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Recognition of emotions from facial expressions: the role of gender, age, personality, and
empathy

by

Rasa Sirkeviciute

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A Thesis submitted in partial fulfillment of the requirements for the degree of

Bachelor's of Psychology

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“The more one knows, the luckier he is, for knowledge is the greatest gift in life”- L. Frank Baum

Abstract

Facial expression perception is crucial in human social interaction. Deficits are associated with various psychopathologies and abnormalities. Previous studies indicate gender and individual differences in emotion recognition. The current study investigates whether gender, age differences, empathy and personality traits (The Big Five) can predict facial emotion recognition. 111 participants completed the questionnaires and the emotion recognition task via an online survey. As predicted, females were found to be more accurate in emotion recognition task. A negative correlation was found between emotion recognition accuracy and neuroticism. The findings contribute to the existing literature and benefit the insufficient literature regarding personality and facial emotion recognition. Recommendations for future research, limitations and implications are discussed.

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The Human face- in repose and in movement, at the moment of death as in life, in silence and in speech, when seen or sensed from within, in actuality or as represented in art or recorded by the camera- is a commanding, complicated, and at times confusing source of information.

Ekman, Friesen, and Ellsworth (1972, p. 1.)

Introduction

Every living creature has a way of communicating. Humans, just like other species, not only use verbal cues to communicate but also use facial expressions. Primates, for example, show their teeth as a threat, humans smile when they show no threat, usually impose friendliness or happiness. The human face is a central organ of sense that allows to identify each other and communicate and that is why perhaps is the most crucial skill in social interactions. It is fascinating that in this variety of cultures and languages humans share something very unique and universal that unites all social beings- facial expressions.

Mehrabian (1968) suggested that 7% of the message is interpreted by spoken words, 38% by voice intonation while 55% of the message is conveyed by facial expressions. Within 100ms humans can discriminate faces from other objects (McCarthy et al, 1997). Facial expressions follow emotions. Expressions provide information about person's behavioural intentions and emotional state (Ekman & Rosenberg, 2005). Affect-as-information hypothesis suggests that the main function of emotion is to provide information about how the situation is being assessed (Schwarz & Clore, 1983). Yet, a controversial theory by William James (James, 1884) argues that emotion arises from bodily changes. Indeed, a study by Hennenlotter et al (2009) found that cosmetic botox injection that incapacitates the ability to flex certain facial muscles, affect amygdala.

Facial expressions are produced by the movement of facial features. There are over 30 muscles in the head and face that are involved in creating facial expression. The mimetic musculature (mimetic muscles) of the face control facial expressions, most of these muscles are innervated by the *VIIth* cranial nerve that includes the motor root that supplies somatic muscle fibers to the muscles of the face, scalp, and outer ear, allowing the muscle movements that compose facial expressions (Ekman, Matsumoto & Friesen, 1997).

Facial expressions develop before the birth. A study by Sato et al (2014) investigated facial expressions of fetuses at 2-24 weeks and 25-34 weeks using four-dimensional ultrasonography found a relationship between different facial expressions and gestational age. Another recent study also indicates that the complexity of facial expressions, specifically “pain/distress” in the study, advance as the fetus develop (Reissland, Francis & Mason, 2013). Although, Piontelli et al (2015) argue that fetuses do not express facial expressions but rather facial motion, as the expression is necessary for communication, and fetuses do not require social signals yet. Research shows that even newborn babies can imitate facial expressions (Meltzoff & Moore, 1983). Children as young as 4-9 months can identify several facial expressions such as happiness, fear, anger, sadness, and surprise (Serrano, et al., 1992). It was found that accuracy to emotional expressions increase from 5 years of age to adulthood (Rodger et al, 2015). Moreover, a study by Izard et al (2001) found that facial emotion recognition ability at age 5 predicted future academic efficiently.

Some non-human primates are as well capable of recognizing human facial expressions. A study by Muller et al (2015) found that dogs can discriminate between happy and angry human faces. Another most recent study found that the grazing pattern of domestic dogs is parallel to humans, systematically fixating on the eyes region (Somppi et al., 2016). According to Vas et al (2005), dogs have intrinsic ability to discriminate aggressive from the friendly manner by humans. That suggests that facial emotion recognition ability in domestic species possibly evolved as a result of interactions with humans.

Brief history of the face research

“Speak, so that I may see you”, Socrates used to say to his students, that even if words can mislead, the face cannot (Fridlund, 2014, p. 9). The interest in the face dates back to ancient times. Aristotle, Plato often referred to theory in respect of the association between facial features and personality. Face-reading known as physiognomy became very popular during the 18th century between many scholars. Pythagoras chose his pupils based on their facial characteristics (Fridlund, 2014, p.2). The British psychiatrist Hugh Diamond (1856) used face reading to identify psychopathologies. Sir Francis Galton developed "Composite Portraits" as a technique to identify criminals and chronic illness. The results were obscure, however, a weak but significant correlation was observed between physical peculiarities and criminality trait (Galton, 1885).

The first scientific approach to study emotion appeared in 1872 by Darwin, who argued that the expression of emotion is the result of evolution. Darwin also proposed universal emotional expressions that even appear in people with congenital blindness (Darwin, 1882). In his work “The Expression of the Emotion in Man and Animals” Darwin studied the muscles involved in emotion expression, which was concluded to be universal and can be evident in both nonhuman primates and mammals.

Universal emotions

Paul Ekman is well-known in psychological research as he contributed a lot in understanding of human emotions. In 1960 together with Wallace Friesen studied the isolated culture of the Fore people living in Papua New Guinea. The sample consisted of 189 adults and 130 children of both genders. Researchers proposed the six universal emotions and the micro expressions.

Six universal emotions include happiness, fear, anger, surprise, sadness, and disgust. According to Ekman and Friesen (1960) humans use cues for emotion indication. Motion cues for happiness are raised or lowered mouth corners, eyes opened wide and a slight jaw drop indicates surprise, sadness is indicated by lowering of mouth corners and raised inner brow corners, raised brows and open eyes are cues for fear, disgust is expressed by wrinkled nose bridge and raised cheeks, bulging eyes and firmly pressed lips are cues for anger.

Microexpressions are very short facial expressions that only last between 1/15- 1/25 seconds. According to Ekman and Friesen, it happens when repression occurs, when people hide their feeling from others. They also proposed that normal facial expressions (Macro expressions) often repeat and last about ½ - 4 seconds and distinguished other types of expressions, false expressions that are not emotionally felt, and masked expressions with intentions to hide macro expressions.

These findings suggest that facial emotions are innate and can occur involuntarily in expression and physiology (Ekman, 1994). However, Markus and Kitayma (1991) proposed cultural differences in emotion recognition. A study by O'Toole et al (1996) found that individuals more accurately identify same-race faces than other-race faces. In addition, A study by Liua et al (2015) in a study using EEG found that English-speaking North Americans read emotions from facial expressions and Chinese speaking Mandarin depend on voices of others. Li (2013) suggested that individuals from individualistic cultures are more accurate at recognizing negative facial emotions than individuals from collectivist cultures. A study by Jack et al (2009) found the perceptual disparity between East Asians and Western Caucasians, challenging the concept of universal facial emotion expressions.

The concept “basic emotions” is still debatable in literature. James (1884) proposed four basic emotions, Arnold (1960) proposed 11, Ekman (1999) suggested six and Power (2006) suggested five. A Recent study suggests that individuals use 21 facial expressions (Du et al, 2014.).

Brain regions involved in recognizing facial emotion

Brain structures that are involved in the emotion recognition involve both perceptual processing and recognition of the emotional meaning of a stimulus. Model of face processing (Bruce & Young, 1986) suggests different psychological processes in facial emotion and identity recognition. Starting with the perceptual processing of the face features of structural encoding then follows to expression analysis and then to the cognitive system on the foundation of such information (Adolphs, 2002).

Expressed emotion understanding is a complex process that involves multiple strategies, involving amygdala, orbitofrontal cortex, the occipitotemporal cortices, basal ganglia and right parietal cortices (Adolphs, 2002; Eimer & Holmes, 2007). It appears that the right hemisphere is important for the perception of emotions (Tucker & Frederick, 1989). People suffering right hemispheric damage find it difficult to understand emotional expression in others (Heilman & Bowers, 1990). Right somatosensory cortex lesion impaired participants to identify basic emotions (Adolphs et al, 2000). Previous studies suggest that hypothalamus is also involved in producing emotions (Sano et al, 1970; Kucharska-Pietura et al, 2003; Siegel, 2005). Individuals with a lesion in the amygdala, basal ganglia, orbitofrontal cortex and anterior insula have difficulties recognizing and experiencing fear, anger and disgust, separately (Adolphs et al, 2005; Suzuki et al, 2006). Amygdala is crucial in the early- stage processing of facial expressions (Calder & Young, 2005) and perception of fear responses (Adolphs et al, 2005).

Bilateral amygdala lesion impairs the recognition of negative emotions such as anger, fear, disgust and sadness (Graham et al, 2007).

