

# What's in a Face? Sources of Variation in Human Facial Attractiveness

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## **Abstract**

Face preferences and facial attractiveness influence broad and varied aspects of social behavior, including partner choices, hiring decisions, and voting behavior. Past research has identified several visual parameters that influence the attractiveness of faces. This chapter outlines prominent theories of attraction: the perceptual bias account (which proposes that attractiveness judgments are a functionless by-product of the visual recognition system) and the evolutionary advantage account (which proposes that attractiveness judgments are psychological adaptations that identify high quality potential mates). Next, this chapter summarizes the literature surrounding the relationship between expression, self-resemblance, apparent health, youthfulness, averageness, symmetry, and sexual dimorphism (i.e., masculinity and femininity)

and perceived attractiveness. In line with the evolutionary advantage view, the literature supports the proposal that facial attractiveness is a potentially adaptive indicator of mate quality in men and women. This chapter concludes with discussion on the relevance of this work to transgender people seeking gender-affirming surgeries and emphasizes the need for additional research using gender and sexual minority participants.

## **Keywords**

Face, facial attractiveness, sexual dimorphism, masculinity, femininity, averageness, symmetry, health, mate preferences

## **-Introduction**

Although both men and women claim in self-report studies that attractiveness is not an important consideration when choosing a partner [1], physical attractiveness is one of many different factors that can influence human social interaction [2]. Moreover, evidence suggests that people are kidding themselves when they claim physical attractiveness does not matter; people prefer to date [3, 4], reproduce with [5, 6], employ [7], and vote for [8, 9] physically attractive people, and the single best predictor of satisfaction with a 'blind date' for both men and women is perceived facial attractiveness [4]. More attractive faces provoke positive emotions, whereas less attractive faces provoke negative emotions [10], and relatedly, we are more likely to trust [11], remember [12], and implicitly associate positive traits with people with attractive faces compared to those with relatively unattractive faces [13].

Basic aspects of human infant care are also influenced by physical attractiveness [14-16]. Not only do mothers bond more closely with physically attractive infants [15], but attractiveness reduces perceptions of the severity of children's misbehavior [14, 16, 17] and increases adult attributions of infant competence [18]. Nurses provide a higher level of care for physically attractive premature newborns than for less attractive premature newborns ([16], see also [17]). Furthermore, physically attractive students tend to be judged more favorably by teachers on various social skills, academic potential, and intelligence [19]. Collectively, these findings emphasize the importance of physical attractiveness for a variety of crucial social and care outcomes, suggesting that studying the determinants of physical attractiveness may offer important insights into the psychology of human social behavior. Such information can also be

used to guide cosmetic and surgical choices, such as decisions made by the transgender population (and their medical professionals) when seeking gender-affirming hormonal therapy and gender-affirming surgeries. However, it is important to note that the majority of research into attractiveness consists of participants that were either entirely or almost entirely comprised of heterosexual cisgender people. Even so, because most sexually reproducing individuals in our ancestral past have been predominantly cisgender and heterosexual (at least in situations where choice of sexual partner was involved, e.g., [20]), and given that mate preferences are heritable [21], these findings should still apply to non-heterosexual, transgender, and intersex people. Still, the reader should be made aware that, unless otherwise indicated, the research described in this chapter uses largely heteronormative samples.

Although several studies have examined the attractiveness of bodies (e.g., [22-31]), many more have investigated facial attractiveness. Consistently, evidence suggests the face is more important than the body for judging a person's overall attractiveness (e.g., [32-34]). For example, a youthful facial appearance in women is more important for judging their overall attractiveness than is a youthful body shape [32]. To be sure, the face is often the primary target of attention when encountering a new person (e.g., [35]). The face also appears to be processed differently than the body (or other stimuli) on a neurological level, and this appears to start at a very young age. Developmental studies have found that the configural processing of faces, which emerges very early in infancy [36, 37], develops earlier than the configural processing of bodies [38]. Infants exhibit more brain activity in response to faces compared to other stimuli [39] and spend

more time looking at faces (especially attractive faces; e.g., [40, 41]) and face-like stimuli compared to other stimuli (e.g., [42]).

