Investigating Empathy Between Dyads:

The Role of Familiarity, Psychopathy, Time, and Gender

By

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Abstract

Empathy research has developed rapidly over the last few decades, yet very little research has examined the relationship between the people within these social interactions and their characteristics. This study aims to explore how familiarity influences cognitive and affective empathy for both familiar and unfamiliar dyads, as well as considering how psychopathy factors, time, and gender may affect empathy. Seventy Eight participants (39 dyads, 20 familiar and 19 unfamiliar) from the general population retrospectively reported their dyad partners' and their own perceived emotional intensity during four prompted conversations and their psychopathic traits (Psychopathic Personality Inventory - Revised - 40). Emotional intensity ratings and electrodermal activity during the conversations were correlated to obtain cognitive, self-reported affective, and physiological affective empathy coefficients. Results showed a significant difference between familiar and unfamiliar dyads for self-reported affective empathy and cognitive empathy. Unfamiliar dyad's ability to empathise improved over the duration of the experiment. Self-centred impulsivity was negatively related to all types of empathy. Lastly, the study found no significant difference between male and female participants for all types of empathy. These results indicate that previous experience and time spent with someone can affect an individuals' ability to empathise. Additionally, the results highlight the potential role of self-centred impulsivity in inhibiting the ability to connect with others.

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Introduction

Empathy sits at the heart of our human ability to connect, create relationships, and develop trust. Communities are based on our ability to empathise with one another, to share, connect and relate. Despite plenty of empathy research over the last 50 years, there is still much to know about this multifaceted skill. While research has looked in-depth at empathy and its association with psychopathy, very little research has looked more broadly at the relationship between the people within everyday interactions. These relationships between individuals are fundamental elements in any interaction, it dictates what is appropriate and provides social guidelines for how humans behave. It then begs the question, does the relationship/familiarity between the individuals within the context of empathy matter? Or are we equally as skilled at empathising with everyone irrespective of their relationship to us? Furthermore, is this true for individuals high in psychopathic personality traits? This study aims to explore how familiarity influences cognitive and affective empathy over time for unfamiliar dyads (a group of two people).

Defining Empathy

Empathy is a crucial skill that we use both consciously and unconsciously. Empathy enables us to communicate with one another, share emotions, and work collectively as a society. It is unsurprising then that the term empathy has existed in literature since the early 1900's (Cooke, 2016; Modic & Schoessler, 2010). Empathy originated from the German word "Einfühlung", meaning "feeling into". However, over the last century, this has developed from describing one's inner feelings into a term that describes one's ability to understand the feelings of another (Cooke, 2016; Modic & Schoessler, 2010). Historically there has been no universally acknowledged definition of empathy; rather, individuals have conceptualised it to best suit their specific context and adapted it accordingly (Elliott et al.,

2011; Segal et al., 2017). Zaki (2017) highlights this best when he comments on the word ‘empathy’ becoming an umbrella term that some academics use instinctively, without giving much thought to what they are defining. He instead recognises that empathy is not a single component, but describes multiple different yet related processes (Zaki, 2017). Thisambiguity has culminated in a field with significant variability of terms and measures, each having a somewhat different conceptualisation of what empathy is, and how best to measure it (Gerdes et al., 2010; Segal et al., 2017).

The lack of a collectively agreed-upon term across the discipline has impacted the body of literature we have today. This is highlighted best in psychology research as different understandings of empathy have resulted in a variety of different measures (Lanzoni, 2018; Palmer, 2018). A meta-analysis by Elliot et al., (2011) emphasised this when they discussed four different methods of measuring empathy and how this methodological variability would influence the results of the study, dependent on the method used. Elliot et al., (2011) reflected on the multidimensional nature of empathy and suggested the complexity of such a construct had allowed for a myriad of measures to be developed. This has become a practical issue for empathy research, as studies can differ significantly depending on the definition of empathy (Gerdes et al., 2010; Segal et al., 2017). As a result, our existing knowledge of empathy is complex due to the multiple different disciplines, conceptualisations, and methodological approaches that have endeavoured to better understand empathy.

Here we will use an everyday example of a situation in which empathy can be utilised. Imagine a friend has just failed a test despite studying hard. A normal response would be feeling sad and slightly disappointed; you can understand how the friend is feeling, so you offer words of encouragement and support to help them. This interaction between friends allows for deeper trust and fosters stronger relationships as you share emotions with one another. It is common everyday interactions like this that led to empathy research

growing exponentially in the late 70's early 80's. Around this time academics began to recognise the importance of empathic interactions, and how communities are built on individuals having strong relationships with one another. Since then empathy research has expanded steadily and empathy has been implicated in a variety of different scopes within psychology (Zaki, 2017). As empathy research has grown over the decades, more is understood about the different facets and types of empathy. Today research and academics alike tend to adopt a model of empathy with two distinct facets: cognitive empathy and affective empathy (Jackson & Decety, 2004). Cognitive empathy is the ability to understand someone else's mental state, whereas affective empathy is the emotional response to the state of another (Kalisch, 1973; Yu & Chou, 2018). Jackson and Decety (2004) summarise this model well by describing it as a system that requires both an understanding of another persons' circumstances and the ability to share in the persons' emotional experience. Research recognises the importance of theory of mind as being crucial in the mechanisms of empathy (Singer & Tusche, 2014; Völlm et al., 2006). The ability to separate yourself from others is essential to effectively empathise with those around you.

Theory of mind is the ability to infer others mental states, this includes an individuals emotions, thoughts, and desires (Gallese, 2003). Theory of mind is crucial for social cognition as it enables individuals to predict behaviour, cooperate and demonstrate interpersonal sensitivity. Theory of mind has long been associated with empathy due to the shared mechanisms in which they both seek to understand others (Bzdok et al., 2012). Studies have demonstrated the neurological similarities these psychological concepts share through similar activation patterns within the brain (Bzdok et al., 2012; Ruby & Decety, 2004; Völlm et al., 2006). Areas of activation occur in the medial prefrontal cortex, temporoparietal junction and in the temporal poles; these regions are associated with decision making, processing auditory information, comprehension, and memory encoding, all of which are

important processes involved in empathy and theory of mind (Frith & Frith, 1999; Ruby & Decety, 2004; Völlm et al., 2006). Research examining individuals with brain injuries and autism spectrum disorder have observed deficits not only in individuals theory of mind but often in their ability to empathise too (Eyuboglu et al., 2018; Holopainen et al., 2019; Kraemer et al., 2012; Yeh & Tsai, 2014). Research by Holopainen et al., (2019) suggested that for children with autism, theory of mind training would be a useful intervention to improve empathetic ability. Research consistently demonstrates the strong association between theory of mind and empathy and the commonalities they share, not just as psychological concepts but also within the neural structures with the brain.

As just previously acknowledged, empathy enables us to understand others internal states, which is referred to as state empathy (Lazarus, 1991). State empathy is the process in which we understand others (Lazarus, 1991). This differs from trait empathy, which is considered a stable characteristic of an individuals' personality and reflects their ability to empathise (Litvack-Miller et al., 1997). [It is important to clarify that what is being conceptualised as empathy in this thesis, is indeed state empathy]. In this study we are examining how state empathy may change in different contexts. It's important to distinguish between the two as state empathy examines how we understand others which sits at the core of this study.

Aspects of Empathy

The literature produced by the psychology discipline supports the two-component model of empathy and finds it is empirically grounded. Studies have provided evidence that affective empathy and cognitive empathy are often found to be mutually exclusive. For example, a study by Maurage et al., (2011) examined alcohol and its effect on the brain; they found that adults, when intoxicated, showed significantly lower emotional empathy, yet their

cognitive empathy remained consistent. Additionally, research with patients diagnosed with bipolar disorder revealed evidence of decreased cognitive empathy and increased affective empathy amongst patients (Shamay-Tsoory et al., 2009). As demonstrated, cognitive and affective empathy are well established independent components that ultimately contribute to our ability to share and understand others' internal states (Zaki & Ochsner, 2012).

Cognitive Empathy

Cognitive empathy is an individuals' ability to understand another person's mental state (Kalisch, 1973; Yu & Chou, 2018). It is sometimes referred to as perspective taking or considered part of a broader concept: theory of mind (Davis, 1994). If we refer to the example used earlier, cognitive empathy will enable the friend to understand the other person's mental state, knowing the friend is sad, upset, and worried due to failing their test. Research examining brain activity indicate that regions such as the medial prefrontal cortex, temporo-parietal junction and the precuneus are active during cognitive empathy tasks (Marsh, 2018; Singer & Lamm, 2009; Walter, 2012; Zaki et al., 2012). Cognitive empathy is a conscious process that is effortful and useful in everyday situations, such as understanding diverse perspectives, negotiating, and motivating individuals. Cognitive empathy is often evaluated in empathy research through a measure of empathic accuracy (van Donkersgoed et al., 2019).

Empathic accuracy is described as the extent to which a person can accurately describe someone's mind or understand someone's thoughts (Mast & Ickes, 2007). A comprehensive methodology was developed by Ickes and Tooke (1988a) to measure empathic accuracy, called the empathic accuracy paradigm. The empathic accuracy paradigm sets up an event with two people: the perceiver and the subject. The perceiver is asked to report the thoughts of the subject after an interaction with them. The subject will describe

their thoughts during the interaction. The two descriptions are then matched to see how similar they are; this is usually done by an objective third party (Ickes & Tooke, 1988b). This procedure has been adapted and used in numerous empathy studies since and appears to be one of the most used methodologies (Rum & Perry, 2020). While cognitive empathy explores ones ability to understand someone's mental state, this only encompasses one part of empathy, affective empathy is another important element to understand.

Affective Empathy

Affective empathy is a persons' emotional response to the state of another (Kalisch, 1973; Yu & Chou, 2018). Affective empathy is the most common term for the phenomena, but it can also be referred to as empathic concern or experience sharing (Davis, 1994; Zaki & Ochsner, 2012). It is a crucial element when developing stable relationships and impacts on our ability to connect with people around us (Zaki & Ochsner, 2012). Affective empathy is the emotional reaction in response to another state (Kerr-Gaffney et al., 2019). In the example of two friends used earlier, an affective empathy response would be to feel sad yourself after finding out your friend has failed. Neuroscience research has linked specific regions of the brain with affective empathy through neuroimaging techniques. Affective empathy has been associated with the anterior cingulate cortex, medial prefrontal cortex, anterior insula, and the amygdala (Marsh, 2018; Singer & Lamm, 2009; Walter, 2012; Zaki et al., 2012). Research suggests that affective empathy emerges early in human development. A study involving week old infants found that babies cried more in response to other infants' cries when compared to silence or when listening to their own cries (Sagi & Hoffman, 1976). Similar findings suggest that affective empathy is a fundamental and instinctive response to others (Jacobson, 2009).

Affective empathy is typically measured in a range of self-report questionnaires or through emotion matching tasks (Lovett & Sheffield, 2007). The items used to measure affective empathy usually aim to examine the individuals' emotional congruence with another persons' emotions (Mazza et al., 2014). Questionnaires such as the Balanced Emotional Empathy Scale (Mehrabian, 1996), Affective and Cognitive Measure of Empathy (Vachon & Lynam, 2016) and the Interpersonal Reactivity Index (Davis, 1983) are commonly used in empathy research (Mazza et al., 2014). The Balanced Emotional Empathy Scale (Mehrabian, 1996) is a unidimensional measure of affective empathy, however the Interpersonal Reactivity Index (Davis, 1983) examines both cognitive and affective empathy. The ACME (Vachon & Lynam, 2016) goes one step further and includes subscales within the measure of cognitive empathy, affective dissonance (contradictory emotional response) and affective resonance (empathetic concern). These self-report questionnaires are explicit measures of empathy designed for adult populations.

Empathy research has historically relied on explicit empathy measures that involve self-reports or direct questioning of participants; some examples are mentioned in the paragraph above. Implicit empathy is a measure of empathy that has not been attempted before, as it is notoriously difficult to measure an implicit response. There is currently a heavy reliance on participant candour, as researchers must trust the responses that participants provide are indeed the truth. Yet it is common knowledge that self-report measures can be unreliable as participants can manipulate their responses (Althubaiti, 2016). The manipulation of responses can be influenced by a myriad of internal and external factors, such as social desirability, misinterpretation of the question, and honesty (Althubaiti, 2016). Implicit empathy could offer an interesting insight into how people respond physiologically to emotional content. An implicit empathy measure would be particularly valuable as it could potentially demonstrate differences between groups of people, such as individuals high or

low on psychopathic personality traits. This would provide a deeper understanding of the mechanisms of empathy.

Psychopathic Personality Traits

Psychopathy is a personality construct characterised by traits such as impulsivity, antisocial behaviour, egocentricity, shallow affect, and callousness (Cleckley, 1941). Psychopathic personality traits and psychopathy are terms typically used interchangeably. Psychopathy traditionally has been considered a personality disorder (Coid, 1992). Neuroscience research suggests that abnormalities in the prefrontal and limbic systems, such as the amygdala and the cingulate gyrus are associated with psychopathy (Craig et al., 2009; Ling & Raine, 2018; Wahlund & Kristiansson, 2009). A review conducted by Kiehl (2006) examined behavioural and cognitive changes associated with psychopathy, and further implicated the brain structures mentioned above, with the addition of the parahippocampal gyrus. Researchers estimate that individuals deemed psychopathic make up 1% of the general population (Bird & Viding, 2014). These estimates are higher in specific populations, such as chief executive officers and incarcerated individuals (Babiak et al., 2010). Recent literature is stepping back from this disorder-based conceptualisation and moving towards the term psychopathic personality traits instead, representing the collection of traits and not requiring a diagnostic threshold to be met (De Brito et al., 2021; Viding et al., 2014). For the purposes of this thesis psychopathic personality traits is the terminology that will be used, as it reflects the dimensional characteristics of said traits.

Psychopathic personality traits are strongly associated with criminal behaviour (Lee & Kim, 2020). This is unsurprising as these individuals often break social and legal norms within society. This consequently results in individuals high on psychopathic traits being caught and convicted of criminal acts, with many spending time being incarcerated. Estimates

within prison populations suggest that anywhere from 10% to 30% of the population are considered high in psychopathic personality traits (Hobson & Shines, 1998; Kiehl & Hoffman, 2011; Vaughn & DeLisi, 2008). With such a high concentration of people with psychopathic personality traits committing crime, it is unsurprising that psychopathic personality trait research has centred around elements of antisocial behaviour and other factors that may affect an individuals' propensity to commit crime.

In relatively recent literature, academics have begun to conceptualise psychopathy as a two or three factor model, this is evident in some of the assessment tools. There is a variety of tools currently used to measure psychopathic personality traits; the most commonly used tools are the Psychopathic Personality Inventory - Revised (PPI-R) developed by Lilienfeld and Andrews (1996), the Psychopathic Checklist-Revised (PCL-R) created by Hare (1980), and the Triarchic Psychopathy Measure (TriPM) developed by Patrick (2010). Although all these measures assess psychopathic personality traits and are widely used, they are aimed at different populations. The PCL-R is a 20-item tool used primarily with incarcerated and forensic populations. It has two factors within the tool: factor one is concerned with interpersonal and effective elements of psychopathic personality traits, while factor two focuses on lifestyle and antisocial aspects (Pérez et al., 2015).

The PPI-R is a 154 item self-report tool used to examine psychopathic traits within a general population sample. Three factors sit within the measure: fearless dominance, self-centred impulsivity, and coldheartedness (Benning et al., 2003; Lilienfeld & Widows, 2005). Fearless dominance is considered to encompass social dominance, a lack of fear, heightened risk-taking behaviour, and an immunity to stress (Benning et al., 2003; Blickle & Genau-Hagebölling, 2022; Seibert et al., 2011). Self-centred impulsivity incorporates diminished sensitivity to others, impulsive and disruptive behaviour, and often a general disregard of taking responsibility for one's own behaviour (Blickle & Genau-Hagebölling, 2022; Edens &

McDermott, 2010; Lilienfeld & Widows, 2005). Coldheartedness includes the absence of guilt, concern, or empathy, often interpreted as being cruel or callous (Blickle & Genau-Hagebölling, 2022; Gaughan et al., 2009; Seibert et al., 2011).

The third measure aforementioned is the Triarchic Psychopathy Measure. It conceptualises psychopathy as encompassing three distinct but interrelated factors; boldness, disinhibition, and meanness (Evans & Tully, 2015; Patrick, 2010; Patrick et al., 2009; Somma et al., 2018). The triarchic measure examines psychopathy through a self-report questionnaire, similar to other measures in the field. However, it differs from the PCL-R and PPI-R as the TriPM has been validated and found to be reliable in both forensic and general populations (Sellbom & Phillips, 2013; van Dongen et al., 2017). While this is a point of difference between the measures, the TriPM is often compared to other measures of psychopathy, in particular, the PPI-R, due to the three conceptually similar factors (Patrick & Drislane, 2015; Patrick et al., 2009). Boldness is often compared to fearless dominance, disinhibition to self-centred impulsivity, and meanness to coldheartedness. Additionally, research has shown the measures are not only conceptually equitable but statistically too. The PPI-R and TriPM share substantial common variance and demonstrate strong statistical convergence (Drislane et al., 2014; Patrick & Drislane, 2015; Sellbom & Phillips, 2013). Both the TriPM and PPI-R contain 3 factors within their respective conceptualisations of psychopathy, however, the PPI-R expands further by acknowledging eight subfactors; impulsive nonconformity, blame externalization, machiavellian egocentricity, carefree nonplanfulness, stress immunity, social potency, fearlessness and coldheartedness

The PPI-R is constructed of eight subfactors; these subfactors load onto two central factors that have been identified as fearless dominance and self-centred impulsivity, sometimes referred to as the interpersonal and behavioural factors (Benning et al., 2003; Lilienfeld & Widows, 2005; Seibert et al., 2011). The third factor; coldheartedness,

encompasses the eighth subfactor that does not load onto either of these original factors (Seibert et al., 2011). Coldheartedness is occasionally referred to as the affective factor. Many studies and theories have traditionally excluded coldheartedness from models, as it overlaps slightly with fearless dominance and self-centred impulsivity (Gaughan et al., 2009). However, it also encompasses conceptually unique variation that is integral to psychopathic personality traits as a whole (Berg et al., 2015; Gaughan et al., 2009).

Collectively fearless dominance, self-centred impulsivity, and coldheartedness represent psychopathic personality traits. However, emerging research has shown these factors are likely to have distinct associations with external constructs and correlates as they represent specific aspects of psychopathy (Edens & McDermott, 2010; Testori et al., 2019; Warren & Clarbour, 2009). Research by Edens and McDermott (2010) examined fearless dominance and self-centred impulsivity independently with theoretically relevant correlations in a forensic inpatient sample. They found that self-centred impulsivity was positively associated with drug abuse, violence risk, antisocial behaviour, anger, and hostility (Edens & McDermott, 2010). Additionally, fearless dominance was negatively associated with anxiousness, depression, and anger, although positively associated with alcohol abuse. Edens and McDermott (2010) ultimately described fearless dominance and self-centred impulsivity as opposing characteristics grouped under a singular construct of psychopathy.

As demonstrated by the growing pool of literature, the way we understand and conceptualise psychopathy as a unitary construct is evolving, and so too are the studies we see as a result. More recently we are seeing that studies no longer look exclusively at psychopathic trait total scores, but also examine the individual factors of psychopathic personality traits. This allows for a more in-depth investigation of these distinct elements of psychopathy, exploring how they affect or are associated with different correlates, such as emotions and empathy research. Studies such as Eisenbarth et al., (2018) find that the

different factors of psychopathy can have contradictory relationships to related concepts. These findings and similar results, such as Warren and Clarbour (2009), demonstrate the need for further research exploring the specific factors of psychopathic personality traits. Ultimately more knowledge about these specific factors will contribute to the conceptualisation of psychopathic personality traits as a whole (Sellbom & Drislane, 2021).

Psychopathic Personality Traits and Empathy

Reduced empathetic ability is repeatedly included in the description of psychopathic personality traits. Additionally, reduced empathy is often a criteria of tools that intend to measure psychopathic personality traits (Brook & Kosson, 2013; Lishner et al., 2012; Vitacco et al., 2019). The large majority of studies that focus on the relationship between empathy and psychopathic personality traits separate empathy into cognitive and affective components. Researchers have discovered that individuals high in psychopathic personality traits typically perform equally well on cognitive empathy tasks compared to those low on psychopathic personality traits (Sest & March, 2017). However, the literature surrounding affective empathy is mixed (Brook & Kosson, 2013).

Despite the diverse literature within affective empathy research, multiple studies report that individuals who score high in psychopathic personality traits show a reduced ability to effectively empathise, meaning they do not experience the target persons' emotion within themselves (Vitacco et al., 2019). Research conducted by Lishner et al., (2012) found in both community and forensic samples that there was no negative association between psychopathic personality traits and affective empathy. Conversely, Sest and March (2017) examined cyber trolling and found that individuals who scored highly in psychopathic trait measures did worse in affective empathy measures. Within the study these individuals were some of the most persistent cyber-trolls (Sest & March, 2017). The authors suggested that

individuals high in psychopathic traits could recognise negative emotions in victims, yet they were able to separate themselves from feeling these emotions, demonstrating a deficit in affective empathy. This deficit may enable them to distance themselves from the negative emotions their victims may be experiencing. However, despite the inconsistent findings and literature, the evidence tends to support an affective empathy impairment being present in individuals high in psychopathic personality traits. To better understand this association between affective empathy and psychopathic personality traits, some studies have turned to examine factor differences within psychopathy.

The body of literature investigating the unique associations fearless dominance, self-centred impulsivity, and coldheartedness have with related concepts such as empathy is relatively small. A meta-analysis explored fearless dominance and self-centred impulsivity relations to other psychological measures and found that empathy was negatively correlated to both factors, though effect sizes were considered small (Miller & Lynam, 2012). Research examining individual factors thus far have discovered that individuals high in fearless dominance have a reduced fear startle response and a reduction in physiological responding to unpleasant emotional stimuli (Benning et al., 2005). The research did not find a general reduction in physiological responding, so this effect is specific to adverse emotional states. For individuals high in fearless dominance, this difference in responding could potentially create a difference in their ability to empathise. If they are physiologically responding less to emotionally unpleasant stimuli, this difference could affect their ability to perceive, understand, and share in the other persons' experience. Benning et al., (2005) also discovered that individuals high in self-centred impulsivity had lower overall skin conductance. This observed reduction in skin conductance during the study could reflect a decrease in arousal, expressing disinterest in what is happening around them. The lack of arousal demonstrated through low levels of physiological responding supports a level of disinterest in others during

emotional events. This implied disinterest is an important element that would affect an individuals' ability to empathise effectively, particularly for affective empathy.

Another element of self-centred impulsivity to consider that may influence empathy is the social aspect of interactions. Self-centred impulsivity is considered the socially deviant factor of psychopathic personality traits; this nonconformity may extend into basic behaviours demonstrated during interactions (Boll & Gamer, 2016). Subtle normative behaviours such as holding eye contact, asking questions, and providing congruent responses during a conversation may not be a priority for someone at ease with breaking social norms (Argyle & Dean, 1965). This deviation from traditional rules of social interactions may consequently cause confusion and negative feelings for the other person in the interaction, as they struggle to understand why their interaction partner is not responding in a normative manner. These elements of self-centred impulsivity highlight the deviant element of psychopathic personality traits and its effect on normal everyday interactions.

Finally, coldheartedness is characterised by a lack of empathy, callousness and guiltlessness, representing a general disregard for others, paired with an empathy deficit (Seibert et al., 2011). Consequently, it is reasonable to infer individuals high in coldheartedness will struggle to empathise accurately with others. The different factors of psychopathy demonstrate varying ways in which they affect an individual's ability to empathise with others. It is interesting to consider how psychopathy factors also affect a person's physiological responding at a biological level.

A compelling element of neuroscience research is the associated brain regions where empathy and psychopathy overlap. As aforementioned, both empathy and psychopathy are associated with brain activity in the orbital frontal cortex, insula, amygdala and cingulate (Craig et al., 2009; Kiehl, 2006; Singer & Tusche, 2014; Zaki et al., 2012). The overlap in these shared spaces might illude to a physical cause occurring within brain functioning that

could explain why studies tend to see a reduction in affective empathy when an individual has higher psychopathic personality traits (Hirschtritt et al., 2018; Ling & Raine, 2018; Van Dongen, 2020). Brain imaging technology is still relatively new, so it is premature to make concreate statements about the mechanisms of these brain structures, but it is an exciting area for future research (Salmon et al., 2015; Schmitz et al., 2005). Studies in this area have been increasing due to recent technology advancement, which has allowed psychological phenomena to be observed and measured within physiological responding.

Physiological Responding

Emotional stimuli and psychopathic personality traits have been examined in depth over the last few decades, particularly within neuropsychology research, as the use of machinery such as fMRI and neurofeedback has become accessible. fMRI is functional magnetic resonance imaging, using changes in blood flow to measure brain activity (Glover, 2011). Neurofeedback measures the brainwaves of an individual and allows in the moment feedback (Hampson et al., 2020). Studies such as Decety et al., (2013) used fMRI and observed activation deficits in multiple brain areas for people high in psychopathic personality traits regardless of the stimulus type, highlighting a selective impairment in processing facial cues of distress. Another study by Seara-Cardoso et al., (2015) used fMRI; their findings supported factor differences within psychopathic personality traits effecting neurological activity differently. The study found that individuals with higher affective-interpersonal (emotional) psychopathic traits were associated with decreased neural responding to people in pain, though individuals high in lifestyle-antisocial (behavioural) psychopathic traits had the opposite experience, experiencing increased neural responding (Seara-Cardoso et al., 2015). These studies provide an insight into the physiological responding of people high in psychopathic personality traits but only in contexts of

responding to stimuli; this however is not representative of physiological responding in real world interactions. The logical next step for research in this area would be to examine physiological responses and psychopathic personality factors in a genuine interaction, with real people in various relationships and with authentic emotions.

Relationships/Familiarity

Our familiarity and closeness with any person is effectively based on our previous interactions and knowledge of them; familiarity being the perception of how well you believe you know someone (Segal et al., 2003). Closeness in this context is the subjective conceptualisation and perceptions of the quality of a relationship between people (Segal et al., 2003). Shared experiences, memories, values, and interests all accumulate to build a conceptual understanding of a person and their environment. These events help grow a relationship with someone and build expectations for future interactions (Hudson et al., 1992). The nature of the relationship and the degree of familiarity we have with someone dictates our interactions and guides what is appropriate with each person. For example, it would be perfectly appropriate to discuss your past regrets and future goals with a partner or close friend. However, this type of intimate emotional information would be inappropriate with a stranger. Therefore, the familiarity and closeness we have with someone tends to lead to more opportunities to know them better and understand them as a person. It is logical to assume, then, that this knowledge we hold of people informs how we empathise with them, as we have this information to draw on and to guide us to better understand their thoughts and feelings.

Similarly, being familiar with how someone traditionally shares emotional information, communicates, and behaves will make you more attentive to what they are expressing and their thoughts and feelings. Preston and de Waal (2002, p. 17) summarise this

well in their article by commenting *'The more similar or familiar the subject and object, the more their representations will be similar, which in turn produces more state-matching, better accuracy'*. Thus, being familiar or close with people you intend to empathise with appears to be of benefit, as you have this wealth of knowledge to draw on.

If you expand upon the example used earlier, a girl failing a test, and now view it from two different perspectives, you can see how empathy would change based on your familiarity. As a friend, you would draw on background knowledge and perhaps remember that this test is crucial for her to graduate from college. The weight of failing this test would be even more significant, as you would understand the wider implications it would have on her life. Accordingly, your emotional reaction and cognitive understanding would differ from a stranger being told she failed. Consequently, a friend's empathy is likely to be more accurate than a strangers because of the insight you have into their life.

Empathising with a stranger would be a completely different experience as you would be severely limited in what information you have access to. Instead, one would rely on the contextual evidence present during the interaction to base the empathy on. More emphasis would be placed on the information occurring at the time, such as body language, verbal exchange, tone, facial expressions, and hand gestures. These examples highlight how interactions and subsequent behaviour largely depend on whom you are interacting with, what is appropriate, and the degree of familiarity.

