Factors Influencing Variation in Face Processing

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Abstract

Perceptions of faces, such as judgments about others' emotional states or attractiveness from facial characteristics, influence social interaction. However, relatively few studies have investigated factors that predict variation among individuals or groups of individuals in how people perceive facial characteristics and results from studies on this topic that have been reported have often been subsequently shown to not be robust. For these reasons, the studies reported in this thesis investigated potential sources of variation in face perception, focusing on (1) the relationship between affective factors and perceptions of facial expression of emotion in a UK sample and (2) the effects of sexually dimorphic face-shape characteristics on social judgments of faces in samples of Arab women. Chapter 2 (the first empirical chapter) reports results from a Registered Report investigating relationships between different affective factors and emotion perception. Results replicated previous studies suggesting that participants scoring higher on generalised anxiety performed poorer on emotion perception tasks, but also found evidence that other affective factors, particularly those related to empathy, also contributed to variation in emotion perception. While Chapter 2 had investigated responses to facial characteristics that can change very rapidly (emotional expressions), Chapters 3 and 4 investigated Arab women's responses to a facial characteristic that is relatively stable over time (sexually dimorphic face-shape characteristics). Results from this series of studies suggested that Arab women perceived feminised versions of men's faces to be more attractive, younger-looking, and less dominant than masculinised versions, but found no effects of sexually dimorphic face-shape characteristics on perceptions of men's trustworthiness or health. These results for Arab women's face perceptions show some similarities (e.g., femininized faces look more attractive, younger, and less dominant than masculinised faces) to results previously reported for UK women's face perceptions, but also show some differences (e.g., UK women typically find feminized faces look more trustworthy, a pattern not seen in this sample of Arab women). Together, the results reported in this thesis suggest that affective factors and cultural differences may contribute to variation in face perceptions and highlight the importance of considering variation when studying face perception.

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Publication statement

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Conferences

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Author's declaration

I, Sarah Alharbi, hereby confirm that this thesis represents my work, completed under normal supervision, and has not been presented as part of any previous application for any other academic degree.

Chapter 1. General Introduction

1.1 The Importance of Facial Structure in Human Interactions:

1.1.1 Human Facial Qualities:

Human facial features are one of the richest tools for social interaction (Tsagkrasoulis et al., 2017). The ability to identify faces and make various inferences, such as determining another as a mate or an enemy, is an essential component of the human experience (Zhao & Chellappa, 2006). Newborn infants have been shown to follow face-like stimuli with their eyes and head more than non-face stimuli (Johnson et al., 1991), suggesting that humans learn to associate traits such as security, pleasure, and fulfillment with faces at a very young age. By the time that they have reached adulthood, they have developed and refined myriad ways of communicating using facial expressions. because they arguably signal the identity, age, race, gender, familiarity, health, or emotional state of others more effectively than any other physical feature, facial cues can have great social consequences (Zhao & Chellappa, 2006; Zebrowitz, 2017).

Throughout history, numerous philosophers and scientists have studied the concept of facial processing, with varied approaches to investigating the evolutionary, cultural, social, and physiological origins of the face (Jack & Schyns, 2015). For example, several chapters of Aristotle's Historia Animalium are devoted to the study of facial characteristics, while Darwin later asserted that the use of the facial expression as a method of identification was fundamental to the continued survival of the species (Zhao & Chellappa, 2006). Additionally, as Solomon Asch (1948, p. 258) stated, "We look at a person and immediately a certain impression of his character forms itself in us" (Lönnqvist, Ilmarinen, & Verkasalo, 2021).

It is also worth noting how empirical studies highlighted some general agreements between faces features and social perceptions. For instance, specific facial characteristics were associated with gender, with information such as high eyebrows and full lips more commonly identified as female attributes than male (Campbell, 1996; Keating, 1985; Keating et al., 1977). Although observers can still identify this information even when it is provided separately from the face (Brown & Perrett, 1993), faces with thin lips, low brows, and angular characteristics were related more to men and associated more with angry expressions (Marsh, Adams, & Kleck, 2005; Zebrowitz, 1997; Hess, Adams, & Kleck, 2004, 2005; Zebrowitz et al., 2010). Facial shape has also been found to correlate with perceived dominance and gender differences (Keating, 1985; Zebrowitz, 1997), with men commonly perceived as more dominant than women (Hess et al., 2005; Zebrowitz, 1997). In the context of fitness cues, faces perceived as feminine may also be more frequently associated with fitness, maturity, and fertility (Adams, Nelson, Soto, Hess, & Kleck, 2012). However, observers are more likely to reject or avoid those with faces perceived as unfit or indicative of genetic anomalies or disease. This may also generalize to unattractive people who are often perceived as being low in fitness (Zebrowitz, 2017).

However, observing and assessing patients' nonverbal behavior, to determine the presence or absence of mental illness, forms an essential part of the clinical evaluations performed by clinicians (Ekman and Friesen, 1974; Garb, 2005; Slepian et al., 2014). Recent evidence has demonstrated a correlation between facial appearance and actual mental and physical health (Daros et al., 2016; Ward & Scott, 2018). Studies have proven that the craniofacial region of individuals with schizophrenia, compared to that of healthy populations, is likely to contain morphological differences (Buckley et al., 2005; Lane et al., 1997). Moreover, images of faces taken under special conditions have displayed notable and obvious discrimination in terms of mental state. When examining photographs of male and female faces, observers accurately detected those with different levels of the dark triad (narcissism, Machiavellianism, and psychopathy) (Holtzman, 2011). Similarly, Daros, Ruocco, and Rule (2016) concluded that neutral facial cues helped to distinguish clinical subjects with borderline personality disorder (BPD).

1.1.2 Mental State Inferences:

Humans have a special ability to infer the inner mental states of others who are being observed (Kaliouby & Robinson, 2005). Individuals can draw inferences about the complex mental states of other people to decide, for example, whether they are scheming, interested in something, or feeling admiration, and individuals can also interpret other people's attitudes as proof of what they are thinking and feeling (Mitchell, 2009). To most effectively navigate social life, people have to be able to carefully infer the mental states of others. There is no doubt that one's face conveys great information about momentary mental states and thus the potential intentions of other people. These states also give information to the perceiver concerning suitable behaviours (Said, Haxby, & Todorov, 2011). Moreover, the identification of mental states includes a degree of the cognitive process by the observers who come to a conclusion about someone's potential state (Back, Jordan, & Thomas, 2009). Baron-Cohen, Wheelwright, and Joliffe (1997) argued that eye input is especially important for the recognition of the mental states of others. There is strong evidence that when people are making cognitive or affective state inferences by looking at facial features, the amygdala has an important role in mental state inferences (Franklin & Zebrowitz, 2016). This ability has been measured using the "Mind in the Eyes" task, which asks subjects to infer someone's mental state according to information from the eyes only. Participants select their choices from a range of labels that involve both cognitive states and social emotions (Baron-Cohen et al., 2001). Individuals with amygdala lesions are usually impaired during the performance of this task (Adolphs et al., 2002; Shaw et al., 2005). Other experiments using the Mind in the Eyes task have found that the amygdala is activated through mental state inference. Some researchers have additionally noted reduced activation of the amygdala in an autistic sample (Baron-Cohen et al., 1999; Adams et al., 2010). In line with this finding, other studies have suggested that perceivers distinguish between depressed and non-depressed individuals (Waxer, 1976; Scott et al., 2013), between people with high and low levels of anxiety (Waxer, 1977), and between patients who have attempted to commit suicide and those who have not (Archinard et al., 2000; Kleiman and Rule, 2012).

One of the few works examining mental state inference used paintings of faces presenting various mental states (Baron-Cohen et al., 1996). The subjects identified eight out of eleven mental states that were reported to be universal among three different cultures (Back, Jordan, & Thomas, 2009). However, several studies have focused on the relationship between dynamic information and the identification of a mental state. By comparing performance between the static and dynamic facial expressions of multiple mental states, the findings demonstrated an effective advantage with the facially dynamic stimuli, indicating that recognition of mental states is more sensitive to dynamic expressions (Back & Jordan, 2014). Furthermore, Baron-Cohen et al. (1997) investigated whether greyscale photographs of partial or whole faces could help with inferring people's mental states and found considerable agreement among participants over particular faces for specific mental states such as admiring, bored, guilty, and thoughtful.

1.1.3 Attention:

In certain circumstances, faces can fall into a special category of stimuli that requires processing to avoid different kinds of distractions (Bindemann et al., 2005; Palermo et al., 2007). This phenomenon, commonly called attention capture, indicates whether what one is seeing depends on a face existing in a visual array or not (Bindemann, Burton, Langton, Schweinberger, & Doherty, 2007). In the literature, there is some evidence that faces can provide more of an advantage than other types of stimulus categories when it comes to catching visual attention. This proof involves studies of a group of patients with hemispatial visual neglect (Vuilleumier, 2000) and other subjects who were neurologically normal (Mack, Pappas, Silverman, & Gay, 2002; Shelley-Tremblay & Mack, 1999), and the findings indicated that faces were more likely to be reported than nonface objects in conditions that produce detection difficulty. Moreover, behavioural evidence has demonstrated that attention can be preferentially guided to faces rather than objects in a scene (Ro, Russell, & Lavie, 2001). Finally, some evidence has shown that attention is exogenously and automatically grabbed by a face (Theeuwes & Stigchel, 2006).

Various studies of attention retention have confirmed the emotional aspects of stimuli. For instance, Bradley, Mogg, Falla, and Hamilton (1998) used faces to determine the placement of a dot probe target to present attentional bias over threatening faces in contrast to faces with happy or neutral expressions. Additional evidence has found that infants can discriminate between facial expressions such as fear, anger, and sadness and that angry faces may be attention-grabbing in particular (Schwartz et al., 1985; Serrano, Iglesias, & Loeches, 1992). Similarly, Hansen and Hansen (1988) noted that subjects detected angry faces more quickly than happy faces, suggesting that an automatic pathway could speed the processing of negative expressions and detection of faces. Importantly, this suggests that the visual system is more effective in leading attention to the location of negative expressions but that this detection is not fully separate from competition among simultaneous stimuli and depends on resources processing distracters, which could lead, for example, to extra time being needed to recognise the target face in a large crowd. Consequently, emotional cues do not seem to bypass attention but indeed facilitate attention by increasing the perceptual saliency of a face over different targets (Vuilleumier & Righart, 2011).

Attractiveness also captures and grabs attention and greatly influences the way people visually explore their environments (Chen, Liu, & Nakabayashi, 2012; Bindemann et al., 2005). This impact is most robust in faces that have outstandingly strong biological and social relevance (Kanwisher, Mcdermott, & Chun, 1997; Goren et al., 1975). Some eye-tracking experiments have shown that attractive faces are gazed on longer than unattractive faces (Leder, Mitrovic, & Goller, 2016; Shimojo, Simion, Shimojo, & Scheier, 2003). Various approaches have been proposed to suggest that the psychological mechanism regarding this bias is simply due to the reward of pleasure and positive emotions that are elicited from an attractive face (Vartanian et al., 2013; Hahn et al., 2014).

1.1.4 Perceiving and Remembering Faces:

Our recall of another individual is often largely influenced by our visual memory of their facial features. The processes employed in perceiving and remembering faces form a major part of the complex procedure by which visual stimuli are

processed. Many studies in this area have demonstrated that individuals can perceive and remember numerous faces (Friedman & Haber, 1974; Friedman, Reed, & Carterette, 1971; Howells, 1938). Friedman and Haber (1974) argue that the underlying mechanisms of facial recall can be traced to a particular process of encoding the face in the observer's memory (Cohen & Nodine, 1978). Many relevant studies have focused on the effect of the contextual and intrinsic facial properties of memorability, such as familiarity, race, expressions, trustworthiness, and distinctiveness (Chang, Nemrodov, Lee, & Nestor, 2017). Researchers have consistently emphasized the way in which emotion impacts memory formation (Blaney, 1986; Bradley, Greenwald, Petry, & Lang, 1992; Talmi, Schimmack, Paterson, & Moscovitch, 2007). Experiments conducted on facial memorization have indicated that an emotional expression increases the likelihood that observers would remember a face (D'Argembeau & Van Der Linden, 2007; Jackson, Wu, Linden, & Raymond, 2009; Mattarozzi, Todorov, & Codispoti, 2015). However, one's memory has also been shown to be less accurate regarding faces from other racial groups compared to those from their own (Lucas, Chiao, & Paller, 2011).

Furthermore, facial perception appears to start early in human life, developing at the same rate as the perception of other objects; meanwhile, the facial memory process evolves more slowly, typically during the first ten years or so of life (Weigelt et al., 2014). However, according to almost 100 reviewed and analyzed studies of facial processing in autism spectrum disorders, Weigelt et al. (2012) reported that subjects with ASD show poor face processing when tasks required a memory demand, in contrast with other tasks related to face perception that did not show face-processing implements (Dalrymple, Garrido, & Duchaine, 2014).

Within a healthy population, there is generally a significant level of variation in individuals' ability to remember and recognize both familiar and unfamiliar faces (Carbon, 2008; Herzmann et al., 2008; Elbich and Scherf, 2017). Many studies have attempted to determine the neural underpinnings of face processing (Bentin et al., 1996; Haxby et al., 1999; Grill-Spector and Malach, 2004; Kanwisher and Yovel, 2006), the findings of which demonstrated that several areas in the brain (e.g., the fusiform face area, the occipital face area, and the ventral anterior temporal lobe) are highly selective for facial stimuli, responding more quickly to

faces than to other objects (Rossion et al., 2012; Avidan et al., 2014; Ramot, Walsh, & Martin, 2019).

Consequently, an impaired ability to recognize faces is therefore not only related to contextual and intrinsic facial properties but can also be strongly linked with impaired neurobiological mechanisms related to face perception and memory issues. Changes in face perception are often undoubtedly followed by alterations in sociability, a phenomenon that is most notable in individuals with mild or severe brain conditions. For example, individuals with autism spectrum disorder may exhibit poor memory for the facial identity and expressions of others (Golarai et al., 2006). Furthermore, the mental rotation difficulties exhibited by Alzheimer's patients can significantly impact their memory retrieval of faces (Adduri and Marotta, 2009; Lopatina, Komleva, Gorina, Higashida, & Salmina, 2018).

1.1.5 Trait Inferences:

There is no doubt that facial appearance is a perennial source of perceived information as to an individual's character (Zebrowitz, 2018). Certainly, people have long inferred personality traits from faces in spite of mixed evidence on the accuracy of such inferences (Penton-Voak et al., 2006; Zebrowitz et al., 1996; Olivola & Todorov, 2010). For instance, perceivers may make inferences about personality traits and beliefs such as one's religious affiliations simply by observing static facial characteristics (Rule et al., 2010).

Furthermore, evidence shows that observers perceive trait information from faces both individually and with common agreement (Todorov et al., 2009; Wilson et al., 2018). For example, Zebrowitz et al. (1993) noted high levels of inter-race agreements for a number of traits (e.g., dominance, honesty, warmth, strength, and shrewdness) perceived from faces of different ethnicities, and even children can infer reliable traits from faces following very short exposures within the first 39 ms of an encounter (Bar et al., 2006; Cogsdill et al., 2014). In addition, Willis and Todorov (2006) demonstrated that trait judgments such as attractiveness, aggressiveness, trustworthiness, competence, and likeability were consistent after exposures ranging from 100 ms to 1000 ms.

Many attempts to highlight the accuracy of one's first impressions measured the agreement between the target's self-report of their personal traits and the observer's estimates of those traits. According to this measure, several studies have found accurate inferencing of certain traits from faces (Jones et al., 2019) including trustworthiness (Tognetti et al., 2013), sociosexuality (Boothroyd et al., 2008; Boothroyd, et al., 2011), dominance (Quist et al., 2011), fighting ability (Little et al., 2015), political affiliation (Rule & Ambady, 2010), physical health (Henderson et al., 2016; Jones, 2018), and mental health issues (Martin et al., 1977; McGovern et al., 1996; Ward & Scott, 2018).

A growing body of evidence further supports the belief that observers link many personality traits with attractive facial appearance. Particularly, people are more likely to agree with the stereotype that "what is beautiful is good" (Dion et al., 1972), in which they tend to assign positive characteristics to attractive people and ascribe negative traits to unattractive people. Therefore, an attractive target guides the perceiver to create strong inferences of positive personality traits, such as gregariousness and likability (Eagly et al., 1991; Paunonen et al., 1999).

Similarly, various works in this field that focus on the objective characteristics of facial appearance have reported a clear relation between facial morphology and personality traits (Kachur et al., 2020). For example, facial symmetry has been found to be associated with extraversion (Pound et al., 2007). Another indicator that has been studied is the facial width to height ratio (FWHR), which has been associated with personality traits such as achievement drive (Lewis et al., 2012), unethical behaviour (Haselhuhn & Wong, 2011), dominance (Valentine et al., 2014), aggressiveness (Carré & Mccormick, 2009), and risk-taking (Welker et al., 2015).

Nevertheless, along with these investigations made on the predictive estimate of facial features for substantive diversity among the Big Five personality traits ratings, several works document the misuse of physical features to predict the personality of strangers. Of the common "misinterpreted" cues, spontaneous smiling seems to be perceived incorrectly the most often, as perceivers are more likely to translate it as indicative of a variety of socially acceptable traits (Petrican

et al., 2014). For instance, Kenny et al. (1992) found that observers tend to use smiling as a cue for high extraversion, agreeableness, and openness to experience. Additionally, studies have demonstrated that smiling targets were often erroneously ascribed a positive personality profile, as they received stronger scores on nearly all socially attractive traits such as extraversion, conscientiousness, emotional stability, agreeableness, and openness to experience (Naumann et al., 2009).