Similarly, adults show greater activation in certain brain regions (e.g., the fusiform gyrus) when processing faces compared to other types of stimuli (e.g., [43-51]). This specialization in the neural mechanisms that underpin the perception of faces suggests that face processing may play a particularly important role in overall person perception. Brain imaging studies have also shown that reward centers in the brain (e.g., the ventral striatum, the medial-orbito frontal cortex) are activated more when viewing attractive faces than when viewing unattractive faces (e.g., [52]), and that this difference is particularly enhanced when viewing potential mates [53] and when the attractive faces demonstrate positive social interest in the viewer [54, 55]. Given this apparent specialized role of faces in person perception and given that physical attractiveness is apparently rewarding and so clearly important for many different aspects of human interaction (e.g., partner choices, maternal bonding, hiring and voting decisions), elements that constitute an attractive face have been thoroughly investigated.

## **Theories of Attraction**

The majority of research into facial attractiveness can be broadly grouped as falling under one of two perspectives: the evolutionary advantage view and the perceptual bias view. The perceptual bias view of attractiveness proposes that attractive stimuli are considered attractive because they

are more easily processed by the visual recognition system [56-61]. Certainly, the easier a stimulus can be processed, the more likely it is that the stimulus will be associated with positive feelings [61]. In line with this perspective, averageness (i.e., prototypicality) and symmetry are associated with both attractiveness (e.g., [23, 62-75]) and faster, more efficient processing [76-80]. Attractive faces are also rated as more attractive and are easier to process with repeat exposure [81]. However, perceptual bias explanations of face preferences cannot easily accommodate many sources of individual differences in face preferences (e.g., hormonal correlates of attractiveness judgements, e.g., [68, 82-85], opposite-sex biases in face preferences (e.g., [86, 87], responses that are specific to biologically-relevant stimuli (e.g., upright faces, [60]), or variation in preferences based on current environment (e.g., threat, pathogen prevalence; e.g., [27, 28, 88, 89]). Other associations, such as those between facial attractiveness and measures of health (e.g., [90]) and fertility (e.g., [91, 92]), are likewise difficult to explain in terms of perceptual bias.

The evolutionary advantage perspective proposes that facial attractiveness reflects underlying qualities that might confer an advantage of some sort to a potential partner (see, e.g., [63, 85, 88, 89, 93-105]). Under this view, attractiveness is thought to signal heritable resistance to multiple forms of genetic and environmental stress. Therefore, attraction to these individuals would be adaptive as it would increase an individual's reproductive success via increased offspring health (i.e., the genetic benefits could be passed on to offspring and increase their chances of survival). Consistent with this view, male facial attractiveness is positively related to a genetic profile associated with immunity to infectious diseases [106, 107], good semen quality (e.g., [108-110;

but see [111]), reproductive success [112, 113] (but see [114]), and longevity [115], as well as their shoulder-to-hip ratio (a measure of masculine body shape), hand grip strength, and number of sexual partners [116]. Female facial attractiveness is positively associated with longevity [115], low numbers of past health problems [90, 117, 118] (but see [119]), and other indicators of health and fertility, such as a low waist-to-hip ratio [120], a normal body mass index [90], a hormonal profile associated with peak fertility [91, 92, 121], and number of offspring [122]. Thus, in line with an evolutionary advantage perspective, it appears that we have evolved to find certain traits attractive because partnering with people who possess those traits likely conferred an adaptive advantage in our ancestral past. What, then, constitutes an attractive face?

## **What Traits Influence Facial Attractiveness?**

Researchers have spent decades attempting to tease apart the specific traits that make a face attractive (for review, see [123]). Far from being only in the eye of the beholder, there is a great deal of cross-cultural agreement with respect to what characteristics make a person physically attractive (e.g., [124-128]). Although personal preferences do vary based on a variety of individual differences, such as environmental context (e.g., [28]) and a person's own attractiveness (e.g., [129]), scholars have found that variance in certain characteristics, including expression, self-resemblance, apparent health, youthfulness, averageness, symmetry, and sexual dimorphism (i.e., masculinity and femininity), reliably predict ratings of facial attractiveness.

## **Facial Expressions**

Static, unchangeable aspects of faces are not the only elements associated with judgements of attractiveness. Changeable social signals in faces, such as gaze direction and expression, influence attraction. We prefer faces that are looking directly at us as opposed to those with averted gaze [130], especially when those faces are attractive [131]. Following gaze cues is essential for fluent social interactions, but, although gaze direction signals the direction of the social attention of others in the environment [130, 132, 133], gaze direction alone provides little information about a person's attitudes and intentions [133].