Non-verbal Communication

To empathise and understand how a person is feeling, an individual uses multiple different communication elements to inform their knowledge; accordingly non-verbal information plays a large part. Reading emotions, understanding body language, differentiating facial expressions, and communicating non-verbally are all crucial for human

interactions. This area of non-verbal communication is referred to as kinesics (Birdwhistell, 2011). We rely on the skills of deciphering physical communication to make inferences about the social interactions we have. Often, we depend on kinesics for confidence in what is being verbally communicated, looking for congruence between the verbal and physical information; this can be as simple as smiling and laughing when telling a funny story. Matsumoto et al., (2012) stated that 65% to 95% of all messages are conveyed non-verbally. This is a large percentage, particularly when considering most people listen to the verbal content of the speaker and rarely deliberately attend to other non-verbal aspects such as facial features, expressions, and body language. These non-verbal actions and behaviours ultimately inform our understanding of the people we interact with and their state, more than what can be verbally communicated alone. For all types of relationships whether familiar or strangers, non-verbal and verbal communication is essential for empathy as we draw on all our skills to relate to one another.

Just as kinesics is implicated in empathy and how we collect information about a person, it is also linked to how individuals interpret relationships. For example, a study by Grahe and Bernieri (1999) found that participants were best at accurately perceiving familiarity between a dyad through visual (non-verbal) information, more so than visual and auditory information together. Similarly, Latif et al., (2014) found that observers of a conversation privy to just kinesics alone could accurately identify which pairs of people were friends or strangers based on their non-verbal communication. Additionally, the study found that dyads that were familiar to one another tended to mirror physical movement more so than strangers did (Latif et al., 2014). Latif et al., (2014) commented that these findings were consistent with similar results in Grahe and Bernieri (1999), suggesting that familiarity and good rapport resulted in behavioural coordination. Research shows us repeatedly that both verbal and non-verbal changes occur in behaviour based on familiarity, demonstrating an

observed difference between people who are familiar and unfamiliar to one another. However, little research has examined to see if these differences in communication alter other elements of interactions such as the ability to empathise (Mather & Yngvesson, 1980). Our study attempts to examine this, and to explore whether we are better at accurately empathising with individuals we are familiar with in comparison to strangers/unfamiliar people.

Gender

Gender is a variable that has been consistently implicated in empathy research. Numerous empathy studies report significant differences between male and female participants, however it was found the majority of studies relied on self-report measures within their methodology (Baum et al., 2014; Benenson et al., 2021; Kessler & McLeod, 1984). Interestingly it was reported that empathy studies that relied on physiological measures or third-party observations tend to find no significant gender differences (Eisenberg & Lennon, 1983; Hofmann et al., 2012). To add to this, recent research carried out by Löffler and Greitemeyer (2021) investigated the mechanisms behind these findings and discovered that contextual and cultural factors are more likely to be influencing empathy behaviours, more so than actual ability. Their study provided evidence to suggest that when activities were associated with the term ‘empathy’, the mere association with what is considered a typically feminine trait induced gender differences between participants in both self-reported measures and objective performance (Löffler & Greitemeyer, 2021). These findings suggest that gender roles and the stereotypical feminine and masculine identities hold significant influence over behaviour and cognition. This then begs the question of whether we are seeing actual gender differences in empathy studies because there is indeed a difference between

female and male participants, or whether we are observing a societal representation of what is stereotypically expected when discussing empathy.

Current Study

Our study aims to examine if familiarity influences the relationship between psychopathy and affective empathy within a dyad interaction. Additionally, we will explore if there is an improvement in empathetic ability between unfamiliar dyads over time compared to dyads who are familiar with one another. Psychopathic personality traits was measured using the abbreviated version of the PPI-R (Eisenbarth et al., 2015), and factors such as fearless dominance, self-centred impulsivity, and coldheartedness were examined separately. Self-reported affective empathy was measured through self-report data during a moderated version of the dyadic interaction paradigm (Ickes & Tooke, 1988a). An additional measure of affective empathy was assessed through the physiological data collected by vests monitoring biological activity. Finally, cognitive empathy was measured using empathic accuracy, the similarity between the reported mental states of the target and those reported by the perceiver.

Hypotheses

1. Unfamiliar dyads will be associated with lower cognitive and affective empathy in comparison to dyads who are familiar with one another.
2. Higher scores for coldheartedness and self-centred impulsivity factors of psychopathy will be associated with decreased affective empathy, whereas cognitive empathy will remain stable.
3. For unfamiliar dyads, there will be an improvement in empathy as time increases.
4. Female participants will generally perform better than male participants in all types of empathy.

Method

This study was nested within a larger project and so where appropriate there are relevant supplementary details, otherwise only the methods used in the current analysis are described. This study was pre-registered on open science framework (https://osf.io/3zqan/).

Participants

One hundred and six adult participants from the wider Wellington community took part in this study. A total of 53 dyads (i.e., a group of two people). Thirteen dyads were not included in our analysis because there was missing data (refer to page 35 for additional detail). Additionally, one dyad was excluded from the study due to a missing consent form. Approximately half of the dyads included in the analysis were unfamiliar to one another (n = 19) and half (n = 20) were familiar, having had an existing relationship prior to the study, e.g., friends, siblings, romantic partners. The primary data collection approach was distributing study advertisement flyers throughout supermarkets, community centres, and cafes in the suburbs of Wellington (see Appendix A). Participants were also recruited through social media and the Victoria University Psychology participant email list. The inclusion/exclusion criteria included 18 years or older and not pregnant (as the study may be stressful for participants and the equipment used is not meant for pregnant women) at the time, to partake in the study.

Table 1

Frequencies of Dyad Gender Identity Combinations

Gender	Familiar Dyads *n* (%)	Unfamiliar Dyads *n* (%)	Total *n* (%)
Female – Female	9 (45.00)	9 (47.37)	18 (46.15)
Male – Male	0 (0)	0 (0)	0 (0)
Female – Male	10 (50.00)	9 (47.37)	19 (48.72)
Non-binary – Female	1 (5.00)	0 (0)	1 (2.64)
Non-binary – Male	0 (0)	1 (5.26)	1 (2.64)
Total	20 (51.28)	19 (48.72)	39 (100)

Note. Percentages are calculated for each column/group

Participants filled in a short demographic questionnaire (Appendix B) at the beginning of the study during which they self-reported their gender identity. The majority of participants identified as female (71.79%), a quarter identified as male (25.64%) and a further two participants identified as other, which they defined as non-binary (2.56%), reflected in Table 2. The average age was 27.96 years old (*SD* = 10.05), with a 52-year age range from 18 to 70 years old (Table 3). Half (50.00%) of the participants identified as New Zealand European (Table 4), and 61.54% of participants recorded their occupation as a student.

Table 2

Participant Gender Identity, Education and Profession

Variables	Unfamiliar (*n* = 38)		Familiar (*n* = 40)		Total (*n* = 78)	
Gender Identity	*n*	%	*n*	%	*n*	%
Male	10	25.31	10	25.00	20	25.64
Female	27	71.05	29	72.50	56	71.79
Non-binary	1	2.63	1	2.50	2	2.56
Education Level	*n*	%	*n*	%	*n*	%
Secondary education or high school	13	34.21	13	32.50	26	33.33
Vocational qualification	2	5.26	2	5.00	4	5.13
Bachelor's degree	14	36.84	13	32.50	27	34.62
Master's degree	7	18.42	9	22.50	16	20.51
Other	2	5.26	3	7.50	5	6.41
Profession	*n*	%	*n*	%	*n*	%
Manager	2	5.26	1	2.50	3	3.85
Professional	3	7.89	8	20.00	11	14.10
Technician & associate professional	3	7.89	2	5.00	5	6.41
Student	26	68.42	22	55.00	48	61.54
Other	4	10.53	7	17.50	11	14.10

Table 3

Participant Age and Psychopathic Personality Inventory - Revised - 40 Scores

Variables	Unfamiliar (*n* = 38)		Familiar (*n* = 40)		Total (*n* = 78)	
	M	*SD*	*M*	*SD*	*M*	*SD*
Age	27.97	10.71	27.95	9.51	27.96	10.05
PPI-R-40 Total	88.43	11.77	88.08	8.45	88.25	10.12
Fearless Dominance Subscale	37.54	7.93	37.78	5.80	37.66	6.86
Self-Centred Impulsivity Subscale	30.62	5.49	29.90	5.55	30.25	5.50
Coldheartedness Subscale	9.46	2.46	8.63	2.05	9.03	2.28

Of the 20 dyads who were familiar with one another, 7 were romantic partners, 11 were friends, 1 dyad were siblings, and 1 dyad were flatmates. The time they had known one another was varied also, ranging from 1 month to 19 years (M = 4.01 years, SD = 5.54 years).

Table 4

Participant Ethnic Identity

Ethnicity	Unfamiliar (n = 38)		Familiar (n = 40)		Total (n = 78)	
Primary Ethnic Identity	*n*	%	*n*	%	*n*	%
Māori	0	0	3	7.50	3	3.85
Pasifika	0	0	1	2.50	1	1.28
New Zealand European	27	71.05	12	30.00	39	50.00
European	4	10.53	8	20.00	12	15.38
Latino/Hispanic	1	2.63	3	7.50	4	5.13
Middle Eastern	0	0	3	7.50	3	3.85
African	1	2.63	0	0	1	1.28
South Asian	3	7.89	6	15.00	9	11.54
East Asian	1	2.63	2	5.00	3	3.85
Other	1	2.63	2	5.00	3	3.85
Secondary Ethnic Identity	*n*	%	*n*	%	*n*	%
Pasifika	0	0	1	2.50	1	1.28
New Zealand European	0	0	2	5.00	2	2.56
European	2	5.26	0	0	2	2.56
Latino/Hispanic	1	2.63	0	0	1	1.28
Other	0	0	1	2.50	1	1.28
No secondary ethnic identity	35	92.11	36	90.00	71	91.03

The Victoria University of Wellington Human Ethics Committee approved the study (Ethics application number: 0000027455) on the 22nd of March 2019. An amendment was approved on the 17th of September 2020 with additional safety precautions, so that the study could continue operating during Covid-19 national alert level 2. However due to the changes in the alert levels, data for the study was only collected during alert level 1.

Participant Sharing Task

The sharing task was designed to encourage participants to share personal experiences and emotions. It consisted of four short conversation prompts based on a study that examined closeness between dyads (Aron et al., 1997). There was an initial neutral trial prompt to confirm participants knew the procedure and experimenters could ensure that all the technology was working. An example of a negative prompt is “Describe a recent failure”; alternatively, a positive prompt example is “Talk about a major positive life event”. The following four prompts were used the most, each prompt was used for 26 of the dyads.

- Talk about a major positive life event (positive)
- Talk about a major negative life event (negative).
- Talk about a major regret (negative).
- Talk about a moment you are very proud of (positive).

There were slightly different prompts with the first 13 dyads. These were changed as they were not typically conducive to conversation for the whole six minutes. ‘Describe a time you were bullied (negative)’ and ‘Describe something kind that has been done for you’ (positive) were used with 13 dyads. Other prompts such as ‘Describe a close friend (positive)’ and ‘Describe a recent failure (negative)’, were both used nine times. Two prompts ‘Describe the best experience of lockdown (positive)’ and ‘Describe the worst experience of lockdown (negative)’ were used with four dyads briefly.

Participants would read the prompt, discuss it for approximately six minutes, then complete the corresponding paperwork. The paperwork consisted of mental state ratings and perceived support needed by the dyad partner during the conversations. Participants were signalled when the six minutes was finished and to begin completing the paperwork when the studio lighting went from red to blue. This procedure was the same for all four prompts. The

four prompts typically alternated in valence, between negative to positive (two of each). The different valences were used to provoke a variety of emotional responses within the study. The four conversations that occurred throughout the sharing task were recorded from a camera in the corner of the studio, observing the task from a wide-angle view.

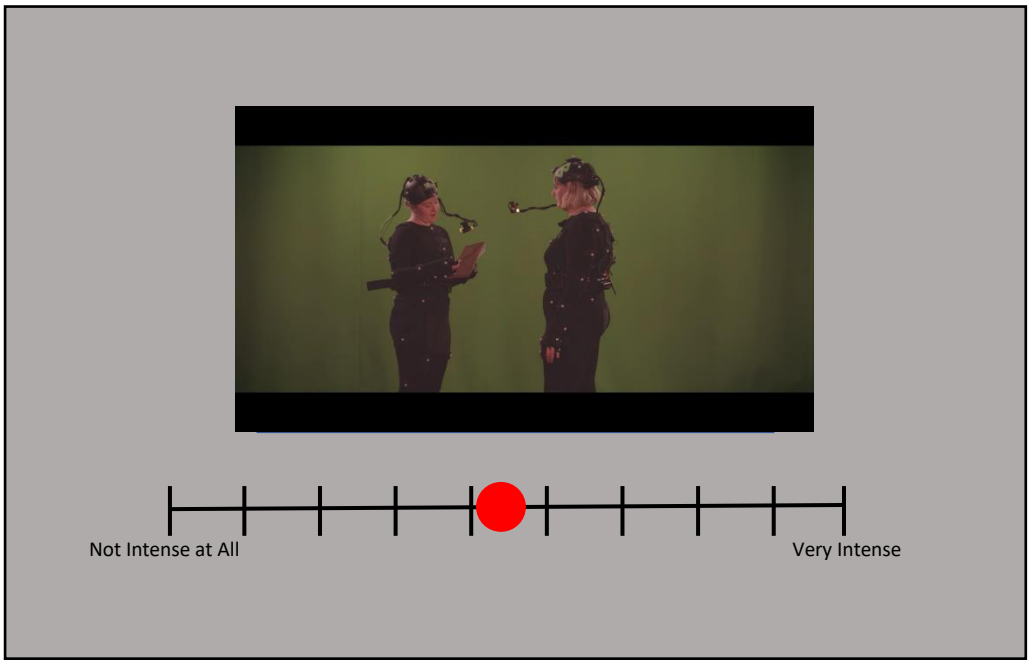
Measures

Cognitive Empathy Measure

Cognitive empathy was assessed through a measure of empathic accuracy (Brook & Kosson, 2013; Mast & Ickes, 2007). Participants were taken to a computer where they were each presented with the sharing task video recordings (see Sharing Task), one for every prompted conversation they had earlier. They were asked to independently watch the videos and while doing so, rated the intensity of their emotions at the time of the conversation (not their current emotions). They indicated emotional intensity continuously throughout the whole video by moving a circular icon on a sliding scale below the video as it played (see Figure 1). Participants were then shown the same videos a second time, but were now asked to rate the perceived intensity of their partner's emotions. By correlating one participants' rating of their own emotional intensity with their dyad partners perceived emotional intensity, we were able to produce a measure of empathic accuracy. The use of empathic accuracy is standard practice in empathy research, with the measure being deemed reliable and repeatedly validated in a variety of samples (Laurent & Hodges, 2008; Marangoni et al., 1995). The resulting value produced for cognitive empathy was a correlation coefficient, values closer to 1 indicate strong correlations, higher cognitive empathy as the two ratings are similar to one another. Whereas values closer to 0 indicate weak correlation and represent variation between ratings, indicating lower cognitive empathy (Cohen, 1988).

Figure 1

Computer Screen Replication During Ratings Task



Self-Reported Affective Empathy Measure

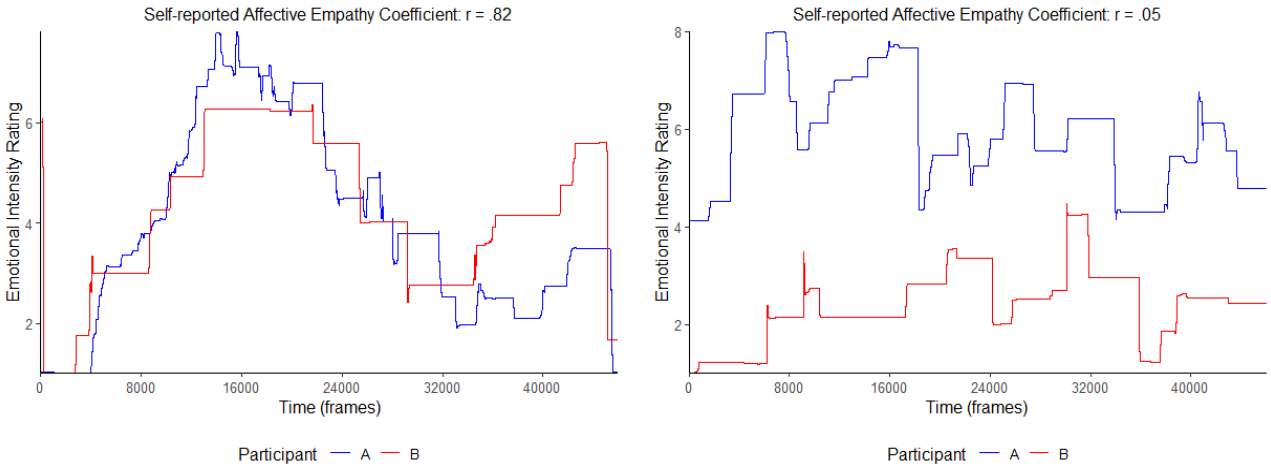
Within the study there are two measures of affective empathy: explicit and implicit. The first measure was explicit affective empathy and is referred to as self-reported affective empathy in this study.

Similar to the cognitive empathy measure, participants were presented with the sharing task videos and asked to rate their own and their dyad partners emotional intensity at the time of the conversations (as demonstrated in Figure 1). For self-reported affective empathy both dyad participants self-reported intensity of their own feelings was correlated. The correlation coefficient produced represents the relationship between the two scores. Higher values closer to 1 represent dyads who scored similarly in the emotional intensity ratings, lower correlation coefficients represent dyads with lower self-reported affective empathy, an example is illustrated in Figure 2.

This method collects both target and perceiver information from participants which allows for multiple different empathy measures to be derived from self-reported ratings (Zaki et al., 2008). This method has been used multiple times before in similar studies examining empathy, furthermore it has been adapted to examine other topics such as pain (Rutgen et al., 2015; Zaki et al., 2008, 2009). While to the best of my knowledge no studies have explicitly explored the statistical reliability of the method it is encouraging that adjacent areas of research are also using the method.

Figure 2

Self-reported Affective Empathy Coefficient of High vs Low Dyad



Note. The y-axis represents participant's ratings of emotional intensity during a conversation in the sharing task. The x-axis represents time across the conversation, which is approximately 6 minutes, with data for 127.7 frames per second.

Physiological Affective Empathy Measure

The second measure of affective empathy was implicit empathy and is referred to in this study as physiological affective empathy. It is an experimental measure of empathy, devised during this study. Autonomic nervous system activity was used as an indicator for emotional arousal, which in turn was used as a proxy for implicit affective empathy.

Physiological responding was measured through sensors attached to a wearable physiological recording vest; participants wore these Equivital vests during the sharing task. The Equivital vests are produced by ADInstruments, the sensors within the vests record physiological activity occurring within the body and transmit that to the sensory electronic module. The sensors record the individuals' electrocardiography, skin temperature and breathing. As pictured in Figure 3 the sensors sit along the bottom of the vest and touch the individuals' skin around their lower chest. This sensory module relays the data to a nearby computer wirelessly via the Bluetooth Dongle or the data can be downloaded directly from the module itself. The design of the vest allows for natural movement to occur while being monitored effectively from a distance.

An additional attachment from ADInstruments allows for galvanic skin response sensors to be connected to the Equivital vest. In this study, we included galvanic skin response equipment to measure the electrical conductance of the skin. This was done by placing two dermal temperature patches on a participant's non-dominant palm and connecting these patches through a small wire to the sensory module. To hold the patches and wire in place, a small Velcro strap sat around the participant's hand.

Figure 3

Image of ADInstruments Equipment used in Data Collection

Note. Items pictured are Equivital Vest, Lead, Bluetooth Dongle, Sensory Electronic Module, Galvanic Skin Response Sensor, Dermal Temperature Patch (ADInstruments, 2020)

To produce the physiological affective empathy value the participants' physiological data from the sharing task, specifically galvanic skin response, was correlated with their dyad partners' self-reported ratings of emotional intensity during the sharing task. The resulting values are used as an implicit affective empathy measure. The correlation coefficient produced will represent the relationship between the emotional intensity ratings and the physiological data of their partner.

Psychopathic Personality Trait Measure

The Psychopathic Personality Inventory - Revised - 40 (PPI-R-40) is a 40-item tool that measures psychopathic personality traits (Eisenbarth et al., 2015). It is a shortened version of the widely used PPI-R developed initially by Lilienfeld & Widows (Eisenbarth et al., 2015; Lilienfeld & Widows, 2005). This abbreviated format has been supported in the literature as being statistically similar to the longer PPI-R (Ruchensky et al., 2017). Subsequently within the academic community it is considered a short form substitute for the PPI-R (Ruchensky et al., 2017). In addition, it has been validated across different cultures, countries, languages, and data collection methods, ultimately demonstrating its reliability with high (~.90) cronbach alpha values (Eisenbarth et al., 2015; Ruchensky et al., 2017).

The PPI-R-40 presents a statement such as "I do not let everyday hassles get on my nerves". The respondent then uses a four-point Likert scale (*1 = false, 2 = mostly false, 3 = mostly true, 4 = true)* to indicate how much that statement refers to them. After the reverse coding of 17 items, an overall score can be derived from the sum of all the items as well as the three factors that specifically examine fearless dominance, self-centred impulsivity, and coldheartedness.

Factors scores of fearless dominance, self-centred impulsivity and coldheartedness were derived from factor specific items within the PPI-R-40. Fearless dominance is characterised by a lack of concern, social dominance, and an immunity to stress (Gaughan et al., 2009). Fearless dominance had a total of 15 items within the PPI-R-40, 7 of which were reverse coded. This allows for a minimum score of 15 and a maximum score of 80 for the factor total of fearless dominance. Self-centred impulsivity is summarised by egocentricity, a disregard for others and of traditional values, reckless nonconformity and a tendency to blame externally (Benning et al., 2003). Within the PPI-R-40 there were 15 items that represented self-centred impulsivity, a third of which were reverse coded. The total factor scores for self-centred impulsivity range from 15 to 80. Coldheartedness is characterised as being callous and possessing a lack of guilt (Berg et al., 2015). Five items within the PPI-R-40 represent coldheartedness, all of which were reverse-coded and totalled to create a score range between 5 (minimum) and 20 (maximum). Five items within the PPI-R-40 do not come under any of the three factors.

Procedure

Data Collection

Data was gathered by trained staff and a technical expert. Participants arrived at the Miramar Creative Centre, either as a familiar or unfamiliar dyad. For the unfamiliar dyads, two individuals had been allocated to the same time slot to participate. To ensure they were indeed strangers when participants were introduced, they were both asked if they knew one another. Participants in the familiar dyads brought along someone they knew with whom they participated. Once participants arrived, they read through information about the study and then provided informed consent (see Appendix C). Next, they filled in a short demographic questionnaire (Appendix B) and were shown through to the studio where the study was taking

place (see Appendix D). Experimenters then demonstrated to the participants how to wear the Equivital vest properly. Participants were also given a motion capture suit to wear over the top, this was a part of the larger project (see Appendix E). They were then escorted to the bathrooms where they put on both the vest and the suit. After participants were fitted out, they were asked to sit in silence and rest for approximately six minutes as a baseline measurement for the physiological measures was recorded. It took approximately an hour from the participants arrival until completing the baseline physiological recording, as much of the technology required timely set-up.

Participants were then asked to share personal stories between themselves for the next section of the study. Each time they were given a positive or negative prompt to begin the conversation. They were instructed to interact normally during this exercise, letting the conversation develop naturally. Once the participants had discussed a prompt for approximately six minutes, they were prompted to complete the corresponding paperwork. The paperwork was a short questionnaire about their emotions and need for support during the conversation. While participants were completing the task, the sensors in the Equivital vests were monitoring their physiological responses. After they completed the paperwork the conversation process was repeated another three times. By the end of the study participants had been prompted for four conversations and filled out four sets of paperwork.

Once the participants had finished their final paperwork, researchers assisted with removing the monitoring equipment (Equivital vests and motion capture suits). Participants were then able to change back into their regular clothing. Participants had a short ten-minute break and were provided with a muesli bar to eat before the next part of the experiment began.

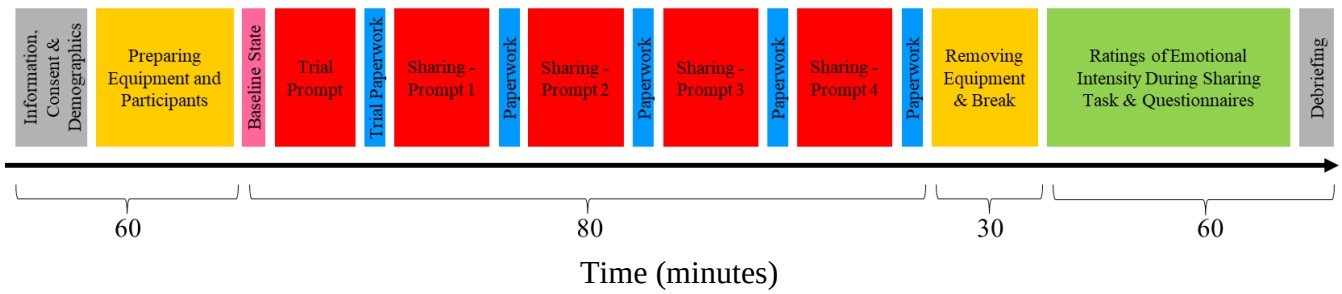
Participants were then taken to an office space in the same building to complete tasks on a computer. They were sat at adjoining desks to one another but could not see each other

as a wall divider was in place. Participants were asked to watch the videos of their sharing exercise from earlier. While they were watching the four conversations, they were asked to rate their own emotion intensity on a scale presented on the computer screen below the video. Once this was done, they repeated this process again but now rating their dyad partners perceived emotional intensity at the time of the conversation. This took approximately 50 minutes as each conversation was six minutes and the videos were watched twice.

After this was finished, the participants completed two personality measures. The first scale was the Psychopathic Personality Inventory - Revised - 40 (Eisenbarth et al., 2015), and the second was the Interpersonal Reactivity Index (Davis, 1983), a multidimensional tool used to assess trait empathy (this was a part of the larger project and not used for the current study). These scales took approximately 10-15 minutes to complete. After this, participants were debriefed about the study by an experimenter and provided with a debriefing sheet (see Appendix F). They were then asked if they had any further questions, and each participant was provided with two $24 grocery vouchers and were thanked for participating in the study.

Figure 4

Timeline of Data Collection for a Dyad



Changes to Procedure

The study endeavoured to be consistent from the start; however, due to running an experiment this long and complex, elements were changed along the way. Additionally, the

Coronavirus global pandemic significantly interrupted and lengthened data collection past what was expected, which resulted in additional changes.

Experimenters changed during data collection. This was unavoidable as coronavirus and scheduling issues with the specialised equipment meant data collection was drawn out. While experimenters did change between four individuals, a detailed instruction book outlined the experiment in a step-by-step manner to keep data collection procedures consistent. The specialised equipment technician remained the same throughout all dyads and was able to intervene or correct if any adjustments to the experiment were made. As referred to earlier, prompts were changed in the first half of the study. The initial four original prompts were as follows:

- Describe a close friend (positive).
- Describe a recent failure (negative).
- Describe a time you were bullied (negative).
- Describe something kind that has been done for you (positive).

As the experiment ran, experimenters observed that participants were often not filling the whole six minutes with conversation. Instead, they would stand in silence for the remainder of the time. Additionally, some of the conversations they were having were surface level and non-emotive. The prompts were intended to initiate emotive conversations. Consequently, the prompts were changed. Two prompts were used briefly with four dyads but were not used again as participants did not tend to discuss them for very long, they were ‘Describe the best experience of lockdown (positive)’ and ‘Describe the worst experience of lockdown (negative)’. The four prompts trialled after these worked well for their intended purpose:

- Talk about a major positive life event (positive).
- Talk about a major negative life event (negative).
- Talk about a major regret (negative).

