minna Lyons

**Please initial box**

1. I confirm that I have read and have understood the information sheet dated January 2018 for the above study. I have had the opportunity to consider the information, ask questions and have had these answered satisfactorily. ☐

2. I understand that my participation is voluntary and that I am free to withdraw at any time without giving any reason, without my rights being affected. In addition, should I not wish to answer any particular question or questions, I am free to decline. ☐

3. I understand that, under the Data Protection Act, I can at any time ask for access to the information I provide and I can also request the destruction of that information if I wish. ☐

4. I agree to take part in the above study. ☐

| Participant Name | Date | Signature |
|---|---|---|
| Name of Person taking consent | Date | Signature |
| Researcher | Date | Signature |

**Principle Investigator:**
Dr. Nicholas Fallon,
Eleanor Rathbone Building
Office: 204b
Phone: 0044 0151 7946956
E-mail: nickfal@liverpool.ac.uk

Appendix. 11. Chapter 5 Ethical Approval Letter


**Health and Life Sciences Research Ethics Committee (Psychology, Health and Society)**

Dear Dr Fallon,

I am pleased to inform you that your application for research ethics approval has been approved. Application details and conditions of approval can be found below. Appendix A contains a list of documents approved by the Committee.

## Application Details

| | |
|---|---|
| Reference: | 2954 |
| Project Title: | Personality traits and pain |
| Principal Investigator/Supervisor: | Dr Nick Fallon |
| Co-Investigator(s): | Miss Sophie Alshukri, Dr Luna Centifanti, Dr Minna Lyons |
| Lead Student Investigator: | - |
| Department: | Psychological Sciences |
| Approval Date: | 21/02/2018 |
| Approval Expiry Date: | Five years from the approval date listed above |

The application was **APPROVED** subject to the following conditions:

## Conditions of approval

- All serious adverse events must be reported via the Research Integrity and Ethics Team (ethics@liverpool.ac.uk) within 24 hours of their occurrence.
- If you wish to extend the duration of the study beyond the research ethics approval expiry date listed above, a new application should be submitted.
- If you wish to make an amendment to the research, please create and submit an
- amendment form using the research ethics system. If the named Principal Investigator or Supervisor leaves the employment of the University during the course of this approval, the approval will lapse. Therefore it will be necessary to create and submit an amendment form using the research ethics system.
- It is the responsibility of the Principal Investigator/Supervisor to inform all the investigators of the terms of the approval.

Kind regards,

Health and Life Sciences Research Ethics Committee (Psychology,

Health and Society) iphsrec@liverpool.ac.uk

0151 795 5420

## Appendix - Approved Documents



(Relevant only to amendments involving changes to the study documentation)

The final document set reviewed and approved by the committee is listed below:

| Document Type | File Name | Date | Version |
|---|---|---|---|
| Questionnaire | YPI-english-1 | | |
| Questionnaire | YPI-english-1 | | |
| Questionnaire | EMPATHY-InterpersonalReactivityIndex | | |
| Advertisement | experiment email | | |
| Questionnaire | Triarchic_Psychopathy_Measure_Manual | | |
| Participant Consent Form | ConsentForm | | |
| Participant Information Sheet | Information Sheet_NF | | |
| Risk Assessment | EEG_Lab_generic_RA | | |
| Risk Assessment | Pressure_Risk_Assessment) | | |
| Risk Assessment | Full_Images_NF | | |
| Participant Consent Form | ConsentForm | | |
| Advertisement | experiment email updated | | |
| Advertisement | screening email updated | | |
| Participant Information Sheet | Information Sheet_NF_update | | |