Expression has been found to differentially qualify the strength of attractiveness preferences for faces with direct and averted gaze. People who smile are perceived as more attractive [133, 134] and trustworthy [135], and are remembered more easily [136] compared with people displaying a neutral expression. For judgments of faces with direct gaze, attractiveness ratings are stronger for smiling faces than for faces with neutral expressions [133]. Contrastingly, for judgments of faces with averted gaze, attractiveness ratings are stronger for faces with neutral expressions than for smiling faces [133]. Conway et al. [137] found that participants demonstrated stronger preferences for direct gaze when judging the attractiveness of happy faces than when judging disgusted faces. This effect of expression on the strength of attraction to direct gaze was particularly pronounced for judgments of opposite-sex faces, though no such opposite-sex bias in preferences for direct gaze was observed when participants judged the same faces for likeability

[137]. When combined, these findings for an opposite-sex bias in preferences for perceiver-directed smiles, but not perceiver-directed disgust, suggest that gaze preference may function to facilitate efficient allocation of mating effort (i.e., attraction to those who show pro-social interest in the viewer; [138]) and also demonstrates how the changeable aspects of both gaze direction and expression can be integrated when forming face preferences. Nevertheless, the majority of research into facial attractiveness has focused on more (relatively) fixed aspects of face color and shape.

### **Self-Resemblance**

How much a person resembles the viewer influences how attractive the viewer considers that person to be. Homogamy refers to the tendency for couples to resemble one another, and a certain degree of resemblance among couples has unquestionably been observed [139]. Evidence suggests that we selectively mate with others who resemble us on a variety of characteristics, such as ethnicity, religion, approximate age, education level, attractiveness, and socioeconomic status (e.g., [140]). Facial resemblance is another cue for which humans mate assortatively (i.e., choose mates based on their possessing similar characteristics to themselves, [141]). However, the findings for the relationship between self-resemblance and mate preferences are mixed.

Although both engaged couples and those married for many years are rated as more similar than randomly paired couples [142, 143], others using photographs of the same couples during their first and 25th years of marriage have found that similarity was only present after many years of

marriage [139]. Facial resemblance is one cue that organisms can use to discriminate between related and unrelated individuals [144, 145]. Experimental manipulations of facial self-resemblance have found that self-resemblance increases the perceived attractiveness of same-sex faces, but that self-resembling opposite-sex faces are considered relatively unattractive [146, 147]. Attraction to self-resembling faces is also stronger when women are in the luteal phase of their menstrual cycles (a phase characterized by high progesterone, which is also high during pregnancy) and weaker during the fertile phase (i.e., when conception is most likely), potentially functioning to prevent inbreeding when fertile and encourage pro-social behavior during pregnancy [148] (but see [149]).

But why, given the potential costs of inbreeding (e.g., [150]), would similarity be considered attractive at all? The inclusive fitness theory [151] predicts that organisms will preferentially help and behave more altruistically towards closely related kin over more distantly related individuals [152] in order to increase the likelihood that their genes will survive and reproduce. However, the degree of relatedness should also be considered when choosing a potential mate [153-160]. The Westermarck Effect [161-164] refers to the lack of sexual attraction between people who were closely associated as young children (usually genetic relatives), and it likely reflects a mechanism that would increase the likelihood of gene-survival. In contrast, Optimal Outbreeding Theory, although it acknowledges the dangers of inbreeding, emphasizes that mating with individuals who are highly genetically dissimilar can also detrimentally impact reproductive fitness [153, 165]. That we are attracted to similar individuals (e.g., those similar in attractiveness, education level, socioeconomic status), but not genetically related individuals

(i.e., those that look like close kin), suggests that facial self-resemblance affects attributions of attractiveness by allowing the viewer to adaptively calibrate the degree of possible genetic relatedness and to respond accordingly.

### **Apparent Health**

Healthy-looking faces are also perceived as attractive [63, 64, 74, 115, 166-171]. A smooth and healthy-looking texture is considered attractive in both male and females faces [168, 172].

Perceptions of health also accurately reflect the underlying health of individuals, as indicated by hormone levels and measures of immune system strength (e.g., [91, 107]). Across various ethnicities and cultures, skin yellowness, which indicates the presence antioxidant carotenoids (i.e., a healthy diet); skin redness, which is indicative of blood oxygenation associated with physical fitness and fertility; and skin luminance are perceived as indicators of physical health and are considered attractive (reviewed in [171]). Similarly, facial adiposity (i.e., the amount of body fat visible in the face) is considered unattractive (e.g., [173]) and is a reliable indicator of body mass index and other negative health-related information (see [174, 175]).

