Self-perceived attractiveness influences human female preferences for sexual dimorphism and symmetry in male faces

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Exaggerated sexual dimorphism and symmetry in human faces have both been linked to potential 'good-gene' benefits and have also been found to influence the attractiveness of male faces. The current study explores how female self-rated attractiveness influences male face preference in females using faces manipulated with computer graphics. The study demonstrates that there is a relatively increased preference for masculinity and an increased preference for symmetry for women who regard themselves as attractive. This finding may reflect a condition-dependent mating strategy analogous to behaviours found in other species. The absence of a preference for proposed markers of good genes may be adaptive in women of low mate value to avoid the costs of decreased parental investment from the owners of such characteristics.

Keywords: facial attractiveness; female preference; good-gene markers; mate value

1. INTRODUCTION

Several researchers have proposed that masculinity and symmetry in human male faces may be cues to heritable fitness benefits and therefore relate to attractiveness. Masculine facial traits (large jaws, prominent brows) in males are thought to be testosterone dependent and therefore may represent an honest immunocompetence handicap (Folstad & Karter 1992), and so should be found attractive by members of the opposite gender (e.g. Grammer & Thornhill 1994). There is some evidence that masculine male faces are found attractive (e.g. Cunningham *et al.* 1990; Grammer & Thornhill 1994), however, several studies have shown that feminine faces and faces of low dominance are also attractive (Berry & McArthur 1985; Perrett *et al.* 1998). This suggests male facial attractiveness judgements may depend on more than just cues to immunocompetence ('good genes').

A second characteristic associated with male genotypic quality is symmetry. Any deviation from perfect symmetry can be considered a reflection of imperfect development. Only high-quality individuals can maintain symmetrical development under environmental and genetic stress and therefore symmetry can serve as an indicator of phenotypic quality as well as genotypic quality (e.g. the ability to resist disease; for a review, see Møller & Thornhill 1998). Studies of real faces (Grammer & Thornhill 1994; Mealey *et al.* 1999; Scheib *et al.* 1999) and recent studies manipulating symmetry (Perrett *et al.* 1999; Rhodes *et al.* 1998) provide evidence that symmetry is indeed found attractive.

In a variety of animals, it has been shown that parasites can bring about changes in a host's attractiveness and competitiveness. Parasite load generally has a negative influence on the host's mating success (e.g. Borgia & Collis 1989; Millinski & Bakker 1990). When both males and females of a species are choosy (as is the case for humans), and are attempting to avoid infected

individuals, we would expect to find positive assortative mating for parasite load (reflecting parasite immunity). Under this hypothesis males and females of high immune system quality and males and females of lower immune system quality are most likely to form partnerships (Møller 1994; Møller & Hoglund 1991). Indeed, matching for parasite load in mating pairs has been demonstrated in several diverse genera (e.g. beetles, Thomas *et al.* 1999; amphipods, Thomas *et al.* 1996; and birds, Møller 1994).

There is further evidence that the phenotypic quality of an individual affects preferences for members of the opposite gender. In three-spined sticklebacks (*Gasterosteus aculeatus*), parasites reduce the intensity of the red coloration around males' throats and females preferentially mate with males with more intense colour (Millinski & Bakker 1990). This preference is modified by the condition of the female chooser (Bakker *et al.* 1999). Females in better condition (high body weight to body size ratio) showed a greater preference for a red-throated model male and those in worse condition showed a preference for an orange-throated model male. Lopez (1999) examined how a parasite influenced female mate-choice decisions in guppies (*Poecilia reticulata*). When infected and uninfected females were presented with a choice of an attractive (high display rate, high colour intensity) and unattractive (low display rate, low colour intensity) male, uninfected females were significantly more likely to choose the attractive male over the less attractive male. By contrast, infected females were less discriminative in their choice of mates and showed no preference for the more attractive male over the less attractive male.

