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Physical attractiveness of face and body as indicators of physical fitness in men

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Abstract

Human physical attractiveness appears to be an important signal of mate value that is utilized in mate choice We argue that performance-related physical fitness (PF) was an important facet of ancestral male mate value and, therefore, that a positive relationship exists between PF and physical attractiveness as well as mating success. We investigated these relationships in a sample of 80 young men. In line with our predictions, we found that (i) a composite measure of PF correlated substantially with body attractiveness ($r = .43$, after controlling for confounds) but not with facial attractiveness; (ii) PF was positively related to various measures of self-reported mating success ($r_S \approx .22$); (iii) the relationship between PF and self-reported mating success was partly mediated by body attractiveness. We conclude it is a key function of men's body attractiveness to signal their PF and that men's faces and bodies signal different facets of mate value.

Keywords: Physical attractiveness; Physical fitness; Sexual selection; Testosterone

1. Introduction

Physical attractiveness (hence attractiveness) plays an important role in human mate choice (e.g., Buss, 1989; Rhodes, Simmons, & Peters, 2005), a role that has been explained within the theoretical framework of sexual selection (e.g., Buss & Schmitt, 1993; Gangestad & Simpson, 2000; Johnston, 2006; Symons, 1979). From this viewpoint, the perception of attractiveness is an evolved adaptation, which promotes preferential mating with individuals of high mate value (i.e., individuals who increase their partner's reproductive success above the level expected in case of random mating).

Several aspects of ancestral life make performance-related physical fitness (PF) a likely component of ancestral men's mate value. Performance-related PF (hence PF) depends on motor skills, cardiorespiratory power, muscular strength and endurance, body composition, and other factors (Bouchard & Shepard, 1992) and largely reflects the ability to perform work (i.e., to exert power along distance). Throughout the longest time of human history, subsistence strongly depended on physical activity. Life included long walks and hunting. Physically fit men, as compared to their less fit peers, (a) could probably better care for themselves and their family without risking health-threatening overexertion (Mackinnon, 2000); (b) they were better prepared for the challenges of male-male violence ubiquitous in ancestral life (Keeley, 1996); and (c) they could use aggression more successfully to co-opt the resources of others, to elevate their own status and to protect their mates and their mates' children against violence (Buss, 2004; Smuts, 1992). Finally, (d) physically fit fathers probably bestowed this advantage to their offspring because PF has a considerable heritable component (Maes et al., 1996; Malina & Bouchard, 1989).

If PF was important to ancestral men's mate value, and if attractiveness signals mate value, then PF and attractiveness should be positively related in men. To investigate this hypothesis is our main objective. Thus far, only indirect evidence supports this hypothesis. First, Hönekopp, Bartholomé, and Jansen (2004) reported a positive relationship between facial attractiveness and PF in young women. Second, several experimental studies using line drawings

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have found female preferences for male figures with a medium body mass index and a pronounced upper body v-shape, a likely indication of a lean, muscular physique and, thus, PF (Dixson, Halliwell, East, Wignarajah, & Anderson, 2003; Furnham & Baguma 1994; Horvath, 1981; Lavrakas, 1975; but see Gitter, Lomranz, & Saxe, 1982 for conflicting results). Moreover, two correlational studies using more realistic stimuli supported these experimental results: Fan, Dai, Liu, and Wu (2005), using 3D wire frame film clips, and Maisey, Vale, Cornelissen, and Tovée (1999), using front view photographs, found male bodies with low body mass index, broad chests and small waists to be attractive for women. Third, women positively respond to faces rated high for masculinity (Cunningham, Barbee, & Pike, 1990; Koehler, Simmons, Rhodes, & Peters, 2004; Rhodes, Chan, Zebrowitz, & Simmons, 2003). Facial masculinity may indicate high testosterone levels (e.g., Johnston, 2006; Penton-Voak & Chen, 2004), and testosterone promotes muscle growth (Bhasin, Woodhouse, & Storer, 2001). Therefore, women's preference for masculine faces may indicate a preference for muscular and, thus, physically fit men.

A potential relationship between attractiveness and PF in men has not been investigated yet. Our objective is to close this gap. We also analyze testosterone, rated masculinity, upper body v-shape, body mass index, and height as potential mediators for the hypothesized relationship between men's attractiveness and their PF. Given that attractiveness has the function to promote mating with individuals of high mate value (see above), we also expect that PF and mating success are positively correlated in men and that attractiveness mediates this relationship.