That cues to health are perceivable in the face and that healthy-looking faces are attractive is consistent with the view that attractiveness judgments are psychological adaptations that identify healthy individuals. Importantly, aversions to unhealthy-looking individuals may reflect an adaptive mechanism for avoiding contagion [176, 177] and/or an adaptive mechanism for identifying healthy mates [64]. Indeed, perceptions of health appear to mediate preferences for

other facial cues, such as symmetry [64, 178]. Yet, many cues to health reflect current condition and do not necessarily reflect underlying mate quality. For example, although the side effects of a cold (e.g., pallor, uneven skin tone) may not be attractive, minor health issues are temporary and do not in and of themselves necessarily indicate that a person is of poor long-term quality. Therefore, although preferences for cues to current health make sense because contagion avoidance is clearly adaptive, other cues that indicate either long-term genetic quality or reproductive potential should likewise be considered attractive.

## **Youthfulness**

The goal of many facial cosmetic surgeries (e.g., face lift) and procedures (e.g., botulinum neurotoxin injections) is to reverse the signs of aging and give the individual a more youthful appearance, and many such procedures are increasing in popularity [179]. Given the apparent widespread obsession with youth and beauty (e.g., [180]), it is perhaps unsurprising that youthfulness is related to perceptions of attractiveness (e.g., [32, 181]. Skin surface topography (i.e., the deviation of the skin from a perfectly smooth, flat plane) and color homogeneity affect judgements of age, health, and attractiveness, such that smoother, more even skin tone is perceived as healthier, younger, and more attractive (e.g., [182-184]. The negative association between aging and attractiveness is strongest for women; young and middle-aged adults rate younger faces as more attractive than older faces, with older female faces being rated as the least attractive, although it is worth noting that older adults rate all aged faces equally [185].

One potential explanation for the negative association between age and perceived attractiveness is health. Certainly, health does decline with age, and so preferences for youthfulness may in part reflect preferences for healthy individuals (see, e.g., [186]). However, this rationalization does not explain the observation that the negative impact of age on perceived attractiveness is stronger when viewing women as compared to men. Women live longer, have lower mortality at all ages [187], and engage in more positive health-related behaviors than men (e.g., [188]), so this relationship cannot only be about health. Another explanation for this relationship is reproductive potential. Although paternal (but not maternal) age at conception is negatively associated with facial attractiveness [189], men do not experience the sudden sharp decline in their ability to reproduce that women do. Because of menopause, a biological woman's ability to reproduce is more closely tied to her age than is a biological man's ability to reproduce, which might explain why youth is more valued when judging women's attractiveness. Correspondingly, Maestriperi et al. [190] found that perceived facial attractiveness was lower for older (aged 51-65 years) men and women than for younger (aged 35-50 years) men and women, and that the age-related reduction in facial attractiveness was greater for women than for men. Interestingly, they also found that there was a larger increase in perceived power at older ages for men compared to women, implying that the decrease in men's attractiveness with age is buffered by increased perceptions of status. Additionally, the greater age-related decrease in female facial attractiveness was driven by male participants, whereas the greater age-related increase in male perceived power was driven by female participants [190], which further suggests that these

perceptions are driven by mating psychology. Regardless, these findings highlight the importance of reproductively-relevant traits in perceptions of attractiveness.

### **Averageness**

“Averageness” in faces (i.e., how closely a face resembles others in the population, also referred to as prototypicality) is another trait that is considered attractive (see [123]). It is associated with health [117], indicating that it may be a cue to good genes and heritable immunity to infectious diseases that may be passed on to offspring, making attraction to averageness a potential adaptation for increasing offspring viability (see [191]). Sir Francis Galton [192] was the first to average faces together to investigate shared features among groups of individuals (e.g., criminals). He created a composite (i.e., average) face image by combining the photographs of different participants using repeated limited photographic exposure, which produced a single blended image. He observed that composite images were more attractive, and this observation has been replicated numerous times since (e.g., [63, 67, 70, 73, 74, 97, 193]). Modern techniques use computer graphic methods that blend faces together to create a composite that represents the mean facial shape, color, and texture of a sample (e.g., [194-196]). Early image processing techniques were unable to maintain texture and, as a consequence, all composite faces had unnaturally smooth skin. Thus, it was suggested that composite faces are only judged attractive because of their smooth skin [197]. However, when facial averageness is manipulated in shape only [67, 70, 198], the attractiveness-averageness relationship remains. By the same token,