However, a study by Adolphs et al, 1994) found that patients with bilateral amygdala damage do not have impaired recognition of facial emotions but rather lack attention to the eye region of the face. When given instructions to move their attention towards the eye region of stimuli then they were able to recognize fear emotion (Adolphs et al, 2005). Individuals with Agenesis of the Corpus Callosum (AgCC) also exhibit a lack of fixations to the eye area that produces deficiencies in emotion perception (Bridgman et al, 2014).

Furthermore brain- imaging studies using fMRI show that when faces are shown, a certain area in the temporal lobe, fusiform gyrus or fusiform face area (FFA) is activated and it differs from the processing of non-face objects (McCarthy et al, 2007) is less active when faces are shown upside down (Anderson, 2005).

The inferior frontal gyrus and posterior parietal cortex produce a mirror neuron system for the motor segments of facial expressions, and it is suggested that amygdala and insula compose supplementary mirror neuron system for emotional condition (van der Gaag et al, 2007, p.179.). The human mirror neuron system is defined as a set of brain regions that are active both when participant acts and when observes the same action performed by another (Rizzolatti & Craighero, 2004). It was first identified in macaque monkeys in the 1990s by a group of neuropsychologists (Gallese et al, 1996). Brain imaging studies including EEG provided the evidence of a mirror neuron system in humans. The MNS activates in response to both self-produced and observed action (Rizzolatti, & Craighero, 2004). Studies show that individuals with autism have dysfunctional mirror neuron system (Williams et al, 2001; Von Hofsten & Rosander, 2012). That suggests that humans have a tendency to unconsciously mimic the facial expressions of others that allow the social information to be delivered to the brain.

Nevertheless, facial expression imitation of others is not fundamental to comprehend the meaning of their facial expressions (Calder et al., 2000). Yet a study by Oberman and Ramachandran (2007) demonstrated that when participants had to hold a pencil in their mouth that would prevent them from imitating facial expressions, their ability to identify facial expressions indeed diminished.

Attention strategies

Emotion recognition in a face is associated with specific patterns of attention. A study by Schurgin et al (2014) found that five main facial regions including eyes, nasion, upper lip, upper nose, lower nose, provided 88.03 % of all fixations, suggesting these facial regions to be most crucial in facial emotion recognition. Both goal-driven and stimulus-driven strategies are used when identifying facial emotions. Bottom-up agency of mimicry contributes to facial emotion recognition, and top-down evaluates emotions using learned behaviour strategies (Adolphs, 2002).

Individuals with autism spectrum conditions use different strategies for face processing by showing reduced attention to faces and facial expressions (Klin et al, 2002). They use feature-based approach when processing faces instead of a holistic approach. That suggests that the emotion recognition deficits can be elucidated by the likelihood that individuals with autism disregard information from the eyes (Baron-Cohen et al, 1997). Guastella et al (2008) gave participants a single dose of oxytocin. It was found that it increased the number of fixations and gaze time towards the eye area to neutral facial stimulus.

It appears that eye contact is essential in non-verbal communication. As discussed previously, individuals with autism display decreased eye contact that contributes to deficits in social interaction. In Western cultures, avoiding eye contact is often a misconception as the

absence of self-assurance (Clucas et al, 2012). Although, in some other cultures eye contact deliberately avoided.

Empathy and facial emotion recognition

Facial emotion recognition task is often used to evaluate empathy deficits, including autism spectrum disorder and psychopathological disorders. Emotion recognition ability (ERA) is the ability to accurately recognize the type and intensity of others' emotional states from their nonverbal expressions conveyed by the face, voice, and body (Elfenbein et al., 2007). Emotion recognition ability task is becoming more popular as an alternative to emotional intelligence tests.

Emotion recognition is related to the notion of empathy, understanding of other's emotions and feelings. Empathy is a complex process that is commenced by recognizing expressed facial emotions (Carr et al, 2003). Cognitive empathy is defined as the ability to identify and understand another's emotion, affective (primitive) empathy as unconscious respond to another's emotions. Previous studies indicate that people with lower empathy tend to have difficulties in recognizing facial emotions (Diane & Besel, 2007; Oberman et al, 2007).

Gender differences in facial emotional recognition ability

Studies indicate gender differences in emotion recognition. Women tend to be more accurate in recognizing facial emotions (Rotter & Rotter, 1988; Halpern, 2000; Lewin et al, 2001; Hall et al, 2010; Herlitz & Loven, 2013). Facial emotion recognition ability develops earlier in females than in males (Thomas et al, 2007). A study by Connellan et al (2000) found gender differences in one-day old infants, girls showed more interest in a face than boys. Researchers link these findings to other gender differences such as higher level of empathy. It is suggested that women usually are more empathetic than men (Baron-Cohen, 1997). During

facial emotion recognition, females spend more time looking at the eyes region than males (Hall et al, 2010).

Age and facial emotional recognition ability

Moreover, previous studies suggest that age, gender or race can impact on facial emotion recognition performance (Ebner, 2008). Emotional facial recognition may not fully develop until adulthood (Thomas et al, 2007, p. 548). Emotions that depend on certain brain regions that continue to develop through adolescence such as fear and anger may develop later. Emotion such as anger that depends on prefrontal cortices maturation usually develops latest.

Leime et al (2013) suggested that the capacity to identify facial expressions enhance in adulthood and decline in old age. Older adults are less accurate in recognizing emotions expressed by face stimuli compared to young adults (Calder et al, 2003; Keightley et al, 2007; Williams et al, 2009). A study by West et al (2012) found that 60-year-olds and over participants were less accurate in the recognition of the fear, sad and anger emotions and were more accurate in recognition of disgust emotion. That suggests that older adults find it difficult to identify negative emotions (Calder et al, 2003). It has been found that older participants exhibit attention preference for positive emotion faces (Isaacowitz et al, 2006). However, both young and older participants perform better at remembering their own age faces expressions (Harrison & Hole. 2009). So far the studies have failed to provide consistent evidence that specific age group has superiority in facial emotion recognition.

Personality traits in facial emotion recognition

The link between personality and facial emotion recognition was also indicated by previous studies (Matsumoto & Zelinsky, 2000; McCrae & Costa, 2003; Teijeiro-Mosquera et al, 2015). However, the research is limited. The Big Five personality traits inventory is often used in scientific research. It includes five personality factors. One of them is Extraversion, includes facets of sociability and assertiveness. Individuals high in extraversion are outgoing, sociable and enthusiastic. Individuals low in extraversion, are referred as introverts and are more reserved and less sociable. Agreeableness is another factor that includes trust and altruism. Individuals high in agreeableness are forgiving and more cooperative, individuals scoring lower are often less sympathetic and less cooperative and often antagonistic. Conscientiousness is a factor that includes facets of competence and self-discipline. Those high in conscientiousness are organized and thoughtful, those scoring low are careless and lack of direction. Openness to experience includes characteristics of imagination. Individuals scoring high are curious, imaginative and have many interests, those scoring low are closed to experience, are less curious and are less artistic. Neuroticism or emotional stability trait includes facets of self-consciousness and impulsiveness. Individuals scoring high tend to be shy, moody and tense and lack of self-confidence.

Studies found openness to Experience to be significantly correlated with the emotion recognition ability (Matsumoto et al, 2000; Terraciano et al, 2003). Mann et al (2000) found that agreeableness was positively correlated with the ability to recognize emotions, a negative correlation was found between emotion recognition ability and anxiety. According to a previous study (Mimrot, 2014), introverts are better at emotion recognition from facial expressions than extroverts. Different findings were proposed in a study by Matsumoto (2000), extroversion predicted accuracy in facial emotion recognition task. According to Janowsky et al (2000),

introversion is a major segment of social phobia. Individuals with social phobia tend to avoid eyes region when observing faces (Horley et al, 2003) and such attentional strategies diminish emotion recognition ability.

A significant negative correlation was found between neuroticism and emotion recognition task accuracy for happy expressions (Andric et al, 2015). Matsumoto et al (2000) also found that neuroticism predicted lower accuracy in face emotion recognition task. Neuroimaging studies suggest that neuroticism is associated with biases towards negative emotional perception (Cremers et al., 2010). Neuroticism is considered to be one of the leading predictors of vulnerability to depression (Kendler, 2006). It was found that individuals with depression are less accurate in emotion recognition task and bias towards negative emotions (Gur et al, 1992).

A study by Canli et al (2001) found that personality is associated with brain reactivity to emotional stimuli, extraversion was found to be correlated with brain activity to positive stimuli, and neuroticism was correlated with brain activity to negative stimuli. However, the study is limited to female participants. As previous studies suggest gender differences can exist in various tasks, whether or not personality is associated with brain reactivity to emotional stimuli remains inconclusive.

Impaired facial emotion recognition

According to Ekman (2003), the ability to accurately recognize facial emotions is inherent however it can be impaired by childhood trauma. Previous findings suggest that deficit in emotion recognition is associated with the development of psychopathological disorders (Fairchild et al, 2009; Evers et al, 2015). The ability to identify someone's emotion is diminished in some disorders ranging from autism to psychopathy (Sasson et al, 2007). People

with psychopathic traits (Blair et al, 2001; Fairchild et al, 2009) schizophrenia (Lee et al, 2010) and autism (Uljarevic and Hamilton, 2013) reveal a deficit in recognizing facial expressions of emotions.

