

The biology of facial beauty

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Synopsis

It was once widely believed that standards of beauty were arbitrarily variable. Recent research suggests, however, that people's views of facial attractiveness are remarkably consistent, regardless of race, nationality or age. Facial characteristics are known to influence human attractiveness judgements and evolutionary psychologists suggest that these characteristics all pertain to health, leading to the conclusion that humans have evolved to view certain bodily features as attractive because the features were displayed by healthy others. Here we review some of the fundamental principles of sexual selection theory that apply to human beauty and summarize the major findings of human beauty perception.

Résumé

Autrefois, l'idée que les standards de la beauté varient de façon arbitraire étaient largement répandue. Toutefois, de récentes recherches suggèrent que l'avis des gens sur l'attrait d'un visage est remarquablement concordant indépendamment de la race, de la nationalité ou de l'âge. Les caractéristiques faciales sont connues pour influencer les jugements sur l'attrait humain et les psychologues de l'évolution suggèrent que ces caractéristiques relèvent toutes de la santé. Ceci conduit à la conclusion que les humains ont

évolué et jugent attrayants certains traits corporels parce que ces traits sont ceux de personnes en bonne santé. Nous verrons dans cet article quelques principes fondamentaux de la théorie de la sélection sexuelle qui s'appliquent à la beauté humaine et nous résumerons les principales découvertes dans la perception de la beauté humaine.

Introduction

Human assessments of beauty and human beauty standards have attracted considerable attention in recent years, not least by cosmetic companies, plastic surgeons and scientists. A beautiful human face provides the receiver with pleasurable feelings mediated by the brain's dopaminergic reward system, especially when that face is staring directly at you [1]. In a seminal early study Dion *et al.* [2] showed that positive qualities are ascribed to attractive people and negative qualities to unattractive people. More recently, Langlois *et al.* [3] demonstrated that attractive children and adults are judged more positively than unattractive children and adults. A common notion however remains that 'beauty is in the eye of the beholder' and some feminist writers even dispute that beauty is an objective quality [4]. In contrast, evolutionary psychologists criticize the idea that beauty reflects some arbitrary cultural convention, such scientists note that while some aspects of judgements may reflect cultural conventions, the geometric features of the human face that give rise to perceptions of beauty may reflect universal adaptations. Human beauty standards may thus reflect culture-independent psychological adaptations reflecting mate choice characteristics (Fig. 1) [5].

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Figure 1 Beauty standards may vary between the cultures, but different ethnic groups seem to share a common attractiveness standard based upon biological rules. The faces are generated by means of digital image morphing technique and illustrate the universality of beauty without ethnic boundaries (Image courtesy: Karl Grammer, LBI for Urban Ethology).

Although beauty standards may vary between cultures and between times, several studies have shown that members of different ethnic groups share common attractiveness standards. For example, Cunningham *et al.* [6] asked males from different ethnic backgrounds to judge the attractiveness of females from same and different racial groups. Mean ratings were highly positively correlated and such ratings did not appear to be influenced by exposure to Western media. In a meta-analytic review, Langlois *et al.* [3] demonstrated that within and between cultures, raters strongly agree about who is and who is not attractive. The similarity of such cross-cultural perceptions suggests that beauty standards are innate, a view strengthened by studies demonstrating that human infants show strong preferences for attractive faces. In one such study, Langlois *et al.* [7] utilized a standard visual preference technique with infants aged 2–3 and 6–8 months old. In this method the infants were shown pairs of faces previously rated for attractiveness – an attractive face was always paired with an unattractive face. Both groups of infants looked significantly longer at the more attractive face of the two. Hence, the constituents of beauty seem to be neither arbitrary nor culture bound but may reflect underlying biological selection pressures that may have shaped these standards. The high consensus of people's judgments of facial attractiveness is consistent with the theory of biologically based standards of beauty.