averaging faces together creates images that tend towards high symmetry (see [72] for a review), leading some to suggest that preferences for averageness may simply reflect attraction to symmetry [73-75]. However, increasing averageness in perfectly symmetrical face images increases their attractiveness, even though symmetry is not affected [198]. The averageness-attractiveness relationship has also been examined with unmanipulated facial images and, using measured facial proportions, most studies have found averageness to be associated with attractiveness [126, 199-201] (but see [202]).

Why, then, are average faces seen as attractive? Average faces may be attractive because averageness signals health [117], because they reflect genetic diversity [102, 191, 203], and/or because average faces are perceived as more normal or familiar [204]. That facial averageness is heritable [191] supports the idea that it reflects genetic quality in some way. However, the relationship between averageness and attractiveness is not completely straightforward. Perrett et al. [101] found that, out of a sample of 60 faces, a composite face made out of the 20 most attractive faces was rated as more attractive than a composite face made out of the entire sample. Also, exaggerating the differences in shape between the two faces using computer graphics techniques also exaggerated the attractiveness discrepancy, showing the shape of highly attractive faces to be systematically different from average (see also [205]). Although ratings of facial distinctiveness, the opposite of facial averageness [206], are inversely associated with ratings of facial attractiveness [73], Wickham and Morris [201] found that unattractive faces were also rated as distinctive, whereas attractive faces varied widely in their rated distinctiveness. This suggests a far more complex interaction between distinctiveness,

averageness, and attraction than was formerly suggested. Furthermore, although average faces are perceived as more normal and more familiar [204], and are therefore more easily processed, faces rated for distinctiveness can be found more attractive than average faces [73, 205, 206]. Thus, some average faces are judged more attractive than others [101], indicating that attractiveness and averageness are dissociable dimensions along which faces vary.

## **Symmetry**

One element of faces that has been found to be attractive, even across diverse cultures and ages, is symmetry [63, 64, 66-69, 71, 74, 198, 207-209]. Symmetry is positively associated with attractiveness judgments of unmanipulated face images [63, 64, 209] and increasing symmetry in faces using computer graphic methods increases their attractiveness (e.g., [66, 74, 86, 87, 210, 211], but see [212]). Under a perceptual bias view (e.g., [58]), preferences for symmetric faces are thought to be due to symmetric stimuli of any kind being easier to process by the visual system than relatively asymmetric stimuli [56, 57, 59]. Therefore, preferences for bilateral symmetry may be explained either by the bilateral symmetry of the ocular muscles [213] or because the processing of the left and right visual fields in different hemispheres allows for an easy point-by-point matching that eases symmetry detection [214]. In fact, preferences for symmetry have been reported for judgments of everyday objects [215] and decorative art [216], and people more easily replicate symmetrical versus asymmetrical figures [62].

Similar to hypotheses surrounding preferences for averageness, some scholars have postulated that the visual system may develop an internal prototypical representation of each category of stimuli (e.g., [217, 218, 219, 220, 221]). These prototypical representations are presumed to be averages of all the stimuli of a given type that the viewer has seen, and novel stimuli would be matched to a prototype for recognition and categorization (e.g., [59, 60, 194, 222, 223]). Under this perspective, symmetry may be attractive because the random asymmetric variations in faces would average to a very symmetric face that was closer to our internal prototype, which, by extension, would be easier to process [59]. However, this perspective does not explain why symmetry is preferred more in upright faces compared to identical inverted faces, or why people prefer symmetrized versions of their own faces over the more familiar original (i.e., relatively asymmetric) versions [60]. Also, although symmetry detection is better for upright faces than for inverted faces [224], the ability to detect facial symmetry is not related to preferences for facial symmetry [225]. Some of the clearest evidence against the perceptual bias view comes from studies that have found that women also prefer the scent and voices of symmetrical men to those of less symmetrical men [226-230], indicating that symmetry preferences cannot be explained by biases in the visual system alone (since the visual system is not implicated in voice or odor preferences). By contrast, these findings suggest that symmetry is associated with aspects of underlying mate quality that are attractive in multiple domains and, consequently, support an important aspect of the evolutionary advantage view.