1.1.6 Faces and Decision Making:

Through social interactions, people employ the available information to guide and lead their decisions (Campellone & Kring, 2013). Facial traits can be a particularly rich source of information, providing indicators of ethnicity, age, and gender as well as the person's current emotional state (Olivola, Funk, & Todorov, 2014); this is notwithstanding of their potential to cause biased decision making and influence judgments of behavioural tendencies, personality traits, and cognitive function. Consequently, faces influence social decisions by enabling the perceiver to predict a large number of significant outcomes (Scharlemann, Eckel, Kacelnik, & Wilson, 2001; Olivola et al., 2014).

Some past research has addressed the question of whether social factors such as faces influence human decision making (Averbeck & Duchaine, 2009). Various studies have shown facial appearances to predict important social outcomes in such diverse contexts as the military (Mueller & Mazur, 1996; Loehr & O'Hara, 2013; Olivola, Eubanks, & Lovelace, 2014), law (Dumas & Testé, 2006; Porter, Brinke, & Gustaw, 2010), business (Rule & Ambady, 2008; Alrajih & Ward, 2013; Re & Rule, 2016), and politics (Lenz & Lawson, 2011; Olivola, Sussman, Tsetsos, Kang, & Todorov, 2012; Carpinella & Johnson, 2016). Many of these studies highlighted that individuals with certain facial attributes tend to experience desirable outcomes, such as winning an election and are more likely to avoid undesirable outcomes, like being convicted of a crime, compared to their peers who do not possess these facial features. Critically, people tend to view political leadership as being closely associated with competence, while military leadership is associated more with the traits of maturity, masculinity, and low emotional warmth (Olivola et al., 2014).

Several studies (e.g., Mazur et al., 1984; Mueller & Mazur, 1996; and Loehr & O'Hara, 2013) indicated that a Cadet's later military rank attainment can be predicted by the extent to which his face looks dominant, despite conflicting evidence that facial morphology associated with dominance negatively predicts military rank (Loehr & O'Hara, 2013). Meanwhile, in the context of business, other works have reported that CEOs who were perceived as more competent and dominant were hired by more successful companies and received higher wages than their less competent-looking peers, even when they made no great effort to perform better (Graham et al., 2010; Rule & Ambady, 2008). Experimental studies have investigated the tendency of defendants with face shapes perceived as untrustworthy (Porter et al., 2010) to receive guilty verdicts, even if the concrete evidence of their guilt is insufficient (Todorov, Olivola, Dotsch, & Mende-Siedlecki, 2015).

However, there is a wide consensus regarding the judgment of faces as trustworthy, competent, and so on. Significant progress has been made in identifying the configurations of facial characteristics that guide some inferred traits such as how the person resolves disputes (Friedman et al., 2004) and responds to ultimatums (van Dijk et al., 2008); their cooperation in dilemmas related to public resources and goods (Wubben et al., 2008); negotiation (van Kleef et al., 2004); and trust (Krumhuber et al., 2007) (Melo, Carnevale, & Gratch, 2013).

An experiment that examined the assumption that smiling indicates the intention to cooperate with a partner proved that individuals tended to trust partners who smiled more than those who did not (Scharlemann et al., 2001). Research demonstrates that when applying for newscaster positions, the presence or absence of facial expressions such as smiles can affect the eventual choice of a candidate (Mullen et al., 1986). Additional evidence illustrates that waitresses receive significantly more tips when smiling than when not (Tidd & Lochard, 1978). LaFrance and Hecht (1995) demonstrated that smiling induces leniency; for example, individuals who smile are, to different degrees, more likely to receive less severe sentences for a criminal conviction than those who do not. Similarly, Winkielman et al. (2005) claim that unconscious affective responses to happy

against angry faces affect consumption attitudes and judgments of value. This is based on the evidence that thirsty individuals drink more of a beverage when subliminally shown happy faces and exhibit a greater willingness to pay more for the drink, in contrast with participants who were shown an angry face. Likewise, Marsh, Ambady, & Kleck (2005) noted that facial displays of anger provoked avoidant behaviour in perceivers, signalling them to keep their distance; faces conveying anger are also perceived as less trustworthy (Dunn & Schweitzer, 2005), high in dominance, and low in affiliation behaviour (Montepare & Dobish, 2003). Conversely, Wilson & Eckel (2006) found that potential partners who were ranked as more attractive were judged as more trustworthy in a game of trust and reciprocity; moreover, they were punished more than the less attractive partners after failing to reciprocate trust.

1.2 The Effect of Affective Factors on Emotional Perception and Face Processing:

1.2.1 Universal Emotions:

There have been many discussions among psychologists about whether emotions are universal (Lim, 2016). However, there is no agreement in the literature about the specific number of primary emotions that people experience. For example, Robert Plutchik argued that there are eight basic emotions: anger, anticipation, disgust, fear, joy, sadness, surprise, and trust. Meanwhile, Paul Ekman stated that there are seven basic emotions: anger, contempt, disgust, fear, joy, sadness, and surprise (Gu, Wang, Patel, Bourgeois, & Huang, 2019). It is noteworthy that several researchers (Gu et al., 2015; Jack et al., 2014; Zheng et al., 2016) have proposed the existence of four basic emotions: anger, fear, joy, and sadness (Gu et al., 2019). Some researchers believe that emotion is a universal construct and that a key part of the emotional experience is growing biologically (Izard, 1994). For example, Charles Darwin thinks that facial expressions are universal and that gestures are specific to different cultures (Ekman, 2009). Moreover, Izard (1977) proposed that the primary emotions hold innate neural substrates and furthermore have universal behavioural phenotypes that are fundamental in development and

adaptation. Similarly, Ekman suggested that emotions are genetically determined, with facial expressions being interpreted the same way across cultures (Lim, 2016). However, some empirical evidence shows that culture also shapes emotion in different ways. A growing body of research (Markus & Kitayama, 1991; Matsumoto & Ekman, 1989; Russell, 1994) has found that some aspects of emotion are culturally different. As a result, these aspects are influenced not only by biology but also by environmental, social, and cultural situations. For instance, some studies have labelled the emotion-by-emotion words used in cultures (Shott,1979), and others have looked at the ways people create and recognize facial expressions for various emotions (Lim, 2016).

On the other hand, classic judgement studies have shown that basic emotions can be accurately identified across cultural groups, which suggests the existence of basic emotions as a universal schema (Marsh, Elfenbein, & Ambady, 2003). Some researchers have proposed that individuals may find it difficult to comprehend nonverbal communication in foreign cultures. For instance, Izard (1971) noted that American individuals in a study accurately recognized emotions expressed in facial photographs of other Americans around 83% of the time, while they only scored 65% for Japanese individuals and 50% for African individuals. Thus, people are more likely to accurately identify the facial expressions of those from their own cultural groups than the facial expressions of those from other cultures. However, Matsumoto et al. (1988) found that American subjects and Japanese subjects felt the same emotions in similar situations, so, for example, they both experienced positive emotions when meeting friends or achieving their goals. To date, the evidence indicates that basic emotional expressions are widely identifiable across cultures even though many emotional expressions are not conveyed in the same manner (Hess & Thibault, 2009).

1.2.2 Functions of Expressions:

Facial expressions consist of facial musculature changes, including scowling, eye-widening, moving the mouth upward or downward, wrinkling the nose, stretching the lips, and opening the mouth (Ekman, Friesen, & Hager, 2002). These facial expression changes are assumed to reflect one's internal emotions, needs, and behavior tendencies (Ekman, 1992). It has been thought that the evolution of

facial expressions can be a signal system that helps one adapt (Darwin,1872; Fridlund,1994). Hence, individuals' accurate transmission and decoding of such social signals are of great importance (Smith et al., 2009; Greening et al., 2018). It has been suggested that expressions of anger can affect the observer's behavior. Because it is a strong emotion, anger is thought to threaten relationships and degrade the level of accuracy in communication (Callister, Geddes, & Gibson, 2017). Previous studies have shown that stress responses attributable to the facial expression of anger may arouse blame, (Aquino, Tripp, & Bies, 2001), the tendency toward revenge (Bies & Tripp, 2000), and increase incivility (Andersson & Pearson, 1999). People attend selectively to angry facial expressions, as anger is a signal of an imminent attack (Wirth & Schultheiss, 2007). Van Peer, Rotteveel, Spinhoven, Tollenaar, and Roelofs (2010) argued that observers avoided those who express anger because it is an aversive stimulus and correlated with a withdrawal-oriented intent.

On the other hand, Reed, Zeglen, and Schmidt (2012) found that smiling faces are correlated significantly with increased rates of cooperative behavior in the prisoner's dilemma game. Similarly, prior research has suggested that in contrast to a frowning face, a smiling face is associated significantly with observers' perception of trustworthiness (Calvo, Krumhuber, & Fernández-Martín, 2018; Centorrino, Djemai, Hopfensitz, Milinski, & Seabright, 2015). The function of the emotion of sadness can be to update the primary aspects of cognitive systems to cope with the implications of a loss, invest in potential resources to avoid future hardships, or make plans to mitigate the loss in the present (Tooby, Cosmides, Sell, Lieberman, & Sznycer, 2008; Reed & DeScioli, 2017).

In addition, empirical findings have demonstrated that fear serves a special function. Öhman, Flykt, and Esteves (2001) reported that participants with a phobia detected the fear-relevant stimuli in a visual search task faster than control participants did. Moreover, Flykt (2005) noted that the detection of fear-related stimuli, such as snakes or spiders, is associated with an accelerated heart rate that indicates a defensive reaction, while detection of stimuli unrelated to fear, such as flowers or mushrooms, is associated with a decelerated heart rate that indicates an orienting response. Other research has supported these findings and found that threatening facial expressions are detected more rapidly than are

non-threatening expressions (Öhman, Flykt, & Lundqvist, 2000; Öhman & Mineka, 2001). Thus, a fearful facial expression is more likely to be a cue of something for which the observer must be vigilant (Frith, 2009), while disgust serves typically as a repulsion mechanism toward certain types of stimuli, such as spoiled food, poor hygiene, a mutilated face or body, animals, and death (Haidt, McCauley, & Rozin, 1994; Rozin et al., 2000). Disgust often serves as a cue that there is something harmful or dangerous to be avoided. By attending to the feeling of disgust, individuals reduce the effect of exposure to potentially noxious stimuli (Frith, 2009). Hence, a good functional explanation for these emotions is that they are beyond conscious control, but can protect people from engaging in dangerous behaviors, such as the fear of jumping or disgust from eating corpses (Reed & DeScioli, 2017).

There are certain common traits associated with emotional expressions, in that they are largely involuntary and difficult to control consciously. In light of this, studies have indicated that individuals' emotional expressions correspond significantly with physiological states and self-reported feelings (Ekman, Levenson, & Friesen, 1983; Rosenberg & Ekman, 2005). Further, the facial muscles used in expressions are difficult to both inhibit or activate during the absence or presence of relevant emotions (Ekman & Friesen, 1982; Ekman). They have also been shown to reflect action tendencies and emotional experiences greatly (Izard, 1971; Fridlund, 1994; Kraut & Jonston, 1979). Commonly, credibility theories hold the view that honest individuals with an honest emotional expression are more likely to attract better social partners (R. H. Frank, 1988; Tooby & Cosmides, 1996). Further, as emotional expressions serve as valuable signals to observers, they may be used as effective acts of communication (Parkinson 2005). For example, Bavelas et al. (1986) found that the pained expression that an observer showed in the waiting room after seeing an injured actor is a communicative act that signals a message such as, I recognize your pain.

1.2.3 Perceptual Mechanisms:

Perceiving emotions in facial expressions is a visually complex process (Vuilleumier & Pourtois, 2007). Recent studies indicate that adaptive coding can lead to individual variation in the ability to recognize emotions because previously viewed

faces can influence the perception of subsequent faces. This mechanism's aftereffects show that recently viewed stimuli can largely bias perception. For example, a person's observation of an overly-expressive smile could bias perception; when exposed to a less expressive smile, the second expression could appear less happy to the observer. Thus, perceptual factors shape neural and cognitive systems' first stage by encoding multiple stimuli (Calvo & Nummenmaa, 2015). Some studies suggest that one's ability to recognize relevant social information depends on a network of neural systems that processes the social signals and does not rely on a specific localized neuronal ensemble, which links this information to the areas of the brain controlling emotions, motivation, and adaptive behaviors (Adolphs, 1999; Vuilleumier & Pourtois, 2007).

The influential cognitive model Bruce and Young (1986) developed indicates that facial identity and expression are processed separately after visual structural encoding (Bauer, 1984; Breen et al., 2000). In fact, data from behavioral experiments suggest that neither familiar nor unfamiliar faces affect the speed and accuracy in performing expression categorization tasks (Young et al., 1986), while other experiments assert that expression ratings can be modified according to the face's identity and familiarity, despite the fact that identity judgments are processed independently of expression (Schweinberger & Soukup, 1998).

Some findings reveal that the fusiform area is fundamental when encoding facial aspects and identity (Haxby et al., 2000; Kanwisher et al., 1997); moreover, it is sensitive to the importance of facial expression when discerning emotion, and consequently, identity and emotion are not entirely processed separately in the brain, as traditional cognitive models have assumed (Vuilleumier & Pourtois, 2007). Conversely, facial familiarity can alter emotional responses in the amygdala.

Some authors have suggested that learning new faces occurs simply when unfamiliar faces present different expressions (Baudouin et al., 2000). However, patients with prosopagnosia who have damage in the associative visual cortices can identify different facial expressions (Damasio et al., 1982; Damasio et al., 1990; Sergent & Villemure, 1989), while individuals who do not have prosopagnosia can also experience different types of impairment in recognizing others'

expressions; some of these impairments are caused by damage to specific areas of the brain. For example, one may have trouble discerning disgust following insula damage (Calder et al., 2000), fear following amygdala lesions (Adolphs et al., 1995), and anger following ventral basal ganglia lesions (Calder et al., 2004).

1.2.4 Variation in Identifying Facial Expressions:

The ability to recognize emotional expressions is vital for human interaction (Grainger, Henry, Phillips, Vanman, & Allen, 2015). That said, multiple factors contribute to the processing of facial expressions and thus affect an individual's recognition of them (Conley et al., 2018; Hussain et al., 2015; Khan et al., 2013).

It is noteworthy that the gender of the observer identifying the emotion is an important variable because it influences eye scan paths (Wells, Gillespie, & Rotshtein, 2016). Findings suggest that females are better at identifying facial expressions than males (Hampson, Vananders, & Mullin, 2006; Montagne, Kessels, Frigerio, de Haan, & Perrett, 2005). According to the primary caretaker theory and evolutionary theories, women's role in caring for offspring may be the key reason for their superior recognition abilities when compared to men (Babchuk et al., 1985; Hampson et al., 2006). Moreover, it is hypothesized that females have a high capacity for empathy that can provide advantages when they are reading the expressions of others (Baron-Cohen, 2002; Hall et al., 2010). But evidence related to female superiority in identifying facial expressions is mixed. Montagne et al. (2005) found that women were overall better than men when tasked with assessing emotional faces. Meanwhile, a meta-analysis shows that 11 of 55 studies had reliable evidence of women performing better than men when identifying facial expressions (Hall, 1978).

In addition, existing literature indicates that age influences the recognition of emotions in facial expressions as well. Findings based on eye-tracking show that age-related variation in the recognition of emotions can be attributed to attentional impairment to facial cues (Abbruzzese et al., 2019). Along the same lines, recent data (Olderbak et al., 2018) suggests high performance in emotion recognition ability across young people between the ages of 15 to 30, with a gradual decline after the age of 30. Empirical evidence shows that people over 65

years old had a poor ability to decode negative emotions such as anger, fear, and sadness. (Ruffman et al., 2008; Grainger et al., 2015).

A series of studies indicate that the sex of the face making the expression can also impact the identification of emotions. The stereotype theory proposes that there exists a division between masculine and feminine emotions (Brody & Hall, 1993; Le Gal & Bruce, 2002). Anger and disgust are more commonly classified as masculine and linked with power across cultures. In contrast, fear, happiness, and sadness are viewed as more feminine and are more often correlated with less power across cultures (Adams, Hess, & Kleck, 2014; Plant et al., 2004). Consequently, it is widely expected that these perspectives will influence recognition accuracy. Also, it is commonly known that women are more likely to express their emotions than men (Adams et al., 2014). Studies have demonstrated that females are often more facially expressive than males (Brody & Hall, 1993). Therefore, women's non-verbal cues can be judged more precisely than men's (Hall, Carter, & Horgan, 2000). However, a range of studies has shown that the influence of sex may depend on the type of facial expression being made (Hess, Blairy, & Kleck, 1997; Tucker & Riggio, 1988).

Furthermore, research indicates that the type of emotion expressed can influence the accuracy with which emotions are identified in facial expressions (Kirita & Endo, 1995; Kirouac & Doré, 1983; Leppänen, Tenhunen, & Hietanen, 2003). It has been noted that humans can more quickly detect angry and fearful facial expressions than happy ones (Fox et al., 2000). These outcomes show that expressions such as anger, fear, and sadness are easier to identify based on the top part of the face, whereas other expressions such as disgust, happiness, and surprise are more accurately identified from the bottom of the face (Calder et al., 2000). These observations have been supported by eye-tracking studies. Empirical evidence demonstrates that dwell time on the eyes was typically longer by approximately 35% on the forehead region than on the mouth region in emotions such as anger, fear, and sadness, while in happy facial expressions, dwell time on the bottom of the face was approximately 25% longer than on the top of the face (Eisenbarth & Alpers, 2011).

Variation in the intensity of facial expressions may also lead to sensitivity in identifying and processing different emotions from such expressions (Calder, Young, Perrett, Etcoff, & Rowland, 1996). A few studies have examined the influence of expression intensity and the type of expression being made, and there is overall agreement that increasing the intensity of facial expressions also leads to an increase in the accurate identification of corresponding emotions (Hess et al., 1997; Rotshtein et al., 2009). It should be noted, though, some works have shown that intensity may have a different influence on expressions. Hoffmann et al. (2010) assessed the accuracy for expressions at 50% and 100% intensity and found that altering the intensity had no influence on the recognition of fear and surprise. However, findings from replications of this same study with a different sample have discovered that changing the intensity impacted people's ability to recognize expressions of anger, fear, and sadness.