Why should some females not show a preference for phenotypic signs in males that provide cues to higher-quality immune systems? In certain species with bi-parental care, high phenotypic-quality males invest less in each female than males of lower phenotypic quality. For example, in male pine engraver beetles (*Ips pini*) large males are found to leave the female and her nest (i.e. stop investing) sooner than smaller males (Reid & Roitberg 1995; Robertson 1998). Robertson & Roitberg (1998) note

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that larger males had a greater potential for further reproduction than did smaller males and therefore benefited by leaving earlier. It has also been argued that, in humans, males in possession of good genes should also invest more time in seeking further mating opportunities with other females than in parenting behaviour (Gangestad & Simpson 2000). It may be adaptive for females in poor condition to show a preference for males displaying cues to relatively poor heritable parasite resistance, as the greater parental investment they may offer may be of greater benefit to them and their offspring than the heritable immunocompetence acquired from high-quality males. High-quality females may be more attracted to markers of quality in males because their own high quality means that lower parental investment (or even desertion) is less detrimental. Alternatively, high-quality males may be more willing to invest in (or not desert) high-quality females compared to lower-quality females.

Findings showing that a variety of species demonstrate condition-dependent mate choice suggested that humans might also show preferences based on condition or self-perceptions of their value as mates. Pawłowski & Dunbar (1999) use the term 'market value' to specify how much demand there is for a particular individual as a mate. High-market-value (or high-value) females should be more attentive than lower-value females to male traits, such as symmetry and secondary sexual characteristics, which are thought to be phenotypic signals linked to heritable immune system quality. Conversely, females who perceive themselves as less competitive in the mating market may lack these preferences or actively prefer cues to non-immunocompetence-related benefits in faces. Previous studies have shown that preferences for masculinity differ when judging for short- and long-term relationships in ways that are potentially adaptive (Penton-Voak *et al.* 1999*a*). In this study, we also examined relationship context. If low-value females are choosing low-value males because these males are less likely to desert or provide more investment, then differences between high- and low-mate-value women's preference should only be seen when judging for a long-term relationship (variations in parental investment should be of less concern in relationships that are not expected to last a long time).

2. METHODS

(a) *Preference for masculinity*

(i) *Participants*

Sixty-six female participants (age 16–39, mean age = 22.0, s.d. = 5.2) judged faces for a long-term relationship and 115 female participants (age 17–39, mean age = 22.4, s.d. = 5.4) judged faces for a short-term relationship. The experiment was administered over the Internet. All participants were volunteers and were selected for reporting to be heterosexual.

(ii) *Stimuli*

Attractiveness was measured by giving participants a five-point scale to rate themselves upon (1, low attractiveness; 3, average attractiveness; 5, high attractiveness). Five interactive face-sequence trials were constructed from five groups of male and female faces (one Japanese and one Caucasian, as used in Perrett *et al.* (1998), and three other groups of Caucasian faces,
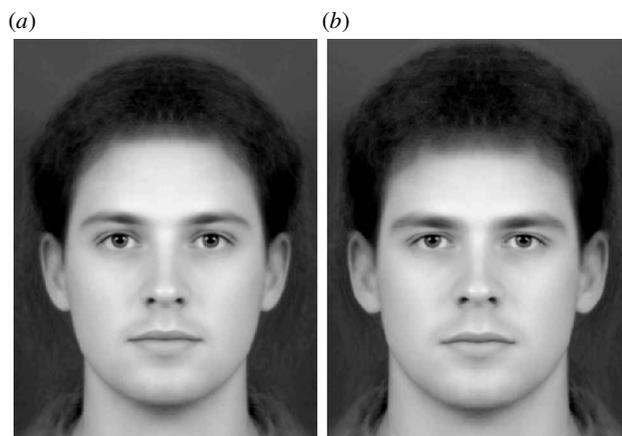

Figure 1. (*a*) 50% feminized male composite; (*b*) 50% masculinized male composite.

as used in Penton-Voak *et al.* (1999*a*); each group contributed to a single sequence.) For every sequence, 174 feature points were delineated on each face image in the group from which the average male and female shapes were calculated. Using the linear difference between feature points in the average male and female shape, a sequence of 11 face shapes ranging from +50% masculinized to +50% feminized were constructed. The 11 images in the sequence were calculated by warping, and then superimposing all of the male faces in the group into each of the face shapes. The images were made perfectly symmetrical by combining them with their mirror image prior to masculinity manipulation. Figure 1 shows an example of a masculinized and feminized male face.

(iii) *Procedure*

Participants were presented with five interactive face-sequence trials followed by an on-screen questionnaire. The face-sequence interactive trials were presented in random order with subjects being cued to make judgements based on either short- or long-term relationships by the message 'alter the face until you think it is closest to the appearance you would find attractive for a short- (or long-) term relationship'. During each trial, left or right (counterbalanced between trials) mouse movement instantly altered the shape of the face in the on-screen image making it more or less masculine.