Face and body symmetry are related to reproductive success [100, 231], semen quality [232, 233], sexual attractiveness [100], health [64, 98, 178], disease resistance, and overall genetic

fitness [99, 234] in many species. Bilateral symmetry is heritable [235-237] and may be indicative of the overall stability of development, including resistance to: pathogens and parasites, deficient food, harsh climate, toxins or injuries, and genetic problems such as inbreeding or chromosomal abnormalities [63, 97, 99-102, 238]. This relationship between symmetry and developmental stability may explain why facial and body symmetry are attractive [239] and why some researchers find an opposite-sex bias in symmetry preferences [64, 71, 86], since preferences for symmetric mates may then increase reproductive success (see [230]). Indeed, women prefer more symmetrical male faces when they are maximally fertile [68, 240] (but see [241, 242]), which may indicate an adaptive shift toward preferences for cues to genetic quality when conception is more likely. As for men, symmetrical human males are likely to have had more sexual partners than less symmetrical males [243, 244], are likely to father more offspring (at least in more rural environments, see [244]), and are more likely to be chosen as extra-pair or short-term (i.e., purely sexual) partners [240, 245]. These preferences for symmetric individuals could potentially be an adaptation for identifying healthy partners, whereby symmetry is preferred because it signals high mate quality (e.g., healthy, fertile individuals). In line with this reasoning, exposure to visual cues of pathogen contagion increases preferences for symmetrical facial features in opposite-sex faces [246]. These findings for an association between symmetry and various measures of health and reproductive success are consistent with an evolutionary advantage explanation of symmetry preferences (see also, e.g., [60]).

## **Sexual Dimorphism**

With respect to physical appearance, sexual dimorphism refers to an individual's sex-typicality.

In other words, you can think of face shape as spanning a continuum that ranges from highly feminine female to highly masculine male, whereby the individuals on the extreme ends of the continuum are the most sexually dimorphic and those falling in the middle are more androgynous-looking. Within a given sex, people can be more or less sex-typical in their appearance. For instance, a woman could look relatively masculine, which means she is less sexually dimorphic than a very feminine-looking woman. The specific features (other than beardedness and culturally-specific grooming and cosmetic preferences) that differentiate male and female faces are jawbone and cheekbone prominence, eyebrow thickness, eye size, and face length, whereby the jawbone, eyebrows, and facial height are all larger in men and eye size and cheekbone prominence are larger in women (e.g., [71, 209]). Of these traits, eyebrow thickness, jawbone prominence, and facial height are the most salient cues when assessing facial masculinity [247]. These sexually dimorphic traits are paramount in perceptions of gender such that more dimorphic individuals are more accurately categorized by gender compared to less dimorphic individuals (e.g., [248-251]), making this dimension of attractiveness highly relevant to transgender people who are in transition and seeking gender-affirming treatments. Less sexually dimorphic people are also more likely to be perceived as non-heterosexual [252-254] (for evidence of differences in measured face shape across sexual orientations, see [255, 256]).

Sexual dimorphism has been linked to attractiveness in a similar way as other important traits (e.g., symmetry, averageness) outlined previously (see, e.g., [108, 257]). Little et al. [87] found

that men and women preferred symmetric faces more when judging faces of the opposite-sex than when judging same-sex faces, that women's preferences for symmetry were positively correlated with their preferences for masculinity in male faces, and that men's preferences for symmetry were positively correlated with their preferences for femininity in female faces. This research suggests that symmetry and sexual dimorphism may advertise a common quality in faces. Specifically, like symmetry (e.g., [64, 178, 238], sexual dimorphism may signal health and underlying immunocompetence.

The same hormones that mediate the expression of sex-typical traits are also immunosuppressants [258] and, thus, it has been argued that only men with strong immune systems will be able to develop exaggerated masculine traits [259-261], although this relationship is much more complex than often portrayed (see [262, 263]. Although men's facial masculinity is related to their circulating testosterone level [264-266], evidence in favor of a relationship between facial sexual dimorphism and men's health has been somewhat mixed. Men's facial masculinity is negatively related to their reports of past infections [267] (but see [262]) and positively related to doctor's ratings of health based on past medical records during adolescence [268]. However, heterozygosity in the major histocompatibility complex (MHC) genes, which indicates the range of (but not magnitude of the response to) harmful substances that the immune system can recognize and fight (see [269]), is not related to facial masculinity [270], although it is related to attractiveness and averageness in male faces [106]. Likewise, male facial masculinity is associated with acquired immunity (i.e., antigen-specific immune responses

[271]) and cytokine response to antigens [272], but not innate immunity (i.e., nonspecific immune responses [258]).