Studies indicate the relationship between deficits in facial emotion recognition and depression (Langenecker et al, 2005; George et al, 2008). People with mood disorders are often less accurate in emotion recognition tasks and more likely to misinterpret an expression with a negative emotion (Feinberg et al, 1986). Individuals suffering from depression tend to express biases towards the recognition of negative emotions (Bouhuys et al, 1999). A study by Corcoran et al (2015) found that emotion recognition deficits exist in at-risk prior to schizophrenia onset. In a study by Kosaka et al (2002) individuals with schizophrenia, when identified positive and negative faces, exhibited substantial activation in the amygdala than the control group.

A study by Maste et al (2008) found that ill-treated children were faster in identifying frightened faces. Maltreated children, both with or without PTSD, show enhanced reaction time compared to control group for fearful faces (Masten et al, 2009) and that suggests that children exposed to violence and witness more fearful facial expressions may enhance greater ability to recognize these expressions. A study by de Montis (2013) found a consistent relationship between avoidant attachment type and deficiency in recognition of sad and surprised expressions. However, the research on the contribution of attachment in emotion recognition has found diverse results (Fralely et al, 2006; Vrtička et al, 2012).

Several studies investigated the effect of alcohol on the ability to recognize facial expressions. Kamboj et al (2013) found that 0.4-g/kg but not 0.8-g/kg alcohol produced misinterpretation sad faces as neutral. Patients with Korsakoff's syndrome are impaired at identifying fearful, angry and surprised facial expressions that are suggested due to sub-cortical brain dysfunction (Montagne et al, 2006). A meta-analysis conducted by Catellano et al (2015)

found that individuals with alcohol or other substance abuse disorders were less accurate in emotion recognition task compared to control group. That suggests that anger, aggression and failed social relationships that are related to excessive alcohol consumption (Kornreich et al, 2002) possibly associated with impaired facial emotion recognition. However the findings whether or not alcohol influences emotion recognition are inconsistent (Kano et al, 2003; Walter et al, 2011).

A study by Poljac et al (2011) demonstrated that participants with PTSD were less accurate compared to control group in identifying fear and sadness. A longitudinal study (Lavenu & Pasquier, 2005) demonstrated that emotion recognition ability declines with the progression of Alzheimer's disease in patients. In a study by Unoka et al (2011) patients with borderline personality disorder were less accurate than the control group in emotion recognition, particularly in recognizing negative emotions. A study by Sprengelmeyer et al (1996) found that patients with Huntington's disease had impaired emotion recognition for fear and anger stimulus. Individuals with OCD also have impaired emotion recognition of disgust (Sprengelmeyer et al, 1997).

Individuals with alexithymia show deficits in the cognitive processing and recognition of emotions (Barnow et al., 2005). A study by Cook et al (2012) suggests that face perception deficits attributed to autism emerge from co-occurring alexithymia. These findings demonstrate that the answer whether or not emotion recognition ability is impaired in autism is still pending.

According to Barbaree et al (1979), sexual offenders are able to commit an assault in a presence of a distressed person is because they incapable of feeling empathy to the victim or the incompetence recognize victim's distress. Low cognitive empathy is associated with impaired ability to identify other's emotions that allow offenders to carry out assault. A study by Jolliffe and Farington (2004) found that sex offenders indeed had lower cognitive empathy but showed

no significant disparity in affective empathy. A study by Robinson et al (2012) found that sexual offenders showed deficits at recognizing surprise emotion, but were more accurate at recognizing sadness, after controlling for IQ. Emotion recognition deficiency is also associated with inadequacy in interpersonal skills. A key component in sexual aggression is believed to be the absence of interpersonal competence (Marshall, 1989; Stinson & Becker, 2013, p. 272). That implies that emotion recognition deficits may predict sexual aggression.

It was found that juvenile delinquents were less accurate compared with control group in the facial emotion recognition of disgust, fear, and surprise (McCown et al, 1986). A study by Sato et al (2009), adolescent delinquents showed bias toward identifying disgust facial expressions as angry expressions. A Meta -analysis by Marsh and Blair (2008) found a strong relationship between adult antisocial behaviour and deficiency in recognizing fearful expressions. However, the study is limited to gender bias, as the majority of studies included male participants. Robinson et al (2012) conducted a study that included 127 prisoners from 11 prisons in Scotland. It was found that prisoners were significantly less accurate at recognizing negative facial emotions than gender, age, and IQ-matched control group.

Interestingly, patients scoring high in psychopathy, score higher on emotion recognition (Pham et al, 2010). One of the main factors in psychopathy is manipulation (Skeem et al, 2011). That suggests that psychopathic individuals may use their emotion recognition competence to manipulate others. Although the study by Stevens et al, (2001) found that individuals scoring high in psychopathy exhibit facial expression recognition deficits, especially identifying sad and fearful facial expressions. Prison study of one hundred and forty-five males by Hastings et al (2008) found that inmates scoring high in psychopathy were less accurate in recognizing sad and happy expressions. According to Gillespie et al (2015) individuals with high psychopathic traits have decreased attention to the eye area when looking at the emotional faces.

Improving emotion recognition skills

Recently a concept is being deliberated of whether or not emotion recognition can improve or be taught. A study by Williams et al (2012) found that children with autism improved performance in emotion recognition task after a number of interventions, by watching a DVD *Transporter* created to teach emotion recognition skills. However, the improvements were observed only for the angry faces in emotion recognition and the follow-up assessment demonstrated that the improvement declined. Other educational software called the *Mindreading*, was built to help autistic individuals to learn to identify emotions. Participants reported improvement in emotion recognition tasks after using *Mindreading* intervention and in one-year follow-up (Golan & Baron-Cohen, 2006). Clinical research suggests that antidepressants and behaviour therapy can improve social cues perception (Tranter et al, 2009). A study by Dadds et al (2006) found that children high in psychopathy with deficits in fear recognition, when given instructions to focus on the eyes area, altered their social cues deficits.

There has been an increase of studies investigating computer abilities in recognizing emotions. A study by Bartlett et al (2014) found that a computer vision system was able to distinguish deceptive facial emotions from genuine facial emotions, achieving 85% of accuracy. Human participants were not that accurate and achieved a moderate 55% of accuracy.

Rationale and research aim/hypotheses

Previously discussed studies demonstrate that impaired face emotion recognition is associated with various pathologies and disorders and looks promising as a cross-cultural assessment tool in the clinical, educational and social environment. In addition, Ciarrochi and Scott (2006) found that individuals with emotion recognition difficulties report lower overall prosperity compared to individuals with no emotion recognition difficulties. Despite the

importance of emotion recognition ability, the understanding of facial emotion recognition is still limited. That is why further research is necessary to develop a broader understanding. This study investigates the link between personality traits, gender, age differences and facial emotion recognition ability. Acknowledging the scarce literature regarding the relationship between the Big Five personality traits and emotion recognition ability, this study tests the hypothesis to contribute in an attempt to resolve these inconsistencies. The study of emotion recognition provides a better understanding of individual differences in ability to recognize expressions.

The aim of this study is to go beyond the existing literature on emotion recognition by introducing a set of faces that varies in age, ethnicity and gender. The main research hypotheses for this study are:

H1. Females will score higher in emotion recognition accuracy test than males

H2. Younger participants will be more accurate in recognition task than older participants

H3. The big five personality trait openness to experience will be significantly correlated with the emotion recognition ability.

H4. . A significant negative correlation will be found between neuroticism and emotion recognition task accuracy.

H5. Agreeableness will highly correlate with high scores on the facial emotion recognition test.

H6. Participants with a high level of empathy will be more accurate in facial emotion recognition test.

Methods

Participants

The sample population was based on convenience sampling. One hundred and eleven participants (47 males and 64 females), age ranged from 19 to 54 years old. The sample size was close to recommendations by Stevens (1996), 15 participants per PV in the model ($8 \times 15 = 120$). The sample included participants with different education backgrounds from the general population.

Design

The study included quantitative design. The research comprised correlational study. The predictor variables were The Big Five personality traits (conscientiousness, extraversion, agreeableness, openness, and neuroticism), age, gender with two levels- male and female, and level of empathy and the criterion variable was facial emotion recognition accuracy.

Materials/Measures

Questionnaires and face emotion recognition test was designed as an online survey using Google Forms. 44.4 % of questionnaires were designed as an offline survey using Microsoft Word and iPad. The survey included the measures of The Big Five personality traits, empathy, and facial emotion recognition.

The Big Five Inventory (BFI)

A well-established and widely accepted measure of personality traits 44-item the Big Five Inventory (Goldberg, 1993) was used in the study. A self-report measure included five factors: Openness, Conscientiousness, extraversion, agreeableness, and neuroticism. Responses were scored on five- point Likert scale. A value ranging from 1 (strongly disagree) to 5 (strongly agree) with some reverse scores.

Previous studies indicate the adequate reliability of the Inventory. The internal consistency reliabilities for all five BFI scales were greater than .75 (Fossati et al, 2011). Study by Zamorano et al (2014) found extroversion =0.76; agreeableness=0.62; conscientiousness =0.78; neuroticism=0.74 and openness =0.77; and for the complete scale study obtained a reliability of =0.72.