- Talk about a moment you are very proud of (positive).

Missing Data

The complex nature of the study and the technical equipment involved lead to there being missing data. To ensure correlations and planned analysis were not impacted by missing data, dyads were excluded if a significant amount of data was missing. If any demographic information, PPI-R-40 scores, or emotional intensity rating data were missing for either participant in a dyad; then the dyad was excluded from the study. The equipment used to record the physiological data was complex and sensitive to all the other equipment and devices working within the studio at the time, subsequently there were technical issues with the transmitting device during the experiments. As a result of this, there was occasionally missing physiological data at the end of conversations. As a way to combat this some dyads had slightly shorter conversations when necessary. However, if the conversation had to be shortened by more than 25% because of missing data, then the dyad was excluded from the study. The study had 53 dyads during data collection, which decreased to 39 dyads in the analysis, most of which were a result of incomplete or missing data. Listwise deletion was used in this study as it was assumed the data was missing completely at random as it was technology that was causing issues, not at all related to participants or any other variable in the study.

Data Pre-processing

The current study utilised four different types of data, emotional intensity ratings, personality inventories, demographics, and physiological responding data. Demographic information required data entry. The PPI-R-40 required initial data entry, reverse coding for specific items and factor totals to be calculated. The emotional intensity ratings and physiological data required pre-processing before being ready for analysis.

The emotional intensity rating data processing involved ensuring that data was distinguishable between ratings of the self and ratings of the other (dyad partner), as well as between the four different conversations participants had. The physiological data (heart rate, electrocardiogram, and galvanic skin response) was visually inspected on LabChart (ADInstruments, 2021) for any artifacts in the data. Galvanic skin response remained a relatively stable measure throughout the data collection with no major artifacts.

Empathy Coefficient Scores

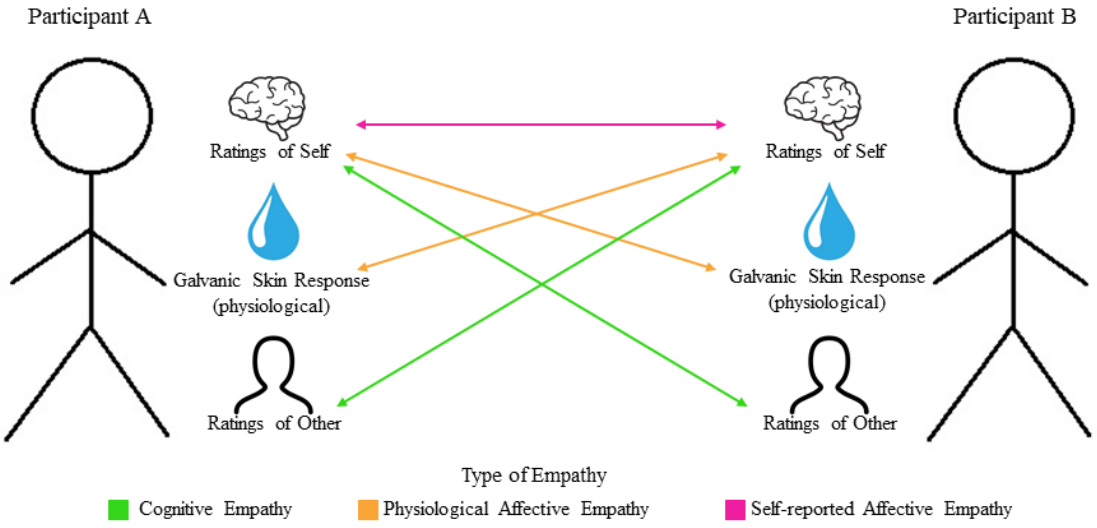
The emotional intensity ratings data and physiological data were correlated for the studies' measures of empathy. For this to occur, both data types had to be the same sampling frequency. A summer scholarship student with expertise in this domain was able to up-sample the emotional intensity ratings data, so the frequency of observations was the same length as the physiological data collected. This allowed the emotional intensity ratings data and the physiological data to be aligned time-wise.

After the emotional intensity ratings and physiological data had been prepared, empathy coefficients for each participant in a dyad could be calculated. For cognitive empathy participant A's ratings of emotional intensity of self were correlated with participants B ratings of emotional intensity of other (dyad partner). For self-reported affective empathy participants A's and B's emotional intensity ratings of self were correlated (dyad partner). Finally, for physiological affective empathy participant A's emotional intensity rating of self was correlated with participant B's galvanic skin response (dyad partner). This process was repeated for each of the four conversations for all 78 participants, so every participant had their own cognitive, self-reported affective, and physiological affective empathy coefficient. The 12 empathy coefficients produced for each participant

were then collated with the demographic and personality inventory data into a spreadsheet awaiting data analysis.

Figure 5

Visual Representation of Empathy Correlation Coefficients Development



Note. Each arrow connects the two pieces of data correlated to create a type of empathy measure.

Statistical Analysis

To test the hypotheses in this study, two types of analyses are reported; multiple linear regression and independent t-tests were computed using the statistical software RStudio (version 1.3), based on the packages lmerTest (version 3.1-3) and lme4 (version 1.1-27.1) (RStudio, 2021). A full list of the packages applied for data preparation and analyses can be found in Appendix G. In this study, we examined dyads, and as such we used a nested model within the statistical analysis to account for participants being in dyads. First, to assess if unfamiliar dyads were associated with lower cognitive and affective empathy in comparison

to familiar dyads, a multiple regression analysis was conducted to examine if there was an interaction between empathy type and familiarity. Multiple linear regression were also used to assess if higher scores for coldheartedness and self-centred impulsivity factors of psychopathic personality traits were associated with decreased affective empathy and stable cognitive empathy. A multiple regression analysis was selected to examine if an improvement in empathy is seen as time increases for unfamiliar dyads. Lastly, multiple independent t-tests were conducted to examine whether there were gender differences between different types of empathy. A power analysis was not conducted as the study had started data collection when the hypotheses were formed, consequently it was not appropriate to do so. Additionally, being an exploratory study, the focus of the study was to begin examining these concepts and undertaking some initial exploration, with findings potentially opening up avenues for further research in the future.

Results

Descriptive Analysis of Core Study Variables

Zero-order Spearman correlations between the study variables are presented in Table 5. The PPI-R-40 total score was significantly positively correlated with all three factors: fearless dominance, self-centred impulsivity and coldheartedness. The factors of the PPI-R-40 were not significantly correlated with one another. Self-reported affective empathy was significantly negatively correlated with self-centred impulsivity, coldheartedness and PPI-R-40 total score (see Table 5). Cognitive empathy was significantly correlated with self-centred impulsivity and self-reported affective empathy. Physiological affective empathy was significantly negatively correlated with self-reported affective empathy and self-centred impulsivity but no other study variables.

Table 5

Zero-order Spearman Correlations of Study Variables

Variable	1	2	3	4	5	6
1. Fearless Dominance						
2. Self-centred Impulsivity	-.09					
3. Coldheartedness	.03	-.06				
4. PPI-R-40 Total Score	.75**	.51**	.21**			
5. Self-reported Affective Empathy Coefficient	-.01	-.17**	-.12*	-.14*		
6. Cognitive Empathy Coefficient	.08	-.20*	.01	-.03	.36**	
7. Physiological Affective Empathy Coefficient	-.02	-.12*	-.10	-.11	-.13*	-.03

Note. PPI-R-40 = Psychopathic Personality Inventory - Revised - 40; * Indicates $p < .05$; ** indicates $p < .01$,

Differences in Empathy Across Dyad and Empathy Types (Hypothesis 1)

A multiple regression analysis was selected to examine if unfamiliar dyads are associated with lower cognitive and affective empathy in comparison to dyads who are familiar with one another. Empathy coefficient was the outcome variable, and the predictor variables were dyad relationship and type of empathy.

Table 6

Multiple Regression Analysis for Dyad Relationship and Empathy Types

		Coefficient	
Predictors	*Estimates*	*CI*	*p*
(Intercept)	0.39	0.32 – 0.46	.001**
Relationship [Unfam - Fam]	-0.09	-0.19 – 0.01	.074
Empathy [PhyAff - Cog]	-0.51	-0.58 – -0.44	<.001***
Empathy [SRAff - Cog]	-0.11	-0.18 – -0.04	.002**
Relationship [Unfam - Fam] x Empathy [PhyAff - Cog]	0.16	0.06 – 0.27	.002**
Relationship [Unfam - Fam] x Empathy [SRAff - Cog]	-0.05	-0.15 – 0.05	.360
N_{Dyad}	39		
Conditional R^2	0.325		

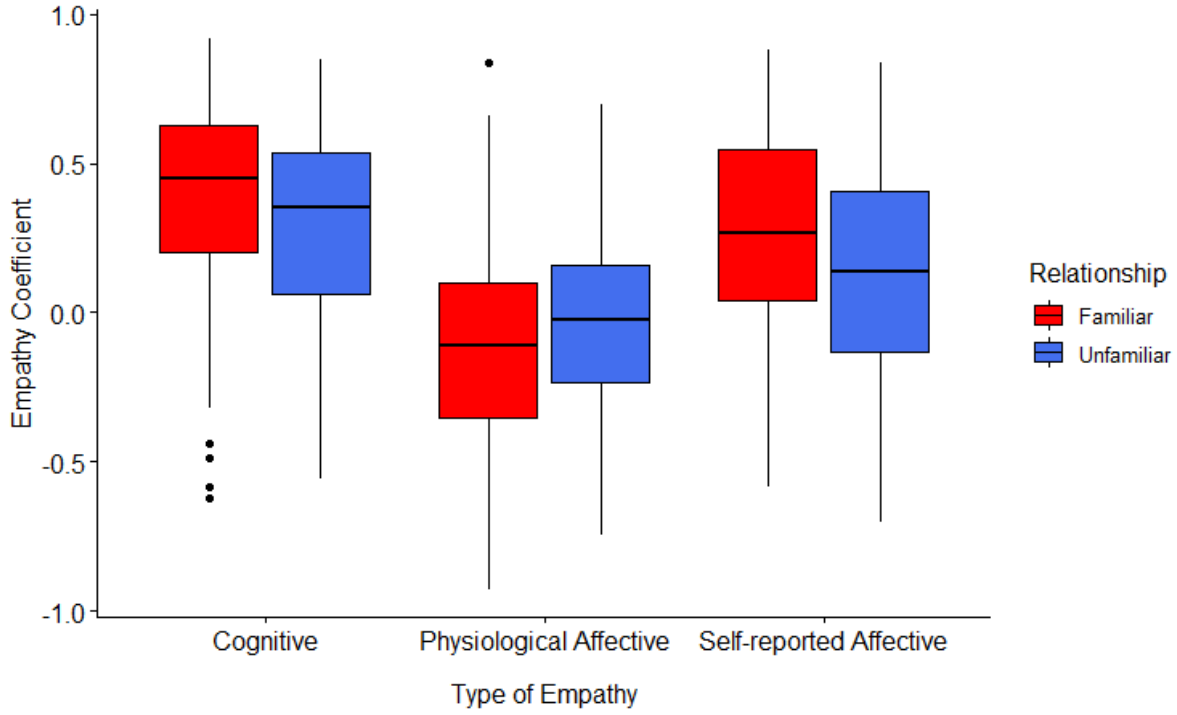
Note. Unfam = Unfamiliar; Fam = Familiar; PhyAff = Physiological Affective; Cog = Cognitive; SRAff = Self-reported Affective; * Indicates p < .05; ** indicates p < .01, *** indicates p<.001

The model included 39 dyads and explained 32.5% of the variance, $R_{cond}^2 = 0.33$ Dyad relationship was not a significant predictor, $\beta = -0.09$, $p = .074$, 95% CI [-0.19, -0.01]. Physiological affective empathy was significantly lower than cognitive empathy, $\beta = -0.51$, p

< .001, 95% CI [-0.58, -0.44]. Self-reported affective empathy was also significantly lower than cognitive empathy, with a smaller estimate than physiological affective empathy, β = -0.11, p = .002, 95% CI [-0.18, 0.04]. The interaction between dyad relationship and the difference between physiological affective empathy and cognitive empathy was significant, β = 0.16, p = .002, 95% CI [0.06, 0.27], indicating that the dyads' relationship had a different effect on physiological affective empathy in comparison to cognitive empathy. This is visualised in Figure 6, showing that familiar dyads empathised more than unfamiliar dyads in cognitive empathy, yet for physiological affective empathy the opposite is true. There was no significant interaction between dyad relationship and the difference between self-reported affective empathy and cognitive empathy, β = -0.05, p = .360, 95% CI [-0.15, 0.05].

Figure 6

Participants Empathy Coefficients by Type of Empathy and Relationship Type



Note. The boxes within the graph indicate the middle 50% of the data. The horizontal line through the box depicts the median value in the data. The vertical lines extending from the box illustrates the range of data values outside of the central 50%. The dots indicate outliers in the data.

Post-hoc tests were completed to compare whether familiar and unfamiliar dyads' empathy coefficients were statistically different from one another. Independent t-tests revealed there was a significant difference in the cognitive empathy scores for familiar (M = 0.39, SD = 0.31) and unfamiliar (M = 0.30, SD = 0.33) participants; t(2.51)=298, p = .013, d = .29; and in the self-reported affective empathy scores (familiar: M = 0.28, SD = 0.34; unfamiliar: M = 0.14, SD = 0.38); t(3.34)=291, p <.000, d = .39 ; but not in the physiological affective empathy scores (familiar: M = -0.12, SD = 0.34; unfamiliar: M = -0.05, SD = 0.30); t(-1.84)=274, p = .068 , d = .22.

The overall hypothesis is partially supported as both cognitive and self-reported affective empathy coefficients were significantly higher for familiar dyads in comparison to unfamiliar dyads, as originally predicted. However, the hypothesis is not fully supported as the opposite was true for physiological affective empathy, as unfamiliar dyads empathised better than familiar dyads.

Difference in Self-centred Impulsivity and Coldheartedness Across Empathy Types (Hypothesis 2)

A multiple regression analysis was conducted to examine if higher scores of coldheartedness and self-centred impulsivity are associated with lower physiological and self-reported affective empathy, yet, cognitive empathy would not be associated with either. The outcome variable in this regression was the empathy coefficient, and the predictor variables were empathy type, coldheartedness and self-centred impulsivity, and their interactions.

Thirty nine dyads were included in the regression analysis, the variance explained within the model is 31.4%, R_{cond}^2 = 0.31 (see Table 7). Self-centred impulsivity was a significant predictor, β = -0.01, p = .030, 95% CI [-0.02, -0.00]. Physiological affective

empathy was significantly different to cognitive empathy with a lower estimate, β = -0.41, p = .038, 95% CI [-0.80, -0.02].

Self-reported affective empathy was not significantly different from cognitive empathy, β = 0.06, p = .771, 95% CI [-0.32, 0.43]. Coldheartedness was not a significant predictor, β = 0.00, p = .597, 95% CI [-0.01, -0.02]. Additionally, there were no significant interaction effects between either coldheartedness and self-centred impulsivity and both types of affective empathy as seen in Table 7. Self-centred impulsivity and physiological affective empathy was not significant, β = 0.00, p = .436, 95% CI [-0.01, 0.01]. Self-centred impulsivity and self-reported affective empathy was not significant β = -0.00, p = .910, 95% CI [-0.01, 0.01]. Coldheartedness and physiological affective empathy was not significant, β = -0.02, p = .154, 95% CI [-0.04, 0.01]. Coldheartedness and self-reported affective empathy was not significant, β = -0.02, p = .073, 95% CI [-0.04, 0.00].

Table 7

Multiple Regression Analysis for Self-centred Impulsivity, Coldheartedness and Empathy Types

		Coefficient	
Predictors	*Estimates*	*CI*	*p*
(Intercept)	0.57	0.28 – 0.87	<.001***
Self-centred Impulsivity	-0.01	-0.02 – -0.00	.030*
Empathy [PhyAff – Cog]	-0.41	-0.80 – -0.02	.038*
Empathy [SRAff – Cog]	0.06	-0.32 – 0.43	.771
Coldheartedness	0.00	-0.01 – 0.02	.597
Self-centred Impulsivity x Empathy [PhyAff – Cog]	0.00	-0.01 – 0.01	.436
Self-centred Impulsivity x Empathy [SRAff – Cog]	-0.00	-0.01 – 0.01	.910
Coldheartedness x Empathy [PhyAff – Cog]	-0.02	-0.04 – 0.01	.154
Coldheartedness x Empathy [SRAff – Cog]	-0.02	-0.04 – 0.00	.073
N_{Dyad}	39		
Conditional R^2	0.314		

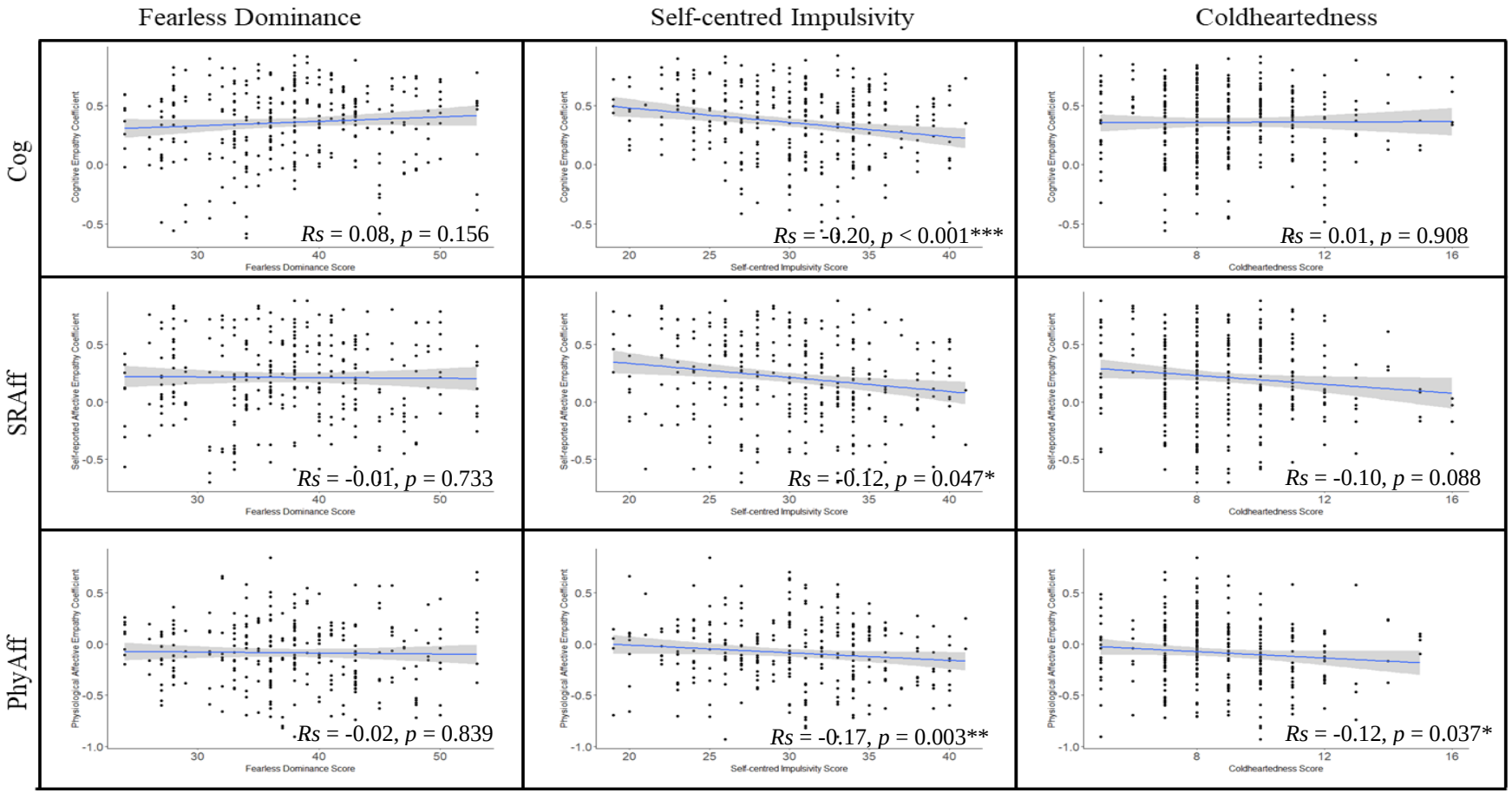
Note. PhyAff = Physiological Affective; Cog = Cognitive; SRAff = Self-reported Affective; * Indicates $p < .05$; ** indicates $p < .01$, *** indicates $p<.001$

The second hypothesis predicted higher scores for coldheartedness and self-centred impulsivity factors would be associated with a decrease in affective empathy. This hypothesis is partially supported by the results of the regression analysis and the correlation matrix (Figure 7). There is indeed a main effect of self-centred impulsivity, this was experienced by all types of empathy and not exclusively affective empathy as originally predicted.

Additionally, no significant findings were observed for coldheartedness and so this element of the hypothesis is also unsupported.

Figure 7

Scatter Plot Matrix of Psychopathy Factors with Types of Empathy



Note. Rs = Correlation Coefficient; PhyAff = Physiological Affective; SRAff = Self-reported Affective; Cog = Cognitive; * Indicates p < .05; ** indicates p < .01, *** indicates p < .001. A scatterplot displays each datapoint on the graph with a single dot. The blue line is the linear relationship of the data between the x axis variable and y axis variable. The grey shading illustrates the confidence interval.

Unfamiliar Dyads' Empathy Improvement over Time (Hypothesis 3)

A multiple regression analysis was conducted to examine if there was an increase in empathy for unfamiliar dyads (19 dyads) across the four conversations. The outcome variable was the empathy coefficient in this multiple regression, and the predictor variables were empathy type and conversation number.

Table 8

Multiple Regression Analysis for Conversation and Empathy Type

		Coefficient	
Predictors	*Estimates*	*CI*	*p*
(Intercept)	0.21	0.11 – 0.31	<.001***
Conversation	0.04	0.01 – 0.06	.008**
Empathy [PhyAff - Cog]	-0.35	-0.42 – -0.27	<.001***
Empathy [SRAff - Cog]	-0.16	-0.23 – -0.09	<.001***
N_{Dyad}	19		
Conditional R^2	0.267		

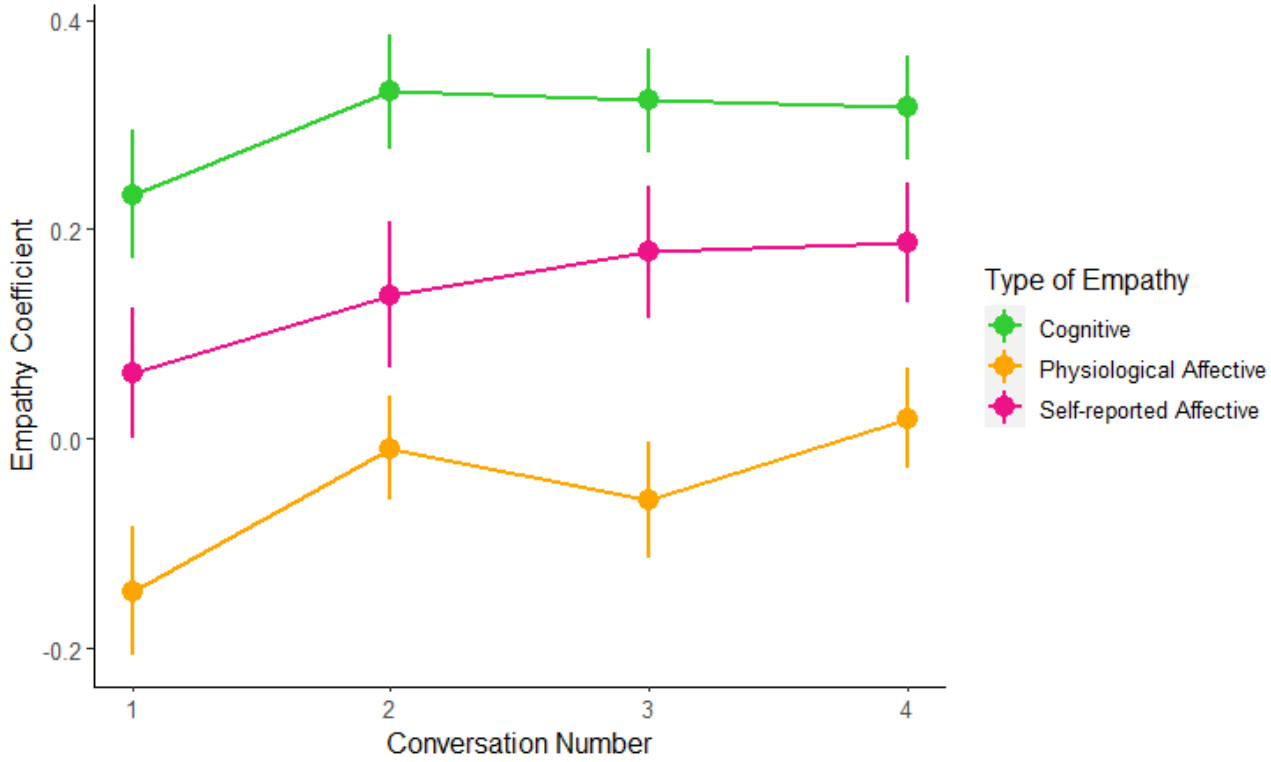
Note. PhyAff = Physiological Affective; Cog = Cognitive; SRAff = Self-reported Affective; * Indicates p < .05; ** indicates p < .01, *** indicates p < .001

The analysis was conducted with 19 dyads, 26.7% of the variance was explained by the model, $R_{cond}^2 = 0.27$ (see Table 8). Conversation was found to be positive significant predictor, $\beta = 0.04$, $p = .008$, 95% CI [0.01, 0.06]. Physiological affective empathy was significantly lower than cognitive empathy, $\beta = -0.35$, $p < .001$, 95% CI [-0.42, -0.27]. Self-report affective empathy was also significantly lower in comparison to cognitive empathy, $\beta = -0.16$, $p < .001$, 95% CI [-0.23, -0.09]. Self-reported affective empathy was higher than

physiological affective empathy, as demonstrated in the β values and illustrated in Figure 8. The results from this multiple regression analysis provide evidence to support the hypothesis that empathy does improve over time for unfamiliar dyads.