Similar arguments have also been put forward for feminine traits in women. Like masculinity in men's faces, femininity in women's faces is negatively related to their reports of past infections [118, 267] (but see [268]) and women's facial attractiveness, a facial characteristic that is closely linked to femininity (e.g., [72, 91, 170, 268, 273]), is positively associated with women's medical health [90, 115]. As with men, these findings are also mixed; women's facial femininity is not associated with their adolescent health as rated by doctors [268], MHC heterozygosity [106], or other measures of immune system response [108, 119]. More recently, however, Foo et al. [274] astutely argued that sexually dimorphic traits in adulthood should not necessarily predict current immune function. Rather, sexually dimorphic traits should indicate immune function during the period in which they develop (i.e., adolescence). Using longitudinal data, they found an association between multiple measures of immunity in adolescence (specifically, measures related to allergic responses and antibacterial immunity in both men and women, and also measures related to cellular immunity in men) and sexually dimorphic traits in both men's and women's faces in adulthood [274]. This study provides strong evidence that sexual dimorphism in faces signals immune health during development.

There is some evidence that masculine characteristics in males and feminine characteristics in females are associated with fertility [91, 275] (but see [110]) and that facial sexual dimorphism positively predicts both men's and women's mating success [276]. When investigating the

relative contributions of sexually dimorphic face shape, facial symmetry, and color cues to health to perceptions of attractiveness in men and women, Mogilski and Welling [170] found that both men and women prioritized sexually dimorphic information over symmetry and healthy coloration. In other words, *sexual dimorphism was the most important trait when considering overall attractiveness rankings*. As one might expect, female facial femininity was strongly related to perceptions of female attractiveness, as has consistently been the case in other studies (e.g., [70, 93, 105, 268, 277-280]). However, participants in this study preferred men with relatively *feminine* faces; although sexually dimorphic traits overall were more important than symmetry or healthy facial coloration in determining attractiveness, participants preferred men who were *less* dimorphic.

Studies that have explored the relationship between male secondary sexual characteristics (i.e., masculine traits) and facial attractiveness have reported inconsistent results. For example, Perrett et al. [278] found people judged a computer-generated average male face as more attractive when the facial shape was shifted towards the mean of a female sample (i.e., was feminized), rather than when it was masculinized by exaggerating the shape differences between an average male and an average female face (see also [67, 86, 170, 279, 281]). Other studies using the same methods, however, have reported general female preferences for masculine male faces [282-284], or no general preference for sexual dimorphism at all [285, 286]. Importantly, these different findings across studies do not seem to be due to methodological issues (see [282]). Instead, because masculinity is associated with both underlying health (e.g., [267, 274]) and negative personality traits [167, 278, 287, 288], researchers have argued that attraction to

masculine men reflects how people resolve the tradeoff between the benefits versus detriments of choosing a masculine male partner (see [257]). In general, heterosexual women do not prefer hyper-masculine faces [84, 86, 257, 278, 281], but do find male masculinity sexually attractive (e.g., [240, 289, 290]). Moreover, the extent to which women prefer masculine versus relatively feminine men is also related to contextual factors, such as hormonal profile (e.g., [82, 84, 85, 291]; although this is highly debated, see [292]), own attractiveness [86, 129, 293], environmental threat (e.g., [28]), and pathogen prevalence (e.g., [88, 89]), suggesting that the relationship between male masculinity and attractiveness is somewhat complex.

Preferences for sexual dimorphism have mostly been investigated among heterosexual cisgender men and women. To date, there is no evidence that heterosexuals differ from non-heterosexuals with respect to their preferences for traits like symmetry and color cues to health, but there are some differences with respect to their preferences for sexual dimorphism. Like heterosexual men, gay men, on average, report preferring partners who are younger than themselves [294, 295] and report valuing physical attractiveness in a partner more [296] than do heterosexual women. Unlike heterosexual men, gay and bisexual men report high preferences for masculine men [297, 298, 299] (but see [300] for contradictory findings), although this seems to interact with preferred sexual position (i.e., self-identified “tops,” “bottoms,” and “versatiles,” with tops preferring more feminine men compared to bottoms and versatiles; [298, 299]). Individual differences like sociosexual orientation (i.e., a permissive attitude toward casual sex; [301, 302] and hostile sexism [303] positively predict preferences for high sexual dimorphism in both gay men (preferring masculine men) and straight men (preferring feminine women). Sex drive also