Sexual selection, health and beauty

Parasites and diseases have played an important role in human evolution, as they exert tremendous selection pressures on their hosts by reducing their longevity and reproductive success. It has been known for a long time that individuals differ in their susceptibility to parasites because of genetically determined host resistance, and sexual selection for healthy partners would obviously provide choosy individuals with potentially important fitness benefits in terms of resistant offspring [8]. Parasite-mediated sexual selection may benefit choosy individuals by preventing them from obtaining mates with contagious parasites that could spread both to themselves and their offspring, obtaining mates that are efficient parents, and obtaining mates that are genetically resistant to parasites [9].

Hosts may reliably avoid the debilitating effects of parasites by evolving efficient immune defences, and the immune system in humans is one of the energetically most costly, only equalled by that of the brain. Immune defence may play a role in host sexual selection because secondary sexual characters may reliably reflect the immunocompetence of individuals [10]. Many secondary sexual characters develop under the influence of testosterone and other sex hormones. However, hormones have antagonistic effects on the functioning of the immune system [10–12], and only individuals in

prime condition may be able to develop the most extravagant secondary sexual characters without compromising their ability to raise efficient immune defences.

In the human face the basic proportions are sexually dimorphic, as male traits develop under the influence of testosterone and female traits develop under the influence of oestrogens. In the case of the broad male chin as a feature of attractiveness, the constraints seem to be known. If females want dominant males, broad male chins may signal a tendency to dominate other males. In eight different cultures, Keating *et al.* [13] have shown that males with broad chins are perceived as being those who are more likely to dominate others than be dominated (see also Ref. [14]). A broad chin could, however, also act as a handicap [15] because testosterone production might be costly due to suppression of immune function and thereby increase disease susceptibility during puberty [10]. Immunocompetence is highly relevant because steroid reproductive hormones may negatively impact immune [10]. Extreme male features, which are triggered by testosterone, thus advertise reliably that their bearer is sufficiently parasite resistant to produce them.

The causal relationship between testosterone levels and these behavioural attributes is still controversial (see review in Ref. [16]). If such relationships are valid, then the aesthetic preference of human females may be an adaptive compromise between the positive attributes associated with higher than average testosterone (health cues) and the negative attributes associated with more extreme masculinization.

The signalling value of many female physical characteristics is linked to age and reproductive condition, both of which correspond to a woman's ratio of oestrogen to testosterone. Attractive features (e.g. prominent cheekbones) correspond to high ratios and signal fertility, but oestrogen in women could be as handicapping as testosterone is in men. Thus, markers of high oestrogen may reliably signal that a female's immune system is of such high quality that it can deal with the toxic effects of high oestrogen.

Skin condition and beauty

Skin condition is supposed to reliably signal aspects of female mate value [17–19]. According

to Morris [20], flawless skin is the most universally desired human feature and human males are expected to be most sexually attracted to female skin that is free of lesions, eruptions, warts, moulds, cysts, tumours, acne and hirsutism. The absence or presence of body hair is a sexually dimorphic characteristic, and relative hairlessness and smooth skin in women may signal fertility because of its association with low androgen and high oestrogen. Females appreciate men's body hair developed under androgens, but males prefer its absence [18]. Skin infection may denote a disturbance of the production of androgen and oestrogen and reduced reproductive ability. Studies in dermatology have found a relationship between dermatoses (i.e. physiological and pathological changes that can occur in the skin, nails and hair shafts) and elevated levels of sex hormones [21, 22]. In numerous types of dermatoses in women, an increase of the level of androgens seems to be responsible for these symptoms. For example, the polycystic ovary syndrome results in an overproduction of androgens, which is clinically manifested as dermatoses in women [23].

