Human Performance in Emotion Recognition and Face Memory

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Abstract

The capacity to recall facial identity and recognise emotional expressions in others is vital for successful social interactions. This study investigated two opposing theories related to the processing of facial information, (1) a shared ability in emotion recognition and face memory driven by a singular visual functioning route, or (2) distinct abilities determined by separate visual functioning routes. In addition, personality variations across an Australian adult population were explored, described in terms of the dark triad of traits, including Machiavellianism, narcissism and psychopathy. Using a correlational within-subjects design, a sample of $N = 113$, age and gender diverse participants were recruited via social media and the University of Adelaide Research Participation System. Participants completed the Cambridge Face Memory Test – Australian, an emotion expression/suppression recognition task, as well as the Short Dark Triad Test. The generation of emotion expression and suppression response videos allowed for recognition ability to be extensively investigated. Results of a Kendall's correlation indicated that facial memory ability and emotion recognition were not significantly related. This supported the existence of separate abilities of facial recognition and emotion recognition. The dark triad traits were also demonstrated to show no significant relationship with emotion expression or suppression recognition ability.

Keywords: Emotion Recognition, Face Memory, Dark Triad, Emotion Expression, Emotion Suppression

Declaration

"This thesis contains no material which has been accepted for the award of any other degree of diploma in any University, and, to the best of my knowledge, this thesis contains no material previously published except where due reference is made. I give permission for the digital version of this thesis to be made available on the web, via the University of Adelaide's digital thesis repository, the Library Search and through web search engines, unless permission has been granted by the School to restrict access for a period of time."

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Human Performance in Emotion Recognition and Face Memory

The accurate recognition of emotion in others is essential to social communication and success in building rapport and trust between people; for example, recognising an individual is angry allows us to alter our behavior appropriately. Literature indicates there are individual differences in people's ability to recognise facial expressions and recall identity among the general population (Palermo et al., 2018; Russell, Duchaine, & Nakayama, 2009). There is also variance in emotion detection that depends on the type of emotion being displayed. Researchers have found that individuals are more accurate at recognizing happiness in comparison to negative emotions such as sadness and anger (Skowronski, Milner, Wagner, Crouch, & McCanne, 2014). Russell, Duchaine, and Nakayama (2009) found that a portion of the population possess exceptional face recognition ability and that differences in face recognition and facial perception skills are wider than previously acknowledged.

A deficit in this area can affect one's psychosocial functioning (Palermo, O'Connor, Davis, Irons, & McKone, 2013) and is a vital component of human socio-cognitive capacity (Bruce & Young, 2012). The capacity to detect emotion is determined by visual cues produced through another's micro-facial movements. Darwin (1872) introduced the concept of basic emotions. Darwin grouped several factors that underpinned each emotion expression and concluded that eight core constructs exist, each with corresponding micro-facial movements (See Table 1). This research inspired the work of Ekman and Friesen (1976) who refined and provided evidence for the universality of spontaneous expressions and determined the existence of five core facial expressions: anger, fear, disgust, sadness and enjoyment. The universality of emotion expression is not without challenge, with some research demonstrating that facial movements are not perceived to have uniform meanings (Barrett, Adolphs, Marsella, & Pollak, 2017). It has been indicated that these emotions are

multifaceted, though can be operationalized and measured empirically (Fontaine, Scherer, Roesch, & Ellsworth, 2017; Harrigan, Rosenthal, & Scherer, 2005; Stemmler, 2003).

Table 1

Darwin's Universal Emotions and Corresponding Facial Movements

Emotions	Facial Movements
Fear	Eyes open, mouth open, lips retract and eyebrows raise.
Anger	Eyes wide open, mouth compressed, nostrils raised.
Disgust	Mouth open, lower lip down, upper lip raised.
Contempt	Turn away eyes, upper lip raised, lip protrusion, nose wrinkle.
Happiness	Eyes sparkle, mouth drawn back at corners, skin under eyes wrinkled.
Surprise	Eyes open, mouth open, eyebrows raised, lips protruded.
Sadness	Corner of mouth depressed, inner corner of eyebrows raised.
Joy	Upper lip raised, nose labial fold formed, orbicularis, zygomatic.

Note. Adapted from "Facial Expression Emotion Detection for Real-Time Embedded Systems", by Turabzadeh, S., Meng, H., Swash., R., Pleva, M., & Juhar, J, 2018, *Technologies, 6* (17), 3.

The claim of universality implies that people are equally able to recognise all facial expressions however, individual differences have been reported (Lewis, Young, & Lefevre, 2016). Deficits have been identified due to clinical conditions such as anxiety, autism and schizophrenia (Demirbuga et al., 2013; Frank, Schulze, Hellweg, Koehne, & Roepke, 2018; Palermo, et al., 2018). Despite considerable attention for several decades, reasons for individual differences in emotion recognition ability amongst the subclinical population have been overlooked and misunderstood (Lewis, Lefevre, & Young, 2016). An exception is alexithymia, the pervasive inability to detect or express emotions (Lewis, Lefevre, & Young, 2016).

An area of interest is the personality traits, categorized as the 'dark triad' by Paulhus and Williams (2002). Narcissism, Machiavellianism and psychopathy are identified as three closely related yet independent personality traits that commonly manifest a callousness and manipulative nature (Jones & Paulhus, 2014). Psychopathy is characterized as overtly anti-social behaviour and impulsivity (Hare & Neumann, 2008), Machiavellianism a cynical worldview and strategic-calculating behaviour and narcissism by grandiosity and self-promotion behaviour fueled by the need for ego-reinforcement, self-entitlement and an exploitative interpersonal style (Jones & Paulhus, 2017). Literature has indicated inconsistencies in the relationship between the traits and emotion recognition. Some suggesting an enhanced ability, potentially motivated by self-gain (Nagler, Reiter, Furtner, & Rauthmann, 2014) and others, a deficit due to a lower emotional intelligence (Zhang, Zou, Wang, & Finy, 2012).

1.1 The Current Study: Aims

The current study explores whether face memory (ability to recall and recognise faces) and emotion recognition abilities are related and share a singular visual functioning route or whether they are distinct abilities which have separate visual functioning routes (no

relationship between abilities). The study also considered whether the subclinical 'dark triad' personality traits demonstrated a relationship with emotion recognition ability. Emotion recognition consisted of two aspects: the capacity to accurately recognise an emotional expression and to accurately recognise a suppressed emotion. This study has the following aims: to identify whether there is a relationship between face memory and emotion recognition abilities and to examine the relationship between endorsement in the dark triad traits and emotion recognition in free and suppressed conditions.

1.2 Relationship between Face Memory and Emotion Recognition.

The first research aim investigated the evidence for two opposing theories, (1) Singular Visual Functioning Route Theory (Calder & Young, 2005): the existence of a shared ability in emotion recognition driven by a singular visual functioning route, or (2) Separate Visual Functioning Routes theory (Bruce & Young, 1986): distinct and unrelated abilities. Exploring this relationship allows for further clarification of the processes contributing to human performance.

1.2.1 Singular Visual Functioning Route Theory. It has been suggested that a relationship between face memory and emotion expression recognition exists through a single-dimensional framework, where a common visual route is used for both processes (Calder & Young 2005). This concept acknowledges a degree of neural separation between mechanisms, suggesting that the facial identity route bifurcates from the facial expression route after a common representation system (coding both facial identity and expression). This concept is explained through the use of principle component analysis (PCA). "PCA is a linearized compact coding that explains the relationships among variables in terms of a smaller set of principle components (PCs)" (Calder & Young, 2005, p.645). This technique demonstrates that the independent perception of the two factors has arisen from an image based analysis of faces, where there is no clear mechanism for routing identity or

expression related cues to different systems (Calder & Young, 2005). Therefore, the "existence of a single multidimensional framework where facial identity and expression are coded largely (not entirely) by different sets of dimensions (PCs) is acknowledged, suggesting partial statistical independence rather than absolute independence. The use of PCA-based systems indicates there is a dissociation in the statistical properties of facial images" (Calder & Young, 2005, p.649).

It can be argued that evidence for impaired facial identity though intact facial expression recognition stems from research where the cause of identity impairments has not been determined (Etcoff, 1984; Young, Newcombe, Small, & Hay, 1993; Shuttleworth, Syring, & Allen, 1982). Such studies offer evidence of a dissociation between the factors, however do not indicate a visuo-perceptual origin. Research overlooks that disparately in performance of the two processes can occur in neuropsychological conditions other than selective damage to the perceptual representation of human faces (prosopagnosia) (Calder & Young, 2005). Therefore, the dissociation seen in these individuals does not necessarily support separate visual coding. Alternative causes that have not been fully considered include: prosopamnesia (inability to learn faces) (Tippet, Miller, & Farah, 2000) and other cognitive impairments such as amnesia (Parry, Young, Saul, & Moss, 1990).

The single-dimension framework is support by a meta-analysis of 8 studies involving schizophrenic participants. This found a moderate correlation of .53 between facial recognition and facial emotion processing ability (Ventura, Wood, Jimenez, & Hellemann, 2013). Research by Pavel and Iordanescu (2012) involving undergraduates, explored the influence of emotion expression on facial recognition performance. The authors found a significant effect (p = .002), demonstrating emotional display influenced the ability to correctly select face identity in a recall task. Negative facial expression had a negative impact on the ability to recall facial identity. D'Argembeau & Van der Linden (2007) also found that

facial expression had a significant effect (p = .002) on the ability to recognise novel faces, particularly happy rather than angry expressions. This research supports an interaction/relationship between abilities. Furthermore, Palermo, O'Connor, Davis, Irons, and McKone (2013) found a moderate association (r =.40, p <.01) between performance on the Cambridge Face Memory Test (CFMT) and the Emotion Hexagon (Young, Calder, Sprengelmeyer, & Ekman, 2002). The Emotion Hexagon test assess facial expression recognition, prompting individuals to judge the expressions presented by a model from Ekman and Friesen's (1976) facial effect series (Fairchild, Goozen, Calder, Stollery, & Goodyer, 2009). The facial expressions are morphed over a continuum that spans across six pairs (e.g. happiness-surprise, surprise-fear), with each continuum containing five images. The blend of each expression gradually changes in percentage (e.g. happy-surprise, 10-90%, 30-70%). An expression is considered correctly rated if the participant selects the emotion when it contains a 70 to 90% representation. The findings demonstrate phases of perceptual face processing which are common in relation to facial identity and emotion.

Similarly, a significant positive correlation (r = .38, p < .001) was found when using the CFMT and a modified six-alternative forced choice paradigm facial expression recognition task stemming from that used by Palermo, et al. (2013). The task had a split-half reliability score of .68 (N = 335) (Rhodes et al., 2015). Rhodes et al. indicated this correlation remained considerable after controlling for non-face recognition and substantially larger than the correlation between the CFMT and the non-face recognition measure, the Cambridge Car Memory Test (CCMT) (r = .075, p = .337). In a well-powered and age-diverse sample (N = 605), Connolly, Young, and Lewis (2018) measured facial emotion recognition through a task stemming from the Emotion Hexagon Test, incorporating Ekman and Friesen's Pictures of Facial Effect (1976). The Benton test of facial recognition was also implemented, measuring a person's capacity to match pictures of unfamiliar faces (Levin, Hamsher, & Benton,

1975). Through a confirmatory factor analysis, the authors found a strong positive correlation ($r = .52$, $p < .001$) between face emotion and face identity recognition. The results indicated a moderate effect size and was highly significant after controlling for general intelligence and short-term memory span. These findings support the theory of a common processing mechanism. Connolly, Young, and Lewis (2018) corresponded with the observations made by Borod et al. (2000) (N = 100), demonstrating a positive correlation between facial recognition (face memory) and emotion detection ($r = .44$) in a subclinical adult population.