(b) *Preference for symmetry*

(i) *Participants*

Ninety female participants (age 17–39, mean age = 21.2, s.d. = 4.5) took part in the study over the Internet. All participants were volunteers and were selected for reporting to be heterosexual.

(ii) *Stimuli*

Attractiveness was measured by giving participants a five-point scale to rate themselves upon (1, low attractiveness; 3, average attractiveness; 5, high attractiveness). The 26 stimulus pairs (previously used in Perrett *et al.* (1999)) were 13 male and 13 female face images of Caucasian individuals between 20 and 30 years. Each pair was made up of one original and one symmetrical image. All images were manipulated to match the position of the left and right eyes. Symmetrical images were warped so that the position of the features on either side of the

Figure 2. Symmetry manipulation for facial images with natural skin textures. A male face on the left and a female face on the right. (*a*) The original faces and (*b*) their symmetrical counterparts, made using the techniques outlined in the text (see § 2(b)(ii)).

Figure 3. Preference for femininity in male faces as a function of female self-rated attractiveness (± 1 s.e.). Preference was measured as the average percentage masculinity or femininity chosen from interactive continua of five faces.

face was symmetrical. An example of an original and symmetrical face can be seen in figure 2.

(iii) *Procedure*

Subjects were presented with two images of the same individual, an original and a symmetrically remapped version. The images were presented side by side on-screen and with the instructions: 'Which face is the most attractive?' and 'Please click the face which you feel is most attractive'. Clicking on one of the faces moved on to the next of the 26 image pairs. The trial order and side of presentation were randomized.

3. RESULTS

(a) *Self-rated physical attractiveness and preference for masculinity*

In line with previous findings, overall, disregarding relationship context and self-rated attractiveness, a significant preference for femininity in male faces was found (mean masculinity preference $= -7.1\%$, s.d. $= 16.0$, $50\% =$ no preference, one-sample *t*-test, $t_{180} = -2.5$, $p = 0.015$). Overall, females did not differ in the level of masculinity they chose for short- and long-term relationships (mean for short term $= -6.3\%$ masculinized, s.d. $= 16.1\%$, mean for long term $= -8.3\%$ masculinized, s.d. $= 15.9\%$, independent samples *t*-test, $t_{179} = 0.74$, $p = 0.46$). Participant age was found to be significantly positively related to a preference for masculinity in male faces (Pearson product moment correlation, $r_{181} = 0.20$, $p = 0.007$).

Participants were divided by score into low (attractiveness score 1–2, long-term $n = 13$, short-term $n = 15$), average (attractiveness score 3, long-term $n = 29$, short-term $n = 69$) and high self-rated attractiveness groups (attractiveness score 4–5, long-term $n = 24$, short-term $n = 31$). ANOVAs were conducted on the effect of self-rated attractiveness on preference for masculinity for long- and short-term partners separately. Age was entered as a
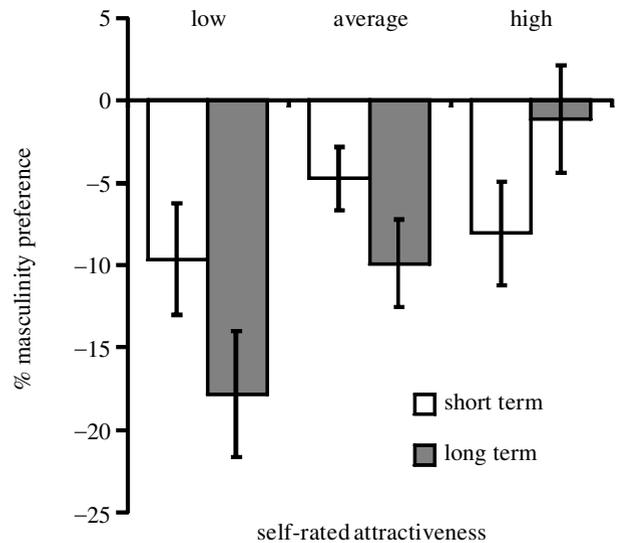
covariate because it was positively related to masculinity preference. A significant effect of self-rated attractiveness was found for masculinity preference when judging for a long-term relationship ($F_{2,62} = 4.64$, $p = 0.013$). Post-hoc comparisons using Tukey's honestly significant difference (HSD) showed that the low group significantly differed from the high group ($p = 0.004$) and the difference between the high and average groups was approaching significance ($p = 0.064$). The low and average groups did not differ significantly in masculinity preference ($p = 0.13$). No significant effect of self-rated attractiveness was found for masculinity preference for short-term relationships ($F_{2,111} = 1.0$, $p = 0.37$). The relationships between self-rated attractiveness and masculinity preference by term of relationship can be seen in figure 3.