Figure 8

Unfamiliar Participants' Empathy Coefficients across Conversations



Note. The dots illustrate the mean empathy coefficient for each conversation. The vertical lines extending from the dots depict the range in the data. The lines between the dots represent the changes in values between each conversation**.**

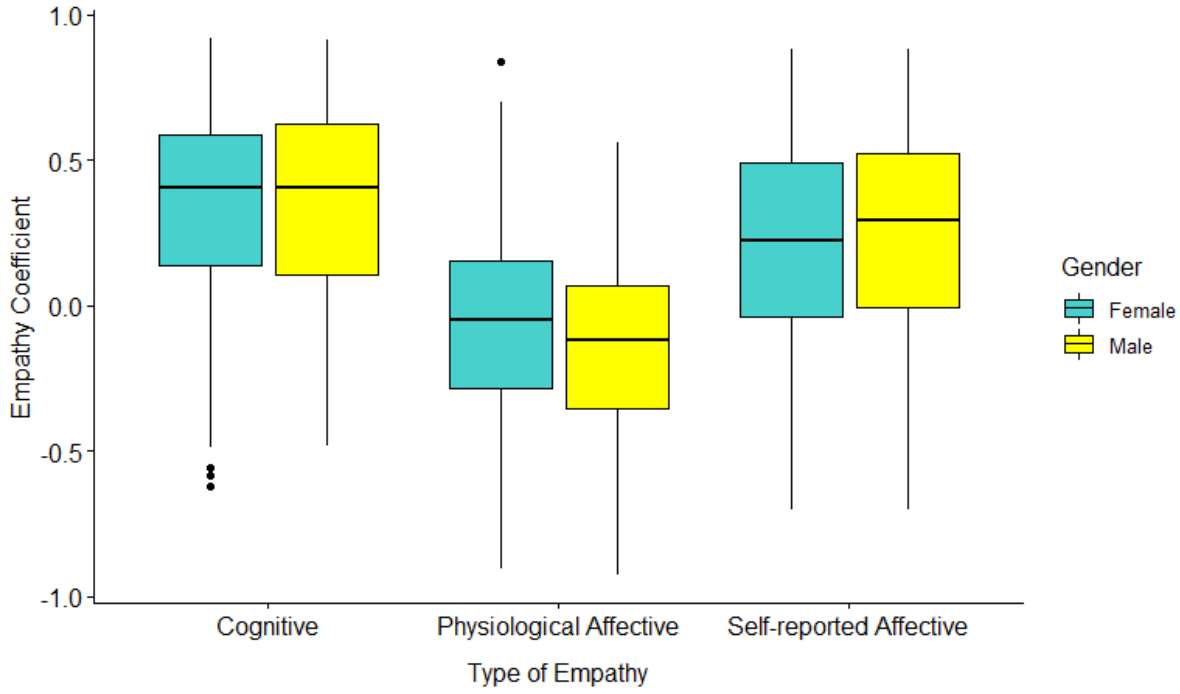
Difference between Females and Males Across Empathy Types (Hypothesis 4)

Three independent sample t-tests were conducted to examine whether female and male participants' empathy coefficients were statistically different from one another. The t-tests revealed there were no significant differences in the cognitive empathy scores for female

(*M* = 0.35, *SD* = 0.32) and male (*M* = 0.35, *SD* = 0.32) participants; *t*(0.08)=134, *p* = .934, *d* = .01; in the self-reported affective empathy scores (female: *M* = 0.20, *SD* = 0.37; male: *M* = 0.25, *SD* = 0.36); *t*(-1.03)=136, *p* = .307, *d* = .13 ; or in the physiological affective empathy scores (female: *M* = -0.07, *SD* = 0.33; male: *M* = -0.13, *SD* = 0.32); *t*(1.45)=141, *p* = .150, *d* = .19. These results do not support the hypothesis, that females empathise better than males, instead they show that there were no gender differences in cognitive, self-reported affective or physiological affective empathy (see Figure 9).

Figure 9

Gender Comparison of Empathy Coefficients



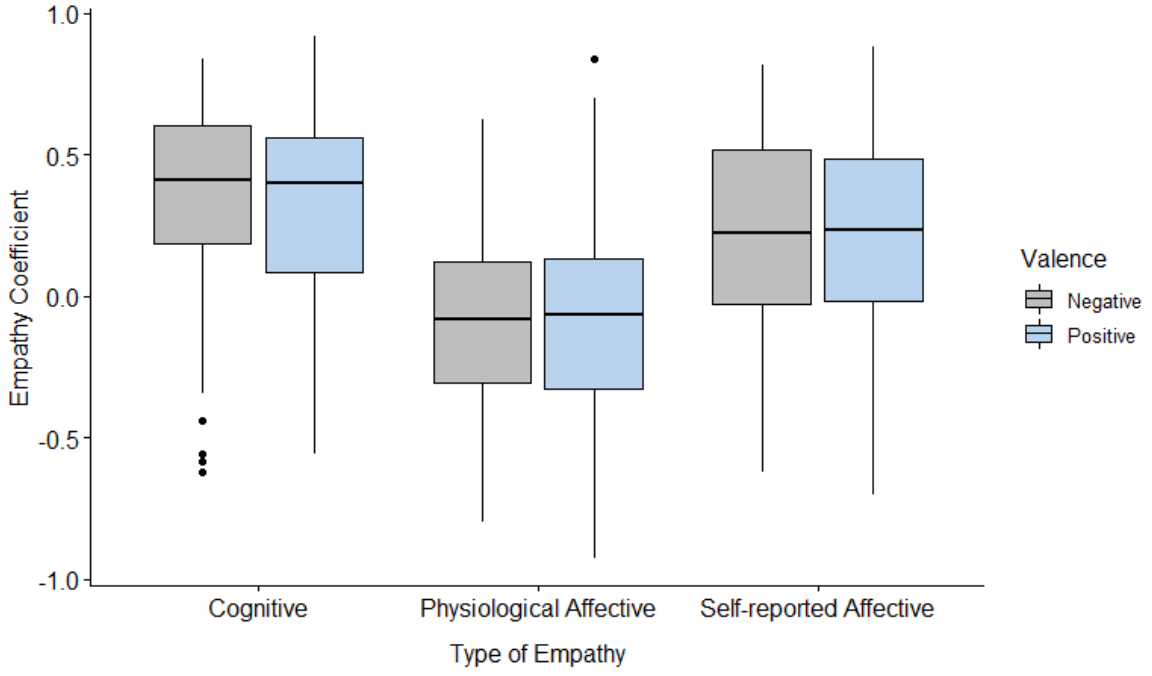
Additional Exploratory Analyses

Examining Valence as a Possible Confounding Variable

To test whether the valence of the conversations prompts was a confounding variable in this study, three independent t-tests were conducted to examine whether empathy coefficients of positive or negative valanced conversations statistically differed from one another. There was no significant difference in the cognitive empathy scores for positive (M = 0.33, SD = 0.33) and negative (M = 0.36, SD = 0.31) conditions; t(0.77)=302, p = .444, d = .09; in the self-reported affective empathy (positive: M = 0.20, SD = 0.37; negative: M = 0.22, SD = 0.36); t(0.467)=300, p = .641, d = .05; or in the physiological affective empathy scores (positive: M = -0.09, SD = 0.33; negative: M = -0.09, SD = 0.32); t(-0.02)=276, p = .980, d = .00. These results indicate that valence did not have an effect on cognitive, self-reported affective or physiological affective empathy, and thus is not a potential confounding variable.

Figure 10

Empathy Coefficients for Conversations of Positive and Negative Valence



Overall Regression Model

As an additional analysis, a series of linear regression models were compared for best model fit, including all study variables at the start. Empathy coefficients were the outcome variable, and the predictor variables were fearless dominance, self-centred impulsivity, coldheartedness, dyad relationship, conversation number, valence, and type of empathy (see Table 9). To find the model of best fit, backward deletion was used.

Table 9

Multiple Regression Analysis Including All Factors

		Coefficient	
Predictors	*Estimates*	*CI*	*p*
(Intercept)	0.61	0.35 – 0.88	<.001***
Fearless Dominance	-0.00	-0.00 – 0.00	.983
Self-centred Impulsivity	-0.01	-0.01 – -0.00	.007**
Coldheartedness	-0.01	-0.02 – 0.01	.307
Relationship [Unfam - Fam]	-0.05	-0.12 – 0.03	.227
Conversation	0.02	0.00 – 0.04	.034*
Valence [Pos - Neg]	-0.01	-0.06 – 0.03	.517
Empathy [PhyAff - Cog]	-0.45	-0.50 – -0.39	<.001***
Empathy [SRAff - Cog]	-0.14	-0.20 – -0.09	<.001***
N_{Dyad}	39		
Conditional R^2	0.316		

Note. Unfam = Unfamiliar; Fam = Familiar; Pos = Positive; Neg = Negative; PhyAff = Physiological Affective; Cog = Cognitive; SRAff = Self-reported Affective; * Indicates $p < .05$; ** indicates $p < .01$, *** indicates $p < .001$

This analysis was conducted with 39 dyads and the variance explained by the model was 31.6%, R_{cond}^2= 0.32. As shown in Table 9 self-centred impulsivity was a significant factor, β = -0.01, p = .007, 95% CI [-0.01, 0.00], as self-centred impulsivity increases empathy coefficients decreased. Conversation number is also a significant factor in the model, β = 0.02, p = .034, 95% CI [0.00, 0.04], showing that empathy coefficients increase across the conversations. These results indicate self-centred impulsivity and conversation number were significant predictors within the multiple regression model. Physiological affective empathy was significantly lower than cognitive empathy, β = -0.45, p < .001, 95% CI [-0.50, -0.39]. Self-report affective empathy was also significantly lower than cognitive empathy, β = -0.14, p < .001, 95% CI [-0.20, -0.09]. Fearless dominance was not a significant factor, β = 0.00, p = .983, 95% CI [-0.00, 0.00], neither was Coldheartedness, β = -0.01, p = .307, 95% CI [-0.02, 0.01], dyad relationship, β = -0.05, p = .227, 95% CI [-0.12, 0.03] or valence β = -0.01, p = .517, 95% CI [-0.06, 0.03].

After this initial model which included all study variables, a stepwise selection process was followed to find the best fit model. This was done using the backward deletion process. In the next step variables were deleted one at a time, and each new model fit was compared to the one before using an ANOVA. If the models differed significantly at the alpha level of .05, then the variable that was just removed was deemed integral to the model and retained in the model. Alternatively, if the model fit did not differ significantly, that variable was removed from the model. This process was repeated until all variables left in the model could not be removed without statistically deteriorating the model fit.

Table 10

Best Fitting Multiple Regression Model

		Coefficient	
Predictors	*Estimates*	*CI*	*p*
(Intercept)	0.52	0.34 – 0.69	<.001***
Self-centred Impulsivity	-0.01	-0.01 – -0.00	.010**
Conversation	0.02	0.00 – 0.04	.034*
Empathy [PhyAff - Cog]	-0.44	-0.50 – -0.39	<.001***
Empathy [SRAff - Cog]	-0.14	-0.20 – -0.09	<.001***
N_{Dyad}	39		
Conditional R^2	0.317		

Note. PhyAff = Physiological Affective, Cog = Cognitive, SRAff = Self-reported Affective; * Indicates p < .05; ** indicates p < .01, *** indicates p < .001

The refined multiple regression analysis included three variables, the variance explained by the model 31.7%, R_{cond}^2 = 0.32. As shown in Table 10 self-centred impulsivity was a significant negative factor, β = -0.01, p = .010, 95% CI [-0.01, 0.00]. Conversation number was a significant positive factor in the model, β = 0.02, p = .034, 95% [0.00, 0.04]. Physiological affective empathy was significantly lower than cognitive empathy, β = -0.44, p < .001, 95% CI [-0.50, -0.39]. Self-report affective empathy was also significantly lower than cognitive empathy, β = -0.14, p < .001, 95% CI [-0.20, -0.09]. The refined model is marginally larger than that of the model with all variables, indicating that the variables removed were surplus to the model and provided no additional explanatory power.

Discussion

This study investigated empathy within dyad interactions and the specific roles of familiarity, psychopathy factors, time, and gender. Hypothesis 1 predicted that dyads who were familiar with one another would show higher empathy coefficients in comparison to dyads who were unfamiliar with one another. We found that familiarity did not have an effect on all types of empathy; in fact, for physiological affective empathy, unfamiliar dyads had higher scores of empathy than familiar dyads. However, there was a significant difference between familiarity conditions for cognitive and self-reported affective empathy, with familiar dyads having higher scores of empathy in comparison to unfamiliar dyads, this is consistent with the hypothesis originally stated. Hypothesis 2 expected self-centred impulsivity and coldheartedness would be negatively related to affective empathy. The results showed a significant negative relationship between self-centred impulsivity and all empathy types. However, no relationship was found between coldheartedness and empathy. The regression analysis associated with hypothesis 3 showed that empathy increased for unfamiliar dyads as time increased across the experiment, as was predicted. Hypothesis 4 anticipated that female participants would perform better than male participants in all forms of empathy. The results instead showed that there was no difference between male and female participants in their ability to empathise across all types of empathy.

The Role of Familiarity Across All Types of Empathy

It was theorised that unfamiliar dyads would produce lower scores for all types of empathy than dyads who were familiar with one another. However, the analysis revealed no difference between familiarity across all types of empathy. Additional analysis conducted after the regression indicated a difference between familiar and unfamiliar dyads scores for

self-reported affective empathy and cognitive empathy, but no significant difference for physiological affective empathy. These results suggest that familiarity plays an important role for only self-reported and cognitive empathy, and not all types of empathy as originally theorised. Additionally, the regression analysis found a significant interaction between familiarity and cognitive and physiological affective empathy.

The significant interaction observed between familiarity and physiological affective and cognitive empathy is not an interaction we expected to find. As visualised in Figure 6, unfamiliar dyads were better at inferring their dyads partners' emotional intensity than familiar dyads. This is in opposition to what was observed for cognitive empathy, as familiar dyads were better at predicting their dyad partners emotional intensity ratings, compared to unfamiliar dyads. However, the physiological element involved in the physiological affective empathy score could potentially explain what is contributing to this interaction.

It is assumed that the physiological measure of this empathy coefficient is the source of this difference, because both self-report affective empathy and cognitive empathy measures were based on self-reported data and show the opposite trend to physiological affective empathy. A reason for this may be that unfamiliar participants felt anxious or nervous to participate in the study for various reasons. This could be due to the unfamiliar environment the study takes place in, or having to interact with a stranger in a monitored setting. Galvanic skin response measurement works by measuring the electrodermal activity within our body; this activity is measured through the sweat glands, reflecting a persons' emotional intensity (Chattopadhyay et al., 1975; Farnsworth, 2018). A symptom of nervousness and anxiety is excessive sweating, which is reflective of their heightened emotional state (Purves et al., 2001; Sharma et al., 2016). This nervousness could be producing symptoms of heightened emotional arousal, such as sweating, which would be recorded by the galvanic skin response measuring devices (Purves et al., 2001).

If both participants in an unfamiliar dyad feel anxious or in a state of heightened emotional intensity, we would see higher scores on the physiological measurements because of the emotional state caused by the environment, not as a result of the experiment itself. This is an important consideration, as a part of the physiological affective empathy scores is the physiological measure. This could explain why unfamiliar dyads reported more congruent emotional intensity ratings than familiar dyads in this measure of physiological empathy. Their physiological responses may be more reflective of nervousness, an emotion that may be reflected in their dyad partner, therefore enabling them to better align with their dyad partners' self-reports of emotional intensity ratings compared to familiar dyads. Additionally, this nervousness may not be experienced by familiar dyads despite being in the same environment, possibly due to having their dyad partner present during the experiment. Having someone present who they know, are familiar with, and feel safe with could be providing a calming influence on them (Jacinto et al., 2013). This may explain the difference we see between unfamiliar and familiar dyads within physiological affective empathy.

Familiarity between dyads did not appear to make participants any better at recording their partners' emotional intensity during the conversations. Additional post hoc tests were completed to examine further if there was a significant difference between familiar and unfamiliar dyads for each type of empathy. There were significant results for cognitive empathy and self-reported affective empathy, demonstrating that familiar participants were better able to recognise their dyad partners' emotional intensity in comparison to unfamiliar dyads, as seen in Figure 6. This aligned with what was initially hypothesised. As predicted, dyads who had an existing relationship with one another were better at empathising with each other. This is unsurprising as these individuals would be familiar with their dyad partners' life details, their family and friends, their significant events, and how they communicate emotions. The wealth of knowledge that people hold about those they are familiar with makes

empathising significantly easier and likely more accurate. This is a major advantage for individuals who are trying to empathise with someone familiar, compared to dyads who have no prior knowledge and only met on the day of the experiment. This pattern is supported by a study that examined empathy bias broadly; they observed a preference amongst participants to empathise with individuals socially closer to them than those who were relatively unknown (Fowler et al., 2021).

The difference within the multiple measures of empathy between unfamiliar and familiar dyads demonstrates why a variety of measures are needed to fully understand how the mechanisms involved in social interactions affect our ability to empathise. While it was assumed familiarity would have a consistent effect on all types of empathy, this was unsupported. The findings of this research support the notion that there is a difference in empathy between unfamiliar and familiar dyads, though this seems to exist only for measures of empathy that rely on self-report methods and not physiological data. An implication of these findings is the idea that we may consciously recognise a distinction between empathising with familiar and unfamiliar people; though our body and physiological responding does not. Understanding familiarity more in-depth would involve investigating more specific dynamics that contribute to familiarity and relationships more generally, such as the type of relationship, length of time, and closeness.

The Role of Self-Centred Impulsivity and Coldheartedness Across All Types of Empathy

Self-centred impulsivity was a significant negative predictor of empathy regardless of the type of empathy. Contrary to expectations, this study found that coldheartedness did not influence the participants' ability to follow their dyad partners' emotional intensity throughout the conversations. It was initially predicted that higher scores of self-centred

impulsivity would be associated with a mismatch between the dyad partners' self-reported emotional intensity ratings. Whereas the alignment between one dyads' partners perceived emotional intensity of their partner and the partners' self-reported emotional intensity was predicted to remain unaffected by higher scores of self-centred impulsivity. However, the results demonstrate that higher scores of self-centred impulsivity was negatively associated with all measures of empathy, not just affective empathy.

This is a surprising observation when the majority of psychopathic personality traits research suggests that self-centred impulsivity would only influence affective empathy (Owens et al., 2018; Pfabigan et al., 2015; Seara-Cardoso et al., 2013). Research suggests that self-centred impulsivity is associated with a reduction in emotion recognition accuracy (Brook & Kosson, 2013; Dawel et al., 2012; Vitacco et al., 2019). Consistent with this research, the current study found that physiological and self-reported affective empathy were significantly lower for individuals higher in self-centred impulsivity. Most of the literature attributes this phenomenon as being a result of individuals high in self-centred impulsivity being unable to recognise social cues and emotional communication from others within interactions (Gehrer et al., 2020; Preston & Anestis, 2019). This deficit in emotion recognition within the context of social interactions subsequently inhibits an individuals ability to empathise accurately.

This study found that deficits in empathy previously found exclusively with affective empathy had also extended to cognitive empathy (Sest & March, 2017). Research has shown that individuals high in self-centred impulsivity are comfortable with non-conformity (Overgaauw et al., 2020; Ruchensky et al., 2017). This element of self-centred impulsivity within psychopathic personality traits could potentially extend into various behaviours during their interactions with others (Argyle & Dean, 1965; Boll & Gamer, 2016; Overgaauw et al., 2020). If the behaviour of people high in self-centred impulsivity is different during

interactions, then it would make sense to see a general empathy deficit across all forms of empathy and not just affective empathy. This is conceptually supportive of the results in the study and could provide further explanatory reasoning as to why in this study we see participants' scores of empathy reduce when self-centred impulsivity scores rise. We could then consider individuals high in self-centred impulsivity to have an empathy deficit more generally than a specific deficit in affective empathy. These findings support the idea that a specific element captured within the self-centred impulsivity factor produces this empathy deficit, as this trend is not observed with other factors of psychopathic personality traits such as coldheartedness.

Coldheartedness was originally theorised to be a significant negative factor. It was expected that individuals high in coldheartedness would show lower scores of affective empathy; however, the analysis found no significant results with any type of empathy. Literature around coldheartedness as a factor of psychopathy is relatively limited because it is not recognised as a prominent factor (Berg et al., 2015; Gaughan et al., 2009). It was included in this study as it encompasses conceptually unique variation that ultimately contributes to psychopathic personality traits (Berg et al., 2015). While very little is known about coldheartedness, a previous study that involved children examined callous-unemotional traits (which is considered a similar factor to coldheartedness; White et al., 2015) and found no difference between children high and low in callous-unemotional traits in affective empathy (Martin-Key et al., 2016). This is consistent with the results we see in this study, as coldheartedness appears to have no association with empathy. What can be understood from this study's results is that the mechanisms captured within coldheartedness appear to have no overall relationship with empathy.

The absence of a relationship between coldheartedness and empathy within this study could indicate that the empathy deficits observed in multiple psychopathic personality trait

studies are specifically exclusive to the factor of self-centred impulsivity. Indicating that these factors of psychopathic personality traits are well divided to represent the different facets of psychopathy. This is an interesting finding when considering that, previously, empathy was directly implicated in the description of coldheartedness (Seibert et al., 2011). Although previous research suggests that an empathy deficit is a major part of psychopathy broadly, this study suggests that empathy deficits may be uniquely confined to aspects of self-centred impulsivity. Aspects of self-centred impulsivity such as reduced emotion recognition, antisocial behaviour, and a general lack of social engagement perfectly encompass elements that have the potential to negatively affect an individuals' ability to empathise (Edens & McDermott, 2010; Lilienfeld & Widows, 2005; Seibert et al., 2011).

Many academics have investigated specific elements of empathy and psychopathy, yet as a field, we have not considered the complexity of psychopathic personality traits and specifically what elements of the broad personality trait is directly associated with empathy mechanisms (Bird & Viding, 2014; Lishner et al., 2012; Pfabigan et al., 2015). This study's exploration of the factors of psychopathy support the notion of there being an empathy deficit present, more specifically within the factor of self-centred impulsivity. Characteristics of self-centred impulsivity ultimately contribute to a reduction in empathy across all types. The absence of coldheartedness having a relationship with all empathy measures demonstrates the differences between factors of psychopathic personality traits. These differences have important implications for how we currently conceptualise and examine factors of psychopathic personality traits within empathy research.

It would be interesting to see if comparable results would be found if a different psychopathic personality trait measure was used, in particular the TriPM as it is statistically similar to the PPI-R (Drislane et al., 2014; Sellbom & Phillips, 2013). It would be insightful to see if disinhibition, which is considered conceptually similar to the self-centred

impulsivity, produced similar findings and exploring those results further. The same could be done for meanness and coldheartedness, investigating whether or not meanness has a relationship with empathy in a methodically similar study. This variation to the current study would allow researchers to better understand if psychopathy factors are driving these associations or if it is the way in which we conceptualise and understand psychopathy. Moving forward, more research examining these specific factors of psychopathic personality traits and their associations with empathy more broadly may lead to a better understanding of the mechanisms that contribute to empathy deficits.

The Role of Time across All Types of Empathy

As predicted in the hypothesis, all types of empathy improved over time for unfamiliar dyads. To the best of my knowledge, this is the first type of study exploring the element of familiarity in empathy research; subsequently, there is little research to compare the results with. However, this is inherently logical if we consider interactions more broadly in the context of getting to know someone new. The prompted conversations in this study allow participants to learn in-depth emotional information that is likely to help build a comprehensive understanding of their dyad partner.

The exchange of information that occurs during the conversations within this study allowed participants to become more familiar with their dyad partner. The increasing amount of time over the number of prompted conversations gives participants the time to become accustomed to how their partner communicates (Popova & Wiese, 2022). Beattie (2003) stated that the majority of information regarding a persons' emotional state is typically conveyed through non-verbal communication such as body language, facial expressions, and hand gestures; this is consistent with Matsumoto et al., (2012) research that explored the functions of non-verbal communication. This is particularly important in the context of this

study as the conversation prompts were intended to be highly emotive. Therefore, recognising how someone communicates emotionally through non-verbal means is crucial to understand their emotional state better. Over time participants are continually exposed to their partners' communication style and are steadily learning how best to understand them during the prompted conversations, and decipher their unique way of sharing (Popova & Wiese, 2022). Non-verbal communication conveys emotional information in addition to information transmitted verbally; therefore, non-verbal communication helps the dyad partner understand their partner better and contribute to more accurate empathy. As time passes and participants are more exposed to their partner, their empathy increases due to participants better understanding and communicating with their partner with each conversation.

During the prompted conversations, participants shared personal information about themselves with their dyad partner, often providing additional explanatory detail along the way. This extra explanatory detail often included more basic information that is contextually important such as relationships, career details, and relevant life events. As time increases, factual knowledge about the person's life accumulates, enabling an individual to build a rudimentary idea of the person's life (McCarthy Veach et al., 2018). As the number of conversations increases, participants can further build on previous knowledge they have acquired in earlier conversations and link essential information together to create a more comprehensive collection of knowledge. This basic understanding of a person informs how they may think, behave, and understand the world through their life experience (Preston & de Waal, 2002). Ultimately as participants become more familiar with one another, they have a greater collection of information about their partner that helps to inform their ability to empathise with them accurately.

Another element contributing to empathy improving as time increases could be that participants are becoming more comfortable with each other while participating in the

prompted conversations. Studies have demonstrated that individuals participating in shared activities often experience increases in amicability, rapport, and cooperation (Gordon et al., 2020; Wiltermuth & Heath, 2009). This may explain the initial steep increase observed in empathy from conversation 1 to conversation 2 in Figure 8.. Studies such as Grahe and Bernieri (1999) suggest that dyads with strong rapport express more non-verbal cues of communication. Prosocial feelings of cooperation, rapport and amicability provide additional opportunities for emotional communication. This will assist the dyads in better understanding and more accurately empathising within their dyad partner (Xie et al., 2021; Zadbood et al., 2017).

Social interaction provides an opportunity for understanding and empathy to grow between individuals, even after a short period of time. Results in this study demonstrate that all types of empathy improved as conversations increased between dyads. This has important implications, particularly for individuals who utilise empathy often with relatively new people or strangers. Actions as simple as initiating a conversation could help build rapport and empathise better. This may be particularly relevant for public-facing professionals, such as doctors and police, who interact with unfamiliar individuals daily.

The Role of Gender Across All Types of Empathy

Contrary to expectations, the results from this study found no significant difference between male and female participants' ability to empathise. This was a surprising observation when multiple studies, particularly research with self-report methodologies, found significant differences between male and female participants (Archer, 2019; Eisenberg & Lennon, 1983; Sathaporn & Pitanupong, 2022). Research has found significant differences between male and female participants in self-reported measures, but did not observe differences in empathy

when examining experimental and neuropsychological measures (Archer, 2019; Baez et al., 2017; Benenson et al., 2021; Eisenberg & Lennon, 1983).

A possible explanation for why the current study found no gender difference amongst the different types of empathy could be a result of the neutral language used during data collection. The recent study by Löffler and Greitemeyer (2021) found that the use of emotive and stereotypically gendered vocabulary typically found within empathy studies has been associated with significant gender difference outcomes. Overall, their research supported the idea that contextual factors and gender roles influenced empathy outcomes (Löffler & Greitemeyer, 2021). The findings of Löffler and Greitemeyer's (2021) results align with traditional thinking when you consider the role of empathy in society more broadly. Empathy is used to connect with people, a largely social skill that has been associated with femininity historically (Christov-Moore et al., 2014; Hoffman, 1977; Karniol et al., 1998). Specific words such as empathy and emotion are still tied to ideas of femininity and are considered gendered, despite societal norms moving away from endorsing typical gender roles in recent times (Eagly, 1987; Hoffman, 1977; Koenig & Eagly, 2014). Löffler and Greitemeyer (2021) suggest this gender association initiates an unconscious self-fulfilling expectation; female participants believe they will do better, so they do, and, vice versa, male participants believe they will do poorly, and consequently perform worse.

In the study, we unintentionally avoided using gendered wording, which could explain the similar empathy results in male and female participants. During data collection, experimenters were careful not to highlight that the purpose of the study was examining empathy between individuals. Instead, participants were told the study was researching normal interactions and conversations between dyads. This encouraged participants to behave as they would in everyday interactions and attempt to reduce the occurrence of observe-expectancy effects. By providing participants with a simple explanation and clear

instructions, we inadvertently used no explicitly feminine or masculine vocabulary. We unknowingly avoided inducing gendered effects, similar to those seen in the Löffler and Greitemeyer (2021) study.

The use of gender-neutral language throughout the study was unintentional; however, it could have potentially contributed to the results we observed. The study results demonstrate that despite societal constructs of gender, there is likely no difference between men and womens' ability to empathise. These findings imply that despite stereotypes of traditional masculine and feminine roles and gendered language, people show no actual difference in empathy ability. Instead, it is the internal belief that alters outcomes, not capability. In the future, it will be interesting to see if studies that observe empathy gender differences decrease in number as stereotypes and gender roles diminish in relevance due to society moving to a more gender-neutral climate.

The Role of Valences Across All Types of Empathy

The additional analysis to test for valence effects showed no difference between positive and negative valence conversation prompts for the different types of empathy, as the results demonstrate that negative and positive prompts did not lead to differences in any of the empathy outcome variables.