1.2.2 Separate Visual Functioning Routes Theory. Bruce and Young (1986) suggested separate visual functioning routes, with the recognition of facial identity and expression being independent abilities. The theory is explained by the Haxby et al.'s (2000) model (See Figure 1), an extension of Bruce and Young's theory (See Figure 2). The model proposes a hierarchical structure with core and extended systems. The core system comprised of occipito-temporal regions in the extra-striate visual cortex and differentiates mechanisms for coding facial properties that are changeable and mechanisms for consistent facial properties. The extended system includes neural regions that are strictly related to the processing of language, semantics, emotion and attention. The extended system acts in conjunction with the core system to extract meaning from faces (Haxby, Hoffman & Gobbini, 2000). Duchaine and Yovel (2015) later revised the Haxby et al. (2000) model. The theory that face perception depends on two separate pathways remains, though variations from the original model have been proposed (See Figure 3). It is now suggested these two pathways consist of a ventral stream that represents form information and a dorsal stream driven by motion and form information (Duchaine & Yovel, 2015). A within-subjects design undertaken by Young, McWeeny, Hay and Ellis (1986) proposed independent processes for the analysis of facial expressions and the establishment of a person's identity. Their conclusion was based on participants' faster reaction times to familiar faces than unfamiliar faces. No difference

was found in reaction time for detection of expression matching between familiar and unfamiliar faces. The research was rudimentary, though seminal in the establishment of the separate functioning route theory.

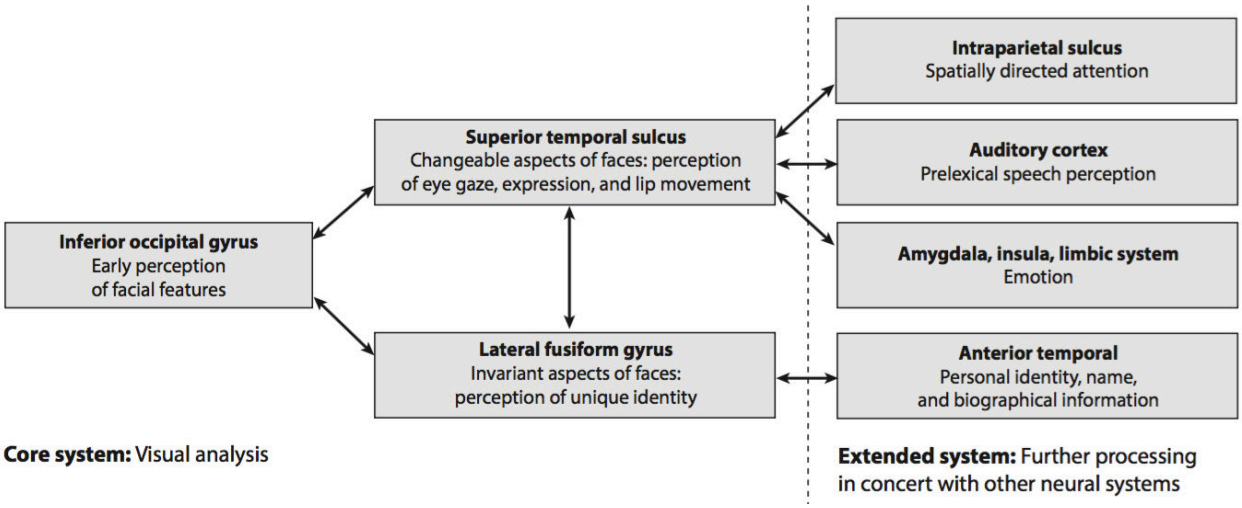

Figure 1. The Haxby et al. (2000) model of face processing. Adapted from "A Revision Neural Framework for Face Processing", by B. Duchaine, and G. Yovel, 2015, *Annual Review of Vision Science, 1,* 399.

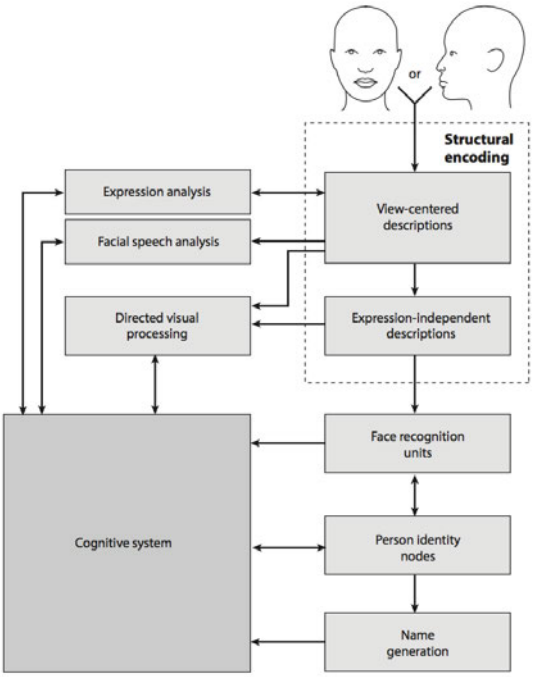

Figure 2. The Bruce & Young (1986) model of face processing. Adapted from "A Revision Neural Framework for Face Processing", by B. Duchaine, and G. Yovel, 2015, *Annual Review of Vision Science, 1,* 396.

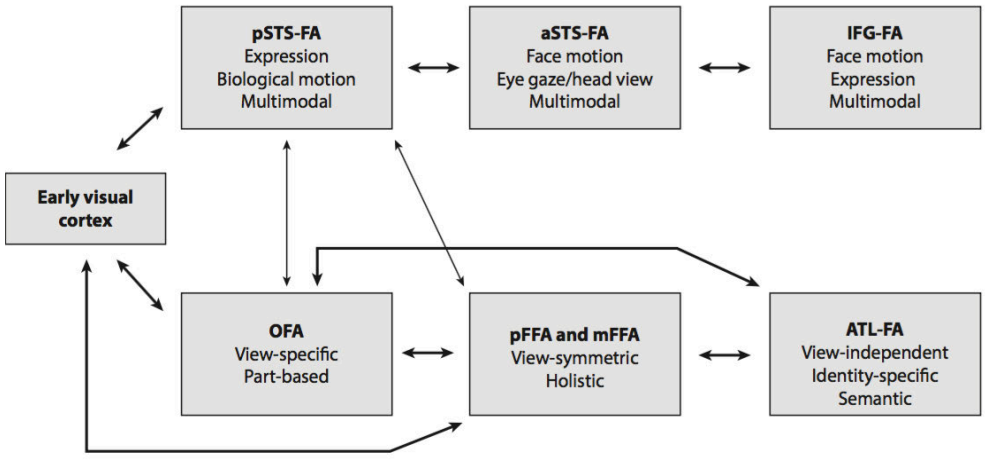

Figure 3. A Revised Framework of The Haxby et al. (2000) model of face processing by Duchaine and Yovel (2015). Adapted from "A Revision Neural Framework for Face Processing", by B. Duchaine, and G. Yovel, 2015, *Annual Review of Vision Science, 1,* 407.

Nunn, Postma and Pearson (2001) undertook a case study involving a prosopagnosic patient. Prosopagnosia is a life-long developmental disorder associated with impaired face recognition (Biotti & Cook, 2016). The study incorporated the use the standardised tests of facial memory at the time: The Benton Face Recognition Test (BFRT) and the Warrington Recognition Memory Test (WRMT). Nunn, Postma and Pearson (2001) found the patient could perceive sex, age, expression from faces, recognise facial parts and make face/non-face distinctions. The emotion expression measure implemented consisted of 10 faces (six females, four males) taken from the Ekman and Friesen series (1976) including static images of enjoyment, sadness, surprise, disgust, anger and fear.

The research appears to have several flaws. The BFRT and WRMT have both been demonstrated to show a lack of construct validity (Duchaine & Nakayama, 2006), with a normal score still obtained when internal features are removed from the faces and only hair and eye brows are depicted. The test permits various strategies, including substantial use of non-facial information, suggesting it may not measure a unidimensional construct. They have also shown to fail to classify a majority of prosopagnosics as impaired (Duchaine & Nakayama, 2006). This was evident in their research, with the patient receiving a normal performance in the BFRT, with performance below the mean of the controls in the WRMT. The patients' WRMT score did not constitute impairment in relation to the normative data (Nunn, Postma, & Pearson, 2001). The use of still imagery drawn from Ekman and Friesen's series, restricted the external validity of performance in emotion recognition, as it did not reflect real-world interaction.

Research in support of the theory progressed to utilize case studies of prosopagnosics without exploring variations in performance amongst the general population. Duchaine, Parker and Nakayama (2003) found that a 40-year old prosopagnosic indicated a severe

impairment in facial identification ability across five of six facial identity recognition tasks: Face One in Ten (OIT), Old and New Discrimination, Warrington Recognition for Faces (WRFT), Famous Faces and the Different Views Test. In contrast, the participant performed in the normal range on four tests of emotion recognition: Emotion Hexagon, Reading the Mind in the Eyes, Emotion Matching and the Emotional Intensity (Duchaine, Parker & Nakayama, 2003). The research had shortcomings: the use of one patient contributed to the problematic lack of external validity and the old/new discrimination task used images of a teenage female population, cropping the images from a high-school year book with non-facial information such as hair partly visible (Duchaine, Parker, & Nakayama, 2003). The inclusion of non-facial information may contribute to the ability to recall faces, therefore reducing construct validity. It is unclear whether the test gauges naturalistic face recognition ability or taps into the capacity to match distinctive features. The Famous Faces test also presents flaws, with the inclusion of hair and clothing as well as the possibility of previous exposure to the stimuli, another factor that must be considered when comparing the score of prosopagnosics to the control group.

The Emotion Hexagon has shown to be a valid and reliable measure across studies, though it has indicated poor range for observing typical population correlations (Calder, Young, Perrett, Sprengelmeyer, & Ekman, 2002; Palmero, O'Conner, Davis, Irons, & McKone, 2013). The Emotional Intensity measure showed the prosopagnosic patient performed similarly to the control group in judging relative intensity of an emotion. The patient was in the normal range (in comparison to control) in categorising emotions expressed by differing models through the use of the Emotion Matching Test (Duchaine, Parker, & Nakayama, 2003). The participant had normal performance in the Reading the Mind in the Eyes test (Baron-Cohen et al., 2001), though this measure has been indicated to have poor internal consistency, with variations including differing word option responses, angle of face,

the ratio of dark and light, and the use of shadows (Olderbak et al., 2015). The test expressed weak agreement between items with several negatively related (Olderbak et al., 2015). The use of black and white static images displaying only eye expressions also deviates from real-world interaction.