(b) *Self-rated physical attractiveness and preference for symmetry*

In line with previous findings showing that symmetry is found attractive in faces, irrespective of self-perceived attractiveness, both male (symmetrical male face chosen 60%, one-sample *t*-test, $t_{89} = 6.1$, $p < 0.001$) and female (symmetrical female face chosen 54%, one-sample *t*-test, $t_{89} = 2.3$, $p = 0.023$) faces were found to be chosen more than expected by chance (6.5 times out of 13). Gender of face had a significant effect on preference for symmetry. Females were found to prefer symmetry in male faces more than they preferred symmetry in female faces (paired-samples *t*-test, $t_{90} = 3.2$, $p = 0.002$).

Participants were divided by score into low (attractiveness score 1–2, $n = 19$), average (attractiveness score 3, $n = 51$) and high self-rated attractiveness groups (attractiveness score 4, $n = 20$, as no participant rated themselves 5 for attractiveness and only three participants rated themselves as 1. The percentage symmetry preferred refers to the proportion of symmetrical faces chosen from a set of 13 faces. Figure 4 illustrates the relationship between self-rated attractiveness and symmetry preference.
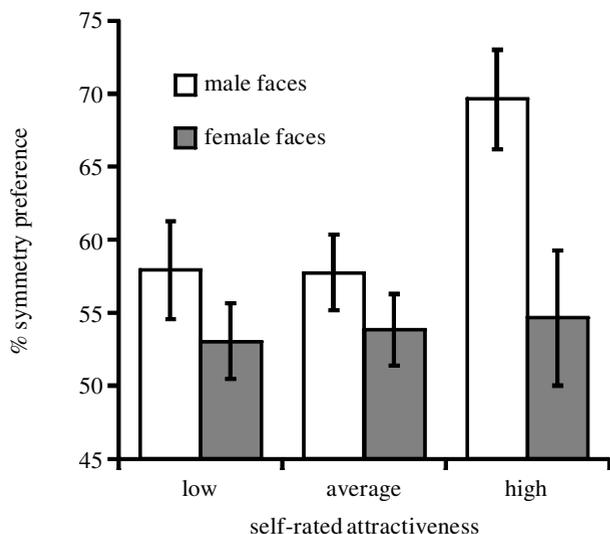
Figure 4. Preference for facial symmetry as a function of female self-rated attractiveness ($\pm$ 1 s.e.). Preference was measured as the number of symmetrical faces chosen from 13 original and symmetrical pairs and is expressed as a percentage.

ANOVAs were conducted on the effect of self-rated physical attractiveness on preferences for symmetry in male and female faces. A significant effect of self-rated attractiveness on a preference for symmetry in male faces was found ($F_{2,87} = 4.4$, $p = 0.015$). Post-hoc comparisons using Tukey's HSD showed that neither the low nor medium self-rated attractiveness groups differed in their preference for symmetry in male faces ($p = 0.66$). The high self-rated attractiveness group differed significantly from both the low ($p = 0.022$) and medium ($p = 0.005$) attractiveness groups. No effect of self-rated attractiveness was found for a preference for symmetry in female faces ($F_{2,88} = 0.11$, $p = 0.95$).

4. DISCUSSION

The current study shows that females who consider themselves physically attractive show a greater preference for two proposed markers of phenotypic and genotypic quality: facial masculinity and facial symmetry. Females who consider themselves above average in attractiveness prefer relatively more masculine male face shapes and show a greater tendency to prefer symmetry in male faces than females rating themselves as less attractive. While self-rated attractiveness is not the only measure of mate value, it correlates with other-rated attractiveness (Feingold 1988) and so does reflect one aspect of what males want in a female partner.

The increased preference for masculine faces was only seen when high-attractiveness females were judging for a long-term relationship, which indicates that the shift in preference is for long-term partners only. The finding that self-rated physical attractiveness had no influence on a preference for symmetry when judging female faces indicates that the change in preference for male faces is important only to mate choice and not to attractiveness judgements in general.