Cronbach's alpha for this study for the extraversion subscale of 8 items was ($\alpha = .77$), the neuroticism subscale of 8 items was found to be acceptable ($\alpha = .70$), the openness inventory of 10 items was found to be highly reliable ($\alpha = .89$), agreeableness subscale of 9 items indicated a high level of internal consistency ($\alpha = .88$), conscientiousness subscale of 9 items also indicated high level of internal consistency ($\alpha = .88$).

Empathy scale

The Toronto Empathy Questionnaire (TEQ) was used as a measure of empathy. It includes 16 questions scored on a five-point scale, a value ranging from 0 (never) to 4 (always) with some reverse scores. Previous studies indicate good internal consistency test-retest reliability, Cronbach's $\alpha = .85$ (Spreng et al, 2009). Cronbach's alpha for this study for the empathy subscale of 16 items was relatively acceptable .74.

Emotion recognition

There have been many research studies conducted using facial stimuli. High demand of facial stimuli in psychological research requires high-quality datasets (Strohming et al, 2015). However, many databases lack appropriate stimuli that include a wide range of ethnic background, facial features, and age range of the faces presented. It is important to include stimuli of different ages in a study of facial emotion recognition in participants of different ages (Ebner et al, 2010). Minear and Park (2004) subdued the lack of appropriate stimuli by creating a large set of different age and ethnical background groups, the Productive Aging Laboratory (PAL) face database that includes over 1000 photographs of different facial expressions.

Coloured photographs of faces from the PAL were acquired with permission from an online database (<http://agingmind.utdallas.edu>). Emotion recognition task was assessed using six universal expressions proposed by Ekman (1960), happiness, fear, anger, surprise, sadness, and disgust. Each of the expression included 3 stimuli (9 male, 9 female of different ethnic groups). Total of 18 stimuli were presented in random order. Participants were asked to choose one of the given words that best describes the emotion expressed or choose “other” option to write their own answer. The sequence of responses was constant across all 18 stimuli (angry, surprised, happy, disgusted, scared, sad, “other” own response). A total score was calculated by adding all the correct answers for each participant (0 for incorrect, 1 for correct). The high score reflected the accuracy in emotion recognition, 18 being the highest possible score.

Procedure

A pilot study was conducted prior the study that included 15 participants. The survey was created using www.esurv.com and posted on Facebook using snowball sampling. The comments received from the participants indicated that the survey was too long that suggested that the measurements needed improvement. The measurement of empathy (40-item Baron-Cohen empathy quotient) was then replaced by 16-item Toronto empathy questionnaire. Esurv.com platform was replaced by GoogleForms, due to pop-up advertising that distracted participants when completing the survey.

The participants were recruited via social networks, blogs, and direct approach. Call for participants request was posted on social networks, Facebook, and LinkedIn. The research was also posted in private Facebook groups and in free to use an online site for researchers <https://www.callforparticipants.com/>. The front page of the study included a brief description of the study, the time that takes to complete the survey, information about identity and privacy protection and information that this study being part of a final year project. Participants had to be over 18 to participate and had to agree to participate by clicking “agree to participate” in order to start the survey. An email was left if anybody were interested in the results or had any questions. Participants were given instructions how to complete questionnaires. To avoid any missing values, all questions had to be answered in order to proceed to the next page. If a response was missing, a pop-up message appeared on the screen to remind to fill in all responses. The program also blocked participant’s IP address after completing the survey to prevent the same participant filling in the same questionnaire numerous times. No reward or credit was offered to participants.

The offline version survey was identical to the online version, except the participants were recruited via direct approach, by giving an iPad to complete the survey where the online connection was not possible.

After completed demographic questionnaire (gender, age, the level of education and marital status) participants were shown colored picture displaying one the six basic emotions and had to choose of one of the given options that best described the expressed emotion stimuli. There was no time limit for responding. 7 available responses were shown under the image (angry, surprised, happy, disgusted, scared, sad and other) in the same order for all 18 stimuli. At the end of this facial emotion, recognition task participants were asked how difficult it was to complete the task for them and were left space for comments or suggestions.

New instructions were given then before starting each questionnaire. At the end of the survey participants were given an empty space for comments and an email for further inquiries and were thanked for participating.

Ethical Considerations

Participants were given information sheet prior the survey, that included a brief information about the study, the researcher and the purpose of the study. The online survey did not collect IP address and no personal information were stored, except for gender, age, the level of education and marital status. The information sheet notified that data collected will be kept anonymous. Participants were also advised that they can withdraw from the study at any time.

Results

Descriptive results

SPSS was used to analyze the results. Descriptive statistics were run to analyze demographic variables and are presented in tables 1 and 2. The sample included 111 participants. 12 of original 123 were removed as outliers. The outliers were identified after the examination of the unstandardized residuals when testing the assumption of normality. Participants were 47 males (42.3%) and 64 females (57.7%). The average age of participants was 30.9 years (SD = 8.17). The age of participants ranged from 19 to 54 years. Supplementary information on age groups is presented in the appendices, figure 1.

Table1. Descriptive Statistics for Demographic Variable Education (N=111).

	Frequency	Percent
<i>No formal education/training</i>	3	2.7
<i>Primary Education</i>	12	10.8
<i>Current Student</i>	44	39.6
<i>Vocational Training</i>	18	16.2
<i>College graduate</i>	25	22.5
<i>Postgraduate</i>	8	7.2
<i>Other</i>	1	.9

Table2. Descriptive Statistics for Demographic Variable Marital Status (N=111).

	Frequency	Percent
<i>Married/Living together</i>	51	45.9
<i>In relationship</i>	24	21.6
<i>Single</i>	27	24.3
<i>Divorced/Separated</i>	8	7.2
<i>Widowed</i>	1	.9

Table 3. Descriptive statistics of the predictor variables (N=111).

Variable	M	SD	Minimum	Maximum
Neuroticism	14.78	2.66	9.00	20.00
Extraversion	26.41	5.88	12.00	39.00
Openness	31.21	9.57	13.00	50.00
Agreeableness	26.84	6.40	11.00	40.00
Conscientiousness	27.53	7.78	9.00	45.00
Empathy	38.37	11.94	15.00	64.00
Face recognition	12.97	1.87	8.00	17.00

Emotion recognition accuracy

The mean of correct responses in emotion recognition task was 12.97, with scores ranging from 8 to 17. Scores were coded 1 for a correct response and 0 for an incorrect response. In facial emotion recognition, happy facial expression was the most accurate (320) and least accurate was an angry expression (209).

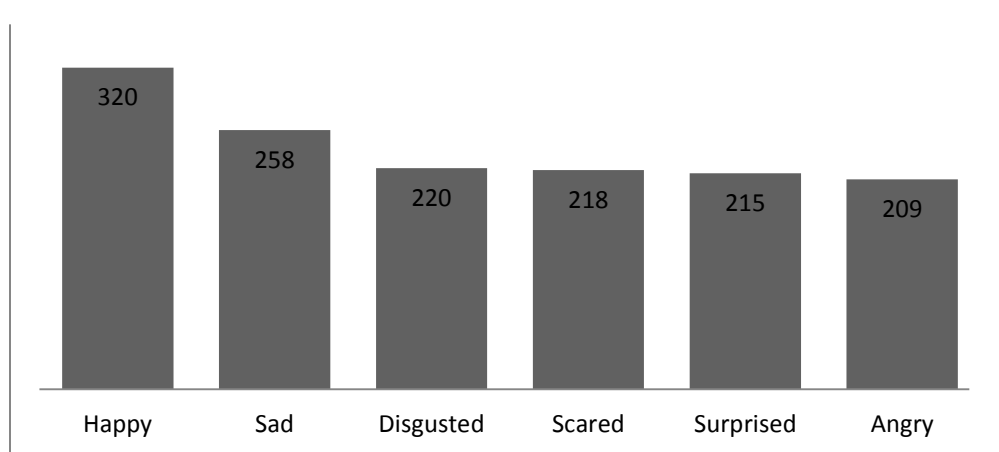


Figure 4. The average accuracy of responses in emotion recognition task.

Table 5. Confusion responses for emotions (top row- facial expressions, left column- available responses).

%	Angry	Surprised	Happy	Disgusted	Scared	Sad
<i>Angry</i>	62.8	11.1	0	16.5	13.5	6
<i>Surprised</i>	0.9	64.6	0	2.1	6	0
<i>Happy</i>	0	0	96.1	0	0	0
<i>Disgusted</i>	17.4	7.5	0	66.1	10.8	8.7
<i>Scared</i>	12	11.4	0	9.6	65.5	3
<i>Sad</i>	4.2	3.6	0	3.6	2.4	77.2
<i>Other</i>	2.7	1.8	3.9	2.1	1.8	5.1

The Angry emotion was most confused with disgusted and scared expressions. Surprised – with angry and scared expressions, disgusted-with angry, scared- with angry and disgusted, sad-with disgusted. Most confusion was reported between angry and disgusted expressions. Confusion responses are shown in table 5.