More recently, Banissy et al., (2011) found supporting evidence for the theory by investigating a selective group of participants who experience Mirror-Touch Synesthesia: a rare condition where individuals experience feelings of contact on their own body when observing touch to another person; a condition linked with heightened sensorimotor stimulation (Banissy et al., 2011). The study utilised The CFMT (McKone, et al., 2011) as well as a filmed facial expression recognition task, involving the presentation of an adjective explaining an emotional state followed by three images of actors displaying different expressions (Banissy et al., 2011). The research indicated these individuals outperformed the control on emotion expression recognition, but not facial identity perception (face memory), suggesting a differentiation between abilities, at least in this population.

In summary, there is limited evidence to support the separate visual functioning routes theory of identity and emotion detection and there are large individual differences across both abilities. Next, we consider the literature on personality traits of relevance to emotion detection.

1.3 Dark Triad Traits and Emotion Recognition

The ‘dark triad traits’ of personality has sparked societal and academic interest, with nearly 4,330 journal articles published in the past decade (PsychInfo, OVID, search 18.6.2019). The traits relate to lower global empathy in individuals, with empathy deficit as a fundamental aspect of the traits (Jonason, Lyons, Bethell, & Ross, 2013). Those scoring highly on any of the three factors expressed reduced affective empathy (motivation to

respond appropriately to another's emotions) (Wai & Tiliopoulos, 2012) but have presented a more equivocal relationship with cognitive empathy (accurately recognizing and understanding another's emotional state) (Jonason & Krause, 2013). Some researchers predict the dark triad traits are associated with emotional impairment due to a deficit in the capacity to experience emotions (Jonason, Lyons, Bethell, & Ross, 2013). The assumption of a deficit also stems from decreased emotional intelligence (EI) (one's ability to identify, process, and utilise emotion-laden information) (Zhang, Zou, Wang, & Finy, 2012). Psychopathy and Machiavellianism have been associated with lower trait EI (Malterer, Glass, & Newman, 2008; Austin, Farrelly, Black, & Moore, 2007).

Wai and Tiliopoulos (2012) studied university students (*N*= 139, Female = 106, Male = 33), examining the relationship between forms of empathy (affective and cognitive) and the dark triad. Wai and Tiliopoulos (2012) utilised a facial identification task for the assessment of cognitive empathy and a self-assessment manikin in relation emotional response (SAM; Bradley & Lang, 1994) for affective empathy. They found those who endorsed narcissism (at a sub-clinical level) showed an increase in cognitive empathy (accurately recognizing and understanding another's emotion state) with no emotion identification deficit. This research reflected an earlier study by Del Gaizo and Falkenback (2008). Wai and Tiliopoulos determined that primary psychopathy (those who possess cool and carefully executed behaviour fueled by lack of morality) was associated with a deficit in emotion identification and Machiavellianism was associated with a decrease ability to identify happy and sad emotions. Contrastingly, Del Gaizo and Falkenback found that primary psychopathy was positively associated with perception accuracy of fearful faces. These findings suggest that, although there was reduced affective empathy, there is little evidence of impaired cognitive empathy across all three of the factors. The results propose that endorsement of the dark triad traits is not associated with emotion identification deficits as previously assumed. Individuals

that have scored highly on the dark triad can be assumed to have the capacity to read and assess other's emotions. This might aid their tactics of manipulation; however, this has not been assessed in the literature. The lack of affective empathy may lead them to ignore possible harm and lack the motivation to respond appropriately.

The global empathy assessments used in this research are insufficient in discriminating between one's ability to read others and one's tendency to produce appropriate reactions (Wai & Tiliopoulos, 2012). The dark triad traits did not reflect a deficit in cognitive empathy, though an impairment in emotion identification remained for those who scored on primary psychopathy and Machiavellianism (Wai & Tiliopoulos, 2012). A further problem is that Wai and Tiliopoulous (2012) used an unspecified facial identification task which did not indicate the ten facial expression emotion images used. Given these problems with measurement of emotion identification and assessment of empathy, it is difficult to conclude the relationship.

1.3.1 Cognitive and Affective Empathy and Measuring Emotion Recognition. A study by Besel and Yuille (2012) found that affective empathy was the only significant predictor of overall expression detection accuracy. If the task solely reflects levels of affective empathy, one would expect deficits in individuals who endorse any of the three traits. Further research by Jonason and Krause (2013), challenged this finding, indicating psychopathy acts as the only predictor of reduced affectively empathy. The findings of Wai and Tiliopoulos (2012) and Del Gaizo and Falkenback (2008) on narcissism also contrast. Jonason and Krause (2013) used the 20-item Basic Empathy Scale (Jolliffe & Farrington, 2006), a self-report measure where participants rank their agreement with presented statements such as, "I can usually figure out when people are happy" (9 cognitive empathy items) ($\alpha = .83$) and "Other people's feelings affect me easily" (11 affective empathy items) ($\alpha = .83$). This is a common problem amongst literature reviewed. The varying use of facial

emotion displays on video and self-report measures are often ignored, though are both used to draw conclusions about overall ability in the identification of emotions. The definition of 'identifying emotion' also deviates, with some determining it by appropriate internal emotional responses and others by direct physiological recognition (micro-facial changes). Turner, Foster and Webster (2019) investigated cognitive and emotional empathy with the dark triad traits, through the use of the Short Dark Triad (SD3) (Jones & Paulhus, 2014) and the Basic Empathy Scale (Jolliffe & Farington). The SD3 has been demonstrated as an efficient measure of the dark triad and indicates acceptable reliability with each factor, narcissism ($\alpha = .71$), Machiavellianism ($\alpha = .77$) and psychopathy ($\alpha = .80$). The authors found that psychopathy was unrelated, though narcissism and Machiavellianism were positively related to cognitive empathy skills and shown to be related to higher than average levels of cognitive empathy (Turner, Foster, & Webster, 2019). The research identified cognitive empathy as: the ability to understand and identify other's emotions (Lockwood, Seara-Cardoso, & Viding, 2014). By measuring this through a self-report measure, real world application diminishes. The research draws conclusions about the internal processes of these individuals and their belief in their ability, though does not contribute to the understanding of direct recognition ability.

Amiri and Behnezhad (2017) undertook a novel study investigating emotion detection using still images. The results indicated there was a significant influence from the dark triad personality traits on emotion recognition, with participants possessing the traits showing lower performance. The research used the international affective picture system, incorporating still images from Ekman and Friesen's images of facial expressions of emotion (Ekman & Friese, 1976).

More recent research has progressed to measures such as: The Reading the Mind in the Eyes test (RMET) as well as self-report measures such as the Basic Empathy Scale

(Pajevic, Vukosavljevic-Gvozden, Stevanovic, & Neumann, 2018) indicating that narcissism has been positively correlated with cognitive empathy, though Machiavellianism and psychopathy were both negatively associated with affective and cognitive empathy. Surprisingly, only psychopathic traits were associated with a depleted ability to accurately recognise emotional states in the facial display task. Although narcissism was deemed as a positive predictor of cognitive empathy, it was obtained through the self-report measure and not confirmed by performance in the emotion recognition task (Pajevic, et al., 2018). This study was vital as it differentiated the ability to physically recognise emotions from overall cognitive empathy. It is proposed that narcissists identify as having improved abilities, though they may actually struggle at recognition. This suggests the positive correlation with narcissism may be due to individuals over-rating their empathetic ability in self-assessment measures (self-report bias), driven by a sense of grandiosity (Pajevic, et al., 2018). Assessments of emotion detection must be based on performance rather than self-reporting. A further problem was the use of a still imagery task limited to the depiction of eyes rather than faces (The Reading the Mind in the Eyes Test). This limitation will be addressed in the current study.

The introduction of colour video footage and variation in expression velocity better reflects a real-life interaction in comparison to the use of simple static imagery and allows for better assessment of identifying micro-facial changes. The research does not attempt to measure empathy or explore its facets, but seeks to simply identify performance. Emotion expression videos of participants giving genuine responses of happiness and disgust were obtained from a concurrent honours thesis at the University of Adelaide (Jovic, 2019). The use contributed to external validity and establishes a database of culturally relevant footage. The incorporation of a confidence scale for each response

will also allow for assessment of the confidence-accuracy relationship, in an emotion detection task.

1.4 Dark Triad Traits and Emotion Suppression Recognition

The availability of suppression footage provides a further step in testing emotion recognition ability. Most studies of emotion detection focus on freely expressed emotion, however it may be that suppressed signs of emotion are more important in interaction contexts where exploitation and manipulation are acknowledged. As key characteristics of the dark triad, this study assessed their relationship with performance on emotion detection from a sample of videos where people were asked not to let their emotions show. Although research indicates a possible deficit in emotion recognition, the three factors all indicated a positive correlation with socio-emotional control (the ability to regulate emotional displays) (Nagler, Reiter, Furtner & Rauthmann, 2014). The traits have been found to positively associate with managing the emotions of others (Austin, Saklofske, Smith, & Tohver, 2014) and suggest individuals may not experience difficulty with emotion dysregulation themselves. Substantial performance in the ability to detect the suppression of emotion in an individual would provide a greater understanding of underlying ability to engage in socio-emotional control of others and contribute to knowledge of maladaptive personality characteristics.

The current study incorporates three main aims, (1) to examine whether there is a relationship between face memory and emotion recognition. The findings of the study will provide further evidence to support either the single visual functioning route theory (a positive relationship between abilities) or separate visual functioning routes (no relationship); (2) to investigate the relationship between the dark triad traits (narcissism, Machiavellianism and psychopathy) and emotion expression recognition ability. This being achieved by the use video footage stimuli, with participants attempting to identify

emotion through viewing the micro-facial movements of others. With the inclusion of self-report confidence scores with each response, the relationship between a belief in one's own ability and accuracy in emotion recognition will also be investigated and (3) to explore the relationship between the dark triad traits and emotion recognition ability in suppressed conditions, in an attempt to further understand the ability of individuals who endorse the dark-triad traits at a subclinical level.

Method

2.1 Participants

Psychology students undertaking the Psychology 1B class at the University of Adelaide in 2019, as well members of the public were invited to complete the online experiment. Individuals under 18 years were not invited to participate to avoid consent restrictions. Few exclusion criteria were implemented, as the study aimed to sample from a wide population and explore individual differences and underlying processes of human performance in emotion and face recognition.

2.2.1 Recruitment. Participants were recruited using the University of Adelaide *Research Participation System*, as well as Facebook, Instagram and email. A credit towards the Psychology 1B course was provided as an incentive.

2.2.2 Demographics. 115 adults aged between 18 and 60 (*M* = 23 *years, SD = 8.20)* participated (37 males and 78 females), 88 students and 27 members of the public were included in the study.

2.3 Measures

Participants completed two measures via an online questionnaire, the Short Dark Triad (SD3) and the Cambridge Face Memory Test- Australian (CFMT-Aus) (Appendix D).