1.2.5 Affective Factors:

Accurate recognition of facial expressions is a fundamental step to deciding on an appropriate response (Besel & Yuille, 2010). Being able to identify emotions from other people's facial expressions depends on multiple individual characteristics (West, Angwin, Copland, Arnott, & Nelson, 2020). Some theoretical developments such as Beck's (1976) and Bower's (1981) network theory have revealed that both depression and anxiety bias the viewer through information processing. For example, anxious individuals tend to be more selectively processing threatening stimuli, while depressed individuals tend to be more selectively processing information linked to stimuli such as failure, loss, and sadness. Mathews (1990) suggests that with anxiety the cognitive system adopts a hypervigilant condition that prioritizes the automatic encoding of a threat rather than other stimuli. It has been reported in the literature that a high level of anxiety makes individuals quicker at responding to angry or threatening faces than happy or neutral ones (Fox, 2002). In contrast, other findings demonstrate that groups with high and low levels of anxiety did not vary in their recognition ability of basic facial expressions, except in identifying fearful faces (Surcinelli, Codispoti, Montebarocci, Rossi, & Baldaro, 2006). Along the same lines, Rosa et al. (2017) discovered that subjects who scored high in depression tended to attribute fear to neutral faces and reference it in the same situations. Some researchers have also suggested that

people with depressive symptoms tend to be more accurate than healthy people in recognizing both negative and positive facial expressions and to be more globally hypervigilant towards emotions in facial expressions (Harkness et al., 2005, 2010). However, it is still not clear whether depression is correlated with an enhanced or impaired ability to recognize expressions (Wu, Pu, Allen, & Pauli, 2012).

Moreover, there is indeed some evidence that mood affects the perception of emotions (Asthana et al., 1998; Schmid & Mast, 2010) based on Beck's (1976) cognitive theory of depression, and mood-congruity theories (Bower, 1981; Schwarz, 1990) have addressed how an individual's mood exerts a congruity influence on memory and social judgements. Meanwhile, a negative mood recalls a negative stimulus and therefore makes people more prone to judge others in a negative way. Thus, a sad mood can be predicted to make the individual impacted better at emotional recognition of sad faces, whereas happy moods can promote better recognition of happy faces. Chepenik, Cornew, and Farah (2007) reported that mood influenced the recognition of basic emotions and that the inducement of a sad mood in adults leads to reduced accuracy in recognition. These findings are compatible with the perspective that a negative mood narrows a person's attention (Easterbrook, 1959). In a similar way, Bouhuys et al. (1995) tested healthy volunteers in happy or sad moods and exposed them to ambiguous facial expressions by using line drawings. The researchers observed that participants in sad moods perceived sadness more and happiness less in the schematic faces compared with the participants in happy moods. Furthermore, this cognitive bias appears to extend to other subjects, not just faces. For example, previous findings indicate that human perception of spatial layout is indeed impacted by non-optical factors such as emotion. When people are sad, they will perceive that a hill is steeper by 5 to 20 degrees compared to when they are happy (Bhalla & Proffitt, 1999; Proffitt, Bhalla, Gossweiler, & Midgett, 1995; Riener, Stefanucci, Proffitt, & Clore, 2010).

Autism-like traits are also hypothesized to be associated with the recognition of expressions. Early work on emotion matching suggested that individuals with autism struggle to match emotional facial expressions with emotional body actions, contexts, or line drawings (Uljarevic and Hamilton, 2012). According to

Poljac et al. (2012), there is selective impairment in the recognition of facial expressions showing emotions such as anger, disgust, and sadness in typical individuals, and this impairment is primarily related to more autism-like traits. Wallace et al. (2011) also noted poor recognition linked to the emotion of sadness and argued that this result is strongly correlated to both symptomatology and social functioning in individuals with autism spectrum traits. However, other works have shown inconclusive and contradictory results for this relationship (Ashwin et al., 2006; Castelli, 2005; Jones et al., 2011; Law Smith et al., 2010).

In view of the fact that empathy conveys the ability to experience and comprehend another's emotional state (Jolliffe & Farrington, 2006), deficits in emotion recognition are believed to reflect impaired empathy. Blair et al. (2002), Blair et al. (2004), and Blair (2005) reported that individuals with psychopathy have low empathy scores and perform poorly on tasks involving the recognition of fear, disgust, and sadness in facial expressions (Quintero, et al., 2017). Few works have assessed self-reported empathy and a person's ability to recognize emotions from facial expressions. But the findings that have been completed suggest a positive connection between self-reported empathy and expression recognition (Gery et al., 2009; Riggio et al., 1989). It has been reported that emotion recognition from faces was positively associated with the cognitive aspect of empathy but not its affective aspect (Lui, Barry, & Sacco, 2015).

1.3 The Role of Facial Appearance in Face Preferences and Social Judgments:

1.3.1 Masculinity and Femininity:

Every human face has unique characteristics that distinguish it from others (Walker & Wänke, 2017). A person's masculine or feminine facial characteristics in faces contribute significantly to others' perceptions of their gender and personality (O'Toole et al., 1998; Locke et al., 2005; Oosterhof & Todorov, 2008). Traditionally, human masculinity and femininity are defined as the comparatively

constant traits, such as appearance, behaviours, and interests, that are considered to be more typical of either females or males (Kachel, Steffens, & Niedlich, 2016). These physiological changes emerge more during and after puberty for both males and females, causing faces to increase in size, change in shape, and begin to demonstrate different characteristics (Hu, Abbasi, Zhang, & Chen, 2018). For instance, men's lips and cheeks become thinner, their jawbones grow, and their cheekbones become more prominent compared to female faces (Rhodes, 2006). These changes in male faces are found to strongly reflect their high level of testosterone (Verdonck et al., 1999; Penton-Voak and Chen, 2004). Likewise, femininity in female faces is positively associated with a high level of oestrogen (Law-Smith et al., 2005).

For instance, a woman with a more feminine facial appearance is not only perceived as female but is also more likely to be categorised as warm than a woman with a masculine facial appearance (Oosterhof & Todorov, 2008, Deaux et al., 1998). Thus, if an individual's facial characteristics resemble those that are perceived as standard for a specific stereotyped group, people are more likely to perceive the presence of associated personality traits; for instance, the personality trait of warmth is often stereotypically associated with women (Blair et al., 2004). According to gender stereotype theory, males are usually perceived as more masculine than females, while females are commonly perceived as more feminine than males. Consequently, masculine male faces and feminine female faces are typically seen as attractive more often than feminine male faces and masculine female faces (Little, 2014). Deaux and Lewis (1984) examine the perceived correlation between gender and related components of gender, such as physical characteristics, roles, occupations, and traits. The subsequent findings indicate that these components are strongly interdependent with and influential on one another and suggest that gender stereotypes may rely on some aspects of masculinity and femininity. Masculine faces in men are more likely associated with antisocial traits such as less warmth, emotionality, and cooperativeness; more dishonesty; and poor-quality parenting (Boothroyd, Jones, Burt, & Perrett, 2007; Perrett et al., 1998).

1.3.2 Attractiveness:

Looking at someone's face enables others to rapidly gain an impression of their attractiveness. (Ibáñez-Berganza, Amico, & Loreto, 2019). There is a noticeable consensus in ratings of human facial attractiveness that tends to be consistent across cultures and across socioeconomic backgrounds (Jones, 1996; Langlois et al., 2000; Little et al., 2011). However, people do not accurately place the same value on rating all attractiveness traits (Thornhill & Gangestad, 1999). Previous works have focused on characteristics that influence social judgments of facial attractiveness, which typically involve cues to personality; facial symmetry; skin quality; facial averageness; femininity and masculinity; and facial adiposity (Thornhill and Gangestad, 1999; Rhodes, 2006; Little et al., 2011; Jager, Coetzee, & Coetzee, 2018).

Multiple studies have found attractiveness to dramatically influence people's behaviour towards others. Individuals perceived as attractive typically receive better treatment than those perceived as less attractive (Langlois et al., 2000), a benefit of attractiveness that has been labelled the "attractiveness halo effect" (Zebrowitz and Montepare, 2008). This phenomenon may be related to the Darwinian perspective of mate value perceived in physically attractive humans, driving biased behaviour in human interactions (Cloutier et al., 2008). For instance, attractive individuals are more likely to have dates than unattractive individuals (Riggio, 1984); furthermore, people who went on dates with attractive individuals generally expressed satisfaction with the dates in general (Berscheid et al., 1971; Walster et al., 1966). Other empirical evidence has shown that these judgments may extend to wider social consequences, such as more attractive job seekers being more successful with their applications than their less attractive counterparts (Cash & Kilcullen, 1985). The level of an individual's attractiveness may also affect their wages (Langlois et al., 2000), judicial judgments regarding crimes (Sigall & Ostrove, 1975), and the extent of parental care offered (Mann, 1992; Langlois et al., 1995; Thornhill et al., 1993).

Other studies have addressed the potential features that influence perceived attractiveness, such as smooth skin, clear eyes, and average body mass index (Tovée et al., 1999). Perrett, May, and Yoshikawa (1994) illustrate that the features perceived as attractive on female faces include large pupils; wide cheekbones; a small chin; and a short distance between the chin and mouth.

Meanwhile, Cunningham et al. (1990) state that males who possess both mature and childlike features often receive high ratings of attractiveness, strength, and masculinity. Additionally, men are judged to be more attractive, dominant, and strong if they possess one or more distinctive facial features such as deep-set eyes, a large chin, or a broad face. Additionally, studies acknowledge a correlation between self-perceived facial attractiveness and a cooperative attitude. For instance, Mulford et al. (1998) report that men who consider themselves as more attractive demonstrate more cooperative behaviour than those who perceive themselves as unattractive. Conversely, women who view themselves as more attractive demonstrate a less cooperative attitude than those who think themselves unattractive.

Previous studies have also noted a connection between attractive features and perceived health (Shackelford & Larsen, 1999). Kalick et al. (1998) report that people are perceived as healthier if they are also perceived as more attractive; similarly, Grammar and Thornhill (1994) indicate their opposite-sex participants perceive more facially attractive individuals to be healthier than unattractive individuals. Johnston and Franklin (1993) assume that female facial attractiveness may reflect hormone markers that serve as strong indicators of their health attribute. Cunningham (1986) reported that males judge females with more facial attractiveness as more fertile and less prone to health issues.

Some recent research suggests that facial attractiveness is correlated with measures of susceptibility to infectious illnesses and immune function. For example, Mengelkoch et al. (2022) found that men's facial attractiveness is correlated with biomarkers of immune function. By contrast with such results, other studies have found no significant correlations between facial attractiveness and measures of immune function, such as salivary measurements of innate immune response or levels of Immunoglobulin A in saliva (Foo et al., 2017; Cai et al., 2019). Furthermore, Pátková et al. (2022) reported no significant link found between perceived facial attractiveness and antibody levels brought on by vaccination. These latter results suggest putative associations between attractiveness and health may be less robust than previously thought (for a recent review, see Jones et al., 2021).

1.3.3 Dominance:

Masculine facial characteristics appear to function fundamentally as dominance cues (Puts, 2010), as the typical features of dominant faces, correlated with perceived dishonesty and a lack of warmth or cooperation, are overwhelmingly associated with masculinity (Perrett et al., 1998). Previous studies have proposed that the dominance of male faces is perceived and interpreted in the same way across various ethnic backgrounds and cultures (Collins and Zebrowitz, 1995; Keating et al., 1981b). For instance, when rating and sorting facial portraits according to the dimensions of dominance and submissiveness, the outcomes of the portraits sorted by American participants are similar to those from various other cultures (Keating, Mazur, & Segall, 1981a; 1981b).

Facial dominance has also been suggested to be predictive of life history. For instance, Mueller & Mazur (1996) report that the perceived dominance of West Point cadets' faces accurately predicted their promotions in their further careers. Moreover, many previous studies have assessed the tendency of voters to choose dominant-appearing leaders during periods of both war and peace (Lausten and Petersen, 2015a; 2015b; Little et al., 2007; Re et al., 2016; Spisak et al., 2012). These studies find that voters typically prefer more dominant leaders during wartime, believing that they would be more able to protect them (Little, 2014; Little et al., 2007; van Vugt and Grabo, 2015; von Rueden and van Vugt, 2015). During peacetime, voters generally prefer a less dominant leader as they believe that they would be more able to cooperate on domestic issues.

Similarly, the results of Sell et al.'s (2009) study indicate that the accurate evaluation of men's facial dominance from photographs can predict their fighting ability, while Christiansen & Winkler (1992) reveal that Kung San Bushmen with broader bizygomatic width engage in violent fights that produce head scars more often than those with narrower bizygomatic measures. Recent evidence suggests a link between facial dominance, aggressive behaviour, and variations in cheekbone size. Variations in bone growth and cranial growth have been associated with the effects of testosterone in adolescence (Verdonck, Gaethofs, Carels, & de Zegher, 1999), with several studies have also indicated a correlation

between male bone growth (facial width to height measurements) and perceived negative traits such as aggression (Carre & McCormick, 2008; Carre et al., 2009), deception (Haselhuhn & Wong, 2011), and exploitativeness (Stirrat & Perrett, 2010).

1.3.4 Trustworthiness:

Attributing trustworthiness from facial appearance is one of the many automatic, instantaneous processes of judgment and reaction that were once crucial to human survival (Dzhelyova et al., 2012; Todorov, 2009). From an evolutionary perspective, it is essential to differentiate between trustworthy and untrustworthy individuals (Barkow et al., 1992), as unwisely trusting an untrustworthy person might lead to negative consequences and a range of uncooperative behaviour; evaluating facial trustworthiness is therefore crucial to human wellbeing (Barkow et al., 1992; Bzdok et al., 2010). Indeed, facial trustworthiness predicts social judgments toward approach and avoidance (Slepian, Young, Rule, Weisbuch, & Ambady, 2012), and some studies have also suggested that facial trustworthiness and threat are inherently related. Behavioural studies have highlighted that the more a social target is identified as untrustworthy, people are more likely to believe and accept that they are a threat to stability. Conversely, high trustworthy targets are more often perceived as beneficial for survival (Brambilla & Leach, 2014).

The trustworthiness of appearance is thought to contribute to social judgements due to the important social information it conveys (Lee et al., 2017). Research on economic games has demonstrated that players feel less trust towards players who are perceived as untrustworthy based on their appearance (Chang et al., 2010; Rezlescu et al., 2012; Stirrat & Perrett, 2010). Similarly, convicted murderers who are perceived as trustworthy are less likely to receive the death sentence than those who are perceived as untrustworthy (Porter et al., 2010; Wilson and Rule, 2015). Similarly, candidates in elections typically receive more votes if their facial trustworthiness is higher (Little et al., 2012; Mattes et al., 2010). Moreover, data from the memory test reveals that individuals remember the negative traits of trustworthy appearance lenders more accurately than those who are perceived as untrustworthy (Suzuki & Suga, 2010).

However, some evidence indicates that perceptions of trustworthiness vary between male and female facial features (Wang, Tong, Shang, & Chen, 2019). Todorov et al. (2009) point out that brow ridge, chin, and cheekbones can be used to highly predict participants' trustworthiness judgments of new faces. According to Stirrat and Perrett (2010), males with greater facial width gain more trust from others in trust games compared to those with narrow faces, regardless of their attractiveness. Meanwhile, Buchan et al. (2008) report that female faces are more frequently perceived as trustworthy than male faces.

In line with these findings, previous work in functional neuroimaging has shown that the amygdala plays an important role in trustworthiness judgments (Adolphs et al., 1998; Engell et al., 2007). Studies have similarly observed the occurrence of unique brain activity and signal change during facial trustworthiness judgments (Winston et al., 2002). Thus, patients who have sustained damage to the ventromedial prefrontal cortex typically find it difficult or impossible to accurately make trustworthiness decisions (Eslinger & Damasio, 1985; Damasio, 1994).

1.3.5 Age:

Age is an essential social dimension; consequently, many people place considerable value on a youthful appearance, usually relying on age perception to drive social behaviour in various contexts (Porcheron et al., 2017). The perception of one's age as older or younger is associated with various environmental, health, and lifestyle factors such as depression, body mass index (BMI), marital status, social class (Mayes et al., 2010; Rexbye et al., 2006), and menopausal status (Guinot et al., 2002).

The ageing process involves several common morphological, histological, and dermatological changes (Windhager et al., 2019). As wrinkled skin is one of the main visual features underlying facial ageing (Rexbye et al., 2006), previous studies have observed that people are often perceived as older than their actual age if their faces have some extent of wrinkling due to multiple clinical consequences, such as excessive sun exposure (Warren et al., 1991; Leyden, 1990), smoking (Daniell, 1971; Ernster et al., 1995), or alcohol consumption

(Goodman et al., 2019). Facial skin appears to undergo dramatic changes with age, including accelerated wrinkling and sagging (Samson, Fink, Matts, Dawes, & Weitz, 2010), increased pigmentation, and decreased homogeneity (Fink, Grammer, & Matts, 2006; Matts, Fink, Grammer, & Burquest, 2007). This also extends to the lips and mandibles; according to Évêque & Goubanova (2004), lower lip dryness tends to occur more than the upper lip over time. Moreover, the size of the mandible decreases with age, while the angle of the mandibular increases (Shaw Jr. et al., 2010).

It is worth noting that experts have observed that the facial characteristics perceived as youthful share similarities across cultures. For example, wrinkles and hyper-pigmentation predict age in Caucasian (Nkengne et al., 2008; Gunn et al., 2009) and Chinese (Mayes et al., 2010) faces. Similarly, reduced skin colour heterogeneity and skin wrinkles have been demonstrated to increase the youthful appearance of both Chinese (Porcheron et al., 2014) and Caucasian females (Fink and Matts, 2008; Samson et al., 2010). Porcheron et al. (2013) note that facial contrast varies with age, and correlates with the ageing perception, in Caucasian female faces. This may include the contrast in luminance close to the eyes and eyebrows and the red or green contrast close to the mouth and eyes. In addition, the faces of Caucasian women were judged as younger when these aspects of faces were changed artificially.