Normality testing

The assumption of normality was tested via examination of the unstandardized residuals. Review of the Kolmogorov-Smirnov test for normality statistics ($KS=120$, $df=111$, $p=.000$) and Shapiro-Wilk ($S-W=.972$, $df=111$, $p=.019$) and skewness (.140) and kurtosis (-.484) statistics suggested that normality was not a reasonable assumption for neuroticism, further examination of boxplot suggested a relatively normal distributional shape with no outliers, of the residuals, the Q-Q plot and histogram suggested normality was reasonable, as seen by figure 6 and 7, however the results should be treated with caution.

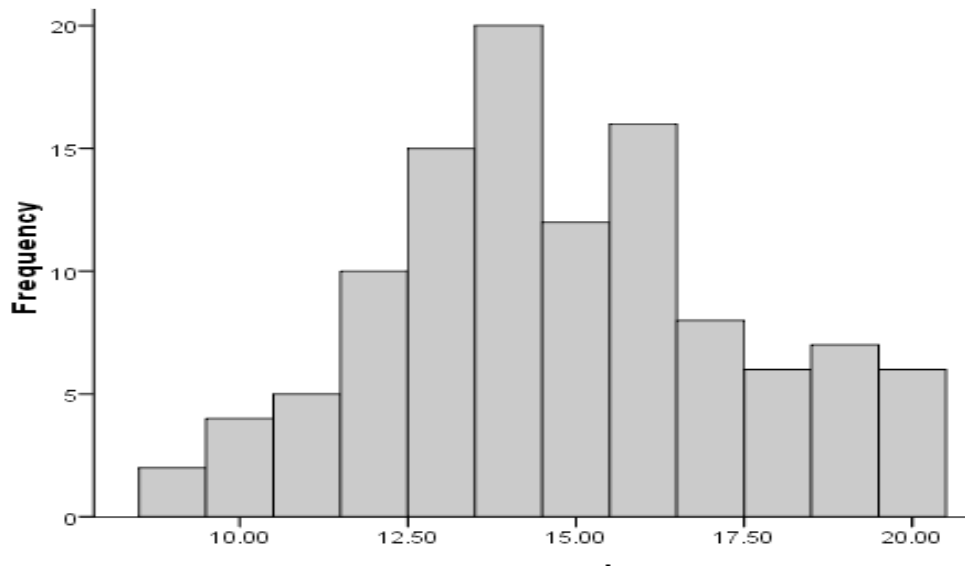


Figure 6. Histogram of normality ($M=14.78$; $SD=2.66$; $N=111$)

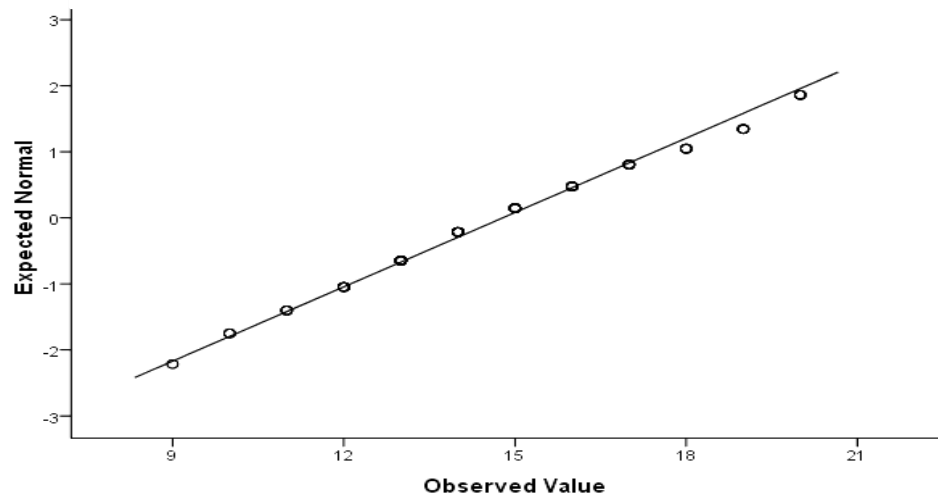


Figure7. The q-q plot of normality for neuroticism.

Inferential statistics

T-test

An independent-samples t-test was conducted to compare scores for extraversion, openness, agreeableness, conscientiousness, neuroticism, empathy and facial emotion recognition between males and females. There was a significant difference in score for facial emotion recognition between the genders, $t(109) = -6.43$, $p = .000$, two-tailed with females ($M = 13.83$, $SD = 1.42$) scoring higher than males ($M = 11.81$, $SD = 1.78$). The magnitude of the differences in the means (mean difference = -2.02 , 95% CI: -2.64 to -1.39) was large (eta-squared = $.27$). Mean differences for other predictor variables are shown in table 8. These results suggest that gender does have an effect on the level of extroversion, openness, agreeableness, conscientiousness, neuroticism, empathy and facial emotion recognition with the magnitude of the difference in the means ranging from medium to large. Specifically, results suggest that females scored higher, except for neuroticism, as seen by table 8.

Results also suggested that there was a significant effect for gender $t(109) = -4.57$, $p = .000$, with females ($M = 6.73$, $SD = 1.13$) scoring higher than males ($M = 5.51$, $SD = 1.56$) in female faces emotion recognition. Females ($M = 7.08$, $SD = .90$) were also more accurate than males ($M = 6.30$, $SD = 1.14$) in male faces emotion recognition $t(109) = -3.90$, $p = .000$.

Table 8. Mean differences for predictor variables between the genders.

Variable	Male		Female		t(4)	p	95%CI	Cohen's d
	M	SD	M	SD				
Extraversion	23.53	4.96	28.53	5.63	-4.86	.000	-7.04; -2.96	.18
Neuroticism	15.72	2.68	14.09	2.45	3.33	.001	6.59; 2.60	.09
Openness	26.83	7.17	34.42	9.88	-4.69	.000	-10.8; -4.38	.17
Agreeableness	23.4	5.37	29.36	5.93	-5.44	.000	- 8.12; 3.79	.21
Conscientiousness	23.32	6.60	30.63	7.14	-5.5	.000	-9.94; -4.67	.22
Empathy	30.60	9.66	44.08	10.13	-7.07	.000	-17.26; 9.70	.31
Face recognition	11.81	1.78	13.83	1.42	-6.43	.000	-2.64; -1.39	.27

Pearson Correlation

Face recognition was positively correlated with extraversion ($r=.62$, $n=111$, $p=.000$), openness ($r=.71$, $n=111$, $p=.000$), agreeableness ($r=.69$, $n=111$, $p=.000$), conscientiousness ($r=.76$, $n=111$, $p=.000$), gender ($r=.54$, $n=111$, $p=.000$), age ($r=.35$, $n =111$, $p=.000$) and negatively correlated with neuroticism ($r=-.54$, $n=111$, $p=.000$). Table 9 provides nine-variable bivariate correlation matrix.

Table 9. Pearson Correlation between predictor variables and face recognition.

Measure	1	2	3	4	5	6	7	8	9
1.Face recognition	-								
2.Empathy	.75	-							
3.Conscientiousness	.76	.81	-						
4.Agreeableness	.69	.65	.86	-					
5.Openness	.71	.79	.89	.77	-				
6.Neuroticism	-.54	-.54	-.44	-.42	-.40	-			
7.Extraversion	.62	.73	.78	.67	.79	-.37	-		
8.Gender	.54	.56	.47	.46	.39	-.30	.42	-	
9.Age	.35	.32*	.37	.40	.34	-.14	.26*	.09**	-

* $p <.005$, ** $p >.05$ (non -significant)

Analysis of Variance

A one-way between groups analysis of variance was conducted to explore the impact of level of education on facial emotion recognition scores. Participants were divided into groups according to their level of education (no formal education/training, primary education, current student, vocational training and college graduate, post-graduate). There was no significant difference in facial emotion recognition scores $F(6,104) = .65, p = .69$

There was also no statistically significant difference in facial emotion recognition scores for groups divided according to their marital status (married/living together, in a relationship, single, divorced/separated, widowed) $F(4, 106) = .78, p = .54$.

Regression analysis

Multiple regression was performed to investigate the ability of gender, age, personality traits, and level of empathy to predict scores in facial emotion recognition task. Preliminary analyzes were conducted to ensure no violation of the assumptions of normality, linearity, and homoscedasticity. Additionally, the correlations between the predictor variables included in the study were examined. All correlations were weak to strong, ranging between $r = -.54, p = .000$ and $r = .86, p = .000$. This indicates that multicollinearity was unlikely to be a problem (see Tabachnick and Fidell, 2007). All predictor variables were statistically correlated with facial emotion recognition which indicates that the data was suitably correlated with the dependent variable for examination through multiple linear regression to be reliably undertaken.

Since no a priori hypotheses had been made to determine the order of entry of the predictor variables, a direct method was used for the multiple linear regression analysis. The eight independent variables explained 69% of variance in facial emotion recognition ($F(8, 102) = 27.72, p < .0005$).

In the final model two predictor variables were statistically significant, gender recording a higher Beta value ($\beta = 1.8$, $p < .05$) than neuroticism with negative Beta value ($\beta = -.18$, $p < .05$). Females scored significantly more accurate in emotion recognition task. High scores in neuroticism were associated with low scores in emotion recognition accuracy. None of other predictors significantly contributed to the model. Results are presented in table 10.