2.3.1 Measuring Personality Traits. Machiavellianism, narcissism and psychopathy were measured using the Short Dark Triad (Jones & Paulhus, 2014). Consisting of 27 items (9 items per construct), the SD3 is concise and shows good validity and reliability (Maples, Lamkin, & Miller, 2014). It's items correspond with the guiding principles of each factor: Machiavellianism (manipulative, callous and a strategic calculating orientation), narcissism (manipulative, callous and an ego-identity) and, psychopathy (callous and lack of self-control), generated from seminal literature and the original independent measures: the Machiavellian Four (MACH-IV) (Christie & Geis, 1970), the Self Report Psychopathy (SRP-

III) (Mahmut, Menictas, Stevenson, & Homewood, 2011; Williams, Paulhus, & Hare, 2007) and the Narcissistic Personality Inventory (NPI) (Raskin & Hall, 1979). Gender differences were identified to run parallel to the original measures and the construct validity of the inventory (Table 2), has been demonstrated in over 100 studies (Jones & Paulhus, 2017). The measure has shown reasonable internal consistency (Table 3) (Jones & Paulhus, 2014). Each item consisted of a statement where participants ranked their agreement using a five-point Likert scale (1 “Strongly Disagree” to 5 “Strongly Agree”).

Table 2

SD3 Subscales Correlation with Golden Standard Counterpart (MACH-IV, SPR-III & NPI)

Subscale	Correlation
Machiavellianism	.68
Psychopathy	.78
Narcissism	.70

Note. All values shown to be significant at $p < .01$. Adapted from “Introducing the Short Dark Triad (SD3): A Brief Measure of Dark Personality Traits,” by Jones, D. N., & Paulhus, D.L, 2014, *Assessment, 21* (1), p. 34.

Table 3

Internal Consistency of the SD3 Subscales

Subscale	Cronbach's *a*
Machiavellianism	.71
Psychopathy	.77
Narcissism	.74

Note. Adapted from "Introducing the Short Dark Triad (SD3): A Brief Measure of Dark Personality Traits," by Jones, D. N., & Paulhus, D.L, 2014, *Assessment, 21* (1), p. 32.

2.3.2 Measuring Face Recognition Ability. This was measured using the Cambridge Face Memory Test-Australian (CFMT-Aus) (McKone, et al., 2011). The CFMT-Aus has three stages: memorising singular faces (three seconds per profile view) which were then identified against two novel faces per item (18 test items), memorising six faces simultaneously (20 seconds) which must be identified against two novel faces per item (target face altered) (30 test items) and recognising these same faces against two novel faces with the addition of noise (24 test items). As face ethnicity within races effects face processing ability, the introduction of European subpopulation items (McKone, et at., 2011) differentiates the Australian model from the original Cambridge Face Memory Test (Duchaine & Nakayama, 2006) allowing a better fit for Australians, New Zealanders, UK, Irish, Northern Europeans and South Africans (McKone, et al., 2011). Much like the CFMT, the Australian version provides a validated format for testing novel face learning. Good reliability has been shown (α = .88), strong convergent validity with the CFMT (r = .71, p = $<.001$) and divergent validity with a non-significant weak correlation (r = .21, p = .091) to the Cambridge Car Memory Test (CCMT), (McKone, et al., 2011).

2.4 Study Design

The study used a within-subjects design to explore correlation between scores in the dark triad personality traits, facial memory ability and the accurate recognition of emotion expression and suppression.

2.5 Procedure

The test was posted on the *FlexiQuiz*^{TM} website for 6 weeks, took approximately 30 minutes to complete and consisted of four sections: Demographic information (5 items), SD3 (27 items), CFMT-Aus (94 total items) and the emotion expression and suppression detection task (24 items). Participants read and signed an information sheet and consent form which outlined the aims and procedures. A series of demographic questions were administered, defining participants age and gender. Contributors were also offered the option to provide their contact details if they wished to receive the results of the study. These details were saved separately from their data.

2.5.1 Dark Triad Data Collection. The individuals were directed to complete the Dark Triad Personality Test Short Form (SD3) which allowed for researchers to generate mean scores for each participant that expressed their level of endorsement for the three traits.

2.5.2 Face Memory Data Collection. Participants were asked to complete the CFMT – Aus, with each stage of the test embedded into FlexiQuiz^{TM}, avoiding the need for participants to navigate away from the study and avoiding withdrawals and incomplete data. A practice round was administered displaying images of Bart Simpson (three seconds per profile) that allowed individuals to familiarise themselves with the test, followed by three test items that required the participant to differentiate the Bart Simpson image from other cartoon characters. The study then progressed to the test trials.

2.5.3 Emotion Expression and Suppression Recognition Data Collection. Participants viewed 24 video recordings (six videos per condition; happiness expression, disgust

expression, happiness suppression and disgust suppression). The recordings were randomised to avoid practice effects and were obtained from a study undertaken at the University of Adelaide as part of a student's honours thesis (Jovic, 2019). The number of videos reflected the structure of the Multimorph Facial Affect Recognition Task (Blair, Colledge, Murray, & Mitchell, 2001) which utilises six differing emotion stimuli footage for each of the universal emotions (happiness, surprise, fear, sadness, disgust and anger) (Ekman & Friesen, 1978).

2.6 Footage Obtained from Honours Thesis (Jovic, 2019)

The study undertaken by Jovic (2019) required participants to view a range of footage that would elicit a response of happiness or disgust while being filmed. They were then requested to suppress these emotions. The stimuli shown to the participants were generated from research into emotion expression, undertaken by Jenkins and Andrewes (2012) and Gross and Levenson (1995). It was acknowledged that variation in the responses of those being filmed were a result of individual differences reflecting differing emotional expression within the population. Some participants were more emotive than others, therefore particular videos shown to members of the current study allowed for the easier detection.

2.7 Exclusion of Information

Participants of the study were not informed that videos were restricted to reactions of happiness and disgust. They were asked to identify what emotion was being displayed in the footage using a six-alternative forced choice paradigm (happiness, disgust, sadness, fear, anger or surprise). After each video, the individual was prompted to indicate which emotion they believed was being expressed/suppressed and asked to rate their confidence in the decision on a five-point Likert scale (guessing, unsure, moderately sure, very sure and certain). Once each test in the study was completed, participants were thanked for their time and provided the contact details of the researchers, if they required further information.

2.8 Ethics

Procedures were approved by the University of Adelaide Psychology School: Human Research Ethics Subcommittee (Appendix E). Approval number: 19/52.

Results

3.1 Data Screening

Prior to undertaking analysis, a data screening process was completed in R Studio and Excel in order to screen for missing values, outliers, invalid values and to assess normality. The results from Shapiro-Wilk Tests, as well as descriptive statistics were generated for each of the variables (displayed in Tables 4 and 5). There was a total of 115 participants with no missing values identified, though two responses were excluded from individuals who participated in the concurrent honours study as this may have effected their recognition ability score, resulting in a final sample size of 113. As the study planned to examine varying performance, no outliers were excluded from the data set. In this study, Shapiro-Wilk test values were significant for a majority of the variables, demonstrating a deviation from normality. Machiavellianism, psychopathy and confidence were recognised to be normally distributed with non-significant Shapiro-Wilk test values.

Table 4

Descriptive Statistics of the Current Sample (N = 113)

Variable		M	SD	Min	Max
Machiavellianism		3.05	.64	1.11	4.67
Narcissism		2.80	.50	1.56	3.78
Psychopathy		1.70	.50	.78	3.00
Cambridge Face Memory		77.96	12.59	47.22	100
Australian Emotion Recognition (Expressed)		53.47	13.81	16.67	91.67
	Happiness	58.85	18.10	16.67	100
	Disgust	48.08	18.20	0	83.33
Emotion Recognition (Suppressed)		32.96	12.76	0.00	66.67
	Happiness	38.79	16.43	0.00	66.67
	Disgust	27.14	17.84	0.00	66.67
Confidence		3.03	0.60	1.00	4.46

Note. CFMT, expression and suppression recognition values presented as (%) in accuracy. Mean dark triad scores of undergraduates in the current study showed to reflect the norms: Machiavellianism (M = 3.1, SD = *.76*), Narcissism (M = 2.8, SD = .88) and Psychopathy (M = 2.4, SD = 1.0). Although the deviation amongst results is smaller.

Table 5

Shapiro-Wilk Tests of Normality

Variables		*W*	*p-value*
Machiavellianism		.99	.79
Narcissism		.96	.00
Psychopathy		.97	.07
Cambridge Face Memory		.97	.01
Australian Expression Detection Performance		.96	.00
	Happiness	.91	.00
	Disgust	.92	.00
Suppression Detection Performance		.95	.00
	Happiness	.90	.00
	Disgust	.90	.00
Confidence		.97	.05

3.2 Aim 1: Identify whether there is a relationship between facial memory (Cambridge Face Memory) and emotion recognition.

The findings intended to contribute to one of two existing theories: singular visual functioning route or separate visual functioning routes. Kendall's Tau-b rank-order correlations were used to test whether there were statistically significant relationships, illustrated by Table 6. Kendall's Tau-b rank-order correlations accounted for the non-normal distributions, confirmed by Shapiro-Wilk tests

and Q-Q plots indicating the assumption of normality was violated in relation to all three variables (p <.05). The test was implemented, as it controls for tied data therefore deviating from Spearman's Rho. Although, results in both tests expressed similar findings, see Table 7.

Participants were more accurate in recognising facial identity as measured by the CFMT-AU (M = 77.96, SD = 12.59*),* in comparison to overall emotion recognition (happiness and disgust) in expressed (M = 53.47, SD = 13.81); Z = .83, p <.01 and suppressed conditions (M = 32.96*, SD* = 12.76); Z = .86, p < .01. To accommodate for non-normally distributed data, Wilcoxon Signed Ranks Tests were implemented to examine the difference in performance in the CFMT-AU and emotion recognition. Approximate p-values were generated as the data was recognised to include ties. A mean accuracy score below 50 percent for emotion recognition in suppressed conditions indicated that participants were reasonably unsuccessful at recognising which emotions were being suppressed, although the rate was above chance responding (16%). The Kendall's Tau-bank rank order test indicated a non-significant relationship between performance in the CFMT-AU and emotion expression recognition ($r_{\tau b}$ (111) = .10, p = .11). A non-significant relationship was also found between CFMT-AU and emotion recognition ability (suppressed conditions) ($r_{\tau b}$ (112) = -.06, p = .36). Further analysis revealed a stronger association between the ability to detect suppressed and expressed emotion, despite the substantial variance in performance, ($r_{\tau b}$ (111) = .21, p <.01).

Using proportion of correct trials as a measure of performance, participants were better at recognising happiness (M = .58, SD = .18) in comparison to disgust (M = .48, SD = .18) across both free (expressed) and suppressed conditions, using the Wilcoxon test; W (112) = 3104.5, p <.001, r_b = .52. Correspondingly, proportion correct detections of happiness (M = .38, SD = .16) were significantly higher than proportion correct detections of disgust (M = .27, SD = .18), W (112) = 2671, p <.001, r_b = .57, under suppressed conditions.

Table 6.