Current literature concerning empathy for positive and negative emotions is varied. The empathy amplification hypothesis posits that greater empathy would be associated with positive emotions as positive emotions enhance other prosocial and advantageous attributes (Devlin et al., 2014); research with children as young as three years old supports this (Borke, 1973). Researchers found that children were better at recognising happy facial expressions than negative emotions such as sadness and anger (Borke, 1973). This suggests a trend of recognising positive emotions more accurately than negative ones, even from a young age.

However, the empathy attenuation hypothesis suggests the opposite is true, and that lower empathy would be associated with positive emotion. The rationale behind this hypothesis is that positive emotions have been observed to promote selfishness, a trait that would negatively impact upon empathy (Devlin et al., 2014). Literature suggests that humans traditionally are more sensitive to negative emotions and losses, due to an evolutionary advantage (Gal et al., 2018; Hintze et al., 2015; Zamir, 2014).

An explanation of why we observed no difference could be due to participants having natural conversations that often strayed from the conversation prompt. Participants were instructed to interact as usual, and, like most typical interactions, conversations develop, and people discuss multiple topics, not just the original subject (Argyle et al., 1981). This is an observation that experimenters made during data collection. Often, participants would discuss related topics, provide background information, and explore commonalities they had with one another. While the prompts were there to encourage a wide range of emotions to be shared throughout the conversations, it did not mean participants stayed focused on the prompt for the whole six minutes. This could explain why we do not see a difference in empathy between positive and negative conversation prompts. Conversations did not necessarily follow the same valence as the prompt because they were merely starting points for the interaction and did not dictate the tone or valence of the whole conversation. It would be interesting to explore this further in additional studies to see if valence influences shorter conversations that have less time to develop, or if other aspects of conversations effect the content or direction of the interaction.

Modelling All Variables Simultaneously

The model of best fit was derived from the backward deletion method. The model includes conversation number and self-centred impulsivity as significant factors. As the

amounts of conversations increased, all types of empathy scores increased, and as self-centred impulsivity values got higher, all types of empathy scores lowered. The model of best fit was not significantly different to the model presented in Table 9. This model of best fit is consistent with the results we found across the rest of the study. Self-centred impulsivity was consistently negatively associated with all types of empathy, and conversation number was a significant factor in all the included analyses. These results demonstrate that overall familiarity did not have a consistent effect on all types of empathy. It would be interesting to see if this result would be different in future research if a different measure of physiological affective empathy is used.

Strengths

A strength of this research is the large sample size that allowed the study to have a wide range of relationships within the familiar group. This is a strength of the research as it captures a diverse range of relationship types, strengths, and durations (Güroğlu et al., 2007). Encompassing a range of different relationships and levels of familiarity within this group is important to ensure the study captures relationships more generally than one specific relationship, such as friends or romantic partners. Additionally, this study has incorporated relationships that have been short, long, intense, casual, and developed and changed over time, which is representative of relationships broadly.

To the best of my knowledge, this is the first empathy study to investigate the relationship between two people when considering how well they empathise with one another. While individual ability to empathise is important, examining the relationship between two people is just as important as it guides behaviour in social interactions, influences information you share, and impacts your knowledge and understanding of that person. Empathy research in the last decade has grown significantly, and it will continue to

do so, yet a study such as this highlights the different avenues of research that remain uninvestigated. Ultimately this research contributes to a more in-depth understanding of how individuals empathise with one another.

Limitations

Experimental Design of the Study

This study is not without its methodological limitations. One such limitation is that this study is, by design, a laboratory experiment. It is an artificial environment that seeks to explore interactions in natural social exchanges; this presents some limitations.

The study's artificial and rather unusual setting could potentially produce behaviour that does not reflect natural social interactions. Elements that are a part of the study that may contribute to this are discussed further. The studio itself is unfamiliar and it is a large, predominantly black room with a green screen and a variety of technical equipment throughout the space. The Equivital vests that participants wear have small cables attached to them, this is not a material that you typically feel on your body. Experimenters noted that male participants found the Equivital vests tight around their chest. The motion capture suits participants wore are not traditional clothing; they are quite form-fitting Velcro suits with small dots attached. Another part of the motion capture suits was a large helmet that had a camera and light that was attached to the helmet; this stuck out approximately 20 centimeters in front of participants faces (see Appendix E). Another aspect of the study that is not typical of normal interactions is that participants are aware that experimenters are watching what they are doing and knowing they are being recorded. This can be particularly important in this environment as experimenters hold positions of authority, which can produce observer-expectancy bias by participants (Balph & Balph, 1983). These elements can make a participant feel uncomfortable, particularly since this environment is not something most

people have experienced before. A participants' feelings and attitudes to such an experimental environment will ultimately play a role in their behaviour during the experiment (Kim et al., 2021; Scrafton, 2015).

While many elements within this study could potentially make participants uncomfortable, experimenters hopefully mitigated this effect during data collection. Experimenters were open and transparent about the equipment, setting, and procedure during the day, providing need-to-know information. Experimenters reported that participants appeared to adapt to their settings and equipment quite fast as they had time to adjust during the initial set-up stage. Additionally, they reported that participants generally enjoyed wearing the technology and all the equipment as they found it to be a unique experience. This is mentioned to accurately report how participants appeared to perceive the whole experience and to provide an insight into the manner in which this study was conducted. Ultimately it is hard to say with confidence that the data collected in such methodologies are inherently representative of the true nature of what we are attempting to measure due to the low ecological validity. Unfortunately, this is a common methodology problem in laboratory experiments.

Physiological Affective Empathy Measure

An additional limitation within the study is the method in which physiological affective empathy was calculated. This measure was new and experimental and had issues in its delivery. The physiological empathy coefficient tended to cluster around the 0.0 value, which indicates no relationship between the physiological data and the self-reported data being correlated. The study used raw data of galvanic skin response, and while we thought it would be a fair representation of emotional arousal within participants, the results suggested otherwise. We would expect self-reported and physiological affective empathy to produce

similar results, as they use different data but both aim to measure affective empathy. The results repeatedly showed that self-reported and physiological affective empathy were statistically different to one another. The physiological affective empathy coefficients tended to cluster around the 0.0 value. This is indicative of a floor effect of physiological empathy, suggesting there was not enough variability within galvanic skin response to produce a good measure.

A way to better prepare this measure in the future could be to use more processed data of the galvanic skin response. By conducting more pre-processing before analysis is carried out, any potential issues could be addressed, such as time delays between participant sensors and recording the physiological responses on the modules. Another way to combat this issue could be to potentially use a different physiological response measure such as heart rate. While this measure of physiological responding has more variability, heart rate is also prone to more artifacts within the data that may be more complex to address during pre-processing. Using technology to measure the physiological functioning of a participant in a natural way is difficult. Advances in this technology area in the future will hopefully produce more accurate readings and further develop the wider field of research.

Missing Data

As stated in the study's methodology, 13 dyads were excluded from the study as there were technical difficulties with the sensitive equipment used to collect data. Thirteen is a sizeable number of dyads to have excluded from the study. This was done to ensure the integrity of the analysis. The technology used to measure physiological responses produced the majority of issues that led to the exclusion of dyads. Since this was an exploratory study of a complex and intricate nature, it was expected that there would be obstacles along the way. The technology used to collect this data was the most appropriate at the time and the

best we had access to during the study. It would not have been appropriate to change such a key methodological element part way through the study. The missing dyads that were excluded from the study appeared to be an equal proportion of unfamiliar and familiar dyads, as the sample used in the study was relatively equal (19 unfamiliar dyads, 20 familiar dyads). However, it is recognised these dyads could have captured elements that were not included in the sample of 39 dyads used in the analysis. A way to ensure this does not occur in future research would be to ensure that the technology used in the study is well tested and reliable. Replicating this methodology and ensuring all the data is available for analysis would allow for a more accurate representation of participants and the wider study variables.

Future Directions of Research

As previously mentioned, replicating this study within an environment in which natural interactions occur would increase ecological validity. While this study is experimental by design, future research could build off this and develop a study that can measure the same elements in a more discrete and naturalistic method. Such research would provide an insight into whether the results produced in this study were indicative of typical social interactions or were a product of the experiment.

An avenue for future research would be to replicate the study and examine if there is an improvement in empathy for familiar and unfamiliar dyads across the four prompts. In the current study only unfamiliar dyads were examined in this aspect. This extension of the current research could provide further explanatory value to the study and demonstrate if the task has any influence on the improvement of empathy over the course of the experiment. It would be interesting to explore the results and examine if familiar dyads improved significantly between the four prompts, and how this compares to the unfamiliar dyads.

In this study, physiological affective empathy was created by correlating a participants' physiological galvanic skin response with their dyad partners' self-rating of emotional intensity. Galvanic skin response was used as a proxy for an emotional arousal measure. As discussed as a part of the limitations, if this measure were to be repeated in future research, it would be beneficial to look at a range of different physiological responding measures, such as heart rate and chest expansion. By exploring the best implicit measure of physiological affective empathy more in-depth, we will be able to better understand how the body responds to emotional information and how we as humans process empathy at a physiological level.

The study investigated the relationship between empathy, psychopathy, and familiarity. While this study is a strong starting point for research that examines familiarity within the wider subject of empathy, an abundance of future research could follow. For example, examining specific relationships such as romantic partners, friends, siblings, and acquaintances would allow a more in-depth evaluation of the factors that lead to better empathy. This could allow researchers to examine if utilising empathy is better based upon specific relationship elements, such as the length of time knowing their partner, perceived closeness, or relationship quality.

Another area of growth would be to examine the element of familiarity and relationships within a professional capacity. Investigating medical or social work professionals would be particularly interesting as they often have some element of empathy training within their education (Moudatsou et al., 2020). Alternatively, studying individuals in specific roles with frequent and diverse interactions with strangers, such as the police, would provide a unique insight into the variety of social interactions. It would be interesting to see if these regular social interactions would be impacted by the power and associations held by the police. While the contextual environment would remain the same, the nuances of

the social interaction would be incredibly different. Ultimately how the relationship between individuals' affects social interactions and empathy is a relatively new section of empathy literature with plenty of interesting avenues for future research.

Conclusion

In terms of addressing the overall research questions, the familiarity of dyads affected cognitive and self-reported affective empathy. Dyads who were familiar with one another produced higher cognitive and self-reported affective empathy values, suggesting that knowing one another was advantageous for these types of empathy. Further investigations of unfamiliar dyads demonstrated a similar result: that with time, unfamiliar dyads got better at empathising with one another across all types of empathy. These results tend to follow a consistent pattern that suggests spending time and developing a relationship or having an existing relationship generally equates to better empathising. This has important implications when you consider the value of maintaining meaningful relationships within a professional and personal setting. This would be particularly relevant for professionals who are constantly interacting with unfamiliar people, helping to enable them to better empathise and connect with the individuals around them.

There was no relationship between coldheartedness and any type of empathy. However, self-centred impulsivity showed the opposite; individuals with high scores of self-centred impulsivity would be expected to do worse when empathising with others. These findings suggest that self-centred impulsivity plays a major role for individuals high in psychopathic personality traits who experience empathy deficits. Knowing how the factors within psychopathic personality traits contribute to psychopathy more broadly will help to further our understanding and better inform treatment and empathy training for individuals high in psychopathic personality traits.

Contrary to the large pool of existing literature, this study found no gender difference for all types of empathy between men and women. It is proposed there is an unintentional bias occurring within empathy studies that draws on traditional gender roles. While this study was able to avoid this inadvertently, it highlights the need for more robust methodologies and procedures in future studies to strengthen empathy research. While there is not a vast amount of literature in this field of interest, adjacent subjects and research provided a solid foundation for exploring the broader mechanisms contributing to the effects observed within the study. Empathy, psychopathic personality traits, and familiarity research would benefit from additional studies exploring more specific elements within each topic in a more naturalistic environment. Understanding empathy better will help enable relationships to develop, and communities to come together as empathy ultimately sits at the heart of our human ability to connect with one another.

References

ADInstruments. (2020). Equivital wearable ECG starter pack. In (Vol. 187 KB): ADInstruments.

ADInstruments. (2021). *Lab chart*. In (Version 8.1.16)

Althubaiti, A. (2016). Information bias in health research: Definition, pitfalls, and adjustment methods. *Journal of Multidisciplinary Healthcare*, *9*(1), 211-217. https://doi.org/10.2147/JMDH.S104807

Archer, J. (2019). The reality and evolutionary significance of human psychological sex differences. *Biological reviews of the Cambridge Philosophical Society*, *94*(4), 1381-1415. https://doi.org/10.1111/brv.12507

Argyle, M., & Dean, J. (1965). Eye contant, distance and affiliation. *Sociometry*, *28*(3), 289–304. https://doi.org/10.2307/2786027

Argyle, M., Furnham, A., & Graham, J. A. (1981). *Social situations*. Cambridge University Press.

Aron, A., Melinat, E., Aron, E. N., Vallone, R. D., & Bator, R. J. (1997). The experimental generation of interpersonal closeness: A procedure and some preliminary findings. *Personality & Social Psychology Bulletin*, *23*(4), 363-377. https://doi.org/10.1177/0146167297234003

Babiak, P., Neumann, C. S., & Hare, R. D. (2010). Corporate psychopathy: Talking the walk. *Behavioral Sciences & the Law*, *28*(2), 174-193. https://doi.org/10.1002/bsl.925

Baez, S., Flichtentrei, D., Prats, M., Mastandueno, R., García, A. M., Cetkovich, M., & Ibáñez, A. (2017). Men, women...who cares? A population-based study on sex differences and gender roles in empathy and moral cognition. *PloS One*, *12*(6), e0179336. https://doi.org/10.1371/journal.pone.0179336

Balph, D. F., & Balph, M. H. (1983). On the psychology of watching birds: The problem of observer-expectancy bias. *The Auk*, *100*(3), 755-757. http://www.jstor.org/stable/4086487

Baum, N., Rahav, G., & Sharon, M. (2014). Heightened susceptibility to secondary traumatization: A meta-analysis of gender differences. *American Journal of Orthopsychiatry*, *84*(2), 111-122. https://doi.org/10.1037/h0099383

Beattie, G. (2003). Two separate languages? In *Visible thought: The new psychology of body language* (pp. 19 - 38). Routledge. https://doi.org/10.4324/9780203500026

Benenson, J. F., Gauthier, E., & Markovits, H. (2021). Girls exhibit greater empathy than boys following a minor accident. *Scientific Reports*, *11*(1), 7965-7965. https://doi.org/10.1038/s41598-021-87214-x

Benning, S. D., Patrick, C. J., Hicks, B. M., Blonigen, D. M., & Krueger, R. F. (2003). Factor structure of the Psychopathic Personality Inventory: Validity and implications for clinical assessment. *Psychological Assessment*, *15*(3), 340-350. https://doi.org/10.1037/1040-3590.15.3.340

Benning, S. D., Patrick, C. J., & Iacono, W. G. (2005). Psychopathy, startle blink modulation, and electrodermal reactivity in twin men. *Psychophysiology*, *42*(6), 753-762. https://doi.org/10.1111/j.1469-8986.2005.00353.x

Berg, J. M., Hecht, L. K., Latzman, R. D., & Lilienfeld, S. O. (2015). Examining the correlates of the coldheartedness factor of the Psychopathic Personality Inventory-Revised. *Psychological Assessment*, *27*(4), 1494-1499. https://doi.org/10.1037/pas0000129

Bird, G., & Viding, E. (2014). The self to other model of empathy: Providing a new framework for understanding empathy impairments in psychopathy, autism, and alexithymia. *Neuroscience and Biobehavioral Reviews*, *47*, 520-532. https://doi.org/10.1016/j.neubiorev.2014.09.021

Birdwhistell, R. L. (2011). *Kinesics and context: Essays on body motion communication*. University of Pennsylvania Press, Inc.

Blickle, G., & Genau-Hagebölling, H. A. (2022). Fearless Dominance: The Upside of Psychopathy? In. Oxford University Press. https://doi.org/10.1093/oso/9780197552759.003.0019

Boll, S., & Gamer, M. (2016). Psychopathic traits affect the visual exploration of facial expressions. *Biological Psychology*, *117*, 194-201. https://doi.org/10.1016/j.biopsycho.2016.03.010

Borke, H. (1973). The development of empathy in Chinese and American children between three and six years of age: A cross-cultural study. *Developmental Psychology*, *9*(1), 102-108. https://doi.org/10.1037/h0035080

Brook, M., & Kosson, D. S. (2013). Impaired cognitive empathy in criminal psychopathy: Evidence from a laboratory measure of empathic accuracy. *Journal of Abnormal Psychology*, *122*(1), 156-166. https://doi.org/10.1037/a0030261

Bzdok, D., Schilbach, L., Vogeley, K., Schneider, K., Laird, A. R., Langner, R., & Eickhoff, S. B. (2012). Parsing the neural correlates of moral cognition: ALE meta-analysis on morality, theory of mind, and empathy. *Brain Structure and Function*, *217*(4), 783-796. https://doi.org/10.1007/s00429-012-0380-y

Chattopadhyay, P. K., Bond, A. J., & Lader, M. H. (1975). Characteristics of galvanic skin response in anxiety states. *Journal of Psychiatric Research*, *12*(4), 265-270. https://doi.org/10.1016/0022-3956(75)90005-9

Christov-Moore, L., Simpson, E. A., Coudé, G., Grigaityte, K., Iacoboni, M., & Ferrari, P. F. (2014). Empathy: Gender effects in brain and behavior. *Neuroscience and Biobehavioral Reviews*, *46 pt 4*(4), 604-627. https://doi.org/10.1016/j.neubiorev.2014.09.001

Cleckley, H. (1941). *The mask of sanity: An attempt to clarify some issues about the so called psychopathic personality*. St. Louis: Mosby.

Cohen, J. (1988). *Statistical power analysis for the behavioral sciences* (2nd ed.). L. Erlbaum Associates.

Coid, J. W. (1992). DSM-III diagnosis in criminal psychopaths: A way forward. *Criminal Behaviour and Mental Health*, *2*(2), 78-94. https://doi.org/10.1002/cbm.1992.2.2.78

Cooke, J. (2016). The violations of empathy. *New Formations*, *89*, 153-169. https://doi.org/10.3898/NEWF:89/90.09.2016

Craig, M. C., Catani, M., Deeley, Q., Latham, R., Daly, E., Kanaan, R., Picchioni, M., McGuire, P. K., Fahy, T., & Murphy, D. G. M. (2009). Altered connections on the road to psychopathy [Report]. *Molecular Psychiatry*, *14*, 946+.

https://link.gale.com/apps/doc/A209408648/AONE?u=vuw&sid=bookmark-AONE&xid=fa76b30a

Davis, M. H. (1983). Measuring individual differences in empathy: Evidence for a multidimensional approach. *Journal of Personality and Social Psychology*, *44*(1), 113-126. https://doi.org/10.1037/0022-3514.44.1.113

Davis, M. H. (1994). *Empathy, a social psychological approach*. Routledge. https://doi.org/https://doi.org/10.4324/9780429493898

Dawel, A., O'Kearney, R., McKone, E., & Palermo, R. (2012). Not just fear and sadness: Meta-analytic evidence of pervasive emotion recognition deficits for facial and vocal expressions in psychopathy. *Neuroscience & Biobehavioral Reviews*, *36*(10), 2288-2304. https://doi.org/https://doi.org/10.1016/j.neubiorev.2012.08.006

De Brito, S. A., Forth, A. E., Baskin-Sommers, A. R., Brazil, I. A., Kimonis, E. R., Pardini, D., Frick, P. J., Blair, R. J. R., & Viding, E. (2021). Psychopathy. *Nature Reviews - Disease Primers*, *7*(1). https://doi.org/10.1038/s41572-021-00282-1

Decety, J., Chen, C., Harenski, C., & Kiehl, K. A. (2013). An fMRI study of affective perspective taking in individuals with psychopathy: Imagining another in pain does not evoke empathy. *Frontiers in Human Neuroscience*, *7*. https://doi.org/10.3389/fnhum.2013.00489

Devlin, H. C., Zaki, J., Ong, D. C., & Gruber, J. (2014). Not as good as you think? Trait positive emotion is associated with increased self-reported empathy but decreased empathic performance. *PloS One*, *9*(10), e110470-e110470. https://doi.org/10.1371/journal.pone.0110470

Drislane, L. E., Patrick, C. J., & Arsal, G. (2014). Clarifying the content coverage of differing psychopathy inventories through reference to the Triarchic Psychopathy Measure. *Psychological Assessment*, *26*(2), 350-362. https://doi.org/10.1037/a0035152

Eagly, A. H. (1987). *Sex differences in social behavior: A social-role interpretation*. Psychology Press. https://doi.org/10.4324/9780203781906

Edens, J., & McDermott, B. (2010). Examining the construct validity of the Psychopathic Personality Inventory-Revised: Preferential correlates of fearless dominance and self-centered impulsivity. *Psychological Assessment*, *22*(1), 32-42. https://doi.org/10.1037/a0018220

Eisenbarth, H., Hart, C. M., & Sedikides, C. (2018). Do psychopathic traits predict professional success? *Journal of Economic Psychology*, *64*, 130-139. https://doi.org/10.1016/j.joep.2018.01.002

Eisenbarth, H., Lilienfeld, S. O., & Yarkoni, T. (2015). Using a genetic algorithm to abbreviate the Psychopathic Personality Inventory–Revised (PPI-R). *Psychological Assessment*, *27*(1), 194-202. https://doi.org/http://dx.doi.org/10.1037/pas0000032

Eisenberg, N., & Lennon, R. (1983). Sex differences in empathy and related capacities. *Psychological Bulletin*, *94*(1), 100-131. https://doi.org/10.1037/0033-2909.94.1.100

Elliott, R., Bohart, A. C., Watson, J. C., & Greenberg, L. S. (2011). Empathy. *Psychotherapy*, *48*(1), 43-49. https://doi.org/10.1037/a0022187

Evans, L., & Tully, R. J. (2015). The triarchic psychopathy measure (TriPM): Alternative to the PCL-R? *Aggression and Violent Behavior*, *27*, 79-86. https://doi.org/10.1016/j.avb.2016.03.004

Eyuboglu, M., Baykara, B., & Eyuboglu, D. (2018). Broad autism phenotype: theory of mind and empathy skills in unaffected siblings of children with autism spectrum disorder. *Psychiatry and Clinical Psychopharmacology*, *28*(1), 36-42. https://doi.org/10.1080/24750573.2017.1379714

Farnsworth, B. (2018). What is GSR (galvanic skin response) and how does it work? *IMOTIONS*.

Fowler, Z., Law, K. F., & Gaesser, B. (2021). Against empathy bias: The moral value of equitable empathy. *Psychological Science*, *32*(5), 766-779. https://doi.org/10.1177/0956797620979965

Frith, C. D., & Frith, U. (1999). Interacting minds - A biological basis. *Science (American Association for the Advancement of Science)*, *286*(5445), 1692-1695. https://doi.org/10.1126/science.286.5445.1692

Gal, D., Rucker, D. D., & Shavitt, S. (2018). The loss of loss aversion: Will it loom larger than its gain? *Journal of Consumer Psychology*, *28*(3), 497-516. https://doi.org/10.1002/jcpy.1047

Gallese, V. (2003). The roots of empathy: The shared manifold hypothesis and the neural basis of intersubjectivity. *Psychopathology*, *36*(4), 171-180. https://doi.org/10.1159/000072786

Gaughan, E. T., Miller, J. D., Pryor, L. R., & Lynam, D. R. (2009). Comparing two alternative measures of general personality in the assessment of psychopathy: A test of the NEO PI-R and the MPQ. *Journal of Personality*, *77*(4), 965-996. https://doi.org/10.1111/j.1467-6494.2009.00571.x

Gehrer, N. A., Duchowski, A. T., Jusyte, A., & Schönenberg, M. (2020). Eye contact during live social interaction in incarcerated psychopathic offenders. *Personality Disorders, 11*(6), 431-439. https://doi.org/10.1037/per0000400

Gerdes, K. E., Segal, E. A., & Lietz, C. A. (2010). Conceptualising and measuring empathy. *The British Journal of Social Work, 40*(7), 2326-2343. https://doi.org/10.1093/bjsw/bcq048

Glover, G. H. (2011). Overview of functional magnetic resonance imaging. *Neurosurgery Clinics, 22*(2), 133-139, vii. https://doi.org/10.1016/j.nec.2010.11.001

Gordon, I., Gilboa, A., Cohen, S., Milstein, N., Haimovich, N., Pinhasi, S., & Siegman, S. (2020). Physiological and behavioral synchrony predict group cohesion and performance. *Scientific Reports, 10*(1), 8484-8484. https://doi.org/10.1038/s41598-020-65670-1

Grahe, J. E., & Bernieri, F. J. (1999). The importance of nonverbal cues in judging rapport. *Journal of Nonverbal Behavior, 23*(4), 253-269. https://doi.org/10.1023/A:1021698725361

Güroğlu, B., Van Lieshout, C. F. M., Haselager, G. J. T., & Scholte, R. H. J. (2007). Similarity and complementarity of behavioral profiles of friendship types and types of friends: Friendships and psychosocial adjustment. *Journal of Research on Adolescence, 17*(2), 357-386. https://doi.org/10.1111/j.1532-7795.2007.00526.x

Hampson, M., Ruiz, S., & Ushiba, J. (2020). Neurofeedback. *NeuroImage, 218,* 116473. https://doi.org/https://doi.org/10.1016/j.neuroimage.2019.116473

Hare, R. D. (1980). A research scale for the assessment of psychopathy in criminal populations. *Personality and Individual Differences*, *1*(2), 111-119. https://doi.org/10.1016/0191-8869(80)90028-8

Hintze, A., Olson, R. S., Adami, C., & Hertwig, R. (2015). Risk sensitivity as an evolutionary adaptation. *Scientific Reports*, *5*(1), 8242. https://doi.org/10.1038/srep08242

Hirschtritt, M. E., Carroll, J. D., & Ross, D. A. (2018). Using neuroscience to make sense of psychopathy. *Biological Psychiatry (1969)*, *84*(9), e61-e63. https://doi.org/10.1016/j.biopsych.2018.08.012

Hobson, J., & Shines, J. (1998). Measurement of psychopathy in a UK prison population referred for long-term psychotherapy. *British Journal of Criminology*, *38*(3), 504-515. https://doi.org/10.1093/oxfordjournals.bjc.a014260

Hoffman, L. W. (1977). Changes in family roles, socialization, and sex differences. *The American Psychologist*, *32*(8), 644-657. https://doi.org/10.1037/0003-066X.32.8.644

Hofmann, S., Asnaani, A., Vonk, I., Sawyer, A., & Fang, A. (2012). The efficacy of cognitive behavioral therapy: A review of meta-analyses. *Cognitive Therapy and Research*, *36*(5), 427-440. https://doi.org/10.1007/s10608-012-9476-1

Holopainen, A., de Veld, D. M. J., Hoddenbach, E., & Begeer, S. (2019). Does theory of mind training enhance empathy in autism? *Journal of Autism and Developmental Disorders*, *49*(10), 3965-3972. https://doi.org/10.1007/s10803-018-3671-1

Hudson, J. A., Fivush, R., & Kuebli, J. (1992). Scripts and episodes: The development of event memory. *Applied Cognitive Psychology*, *6*(6), 483-505. https://doi.org/10.1002/acp.2350060604

Ickes, W., & Tooke, W. (1988a). The observational method: Studying the interaction of minds and bodies.

Ickes, W., & Tooke, W. (1988b). The observational method: Studying the interaction of minds and bodies. *Handbook of Personal Relationships: Theory, Research and Interventions*, 79 - 97.