2. Methods

2.1. Participants

One hundred two healthy Caucasian men from Chemnitz and vicinity participated in this study after giving their informed consent. Participants were recruited via an advertisement in a local newspaper and by leaflets distributed on the University Campus. All participants received a payment of 25€. Relationships of 2nd- to 4th-digit ratio with PF and number of sex partners in this sample have been previously reported (Hönekopp, Manning, & Müller, 2006; Hönekopp, Voracek, & Manning, 2006). Here, we report the data of all 80 men who agreed to be photographed unclothed (see below). Participants completed a questionnaire surveying age, height, weight, sexual orientation, and potential confounds of PF (smoking, alcohol consumption, drug use, and amount of exercising). Descriptive statistics are given in Table 1. Due to men's low minimum parental investment, their mating success importantly hinges on their number of sex partners (Buss & Schmitt, 1993; Trivers, 1972). Therefore, we used the following variables to assess men's self-reported mating success: lifetime number of sex partners, age at first intercourse, and number of times they had been an extra-pair copulation partner (i.e., how often another person cheated on their partner). We relied on self-reported height and weight because these have turned out to be highly accurate (Bowman & DeLucia, 1992; Imrhan, Imrhan, & Hart, 1996).

Table 1
Descriptive statistics of sample

	Mean±SD
Age (years)	22.4±1.3
Height (cm)	182±7
Weight (kg)	75.9±9.9
Body mass index (kg/m^2)	23.0±2.3
Upper body v-shape	1.38±.09
Testosterone (nmol/l)	17.9±5.2
SHBG (nmol/l)	24.7±8.7
Free androgen index	.83±.41
PF score	175±20
Exercising (min/week)	337±273
Smoking (cigarettes/d)	2.5±4.9
Drug use (% users)	18
Number of sex partners[a]	4.6±4.7
Number of extrapair copulations[a]	.6±1.0
Age at first sex[a,b]	17.7±2.2

[a] Seventy-seven exclusively heterosexual participants.
[b] Actual age was used for five inexperienced participants.

2.2. Assessment of PF

Participants' PF was assessed using the Haro fitness test (Haag 1981; see also Hönekopp et al., 2004). This gym-based test consists of six heterogeneous exercises, which require (i) running and crawling beneath an obstacle, (ii) sit ups, (iii) repeated jumps over a hurdle, (iv) push ups, (v) running and picking up items from the floor, and (vi) throwing a ball repeatedly against the wall while lying on the belly. All exercises were scored according to the test rules. Participants were tested by two male experimenters blind to the hypotheses.

2.3. Ratings of attractiveness and masculinity

For later assessment of attractiveness, three digital color photographs (face, body front, and body back) were taken from each participant. Pictures were taken from a standard distance (faces: 1.5 m; bodies: 3 m) at a resolution of 1024×1344 pixels. For the face photographs, sitters wore a bathing cap (to reduce the influence of hair style), showed a neutral expression, and faced the camera frontally. For the body photographs, 80 men agreed to pose unclothed. A brick wall served as background for the body photographs. For the face photographs, backgrounds varied slightly and were later blurred. All photographs were cropped and standardized to the same height of 520 pixels. Faces were made unrecognizable on all front body photographs.

Twenty-seven women (age 25.6±6.6 years) rated all 240 individual photographs for attractiveness (1="not at all

attractive," 7="very attractive"). Fourteen other women (age 25.1±2.9 years) did the same for masculinity (1="not at all masculine," 7="very masculine"). In agreement with previous research, we did not provide a definition of attractiveness or masculinity (e.g., Penton-Voak & Chen, 2004; Rhodes et al., 2003). Raters were approached at university campuses in Dresden and Leipzig (Germany) and received 3€ for participation. All raters reported to feel sexually attracted by men. Ratings were performed on notebook computers. In each group, half of the raters rated all face pictures first and then all body pictures, whereas this order was reversed for the other raters. The order of pictures within each block was individually randomized for each rater. We relied on ratings instead of measurements of facial masculinity because the former appear to be more valid (Penton-Voak & Chen, 2004; Rhodes et al., 2003).

2.4. Assessment of upper body v-shape

Two raters blind to all other data measured upper body v-shape (distance between armpits divided by narrowest waist diameter) from back photographs using Morph Man 2.01 software, which allows for storing the coordinates of specified points. Both measurements correlated highly (r=.97, p<.001). Subsequent analyses are based on the average of both measurements.

2.5. Hormone measurements

On the day of testing, participants provided blood samples between 8:00 and 10:00 AM. The obtained serum was aliquoted and stored at −20°C. Total testosterone and SHBG (sex hormone-binding globuline) serum concentrations were analyzed by radioimmunoassay at the Klinikum Chemnitz. The kits RIA ACTIVE TESTOSTERONE and RIA SHBG (Diagnostic System Laboratories, Webster, TX, USA) were used, following the manufacturer's protocol. The kits show interassay variabilities of <10% and <5%, respectively. All control values were within the range specified by the manufacturer. We based our analyses of testosterone on a free androgen index, which was computed as total testosterone/SHBG. Free androgen index highly correlates with free testosterone (Nanjee & Wheeler 1985).