Table 10. Summary of Multiple Regression Analyses for variables predicting facial expression recognition accuracy. (N=111).

	R^2	β	B	SE	CI 95% (B)
Model	.69***				
Empathy		.21	.03	.02	-.01/.07
Conscientiousness		.22	.05	.04	-.03/.13
Agreeableness		.09	.03	.03	-.04/.09
Openness		.15	.03	.03	-.02/.08
Neuroticism		-.18**	-.13	.05	-.22/-.04
Extraversion		-.05	-.01	.03	-.08/.05
Gender		.18*	.66	.27	.13/1.19
Age		.09	.02	.01	-.01/.05

*Statistical significance: * $p < .05$; ** $p < .01$; *** $p < .001$*

Discussion

The current study investigated whether gender, age, empathy and the Big Five personality traits can predict accuracy in emotion recognition. The findings of the current study suggest that emotion recognition accuracy can be indeed influenced by individual differences. Therefore, hypotheses were partially supported. The study also found that certain facial expressions can be more difficult to recognize and some tend to be more confusing than others.

The results supported the hypothesis that there will be gender differences in facial emotion recognition task and that females will be more accurate. This finding is consistent with previous studies (Derntl et al, 2008; Lambrecht, Kreifelts & Wildgruber, 2014; McKelvie, 1981; Wright et al, 2009). Previous research also found that females tend to be more accurate on facial detection and facial identity recognition tasks (Lewin & Herlitz, 2002). It suggests that females are better at recognizing social cues and that gender plays a crucial role in emotion perception. One proposed explanation for this is that females show more interest in other people's faces than men (Lewin & Herlitz, 2002). Females tend to gaze at unfamiliar faces more than males (Heisz, Pottruff & Shore, 2013).

Another explanation might be in differences in cognitive functioning in males and females. Gender difference exists in spatial cognition performance and overall cognitive abilities (Grön et al, 2000; Halpem, 2013; Li, 2014; Tzuriel & Egozi, 2010). Previous studies also indicated gender differences in visual perception (Gregoric et al, 2014; Yamada, 2015). Females tend to display a divergent scanning behaviour that allows to outperforming males on recognition tasks (Heisz, Pottruff & Shore, 2013). Furthermore, when males are instructed to intensify their scanning behaviour, their performance on recognition task increase and the gender differences decline. These studies demonstrate that females perceive social cues

differently than males and that is potentially why they are more accurate at recognizing facial emotions.

The current study also found that females were more accurate at recognizing emotions of female faces, as well as male faces. These findings are similar to a meta-analysis conducted by Herlitz and Loven (2013) that indicate female own-gender bias, but not a male own-gender bias. A study by Rehnman and Herlitz (2006) found that 9-year-old girls remember faces of females better than faces of males.

The results also supported the hypothesis that a significant negative correlation will be observed between neuroticism and emotion recognition task accuracy. This finding is consistent with previous research (Bothwell et al, 1987; Matsumoto et al, 2000; Li et al, 2010).

Neuroticism is a personality trait that is associated with anxiety and those who score high on neuroticism tend to be emotionally unstable and shy. Social anxious individuals often withdraw from social interactions and tend to avoid eye region when observing faces that potentially leads to emotion recognition errors. That suggests that individuals scoring high in neuroticism do not have impaired emotion recognition but rather use incorrect attention strategy when observing faces. Although previous research suggests that those scoring high in neuroticism exhibit biases towards negative stimuli (Costa & McCrae, 1980) the current study failed to detect any propensities. A meta-analysis of eye tracking research on anxiety and depression (Armstrong & Olatunji, 2012) suggests that a task- driven strategy is often distributed during emotion discrimination task. That suggests that individuals can orient their attention differently during emotion recognition task. In other words, when participants are asked to complete a facial expression task, they tend to observe faces more intensified than normally as they have the intention to complete the task. So, even those who normally avoid eye region can adjust their attention patterns in order to achieve a goal.

Although other personality traits did not contribute to the final model, there was a relatively high correlation between emotion recognition and extraversion, agreeableness, openness, and conscientiousness. Yet a correlation does not disclose the primary source of this relationship, it can only be argued that there was a potential confounding effect. While the singular variables can be strongly correlated, it can also lack statistical power to the final model. That can also suggest that variables are congruent and lack own distinctive variance. Another possible explanation can be due to the condition when the predictor variables are highly correlated with one another and a competition might occur that can lead to nonsignificant results (Warner, 2012, p.599). In other words, extraversion, agreeableness, openness, and conscientiousness correlated with emotion recognition but in combination failed to predict the criterion variable.

Furthermore, previous studies investigating the role of personality traits in emotion recognition accuracy demonstrated mixed results (Merritt et al, 2016; Terracciano et al, 2015). One potential explanation for these inconsistent findings may be due to unconventional designs. Studies use different stimuli, such as 3D models (Chen et al, 2015; Sandbach et al, 2012), virtual models (Bosse & Schnitfink, 2015), non-coloured images (Schurgin et al, 2014) or coloured images (Gilespie et al, 2015). That potentially creates an issue when results across the studies need to be compared. Perhaps personality differences exist in stimulus preferences that could also potentially affect the recognition.

Previous studies suggest that age differences exist in facial emotion recognition and specifically that younger adults tend to be more accurate than older adults (Keightley et al, 2007; Sullivan et al, 2015; Williams et al, 2009). However in this study participant's age did not contribute to the final model and the hypothesis that younger participants will be more accurate in recognition task than older participants was rejected. The current study aimed to recruit

participants of different age and compare the groups in emotion recognition accuracy. As seen by participant's age figure (in Appendices) there was a larger number of younger participants than older participants. The current study failed to recruit equal sample sizes in different age groups and perhaps that could be one of the possible explanations of why it didn't contribute to the model

Previous studies suggested that individuals with higher empathy scores recognize facial expressions more accurate than those with lower empathy scores (Kosonogorov, Titova & Vorobyeva, 2015; Oberman et al, 2007), as they tend to fixate more at the eye-region (Cowan, Vanman & Nielsen, 2014; van Rijn et al, 2014) that allows for a better identification of expressed emotion. Surprisingly, empathy did not significantly contribute to the final model, however, there was a relatively high correlation (.75), between emotion recognition and empathy. A relatively high correlation was also observed between empathy and extroversion, agreeableness, openness, and conscientiousness. As discussed previously, potentially there was a confounding effect or perhaps because variables were that correlated, then when combined, a competition occurred and that lead to the nonsignificant outcome. The relationship between empathy and emotion recognition is still not completely comprehended (Lee & Akhtar, 2011) and further research is essential

Emotion recognition accuracy

This study showed that happy faces were recognized more accurately than other emotional facial expressions. This finding is consistent with previous studies that found that recognition performance for happy expressions was better than for other expressions (Du & Martinez, 2013; Ekman, 1992; Khawar et al, 2012; Schurgin et al, 2014; Svard et al, 2012). According to Martinez & Du (2012) individuals are very good at recognizing happiness and surprise and not so good at identifying anger, sadness, fear and disgust. Yet happy facial

expressions are also the most often used ones (Ekman & Friesen, 1976). When individuals perceive happy facial expressions they tend to fixate most at the upper lips and least at the eyes area (Schurgin et al, 2014; Vaidya, Jin & Fellows, 2014). That suggests that smile is being the main feature of happiness that enables easier recognition.

Sad facial expression was the second most accurately recognized emotion in this study. However the accuracy scores for sad expressions were significantly lower than for happy expressions and similar with scores for angry, disgust, scared and surprised expressions. In the current study, participants displayed confusion in differentiating between facial expressions of anger, disgust, fear and surprise. This finding is consistent with previous studies that found that participants often display confusion in recognition between these expressions (Ekman, 1992; Jack et al, 2009; Schurgin et al, 2014; Svard et al, 2012). Particularly in this study disgust was confused with angry expression, what was also observed by previous research (Arellano, et al., 2008; Broekens, Qu & Brinkman, 2012; Widen & Russell, 2008).

One potential explanation is that both disgust and angry expressions contain similar facial elements. These expressions are postulated to be the most similar compared to other expressions (Ambady & Skowronski, 2008, p.272). Disgust often occurs with anger and discloses similarities in facial appearance and situational context (Ekman & Friesen, 2003, p. 92). That suggests that because both anger and disgust expressions tend to be relatively similar it can be demanding to differentiate these expressions one from another.

Furthermore it was found that when perceiving sad facial expressions individuals fixate most at the eyes area and fixate less at the lips area and for both scared and angry expressions individuals fixate most at the eyes area, for disgust individuals fixate more at the upper lip and least at the eyes (Schurgin et al, 2014; Vaidya, Jin & Fellows, 2014), that suggests that the recognition process becomes more demanding, as the same facial region is used for recognition.

Perhaps that is why individuals often display confusion between these expressions, as they fixate at the same face region and that requires more rigorous competence.