1.3.6 Health:

Evolutionary theories suggest that one's preferences for particular traits can be evolved and provide a form of biological quality signals such as physical health (Andersson, 1994). Various aspects of health are commonly known to be associated with survival and reproduction. The choice of a healthy mate has been proposed to provide a variety of benefits, such as disease prevention and improved fertility, parenting, and protection (Foo, Simmons, & Rhodes, 2017).

Masculinity in male faces potentially acts as cues to good health, such as genes promoting health (Henderson, Holzleitner, Talamas, & Perrett, 2016); masculinity may also indicate a high-quality immune system, as the healthiest males with higher levels of testosterone can afford threats to their immunity (Alonso-Alvarez

et al., 2007). Rhodes et al.'s (2003) evaluation of medical records provide evidence that good long-term health is associated with facial masculinity, as is the duration and incidence of previous illnesses (Thornhill and Gangestad, 2006). Thornhill & Gangestad (2006) and Boothroyd et al. (2013) observe a negative correlation in male subjects between their perceived masculinity and the frequency of their previous colds and flu. According to Rantala et al. (2013), men with a highly masculine appearance are able to produce more antibody responses to a hepatitis B vaccination (Henderson, Holzleitner, Talamas, & Perrett, 2016).

However, feminine traits in women's faces have been reported to be associated with different cues to health and correlated with various health conditions. Long-term health assessments indicate a correlation between the women's facial symmetry (Little et al., 2008) and the duration and incidence of prior illnesses (Thornhill and Gangestad, 2006; Smith, Jones, Debruine, & Little, 2008) and skin conditions (Fink et al., 2006).

An increasing number of medical studies have identified a connection between the colour of facial features and the individual's health. From a perceptual perspective, poorer health and the colours of facial features result in variances between the features and the skin. For instance, the loss of eyelashes or eyebrow hair reduces the visual contrast with the surrounding skin (Kumar & Karthikeyan, 2012). Also, Mosley & Gibbs (1996) identify a common association between the early greying of hair and certain health factors such as smoking. Moreover, high redness or yellowness of the sclera causes poor contrast between the eye and the surrounding skin that can be produced by infection, fatigue, allergy, and several ocular illnesses (Leibowitz, 2000; Murphy, Lau, Sim, & Woods, 2006; Russell et al., 2016). Other research has found that women's facial attractiveness relates negatively to their levels of cortisol and body fat (Rantala et al., 2013). Furthermore, liver malfunction can be reflected in faces, due to different cutaneous and mucosal changes such as abnormal hair growth (Żelaźniewicz, Nowak, Łącka, & Pawłowski, 2020).

1.4 THE CURRENT STUDIES:

The goal of psychological science is arguably to create generalisable and robust theories concerning the human psyche (Rozin, 2009; Crandall & Sherman, 2016). Consequently, scholars have emphasized the value of replicating previous studies to determine the reliability of results upon repetition (Zwaan et al., 2017). Thus, the main aim of the work reported in this thesis was to investigate how well previously reported findings in the face processing literature generalise to new samples.

1.4.1 Emotion perception and affective factors:

Recognizing emotions from faces is critical for effective interpersonal relationships as it allows individuals to infer the emotional states and communicational intents of others from their facial expressions (Seidel et al., 2010). However, deficits in the processing of emotional faces may lead to inappropriate behaviors and misinterpretations of social contexts (Kang et al., 2019). Moreover, variation in how well people can perceive, recognize, and understand facial expressions has previously been linked with affective factors, and the inability to accurately identify facial emotions is a characteristic of many psychological disorders (Dalili et al., 2014), such as adults with clinically significant levels of anxiety and depression usually showing impaired facial expression recognition abilities (Bistricky et al., 2011).

However, the findings from nonclinical samples are more equivocal. For instance, the recognition of basic facial emotions did not differ between the high- and low-trait anxiety groups, with the exception of the recognition of fearful expressions, the high-trait anxiety group showed better performance (Surcinelli et al., 2006). Additionally, the ability to recognize basic emotions is similarly influenced by mood, with typical individuals performing worse when they have a sad mood (Chepenik et al., 2007). Furthermore, recognition of facial expressions appears to be related to autism-like traits, as typical adults who reported more autism-like traits performed worse in identifying emotions such as anger, disgust, and sadness than those who reported less autism-like traits (Poljac et al., 2012). On the other hand, empathy is likely to have a positive relationship with the ability to recognize facial expressions, as it involves the ability to understand and experience other people's emotions (Besel & Yuille, 2010; Lewis et al., 2016).

Given the important role of the ability to recognise facial expressions in social interactions, it is likely that this difference among non-clinical adults affects social functioning. However, the causes of this variation in expression recognition ability are still unknown. In the first empirical chapter (Chapter 2), we investigated whether previously reported results suggesting that individual differences in affective factors predict recognition of emotional facial expressions. This study is a Registered Report, that attempted to replicate Palermo et al's (2018) study of individual differences in emotion recognition. By contrast with Palermo et al., who investigated this issue in a sample of Australian participants, my replication study tested a UK sample.

1.4.2 Facial Appearance in Face Preferences and Social Judgments:

In the first study of Chapter 2, researchers examined how people respond to aspects of faces that can change quickly, such as emotional expressions. However, other facial characteristics, such as masculinity and femininity, tend to remain stable over time and have been found to affect trait attributions. Previous research on this topic has mostly focused on perspectives from Western cultures. Thus, the second and third empirical chapters (Chapters 3 and 4) looked at social perceptions of masculinized and feminized faces. Studies have shown that women find feminized versions of faces to be more attractive and trustworthy, but view masculinized versions as more dominant (Perrett et al., 1998).

In my research, I focused on exploring the relationship between masculinity and femininity on social perceptions in an Arab sample by examining the effects of altering the masculinity or femininity of face images on Arab women's perceptions of attractiveness, trustworthiness, and dominance (Chapter 3). Given the importance of health and personality in attraction (Little et al., 2011), I aimed to replicate previous findings (Boothroyd et al., 2005) that showed that masculinized versions of male faces are perceived as older but not healthier-looking compared to feminized versions in a sample of Arab women (Chapter 4). To ensure the ethnicity of the stimuli matched that of the participants, both of these studies used Turkish faces. Together (Chapter 3 and 4) aimed to gain insight into how

facial features shape social perceptions and interactions in Arab women, and how they may vary compared to findings from other cultures.

Chapter 2. Are affective factors related to individual differences in facial expression recognition?

The following chapter is based on work published in the Royal Society Open Science

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Abstract

Evidence that affective factors (e.g. anxiety, depression, affect) are significantly related to individual differences in emotion recognition is mixed. Palermo *et al*. (Palermo *et al*. 2018 *J. Exp. Psychol. Hum. Percept. Perform.***44**, 503–517) reported that individuals who scored lower in anxiety performed significantly better on two measures of facial-expression recognition (emotion-matching and emotion-labelling tasks), but not a third measure (the multimodal emotion recognition test). By contrast, facial-expression recognition was not significantly correlated with measures of depression, positive or negative affect, empathy, or autistic-like traits. Because the range of affective factors considered in this study and its use of multiple expression-recognition tasks means that it is a relatively comprehensive investigation of the role of affective factors in facial expression recognition, we carried out a direct replication. In common with Palermo *et al*. (Palermo *et al*. 2018 *J. Exp. Psychol. Hum. Percept. Perform.***44**, 503–517), scores on the DASS anxiety subscale negatively predicted performance on the emotion recognition tasks across multiple analyses, although these correlations were only consistently significant for performance on the emotion-labelling task. However, and by contrast with Palermo *et al*. (Palermo *et al*. 2018 *J. Exp. Psychol. Hum. Percept. Perform.***44**, 503–517), other affective factors (e.g. those related to

empathy) often also significantly predicted emotion-recognition performance. Collectively, these results support the proposal that affective factors predict individual differences in emotion recognition, but that these correlations are not necessarily specific to measures of general anxiety, such as the DASS anxiety subscale.

2.1 Introduction

Facial expression recognition plays an important role in social interaction. Although it is widely acknowledged that substantial individual differences in facial expression recognition exist, the factors that underpin these individual differences are poorly understood (Palermo et al., 2018). Many studies that have investigated this issue have focused on the role of affective factors, such as anxiety, depression, mood, and empathy.

Evidence from studies investigating the relationship between affective factors and facial expression recognition has been mixed. For example, while studies of clinical samples have found that anxious or depressed people show impaired facial expression recognition (e.g., Bistricky et al., 2011; Demenescu et al., 2010), some studies of non-clinical samples have not observed significant correlations between facial expression recognition and anxiety or depression (e.g., Surcinelli et al., 2006). Similarly, while some studies have reported that people who score higher on measures of empathy or lower on measures of autistic-like traits perform better on facial expression recognition tasks (e.g., Lewis et al., 2016; Poljac et al., 2013), other studies have not replicated these results (e.g., Palermo et al., 2018).

Similarly, Leppänen et al. (2004) reported that healthy participants were not biassed in any manner when they viewed neutral faces. By contrast, Surguladze et al. (2004) found that normal individuals perceived neutral faces as happy, while they were seen as neutral faces by depressed participants. Furthermore, some researchers have suggested that people with trait anxiety show enhanced processing of fear. For example, Surcinelli et al. (2006), reported that typical adults who exhibit higher levels of trait anxiety are better able to recognise fearful facial expressions than those who exhibit lower levels of trait anxiety (Surcinelli et al., 2006). Similarly, Dyer et al.(2022) observed reported that adults

with higher trait anxiety displayed a higher tendency to perceive anger in faces. Higher scores for depression in non-clinical adults also appear to be correlated with lower performance in detecting fear, happiness, and anger (Rutter et al., 2020). These findings suggest that emotional processing may be different in non-clinical adults with anxiety and/or depression and that this difference may be somewhat specific to certain emotions.

Interpreting the mixed results for affective factors and facial expression recognition described above is complicated because different studies have investigated different affective factors and/or used different methods to assess facial expression recognition. Direct replications (i.e., studies using the same measures as the original work) are one way to address this difficulty because they allow for a more direct comparison of results across studies (Simons, 2014). Thus, the current study may help identify potential sources of variability and bias in the recognition of emotions in relation to affective factors and, potentially, go some way towards resolving inconsistent findings in the literature.

In light of the above, we directly replicated one recent study of the possible link between affective factors and facial expression recognition (Palermo et al., 2018). We chose this particular study to replicate because it considered a relatively broad range of affective factors (various measures of anxiety, depression, mood, and empathy) and showed consistent results across two recently developed comprehensive facial expression recognition tasks (the emotion-matching and emotion-labeling tasks developed and described in Palermo et al., 2013). We also chose Palermo et al. (2018) for our direct replication because, despite these methodological strengths, the significant relationships between affective factors and facial expression recognition would not have been significant if corrected for multiple comparisons. This pattern of results suggests that the correlations between anxiety and facial expression recognition may not necessarily be robust.

Palermo et al. (2018) reported that participants' (N=63) scores on the anxiety scale of the Depression Anxiety and Stress Scales (DASS) were negatively correlated with their performance on Palermo et al's (2013) emotion-matching ($r = -0.287$, $p = 0.023$) and emotion-labeling ($r = -0.255$, $p = 0.044$) tasks. By contrast with their results for anxiety, participants' performance on neither of these

emotion-recognition tasks was significantly correlated with their scores on questionnaires measuring a range of other affective factors (empathy, depression, or mood). Performance on a third emotion recognition test (Bänziger et al's 2009 Multimodal Emotion Recognition Test) was not significantly correlated with any of the affective factors. Based on these results, Palermo et al. (2018) concluded that anxiety is the critical affective factor for individual differences in facial expression recognition.

Following Palermo et al's (2018) results, we tested four specific hypotheses:

Hypothesis 1. Scores on the anxiety scale of the Depression Anxiety and Stress Scales (DASS) will be significantly negatively correlated with performance on the emotion-matching task.

Hypothesis 2. Scores on the anxiety scale of the Depression Anxiety and Stress Scales (DASS) will be significantly negatively correlated with performance on the emotion-labeling task.

Hypothesis 3. Performance on neither the emotion-matching nor emotion-labeling tasks will be significantly correlated with scores on the depression scale of the Depression Anxiety and Stress Scales (DASS), the positive affect scale of the Positive and Negative Affect Schedule (PANAS), the negative affect scale of the Positive and Negative Affect Schedule (PANAS), scores on the Autism Quotient (AQ), scores on the Empathy Quotient (EQ), scores on the affective component of the Basic Empathy Scale (BES), or scores on the cognitive component of the Basic Empathy Scale (BES).

Hypothesis 4. Performance on Bänziger et al's (2009) Multimodal Emotion Recognition Test will not be significantly correlated with scores on any of the affective factors.

This article received in-principle acceptance (IPA) on 26 April 2019. Following IPA, the accepted Stage 1 version of the manuscript was preregistered on the OSF at https://psyarxiv.com/fg8yz/. This preregistration was performed prior to data collection and analysis.

2.2 Methods

2.2.1 Ethics

All aspects of this project were approved by the University of Glasgow College of Science and Engineering Ethics Committee (application number 300180047).

2.2.2 Participants and justification of sample size

Palermo et al. (2018) tested 63 university students (55% women, 45% men). Simonsohn (2015) recommends that sample sizes in replication studies be approximately two and a half times the sample size of the original study. Consequently, we aimed to test 160 University of Glasgow students between the ages of 16 and 45 years with a similar sex ratio to Palermo et al's (2018) original study. 168 participants in total took part in the study.

2.2.3 Emotion-matching task

We used the same emotion-matching task as Palermo et al. (2018). This is the 100-item emotional masking task originally developed by Palermo et al. (2013). Images of three different individuals (matched for sex) are presented in each trial. Two of the images (the distractor images) are shown with the same emotional expression (e.g., anger). The other image (the target image) is shown with a different emotional expression (e.g., disgust), making it the 'odd one out. Target and distractor emotions are paired to be maximally confusable accordingly to previously published data (Young et al., 2002). Participants use numbered keys to indicate whether face 1, face 2, or face 3 is displaying the 'odd-one-out' emotion. Participants can respond either while the faces are presented onscreen (4500ms) or any time up to 7000ms time after the faces are no longer presented onscreen. The 100 trials are presented in the same order for each participant and are preceded by eight practise trials. The stimuli, target-distractor pairings, and trial order we used are identical to those in Palermo et al. (2013) and described in their supplemental materials. Performance on this task is indicated by the percentage of trials on which a participant correctly identifies the target face. An example

trial from the emotion-matching task is shown in Figure 1. We have obtained the code and stimuli for this task from the corresponding author of Palermo et al. (2018), allowing us to precisely replicate this task. Stimuli are from the Karolinska Directed Emotional Faces image database (Lundqvist et al., 1998), were shown in color on an iMAC12.1, at 1686 × 762 pixels.

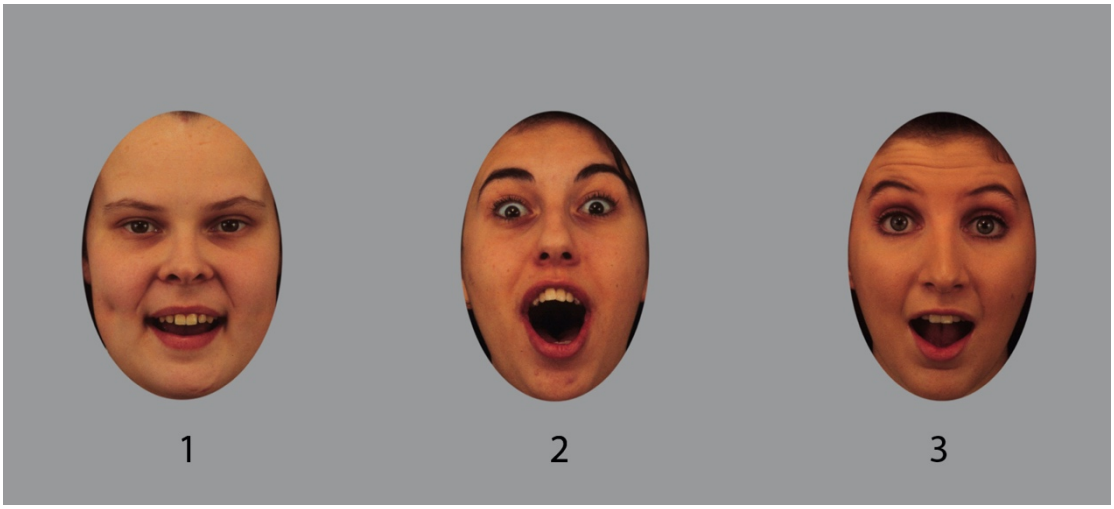

Figure 1. An example trial from the emotion-matching task. Participants are instructed to indicate which face is showing a different emotional expression to the other two faces (i.e., which emotion is the 'odd-one-out'). The correct answer on the trial shown is face 1.

2.2.4 Emotion-labeling task

We used the same emotion-matching task as Palermo et al. (2018). This is the 100-item emotion-labeling task originally developed by Palermo et al. (2013), but with two modifications (presentation time for each face reduced from 1000ms to 400ms and the number of facial expressions in each emotion category being the same). Both of these modifications to the task described in Palermo et al. (2013) were also made in Palermo et al. (2018). Each face is individually presented on screen. Participants use a computer mouse to select the appropriate emotion label from a set of six labels presented underneath the face (anger, disgust, fear, surprise, sadness, happiness). Responses can be made while the face is presented (400ms) or up to 7000ms after the face is no longer presented onscreen.