Kendall's Tau Rank Correlation Coefficients

	1	2	3	4	5	6	7	8	9	10	11
1. Machiavellianism		.12	.21**	-.04	-.03	-.02	-0.05	-.03	.02	-.04	.07
2. Narcissism			.07	.00	.07	.04	.02	.07	.07	.05	.08
3. Psychopathy				-.03	-.11	-.03	-.13	.05	.01	.05	-.04
4. Cambridge Face Memory Australian					.10	.11	.07	-.06	.02	-.09	.05
5. Emotion Recognition (Expressed)						.63**	.65**	.21**	.16*	.14	.16*
6. Happiness (EX)							.11	.18*	.20*	.10	.16*
7. Disgust (EX)								.15*	.06	.12	.07
8. Emotion Recognition (Suppressed)									.58**	.67**	.06
9. Happiness (SU)										0.06	.07
10. SU Disgust (SU)											.04
11. Confidence											

*Note. *. Correlation is significant at 0.05 level (2-sided). ** Correlation is significant at 0.01 level (2-sided). 'EX' refers to expressed (free condition) and 'SU' refers to suppressed.*

Table 7

Spearman's Rho Rank Correlation Coefficients

	1	2	3	4	5	6	7	8	9	10	11
1. Machiavellianism		.17	.29**	-.06	-.04	-.02	-.06	-0.04	.03	-.05	.10
2. Narcissism			.11	.00	.09	.05	.03	.10	.09	.07	.11
3. Psychopathy				-.05	-.16	-.04	-.17	.07	.02	.06	-.06
4. Cambridge Face Memory Australian					.14	.14	.09	-.08	.02	-.13	.06
5. Emotion Recognition (Expressed)						.73**	.75**	.27**	.20*	.18	.21*
6. Happiness (EX)							.13	.23*	.24**	.12	.21*
7. Disgust (EX)								.19*	.07	.15	.10
8. Emotion Recognition (Suppressed)									.67**	.76**	.08
9. Happiness (SU)										.07	.09
10. Disgust (SU)											.05
11. Confidence											

*Note. *. Correlation is significant at 0.05 level (2-sided). ** Correlation is significant at 0.01 level (2-sided).* 'EX' refers to expressed (free condition) and 'SU' refers to suppressed.

3.3 Aim 2: Examine the relationship between endorsement in the dark triad traits and emotion expression recognition ability.

Kendall's Tau-b rank order correlation test was implemented as the data for narcissism was shown to violate the assumption of normality with the inclusion of tied data (Shapiro-Wilk Test, $p < .05$). Contrarily, Machiavellianism and psychopathy were normally distributed as indicated by a Shapiro-Wilk Test ($p < .05$), scores illustrated in Table 5.

Monotonic relationships were shown for all three traits with emotion recognition performance through the visual inspection of scatter plots (See Appendix F).

Participants had the strongest endorsement in Machiavellianism ($M = 3.05$, $SD = .64$), followed by narcissism ($M = 2.80$, $SD = .50$) and psychopathy ($M = 1.70$, $SD = .50$). The results from this sample closely reflected the mean scores generated by the initial undergraduate sample (N = 387) investigated by Paulhus and Jones (2011), Machiavellianism ($M = 3.1$, $SD = .76$), narcissism ($M = 2.8$, $SD = .88$) and psychopathy ($M = 2.4$, $SD = 1.0$). These results demonstrated that few members of this study demonstrated an extreme endorsement of the traits at a subclinical level, though deviation amongst individuals was smaller.

None of the three dark triad traits indicated relationships with emotion expression recognition ability. Machiavellianism and emotion expression recognition, ($r_{\tau b}(111) = -.03$, $p = .58$), narcissism and emotion expression recognition, ($r_{\tau b}(111) = .07$, $p = .30$) and psychopathy and emotion expression recognition, ($r_{\tau b}(111) = -.11$, $p = .09$). However, Machiavellianism was found to have a small-moderate significant positive correlation with psychopathy, ($r_{\tau b}(111) = .21$, $p < .01$). In contrast to the findings of previous research by

Jones & Paulhus (2011), Machiavellianism indicated a non-significant relationship with narcissism, ($r_{\tau b}$ (111) =.12, p =.05) as well as narcissism and psychopathy, ($r_{\tau b}$ (111) =.07, p =.24)

It is acknowledged that Kendall's Tau and Spearman's rho correlation demonstrates less power than other statistical analyses such as Pearson's correlation coefficient (Hauke & Kossowski, 2011). As Machiavellianism and psychopathy were indicated to have normal distributions, the relationships were reviewed using Pearson's correlation, compared and displayed in Table 8. Similarly, non-significant relationships were found between the dark triad traits and emotion expression recognition ability, illustrated in Table 8. The relationship between each trait reflected that found by the Kendall's correlation, with a non-significant relationship remaining between Machiavellianism and narcissism (r = .15, p =.10) and narcissism and psychopathy (r = .09, p = .31).

Table 8

Pearson's r Correlation Coefficient

	1	2	3	4	5	6	7	8	9	10	11
1. Machiavellianism		0.15	0.28**	-0.08	-0.07	-0.04	-0.06	-0.03	0.01	-0.05	0.07
2. Narcissism			0.09	0.03	0.04	0.04	0.02	0.11	0.06	0.09	0.15
3. Psychopathy				-0.03	-0.12	-0.03	-0.15	0.06	0.02	0.06	-0.00
4. Cambridge Face Memory Australian					0.16	0.17	0.08	-0.06	0.02	-0.11	0.03
5. Emotion Recognition (Expressed)						0.75**	0.76**	0.25**	0.20*	0.16	0.19*
6. EX Happiness							0.15	0.23**	0.25**	0.10	0.24*
7. EX Disgust								0.14	0.06	0.14	0.05
8. Emotion Recognition (Suppressed)									0.71**	0.76**	0.14
9. Happiness (SU)										0.10	0.13
10. Disgust (SU)											0.08
11. Confidence											

*Note. *. Correlation is significant at 0.05 level (2-sided). ** Correlation is significant at 0.01 level (2-sided).* 'EX' refers to expressed (free condition) and 'SU' refers to suppressed.

3.4 Aim 3: Explore the relationship between endorsement in the dark triad traits and emotion suppression recognition ability.

Statistical analysis was conducted in a similar manner with the use of Kendall's Tau-b rank order correlation in order to accommodate for ties. The assumptions for the test were met. Visual inspection of scatter plots (See Appendix F) indicated that a monotonic relationship was demonstrated between the dark triad traits and emotion suppression recognition. The Shapiro-Wilk Test showed that suppression recognition ability violated the assumption of normality (p <.05), much like the dark triad traits.

There was no relationship between the dark triad traits and recognition of suppressed emotions. As indicated by the correlations for Machiavellianism, narcissism and psychopathy, respectively; ($r_{\tau b}$ (111) =-.03. p =.62), ($r_{\tau b}$ (111) =.07, p =.30), ($r_{\tau b}$ (111) =.05, p =.45). These results closely reflecting those generated by a Spearman's Rank Correlation, depicted in Table 6.

Finally, the relationships between expression recognition and confidence as well as suppression recognition and confidence were examined. A mean confidence rating for each participant was obtained through an ordinal scale measure: (1) guessing to (5) being certain. Each participant ranked their confidence in their response (choosing the correction emotion) to each expression/suppression footage shown. The Shapiro-Wilk test show that the confidence data was normally distributed (p > .05). The group were on average, 'moderately sure' (3) of their responses with little deviation amongst the sample (M = 2.98, SD = .60). As the expression and suppression recognition data did not reflect a normal distribution and contained ties, Kendall's correlation was used investigate the relationship. Expression recognition ability demonstrated a significant relationship with self-reported confidence in the

task, with a weak positive correlation, ($r_{\tau b}$ (111) =.16, p =.01). Suppression had no significant relationship with self-reported confidence in the task, ($r_{\tau b}$ (111) =-.06, p =.34). The relationship between confidence and accuracy in both tasks is expressed in Figure 4 and demonstrates positive trends, suggesting that individuals are somewhat aware of their capabilities. Figure 5 provides an overview of the confidence and accuracy relationship across each condition (happiness and disgust expressed, happiness and disgust suppressed).

All three of the dark triad traits indicated non-significant relationships with self-reported confidence. A Kendall's correlation was used to assess the relationship between narcissism and confidence, ($r_{\tau b}$ (111) =.08, p =.20). Although, Machiavellianism, psychopathy and confidence data were normally distributed, it was preferred not to remove observed outliers as the study intended to explore variance in ability amongst the sample. This therefore violates an assumption of the Pearson's correlation test. A Kendall's correlation was utilised to assess the relationship between the variables, demonstrating a non-significant relationship between Machiavellianism and self-reported confidence, ($r_{\tau b}$ (111) =.07, p =.20) and psychopathy and confidence, ($r_{\tau b}$ (111) =-.04, p =.50).

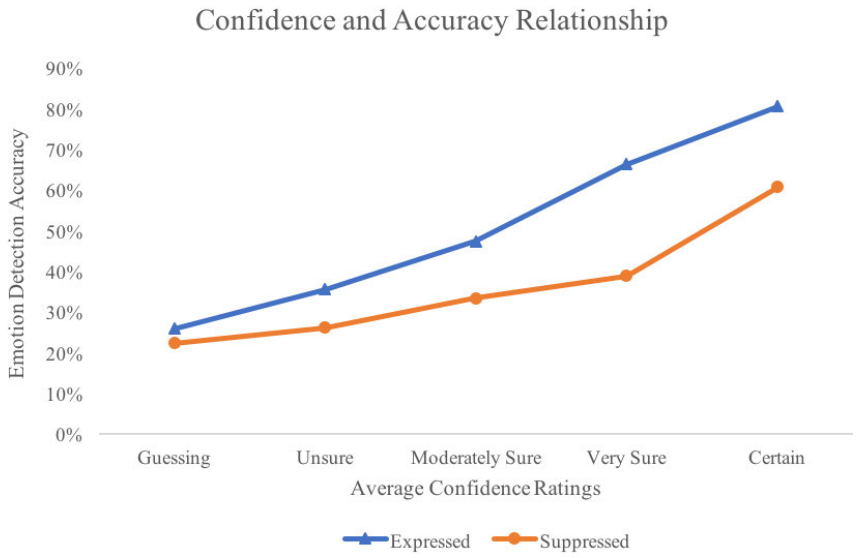

Figure 4. The relationship between confidence ratings and accuracy for the recognition of expressed and suppressed emotion.