Mood-congruity theory suggests that individual's mood deploys a congruity effect on social judgments (Bower and Cohen, 2014). An eye-tracking study by Schmid et al (2011) found that participants in happy mood observed faces in a more global manner, the whole sum of details and when they were in sad moods used a local processing style, focusing on the parts instead of the whole. A study by Schmid and Mast (2010) found that when participants are primed with positive mood they exhibit positive bias and when primed with negative mood then exhibit negative bias. A study that included Chinese participants also found that in sad mood participants tend to identify emotions as negative (Lee et al, 2008). As these studies suggest that emotion perception can be affected by mood biases, perhaps it would be beneficial to report the current mood prior the recognition task.

Limitations and strengths

There are few potential limitations to be considered. This study like most studies in social research collected data via questionnaires. There are many advantages of using questionnaires, such as easier to reach participants and less time consuming. However, self-reports are often exposed to biases that can impact the validity and reliability of a measurement used in a study. Often participants answer the questionnaires that do not represent their true beliefs or attitudes when completing self-reports. Social desirability biases often occur in social research, when participants tend to respond in a matter that they think will be more acceptable by others or more socially desirable. According to a study by Hart & Tomazic (1999) participants were found to over-report their height and under-report their weight. Halo effect occurs when participants previously made response decide the pattern of later responses (Polit & Beck, 2004). Often in research that use self-reports participants exhibit extreme response style

by choosing most extreme scores, such as 1 or 5 (Likert scale), regardless of the item matter (Greenleaf, 1992) or neutral responses. According to Brener et al (2003), self-reports are only valid when participants comprehend the questions and are given anonymity. The presumption is that anonymity produces sincere responses. However it also reduces the sense of accountability and the cognitive commitment in the task (Zimbardo, 1969, p. 236-238).

This study included closed-ended questionnaires that measured more abstract propositions, including personality and empathy that could potentially lead to discrete interpretation and understanding of particular questions. Closed-ended questionnaires are easier to analyze, but they can be interpreted differently and sometimes can be irritating for participants not to have a possibility to express their own opinion but rather obey the structure (Garber et al, 2004).

Emotion recognition stimuli dataset could be one of the limitations as well. Strohminger et al (2015) argue that the dataset created by Minear and Park (2004) that was used in this study is badly controlled with dissimilarity in lighting and pose across stimuli and lack internal consistency. A relatively small number of stimuli (18) could be also a possible limitation and perhaps more effective results could be also obtained by a larger number of stimuli in the recognition task.

It has been argued that it is unnatural for individuals to identify emotions from photographs (Kalat, 1996, p. 421). All the faces in the emotion recognition task are often at the same position, however, sad individuals tend to look down instead of looking directly at the participant. Facial expressions in pictures can be interpreted as fake and unnatural. According to Collignon et al (2008) attending voices influence the comprehension of facial emotions. Studies suggest that body expressions (Steinen et al, 2011; Van den Stock et al, 2007) and voices (Collignon et al, 2008; Rigoulot & Pell, 2014) impact recognition of facial emotions. However,

humans encounter many of still expressions in magazines, newspapers, advertising and social media. That suggests that our environment is surrounded by numerous of nonverbal cues in many different contexts, and still, for instance when looking at the photographs of others, individuals apprehend facial expressions, despite the quality of the image or being fake.

Despite the limitations, the study potentially included a number of advantages. The strength of this study was facial emotion recognition stimulus that was used in this study. The current stimulus included faces of different age. Most of previous studies included faces of the same age (Calder et al, 2003; Schurgin et al, 2014) and often only Caucasian faces (Gilespie et al, 2015; Pelphrey & Shultz, 2013; Sucksmith et al, 2013). The current study included faces of different age and different ethnical background. Most previous studies used an experimental laboratory-based research method that potentially reduces ecological validity. The current research allowed participants to complete the questionnaires from their home at any time.

Future research and implications

Previous studies suggest that facial emotion recognition, by disclosing abnormal attention patterns or reduced accuracy, can help to detect schizophrenia (Amminger et al, 2012; Barkhof et al, 2015; Goghari & Sponheim, 2013), depression (Szanto et al, 2012; Van Winger et al, 2011), dementia (Kumfor et al, 2011), Parkinson's disease (Herrera et al, 2011) and autism (Bal et al, 2010; Smith et al, 2010; Walsh, Creighton & Rutherford, 2015). These studies suggest that emotion recognition test can be beneficial as a clinical tool. The findings of the current study contribute to the existing theoretical scientific literature on facial emotion recognition and expand the insufficient research on personality in facial emotion recognition.

The facial stimuli used in this study also included faces of different ethnic groups. Previous research suggests the existence cultural differences (Jack et al, 2012; O'Toole et al, 1996.) that were not explored in the current study. It suggests that it could be one of the elements affecting emotion recognition ability and it seems as a propitious area to include in future research. Future research should also increase the number of stimuli in facial emotion recognition task. Another suggestion would be to compare differences between picture stimuli and real stimuli (i.e., video clips). Swiss National Center of Competence in Research produced emotion recognition test GERT that incorporates dynamic and multimodal emotion expressions in short video clips with sound (Schlegel & Scherer, 2015). A different method of using facial stimuli could potentially provide distinct recognition results. A critical review by Kashlak (2014) investigated the effect of dynamic and static stimuli in emotion recognition task that included individuals with autism. Although no significant difference was found between dynamic and static stimuli, it was indicated that the literature exploring the differences of stimuli is insufficient.

Conclusion

In conclusion, the current findings demonstrate that gender is fundamental in facial emotion recognition accuracy. Although only two variables, gender, and neuroticism, contributed to the model, a relatively high correlation was observed between positive personality traits, empathy and emotion recognition. As discussed earlier, social cues recognition plays a crucial role in any individual's life and inability to comprehend facial expressions creates numerous of disadvantages in a social environment. Impaired facial emotions perception can also indicate numerous of psychopathologies suggesting it is a beneficial tool in clinical evaluation. To identify emotion expressed through facial expressions is particularly important for healthcare professionals, emergency services, educators and business leaders. Although facial emotion recognition has been widely studied, the results are still far from being indisputable. The main purpose of this study was to contribute to the existing literature, although it failed to confirm all the hypotheses, further research is required.

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Appendices

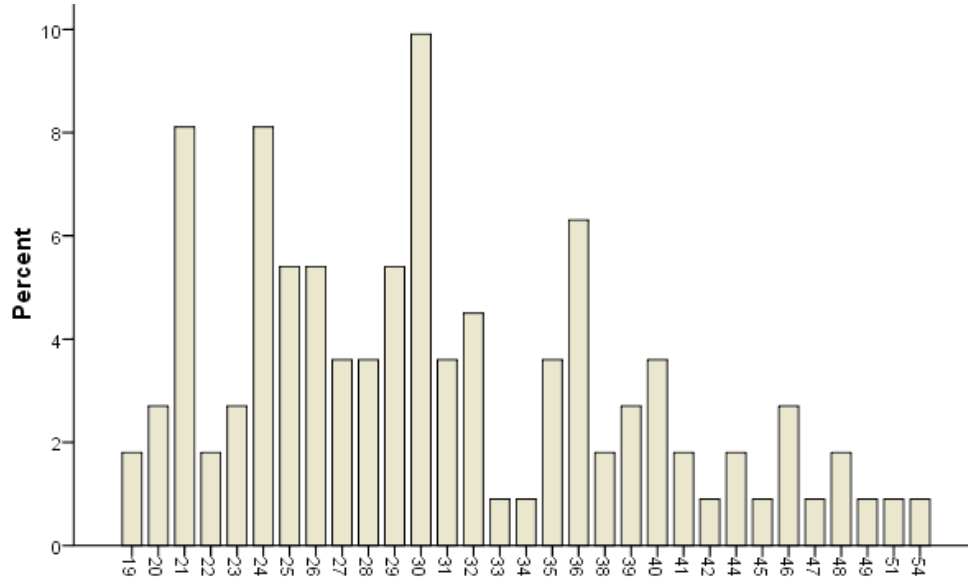


Figure 1. Participant's age. The bottom row shows participants reported age.

BIG FIVE INVENTORY (BFI)

Reference

John, O. P., & Srivastava, S. (1999). [The Big-Five trait taxonomy: History, measurement, and theoretical perspectives](#). In L. A. Pervin & O. P. John (Eds.), *Handbook of personality: Theory and research* (Vol. 2, pp. 102–138). New York: Guilford Press.

Description of Measure:

44-item inventory that measures an individual on the Big Five Factors (dimensions) of personality (Goldberg, 1993). Each of the factors is then further divided into personality facets. The Big Five Factors are (chart recreated from John & Srivastava, 1999):

Big Five Dimensions	Facet (and correlated trait adjective)
Extraversion vs. introversion	Gregariousness (sociable) Assertiveness (forceful) Activity (energetic) Excitement-seeking (adventurous) Positive emotions (enthusiastic) Warmth (outgoing)
Agreeableness vs. antagonism	Trust (forgiving) Straightforwardness (not demanding) Altruism (warm) Compliance (not stubborn) Modesty (not show-off) Tender-mindedness (sympathetic)
Conscientiousness vs. lack of direction	Competence (efficient) Order (organized) Dutifulness (not careless) Achievement striving (thorough) Self-discipline (not lazy) Deliberation (not impulsive)
Neuroticism vs. emotional stability	Anxiety (tense) Angry hostility (irritable) Depression (not contented) Self-consciousness (shy) Impulsiveness (moody) Vulnerability (not self-confident)
Openness vs. closedness to experience	Ideas (curious) Fantasy (imaginative) Aesthetics (artistic) Actions (wide interests) Feelings (excitable) Values (unconventional)

For more information about the Big Five, visit this website:

<http://www.uoregon.edu/~sanjay/bigfive.html#where>

Abstracts of Selected Related Articles:

Bouchard, T. J. & McGue, M. (2003). Genetic and environmental influences on human psychological differences. *Journal of Neurobiology*, 54, 4-45.