Empirical evidence shows that women's facial skin texture affects males' judgements of their facial attractiveness, and homogeneous (smooth) skin is most attractive (Fig. 2) [24]. Males evaluate females' skin texture in addition to the characteristics of age and facial shape in judging facial beauty. Fink *et al.* [24] also found that colour parameters that indicate a light skin as well as blue and green components in a face correlated negatively with attractiveness. In contrast, saturation showed a significant positive correlation with attractiveness. The red component showed a positive but statistically insignificant correlation with attractiveness. These authors interpreted this finding in terms of the suggestion that a slightly reddish skin (indicating good blood circulation) is considered attractive and healthy. In contrast to previous studies [25], Fink *et al.* [24] did not find that men prefer women with a paler skin. The preference for dark skin may be explicable in terms of a preference for suntanned skin.

The condition of the skin surface may thus provide an indication of the quality of the immune system of the respective individual. A reduced immune defence provides the possibility of a more aggressive attack by micro- and macroparasites



Figure 2 Analysis of skin texture qualities by means of spatial grey level dependency matrices. Within the rectangle over the cheeks and nose, an enhancement filter increases contrast in the face for the subsequent calculation of homogeneity and contrast features (Image courtesy: Paul Matts, Procter & Gamble).

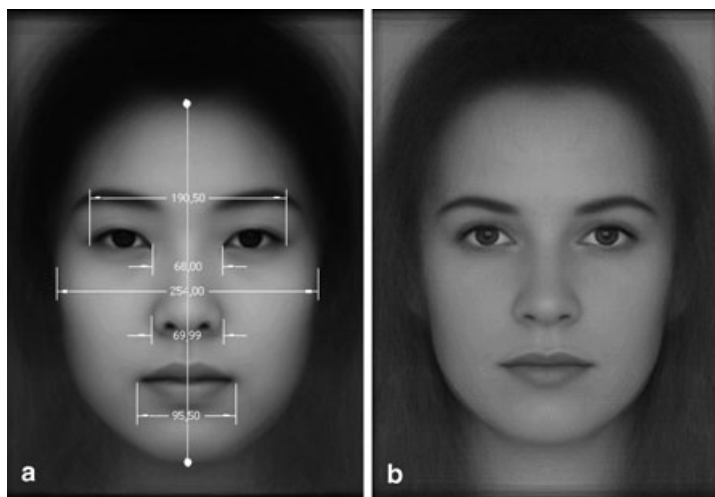
[26], which may be indicated in skin surface textures. Therefore, biologists argue that the use of makeup in modern societies may be functional and deceptive.

Facial symmetry

Besides secondary sexual characteristics and aspects of skin condition, evolutionary psychology has focused on the perception of facial symmetry and averageness, and suggested that this may underpin biologically significant assessments of mate value. Fluctuating asymmetry – non-directional deviations from perfect symmetry in morphological characters – as measure of developmental stability is thought to reflect an ability to resist the harmful effects of mutations, parasites and/or toxins during development (Fig. 3) [27]. Across species, symmetrical males have significantly greater mating success [28], and symmetrical men have been shown to be more desirable and have more sexual opportunities than asym-

metrical men [29, 30]. Symmetrical people of both sexes are reported to have greater emotional and psychological health, and symmetrical men were also found to have greater physiological health, than their asymmetrical counterparts [31, 32]. A number of studies have shown a relationship between symmetry and attractiveness leading to the conclusion that preferences for symmetric faces may have some adaptive value. However, despite the correlation between symmetry and attractiveness, it appears that human females may not use or even perceive fluctuating asymmetries when judging the attractiveness of male faces [33]. These results suggest that attractive features other than symmetry can be used to assess physical condition. Symmetry may simply covary with these other features rather than acting as a primary cue to attractiveness. It may be the case that the human preference for facial symmetry is not the result of evolved psychological adaptations, but rather is a by-product of the perceptual system's design.

Figure 3 These faces (a = Japanese, b = Caucasian) are both perfectly symmetrical as a result of digital blending of a face with its mirror image. Symmetry as a measure of developmental stability is known to be associated with beauty perception. Image (a) depicts some of the distances, which are used for measuring right-left deviations from perfect bilateral symmetry.