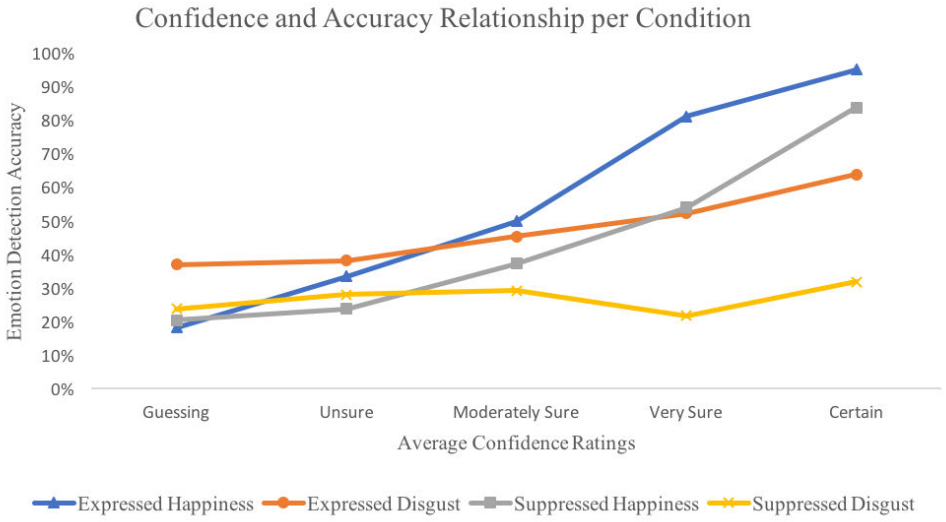

Figure 5. The relationship between confidence ratings and accuracy for the recognition of expressed happiness and disgust as well suppressed happiness and disgust.

Discussion

4.1 Overview

The primary aims of this research were to identify whether there was a significant relationship between facial memory and emotion recognition and to examine the relationship between endorsement in the dark triad traits and emotion recognition in free and suppressed conditions. The findings indicated no significant relationship between facial identity memory and emotion recognition. This result is coherent with the separate visual functioning routes theory; however, this lack of relationship does not provide very strong support – as it is only correlational. No significant relationships were identified between the dark triad personality traits and emotion expression/suppression recognition ability. It was proposed that endorsement in the traits cannot be confirmed to promote a declined or enhanced ability to detect emotional displays. Therefore, individuals who endorse the dark triad traits at a high subclinical level do not suffer from reduced performance and are able to utilise their functioning capacity to manipulate others. Additionally, by measuring self-reported confidence in performance the study was able to identify that the personality traits indicated no significant relationship with subjective confidence. This result was surprising due to narcissism being driven by a grandiose identity (Jones & Paulhus, 2014). Confidence holds no relationship with suppression recognition ability, although a significant positive relationship was found with emotion expression recognition ability. The following discussion evaluates these findings, explaining their practical and research implications as well as their limitations.

4.2 Aim 1: Identify whether there is a relationship between facial memory and emotion recognition.

Overall the findings of the study demonstrate there is no significant relationship between facial memory as tested using the Cambridge Face Memory Test – Australian (CFMTAU) and emotion recognition in free and suppressed conditions, utilising video footage of authentic responses. The results provide evidence to suggest the two functions may be distinct and separate abilities, as proposed by Bruce and Young (1985) and illustrated by the Haxby et al. Model (2000). This finding supports literature proposing individuals can demonstrate a deficit in in the ability to recall and recognise face while maintaining the capacity to detect emotional displays and vice versa (Nunn, Postma, & Pearson, 2001; Duchaine, Parker & Nakayama, 2003; Banissy et al., 2001).

The research that corresponds with these findings suffers from multiple shortcomings which were considered in the study. Nunn, Postma and Pearson (2001) and Duchaine, Parker and Nakayama (2003) indicated that prosopagnosic patients held the capacity to differentiate emotional displays, though utilised older facial memory tests such as the BFRT and the WRMT tests. These tests have poor construct validity with the inclusion of non-facial information. They were replaced with the CFMT-AU, which incorporates actors of common ethnicities in the Australian population and controls for these factors with the exclusion of hair, clothing and the inclusion of fixed changes in lightening, face angle and noise, in order to test variances in ability. Similarly, the literature revealed issues with the measurement of emotion recognition. Nunn, Postma and Pearson (2001) implemented emotion recognition tasks that stemmed from the Ekman and Friesen facial series (1976) and utilised static images of actors demonstrating emotional displays (Diehel-Schmid et al., 2007). This resulted in poor external validity.

Additionally, tests such as the Reading the Mind Through the Eyes test were included in the research of Duchaine, Parker and Nakayama (2003) and acknowledged to also suffer from poor external validity and internal consistency. This study replaced these stimuli with colour footage, displaying unintentional and authentic emotional displays. Even with the changes, the results remain consistent in identifying no relationship. The previous studies investigated a singular prosopagnosic individual, with the current study examining a sample from the subclinical adult population ($N = 113$). Therefore, the current study offers results that support no relationship between the variables across a more generalised sample and therefore promote further research which utilises updated means of emotion recognition stimuli and considers a larger sample. Performance in emotion recognition could be further tested with stimuli that vary in difficulty and better reflect a real interaction. This would provide reliable means to further confirm the existence of distinct abilities between facial memory and emotion recognition.

The recent findings conflict with a range of literature that provide support for the singular visual functioning route theory and the existence of a significant relationship between abilities. The deviation from previous results may be attributed to the variation of emotional responses presented by those in the emotion expression footage. Palmero, O'Conner, Irons and McKone (2013) as well as Rhodes et al. (2015) utilised the CFMT in order to measure face memory ability. To measure emotion recognition, the previous studies included the Emotion Hexagon. The Emotion Hexagon uses computer-manipulated images drawn from the work of Ekman and Friesen (1976) and is recognised as ideal replications of the micro facial movements for each emotion according to the theory of universal expressions (Calder, Young, Perrett, Sprengelmeyer, & Ekman, 2002). This task allows for individuals to be classified as impaired in performance through the comparison to normed scores generated for a range of age brackets. In contrast, this

study utilised video footage of authentic expressions of emotion as well as attempts to suppress these displays. The task does not categorise an individual as impaired in the ability to recognise emotion, as the results cannot be compared across a population. In summary, the test needs to be normed. Although, the stimuli reflected real-world interaction, the micro-facial movements of the individuals were not directly measured and calculated in order to objectively term their movements to reflect what had been deemed as 'happiness' or 'disgust' in literature regarding universal expressions. Rather, the emotion expression footage was selected by identifying those who self-reported the highest ratings of the correct emotion while watching the trigger footage in the concurrent honours thesis. The variation generated by individual differences contributes to the study, as it was intended to differentiate those who show an enhanced ability. Unfortunately, as the videos were selected based on self-report measures, there are a range of flaws. The emotion responses captured on camera may have not reflected the participants internal experience, with the possibility of self-reported emotion experience being fabricated to fit what the participant believed was appropriate (e.g. reporting high level of disgust to the amputation footage, although the participant found it enjoyable). As the facial movements shown in the footage could not be measured and confirmed to correspond with the necessary emotions (happiness and disgust), performance in emotion recognition of participants in the current study may have been restricted.

The facial movements from the individuals in the expression videos are currently being measured using computer technology, with the action units being recorded. If the study was to be replicated and completed over a greater span of time, the emotion expression footage shown to participants could be confirmed to reflect the correct emotional display according to existent literature, with the strength of each expression (in action units) considered.

4.3 Aim 2: Examine the relationship between endorsement in the dark triad traits and emotion expression recognition ability.

The dark triad traits were found to have no significant relationship with emotion expression recognition. Therefore, endorsement in the dark triad traits cannot be concluded to harbor a deficit or enhanced ability to recognise the emotional displays of others. The findings question the proposed deficit in emotion recognition, due to the traits being associated with reduced emotional intelligence (Zhang, Zou, Wang, & Finy, 2012) and an inability to experience internal emotions themselves (Jonason, Lyons, Bethell, & Ross, 2013). The results deviate from studies such as Wai and Tiliopoulos (2012), who suggested that each trait held a distinct relationship with emotion expression recognition.

Wai and Tiliopoulous (2012) implemented the standardised individual measures for each trait including: the Mach-IV (Chrisitie & Geis, 1970), the Narcissistic personality inventory (Raskin & Hall, 1979) and the Levenson self-report psychopathy scale (Levenson, Kiehl, & Fitzpatrick, 1995) as well as emotion recognition task and self-report measure to assess cognitive and affective empathy. This study incorporated the SD3, an efficient and compact measure, consisting of 27 items (9 items per trait). The measure has an acceptable reliability with each factor (Ashton-James & Levordashka, 2013), though the construct validity of the brief measure may have had an influence on the results of the study.

Previously, the SD3 has shown stronger convergent validity with the traditional measures of the traits (NIP, SRP-III, MACH-IV) in comparison to earlier brief measures of the dark triad such as the Dirty Dozen (Jonason & Webster, 2010; Maples, Lamkin & Miller, 2014). The SD3 is suggested to effectively handle the tension between precision and efficiency, although it is still suggested that the use of established individual measures should be

implemented unless the study is severely restricted by time to ensure that all central traits are assessed (Maples, Lamkin & Miller, 2014). The Machiavellianism scale used in the SD3 has shown the weakest discriminant validity in comparison to the other traits, with the Machiavellianism scale showing a greater correlation with interpersonal manipulation items from the Self Report of Psychopathy –III test (r = .76) than to the MACH IV (r = .74) (Maples, Lamkin & Miller, 2014). Therefore, a potential issue in the measurement of the dark triad traits at a subclinical level could have generated a non-significant relationship between the traits and emotion recognition ability. As the research attempted to test for individual differences in personality that are attributed to behavioural differences, the influence of a flawed measure restricts the ability to draw conclusions on whether the personality traits truly have effect on cognitive ability. The results of the recent study further question the construct validity of the SD3. A significant relationship between Machiavellianism and psychopathy, though no significant relationship was identified between Machiavellianism and narcissism or narcissism and psychopathy. This finding contrasts the literature describing the dark triad traits, consistently proposing that the triad consists of three closely related yet independent personality traits (Jones & Paulhus, 2014).

4.4 Aim 3: Explore the relationship between endorsement in the dark triad traits and emotion suppression recognition ability.

The dark triad traits did not indicate a significant relationship with emotion suppression recognition. The mean score of 32.96% accuracy generated from the emotion suppression recognition task indicated that participants did not perform efficiently. As displayed in Figure 1, an increase in confidence reflected a gradual increase in accuracy, although the relationship between confidence and suppression recognition ability was non-significant. The

research findings propose that individuals who endorse the dark triad traits do not show an increased ability to detect the suppression of emotion. This rejects the proposition that a positive relationship with socio-emotional control, the ability to regulate emotional displays and manage the emotions of others (Nagler, Reiter, Furtner, & Ruthmann, 2014; Austin, Saklofske, Smith, & Tohver, 2014) may result in a form of hypervigilance. The finding supports the concept of individuals possessing neither a deficit or enhanced ability to recognise suppressed emotional displays. The participants presented in the emotion suppression footage were also chosen as they expressed high ratings of the correct internal emotional experience to the trigger stimuli. As the physical suppression of emotion promotes diverse individual differences in facial movements, the videos chosen could not be confirmed (in action units) to suggest that an individual was beginning to express a specific emotion (e.g. happiness). This factor may have effected participants in the recent study and their ability to detect which emotion was being suppressed.