3. Results

A principal components analysis of the six Haro exercise scores suggested a one-factor solution. The factor explained 54% of the variance, and all six exercise scores loaded high on it (see Table 2 for intercorrelations and factor loadings). This justified summing all scores into a single measure of PF, henceforth, PF. Cronbach's alpha for PF was .80.

Block order of ratings (faces first vs. bodies first) proved to be inconsequential. We thus analyzed all data together. All average ratings of faces and bodies proved reliable (Cronbach's alpha for attractiveness were: face=.89, body front=.93, body back=.96; masculinity: face=.85, body front=.93, body back=.91). If not noted otherwise, all following analyses involving attractiveness or masculinity pertain to values averaged across raters. Attractiveness ratings took little time. Median response times were 3.3 s (faces), 3.6 s (front), and 3.3 s (back) for each picture. Facial attractiveness correlated moderately with attractiveness of front (r=.34, p=.002) and back (r=.29, p=.009). Attractiveness of front and back correlated highly (r=.83, p<.001). For the sake of reporting economy, we use a single measure of body attractiveness (front attractiveness/2+back attractiveness/2) and body masculinity (masculinity front/2+masculinity back/2) in all subsequent analyses. Body attractiveness moderately correlated with facial attractiveness (r=.33, p=.003).

Table 2
Correlations between fitness subtests and their loadings on the first factor

	Test 2	Test 3	Test 4	Test 5	Test 6	Loading
Test 1	.44***	.47***	.53***	.53***	.53***	.80
Test 2		.39***	.30**	.26*	.34**	.59
Test 3			.46***	.61***	.54***	.80
Test 4				.44***	.41***	.72
Test 5					.44***	.76
Test 6						.74

*$p \le .05$; **$p \le .01$; ***$p \le .001$, respectively.

In order to identify potential effects of modern lifestyle variables on PF, we entered reported exercising time, smoking, alcohol consumption, dummy-coded drug use, and body mass index into a stepwise regression analysis to predict PF. Exercising (β=.45, T=4.4; p<.001) and smoking (β=−.24, T=2.4; p=.018) proved significant. Consequently, we report all correlations between attractiveness and PF (a) as first-order correlations and (b) to exclude potential artefacts, controlling for exercising and smoking (enclosed in brackets).

In line with our main hypothesis, we found a substantial correlation between PF and body attractiveness (r=.48[.43], p<.001[<.001]), depicted in Fig. 1. In contrast, facial attractiveness did not correlate with PF (r=.01[−.04], p=.92[.75]).

To understand which factors contribute to body attractiveness, we entered age, height, body mass index, free androgen index, rated body masculinity, and upper body v-shape into a stepwise regression analysis to predict body attractiveness. Rated masculinity (β=.78, T=12.0; p<.001) and body mass index (β=−.36, T=5.5; P <.001) proved significant. To test whether these variables might mediate the relationship between PF and body attractiveness, we also entered them into a stepwise regression analysis to predict PF. Only rated masculinity proved to be significant (β=.58, T=6.1; p<.001). As rated masculinity correlated highly with body attractiveness and with fitness, it is likely that masculinity mediated the relationship between the latter variables. Therefore, we correlated PF and body attractiveness while controlling for rated masculinity (Baron & Kenny, 1986). The relationship disappeared (r=.10[.07], p=.37[.53]). We thus conclude that masculinity, as

measured by ratings, mediated the obtained relationship between PF and body attractiveness.

Aggregated attractiveness ratings may only loosely reflect the preferences of individual raters (Hönekopp, 2006). Therefore, any relationship between aggregated attractiveness ratings (e.g., body attractiveness) and ratee properties (e.g., PF) may not hold for the vast majority of raters. However, we expect that the obtained relationship between men's body attractiveness and their PF holds for (almost) all raters individually. This is because we regard this relationship as an evolved adaptation of female preferences; hence, such an adaptation should have penetrated the relevant population (Williams, 1966). In order to test how reliably the relationship between PF and body attractiveness generalized across raters, we analyzed the 27 individual correlations between perceived body attractiveness and PF. In line with the assumption of an evolved adaptation, the correlation was positive for all [all] 27 raters. The mean of the individual correlations was .34[.30]± .14[.12] and significantly greater than zero (one-sample t test: $T_{26[26]}=13.8[13.5]$, $p<.001[<.001]$).