Facial averageness

The study of facial symmetry effects on attractiveness is closely related to another possible cue to attractiveness: facial averageness (Fig. 4). Experiments studying the effect of facial symmetry on perception suggested that preference for average trait values in some facial features could have evolved because in heritable traits the average denotes genetic heterozygosity [11]. Heterozygosity could signal an outbreed mate or provide genetic diversity in defence against parasites. Studies indicate that average faces are attractive but can be improved by the addition of specific non-average features. However, Halberstadt and Rhodes [34] found a strong relationship between averageness and attractiveness also for stimuli like dogs and wristwatches. It may be that humans have a general attraction to prototypical exemplars, and that their attraction to average faces is a reflection of this more general attraction. The contribution of averageness to attractiveness is still a matter of debate [35]. Exactly what features contribute to the averageness effect remains unclear. Most studies find that there are some faces in the tested samples that are considered more attractive than average faces [36]. The conclusion of studies focusing on the attractiveness of averaged faces is still questionable. It could be that these faces show non-average features, which are developed under the influence of sex hormones. There is now substantial evidence indicating that attractive female faces are not average, but differ from the average in a systematic manner. More specifically, they

possess a shorter, narrower lower jaw, fuller lips, and larger eyes than an average face [37, 38]. Because pubertal bone growth (brow ridges and lower jaw) is stimulated by androgens [39] and lip fullness parallels oestrogen-dependent fat deposits elsewhere on the female body [40], Johnston and Franklin [37] have hypothesized that an attractive female face may be displaying hormone markers (high oestrogen/low androgen) that serve as reliable indicators of fecundity.

Some of the discrepancy in findings among male attractiveness studies may be a consequence of differences in the participant populations. One potential source of variance is the hormonal status of female participants. Penton-Voak *et al.* [41] have shown that females' preferences for male faces changed as a function of the viewer's menstrual phase at the time of testing. Females tested during the 9 days prior to ovulation preferred a less feminized male face than females tested outside of this window. The authors interpret their findings as evidence for a conditional mate choice strategy whereby females in the high conception risk group are exhibiting a preference for male facial cues that signal adaptive heritable genetic characteristics, such as immunocompetence. Further, relatively feminine faces possibly indicate prosociality whereas more masculine faces possibly signal reproductive potential in terms of heritable benefits. Johnston *et al.* [42] also examined the facial preferences of female volunteers at two different phases of their menstrual cycle. In agreement with prior studies [41], their results suggest that women prefer more masculinized male faces

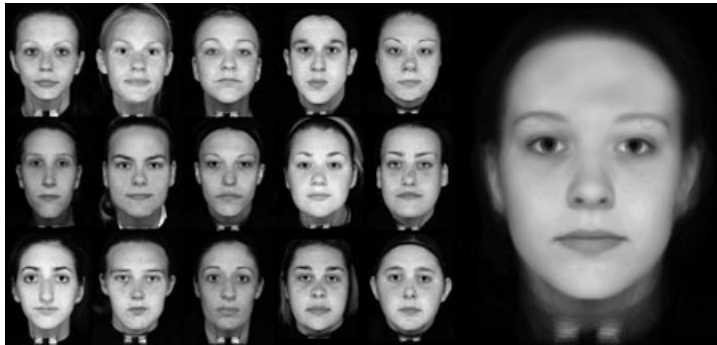


Figure 4 Computer-generated prototypical faces (composites) are known to be rated higher attractive than the single faces, which were used for generating them. Here this is illustrated with 15 single faces (left), and the resulting composite face (right) (Image courtesy: Paul Matts, Procter & Gamble).