Jacinto, L. R., Reis, J. S., Dias, N. S., Cerqueira, J. J., Correia, J. H., & Sousa, N. (2013). Stress affects theta activity in limbic networks and impairs novelty-induced exploration and familiarization. *Frontiers in Behavioral Neuroscience*, *7*, 127. https://doi.org/10.3389/fnbeh.2013.00127

Jackson, P. L., & Decety, J. (2004). Motor cognition: A new paradigm to study self–other interactions. *Current Opinion in Neurobiology*, *14*(2), 259-263. https://doi.org/10.1016/j.conb.2004.01.020

Jacobson, A. J. (2009). Empathy and instinct: Cognitive neuroscience and folk psychology. *Inquiry (Oslo)*, *52*(5), 467-482. https://doi.org/10.1080/00201740903302618

Kalisch, B. J. (1973). What is empathy? *The American Journal of Nursing*, *73*(9), 1548-1552. https://doi.org/10.1097/00000446-197309000-00034

Karniol, R., Gabay, R., Ochion, Y., & Harari, Y. (1998). Is gender or gender-role orientation a better predictor of empathy in adolescence? *Sex Roles*, *39*(1), 45-59. https://doi.org/10.1023/A:1018825732154

Kerr-Gaffney, J., Harrison, A., & Tchanturia, K. (2019). Cognitive and affective empathy in eating disorders: A systematic review and meta-analysis. *Frontiers in Psychiatry*, *10*, 102-102. https://doi.org/10.3389/fpsyt.2019.00102

Kessler, R. C., & McLeod, J. D. (1984). Sex differences in vulnerability to undesirable life events. *American Sociological Review*, *49*(5), 620-631. https://doi.org/10.2307/2095420

Kiehl, K. A. (2006). A cognitive neuroscience perspective on psychopathy: Evidence for paralimbic system dysfunction. *Psychiatry Research*, *142*(2), 107-128. https://doi.org/https://doi.org/10.1016/j.psychres.2005.09.013

Kiehl, K. A., & Hoffman, M. B. (2011). The criminal psychopath: History, neuroscience, treatment, and economics. *Jurimetrics Journal of Law, Science and Technology*, *51*(4), 355-397. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4059069/

Kim, J. Y., Choi, J. K., Han, W. H., & Kim, J. H. (2021). The influence of users' spatial familiarity on their emotional perception of space and wayfinding movement patterns. *Sensors*, *21*(8), 2583. https://doi.org/10.3390/s21082583

Koenig, A. M., & Eagly, A. H. (2014). Evidence for the social role theory of stereotype content: Observations of groups' roles shape stereotypes. *Journal of Personality and Social Psychology*, *107*(3), 371-392. https://doi.org/10.1037/a0037215

Kraemer, M., Herold, M., Uekermann, J., Kis, B., Wiltfang, J., Daum, I., Dziobek, I., Berlit, P., Diehl, R. R., & Abdel-Hamid, M. (2012). Theory of mind and empathy in patients at an early stage of relapsing remitting multiple sclerosis. *Clinical Neurology and Neurosurgery*, *115*(7), 1016-1022. https://doi.org/10.1016/j.clineuro.2012.10.027

Lanzoni, S. (2018). Conclusion. In *Empathy* (pp. 277-280). Yale University Press. https://doi.org/10.2307/j.ctv5cgb7s.15

Latif, N., Barbosa, A. V., Vatiokiotis-Bateson, E., Castelhano, M. S., & Munhall, K. G. (2014). Movement coordination during conversation [Article]. *PLoS One*, *9*(8). https://doi.org/10.1371/journal.pone.0105036

Laurent, S. M., & Hodges, S. D. (2008). Gender roles and empathic accuracy: The role of communion in reading minds. *Sex Roles*, *60*(5-6), 387-398. https://doi.org/10.1007/s11199-008-9544-x

Lazarus, R. S. (1991). *Emotion and adaptation*. Oxford University Press.

Lee, Y., & Kim, J. (2020). Psychopathic traits and different types of criminal behavior: An assessment of direct effects and mediating processes. *Journal of Criminal Justice*, 101772. https://doi.org/https://doi.org/10.1016/j.jcrimjus.2020.101772

Lilienfeld, S. O., & Andrews, B. P. (1996). Development and preliminary validation of a self-report measure of psychopathic personality traits in noncriminal population. *Journal of Personality Assessment*, *66*(3), 488-524. https://doi.org/10.1207/s15327752jpa6603_3

Lilienfeld, S. O., & Widows, M. R. (2005). *Psychopathy Personality Inventory Revised (PPI-R). Professional manual*. Lutz, FL: Psychological Assessment Resources.

Ling, S., & Raine, A. (2018). The neuroscience of psychopathy and forensic implications. *Psychology, Crime & Law*, *24*(3), 296-312. https://doi.org/10.1080/1068316X.2017.1419243

Lishner, D. A., Vitacco, M. J., Hong, P. Y., Mosley, J., Miska, K., & Stocks, E. L. (2012). Evaluating the relation between psychopathy and affective empathy: Two preliminary

studies. *International Journal of Offender Therapy and Comparative Criminology*, *56*(8), 1161-1181. https://doi.org/10.1177/0306624X11421891

Litvack-Miller, W., McDougall, D., & Romney, D. M. (1997). The structure of empathy during middle childhood and its relationship to prosocial behavior. *Genetic, Social, and General Psychology Monographs*, *123*(3), 303-324.

Löffler, C. S., & Greitemeyer, T. (2021). Are women the more empathetic gender? The effects of gender role expectations. *Current Psychology*. https://doi.org/10.1007/s12144-020-01260-8

Lovett, B. J., & Sheffield, R. A. (2007). Affective empathy deficits in aggressive children and adolescents: A critical review. *Clinical Psychology Review*, *27*(1), 1-13. https://doi.org/10.1016/j.cpr.2006.03.003

Marangoni, C., Garcia, S., Ickes, W., & Teng, G. (1995). Empathic accuracy in a clinically relevant setting. *Journal of Personality and Social Psychology*, *68*(5), 854-869. https://doi.org/10.1037/0022-3514.68.5.854

Marsh, A. A. (2018). The neuroscience of empathy. *Current Opinion in Behavioral Sciences*, *19*, 110-115. https://doi.org/10.1016/j.cobeha.2017.12.016

Martin-Key, N., Brown, T., & Fairchild, G. (2016). Empathic accuracy in male adolescents with conduct disorder and higher versus lower levels of callous-unemotional traits. *Journal of Abnormal Child Psychology*, *45*(7), 1385-1397. https://doi.org/10.1007/s10802-016-0243-8

Mast, M., & Ickes, W. (2007). Empathic accuracy: Measurement and potential clinical applications. In *Empathy in Mental Illness* (pp. 408-427). Cambridge University Press. https://doi.org/10.1017/CBO9780511543753.023

Mather, L., & Yngvesson, B. (1980). Language, audience, and the transformation of disputes. *Law & Society Review*, *15*(3/4), 775-821. https://doi.org/10.2307/3053512

Matsumoto, D., Frank, M. G., & Hwang, H. (2012). Reading people: Introduction to the world of nonverbal behavior. In *Nonverbal Communication: Science and Applications* (pp. 3 - 14). SAGE Publications.

Maurage, P., Grynberg, D., Noël, X., Joassin, F., Philippot, P., Hanak, C., Verbanck, P., Luminet, O., de Timary, P., & Campanella, S. (2011). Dissociation between affective and cognitive empathy in alcoholism: A specific deficit for the emotional dimension. *Alcoholism Clinical and Experimental Research*, *35*(9), 1662-1668. https://doi.org/10.1111/j.1530-0277.2011.01512.x

Mazza, M., Pino, M. C., Mariano, M., Tempesta, D., Ferrara, M., De Berardis, D., Masedu, F., & Valenti, M. (2014). Affective and cognitive empathy in adolescents with autism spectrum disorder [Original Research]. *Frontiers in Human Neuroscience*, *8*. https://doi.org/10.3389/fnhum.2014.00791

McCarthy Veach, P., LeRoy, B. S., & Callanan, N. P. (2018). Listening to patients: Primary empathy skills. In P. McCarthy Veach, B. S. LeRoy, & N. P. Callanan (Eds.), *Facilitating the Genetic Counseling Process: Practice-Based Skills* (pp. 77-110). Springer International Publishing. https://doi.org/10.1007/978-3-319-74799-6_4

Mehrabian, A. (1996). *Manual for the balanced emotional empathy scale (BEES)*. (Available from Albert Mehrabian, 1130 Alta Mesa Road, Monterey, CA, USA 93940)

Miller, J. D., & Lynam, D. R. (2012). An examination of the psychopathic personality inventory's nomological network: A meta-analytic review. *Personality Disorders*, *3*(3), 305-326. https://doi.org/10.1037/a0024567

Modic, M. B., & Schoessler, M. (2010). Empathy. *Journal for Nurses in Staff Development*, *26*(2), 88-89. https://doi.org/10.1097/NND.0b013e3181d4d44b

Moudatsou, M., Stavropoulou, A., Philalithis, A., & Koukouli, S. (2020). The role of empathy in health and social care professionals. *Healthcare (Basel)*, *8*(1), 26. https://doi.org/10.3390/healthcare8010026

Overgaauw, S., Jansen, M., & de Bruijn, E. R. A. (2020). Self-centered or other-directed: Neural correlates of performance monitoring are dependent on psychopathic traits and social context. *Cortex*, *129*, 199-210. https://doi.org/https://doi.org/10.1016/j.cortex.2020.01.030

Owens, E. S., McPharlin, F. W. H., Brooks, N., & Fritzon, K. (2018). The effects of empathy, emotional intelligence and psychopathy on interpersonal interactions. *Psychiatry, Psychology, and Law*, *25*(1), 1-18. https://doi.org/10.1080/13218719.2017.1347936

Palmer, J. (2018). Empathy. *Brock education*, *27*(2), 34 - 37. https://doi.org/10.26522/brocked.v27i2.574

Patrick, C. (2010). Operationalising the triarchic conceptualisation of psychopathy: Preliminary description of brief scales for assessment of boldness meanness and disinhibition. In.

Patrick, C. J., & Drislane, L. E. (2015). Triarchic Model of Psychopathy: Origins, operationalizations, and observed linkages with personality and general

psychopathology. *Journal of personality*, *83*(6), 627-643. https://doi.org/10.1111/jopy.12119

Patrick, C. J., Fowles, D. C., & Krueger, R. F. (2009). Triarchic conceptualization of psychopathy: Developmental origins of disinhibition, boldness, and meanness. *Development and Psychopathology*, *21*(3), 913-938. https://doi.org/10.1017/S0954579409000492

Pérez, B., Herrero, J., Velasco, J., & Rodriguez-Díaz, F. J. (2015). A contrastive analysis of the factorial structure of the PCL-R: Which model fits best the data? *The European Journal of Psychology Applied to Legal Context*, *7*(1), 23-30. https://doi.org/10.1016/j.ejpal.2014.10.001

Pfabigan, D. M., Seidel, E.-M., Wucherer, A. M., Keckeis, K., Derntl, B., & Lamm, C. (2015). Affective empathy differs in male violent offenders with high- and low-trait psychopathy. *Journal of Personality Disorders*, *29*(1), 42-61. https://doi.org/10.1521/pedi_2014_28_145

Popova, T., & Wiese, H. (2022). The time it takes to truly know someone: Neurophysiological correlates of face and identity learning during the first two years. *Biological Psychology*, *170*, 108312. https://doi.org/https://doi.org/10.1016/j.biopsycho.2022.108312

Preston, O. C., & Anestis, J. C. (2019). The indirect relationships between psychopathic traits and proactive and reactive aggression through empathy and emotion dysregulation. *Journal of Psychopathology and Behavioral Assessment*, *42*(3), 409-423. https://doi.org/10.1007/s10862-019-09760-z

Preston, S. D., & de Waal, F. B. M. (2002). Empathy: Its ultimate and proximate bases. *The Behavioral and Brain Sciences*, *25*(1), 1-20. https://doi.org/10.1017/S0140525X02000018

Purves, D., Augustine, G. J., Fitzpatrick, D., Katz, L. C., LaMantia, A.-S., McNamara, J., & Willaims, M. (2001). *Neuroscience* (2 ed.).

RStudio. (2021). *R: A language and environment for statistical computing*. In (Version 4.0.5) R Core Team. https://www.R-project.org

Ruby, P., & Decety, J. (2004). How would you feel versus how do you think she would feel? A neuroimaging study of perspective-taking with social emotions. *Journal of Cognitive Neuroscience*, *16*(6), 988-999. https://doi.org/10.1162/0898929041502661

Ruchensky, J. R., Edens, J. F., Donnellan, M. B., & Witt, E. A. (2017). Examining the reliability and validity of an abbreviated Psychopathic Personality Inventory-Revised (PPI-R) in four samples. *Psychological Assessment*, *29*(2), 238-244. https://doi.org/10.1037/pas0000335

Rum, Y., & Perry, A. (2020). Empathic accuracy in clinical populations. *Frontiers in Psychiatry*, *11*, 457-457. https://doi.org/10.3389/fpsyt.2020.00457

Rutgen, M., Seidel, E.-M., Silani, G., Riecansky, I., Hummer, A., Windischberger, C., Petrovic, P., & Lamm, C. (2015). Placebo analgesia and its opioidergic regulation suggest that empathy for pain is grounded in self pain. *Proceedings of the National Academy of Sciences - PNAS*, *112*(41), E5638-E5646. https://doi.org/10.1073/pnas.1511269112 (PNAS Plus)

Sagi, A., & Hoffman, M. L. (1976). Empathic distress in the newborn. *Developmental Psychology*, *12*(2), 175-176. https://doi.org/10.1037/0012-1649.12.2.175

Salmon, E., Bernard Ir, C., & Hustinx, R. (2015). Pitfalls and limitations of PET/CT in brain imaging. *Seminars in Nuclear Medicine*, *45*(6), 541-551. https://doi.org/https://doi.org/10.1053/j.semnuclmed.2015.03.008

Sathaporn, K., & Pitanupong, J. (2022). Factors associated with the improvement of the empathy levels among clinical-year medical students in southern Thailand: A university-based cross-sectional study. *BMC Psychology*, *10*(1), 128-128. https://doi.org/10.1186/s40359-022-00842-4

Schmitz, B. L., Aschoff, A. J., Hoffmann, M. H. K., & GrÖN, G. (2005). Advantages and pitfalls in 3T MR brain imaging : A pictorial review. *American Journal of Neuroradiology*, *26*(9), 2229-2237.

Scrafton, S. (2015). *Familiarity in natural behaviour: Effect of task, objects and environment on gaze allocation* ProQuest Dissertations Publishing].

Seara-Cardoso, A., Dolberg, H., Neumann, C., Roiser, J. P., & Viding, E. (2013). Empathy, morality and psychopathic traits in women. *Personality and Individual Differences*, *55*(3), 328-333. https://doi.org/10.1016/j.paid.2013.03.011

Seara-Cardoso, A., Viding, E., Lickley, R. A., & Sebastian, C. L. (2015). Neural responses to others' pain vary with psychopathic traits in healthy adult males. *Cognitive, Affective, & Behavioral Neuroscience*, *15*(3), 578-588. https://doi.org/10.3758/s13415-015-0346-7

Segal, E. A., Gerdes, K. E., Lietz, C. A., Wagaman, A., & Geiger, J. M. (2017). *Assessing empathy*. Columbia University Press.

Segal, N. L., Hershberger, S. L., & Arad, S. (2003). Meeting one's twin: Perceived social closeness and familiarity. *Evolutionary Psychology*, *1*(1). https://doi.org/10.1177/147470490300100105

Seibert, L. A., Miller, J. D., Few, L. R., Zeichner, A., & Lynam, D. R. (2011). An examination of the structure of self-report psychopathy measures and their relations with general traits and externalizing behaviors. *Personality Disorders*, *2*(3), 193-208. https://doi.org/10.1037/a0019232

Sellbom, M., & Drislane, L. E. (2021). The classification of psychopathy. *Aggression and Violent Behavior*, *59*. https://doi.org/10.1016/j.avb.2020.101473

Sellbom, M., & Phillips, T. R. (2013). An examination of the triarchic conceptualization of psychopathy in incarcerated and nonincarcerated samples. *Journal of Abnormal Psychology*, *122*(1), 208-214. https://doi.org/10.1037/a0029306

Sest, N., & March, E. (2017). Constructing the cyber-troll: Psychopathy, sadism, and empathy. *Personality and Individual Differences*, *119*, 69-72. https://doi.org/10.1016/j.paid.2017.06.038

Shamay-Tsoory, S. G., Aharon-Peretz, J., & Perry, D. (2009). Two systems for empathy: A double dissociation between emotional and cognitive empathy in inferior frontal gyrus versus ventromedial prefrontal lesions. *Brain*, *132*(3), 617-627. https://doi.org/10.1093/brain/awn279

Sharma, M., Kacker, S., & Sharma, M. (2016). A brief introduction and review on galvanic skin response. *International Journal of Medical Research Professionals*. https://doi.org/10.21276/ijmrp

Singer, T., & Lamm, C. (2009). The social neuroscience of empathy. *The Year in Cognitive Neuroscience 2009*, *1156*(1), 81 - 96.

Singer, T., & Tusche, A. (2014). Understanding others: Brain mechanisms of theory of mind and empathy. In P. W. Glimcher & E. Fehr (Eds.), *Neuroeconomics* (2 ed., pp. 513-532). Academic Press. https://doi.org/https://doi.org/10.1016/B978-0-12-416008-8.00027-9

Somma, A., Borroni, S., Drislane, L., Patrick, C., & Fossati, A. (2018). Modeling the structure of the Triarchic Psychopathy Measure: Conceptual, empirical, and analytic considerations. *Journal of Personality Disorders*, *33*, 1-27. https://doi.org/10.1521/pedi_2018_32_354

Testori, M., Hoyle, R. B., & Eisenbarth, H. (2019). How group composition affects cooperation in fixed networks: Can psychopathic traits influence group dynamics? *Royal Society Open Science*, *6*(3). https://doi.org/10.1098/rsos.181329

Vachon, D. D., & Lynam, D. R. (2016). Fixing the problem with empathy: Development and validation of the Affective and Cognitive Measure of Empathy. *Assessment*, *23*(2), 135-149. https://doi.org/10.1177/1073191114567941

Van Dongen, J. D. M. (2020). The empathic brain of psychopaths: From social science to neuroscience in empathy [Brief article]. *Frontiers in Psychology*, NA. https://link.gale.com/apps/doc/A621054763/PPPC?u=vuw&sid=bookmark-PPPC&xid=70de7f0d

van Dongen, J. D. M., slane, L. E., Nijman, H., Soe-Agnie, S. E., & Marle, H. (2017). Further evidence for reliability and validity of the Triarchic Psychopathy Measure in a forensic sample and a community sample. *Journal of Psychopathology and Behavioral Assessment, 39*(1), 58-66. https://doi.org/10.1007/s10862-016-9567-5

van Donkersgoed, R. J. M., de Jong, S., aan het Rot, M., Wunderink, L., Lysaker, P. H., Hasson-Ohayon, I., Aleman, A., & Pijnenborg, G. H. M. (2019). Measuring empathy in schizophrenia: The empathic accuracy task and its correlation with other empathy measures. *Schizophrenia Research, 208*, 153-159. https://doi.org/10.1016/j.schres.2019.03.024

Vaughn, M. G., & DeLisi, M. (2008). Were Wolfgang's chronic offenders psychopaths? On the convergent validity between psychopathy and career criminality. *Journal of Criminal Justice, 36*(1), 33-42. https://doi.org/10.1016/j.jcrimjus.2007.12.008

Viding, E., McCrory, E., & Seara-Cardoso, A. (2014). Psychopathy. *Current Biology, 24*(18), R871-R874. https://doi.org/10.1016/j.cub.2014.06.055

Vitacco, M. J., Lishner, D. A., Gay, J. G., & Trice, A. (2019). Psychopathy and empathy. In M. Delisi (Ed.), *Routledge International Handbook of Psychopathy and Crime* (1 ed., pp. 46-57). Routledge. https://doi.org/10.4324/9781315111476-4

Völlm, B. A., Taylor, A. N. W., Richardson, P., Corcoran, R., Stirling, J., McKie, S., Deakin, J. F. W., & Elliott, R. (2006). Neuronal correlates of theory of mind and empathy: A functional magnetic resonance imaging study in a nonverbal task. *NeuroImage, 29*(1), 90-98. https://doi.org/https://doi.org/10.1016/j.neuroimage.2005.07.022

Wahlund, K., & Kristiansson, M. (2009). Aggression, psychopathy and brain imaging — Review and future recommendations. *International Journal of Law and Psychiatry*, *32*(4), 266-271. https://doi.org/10.1016/j.ijlp.2009.04.007

Walter, H. (2012). Social cognitive neuroscience of empathy: Concepts, circuits, and genes. *Emotion Review*, *4*(1), 9-17. https://doi.org/10.1177/1754073911421379

Warren, G. C., & Clarbour, J. (2009). Relationship between psychopathy and indirect aggression use in a noncriminal population. *Aggressive Behavior*, *35*(5), 408-421. https://doi.org/10.1002/ab.20317

Wiltermuth, S. S., & Heath, C. (2009). Synchrony and cooperation. *Psychological Science*, *20*(1), 1-5. https://doi.org/10.1111/j.1467-9280.2008.02253.x

Xie, E., Yin, Q., Li, K., Nastase, S. A., Zhang, R., Wang, N., & Li, X. (2021). Sharing happy stories increases interpersonal closeness: Interpersonal brain synchronization as a neural indicator. *eNeuro*, *8*(6), ENEURO.0245-0221.2021. https://doi.org/10.1523/ENEURO.0245-21.2021

Yeh, Z. T., & Tsai, C. F. (2014). Impairment on theory of mind and empathy in patients with stroke. *Psychiatry and Clinical Neurosciences*, *68*(8), 612-620. https://doi.org/10.1111/pcn.12173

Yu, C. L., & Chou, T. L. (2018). A dual route model of empathy: A neurobiological prospective. *Frontiers in Psychology*, *9*(2212). https://doi.org/10.3389/fpsyg.2018.02212

Zadbood, A., Chen, J., Leong, Y. C., Norman, K. A., & Hasson, U. (2017). How we transmit memories to other brains: Constructing shared neural representations via

communication. *Cerebral Cortex*, *27*(10), 4988-5000. https://doi.org/10.1093/cercor/bhx202

Zaki, J. (2017). Moving beyond stereotypes of empathy. *Trends in Cognitive Sciences*, *21*(2), 59-60. https://doi.org/10.1016/j.tics.2016.12.004

Zaki, J., Bolger, N., & Ochsner, K. (2008). It takes two: The interpersonal nature of empathic accuracy. *Psychological Science*, *19*(4), 399-404. https://doi.org/10.1111/j.1467-9280.2008.02099.x

Zaki, J., Bolger, N., & Ochsner, K. (2009). Unpacking the informational bases of empathic accuracy. *Emotion*, *9*(4), 478-487. https://doi.org/10.1037/a0016551

Zaki, J., & Ochsner, K. N. (2012). The neuroscience of empathy: Progress, pitfalls and promise. *Nature Neuroscience*, *15*(5), 675-680. https://doi.org/10.1038/nn.3085

Zaki, J., Ochsner, K. N., & Ochsner, K. (2012). The neuroscience of empathy: Progress, pitfalls and promise. *Nature Neuroscience*, *15*(5), 675-680. https://doi.org/10.1038/nn.3085

Zamir, E. (2014). The psychology of loss aversion. In *Law, psychology, and morality: the role of loss aversion*. Oxford University Press.

Appendix A

Flyer Advertising the Study

Let's chat, for science?

TAKE PART IN RESEARCH ON

EMOTIONAL COMMUNICATION

HELP US UNDERSTAND DEEP & MEANINGFUL CONVERSATIONS USING MOTION CAPTURE TECHNOLOGY.

WE HAVE $48 NEW WORLD VOUCHERS FOR ANYONE WILLING TO WEAR A DATA COLLECTION SUIT, CHAT TO A PARTNER ABOUT MEANINGFUL PAST EVENTS, AND ANSWER QUESTIONAIRES.

IF YOU ARE AVAILABLE WEEKDAYS AND CAN SPARE FOUR HOURS FOR THIS RESEARCH, PLEASE EMAIL:
AFCRINLAB@GMAIL.COM
WITH THE SUBJECT HEADER:
EMOTION
OR FOLLOW THE QR CODE...

Appendix B

Demographic Questionnaire

A

TE WHARE WĀNANGA O TE ŪPOKO O TE IKA A MĀUI
VICTORIA
UNIVERSITY OF WELLINGTON

Investigating interaction in pairs (E-motion)
#0000027455

Demographics questionnaire

Please fill out the following questions.

1. How old are you?

_____

2. What gender do you identify (most) with?
- ☐ Female
- ☐ Male
- ☐ Other (please specify) _____

3. What is your main profession?
- ☐ Manager
- ☐ Professional
- ☐ Technician and associate professional
- ☐ Clerical support worker
- ☐ Service and sales worker
- ☐ Skilled agricultural, forestry and fishery worker
- ☐ Craft and related trades worker
- ☐ Plant and machine operator, and assembler
- ☐ Elementary occupation
- ☐ Armed forces occupation
- ☐ Student
- ☐ Other (please specify) _____

4. What is your highest completed education level?
- ☐ No formal education
- ☐ Primary education
- ☐ Secondary education or high school
- ☐ Vocational qualification
- ☐ Bachelor's degree
- ☐ Master's degree
- ☐ Doctorate or higher
- ☐ Other (please specify) _____

Appendix C

Consent Form

A

TE WHARE WĀNANGA O TE ŪPOKO O TE IKA A MĀUI
VICTORIA
UNIVERSITY OF WELLINGTON

Investigating interaction in pairs (E-motion)
#0000027455

Information Sheet

Principal investigator: Dr. Hedwig Eisenbarth
School of Psychology
Victoria University of Wellington
Email: Hedwig.Eisenbarth@vuw.ac.nz
Phone: 04 463 9541

What is the purpose of this research?
This research will explore how motion capture can be used to understand interaction during emotional sharing exercises.

Who is conducting the research?
We are researchers from Victoria University of Wellington's School of Psychology and School of Design. Dr. Eisenbarth is supervising this project, alongside Areito Echevarria. It will be administered by Daniela Egersdoerfer and MacGregor Pipson. This research has been approved by the School of Psychology's Human Ethics Committee under delegated authority of Victoria University of Wellington's Human Ethics Committee.

What is involved if you agree to participate?

- You will spend approximately forty minutes sharing stories, both positive and negative, about your life.
- During this sharing exercise, you will be wearing a motion capture suit and devices that will measure your heart rate and skin conductance. To help you correctly put on

A

the motion capture suit and the measurement devices, you should be comfortable with a researcher touching you below your waist (hip bones, feet).

- You will also be wearing a head mounted camera that captures your facial movements. For the camera to detect your facial features, we will need to draw some dots on your face (using a cosmetic pen that can easily be removed afterwards).
- After the sharing exercise you'll be asked individually about some of your thoughts while sharing. A video recording of the exercise will be used as a prompt for some questions.
- While watching the video, you will be able to anonymise (bleep out) parts of the data that could identify you.
- You will be compensated with a $10 voucher for every hour you spend in the project.
- You will likely spend two hours completing the sharing exercise and surveys.
- Any time you are feeling uncomfortable, you are welcome to leave the exercise. You will still receive vouchers, even if you leave.

Privacy and Confidentiality

- You will never be identified in any research project, presentation, or publication. The data you provide will be coded by number only.
- So that audio data cannot be used to identify you, you will be welcome to point out names and details to the researchers and they will bleep these parts.
- So that video data cannot be used to identify you, your face in the footage will be blurred.
- In accordance with the requirements of some scientific journals and organizations, your anonymous data may be shared with other researchers and posted online as data with no identifying information.
- Data without identifying information will be kept indefinitely, may be used in other studies and may be made available in open science online platforms.
- A copy of the data, without identifying information, will indefinitely remain in the custody of both Hedwig Eisenbarth and Areito Echevarria, and their research teams.

What happens to the information that you provide?

The data you provide may be used for one or more of the following purposes:

- The overall findings may be submitted for publication in a scientific journal, or presented at scientific conferences.

A

- The overall findings may form part of a PhD Thesis, Masters Thesis, or Honours research project that will be submitted for assessment.
- The Data may be used in programing CGI.