Furthermore, narcissism was not identified to be associated with higher ratings of confidence. This contrasts with previous literature identifies the endorsement of narcissism is driven by grandiosity (Jones & Paulhus, 2014). As proposed by Pajevic et al. (2018) the studies undertaken regarding emotion recognition and the dark triad traits have depended on self-report measures of empathy in the past and therefore, narcissism may have begun to be attributed to have a positive relationship with cognitive empathy due to individuals over-rating their own abilities. There may be several reasons for the results of the recent study showing a deviation: It could be issues in the measurement of the dark triad as previously highlighted with the use of the SD3. Additionally, the sample analysed reflects that of a narrow population as it contained predominantly undergraduate students at the University of Adelaide (88 students, *N = 113)* with other participants being associates of the researcher (recruited through social media),

who share demographic factors such as economic background and level of education. This was a limitation of the study. The group did not express high levels of narcissism with the mean for narcissism scores below reported norms for an undergraduate sample (Paulhus & Jones, 2011). The incorporation of a sample suggested to express more deviant personality characteristics at a subclinical level (such as youth offenders) would allow for the relationship between confidence and a sense of grandiosity to be explored.

4.5 Implications & Future Research Directions

The study highlighted inconsistencies in research surrounding the investigation of a face memory and emotion recognition link, as well as the measurement of emotion expression and suppression recognition abilities amongst a sub-clinical population. Acknowledging the flaws in previous research, such as measuring empathy to draw conclusions about emotion expression recognition ability (using self-report measures) and emphasising the necessity for physiological detection of emotional displays to be measured, confirms the need for further research to grasp a greater understanding the human processes involved. The attempt to generate authentic expression and suppression footage encourages the development of an Australian database such as that developed by Professor Xiaolan Fu's Group at the Chinese Academy of Sciences. This would allow for psychological research to further assist in the development. The establishment of such a database would not only allow for the relationship between micro-facial movements and emotion to be better understood but promote further studies to be undertaken regarding the influence of personality factors. As the recent means of testing emotion expression/suppression recognition (static black and white imagery) is outdated and shows poor external validity, the generation of new measures would provide a sufficient means for measuring variance in ability across the population. Emotion detection ability may also only be manifested in relation to the

dark triad in a more realistic scenario, where a form of reward is available for the individual correctly identifying an emotion (such as praise or control over another's behaviour). If the study was replicated, the combination of video stimuli (reflecting a real-world interaction), a displayed de-identified ranking order of detection ability amongst participants (e.g. participant 1) or a product voucher for enhanced performance may encourage individuals to engage with the task due to self-gain.

4.6 Conclusions

There are several points of interest that can be drawn from the recent study. Firstly, further limited support has been provided for the separate visual functioning routes theory as originally proposed by Bruce & Young (1985). This suggests that face memory and emotion expression recognition act as distinct abilities and therefore deficits or enhanced performance in one does not necessarily attribute to the other. Furthermore, it is acknowledged that individuals who endorse the dark triad traits may attain a drive to manipulate and deceive others, though their own ability to conceal emotion and maintain social control does not contribute to their ability to recognise expression or the suppression of emotions in others.

It is hoped this research will contribute to the understanding of the sub-clinical population's ability to recognise emotion expression and suppression, while provoking further research to ascertain information about the human cognitive processes involved.

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Appendix A: Information Sheet

PARTICIPANT INFORMATION SHEET

PROJECT TITLE: Human Performance in Emotion Detection
HUMAN RESEARCH ETHICS COMMITTEE APPROVAL NUMBER: 19/52:
PRINCIPAL INVESTIGATOR: Dr. Carolyn Semmler
STUDENT RESEARCHER: Vincent Barbaro
STUDENT'S DEGREE: Honours Degree in Psychological Science

You are invited to participate in the research project described below:
Human performance in the detection of emotion in natural and suppressed circumstances through micro-facial movements and its relation to facial recognition performance and dark triad personality traits.

What is the project about?

The following study seeks to further explore human performance in emotion detection and whether this ability relates to facial recognition. The measurement of personality traits (Narcissism, Machiavellianism & psychopathy) will assist in understanding the individual differences that may contribute to a person's ability.

Who is undertaking the project?
This project is being conducted by Vincent Barbaro and will form the basis for the honours degree of psychological science at the University of Adelaide under the supervision of Dr. Carolyn Semmler and David Booth (DST Group).

Why *am I being invited to participate?*
You are being invited as you are a member of the public that is above 18 years of age and has basic literacy skills.

What am I being invited to do?
You are being invited to complete a range of surveys that will identify your ability in facial recognition, emotion detection and your level in a range of specific personality traits. You will complete a brief online survey and facial recognition task.

How much time will my involvement in the project take?
The following tasks will take approximately 30-35 minutes to complete though this time may differ between individuals.

You may experience feelings of confusion or discomfort while answering questions related to your personality, as well as feelings of frustration due to the difficulty of the facial memory test.

If experiencing strong feelings of discomfort please contact the researcher, Vincent Barbaro (Vincent.Barbaro@student.adelaide.edu.au). The following study has been approved by the subcommittee of the Human Research Ethics Committee at the University of Adelaide (HREC).

Other support services include: Lifeline **13 11 14** and University Counselling services for students **8313 5663.**

What are the potential benefits of the research project?
The responses of participates will not only contribute to strengthening the understanding of emotion detection performance in humans but also its relation to face recognition ability, a concept that lacks research. This information will also assist in understanding individual differences and its effect on performance, therefore benefitting national and state security in recognising human behaviour. By undertaking the study, participants are offered the opportunity to further understand their abilities and become aware of characteristics that they may have not considered in their everyday lives.

Can I withdraw from the project?
Participation in this project is completely voluntary. If you agree to participate, you can withdraw from the study at any time by exiting the study online.

What will happen to my information?
Confidentiality and privacy: When beginning the study, participants will be required to enter their age, gender and contact details (if wanting to receive the results of the study). This information will be kept to provide credits for the students participating. Once completing the study, the results of individual will be de-identified and coded (e.g. participant 1).

Storage: At no time will the results of an individual be shared prior to the de-identification process. Identified data will never be held on any private devices of the researcher and will be strictly saved on the University of Adelaide server. Only the researcher [redacted] will have access to the de-identified data prior to publication.

Sharing: If the participant seeks to receive overall results of the study and performance in the emotion detection tasks, they must select this option in the demographic survey at the beginning of the study. It will then be arranged for the data to be shared with them online (through Figshare or another similar online platform).

The data may be used in meta-analyses, or re-analyses if future research is conducted to replicate or extend the results. The data may also be made available on the Open Science Framework for reuse and analysis by other researchers.

Your information will only be used as described in this participant information sheet and it will only be disclosed according to the consent provided, except as required by law.

Who do I contact if I have questions about the project? If further questions arise after reading this information sheet, please contact the researcher [redacted]

What if I have a complaint or any concerns?
The study has been approved by the subcommittee of the Human Research Ethics Committee at the University of Adelaide (approval number 19/52). This research project will be conducted according to the NHMRC National Statement on Ethical Conduct in Human Research 2007 (Updated 2018). If you have questions or problems associated with the practical aspects of your participation in the project, or wish to raise a concern or complaint about the project, then you should consult the Principal Investigator. If you wish to speak with an independent person regarding concerns or a complaint, the University's policy on research involving human participants, or your rights as a participant, please contact Diana Dorstyn, Deputy Head of Low Risk Ethics.

[redacted]

Any complaint or concern will be treated in confidence and fully investigated. You will be informed of the outcome.

If I want to participate, what do I do?
If you are interested in undertaking the study, please contact the researcher, Vincent Barbaro via email. Once confirming interest, a link will be provided that will allow you to undertake the study.

Yours sincerely,

[redacted]

Appendix B: Consent Form

I am 18+ years of age, have read the consent form and give my consent to undertake the study, agreeing to the listed factors:

CONSENT FORM

1. I have read the attached Information Sheet and agree to take part in the following research project:

Title:	**Human performance in the detection of emotion in natural and suppressed circumstances through micro-facial movements and its relation to facial recognition performance and dark triad personality traits.**
Ethics Approval Number:	**19/52**

2. I have had the project, so far as it affects me, and the potential risks and burdens fully explained to my satisfaction by the research worker. I have had the opportunity to ask any questions I may have about the project and my participation. My consent is given freely.

3. I have been given the opportunity to have a member of my family or a friend present while the project was explained to me (information sheet sent online)

4. Although I understand the purpose of the research project, it has also been explained that my involvement may not be of any benefit to me.

5. I agree to participate in the activities outlined in the participant information sheet;
A brief online survey, involving questions relating to my personality in addition to an online facial recognition task.

6. I understand that I am free to withdraw from the project at any time.

7. I have been informed that the information gained in the project may be published in a journal article and thesis.

8. I have been informed that in the published materials I will not be identified and my personal results will not be divulged.

I agree to my information being used for future research purposes as follows:

- Research undertaken by these same researcher(s) Yes ☐ No ☐
- Related research undertaken by any researcher(s) Yes ☐ No ☐
- Any research undertaken by any researcher(s) Yes ☐ No ☐

9. I understand my information will only be disclosed according to the consent provided, except where disclosure is required by law.

10. I am aware that I should keep a copy of this Consent Form, when completed, and the attached Information Sheet.

Appendix C: Recruitment Material

Study Information

Study Name	Face Recognition and Emotion Detection
Study Type	**Online External Study** This study is an online study located on another website. Participants are not given access to the Study URL until after they sign up for the study.
Study Status	**Visible to participants :** Approved **Active study :** Appears on list of available studies **Online (web) study :** Administered outside the system
Duration	35 minutes
Credits	1 Credits
Website	View Study Website
Abstract	Exploring performance in emotion detection in relation to facial recognition ability and the dark triad personality traits for the development of AI-like technology.
Description	The following study seeks to explore human performance in emotion detection and whether this ability relates to facial recognition and the dark triad personality traits (narcissism, Machiavellianism & psychopathy). This research is in conjunction with the Defence, Science and Technology Group (DST) and is looking to the contribute to the development of AI-like technology. The study will involve participants completing the SD3 (Dark Triad Personality Short Form) questionnaire, the Cambridge Face Memory Test-Australia and a brief emotion detection activity. This study is great for students interested in criminology and individual differences.
Eligibility Requirements	Must be above 18 years of age.
Preparation	No preparation necessary for participants.

Appendix D: Measures

Short Dark Triad (SD3)

Please rate your agreement or disagreement with each item using the following guidelines

1 – Strongly Disagree

2 – Disagree

3 – Neither Agree nor Disagree

4 –Agree

5 – Strongly Agree

Machiavellianism subscale

1. It's not wise to tell your secrets.
2. I like to use clever manipulation to get my way.
3. Whatever it takes, you must get the important people on your side.
4. Avoid direct conflict with others because they may be useful in the future.
5. It's wise to keep track of information that you can use against people later.
6. You should wait for the right time to get back at people.
7. There are things you should hide from other people because they don't need to know.
8. Make sure your plans benefit you, not others.
9. Most people can be manipulated.