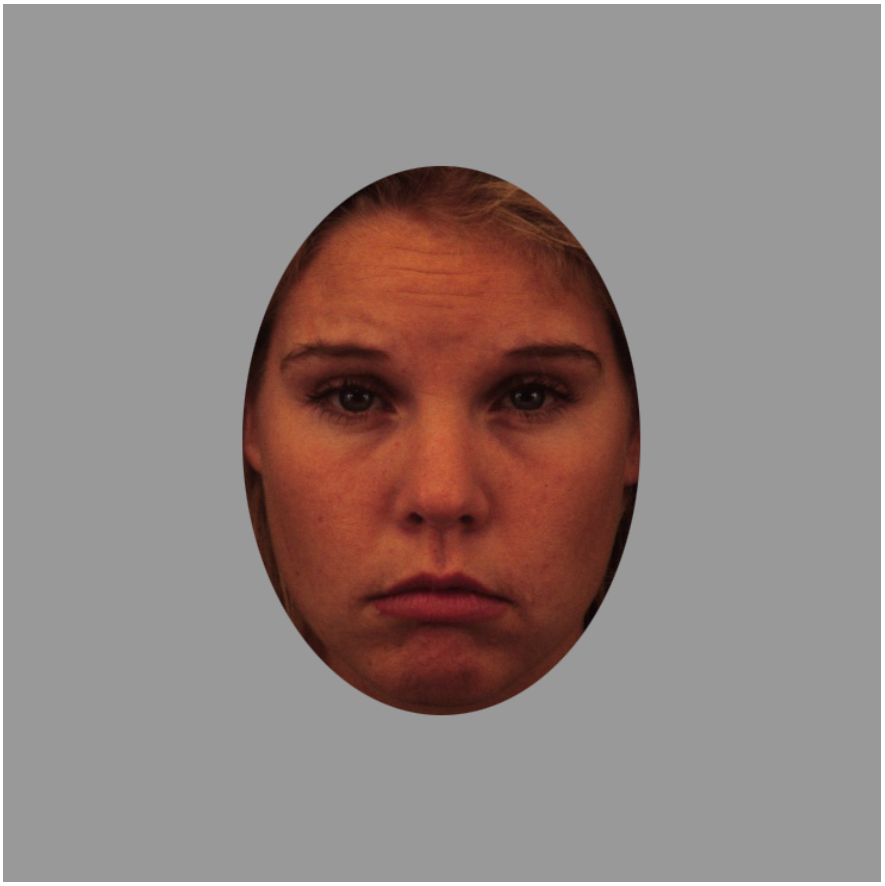

Figure 2. An example trial from the emotion-labeling task. Participants are instructed to select the appropriate emotion label from a set of six labels presented underneath the face (anger, disgust, fear, surprise, sadness, happiness). The correct answer on the trial shown is sadness.

The stimuli and trial order we used are identical to those used in Palermo et al. (2018) and described in an email provided by the corresponding author of the Palermo et al. (2018) paper. Performance on this task is indicated by the percentage of trials on which the participant correctly labels the facial expression. An example trial from the emotion-labeling task is shown in Figure 2. We have obtained the code and stimuli for this task from the corresponding author of Palermo et al. (2018), allowing us to precisely replicate this task. Stimuli are from the Karolinska Directed Emotional Faces image database (Lundqvist et al., 1998), were shown in color on a iMAC12.1 monitor, at 737 × 737 pixels.

2.2.5 Multimodal Emotion Recognition Test

This test is used to evaluate emotions through a range of stimuli, including facial expressions, speech, and body language. described in full in Bänziger et al. (2009),

is an online test administered via the Swiss Centre for Affective Sciences webpage. The task consists of 30 video clips of actors (three for each of 10 emotions: irritation, anger, anxiety, fear, happiness, elated joy, disgust, contempt, sadness, despair) that are presented in four modalities: (still picture, video only, audio only, audio with video) yielding a total of 120 items. In the video-only format, participants are asked to identify emotions based on facial expressions and body posture for a person's face and upper torso, whereas, in the still image format, they are instructed to recognize emotions from facial expressions. Similarly, in the audio-only, the test subjects are asked to identify the emotions being expressed based on vocal cues such as tone and pitch. However, in the audio with video, emotions are identified by combining both facial expressions and vocal cues. We used the English-language version of the task for our replication. Format was fully randomised.

2.2.6 Affective factors questionnaires

Each participant completed the same affective factor questionnaires used by Palemro et al. (2018). These are Lovibond and Lovibond's (1995) Depression Anxiety and Stress Scales (DASS), Watson et al's (1988) Positive and Negative Affect Schedule (PANAS), Baron-Cohen et al's (2001) Autism Quotient (AQ), Baron-Cohen and Wheelwright's (2004) Empathy Quotient (EQ), and Jolliffe and Farrington's (2006) Basic Empathy Scale (BES).

2.3 Procedure

As in Palermo et al. (2018), the DASS and PANAS were administered before the emotion-labeling and emotion-matching tasks. The other affective questionnaires were administered after the emotion-labeling and emotion-matching tasks. Following Palermo et al. (2018), we ran the emotion-matching task before the emotion-labeling task and ran both of these tasks before the Multimodal Emotion Recognition Test.

All subscale and component scores tested by Palermo et al. (2018) were calculated following the instructions for these questionnaires. The scales we used were the anxiety scale of the DASS, the depression scale of the DASS, the positive affect

scale of the PANAS, the negative affect scale of the PANAS, the AQ, the EQ scores, scores on the affective component of the BES, and scores on the cognitive component of the BES. These are the same scales employed by Palermo et al. (2018). Cronbach's alpha was high for each scale (> 0.75), except the BES cognitive subscale, for which it was 0.62 (see supplemental materials for all individual Cronbach's alphas).

2.3.1 Data exclusions and data quality checks

Outliers (scores on a measure that were more than 3 standard deviations from the mean score for that measure) were adjusted to score one point higher than the closest non-outlier score (following Palermo et al., 2018). As a positive control, participants scoring lower than chance on any of the expression recognition tasks were excluded from all analyses. No other exclusions or data manipulations were carried out. Three participants were removed who did not complete one of the emotion tasks and nine participants were removed who had missing questionnaire data (i.e., the final dataset consisted of 156 participants). A total of 10 scores were truncated. Descriptive statistics for all measures are given in Table 1. Although we had aimed for a similar ratio of male and female participants to Palermo et al. (2018,; 55% women, 45% men), the impending Covid-19 crisis and associated lockdown meant that this was not possible. Our final dataset consisted of 113 women, 37 men, and six participants who did not report their sex. Participants who did not report their sex were not included in analyses controlling for participant sex.

Table 1. Descriptive statistics for all measures after truncation and exclusions (N = 156).

Measure	Minimum	Maximum	Mean	SD
Age	18	37	22.87	3.74
AQ	3	37	20.04	6.4
BES affective subscale	18	53	39.81	7.24
BES cognitive subscale	24	42	33.93	3.70
DASS anxiety subscale	0	16	4.63	3.5
DASS depression subscale	0	17	4.48	4.06

Measure	Minimum	Maximum	Mean	SD
EQ	17	70	41.13	11.48
PANAS negative affect	10	40	20.79	6.5
PANAS positive affect	13	49	30.66	7.75
Emotion labeling	45	92.36	75.39	8.57
Emotion matching	25	82.64	64.06	11.26
Multimodal emotion recognition test MERT	24	74.36	53.16	9.01

2.4 Results

All analysis code, data, and full results are publicly available at https://osf.io/kexhr/ and in our supplemental materials.

Hypothesis 1. Scores on the anxiety scale of the Depression Anxiety and Stress Scales (DASS) will be significantly negatively correlated with performance on the emotion-matching task.

As in Palermo et al. (2018), we tested Hypothesis 1 by calculating Pearson's product-moment correlation coefficient for the relationship between scores on the anxiety scale of the Depression Anxiety and Stress Scales (DASS) and performance on the emotion-matching task. Our sample size had 80% power to detect effects as small as $|r| = 0.219$ at the 5% significance level.

Scores on the emotion matching task and the DASS anxiety subscale were not significantly correlated ($r = -0.117$, 95% CI = [-0.269, 0.041], $p = 0.147$).

Hypothesis 2. Scores on the anxiety scale of the Depression Anxiety and Stress Scales (DASS) will be significantly negatively correlated with performance on the emotion-labeling task.

As in Palermo et al. (2018), we tested Hypothesis 2 by calculating Pearson's product-moment correlation coefficient for the relationship between scores on the anxiety scale of the Depression Anxiety and Stress Scales (DASS) and performance on the emotion-labeling task. Our sample size had 80% power to detect effects as small as $|r| = 0.219$ at the 5% significance level.

Scores on the emotion labeling task and the DASS anxiety subscale were significantly negatively correlated ($r = -0.175$, 95% CI = [-0.323, -0.018], $p = 0.029$).

Hypothesis 3. Performance on neither the emotion-matching nor emotion-labeling tasks will be significantly correlated with scores on the depression scale of the DASS, the positive affect scale of the PANAS, the negative affect scale of the PANAS, AQ scores, EQ scores, scores on the affective component of the BES, or scores on the cognitive component of the BES.

As in Palermo et al. (2018), we tested Hypothesis 3 by calculating the Pearson's product-moment correlation coefficients for the relationships between the emotion-matching and emotion-labeling tasks and scores on the depression scale of the DASS, the positive affect scale of the PANAS, the negative affect scale of the PANAS, AQ scores, EQ scores, scores on the affective component of the BES, and scores on the cognitive component of the BES. Our sample size had 80% power to detect effects as small as $|r| = 0.219$ at the 5% significance level. These results are summarized in Table 2. None of the affective measures were correlated significantly with performance on the emotion matching or labeling tasks.

Table 2. Correlations between affective measures and performance on the emotion recognition tasks. The table shows r values, with p values in parentheses. N = 156.

	Emotion matching	**Emotion labeling**
AQ	-0.061 (0.447)	-0.108 (0.181)
BES affective subscale	0.122 (0.130)	0.058 (0.473)
BES cognitive subscale	0.103 (0.201)	0.153 (0.057)
DASS depression subscale	0.018 (0.826)	-0.035 (0.665)
EQ	0.085 (0.29)	0.13 (0.106)
PANAS negative affect	-0.088 (0.273)	-0.149 (0.063)
PANAS positive affect	-0.094 (0.242)	-0.055 (0.494)

Hypothesis 4. Performance on Bänziger et al's (2009) Multimodal Emotion Recognition Test will not be significantly correlated with scores on any of the

affective factors.

As in Palermo et al. (2018), we tested Hypothesis 4 by calculating the Pearson's product-moment correlation coefficients for the relationships between the Multimodal Emotion Recognition Test and scores on the depression scale of the DASS, the positive affect scale of the PANAS, the negative affect scale of the PANAS, AQ scores, EQ scores, scores on the affective component of the BES, and scores on the cognitive component of the BES. Our sample size had 80% power to detect effects as small as $|r| = 0.219$ at the 5% significance level. Analysis code for Hypothesis 4 is publicly available at https://osf.io/kexhr/ and in our supplemental materials.

These results are summarized in Table 3. Only the AQ (negatively), EQ (positively), and BES cognitive subscale (positively) significantly predicted performance on the MERT.

Table 3. Correlations between affective factors and performance on the MERT. N = 156.

	r	**p**
AQ	-0.195	0.015
BES affective subscale	0.155	0.153
BES cognitive subscale	0.237	0.003
	r	**p**
DASS anxiety subscale	-0.112	0.163
DASS depression subscale	0.013	0.868
EQ	0.238	0.003
PANAS negative affect	-0.02	0.808
PANAS positive affect	-0.024	0.765

2.4.1 Robustness checks

As in Palermo et al. (2018), repeated each analysis using partial correlations to control for possible effects of participant sex, participant age, and both participant sex and participant age simultaneously.

Controlling for sex and age did not alter the pattern of results for the DASS anxiety subscale. Scores on the DASS anxiety subscale negatively and significantly predicted performance on the emotion-labeling task in all of these analyses. By contrast, scores on the DASS anxiety subscale did not significantly predict performance on either the emotion-matching task or the MERT in any analyses. Note that a larger proportion of our participants were women than we had planned in our Stage 1 submission. Because of the large proportion of women in our sample, the results of robustness checks controlling for participant sex should be treated cautiously.

Following Palermo et al. (2018), we also tested the correlation between each of the affective factors and the first component produced by principal component analysis of scores on the three emotion recognition tasks. Scores on this component were significantly correlated with anxiety, but no other affective factors, in Palermo et al. (2018).

These results are summarized in Table 4. The component produced from a principal component analysis of scores on the three emotion recognition tasks was significantly predicted by scores on the BES cognitive subscale, DASS anxiety subscale, and EQ only.

Table 4. Correlations between affective factors and the component produced from a principal component analysis of scores on the three emotion recognition tasks. N = 156.

	r	**p**
AQ	-0.146	0.069
BES affective subscale	0.118	0.143
BES cognitive subscale	0.199	0.013

	r	p
DASS anxiety subscale	-0.167	0.038
DASS depression subscale	-0.003	0.968
EQ	0.182	0.023
PANAS negative affect	-0.109	0.177
PANAS positive affect	-0.071	0.377

We also conducted additional robustness checks restricting the sample to only those participants (N = 106) who scored within the maximum and minimum values for each measure as reported in Table 1 of Palermo et al. (2018).

In this smaller dataset, scores on the DASS anxiety subscale were negatively and significantly correlated with performance on the emotion-labeling task ($r = -0.245$, $p = 0.011$). Scores on the DASS anxiety subscale were negatively correlated with performance on the emotion-matching task ($r = -0.161$, $p = 0.098$) and the MERT ($r = -0.148$, $p = 0.131$), but these correlations were not significant.

2.4.2 Exploratory analyses of social anxiety

Although data on social anxiety specifically were not collected by Palermo et al. (2018), some researchers have suggested that because of fears concerning negative evaluation, social anxiety may be a key correlate of individual differences in emotion recognition (e.g., Rapee & Heimberg, 1997; Hirsch & Clark, 2004). Consequently, we repeated the analyses described in Hypotheses 1, 2, and 4 (and the related robustness checks) using scores on the Brief Fear of Negative Evaluation Scale (BFNE; Leary, 1983) and the 6-item versions of the Social Interaction Anxiety Scale (SIAS) and Social Phobia Scale (SPS) developed by Peters et al. (2012). So as to not interfere with our replication of Palermo et al's (2018) study, these questionnaires were administered in a fully randomized order at the very end of the study.

Analysis code for these exploratory analyses and full results are publicly available at https://osf.io/kexhr/ and in our supplemental materials. These analyses

showed little evidence that the BFNE, SIAS, or SPS consistently predicted emotion recognition.

2.4.3 Open data statement

All data and analysis code are publicly available on the Open Science Framework (https://osf.io/kexhr/).

2.5 Discussion

Palermo et al. (2018) reported that performance on a range of emotion-recognition tasks, including the first component produced by principal component analysis of scores on these emotion-recognition tasks, was negatively correlated with scores on the DASS anxiety subscale, but not measures of other aspects of affective factors. Here we replicated Palermo et al's (2018) study with a larger sample. We carried out this replication because results for individual differences in emotion recognition have often not replicated well.

Replicating Palermo et al. (2018), participants who scored higher on the DASS anxiety subscale showed significantly poorer performance on the emotion-labeling task across all analyses. We also replicated Palermo et al's finding that participants who scored higher on the DASS anxiety subscale showed significantly poorer emotion recognition as measured by a component produced by principal component analysis of scores on all emotion-recognition tasks. Although participants who scored higher on the DASS anxiety subscale tended to perform more poorly on the emotion-matching task, these correlations were not significant in our study (by contrast with Palermo et al's significant results). Nonetheless, we suggest that, collectively, our results show clear support for Palermo et al's claim that the DASS anxiety subscale predicts individual differences in general emotion recognition.

While Palermo et al. (2018) observed no significant correlations between scores on any of the other affective factor scales and measures of emotion recognition, we saw some evidence that other affective factors may reliably predict individual differences in emotion recognition. For example, scores on the EQ were positively

and significantly correlated with performance on the MERT both in our full sample and in the subsample of participants whose scores fell within the range of scores reported by Palermo et al. (2018). Scores on the EQ were also positively and significantly correlated with performance on the emotion-matching task in the smaller dataset. Participants who scored higher on the EQ also performed significantly better on emotion recognition as measured by a principal component analysis of scores on all three emotion-recognition tasks. While Palermo et al's results suggested that individual differences in emotion recognition were predicted specifically (i.e., uniquely) by scores on the DASS anxiety subscale, our results (and our results for EQ in particular) do not support this claim. However, our results for EQ and emotion recognition are consistent with those of some previous studies that also found that people who scored higher on measures of empathy or lower on measures of autistic-like traits performed better on emotion-recognition tasks (e.g., Lewis et al., 2016; Poljac et al., 2013). Indeed, other measures of empathy (i.e., the BES cognitive subscale) and autistic-like traits (i.e., the AQ) also appeared to predict individual differences in emotion recognition (see, e.g., Tables 3 and 4). Nonetheless, we stress here that our results for EQ and emotion recognition be treated cautiously until direct replications have been carried out.

In exploratory analyses, we investigated the possible role in emotion recognition of three measures of social anxiety specifically that were not considered in Palermo et al. By contrast with our results for the DASS anxiety subscale, we saw little evidence that any of these measures significantly predicted emotion recognition. We tentatively propose that these null results for social anxiety suggest that the power of DASS anxiety in predicting emotion recognition is unlikely to reflect individual differences in social anxiety specifically, despite some researchers having previously suggested social anxiety may be particularly important for emotion recognition (e.g., Rapee & Heimberg, 1997; Hirsch & Clark, 2004). However, it should be noted that both our study and Palermo et al. (2018) look at predictors of emotional processing averaged across emotional expressions. We cannot therefore rule out that depression and/or anxiety are associated with differences in the processing of specific emotions.