What if this turns out to be stressful?

These exercises are in an artificial setting but tap into real emotion. A lot of emotions are delicate, they can make an experience really good, but also have the potential to go bad. If you feel like this went terribly, we'd love you to have a second round with a professional partner. Some contact details that can point you in the right direction are below.

- Thelowdown.com has excellent information on how to seek help, as well as a telephone counselling service that can be reached on 0800 111 757, free-text on 5626 or messaged through their website.
- Talkingworks.co.nz also has a directory of local counsellors, psychologists and psychotherapists.
- *Need to talk?* provides trained counsellors that can be free called or texted on 1737 any time.

If you would like to get more information about the study please email hedwig.eisenbarth@vuw.ac.nz. If you have any concerns about the ethical conduct of the research, you may contact the Victoria University HEC Convener: Dr Judith Loveridge. Email hec@vuw.ac.nz or telephone +64 4 463 6028.

Please turn page over

A

Investigating interaction in pairs (E-motion)
#0000027455

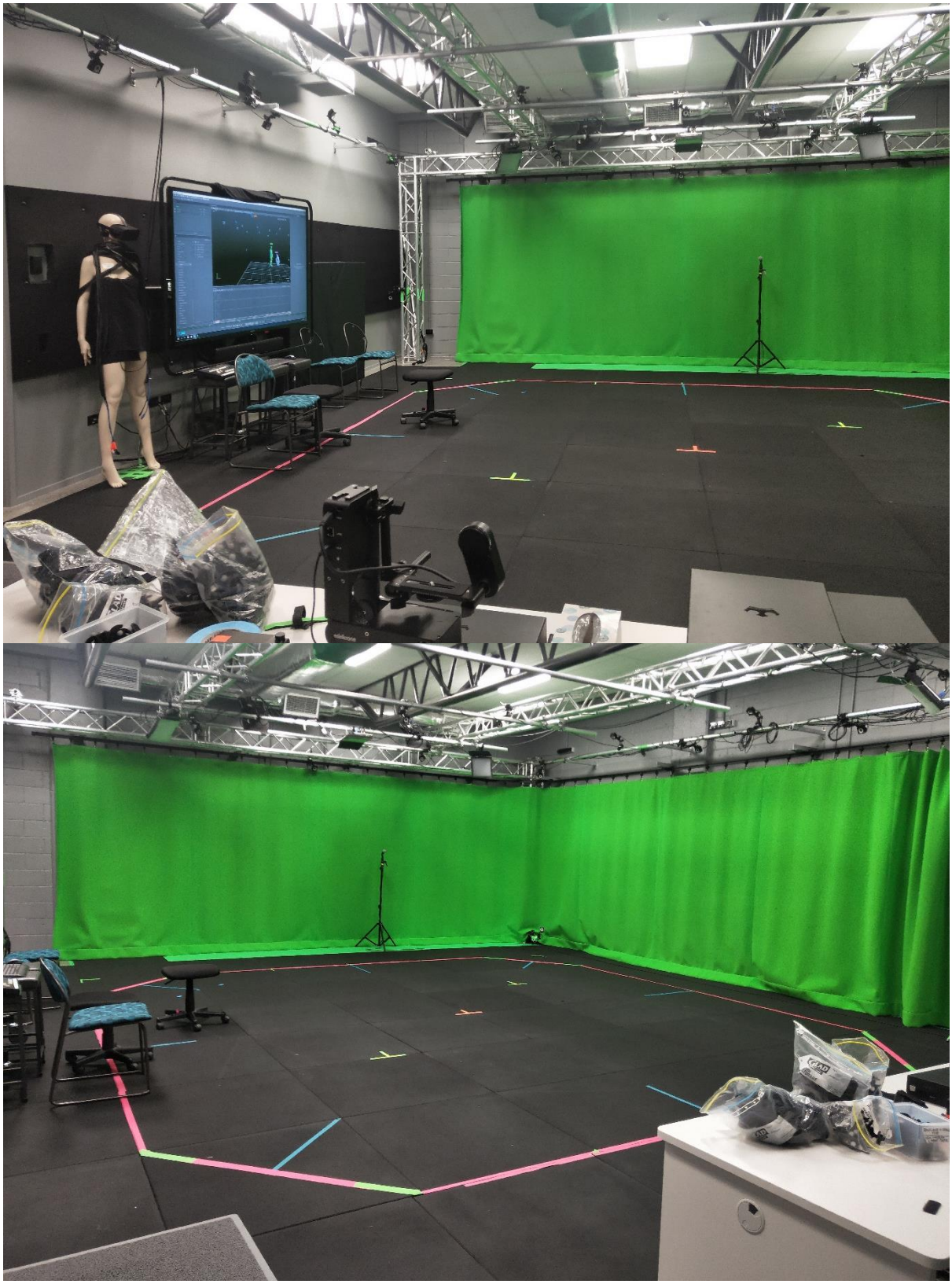
Statement of consent

I have read the information about this research. I agree to participate in this research. I understand that I can withdraw my consent at any time up until the end of the survey, and stop participation.

Date:_____ Participant signature:_____

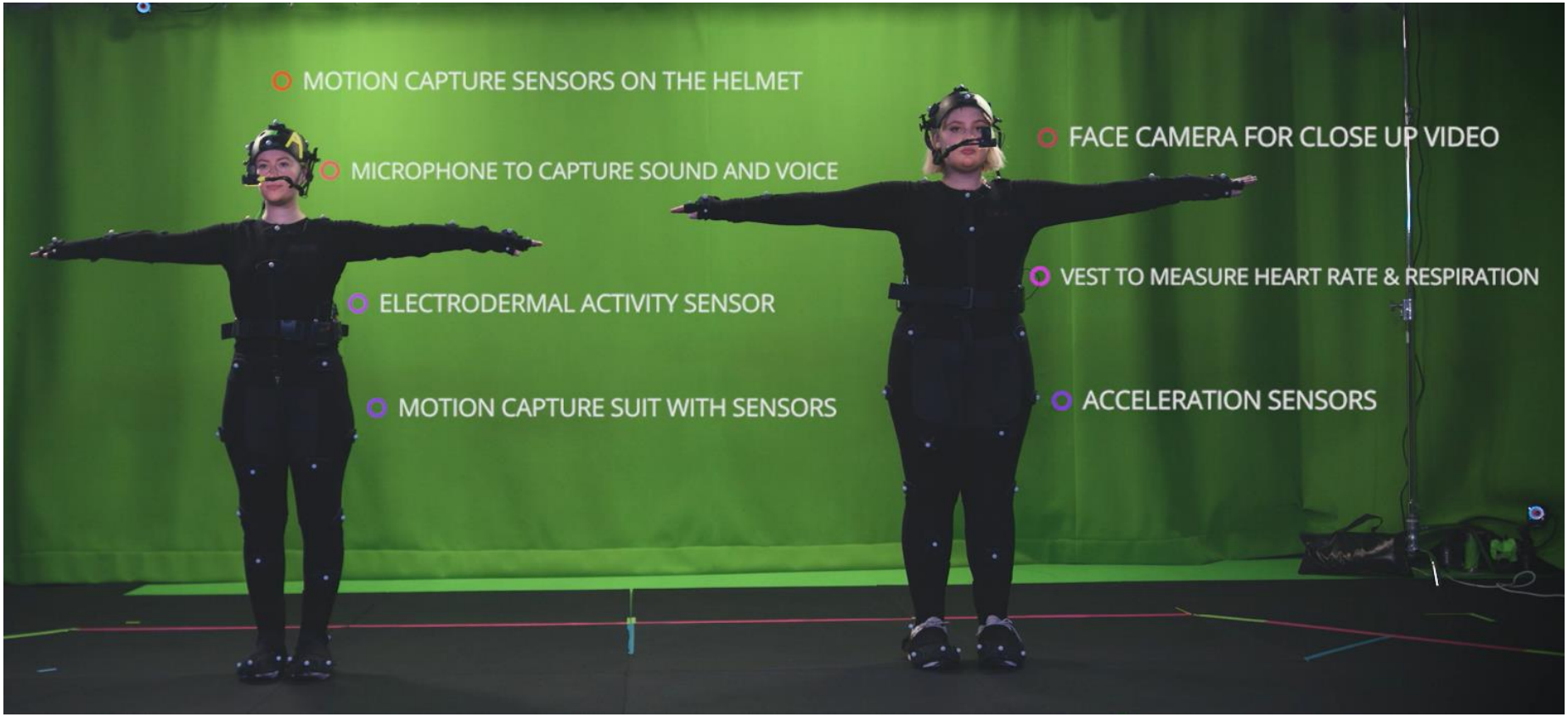
Appendix D

Images of the Studio Used in the Study



Appendix E

Image of Motion Capture Suits



Appendix F

Debriefing Sheet

A

TE WHARE WĀNANGA O TE ŪPOKO O TE IKA A MĀUI
VICTORIA
UNIVERSITY OF WELLINGTON

Investigating Empathetic Interactions in Pairs of People (E-motion)
Ethics Application #0000027455

Debriefing

Principal investigator: Dr. Hedwig Eisenbarth
School of Psychology
Victoria University of Wellington
Email: Hedwig.Eisenbarth@vuw.ac.nz
Phone: 04 463 9541

Thank you for taking part in the study.
Below we briefly explain what this study is about.

What is this research about?
This project captures data from individuals empathizing with one another. The data collected came from a variety of different measurements: motion capture, recording of facial movements, heart-rate monitors, skin conductance and surveys. These will be used to check when empathy was occurring and to model how empathetic communication operates. In summary, by taking part in this study, you have provided data about empathetic communication between individuals.

Why is this study important?
Empathic interactions are a way of communicating emotional information. People vary in their ability to understand emotional information, and not understanding this information can lead to huge social problems. Finding ways to better communicate emotional information is crucial for helping people with low emotional understanding and curbing social problems. If researchers were able to provide a model of empathic communication, this would facilitate interventions that increase emotional understanding. Those with low emotional understanding could potentially have their lives improved and improve the lives of those around them.

A

Want to know more about the study?
If you would like to get more information about the study, please email one of us above.

If you have any concerns about the ethical conduct of the research, you may contact the Victoria University HEC Convener: Dr Judith Loveridge. Email hec@vuw.ac.nz or telephone +64 4 463 6028.

Thank you again for your participation in this research project!

Best,
Areito Echevarria, Hedwig Eisenbarth, Daniela Egersdoerfer and MacGregor Pipson

Appendix G

Packages used in Code

Package	Version
apaTables	2.0.8
breakDown	0.2.1
corrplot	0.92
crunch	1.28.2
data.table	1.14.2
dplyr	2.1.1
effsize	0.8.1
emmeans	1.7.1-1
epiDisplay	3.5.0.1
filesstrings	3.2.2
ggplot2	3.3.5
ggpubr	0.4.0
here	1.0.1
hexbin	1.28.2
janitor	2.1.0
lavaan	0.6-9
lme4	1.1-27.1
lmerTest	3.1-3
lsr	0.5.2
Matrix	1.3-4
MuMIn	1.43.17
nlme	3.1-153
pacman	0.5.1
patchwork	1.1.1
PerformanceAnalytics	2.0.4
plyr	1.8.6
psych	2.1.9
qwraps2	0.5.2

rcompanion	2.4.1
readr	2.1.0
readxl	1.3.1
RSQLite	2.2.8
rstatix	0.7.0
semTools	0.5-5
sjPlot	2.8.10
stringr	1.4.0
table1	1.4.2
tibble	3.1.6
tidyr	1.1.4
tidyselect	1.1.1
tidyverse	1.3.1
viridis	0.6.2
vroom	1.5.6