Narcissism subscale

1. People see me as a natural leader.
2. I hate being the center of attention.

3. Many group activities tend to be dull without me.

4. I know that I am special because everyone keeps telling me so.

5. I like to get acquainted with important people.

6. I feel embarrassed if someone compliments me.

7. I have been compared to famous people.

8. I am an average person.

9. I insist on getting the respect I deserve.

Psychopathy subscale

1. I like to get revenge on authorities.

2. I avoid dangerous situations.

3. Payback needs to be quick and nasty.

4. People often say I'm out of control.

5. It's true that I can be mean to others.

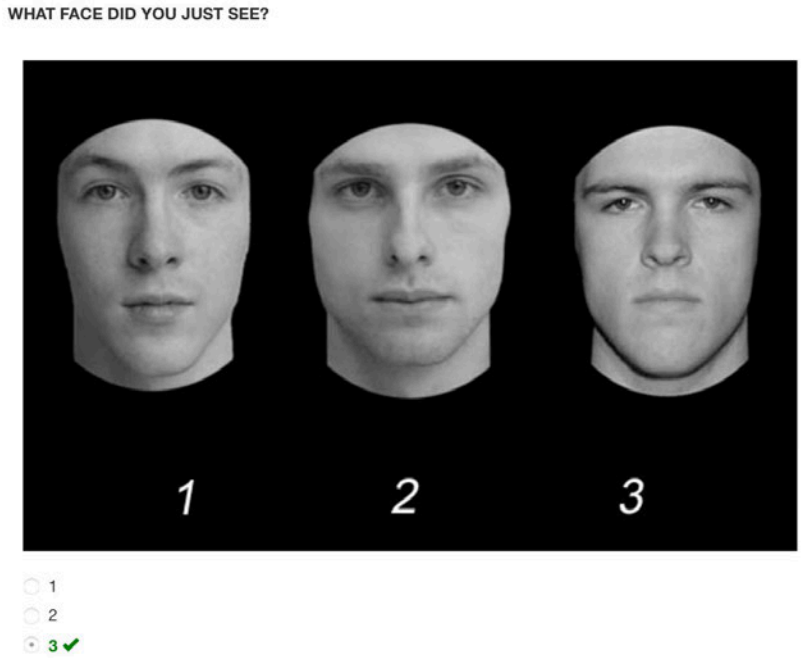
6. People who mess with me always regret it.

7. I have never gotten into trouble with the law.

8. I like to pick on losers.

9. I'll say anything to get what I want.

Cambridge Face Memory Test – Australian (Example)



Emotion Recognition Task

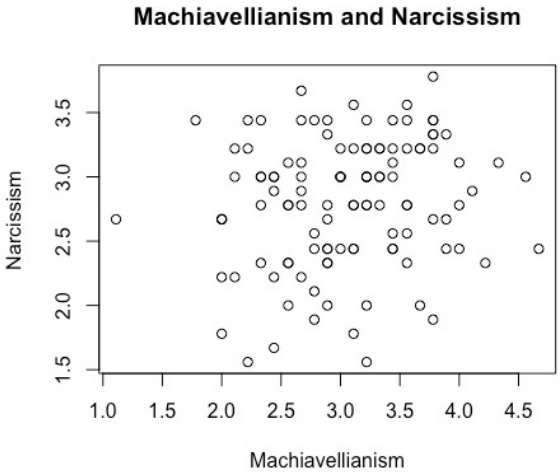
* Examples of the expression/suppression emotion response videos could not be included due to consent restrictions (relating to the concurrent honours thesis).

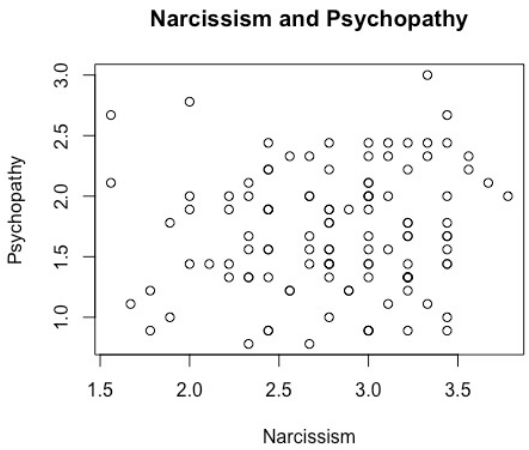
Appendix E: Ethics Approval

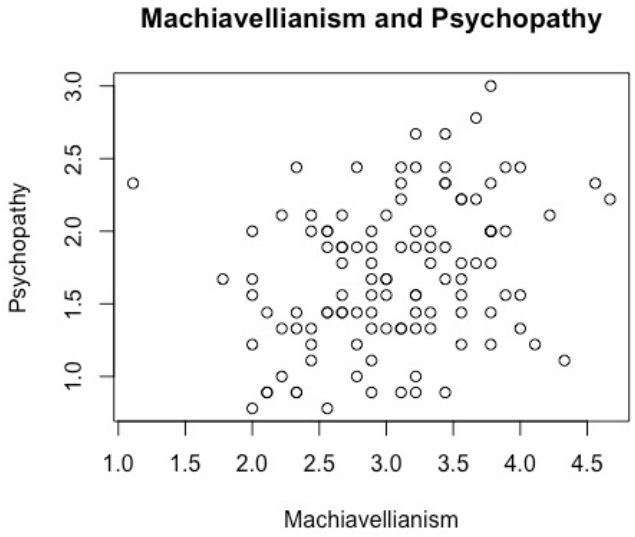
Thank you for your responses to the matters raised in regards to the above ethics application.

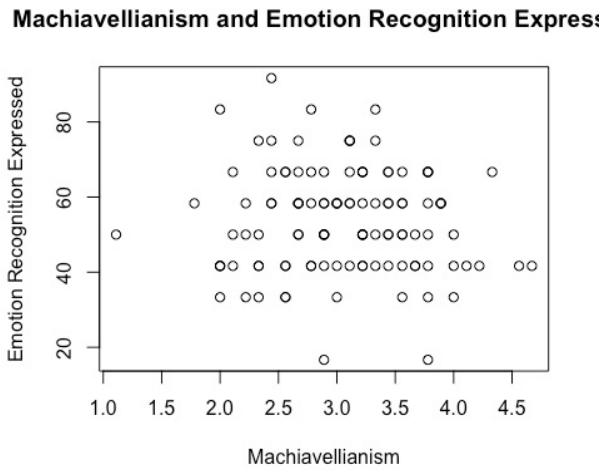
The revised application provided on 24/05/19 has been approved and given the ethics approval number **HREC 19/52.**

Appendix F: Scatter Plots








Machiavellianism and Emotion Recognition Expres
Emotion Recognition Expressed
20
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80
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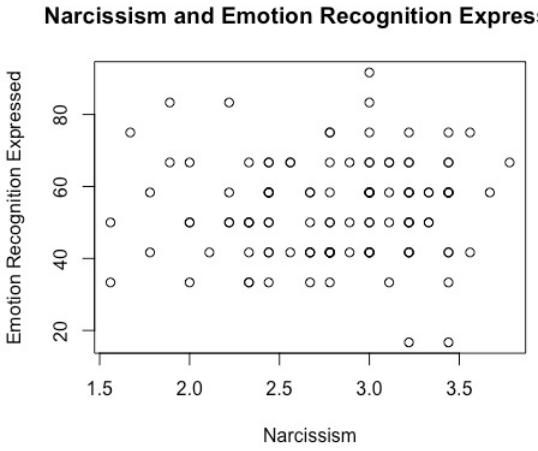
1.5
2.0
2.5
3.0
3.5
4.0
4.5
Machiavellianism


Narcissism and Emotion Recognition Expressed
Emotion Recognition Expressed
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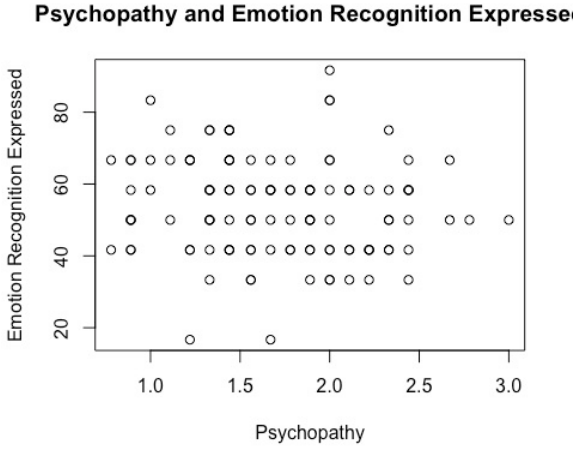
3.5
Narcissism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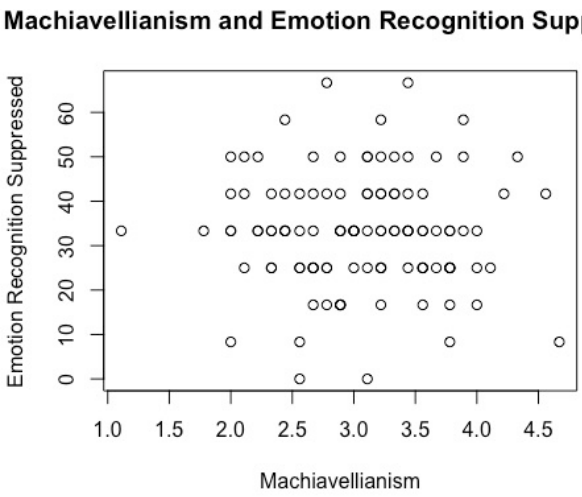
Psychopathy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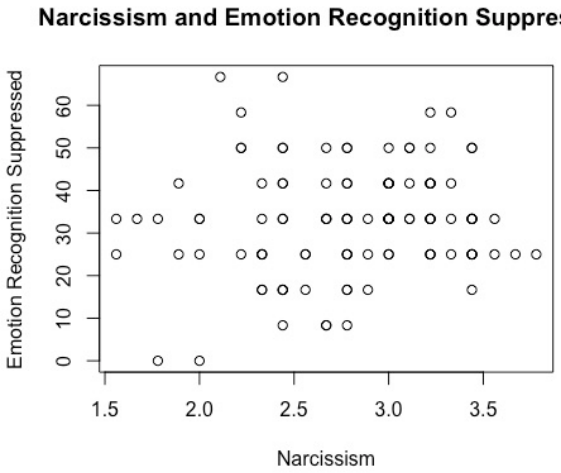
Machiavellianism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Emotion Recognition Suppressed
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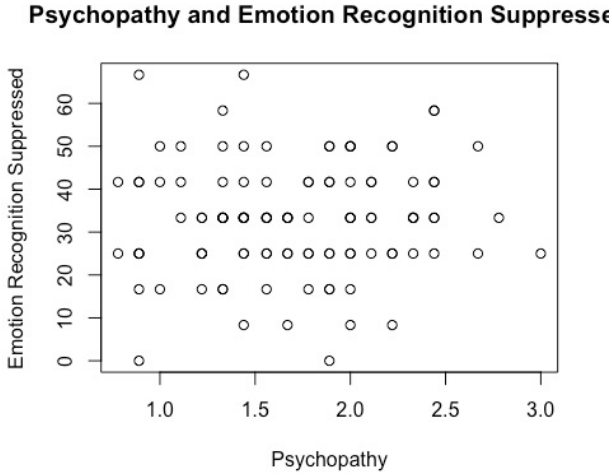
3.5
Narcissism


Psychopathy and Emotion Recognition Suppresse
Emotion Recognition Suppressed
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Psychopathy