Figure 5 Menstrual cycle alters face preference. While women tend to prefer masculine male faces (a) around ovulation, they have a preference for feminized male faces (b) at the other days of their cycle. This probably indicates an adaptive compromise between interest in males that seem to guarantee reproductive success and males perceived as 'good fathers' (Image courtesy: Victor Johnston, New Mexico State University).

around times of ovulation. That is, the attractive male face possesses more extreme testosterone markers, such as a longer, broader lower jaw, and more pronounced brow ridges and cheekbones than the average male face (Fig. 5). This finding suggests that women consider such testosterone markers, whether this is because such characters act as an index of good health and that important health considerations may underlie their aesthetic preference remains to be determined (see Ref. [43] for review). However, pronounced testosterone facial markers were considered to be associated with dominance, unfriendliness, and a host of negative traits (threatening, volatile, controlling, manipulative, coercive, and selfish).

The beauty of eyes and lips

It has been shown that the eyebrows receive the highest rank in the order of magnitude of gender information carried by parts of the face [44]. More recently Baudouin and Tiberghien [45] applied a

facial metric approach to the study of beauty and found that female facial attractiveness is greater when the face has certain features, large eyes and thin eyebrows being of prime importance. The importance of the eyes in judgements of attractiveness is known even in children. Geldart *et al.* [46] studied the influence of eye size on adults' ratings of facial attractiveness and 5-month-olds' looking times. When using realistic photographs, babies looked significantly longer at the faces with larger eyes, suggesting that a preference for larger eyes has emerged even at the age of 5 years. Other studies suggested that luminance effects of facial features might account for variation in attractiveness ratings. This effect is known and enhanced by the application of cosmetics, i.e. in order to make the female face more attractive the eyes are darkened with the use of make-up. Russell [47] confirmed this influence upon attractiveness judgements by suggesting that increasing or decreasing the luminance difference will make a face more feminine or masculine, respectively, and hence,

more or less attractive. Moreover, these effects seem to be opposite for men and women. Female faces were found to be more attractive when this luminance difference was increased whereas male faces were rated higher on attractiveness when it was decreased.

In contrast to study of the attractiveness of the eyes and eye gaze, attractiveness research has paid little attention to the lips, although they are apparently a central feature in the lower face. When they are full and well defined, they impart a sense of youth, health and attractiveness. Thin, flat lips, on the other hand, imply fragility and senility [48]. Lipsticks even determine the first impression of personality. McKeachie [49] reported that young male students rated women as more frivolous, less talkative, more anxious, less conscientious, and more interested in the opposite sex when wearing make-up than when not. This has only recently been replicated by Richetin *et al.* [50]. These authors used the Implicit Association Test to study attributions towards women wearing or not-wearing make-up and found that those wearing make-up were regarded in a more positive way and assumed to have higher professional status.

Such effects have been well known by make-up artists and cosmetic surgeons for years. But where does the obsession with having beautiful lips come from? Evolutionary psychologists consider also the shape and colour of the lips as an indicator of youth and fertility. Full lips in women are developed under the influence of oestrogens, and several other features of the face and body that indicate fertility develop under the influence of sex-steroids. There is however another interpretation for the fact that women themselves apply exclamation points to their lips. The most often used colour for lipsticks is probably red, and this is also the colour of blushes and flushes. It signals both good blood circulation and presumably also emotional arousal or perhaps even sexual excitement. By applying lipstick women therefore simply enhance the amount of natural (red) colour by exaggerating these facial characteristics men are attracted to.

Conclusion

Evolutionary psychologists widely agree that there are biological reasons for certain face preferences in potential partners. Given that evolutionary processes have shaped our psychological adaptations,

it seems likely that humans have evolved mechanisms for detecting and assessing honest cues of mate value. In this view, physical attractiveness is based upon the detection of reproductive potential in males and females. Natural and sexual selection are thought to have operated in a way that men and women who were best suited for tasks such as hunting or food gathering activities were most attractive to potential mates. Today, the face, as a permanently visible source of information still seems to signal reproductive potential and beauty, and the cosmetics industry taps into this by producing a wide range of products advertised to enhance facial characteristics in both men and women, specifically to make us look younger, healthier and more attractive. Facial features enhanced by such products are still those our ancestors have been looking at. Hence, in this view, beauty is not only 'skin deep' but rather lies in the adapted preferences of the beholder.

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