predicts the strength of men's preference for sexually dimorphic facial features in the sex they are attracted to (i.e., gay men with high sex drives prefer more masculine men more than those with low sex drive, whereas straight men with high sex drives prefer feminine women more than those with low sex drive [304, 305]. For women, who tend to be more fluid in their sexual attractions compared to men (e.g., [306], sex drive predicts the strength of straight women's reported preference for both sexually dimorphic men and women [289], but predicts lesbian's reported preferences for sexually dimorphic men only [305]. The authors who reported this latter finding suggest that the null finding with respect to an impact of sex drive on lesbian's preferences for other women may be due to unmeasured differences across lesbian sub-cultures (e.g., self-identified "butch" versus "femme" lesbians), and argue that future research should explore this possibility further [305]. Generally, lesbians demonstrate stronger preferences for masculinity in female faces than do straight women [297], but the extent of their preference for male masculinity depends on the strength of their reported attraction to men, with strongly heterosexual women reporting stronger preferences for male masculinity than women who are not attracted to or less attracted to men [257, 307].

## **Relevance to the Transgender Population**

Many studies have emphasized high agreement in preferences for youthful (e.g., [32, 181], symmetric (e.g., [65, 67, 71, 209]), average (e.g., [63, 65, 67, 70, 97]), and healthy-looking [63, 115, 168, 169] faces, and for femininity in women's faces (e.g., [72, 277, 278]). Preferences for

other facial characteristics, however, appear to be more variable. For example, women's preferences for masculinity in men's faces may systematically vary to a small extent during the menstrual cycle (see [292]) and as a function of their own attractiveness (e.g., [86]). Still, scientists have identified many sources of agreement in perceived facial attractiveness, particularly in research on sexually dimorphic traits. This is principally important for transgender individuals looking to transition. Several studies have shown that gender-affirming hormonal therapy and gender-affirming surgery positively impact the quality of life and psychological wellbeing of trans people, with high satisfaction rates after gender-affirming surgery (see [308]). Correspondingly, reported quality of life is also higher in trans women who have undergone facial feminization surgery when compared to trans women who did not undergo this type of surgery [309]. Although rare, dissatisfaction with gender-affirming surgical outcomes often relate to aesthetics (e.g., [310, 311]), which highlights the importance of surgeons knowing what type of objective results are considered desirable.

Although current research on facial attractiveness is very relevant to transgender individuals, particularly those in transition, more research is needed. In particular, more work is needed that uses non-heterosexual and non-cisgender participants. While coupled individuals may be concerned with their current partner's attraction to them post-transition, single individuals may be concerned with the mate preferences of the group to which they are attracted (e.g., gay men versus straight women) more generally. We also know very little about how the synthetic hormones used in transition may influence mate preferences. Although menopausal hormone replacement therapy does not seem to influence masculinity preferences among post-menopausal

women [312], there is evidence that other synthetic hormones, including hormonal contraceptives (reviewed by [313]) and testosterone therapy [93] given to cisgender women and men, respectively, may subtly alter these preferences. Whether or not the initiation of gender-affirming hormonal therapy given to transgender men and women influences mate choice or preferences remains to be investigated.

## **Conclusions**

The suggestion that beauty is in the eye of the beholder implies that individual differences in face preferences are essentially arbitrary. On the contrary, evidence suggests that individual differences in face preferences are far from arbitrary. Rather, they reflect adaptive responses shaped by selection pressures during our ancestral past. Put another way, we tend to find certain traits attractive because people who found those traits attractive in the past were more likely to reproduce successfully; so, essentially, beauty is of reproductive relevance. These preferences are at least somewhat heritable [21], which means they are passed on to offspring regardless of that offspring's sexual orientation or intentions to reproduce (i.e., these preferences are not only applicable to the heterosexual cisgender population, nor are they only relevant to those intending to reproduce). Clearly, more research is needed within gender and sexual minority groups. Nonetheless, current research into human facial attractiveness elucidates important information about human behavior and preferences, and can inform decision-making by those seeking gender-affirming facial treatments.

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