Psychological researchers typically distinguish five major domains of individual differences in human behavior: cognitive abilities, personality, social attitudes, psychological interests, and psychopathology (Lubinski, 2000). In this article we: discuss a number of methodological errors commonly found in research on human individual differences; introduce a broad framework for interpreting findings from contemporary behavioral genetic studies; briefly outline the basic quantitative methods used in human behavioral genetic research; review the major criticisms of behavior genetic designs, with particular emphasis on the twin and adoption methods; describe the major or dominant theoretical scheme in each domain; and review behavioral genetic findings in all five domains. We conclude that there is now strong evidence that virtually all individual psychological differences, when reliably measured, are moderately to substantially heritable.

Tkach, C., & Lyubomirsky, S. (2006). How do people pursue happiness?: Relating personality, happiness-increasing strategies, and well-being. *Journal of Happiness Studies*, 7, 183-225.

Five hundred ethnically diverse undergraduates reported their happiness strategies – that is, activities undertaken to maintain or increase happiness. Factor analysis extracted eight general strategies: Affiliation, Partying, Mental Control, Goal Pursuit, Passive Leisure, Active Leisure, Religion, and Direct Attempts at happiness. According to multiple regression analyses, these strategies accounted for 52% of the variance in self-reported happiness and 16% over and above the variance accounted for by the Big Five personality traits. The strongest unique predictors of current happiness were Mental Control (inversely related), Direct Attempts, Affiliation, Religion, Partying, and Active Leisure. Gender differences suggest that men prefer to engage in Active Leisure and Mental Control, whereas women favor Affiliation, Goal Pursuit, Passive Leisure, and Religion. Relative to Asian and Chicano(a) students, White students preferred using high arousal strategies. Finally, mediation analyses revealed that many associations between individuals' personality and happiness levels are to some extent mediated by the strategies they use to increase their happiness – particularly, by Affiliation, Mental Control, and Direct Attempts.

Shiota, M.N., Keltner, D., & John, O. P. (2006). Positive emotion dispositions differentially associated with Big Five personality and attachment style. *The Journal of Positive Psychology*, 1, 61-71.

Although theorists have proposed the existence of multiple distinct varieties of positive emotion, dispositional positive affect is typically treated as a unidimensional variable in personality research. We present data elaborating conceptual and empirical differences among seven positive emotion dispositions in their relationships with two core personality constructs, the “Big Five” and adult attachment style. We found that the positive emotion dispositions were differentially associated with self- and peer-rated Extraversion, Conscientiousness, Agreeableness, Openness to Experience, and

Neuroticism. We also found that different adult attachment styles were associated with different kinds of emotional rewards. Findings support the theoretical utility of differentiating among several dispositional positive emotion constructs in personality research.

The Big Five Inventory (BFI)

Here are a number of characteristics that may or may not apply to you. For example, do you agree that you are someone who likes to spend time with others? Please write a number next to each statement to indicate the extent to which you agree or disagree with that statement.

Disagree Strongly	Disagree a little	Neither agree nor disagree	Agree a little	Agree strongly
1	2	3	4	5

I see Myself as Someone Who...

- | | |
|--|--|
| ___ 1. Is talkative | ___ 23. Tends to be lazy |
| ___ 2. Tends to find fault with others | ___ 24. Is emotionally stable, not easily upset |
| ___ 3. Does a thorough job | ___ 25. Is inventive |
| ___ 4. Is depressed, blue | ___ 26. Has an assertive personality |
| ___ 5. Is original, comes up with new ideas | ___ 27. Can be cold and aloof |
| ___ 6. Is reserved | ___ 28. Perseveres until the task is finished |
| ___ 7. Is helpful and unselfish with others | ___ 29. Can be moody |
| ___ 8. Can be somewhat careless | ___ 30. Values artistic, aesthetic experiences |
| ___ 9. Is relaxed, handles stress well | ___ 31. Is sometimes shy, inhibited |
| ___ 10. Is curious about many different things | ___ 32. Is considerate and kind to almost everyone |
| ___ 11. Is full of energy | ___ 33. Does things efficiently |
| ___ 12. Starts quarrels with others | ___ 34. Remains calm in tense situations |

- | | |
|--------------------------------------|---|
| ___13. Is a reliable worker | ___35. Prefers work that is routine |
| ___14. Can be tense | ___36. Is outgoing, sociable |
| ___15. Is ingenious, a deep thinker | ___37. Is sometimes rude to others |
| ___16. Generates a lot of enthusiasm | ___38. Makes plans and follows through
with them |
| ___17. Has a forgiving nature | ___39. Gets nervous easily |
| ___18. Tends to be disorganized | ___40. Likes to reflect, play with ideas |
| ___19. Worries a lot | ___41. Has few artistic interests |
| ___20. Has an active imagination | ___42. Likes to cooperate with others |
| ___21. Tends to be quiet | ___43. Is easily distracted |
| ___22. Is generally trusting | ___44. Is sophisticated in art, music, or
literature |

Scoring:

BFI scale scoring (“R” denotes reverse-scored items):

Extraversion: 1, 6R, 11, 16, 21R, 26, 31R, 36

Agreeableness: 2R, 7, 12R, 17, 22, 27R, 32, 37R, 42

Conscientiousness: 3, 8R, 13, 18R, 23R, 28, 33, 38, 43R

Neuroticism: 4, 9R, 14, 19, 24R, 29, 34R, 39

Openness: 5, 10, 15, 20, 25, 30, 35R, 40, 41R, 44

Toronto Empathy Questionnaire instructions

Below is a list of statements. Please read each statement carefully and rate how frequently you feel or act in the manner described. Circle your answer on the response form. There are no right or wrong answers or trick questions. Please answer each question as honestly as you can.

1. When someone else is feeling excited, I tend to get excited too
2. Other people's misfortunes do not disturb me a great deal
3. It upsets me to see someone being treated disrespectfully
4. I remain unaffected when someone close to me is happy
5. I enjoy making other people feel better
6. I have tender, concerned feelings for people less fortunate than me
7. When a friend starts to talk about his\her problems, I try to steer the conversation towards something else
8. I can tell when others are sad even when they do not say anything
9. I find that I am "in tune" with other people's moods
10. I do not feel sympathy for people who cause their own serious illnesses
11. I become irritated when someone cries
12. I am not really interested in how other people feel
13. I get a strong urge to help when I see someone who is upset
14. When I see someone being treated unfairly, I do not feel very much pity for them
15. I find it silly for people to cry out of happiness
16. When I see someone being taken advantage of, I feel kind of protective towards him\her

Scoring Item responses are scored according to the following scale for positively worded items 1, 3, 5, 6, 8, 9, 13, 16. Never = 0; Rarely = 1; Sometimes = 2; Often = 3; Always = 4. The following negatively worded items are reverse scored: 2, 4, 7, 10, 11, 12, 14, 15. Scores are summed to derive total for the Toronto Empathy Questionnaire.



Facial Expression study

Humans not only use verbal cues to communicate but also use facial expressions. As suggested by previous research facial expressions are universal.

The main purpose of this study is to investigate personality differences in how well people can recognize emotions in the faces of others.

The research is being carried in partial fulfillment of the BA (Hons) in Psychology degree. The study has been approved by the National College of Ireland Ethics committee. Your participation will be completely confidential, no identification details will be asked and you can withdraw from the study at any time. It will take about 10 minutes to complete the survey. You will be asked to complete a personality questionnaire and shown series of photographs of human faces. This survey has no time limit. You must be over 18 to participate.

If you require more information about the study please contact us

Rasa.Sirkeviciute@student.ncirl.ie or Dr. Rebecca Maguire, rebecca.maguire@ncirl.ie If you are agreeing to participate in this study please proceed to the survey by clicking "I agree" to the following question.*

Thank You for taking part in this study!

Do you agree to participate in this study?

I agree to participate in this study

ALL INFORMATION REMAINS STRICTLY CONFIDENTIAL

Please mark the space box next to your answer choice that best applies to you:

1. **What is your gender?**

Male

Female

2. **What is your age?**

3. **What is the highest degree or level of education you have completed?**

No formal education/training

Primary education

Current student

Vocational training

College graduate

Post graduate

Other

4. What is your current marital status?

Married/Living together

In relationship

Single

Divorced/Separated

Widowed

Other _____

Next, you will be shown pictures of human faces. Your job is to identify expressed emotions. Please choose your answer for the following pictures:



1. This person is...

Angry

Surprised

Happy

Disgusted

Scared

Sad

Other (write your own answer)_____