In conclusion, we found that general emotion recognition was negatively correlated with scores on the DASS anxiety subscale, replicating Palermo et al's (2018) results. However, by contrast with Palermo et al's results, we found that other affective factors, most notably those related to empathy (e.g., the EQ) also appeared to predict general emotion recognition. Collectively, these results support the proposal that affective factors predict individual differences in emotion recognition, but that these correlations are not necessarily specific to measures of general anxiety, such as the DASS anxiety subscale, and may also extend to measures of empathy.

The results reported in this chapter strengthen the claim that affective factors play contribute to individual differences in emotion perception. While this study focused on responses to aspects of faces that can change very quickly (emotional expressions), other aspects of faces are much more stable over time. One such characteristic, sexually dimorphic aspects of face shape, has been shown to influence trait attributions (e.g., judgments regarding attractiveness, dominance, and trustworthiness), but this research has focused almost exclusively on perceptions made by participants in western cultures. Given this strong focus on western cultures, the following two chapters investigated Arab women's perceptions of sexually dimorphic face-shape characteristics.

Chapter 3. Women's Preferences for Sexual Dimorphism in Faces: Data from a Sample of Arab Women

The following chapter is based on work published in the Evolutionary Psychological Science

Alharbi, S. A. H., Holzleitner, I. J., Lee, A. J., Saribay, S. A., & Jones, B. C. (2020). Women's Preferences for Sexual Dimorphism in Faces: Data from a Sample of Arab Women. *Evolutionary Psychological Science*, *6*(4), 328–334.

Abstract

Many previous studies have investigated the effects of manipulating sexually dimorphic shape characteristics in face images on attractiveness judgments. However, results have been mixed and show considerable cross-cultural variability, particularly for women's judgments of men's facial attractiveness. Because very little research has investigated face preferences in Arab samples, we assessed Arab women's preferences for sexually dimorphic face shapes (Study 1) and the effect of sexually dimorphic face shapes on Arab women's dominance perceptions (Study 2). Analyses showed that Arab women preferred feminized versions of both women's and men's faces over masculinized versions (Study 1, N = 272) and that masculinizing face shape had a positive effect on Arab women's perceptions of the dominance of men, but not women (Study 2, N = 270). These image manipulations did not have a significant effect on perceptions of trustworthiness, however (Study 3, N = 434). Collectively, these results suggest that Arab women prefer relatively feminine face shapes in potential mates that they perceive as being low dominance. We discuss some directions for future research on the ultimate function of Arab women's preferences for sexual dimorphism in faces.

3.1 Introduction

Many researchers have suggested that exaggerated sex-typical characteristics in faces (masculine characteristics in men's faces and feminine characteristics in women's faces) advertise good health (Thornhill & Gangestad, 1999; Little et al., 2011). However, empirical tests of this hypothesis have produced mixed results, with some studies reporting significant correlations between exaggerated sex-typical characteristics and health measures (e.g., Thornhill & Gangestad, 2006), while others either did not (e.g., Cai et al., 2019; Foo et al., 2017) or reported significant correlations for only one sex (e.g., Rhodes et al., 2003). By contrast with these mixed results for health and sexually dimorphic facial characteristics, studies have consistently found that feminized versions of images of men's and women's faces are ascribed pro-social traits, such as emotional warmth and trustworthiness, while masculinized versions are ascribed anti-social traits, such as dominance and aggressiveness (Boothroyd et al., 2007; Perrett et al., 1998).

Because both health and personality are important for attraction (Little et al., 2011), many studies have investigated how feminizing versus masculinizing shape characteristics in face images influences attractiveness judgments. While these studies have consistently reported positive effects of feminizing shape characteristics on attractiveness judgments of women's faces (Jones et al., 2018; Little et al., 2011; Perrett et al., 1998), findings are considerably more mixed for judgments of men's facial attractiveness (Little et al., 2011). Moreover, evidence suggests that women's judgments of men's facial attractiveness may vary considerably across cultures. For example, studies of men's facial attractiveness conducted in the UK, Japan, and Bangladesh have typically reported that women prefer versions of men's faces with relatively feminine shapes (e.g., De Barra et al., 2013; Penton-Voak et al., 1999; Perrett et al., 1998; but see Jones et al., 2018). By contrast, studies of men's facial attractiveness conducted in the US and Jamaica have typically reported that women prefer versions of men's faces with relatively masculine shapes (e.g., Johnston et al., 2001; Penton-Voak et al., 2004; Rennels et al., 2008).

Several previous studies have attempted to link cultural differences in women's preferences for male faces with masculinized versus feminized shape

characteristics to regional differences in ecological conditions. For example, some studies have reported that women show stronger preferences for masculinity in men's faces in countries where health is poor (DeBruine et al., 2010), violent crime commonplace and income inequality pronounced (Brooks et al., 2011), or where environmental conditions were favourable, as opposed to harsh (Marcinkowska et al., 2019). Other work has found that women in more industrialized societies show stronger preferences for masculine men (Scott et al., 2014). However, these findings for ecological conditions and masculinity preferences have not replicated well across studies (Brooks et al., 2011; DeBruine et al., 2010; Marcinkowska et al., 2019; Scott et al., 2014).

To date, Arab women's preferences for sexually dimorphic shape characteristics in face images have not been well documented. Of the cross-cultural studies of women's facial masculinity preferences (i.e., those testing women from many geographic regions), only Marcinkowska et al. (2019) included a small sample of Arab women (21 Saudi Arabian women). This sample showed a preference for feminized versions of male faces over masculinized versions. This relative lack of comprehensive data on Arab women's preferences may reflect the well-established tendency for studies of face preferences to focus mostly on preferences in Western Europe and North America (Scott et al., 2014). Consequently, we investigated 272 Arab women's preferences for masculinized versus feminized versions of images of male and female faces (Study 1).

Research on perceptions of masculinized versus feminized versions of face shapes have found that masculinized faces are perceived as more dominant than feminized versions, particularly when assessing men's dominance (e.g., Perrett et al., 1998). To establish whether Arab women preferred faces of men judged to be high or low dominance, Study 2 investigated whether masculinizing face shapes increased Arab women's perceptions of dominance. We know of no previous research that has investigated the effects of sexually dimorphic face shapes on dominance perceptions in an Arab sample.

Finally, in Study 3, we investigated perceptions of the trustworthiness of masculinized versus feminized versions of face shapes. Previous research on Western and Japanese samples has found that feminized faces are typically judged

to be more trustworthy than masculinized faces (Perrett et al., 1998). Here we investigated whether this pattern also holds for a sample of Arab women.

3.2 Study 1. Attractiveness

3.2.1 Methods

3.2.1.1 Participants

Two hundred and seventy-two Arab women (mean age = 31.68 years, SD = 8.15 years) took part in this online study. Participants were recruited by following links to an online study of facial attractiveness posted on Saudi Arabian social media and were recruited from Saudi Arabia, Jordan, Oman, Egypt, United Arab Emirates, and Kuwait. The study was administered via faceresearch.org (DeBruine, 2019).

3.2.1.2 Stimuli

Stimuli were manufactured using the same methods used in previous studies of preferences for sexual dimorphism in face shape (e.g., DeBruine et al., 2010; Jones et al., 2018; Perrett et al., 1998), from an open access set of Turkish face images (Saribay et al., 2018), and using standard computer graphic methods implemented in webmorph.org (DeBruine, 2018; Tiddeman et al., 2001). Eleven images of people wearing glasses or headscarves that obscured the face were removed from the image set.

First, we manufactured a female face prototype by averaging the shape, color, and texture information from 142 female face images. Next, we manufactured a male face prototype by averaging the shape, color, and texture information from 111 male face images. Finally, we created masculinized and feminized versions of 60 of the individual face images (30 male, 30 female) by adding or subtracting 50% of the differences in 2D shape between the male and female prototypes to each of 60 individual faces randomly selected from the full image set. Examples of these manipulations applied to the male and female prototypes are shown in Figure 1.

This process created 60 pairs of faces (30 male and 30 female pairs), with each pair consisting of a masculinized and feminized version of a given face.

Figure 1. Examples of the sexual dimorphism transform applied to male (top row) and female (bottom row) face prototypes. Masculinized versions are shown in the left column and feminized versions in the right column. We show example of the shape transforms applied to prototype faces because we do not have permission to show individual face images.

3.2.1.3 Procedure

The sixty pairs of faces were shown in a fully randomized order, with the side of the screen on which the masculinized and feminized versions were presented also fully randomized. Participants were instructed to click on the face in each pair they thought was more attractive. Instructions were presented in Arabic. A back-translated version of the instructions confirmed that our initial translation of instructions from English to Arabic was accurate.

Some recent research suggests that forced-choice paradigms can produce qualitatively different patterns of results than other methods for assessing preferences for sexually dimorphic face-shape characteristics (Jones & Jaeger, 2019). However, we used the forced choice method in the current study to allow our results to be directly compared with the previous research discussed in our Introduction.

3.2.2 Results

All data, output, and analysis code are publicly available on the Open Science Framework (osf.io/24tjz/). Preferences were analyzed with binomial mixed effects models using the lme4 (Bates et al., 2015) and lmerTest (Kuznetsova et al., 2015) package in the R statistical software (R Core Team, 2013). Participant's choice was the dependent variable, coded such that greater scores indicated a greater preference for femininity (chose masculinized face = 0, chose feminized face = 1). Participant age (z-standardized at the participant level) and sex of face (effect code: male = -0.5, female = 0.5) were added as predictors. Random slopes were specified maximally (Barr et al., 2013).

In this initial analysis, the intercept was significant and positive (estimate = 0.81, SE = 0.11, z = 7.64, $p < .001$). Converting this estimate to proportions, this equates to women choosing, on average, the feminized version of faces as the more attractive face on 69% of trials. Neither the main effect of participant age (estimate = 0.05, SE = 0.06, z = 0.75, p = .45) nor the main effect of sex of face (estimate = 0.23, SE = 0.18, z = 1.26, p = .21) was significant.

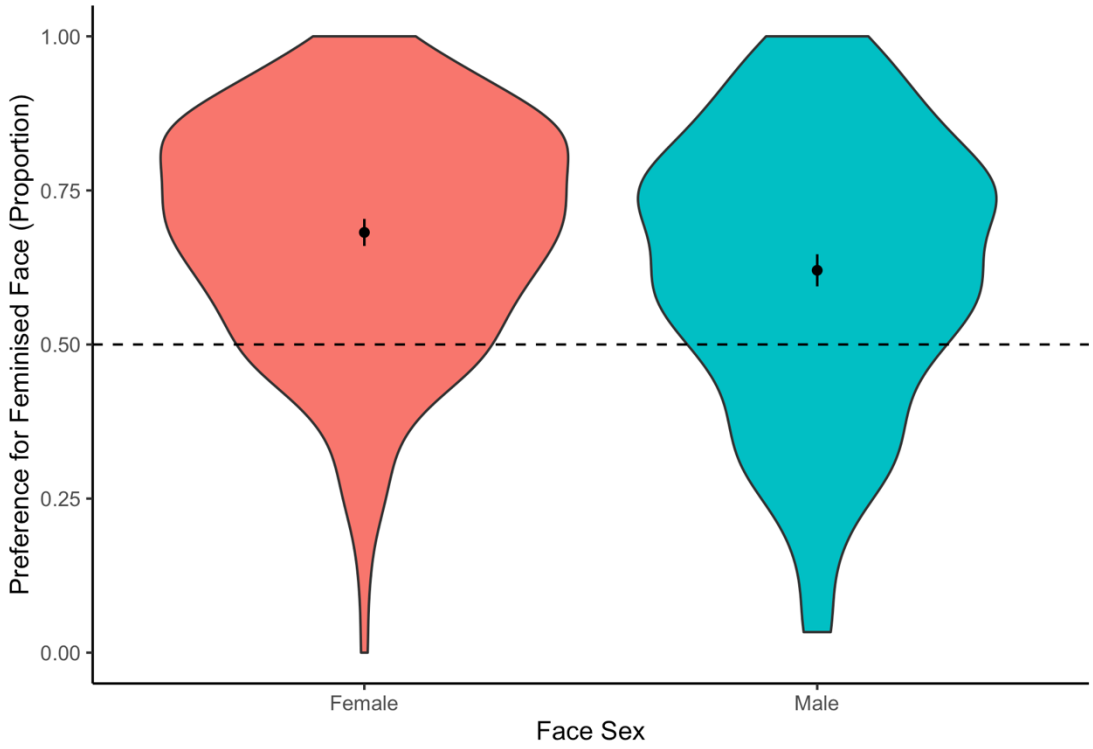

Figure 2. Violin plots showing distributions of the proportion of feminized versions of male and female faces chosen as more attractive by Arab women. Dots and lines show mean and 95% confidence intervals respectively.

When male and female faces were analyzed separately, the intercepts were both significant (female faces: estimate = 0.97, SE = 0.15, z = 6.63, p < .001; male faces: estimate = 0.65, SE = 0.13, z = 4.87, p < .001). This equates to, on average, women choosing the feminized version of female faces as the more attractive face on 73% of trials and choosing the feminized version of male faces as the more attractive face on 66% of trials. The effect of participant age was not significant for either sex of face (female faces: estimate = -0.01, SE = 0.07, z = -0.16, p = .88; male faces: estimate = 0.14, SE = 0.08, z = 1.87, p =.06). These results are summarized in Figure 2.

3.3 Study 2. Dominance

3.3.1 Methods

Stimuli, recruitment, and testing procedure were identical to those used in Study 1, except that we asked participants to click on the person who looked more dominant and tested 270 women (mean age = 25.72 years, SD = 6.39 years).

3.3.2 Results

Analyses were identical to those used in Study 1. In our initial analysis of dominance perceptions, the intercept was significant and negative (estimate = -0.20, SE = 0.09, z = -2.37, p < 0.05). Converting this estimate to proportions, this equates to women choosing, on average, the feminized version of faces as the more dominant face on 45% of trials. The main effect of sex of face was significant (estimate = 0.55, SE = 0.08, z = 6.90, p < .001), indicating that the effect of sexually dimorphic face shapes on dominance perceptions was greater for male than female faces. The main effect of participant age was not significant (estimate = -0.04, SE = 0.08, z = -0.45, p = 0.65).

When male and female faces were analyzed separately, the intercept was significant for male (estimate = -0.47, SE = 0.09, z = -5.02, p < .001), but not female faces. This equates to, on average, women choosing the feminized version of male faces as the more dominant on 38% of trials and choosing the feminized version of female faces as the more dominant on 52% of trials. The effect of participant age was not significant for either sex of face (female faces: estimate = -0.01, SE = 0.09, z = -0.08, p = .94; male faces: estimate = -0.05, SE = 0.08, z = -0.7, p = .51). These results are summarized in Figure 3.

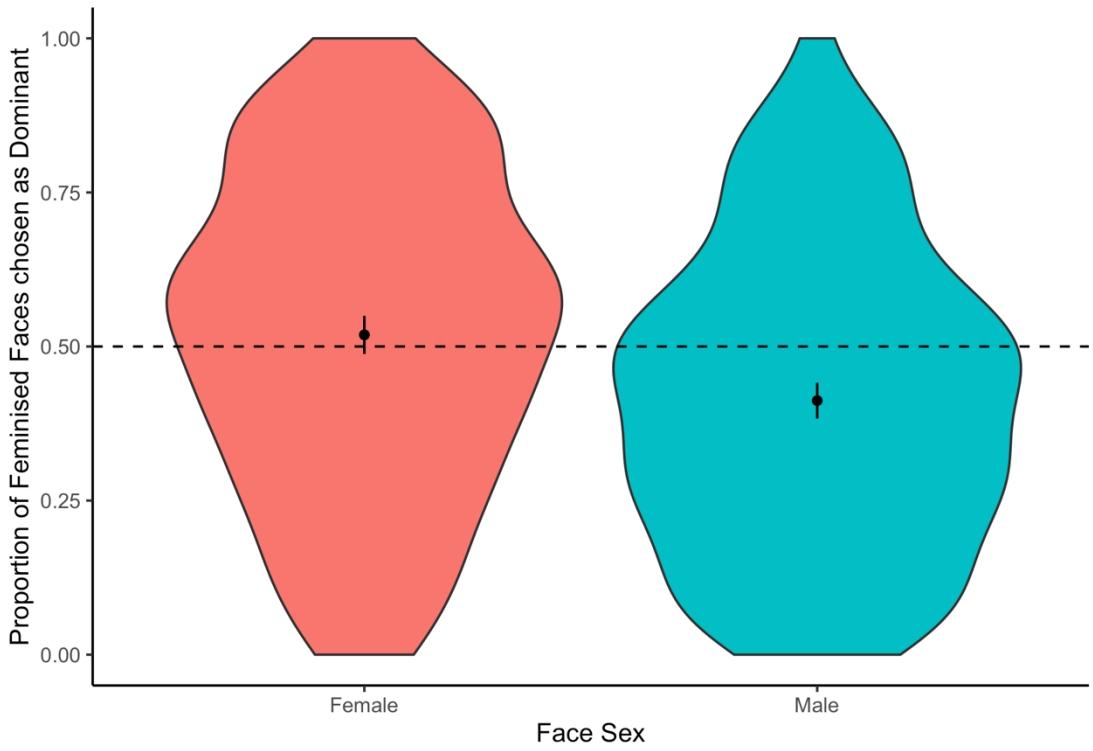

Figure 3. Violin plots showing distributions of the proportion of feminized versions of male and female faces chosen as more dominant by Arab women. Dots and lines show mean and 95% confidence intervals respectively.

3.4 Study 3. Trustworthiness

3.4.1 Methods

Stimuli, recruitment, and testing procedure were identical to those used in Study 1 and Study 2, except that we asked participants to click on the person who looked more trustworthy and tested 434 women (mean age = 23.88 years, SD = 6.11 years).