The study also replicates previous findings demonstrating overall preferences for small amounts of femininity (Perrett *et al*. 1998; Penton-Voak *et al*. 1999*a*) and symmetry (Perrett *et al*. 1999; Rhodes *et al*. 1998) in male faces. Overall, a preference for symmetry was more marked when females were assessing male faces than when assessing female faces, again indicating that symmetry is relatively more important for judgements reflecting mate choice than for attractiveness judgements in general. No difference was found in the level of masculinity desired between individuals judging for a long- and a short-term relationship, which indicates similar preferences under both conditions. This is in line with previous studies suggesting that females have similar standards for long- and short-term mates (Buss & Schmitt 1993).

Differences in mate preferences may reflect different strategies for individuals. Females of high attractiveness may attempt to maximize phenotypic quality (indicating immunocompetence) in prospective partners and females of low attractiveness may maximize reproductive success by pursuing males most likely to invest or least likely to desert. Such differences would only arise if there existed advantages to low-value females not to be as attentive to cues to heritable immunocompetence in a partner as high-value females.

Human males may also balance the prospect of seeking further mating opportunities with the amount they invest (e.g. time, resources) in each mate. Males in possession of good immunity genes may spend more time seeking extra mating opportunities relative to males who do not possess these good genes because they are more likely to be able to pursue a short-term mating strategy. Indeed, more symmetrically faced human males report more sexual partners than less symmetrically faced men (Thornhill & Gangestad 1994). Males with enhanced secondary sexual characteristics are also associated with lower parental investment. Perrett *et al*. (1998) have shown that masculinized faces are associated with the attribution of bad parenting skills. Masculine male faces are also more associated with pursuing short-term relationships than feminine faced males (Little *et al*. 2001).

If males in possession of good genes are less likely to invest in mates (Gangestad & Simpson 2000), a preference for high phenotypic quality in males in low-value females may thus be maladaptive, as the cost of selecting a low-investment male might outweigh the benefit of the good genes acquired from him. High-quality females may be either more able to cope with lower paternal investment from high-quality males (by being able to provide more investment themselves) or be able to acquire both good genes and investment from a high-quality male (if high-quality males are more likely to invest in high-quality females). The finding that attractive females are only more attentive to the good-gene markers for long-term relationships and the high cost of loss of parental care lends more support to the latter.

It is interesting to note that preferences away from the maximization of the heritable benefits of immunocompetence may be adaptive for certain individuals. Paradoxically, those males of high mate value (e.g. good genes for immunocompetence) may not have the highest mate value when being judged by females of low mate value.

Preferences based on self-perceived attractiveness also have implications for assortative mating. In humans, there are studies showing that individuals pair up with others of similar attractiveness (Shepherd & Ellis 1972), and that couples possess faces that are similar to each other (Hinsz 1989; but see Penton-Voak *et al.* 1999*b*). Recent models of assortative mating argue that organisms do not want to mate assortatively but are forced to because of market pressures: their own attractiveness limits the attractiveness of the mates they can acquire (e.g. Burley 1983; Feingold 1988; Kalick & Hamilton 1986). High-attractiveness individuals are able to acquire high-attractiveness mates and, as they pair up, less-attractive individuals are left to pair up with less-attractive mates. In this way, a species-wide preference for high-quality mates can result in a positive assortative mating pattern. This view posits that we are each trying to find the most 'attractive' mate. In this study, participants actively demonstrated a preference for different faces when the perceivers believed themselves to be of low attractiveness, which provides an alternative mechanism to explain assortative mating (although it is likely to interact with competitive factors). Indeed, Møller (1994) has argued that the matching for parasite load observed in swallows may be due to mutual mate choice based on tail length (a secondary sexual characteristic negatively associated with parasite infection). Pairing due to preferences does not preclude the possibilities that pairing can occur because those of high attractiveness pair up or that these preferences are the result of individuals learning their mate value through competition.

5. CONCLUSIONS

Females rating themselves as highly attractive are more demanding of visual characteristics associated with proposed markers of phenotypic quality in males: symmetry and masculinity. Women with high mate value may be more attracted to signs of good genes because they are better able to extract investment from high-quality males or because they are more able to cope with the lower paternal investment from such males. Women with low mate value appear not to be attracted to such high-quality masculine and symmetrical males and may be more attracted to signs of increased investment.

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