Appendix H

Code used for Analysis

```
#-------------------------------------------------------------------------------------------------------
#PACKAGES

#packages needed
library(apaTables)
library(breakDown)
library(corrplot)
library(crunch)
library(data.table)
library(dplyr)
library(effsize)
library(emmeans)
library(epiDisplay)
library(filesstrings)
library(ggplot2)
library(ggpubr)
library(here)
library(hexbin)
library(janitor)
library(lavaan)
library(lme4)
library(lmerTest)
library(lsr)
library(Matrix)
library(MuMIn)
library(nlme)
library(pacman)
library(patchwork)
library(PerformanceAnalytics)
library(plyr)
library(psych)
library(qwraps2)
library(rcompanion)
library(readr)
library(readxl)
library(RSQLite)
library(rstatix)
library(semTools)
library(sjPlot)
library(stringr)
library(table1)
library(tibble)
library(tidyr)
```

```
library(tidyselect)
library(tidyverse)
library(viridis)
library(vroom)

#-----------------------------------------------------------------------------------------------------------
#IMPORTING ALL DATA INTO CORRELATIONS

fdata = list()    # Ra data
fset1 = list()    # Data with extra columns removed
fset2 = list()    # Data renamed
fset3 = list()    # Data with rows deleted
fset4 = list()    # Data combined
bcorr = list()    # Data correlations
fpath = "Z:/DataCleaned_study1/Brianna/Done"
myfiles = list.files(path=fpath, pattern="*_PA_PSYCHOPY_ALIGNED_LONG.csv",
full.names=FALSE)
Trial_Correlations <- read_excel(paste(fpath , "/" , "Trial_Correlations.xlsx" , sep = ""))
for (cfile in 1:length(myfiles))
{

  ## Load the CSV file into FDATA
  cat("Processing file :" , myfiles[cfile] , "\n")
  fileA = myfiles[cfile]
  fileB = paste(substr(myfiles[cfile],1,5) , "B_PSYCHOPY_ALIGNED_LONG.csv" , sep="")
  fileC = paste(substr(myfiles[cfile],1,4) , "PHYS_SHORT.csv" , sep="")
  nameA = substring(fileA,0,6)
  nameB = substring(fileB,0,6)
  nameC = substring(fileC,0,8)

  ## Read the CSV files in
  fdata[[nameA]] <- ldply(paste(fpath , fileA , sep = "/"), read_csv)
  fdata[[nameB]] <- ldply(paste(fpath , fileB , sep = "/"), read_csv)
  fdata[[nameC]] <- ldply(paste(fpath , fileC , sep = "/"), read_csv)

  ## Deleting columns that are extra and renaming columns
  keeps <- c("Time","Response", "Trial", "Self/Other", "Time Code", "PreFrame",
"TimeOrig", "TimeMS", "Frame", "LongNum")
  keeps1 <- c("A_HR", "A_ECG", "A_ChestEx", "A_GSR", "B_HR", "B_ECG",
"B_ChestEx", "B_GSR", "Trial","FrameNum")
  fset1[[nameA]] <- data.frame(fdata[[nameA]][keeps])
  fset1[[nameB]] <- data.frame(fdata[[nameB]][keeps])
  fset1[[nameC]] <- data.frame(fdata[[nameC]][keeps1])

  ## Rename the data
  fset2[[nameA]] <- dplyr::rename(fset1[[nameA]], A_Time = Time, A_Response =
Response, A_Trial = Trial, A_SelfOther = Self.Other, A_TimeCode = Time.Code,
A_PreFrame = PreFrame, A_TimeOrig = TimeOrig, A_TimeMS = TimeMS, A_Frame =
Frame, A_LongNum = LongNum)
```

```
 fset2[[nameB]] <- dplyr::rename(fset1[[nameB]], B_Time = Time, B_Response =
Response, B_Trial = Trial, B_SelfOther = Self.Other, B_TimeCode = Time.Code,
B_PreFrame = PreFrame, B_TimeOrig = TimeOrig, B_TimeMS = TimeMS, B_Frame =
Frame, B_LongNum = LongNum)
 fset2[[nameC]] <- dplyr::rename(fset1[[nameC]])

 #need to delete blank rows
 if(prod(is.na(fset2[[nameA]][1,]))!= 0) {
  fset2[[nameA]] <- fset2[[nameA]][2:nrow(fset2[[nameA]]),]
 }

 if(prod(is.na(fset2[[nameB]][1,]))!= 0) {
  fset2[[nameB]] <- fset2[[nameB]][2:nrow(fset2[[nameB]]),]
 }


 fset3[[nameA]] <- fset2[[nameA]][!fset2[[nameA]]$A_Trial > 4,]
 fset3[[nameB]] <- fset2[[nameB]][!fset2[[nameB]]$B_Trial > 4,]

 #need to fill in blanks in physio when ratings is longer
 Agap <- nrow(fset3[[nameA]] %>% dplyr::filter(A_Trial == 4 & A_SelfOther == "Self"))
 Bgap <- nrow(fset3[[nameB]] %>% dplyr::filter(B_Trial == 4 & B_SelfOther == "Self"))

 Pgap <- nrow(fset3[[nameC]] %>% dplyr::filter(Trial == 4))

 if(Agap != Pgap) {
  NA.mat <- data.frame(matrix(NA,
                              nrow = Agap - Pgap,
                              ncol = ncol(fset3[[nameC]])))
  names(NA.mat) <- names(fset3[[nameC]])
  fset3[[nameC]] <- rbind(fset3[[nameC]], NA.mat)
  extraNA <- 1
 }else{
  extraNA <- 0
 }

 ## Deleting extra rows and then merging
 fset3[[nameA]] <- fset2[[nameA]][!fset2[[nameA]]$A_Trial > 4,]
 fset3[[nameB]] <- fset2[[nameB]][!fset2[[nameB]]$B_Trial > 4,]
 fset3[[nameC]] <- rbind(fset2[[nameC]], fset2[[nameC]])

 ## Combine A & B & Physio sets
 cname = substring(fileA,0,3)
 fset4[[cname]] <- cbind(fset3[[nameA]],fset3[[nameB]],fset3[[nameC]])

 #sanity check
 if (all((fset4[[cname]]$A_Frame == fset4[[cname]]$FrameNum)== TRUE)){
  print ("numbers match")
 }else{
  print("Error! Numbers do not match!")
```

```
  sys.exit()}

 # need to export this data
 csv_file = paste("Z:/DataCleaned_study1/Brianna/Exported/" , cname , ".csv" , sep = "")
 write.csv(fset4[[cname]],csv_file,row.names = FALSE)

 Identifier <- c(cname)

 #correlations, Affective = r of self:self, one for each trial
 #ExpAffective = r of self:physio, one of each trial, one for each participant
 # Cognitive = r of self:other, one of each trial, one for each participant

 #checking for NA matrix within each set(A, B and PHYSIO)
  if ((sum(is.na(datacor$A_Response))>0) == TRUE) {
  NApresentA <- 1
  NApresent_A <- (sum(is.na(datacor$A_Response)))
 } else {
  NApresentA <- 0
  NApresent_A <- 0
 }


 if ((sum(is.na(datacor$B_Response))>0) == TRUE) {
  NApresentB <- 1
  NApresent_B <- (sum(is.na(datacor$B_Response)))
 } else {
  NApresentB <- 0
  NApresent_B <- 0
 }


 if ((sum(is.na(datacor$Trial))>0) == TRUE) {
  NApresentPHY <- 1
  NApresent_PHY <- (sum(is.na(datacor$Trial)))
 } else {
  NApresentPHY <- 0
  NApresent_PHY <- 0
 }

 #Affective - Trials 1-4
 AffectiveAT1 <- data.frame(dplyr::filter(datacor,A_Trial == 1, B_SelfOther == "Self"))
 AffectiveBT1 <- data.frame(dplyr::filter(datacor,B_Trial == 1, B_SelfOther == "Self"))
 Affective1 <- c(cor.test(AffectiveAT1$A_Response, AffectiveBT1$B_Response))
 Affective1 <- (Affective1$estimate)

 AffectiveAT2 <- data.frame(dplyr::filter(datacor,A_Trial == 2, A_SelfOther == "Self"))
 AffectiveBT2 <- data.frame(dplyr::filter(datacor,B_Trial == 2, B_SelfOther == "Self"))
 Affective2 <- c(cor.test(AffectiveAT2$A_Response, AffectiveBT2$B_Response))
 Affective2 <- (Affective2$estimate)
```

```
AffectiveAT3 <- data.frame(dplyr::filter(datacor,A_Trial == 3, A_SelfOther == "Self"))
AffectiveBT3 <- data.frame(dplyr::filter(datacor,B_Trial == 3, B_SelfOther == "Self"))
Affective3 <- c(cor.test(AffectiveAT3$A_Response, AffectiveBT3$B_Response))
Affective3 <- (Affective3$estimate)

AffectiveAT4 <- data.frame(dplyr::filter(datacor,A_Trial == 4, A_SelfOther == "Self"))
AffectiveBT4 <- data.frame(dplyr::filter(datacor,B_Trial == 4, B_SelfOther == "Self"))
Affective4 <- c(cor.test(AffectiveAT4$A_Response, AffectiveBT4$B_Response))
Affective4 <- (Affective4$estimate)

#Cognitive - Trials 1 - 4, Participant A
CognitiveAAT1 <- data.frame(dplyr::filter(datacor,A_Trial == 1, A_SelfOther == "Self"))
CognitiveABT1 <- data.frame(dplyr::filter(datacor,B_Trial == 1, B_SelfOther == "Other"))
CognitiveA1 <- c(cor.test(CognitiveAAT1$A_Response, CognitiveABT1$B_Response))
CognitiveA1 <- (CognitiveA1$estimate)

CognitiveAAT2 <- data.frame(dplyr::filter(datacor,A_Trial == 2, A_SelfOther == "Self"))
CognitiveABT2 <- data.frame(dplyr::filter(datacor,B_Trial == 2, B_SelfOther == "Other"))
CognitiveA2 <- c(cor.test(CognitiveAAT2$A_Response, CognitiveABT2$B_Response))
CognitiveA2 <- (CognitiveA2$estimate)

CognitiveAAT3 <- data.frame(dplyr::filter(datacor,A_Trial == 3, A_SelfOther == "Self"))
CognitiveABT3 <- data.frame(dplyr::filter(datacor,B_Trial == 3, B_SelfOther == "Other"))
CognitiveA3 <- c(cor.test(CognitiveAAT3$A_Response, CognitiveABT3$B_Response))
CognitiveA3 <- (CognitiveA3$estimate)

CognitiveAAT4 <- data.frame(dplyr::filter(datacor,A_Trial == 4, A_SelfOther == "Self"))
CognitiveABT4 <- data.frame(dplyr::filter(datacor,B_Trial == 4, B_SelfOther == "Other"))
CognitiveA4 <- c(cor.test(CognitiveAAT4$A_Response, CognitiveABT4$B_Response))
CognitiveA4 <- (CognitiveA4$estimate)

#Cognitive - Trials 1 - 4, Participant B
CognitiveBAT1 <- data.frame(dplyr::filter(datacor,A_Trial == 1, A_SelfOther == "Other"))
CognitiveBBT1 <- data.frame(dplyr::filter(datacor,B_Trial == 1, B_SelfOther == "Self"))
CognitiveB1 <- c(cor.test(CognitiveBAT1$A_Response, CognitiveBBT1$B_Response))
CognitiveB1 <- (CognitiveB1$estimate)

CognitiveBAT2 <- data.frame(dplyr::filter(datacor,A_Trial == 2, A_SelfOther == "Other"))
CognitiveBBT2 <- data.frame(dplyr::filter(datacor,B_Trial == 2, B_SelfOther == "Self"))
CognitiveB2 <- c(cor.test(CognitiveBAT2$A_Response, CognitiveBBT2$B_Response))
CognitiveB2 <- (CognitiveB2$estimate)

CognitiveBAT3 <- data.frame(dplyr::filter(datacor,A_Trial == 3, A_SelfOther == "Other"))
CognitiveBBT3 <- data.frame(dplyr::filter(datacor,B_Trial == 3, B_SelfOther == "Self"))
CognitiveB3 <- c(cor.test(CognitiveBAT3$A_Response, CognitiveBBT3$B_Response))
CognitiveB3 <- (CognitiveB3$estimate)

CognitiveBAT4 <- data.frame(dplyr::filter(datacor,A_Trial == 4, A_SelfOther == "Other"))
CognitiveBBT4 <- data.frame(dplyr::filter(datacor,B_Trial == 4, B_SelfOther == "Self"))
CognitiveB4 <- c(cor.test(CognitiveBAT4$A_Response, CognitiveBBT4$B_Response))
```

```
  CognitiveB4 <- (CognitiveB4$estimate)

  #Experimental Affective, Trials 1-4, Participant A
  #ExpAffective - Trials 1-4, Participant A
  ExAffectiveAT1 <- data.frame(dplyr::filter(datacor,A_Trial == 1, A_SelfOther == "Self"))
  ExAffectiveA1 <- c(cor.test(ExAffectiveAT1$A_Response, ExAffectiveAT1$B_GSR))
  ExAffectiveA1 <- (ExAffectiveA1$estimate)

  ExAffectiveAT2 <- data.frame(dplyr::filter(datacor,A_Trial == 2, A_SelfOther == "Self"))
  ExAffectiveA2 <- c(cor.test(ExAffectiveAT2$A_Response, ExAffectiveAT2$B_GSR))
  ExAffectiveA2 <- (ExAffectiveA2$estimate)

  ExAffectiveAT3 <- data.frame(dplyr::filter(datacor,A_Trial == 3, A_SelfOther == "Self"))
  ExAffectiveA3 <- c(cor.test(ExAffectiveAT3$A_Response, ExAffectiveAT3$B_GSR))
  ExAffectiveA3 <- (ExAffectiveA3$estimate)

  ExAffectiveAT4 <- data.frame(dplyr::filter(datacor,A_Trial == 4, A_SelfOther == "Self"))
  ExAffectiveA4 <- c(cor.test(ExAffectiveAT4$A_Response, ExAffectiveAT4$B_GSR))
  ExAffectiveA4 <- (ExAffectiveA4$estimate)

  #ExpAffective - Trials 1-4, Participant B
  ExAffectiveBT1 <- data.frame(dplyr::filter(datacor,A_Trial == 1, B_SelfOther == "Self"))
  ExAffectiveB1 <- c(cor.test(ExAffectiveBT1$B_Response, ExAffectiveBT1$A_GSR))
  ExAffectiveB1 <- (ExAffectiveB1$estimate)

  ExAffectiveBT2 <- data.frame(dplyr::filter(datacor,A_Trial == 2, B_SelfOther == "Self"))
  ExAffectiveB2 <- c(cor.test(ExAffectiveBT2$B_Response, ExAffectiveBT2$A_GSR))
  ExAffectiveB2 <- (ExAffectiveB2$estimate)

  ExAffectiveBT3 <- data.frame(dplyr::filter(datacor,A_Trial == 3, B_SelfOther == "Self"))
  ExAffectiveB3 <- c(cor.test(ExAffectiveBT3$B_Response, ExAffectiveBT3$A_GSR))
  ExAffectiveB3 <- (ExAffectiveB3$estimate)

  ExAffectiveBT4 <- data.frame(dplyr::filter(datacor,A_Trial == 4, B_SelfOther == "Self"))
  ExAffectiveB4 <- c(cor.test(ExAffectiveBT4$B_Response, ExAffectiveBT4$A_GSR))
  ExAffectiveB4 <- (ExAffectiveB4$estimate)

  #putting all these correlations into a table
  bcorr <- c(Identifier,Affective1,Affective2,Affective3,Affective4,
          CognitiveA1,CognitiveA2,CognitiveA3,CognitiveA4,
          CognitiveB1,CognitiveB2,CognitiveB3,CognitiveB4,
          ExAffectiveA1,ExAffectiveA2,ExAffectiveA3,ExAffectiveA4,
          ExAffectiveB1,ExAffectiveB2,ExAffectiveB3,ExAffectiveB4,
          NApresentA, NApresent_A, NApresentB, NApresent_B,NApresentPHY,
NApresent_PHY)

  Trial_Correlations <-rbind(Trial_Correlations, bcorr)
}

write.csv(Trial_Correlations, "Z:/DataCleaned_study1/Brianna/Exported/Correlations.csv")
```

```
#-------------------------------------------------------------------------------------------------------

#After the correlation table was completed that was manually merged with demographic
variables, This then had to be transformed into longform data

#-------------------------------------------------------------------------------------------------------
#TRANSFORMING DATA INTO LONGFORM

Data2 <- read_excel("Z:/DataCleaned_study1/Brianna/Exported/Data/Demo_Cor2.xlsx")

longdata <- Data2 %>% pivot_longer(-c(Identification, Dyad, Familiarity, Type,
Time_Known, Age,    Gender,
                                      Primary_Ethnic_Identity, Secondary_Ethnic_Identity, Profession,
Education,
                                      FD, SCI, CH, PPIR_total, NA_in_A, Amount_A, NA_in_B,
Amount_B, NA_in_PHY, Amount_PHY),
                                   names_to = c(".value","Conversation"),
                                   names_pattern = "(.+)_(.+)",
                                   values_drop_na = FALSE)

write_excel_csv
(longdata,"Z:/DataCleaned_study1/Brianna/Exported/Data/Data_valence3.csv")
Data_valence3 <-
read_csv("Z:/DataCleaned_study1/Brianna/Exported/Data/Data_valence3.csv")

longerdata <- Data_valence3 %>% pivot_longer(-c(Identification, Dyad, Familiarity, Type,
Time_Known, Age,    Gender,
                                               Primary_Ethnic_Identity, Secondary_Ethnic_Identity,
Profession, Education,
                                               FD, SCI, CH, PPIR_total, Conversation, Valence, NA_in_A,
Amount_A, NA_in_B, Amount_B, NA_in_PHY, Amount_PHY),
                                            names_to = c("Empathy"),
                                            values_to = "Correlations",
                                            values_drop_na = FALSE)

write_excel_csv
(longerdata,"Z:/DataCleaned_study1/Brianna/Exported/Data/Data_longform5.csv")


#-------------------------------------------------------------------------------------------------------
#ANALYSIS OF HYPOTHESIS

Data <- read.csv("Z:/DataCleaned_study1/Brianna/Data/Data_longform5.csv")
Data <- dplyr:::rename(Data, "ID" = "ï..Identification")
Data <- dplyr:::rename(Data, "Coefficient" = "Correlations")
names(Data)

#subsetting to different types of empathy
Cognitive <- filter(Data, Empathy == "Cognitive")
```

```
Self_reported_Affective <- filter(Data, Empathy == "Self-reported Affective")
Physiological_Affective <- filter(Data, Empathy == "Physiological Affective")
Strangers <- filter(Data, Familiarity == "Strangers")
Relationship <- filter(Data, Familiarity == "Familiar")
Male <- filter(Data, Gender == "Male")
Female <- filter(Data, Gender == "Female")
Gender <- rbind(Male,Female)


########## HYPO 1-4 ##########


#Hypothesis 1 ----------------------------------------------------------------
#Unfamiliar dyads will be associated with lower cognitive and affective empathy in
comparison to dyads who are familiar with one another.
hypo1 <- lmer(Coefficient ~ Familiarity*Empathy + (1|Dyad), data = Data)
hypo1
summary(hypo1)
tab_model(hypo1)
anova(hypo1)

tab_model(hypo1, file = "hypo1table.doc")


#Hypothesis 2----------------------------------------------------------------
#Higher scores for coldheartedness and self-centred impulsivity factors of psychopathy will
be associated with decreased affective empathy, whereas cognitive empathy will remain
stable.
hypo2 <- lmer(Coefficient ~ SCI*Empathy + CH*Empathy + (1| Dyad), data = Data)
hypo2
summary(hypo2)
tab_model(hypo2)
anova(hypo2)

tab_model(hypo2, file = "hypo2table.doc")


#Hypothesis 3 ----------------------------------------------------------------
#For unfamiliar dyads, there will be an improvement in empathy as time increases.
hypo3 <- lmer(Coefficient ~ Conversation + Empathy + (1| Dyad), data = Strangers)
hypo3
summary(hypo3)
tab_model(hypo3)
anova(hypo3)

tab_model(hypo3, file = "hypo3table.doc")


#Hypothesis 4 ----------------------------------------------------------------
#Females will generally perform better than males in both types of empathy.
```

```
gender_data <- filter(Data, Gender %in% c("Male","Female"))
gender_test <- gender_data %>%
  group_by(Empathy) %>%
  t_test(Coefficient ~ Gender) %>%
  add_significance()
gender_test
summary(gender_test)

mean(Cognitive$Correlations[Cognitive$Gender == "Female"], na.rm = TRUE)
mean(Cognitive$Correlations[Cognitive$Gender == "Male"], na.rm = TRUE)
mean(Affective$Correlations[Affective$Gender == "Female"], na.rm = TRUE)
mean(Affective$Correlations[Affective$Gender == "Male"], na.rm = TRUE)
mean(EXAffective$Correlations[EXAffective$Gender == "Female"], na.rm = TRUE)
mean(EXAffective$Correlations[EXAffective$Gender == "Male"], na.rm = TRUE)

sd(Cognitive$Correlations[Cognitive$Gender == "Female"], na.rm = TRUE)
sd(Cognitive$Correlations[Cognitive$Gender == "Male"], na.rm = TRUE)
sd(Affective$Correlations[Affective$Gender == "Female"], na.rm = TRUE)
sd(Affective$Correlations[Affective$Gender == "Male"], na.rm = TRUE)
sd(EXAffective$Correlations[EXAffective$Gender == "Female"], na.rm = TRUE)
sd(EXAffective$Correlations[EXAffective$Gender == "Male"], na.rm = TRUE)


########## ADDITIONAL ANALYSIS ##########


#all variable model ----------------------------------------------------------
fullmodel <- lmer(Coefficient ~ FD + SCI + CH + Familiarity + Conversation + Valence +
Empathy + (1|Dyad), data = Data)
summary(fullmodel)
tab_model(fullmodel)

tab_model(fullmodel, file = "fullmodeltable.doc")

#removed FD
fullmodela <- lmer(Coefficient ~ SCI + CH + Familiarity + Conversation + Valence +
Empathy + (1|Dyad), data = Data)
summary(fullmodela)
tab_model(fullmodela)
anova(fullmodela, fullmodel)

#removed Valence
fullmodelb <- lmer(Coefficient ~ SCI + CH + Familiarity + Conversation + Empathy +
(1|Dyad), data = Data)
summary(fullmodelb)
tab_model(fullmodelb)
anova(fullmodelb, fullmodela)

#removed CH
```

```
fullmodelc <- lmer(Coefficient ~ SCI + Familiarity + Conversation + Empathy + (1|Dyad),
data = Data)
summary(fullmodelc)
tab_model(fullmodelc)
anova(fullmodelc, fullmodelb)

#removed Familiarity
fullmodeld <- lmer(Coefficient ~ SCI + Conversation + Empathy + (1|Dyad), data = Data)
summary(fullmodeld)
tab_model(fullmodeld)
anova(fullmodeld, fullmodelc)

#cannot remove further variables without comprimising model, so this is the model of best fit
fullmodele <- lmer(Coefficient ~ SCI + Conversation + Empathy + (1|Dyad), data = Data)
summary(fullmodele)
tab_model(fullmodele)
anova(fullmodele, fullmodeld)

#model of best fit is
modelfit <- lmer(Coefficient ~ SCI + Conversation + Empathy + (1|Dyad), data = Data)
summary(modelfit)
tab_model(modelfit)
tab_model(modelfit, file = "modelofbestfit.doc")


#Does Valance differ within empathy scores ----------------------------------
val_test <- Data %>%
  group_by(Empathy) %>%
  t_test(Coefficient ~ Valence) %>%
  add_significance()
val_test

mean(Cognitive$Correlations[Cognitive$Valence == "Positive"], na.rm = TRUE)
mean(Cognitive$Correlations[Cognitive$Valence == "Negative"], na.rm = TRUE)
mean(Affective$Correlations[Affective$Valence == "Positive"], na.rm = TRUE)
mean(Affective$Correlations[Affective$Valence == "Negative"], na.rm = TRUE)
mean(EXAffective$Correlations[EXAffective$Valence == "Positive"], na.rm = TRUE)
mean(EXAffective$Correlations[EXAffective$Valence == "Negative"], na.rm = TRUE)

sd(Cognitive$Correlations[Cognitive$Valence == "Positive"], na.rm = TRUE)
sd(Cognitive$Correlations[Cognitive$Valence == "Negative"], na.rm = TRUE)
sd(Affective$Correlations[Affective$Valence == "Positive"], na.rm = TRUE)
sd(Affective$Correlations[Affective$Valence == "Negative"], na.rm = TRUE)
sd(EXAffective$Correlations[EXAffective$Valence == "Positive"], na.rm = TRUE)
sd(EXAffective$Correlations[EXAffective$Valence == "Negative"], na.rm = TRUE)
```

```
#-----------------------------------------------------------------------------------------------------------
#CODE FOR GRAPHS

Data <- read.csv("Z:/DataCleaned_study1/Brianna/Data/Data_longform5.csv")
Data <- dplyr:::rename(Data, "ID" = "ï..Identification")
Data <- dplyr:::rename(Data, "Coefficient" = "Correlations")
names(Data)

#subsetting to different types of empathy
Cognitive <- filter(Data, Empathy == "Cognitive")
Self_reported_Affective <- filter(Data, Empathy == "Self-reported Affective")
Physiological_Affective <- filter(Data, Empathy == "Physiological Affective")
Strangers <- filter(Data, Familiarity == "Strangers")
Relationship <- filter(Data, Familiarity == "Familiar")
Male <- filter(Data, Gender == "Male")
Female <- filter(Data, Gender == "Female")
Gender <- rbind(Male,Female)

cleanup = theme(panel.grid.major = element_blank(),
                panel.grid.minor = element_blank(),
                panel.background = element_blank(),
                axis.line = element_line(color = "black"))

#colours (examples but save the colours you choose here)
#Positive = slategray2
#Negative = grey
#Self-reported_Affective = deeppink2
#Cognitive = limegreen
#Physiological_Affective = orange1
#Familiar = red1
#Strangers = royalblue2
#Female = yellow1
#Male = mediumturquoise


######## BOXPLOTS #############


#Unfamiliar dyads will be associated with lower cognitive and affective empathy in
comparison to dyads who are familiar with one another.
hypo1plot <- ggboxplot(
  Data, x = "Empathy", y = "Coefficient",
  color = "black",
  fill = "Familiarity",
  palette = "npg")+
  labs(y = "Empathy Coefficient",
       fill = "Familiarity")+
  scale_fill_manual(labels = c("Familiar", "Unfamiliar"),values = c("red1", "royalblue2"))+
  theme(legend.position = "right")+
  theme(text=element_text(family="Times New Roman", size=12))+
```

```
  theme(axis.title.x = element_text(margin = margin(t = 12)))+
  labs(y = "Empathy Coefficient",
       fill = "Relationship",
       x = "Type of Empathy")+
  scale_x_discrete(limits = c("Cognitive","Physiological Affective","Self-reported
Affective"))
hypo1plot


#Females will generally perform better than males in both types of empathy
genderplot <- ggboxplot(
  Gender, x = "Empathy", y = "Coefficient",
  color = "black",
  fill = "Gender")+
  scale_fill_manual(values = c("mediumturquoise", "yellow1" ))+
  labs(y = "Empathy Coefficient",
       fill = "Gender")+
  theme(legend.position = "right")+
  theme(text=element_text(family="Times New Roman", size=12))+
  labs(y = "Empathy Coefficient",
       fill = "Gender",
       x = "Type of Empathy")+
  scale_x_discrete(limits = c("Cognitive","Physiological Affective","Self-reported
Affective"))
genderplot


#Does Valance differ within empathy scores
valplot <- ggboxplot(
  Data, x = "Empathy", y = "Coefficient",
  color = "black",
  fill = "Valence",
  palette = "npg")+
  labs(y = "Empathy Coefficient",
       fill = "Valence")+
  scale_fill_manual(values = c("grey", "slategray2"))+
  theme(legend.position = "right")+
  theme(text=element_text(family="Times New Roman", size=12))+
  labs(y = "Empathy Coefficient",
       fill = "Valence",
       x = "Type of Empathy")+
  scale_x_discrete(limits = c("Cognitive","Physiological Affective","Self-reported
Affective"))
valplot


########## LINEGRAPHS #############


#For unfamiliar dyads, there will be an improvement in empathy as time increases.
```

```
ggplot(Strangers, aes(x=Conversation, y=Coefficient, color=Empathy))+
  stat_summary(fun = "mean", geom = "pointrange", lwd=0.9,
               fun.max = function(x) mean(x) + sd(x) / sqrt(length(x)),
               fun.min = function(x) mean(x) - sd(x) / sqrt(length(x))) +
  stat_summary(fun = "mean", geom = "line", lwd=0.9) +
  scale_color_manual(values = c( "limegreen", "orange1", "deeppink2")) +
  labs(x="Conversation Number", y="Empathy Coefficient", color="Type of Empathy")+
  theme(text=element_text(family="Times New Roman", size=12))+
  cleanup


############## SCATTERPLOTS ################


#same as above but seperated by familiarity also
ggplot(Self_reported_Affective,aes(x=CH,y=Coefficient))+
  labs(y = "Empathy Coefficient", x = "Familiarity")+
  geom_point(size=1.5)+
  geom_point(shape=19)+
  geom_point(aes(color=Familiarity))+
  theme(text=element_text(size=12))+
  geom_smooth(method = "lm", aes(fill=Familiarity))+
  stat_cor(method = "pearson", label.x = 13, label.y = -0.7, r.accuracy = 0.01, p.accuracy =
0.001)+
  cleanup


########### SPEARMANS CORRELATION TABLE (descriptives) ###############


#For this table a seperate data needs to be made with just the study variables and no other
stuff in it
Short <- read.csv("Z:/DataCleaned_study1/Brianna/Data/Playing5.csv")
allcor <- cor(Short, use = "complete")

#All study variables correlated with one another
apa.cor.table(
  allcor,
  filename = NA,
  table.number = 1,
  show.sig.stars = TRUE,
  show.conf.interval = TRUE,
  landscape = FALSE)
allcor

tibble(allcor)
apa.cor.table(Short, filename = ‘Correlationstable.doc’)


########### MATRIX OF SCATTERPLOTS####################
```

```
#Cognitive
ggplot(Cognitive,aes(x=FD,y=Coefficient))+
  labs(y = "Cognitive Empathy Coefficient", x = "Fearless Dominance Score")+
  geom_point(size=1.5)+
  geom_point(shape=19)+
  theme(text=element_text(size=12))+
  theme(axis.text=element_text(size=16))+
  geom_smooth(method = "lm")+
  stat_cor(method = "pearson", label.x = 43, label.y = -0.6, r.accuracy = 0.01, p.accuracy =
0.001, size = 6)+
  cleanup

ggplot(Cognitive,aes(x=SCI,y=Coefficient))+
  labs(y = "Cognitive Empathy Coefficient", x = "Self-centred Impulsivity Score")+
  geom_point(size=1.5)+
  geom_point(shape=19)+
  theme(text=element_text(size=12))+
  theme(axis.text=element_text(size=16))+
  geom_smooth(method = "lm")+
  stat_cor(method = "pearson", label.x = 33.5, label.y = -0.6, r.accuracy = 0.01, p.accuracy =
0.001, size = 6)+
  cleanup

ggplot(Cognitive,aes(x=CH,y=Coefficient))+
  labs(y = "Cognitive Empathy Coefficient", x = "Coldheartedness Score")+
  geom_point(size=1.5)+
  geom_point(shape=19)+
  theme(text=element_text(size=12))+
  theme(axis.text=element_text(size=16))+
  geom_smooth(method = "lm")+
  stat_cor(method = "pearson", label.x = 12.4, label.y = -0.6, r.accuracy = 0.01, p.accuracy =
0.001, size = 6)+
  cleanup

#Physiological Affective
ggplot(Physiological_Affective,aes(x=FD,y=Coefficient))+
  labs(y = "Physiological Affective Empathy Coefficient", x = "Fearless Dominance Score")+
  geom_point(size=1.5)+
  geom_point(shape=19)+
  theme(text=element_text(size=12))+
  theme(axis.text=element_text(size=16))+
  geom_smooth(method = "lm")+
  stat_cor(method = "pearson", label.x = 42, label.y = -0.9, r.accuracy = 0.01, p.accuracy =
0.001, size = 6)+
  cleanup

ggplot(Physiological_Affective,aes(x=SCI,y=Coefficient))+
```

```
  labs(y = "Physiological Affective Empathy Coefficient", x = "Self-centred Impulsivity
Score")+
  geom_point(size=1.5)+
  geom_point(shape=19)+
  theme(text=element_text(size=12))+
  theme(axis.text=element_text(size=16))+
  geom_smooth(method = "lm")+
  stat_cor(method = "pearson", label.x = 32.7, label.y = -0.9, r.accuracy = 0.01, p.accuracy =
0.001, size = 6)+
  cleanup

ggplot(Physiological_Affective,aes(x=CH,y=Coefficient))+
  labs(y = "Physiological Affective Empathy Coefficient", x = "Coldheartedness Score")+
  geom_point(size=1.5)+
  geom_point(shape=19)+
  theme(text=element_text(size=12))+
  theme(axis.text=element_text(size=16))+
  geom_smooth(method = "lm")+
  stat_cor(method = "pearson", label.x = 12.2, label.y = -0.9, r.accuracy = 0.01, p.accuracy =
0.001, size = 6)+
  cleanup

#Self-reported Affective
ggplot(Self_reported_Affective,aes(x=FD,y=Coefficient))+
  labs(y = "Self-reported Affective Empathy Coefficient", x = "Fearless Dominance Score")+
  geom_point(size=1.5)+
  geom_point(shape=19)+
  theme(text=element_text(size=12))+
  theme(axis.text=element_text(size=16))+
  geom_smooth(method = "lm")+
  stat_cor(method = "pearson", label.x = 42, label.y = -0.7, r.accuracy = 0.01, p.accuracy =
0.001, size = 6)+
  cleanup

ggplot(Self_reported_Affective,aes(x=SCI,y=Coefficient))+
  labs(y = "Self-reported Affective Empathy Coefficient", x = "Self-centred Impulsivity
Score")+
  geom_point(size=1.5)+
  geom_point(shape=19)+
  theme(text=element_text(size=12))+
  theme(axis.text=element_text(size=16))+
  geom_smooth(method = "lm")+
  stat_cor(method = "pearson", label.x = 32.5, label.y = -0.7, r.accuracy = 0.01, p.accuracy =
0.001, size = 6)+
  cleanup

ggplot(Self_reported_Affective,aes(x=CH,y=Coefficient))+
  labs(y = "Self-reported Affective Empathy Coefficient", x = "Coldheartedness Score")+
  geom_point(size=1.5)+
  geom_point(shape=19)+
```

```
  theme(text=element_text(size=12))+
  theme(axis.text=element_text(size=16))+
  geom_smooth(method = "lm")+
  stat_cor(method = "pearson", label.x = 12, label.y = -0.7, r.accuracy = 0.01, p.accuracy =
0.001, size = 6)+
  cleanup


######### EXAMPLE GRAPH (Self-reported Affective Empathy) ###########


D21 <- read_csv("C:/Users/DELL/Dropbox/eMotion
Capture/Data_projects/FEP_project/graph/D21.csv")
D36 <- read_csv("C:/Users/DELL/Dropbox/eMotion
Capture/Data_projects/FEP_project/graph/D36.csv")

#high
ggplot(data=D36, aes(x=Frame, y=Response, group=Participant)) +
  geom_line(aes(color=Participant), lwd=0.7)+
  scale_colour_manual(values=c(A="blue",B="red"))+
  theme_classic() +
  theme(text=element_text(family="Times New Roman", size=12))+
  labs(subtitle = "Self-reported Affective Empathy Coefficient: r = .82", x = " Time (frames)",
y = "Emotional Intensity Rating") +
  theme(plot.title = element_text(hjust = 0.5),
        plot.subtitle = element_text(hjust = 0.5),
        plot.caption = element_text(hjust = 0.9)) +
  ylim(0, 10) +
  theme(legend.position="bottom")+
  scale_x_continuous(expand = c(0, 0),breaks=seq(0,47000,8000))+
  scale_y_continuous(expand = c(0, 0),breaks=seq(0,12,2))


#low
ggplot(data=D21, aes(x=Frame, y=Response, group=Participant)) +
  geom_line(aes(color=Participant), lwd=0.7)+
  scale_colour_manual(values=c(A="blue",B="red"))+
  theme_classic()+
  theme(text=element_text(family="Times New Roman", size=12))+
  labs(subtitle = "Self-reported Affective Empathy Coefficient: r = .05", x = "Time (frames)",
y = "Emotional Intensity Rating") +
  theme(plot.title = element_text(hjust = 0.5),
        plot.subtitle = element_text(hjust = 0.5),
        plot.caption = element_text(hjust = 0.9)) +
  ylim(0, 10) +
  theme(legend.position="bottom")+
  scale_y_continuous(expand = c(0, 0),breaks=seq(0,12,2))+
  scale_x_continuous(expand = c(0, 0),breaks=seq(0,47000,8000))
```

```
#-----------------------------------------------------------------------------------------------------------
#COHENS D AND AVERAGES

Data <- read.csv("Z:/DataCleaned_study1/Brianna/Data/Data_longform5.csv")
Data <- dplyr:::rename(Data, "ID" = "ï..Identification")
Data <- dplyr:::rename(Data, "Coefficient" = "Correlations")
names(Data)

#subsetting to different types of empathy
Cognitive <- filter(Data, Empathy == "Cognitive")
Self_reported_Affective <- filter(Data, Empathy == "Self-reported Affective")
Physiological_Affective <- filter(Data, Empathy == "Physiological Affective")
Male <- filter(Data, Gender == "Male")
Female <- filter(Data, Gender == "Female")
Gender <- rbind(Male,Female)

cleanup = theme(panel.grid.major = element_blank(),
                panel.grid.minor = element_blank(),
                panel.background = element_blank(),
                axis.line = element_line(color = "black"))


#######COHENS D######


# cohens D for males vs females
PhysMale <- filter(Physiological_Affective, Gender == "Male")
PhysFemale <- filter(Physiological_Affective, Gender == "Female")
CogMale <- filter(Cognitive, Gender == "Male")
CogFemale <- filter(Cognitive, Gender == "Female")
SREMale <- filter(Self_reported_Affective, Gender == "Male")
SREFemale <- filter(Self_reported_Affective, Gender == "Female")

cohensD(PhysMale$Coefficient, PhysFemale$Coefficient)
cohensD(CogMale$Coefficient, CogFemale$Coefficient)
cohensD(SREMale$Coefficient, SREFemale$Coefficient)

#cohens D for positive vs negative
Physpos <- filter(Physiological_Affective, Valence == "Positive")
Physneg <- filter(Physiological_Affective, Valence == "Negative")
Cogpos <- filter(Cognitive, Valence == "Positive")
Cogneg <- filter(Cognitive, Valence == "Negative")
SREpos <- filter(Self_reported_Affective, Valence == "Positive")
SREneg <- filter(Self_reported_Affective, Valence == "Negative")

cohensD(Physpos$Coefficient, Physneg$Coefficient)
cohensD(Cogpos$Coefficient, Cogneg$Coefficient)
cohensD(SREpos$Coefficient, SREneg$Coefficient)
```

```
#cohens D for familiar vs strangers
Physfam <- filter(Physiological_Affective, Familiarity == "Familiar")
Physstra <- filter(Physiological_Affective, Familiarity == "Strangers")
Cogfam <- filter(Cognitive, Familiarity == "Familiar")
Cogstra <- filter(Cognitive, Familiarity == "Strangers")
SREfam <- filter(Self_reported_Affective, Familiarity == "Familiar")
SREstra <- filter(Self_reported_Affective, Familiarity == "Strangers")

cohensD(Physfam$Coefficient, Physstra$Coefficient)
cohensD(Cogfam$Coefficient, Cogstra$Coefficient)
cohensD(SREfam$Coefficient, SREstra$Coefficient)


#Some averages, mean & sd for empathy types for familar vs stranger
mean(Physfam$Coefficient,na.rm = TRUE)
mean(Physstra$Coefficient,na.rm = TRUE)
mean(Cogfam$Coefficient,na.rm = TRUE)
mean(Cogstra$Coefficient,na.rm = TRUE)
mean(SREfam$Coefficient,na.rm = TRUE)
mean(SREstra$Coefficient,na.rm = TRUE)

sd(Physfam$Coefficient,na.rm = TRUE)
sd(Physstra$Coefficient,na.rm = TRUE)
sd(Cogfam$Coefficient,na.rm = TRUE)
sd(Cogstra$Coefficient,na.rm = TRUE)
sd(SREfam$Coefficient,na.rm = TRUE)
sd(SREstra$Coefficient,na.rm = TRUE)



########TABLES FOR METHOD#########


Main_data <- read_excel("Z:/DataCleaned_study1/Brianna/Data/Demo_Cor2.xlsx")
View(Main_data)
summary(Main_data)

#filtering out the two groups
Relationship_data <- data.frame(filter(Main_data, Familiarity == "Familiar"))
Strangers_data <- data.frame(filter(Main_data, Familiarity == "Strangers"))
summary(Main_data)
summary(Relationship_data)
summary(Strangers_data)
summary(Main_data$Age)

#1st table - mean and sd of PPIR & Age
mean(Main_data$Age, na.rm = TRUE)
mean(Main_data$PPIR_total, na.rm = TRUE)
mean(Main_data$FD, na.rm = TRUE)
mean(Main_data$SCI, na.rm = TRUE)
```

```
mean(Main_data$CH, na.rm = TRUE)
sd(Main_data$Age, na.rm = TRUE)
sd(Main_data$PPIR_total, na.rm = TRUE)
sd(Main_data$FD, na.rm = TRUE)
sd(Main_data$SCI, na.rm = TRUE)
sd(Main_data$CH, na.rm = TRUE)

mean(Relationship_data$Age, na.rm = TRUE)
mean(Relationship_data$PPIR_total, na.rm = TRUE)
mean(Relationship_data$FD, na.rm = TRUE)
mean(Relationship_data$SCI, na.rm = TRUE)
mean(Relationship_data$CH, na.rm = TRUE)
sd(Relationship_data$Age, na.rm = TRUE)
sd(Relationship_data$PPIR_total, na.rm = TRUE)
sd(Relationship_data$FD, na.rm = TRUE)
sd(Relationship_data$SCI, na.rm = TRUE)
sd(Relationship_data$CH, na.rm = TRUE)

mean(Strangers_data$Age, na.rm = TRUE)
mean(Strangers_data$PPIR_total, na.rm = TRUE)
mean(Strangers_data$FD, na.rm = TRUE)
mean(Strangers_data$SCI, na.rm = TRUE)
mean(Strangers_data$CH, na.rm = TRUE)
sd(Strangers_data$Age, na.rm = TRUE)
sd(Strangers_data$PPIR_total, na.rm = TRUE)
sd(Strangers_data$FD, na.rm = TRUE)
sd(Strangers_data$SCI, na.rm = TRUE)
sd(Strangers_data$CH, na.rm = TRUE)


#2nd table - familiar couples
summary(Relationship_data$Time_Known)
factor(Relationship_data$Time_Known)
mean(Relationship_data$Time_Known, na.rm = TRUE)
sd(Relationship_data$Time_Known, na.rm = TRUE)

class(Relationship_data$Type)
tabyl(Relationship_data$Type)

#3rd table - frequency of everything else
tabyl(Main_data$Gender)
tabyl(Main_data$Primary_Ethnic_Identity)
tabyl(Main_data$Secondary_Ethnic_Identity)
tabyl(Main_data$Education)
tabyl(Main_data$Profession)

tabyl(Relationship_data$Gender)
tabyl(Relationship_data$Primary_Ethnic_Identity)
tabyl(Relationship_data$Secondary_Ethnic_Identity)
tabyl(Relationship_data$Education)
```

```
tabyl(Relationship_data$Profession)

tabyl(Strangers_data$Gender)
tabyl(Strangers_data$Primary_Ethnic_Identity)
tabyl(Strangers_data$Secondary_Ethnic_Identity)
tabyl(Strangers_data$Education)
tabyl(Strangers_data$Profession)


#-------------------------------------------------------------------------------------------------------------
```