3.4.2 Results

Analyses were identical to those used in Study 1 and Study 2. The analysis revealed no significant effects (all absolute estimates < 0.15, all SE < 0.13, all absolute z < 1.15, all p > 0.25). These results indicate that our participants' perceptions of trustworthiness were not influenced by manipulating face shape. These null results are summarized in Figure 4. Women chose the feminized female faces on 53% of trials and the feminized male faces on 50% of trials.

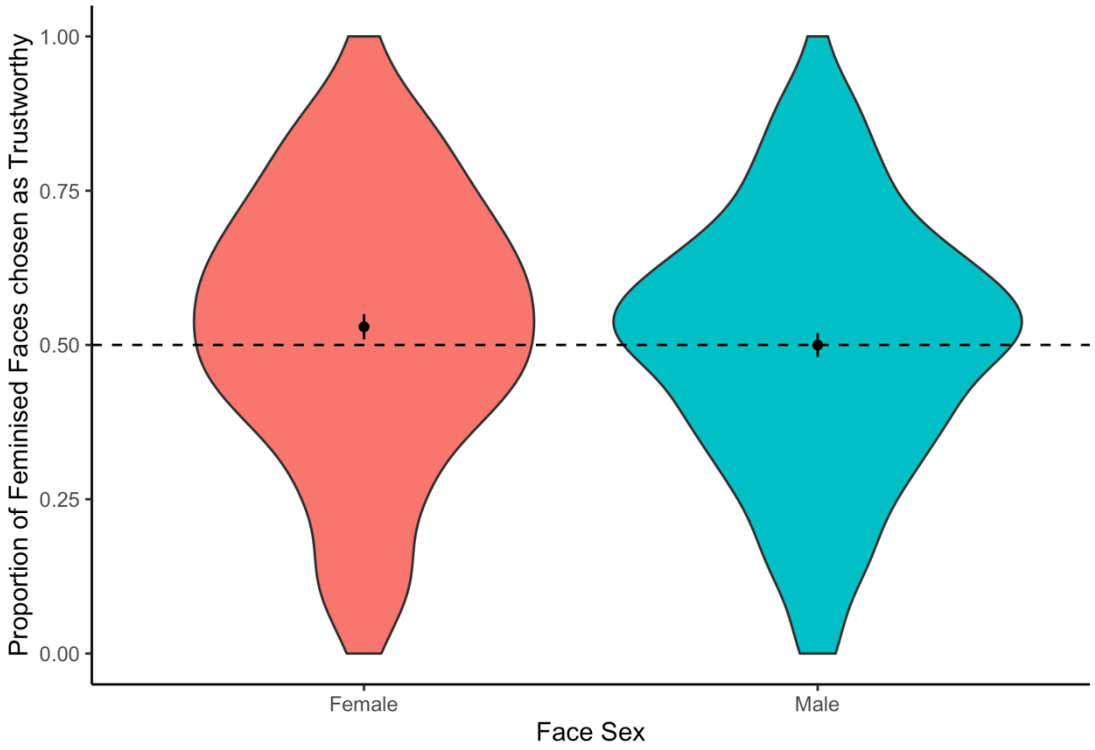

Figure 4. Violin plots showing distributions of the proportion of feminized versions of male and female faces chosen as more trustworthy by Arab women. Dots and lines show mean and 95% confidence intervals respectively.

3.5 Discussion

Study 1 investigated 272 Arab women's preferences for feminized versus masculinized versions of male and female face images. In this study, Arab women preferred feminized over masculinized versions for judgments of both male and female faces. These results are similar to women's preferences for facial femininity in studies of UK, Bangladeshi, and Japanese women's preferences, which also showed clear femininity preferences (e.g., De Barra et al., 2013; Penton-Voak et al., 1999; Perrett et al., 1998; but see Jones et al., 2018). They are also consistent with the results of a previous study of 21 Arab women's preferences (Marcinkowska et al., 2019), which found that Arab women preferred feminized versions of male face images over masculinized versions. Collectively, these results suggest that UK, Bangladeshi, Japanese, and Arab women prefer male faces displaying shape characteristics associated with feminine shape characteristics.

As mentioned above, our results are consistent with some previous studies of women's judgments of men's facial attractiveness (e.g., De Barra et al., 2013; Marcinkowska et al., 2019; Penton-Voak et al., 1999; Perrett et al., 1998; but see Jones et al., 2018). However, they differ from those of studies of US and Jamaican women's face preferences, which reported that women tended to prefer masculinized versions of men's faces over feminized versions (e.g., Johnston et al., 2001; Penton-Voak et al., 2004; Rennels et al., 2008). Although some work has recently demonstrated that women's face preferences can differ according to the type of paradigm used to assess preferences (Jones & Jaeger, 2019), this effect of testing paradigm is unlikely to explain this difference in preferences across studies: all of the studies described above employed similar forced-choice paradigms. It is possible that differences in results for the effects of face shape on attractiveness judgments by Western and Arab women at least partly reflect the differences in ecological conditions between world regions that have been reported in previous studies (e.g., Holzleitner and Perrett, 2017; Penton-Voak et

al., 2003).

In Study 2, we found that masculinizing male, but not female, faces increased Arab women's (N = 270) perceptions of others' dominance. These results are consistent with previous research reporting that masculinity had stronger positive effects on dominance perceptions of male than female faces (e.g., Perrett et al., 1998). Together with our results for face preferences in Study 1, these results suggest that Arab women tend to find feminine face shapes that they consider as low dominance particularly attractive.

Study 3 found no evidence that masculinizing shape characteristics influenced Arab women's (N = 434) perceptions of trustworthiness. This null result is noteworthy for two reasons. First, most previous studies have found that feminizing face images increased perceived trustworthiness (e.g., Perrett et al., 1998). While these results have been reported for Western and Japanese samples, Study 3's null results suggest that this effect of femininity on trustworthiness is not a universal characteristic of social perception. Second, Study 3's null results suggest that Arab women's preferences for feminized, rather than masculinized, male faces is not due to feminine men being perceived to be relatively trustworthy.

Why might Arab women show strong preferences for feminized versions of men's faces? One possibility is that this pattern is a consequence of Arab women showing relatively low interest in uncommitted sexual relationships in combination with the tendency for women with low interest in casual sex to prefer more feminine men as potential mates. Marcinkowska et al. (2019) have previously found that Arab women do score relatively low on the Sociosexual Orientation Inventory (a widely used measure of openness to uncommitted sexual relationships, Penke & Asendorpf, 2008). Indeed, some studies have reported that women who are more open to uncommitted sexual relationships exhibit a stronger preference for masculinity in male faces (Waynforth et al., 2005; Provost et al., 2006; Ekrami et al., 2020). However, further work would be needed to explore this potential explanation.

Chapter 4. Facial masculinity increases perceptions of men's age, but not perceptions of their health: Data from an Arab sample

The following chapter is based on work published in the Evolutionary Psychological Science

Alharbi, S. A., Holzleitner, I. J., Lee, A. J., Saribay, S. A., & Jones, B. C. (2020). Facial Masculinity Increases Perceptions of Men's Age, But Not Perceptions of Their Health: Data From an Arab Sample. *Evolutionary Psychological Science*, *7*(2), 184–188.

Abstract

Masculine characteristics in men's faces are often assumed to function as health cues. However, evidence for this assumption from empirical tests is mixed. For example, research on western women's face perceptions found that masculinised versions of men's faces were perceived to be older, but not healthier, than feminised versions. Since research on this topic has focused on western women's face perceptions, we investigated the effects of masculinizing face images on Arab women's perceptions of men's health (Study 1, N = 211) and age (Study 2, N = 209). Arab women perceived masculinized versions of male face images to be older, but not healthier, than feminized versions. These results add to a growing body of evidence challenging the assumption that male facial masculinity functions primarily as a health cue.

4.1 Introduction

Although masculine characteristics in men's faces are often assumed to function as a health cue (Little et al., 2011; Thornhill & Gangestad, 1999; Rhodes, 2006), evidence for this assumption is mixed. For example, tests for correlations between masculine characteristics in men's faces and measures of actual health have

reported both positive (e.g., Foo et al., 2020; Thornhill & Gangestad, 2006; Rhodes et al., 2003) and null (e.g., Boothroyd et al., 2013; Foo et al., 2017; Zaidi et al., 2019) results. Evidence that women's preferences for masculine characteristics in men's faces are stronger when women are in environments or hormonal conditions in which they might be expected to place greater emphasis on health when choosing mates (e.g., where childhood mortality is high or during the fertile menstrual cycle phase) is also equivocal (DeBruine et al., 2010; Jones et al., 2018; Penton-Voak et al., 1999; Scott et al., 2014).

Findings from studies that investigated whether exaggerating masculine shape characteristics in images of men's faces increases women's perceptions of men's health have also not suggested that masculine characteristics in men's faces function primarily as a health cue. A study of UK women's face perceptions (Boothroyd et al., 2005) found that masculinized versions of male face images looked older, but not healthier, than feminized versions. Although explicit health perceptions may not necessarily be a requirement for preferences for health mates to occur, these results do appear to challenge the claim that masculine characteristics in men's faces function primarily as a health cue. Instead, these results suggest that facial masculinity may function as an age cue.

A limitation of much previous research on women's perceptions of masculine characteristics in men's faces is that it focused mainly on judgments by women in western countries. Indeed, many researchers have emphasized the importance of expanding this focus so that non-western women's perceptions are also represented in the literature (Alharbi et al., 2020; Marcinkowska et al., 2019; Scott et al., 2014). Representing such women is particularly important, since many researchers have argued that face perceptions should be stable across cultures (Rhodes, 2006). For example, Scott et al. (2014) reported cultural differences in judgments of the attractiveness and aggressiveness of masculinized versus feminized faces.

In light of the above, we replicated Boothroyd et al's (2005) study of the effects of facial masculinity on women's perceptions of men's health (Study 1) and age (Study 2). However, we tested Arab women's judgments. If effects of masculinity on perceptions of health and age are similar for UK and Arab women, masculinizing

male face images will increase perceptions of men's age, but not perceptions of their health.

4.2 Study 1. Health perceptions

4.2.1 Methods

4.2.1.1 Participants

Two hundred and eleven Arab women (mean age = 23.29 years, SD = 7.70 years) participated in this online study (faceresearch.org, DeBruine, 2019). Participants were recruited using links to an online study of face perceptions on Saudi Arabian social media and were from Saudi Arabia, Algeria, Jordan, Oman, Egypt, and Kuwait.

4.2.1.2 Stimuli

Stimuli were manufactured using methods used in previous studies on this topic (e.g., DeBruine et al., 2010; Jones et al., 2018; Perrett et al., 1998), from an open access set of Turkish face images with an age range of 19-32 (Saribay et al., 2018), and using standard computer graphic methods (DeBruine, 2018; Tiddeman et al., 2001). Eleven images of people wearing glasses or headscarves that obscured the face were removed from the image set.

First, we manufactured a female prototype by averaging the shape, color, and texture information from 142 female images. Next, we manufactured a male prototype by averaging the shape, color, and texture information from 111 male images. Finally, we created masculinized and feminized versions of 60 of the individual face images (30 male, 30 female) by adding or subtracting 50% of the differences in 2D shape between the male and female prototypes to each of 60 individual faces randomly selected from the full image set.

This process created 30 male and 30 female pairs, with each pair consisting of a masculinized and feminized version of a given face (Alharbi et al., 2020).

4.2.1.3 Procedure

The 60 pairs of faces were shown in a fully randomized order, with the side of the screen on which the masculinized and feminized versions were presented also fully randomized. Participants were instructed (in Arabic) to click on the face in each pair that looked healthier.

Forced-choice paradigms can produce qualitatively different patterns of results to other methods for assessing perceptions of faces (Jones & Jaeger, 2019). We used the forced choice method in the current study to allow our results to be directly compared with those of Boothroyd et al. (2005).

4.2.2 Results

Data, output, and analysis code are available at https://osf.io/vhgbn/. Responses were analyzed with binomial mixed effects models using the lme4 (Bates et al, 2015) and lmerTest (Kuznetsova et al., 2015) package in the R software (R Core Team, 2013). Participant's choice was the dependent variable (chose masculinized = 0, chose feminized = 1). Participant age (z-standardized at the participant level) and sex of face (effect coded: male = -0.5, female = 0.5) were predictors. Random slopes were specified maximally (Barr et al., 2013). We included participants' random slopes for the effect of the sex of face that captured variability in the fixed effects across participants and the sex of face. Results are summarized in Figure 1.

In this initial analysis, the intercept was significant and positive (estimate = 0.41, SE = 0.09, z = 4.56, $p < .001$). Converting this estimate to proportions, this equates to women choosing, on average, the feminized versions as the healthier face on 60% of trials. The main effect of participant age was not significant (estimate = -0.09, SE = 0.06, z = -1.35, p = .177), but the main effect of sex of face was significant (estimate = 0.35, SE = 0.14, z = 2.52, p = .012).

When male and female faces were analyzed separately, the intercept was significant for female faces (estimate = 0.60, SE = 0.11, z = 5.41, $p < 0.001$), but not for male faces (estimate = 0.21, SE = 0.11, z = 1.84, p = 0.066). This equates

to, on average, women choosing the feminized version as the healthier face on 65% of female-face trials and 55% of male-face trials. The effect of participant age was not significant for either sex of face (female faces: estimate = -0.12, SE = 0.07, z = -1.78, p = 0.075; male faces: estimate = -0.01, SE = 0.08, z = -0.18, p = 0.859).

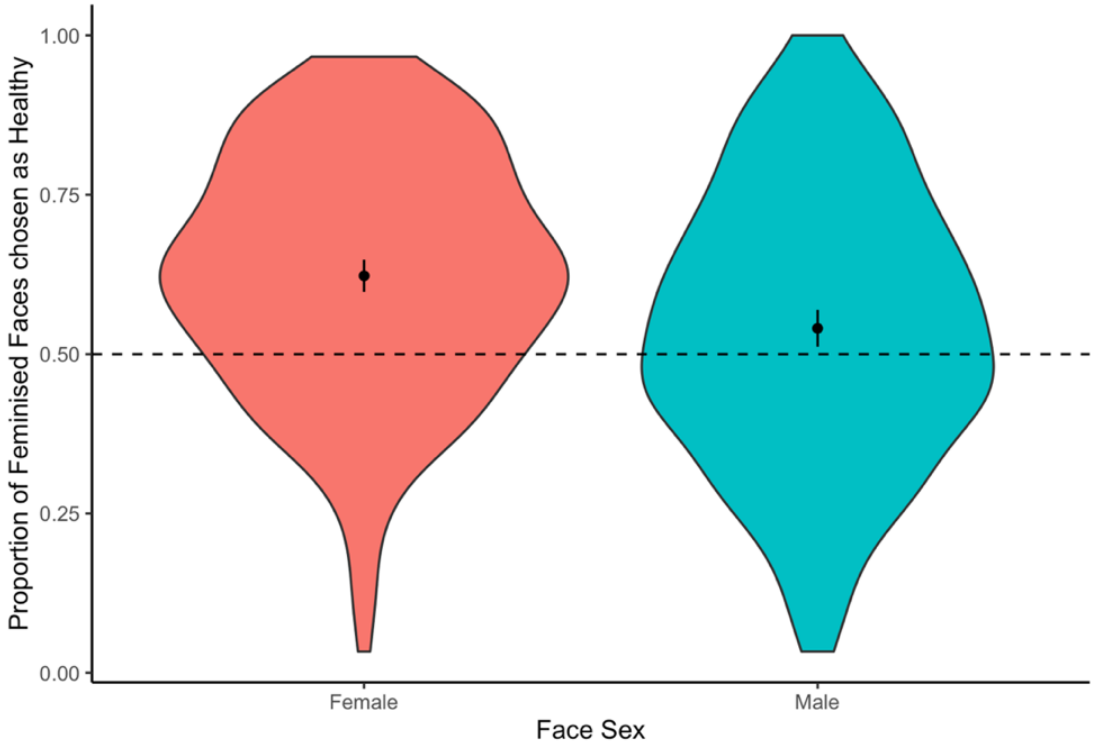

Figure 1. Violin plots showing distributions of the proportion of feminized versions of male and female faces chosen as healthier by Arab women. Dots and lines show mean and 95% confidence intervals respectively.

4.3 Study 2. Age perceptions

4.3.1 Methods

Stimuli, recruitment, and testing procedure were identical to those used in Study 1, except that we asked participants to select the face that looked older and tested 209 women (mean age = 23.27 years, SD = 7.15 years).

4.3.2 Results

Analyses were identical to those used in Study 1. Results are summarized in Figure 2. Data, output, and analysis code are publicly available at https://osf.io/vhgbn/.

In the initial analysis, the intercept was significant and negative (estimate = -1.42, SE = 0.11, z = -13.00, p < 0.001). Converting this estimate to proportions, this equates to women choosing, on average, the feminized version as the older face on 19% of trials. The main effect of participant age was not significant (estimate = -0.00, SE = 0.11, z = -0.02, p = 0.99), but the main effect of sex of face was significant (estimate = 0.71, SE = 0.09, z = 7.77, p < 0.001).

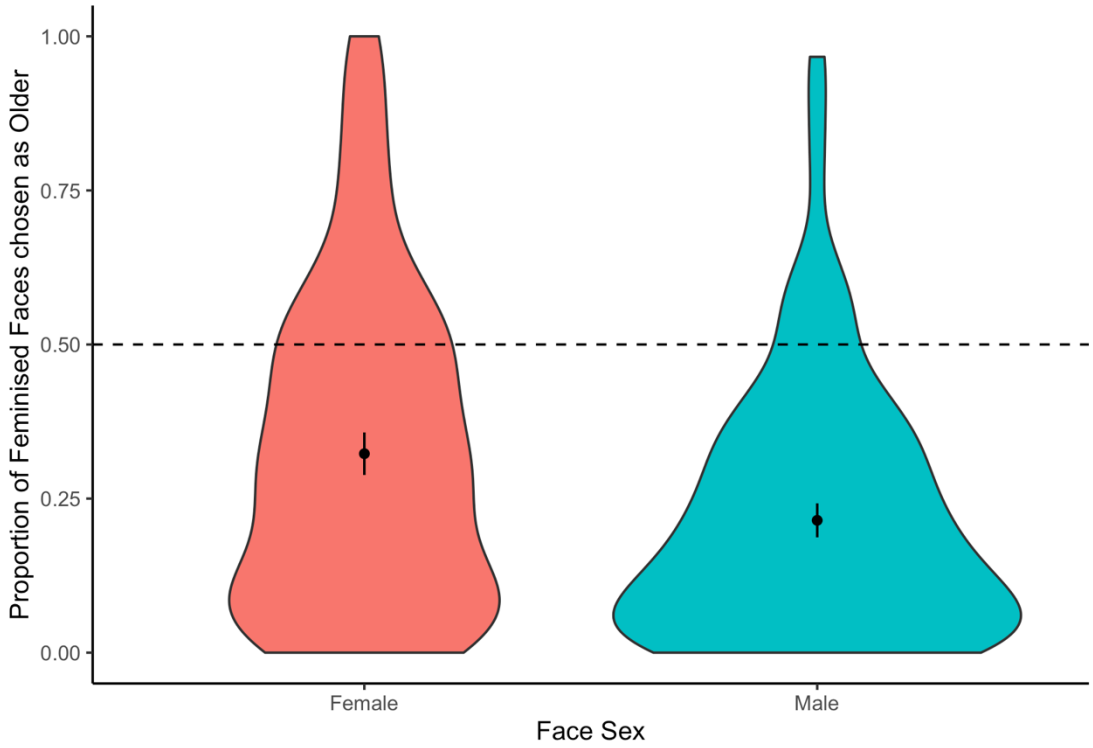

Figure 2. Violin plots showing distributions of the proportion of feminized versions of male and female faces chosen as older-looking by Arab women. Dots and lines show mean and 95% confidence intervals respectively.

When male and female faces were analyzed separately, the intercept was significant and negative for both female faces (estimate = -1.05, SE = 0.12, z = 8.70, p < 0.001) and male faces (estimate = -1.76, SE = 0.11, z = -15.65, p < 0.001). This equates to, on average, women choosing the feminized versions the older face on 26% of female-face trials and 15% of male-face trials. The effect of

participant age was not significant for either sex of face (female faces: estimate = -0.02, SE = 0.11, z = -0.22, p = 0.83; male faces: estimate = 0.01, SE = 0.11, z = 0.11, p = 0.91).

4.4 Discussion

We investigated the effects of masculinizing male face images on Arab women's perceptions of men's health and age. Masculinized versions were judged to look older, but not healthier, than feminized versions. This pattern of results replicated Boothroyd et al's (2005) results for UK women. Both results challenge the assumption that male facial masculinity functions primarily as a health cue, instead suggesting it functions as a cue of age.

For judgments of women's faces, we found that Arab women perceived masculinized versions to look older and less healthy than feminized versions. This is consistent with results of previous research suggesting that femininity has robust positive effects on perceptions of women's health and youth (e.g., Perrett et al., 1998).

An unresolved issue is whether this pattern of results generalizes to other types of testing paradigm. We used a forced choice paradigm that some researchers have suggested can produce qualitatively different patterns of results to other types of testing paradigm (e.g., ratings of individual faces, Jones & Jaeger, 2019). Further work would be needed to clarify this issue.

Interestingly, our analyses suggest that the effect of masculinizing shape can be quite variable across face images. This is in many ways unsurprising, since individual faces vary in the degree to which they display sexually dimorphic shape characteristics and so manipulating face shape would be expected to have somewhat different effects on different faces. Further work investigating the characteristics of the original face images that influences the degree to which masculinizing faces may shed light on this issue.

Our findings for Arab women's perceptions of men's health and age add to a growing body of research challenging the common assumption in the mate

preference literature that facial masculinity is a cue of men's health. Together with other recent work suggesting Arab women perceive men with masculinized faces to be particularly dominant (Alharbi et al., 2020), they also add to a growing body of evidence suggesting that facial masculinity primarily functions as a cue to men's age and dominance, as some researchers have previously proposed (Boothroyd et al., 2007; Scott et al., 2013).

Chapter 5. General discussion

This thesis investigated some of the factors that might influence individual variation in face processing. Multiple studies have suggested that face processing is influenced by a variety of factors (Yan et al., 2017; Xie & Zhang, 2015; Yang et al., 2017; Forni-Santos & Osório, 2015; Li et al., 2020). The main purpose of the thesis was to determine how effectively some of the previously reported findings in the face processing literature can be generalised to new samples.

5.1 Summary of Main Findings and Consistency with Literature

The first empirical study (Chapter 2) was a registered report examining the affective factors that influence facial expression recognition. With a larger sample size (N = 168), it directly replicated a Palermo et al's (2018) study. This study assessed a broad range of affective factors such as depression, anxiety, mood, empathy, and autistic-like traits, and used three different measures of facial expression recognition: the emotion-matching task, an emotion-labelling task, and the multimodal emotion recognition test (MERT).

Previously, Palermo et al. (2018) found that performance on the three emotion-recognition tasks, as well as the first component derived from a principal component analysis of total scores on these tasks, were negatively correlated with DASS anxiety subscale scores, but not with other affective factors. Although individuals with higher scores on the DASS anxiety subscale tended to perform more poorly on the task, this correlation was not significant.

In addition, we replicated Palermo et al.'s (2018) result that a high degree of self-reported anxiety on the DASS anxiety subscale was linked to poor emotion recognition, as measured by a component derived from principal component analysis of scores across emotion-recognition tasks. Although individuals with high scores on the DASS anxiety subscale were more likely to reflect that there was no correlation on the emotion-matching task, in our analysis, these relationships were not significant (in contrast to Palermo et al.'s results). Nonetheless, our

findings regarding the link between DASS anxiety subscale and emotion-labelling test confirm Palermo et al.'s claim that the DASS anxiety subscale predicts individual differences in general emotion recognition.

On the other hand, Palermo et al. (2018) found no significant correlations between facial expression recognition tests and other affective factor questionnaire scores (e.g., scores for depression, positive or negative affect, autism-like traits, and empathy). Notably, we found evidence that other affective factors tended to predict individual variations in emotion recognition. For instance, the level of self-reported empathy quotient was significantly related to the individual's performance on the multimodal emotion recognition test based on participants in our full sample, as well as in the subsample, whose results were within the given range highlighted by Palermo et al. Likewise, in the smaller dataset, the scores of self-reported in empathy quotient were positively associated with performance on the emotion-matching test.

In our study, individuals with a high score of self-reported in empathy quotient tended to perform significantly better on emotion recognition, as assessed by a principal component analysis across all emotion-recognition tasks. While Palermo et al.'s (2018) result suggested that individual variations in emotion recognition were predicted particularly by performance on the DASS anxiety subscale, this claim is not supported by our findings, specifically for empathy quotient scores. Despite this, our findings for empathy and emotion recognition are consistent with prior research, in which those who scored higher on empathy or lower on autistic-like traits were revealed to be more likely to perform better on emotion-recognition tasks (Lewis et al., 2016; Poljac et al., 2012). In other words, other affective factors including empathy and autistic-like traits appeared to predict individual variation in emotion recognition.

According to previous research, people with social anxiety have difficulty perceiving facial emotional expression (Demenescu et al., 2010; Cooper et al., 2008; Rossignol et al., 2005). In exploratory analyses, we investigated the effect of social anxiety on emotion recognition, which was not considered by Palermo et al. (2018) In contrast to our earlier findings for the DASS anxiety subscale, this study found little evidence that any of these measures significantly predicted

emotion recognition. We suggest that the null results for social anxiety indicate that the DASS anxiety subscale for predicting emotion recognition is unlikely to be sufficiently sensitive to reflect individual variations. However, some researchers have claimed that social anxiety is particularly crucial for emotion recognition (Rapee & Heimberg, 1997; Hirsch & Clark, 2004). It should be noted that both our work and that of Palermo et al. (2018) focused on predictors of emotional processing averaged over emotional expressions. Thus, we cannot rule out the possibility that anxiety and depression are linked to differences in how people process particular emotions.

The second empirical chapter in this thesis investigated the social perceptions of facial appearance of masculinised versus feminised faces. According to a previous study, women perceived feminised versions of faces as more trustworthy and attractive than masculinised versions, whilst masculinised versions were perceived as more dominant (Perrett et al., 1998). For both female and male face judgements, our findings showed that Arab women preferred feminine face shapes over masculine versions. This result corresponds with other studies among women from the United Kingdom, Bangladesh, and Japan, all of which revealed clear femininity preferences (Penton-Voak et al., 1999; Perrett et al., 1998; De Barra et al., 2013; Jones et al., 2018). These findings were consistent with the findings of a recent study on 21 Arab women's preferences (Marcinkowska et al., 2019) in which Arab women were found to prefer feminine versions of male faces over masculinised versions of male faces. However, these results contradict other studies of women's face preferences in the United States and Jamaica, in which women were found to be more likely to prefer masculinised versions of men's faces over feminised versions (Johnston et al., 2001; Penton-Voak et al., 2004; Rennels et al., 2008). Together, these findings revealed that women from Bangladesh, Japan, the UK, and Arab prefer male faces with feminine shape characteristics. It is important to note that many researchers believe that the variations in how women perceive faces is an indication that the judgment of attractiveness is shaped by ecological factors. According to cross-cultural research, women from regions with poorer health indices, highere levels of pathogens, and greater rates of violent crime and income inequality tend to have stronger preference for masculine facial features (DeBruine et al., 2010; DeBruine et al., 2012; Brooks et al., 2010). These ecological factors may affect women's

perception of faces and contribute to differences in the face preferences of Arab and Western women.

Additionally, we noticed in Experiment 2 that masculinising male faces led Arab women (N = 270) to perceive them as more dominant, but this was not observed with masculinising female faces. These findings support an earlier study that found masculinity had a larger impact on dominance perceptions of male than female faces (Perrett et al., 1998). These findings, along with our findings in Experiment 1 for face preferences, suggest that Arab women consider the faces of potential mates with low dominance to be particularly attractive.

Furthermore, there was no evidence that masculinising the shape of faces influenced Arab women's perceptions of others' trustworthiness (N = 434) in Experiment 3. This result does not correspond with other findings that reported an association of facial masculinity with perceived trustworthiness (Stirrat & Perrett, 2010). In most prior studies, feminising face shapes increased perceived trustworthiness (Perrett et al., 1998). Whilst these findings have been observed in both Western and Japanese groups, the null results in Experiment 3 demonstrate that this influence of femininity on perceived trustworthiness is not a universal social perception, which supports the idea that cross-cultural differences exist in face perception. This is inconsistent with the idea that face perceptions must be stable across cultures (Rhodes, 2006). The null findings of Experiment 3 also imply that Arab women's preferences for feminised, rather than masculinised, male faces are not attributable to a perception of feminine males as more trustworthy.

Chapter 4 reported perceptions of both age and health based on facial observation. For instance, masculine features in men's faces served as potential health cues. According to previous research on the face perceptions of UK women, masculinised versions of male face images were perceived as older, but not healthier, than their feminised counterparts (Boothroyd et al., 2005). Similarly, our study observed that Arab women considered masculinised versions of faces to be older and less healthy than feminised versions. This result is in line with other prior studies, which found that femininity had strong effects on women's perception of health and youth (e.g., Perrett et al., 1998). Thus, these findings

do not rule out the possibility of a link between masculinity and underlying health, further implying that age plays a major role in masculinity preferences for facial shape. Notably, our findings in Chapter 3 imply that Arab women perceive males with masculinised faces as particularly dominant. Together, these findings contribute to the growing body of evidence that suggests facial masculinity functions mainly as a cue to men's age and dominance, as some researchers have previously suggested (Boothroyd et al., 2007; Scott et al., 2013).

5.2 Directions for Future Research

The following section considers some of the possibilities for future work related to the studies reported in this thesis.

5.2.1 Directions for future research on individual differences in emotion recognition

In Chapter 2, we discussed how affective factors can predict individual differences in emotion recognition. Because emotions are perceived not only through facial expressions but also through body movement (Kret et al., 2013; de Gelder, 2006; Meeren et al., 2005) and voices (Van den Stock et al., 2007: Sauter & Scott, 2007), future studies can expand on our research, which focuses on facial attributes. There is some evidence that body movements can convey emotions and that observers can interpret emotional states from these movements, even at a distance where faces are not visible (Michalak et al., 2009; Lorey et al., 2012; Kaletsch et al., 2014). Thus, while my work focused on facial expressions of emotion, it is also important to examine whether affective factors influence emotional recognition in other domains, such as voices and body posture. Doing so would allow researchers to examine whether affective factors, such as anxiety, depression, mood, and empathy, reliably predict individual differences in emotion recognition on vocal and body posture. Considering this issue could provide deeper insights into the ability to process emotional signal and, potentially, increase the ecological validity of findings on this topic.

In Chapter 2, following Palermo et al. (2018), we used emotion-matching and emotion-labelling tasks to explore facial expressions since these are sensitive to

individual variation in emotion recognition ability. For similar reasons, MERT (Bänziger et al., 2009) can measure the recognition of emotion expression types using static and moving facial stimuli. Since there is significant variability across individuals in terms of emotion recognition, understanding the mechanisms underlying this variability is crucial. We recommend that researchers should replicate our findings by using different methods of emotion recognition. To this end, the following systems might be used to examine the affective processes in the human brain: EEG, PET scans, Eye tracking, or FMRI (López-Gil et al., 2016). Thus, assessing the performance of emotion recognition in static images, the real world of single faces, and across emotional states is an important area for future research.

5.2.2 Directions for future research on emotion recognition and social perception of faces

Chapter 2 focused on emotions without considering the effects of factors such as the masculinity/femininity of emotion perception. To understand the influence such factors might have on emotion recognition, we need further research. First, it would be interesting to determine whether facial features, such as a masculine face, influence perceived emotions more than an indication of the emotion itself. Previous studies have shown that happy or fearful expressions are easier to recognize since they appear to be more feminine (Becker et al., 2007; Marsh et al., 2005; Sacco & Hugenberg, 2009). Furthermore, faces with a modified brow-ridge distance were evaluated as being angrier to almost the same extent as being more masculine regardless of the target's gender (Becker et al., 2007). Therefore, femininity/masculinity may be plausible cues for specific emotion perceptions.

It is also necessary to investigate whether emotion perceptions are influenced by perceptions of trustworthiness, dominance, and affiliation. Along with assessing the level of these perceptions and the social orientations of the manipulation of facial appearances, Hess, Adams, and Kleck (2007) argue that it is the related and more behaviourally proximate conceptions of dominance and affiliation, which pervade all domains of social perception and have direct behavioural implications, that drive this influence rather than masculinity or femininity per se. Although recent research suggests that one person might rely largely on an emotional

expression to judge trustworthiness and another might focus on gender (Sutherland et al., 2020). Thus, further research is needed to show a direct link or links between perceptual markers and common morphological features. One possibility for this is that those who do the rating might be asked to rate a series of masculine and feminine faces that display a neutral facial expression or an expression such as anger or fear. Similarly, they might rate these faces on a level of trustworthiness, dominance, and affiliation. Given these considerations, we should be able to clarify how judgments of emotional states can be influenced by manipulating facial appearances.

5.2.3 Directions for future research on masculinity and femininity

In Chapters 3 and 4, we considered whether Arab women prefer feminized versions of both male and female faces, which they do, seeing them as more attractive than masculinized versions that tend to indicate age and dominance. Yet, further investigation of Arab women finds similar preferences for masculinity as Western women. Indeed, there is some evidence that personal circumstances such as a harsh environment, time in the menstrual cycle, relationship status, and self-perception of physical attractiveness are associated with how women perceive faces (Holzleitner and Perrett, 2017; Little et al., 2001; Penton-Voak et al., 2003). Several studies have found a link between cultural variations in ecological conditions and women's preferences for attractiveness. For example, women from regions with low health indices, high levels of pathogens, increased violent crime, and income inequality prefer masculine faces (DeBruine et al., 2010; DeBruine et al., 2012; Brooks et al., 2010). Although we did not investigate these findings, it would be beneficial to replicate this research using demographic data collection methods that accurately represent individual preferences in terms of social, environmental, and economic factors, to obtain a deeper understanding of the factors that reliably predict individual differences in facial preferences.

The research also indicated that perceptions of sexually dimorphic traits in voices are highly similar to those reported in the literature on face perception. (Bruckert et al., 2010; McAleer et al., 2014; Young et al., 2020). For example, while average faces and voices are generally considered to be more attractive, distinctive faces and voices are more easily recognized (Johnson et al., 2020). Further, individuals with attractive voices tend to have more symmetrical features, which tend to

make them more attractive (Gallup & Fredrick, 2010; Hughes, Farley, & Rhodes, 2010). Feinberg et al. (2008) observed an associated female preference for masculine appearances and voices, although their stimuli were not source matched. However, it remains unclear how attractiveness judgments based on these signals vary. Future research will be required to determine whether the same pattern of findings in attractiveness judgments, which we discussed in Chapter 3, extends to other domains such as voices.

5.3 Conclusion

This thesis adds to the body of knowledge about facial perception. According to the findings, individual differences in emotion recognition are predicted by affective factors. These relationships are not limited to measures of general anxiety, such as the DASS anxiety subscale, and may also include measures of empathy. Additionally, the results of our cultural differences studies revealed that Arab women found feminised versions of both male and female faces to be more attractive than masculinised versions and that they perceived masculinised faces to indicate a man's age and dominance. All of these findings suggest that emotional perceptions and social judgements differ among individuals and groups of individuals, underlining the importance of considering variation in face perceptions when trying to understand how people 'read' facial cues.

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