We restricted our analyses of self-reported mating success variables to all 77 exclusively heterosexual men. For five inexperienced participants, we entered their actual age as age at first sex. Number of sex partners and number of extrapair copulations were right-tailed and could not be normalized. We therefore used Spearman's rank correlations (r_S) to investigate the predicted relationship between PF and self-reported mating success. Thus, we could not control the effect of age on number of sex partners and number of extrapair copulations. However, due to the low variation in participants' age, the correlations between age and number of sex partners and number of extrapair copulations were negligible ($r_S=.07$, $p=.57$, and $r_S=-.02$, $p=.85$, respectively). Therefore, age added little noise to our data, and not controlling for age should be inconsequential. We obtained

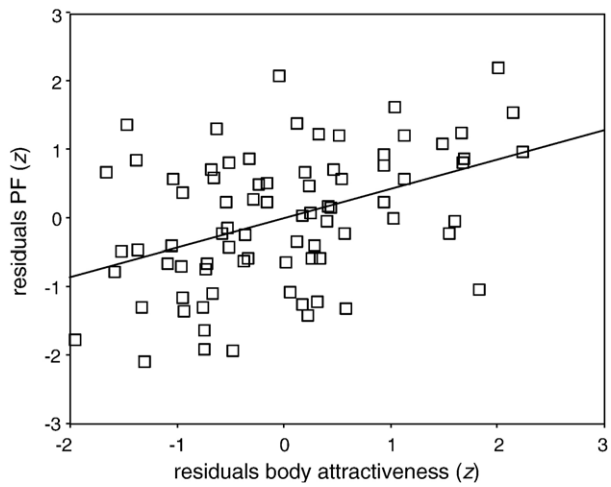

Fig. 1. Relationship between a composite measure of PF and body attractiveness (line indicating best linear fit) for 80 young men. Values are controlled for exercising and smoking.

Table 3
Spearman correlations between attractiveness and self reported mating success

Attractiveness	Number of sex partners	Age at first sex	Number of extrapair copulations
Face	.30**	−.08	.14
Body	.39***	−.09	.27*

Asterisks indicate *$p\leq.05$; **$p\leq.01$; ***$p\leq.001$, respectively.

significant correlations with number of sex partners ($r_S=.23$, $p=.042$) and age at first sex ($r_S=-.25$, $p=.030$) but not with number of extrapair copulations ($r_S=.18$, $p=.114$). We hypothesized that attractiveness may mediate any relationship between PF and self-reported mating success. In order to test this, we correlated number of sex partners and age at first sex with PF after removing the relationship between body attractiveness and PF (i.e., we entered body attractiveness into a linear regression to predict PF and correlated the residuals of PF with number of sex partners and age at first sex). The correlation with number of sex partners disappeared ($r_S=.04$, $p=.74$), whereas the correlation with age at first sex remained unaltered ($r_S=-.27$, $p=.018$). This suggests that the relationship between PF and lifetime number of sex partners was mediated by body attractiveness. Overall, body attractiveness was a better predictor of self-reported mating success than facial attractiveness (see Table 3).

The idea that male attractiveness and masculinity may be signals of high testosterone has received a lot of attention (e.g., Johnston, 2006; Rhodes, 2006). As direct evidence on these relationships is scarce, we briefly report our findings (although they are not central to our objectives). In our sample, a single morning measure of free androgen index did not correlate with facial attractiveness ($r=-.04$; $p=.75$), facial masculinity ($r=.06$; $p=.57$), body attractiveness ($r=-.18$; $p=.11$), or body masculinity ($r=-.19$; $p=.09$). Previously, Penton-Voak and Chen (2004), found a weak relationship between testosterone and facial masculinity; they also failed to find a relationship between testosterone and facial attractiveness.

4. Discussion

From a sexual selection perspective on human mating, attractiveness serves as a detector of and a motor towards high mate value (e.g., Buss & Schmitt, 1993; Gangestad & Simpson, 2000; Symons, 1979). Here, we proposed that performance-related physical fitness was an important component of ancestral male mate value and that females evolved to regard men whose faces or bodies signalled physical fitness as attractive. To test these claims, we investigated relationships between physical fitness, attractiveness as perceived by females, and self-reported mating success in a sample of young men.

In line with our main hypothesis, we found a positive relationship between a composite measure of men's physical

fitness (PF) and men's body attractiveness. This was obtained not only for aggregated attractiveness ratings but also for all 27 female raters individually. This finding is remarkable because individual attractiveness judgments reflect a strong idiosyncratic component, at least for faces (Hönekopp, 2006). Attractiveness judgments were made fast and effortless. All these facts support our argument that women's ability to perceive physically fit men as attractive is an evolved adaptation. The relationship between PF and body attractiveness was mediated by body masculinity. This supports the idea that sexual dimorphism plays an important role in human attractiveness (e.g., Johnston, 2006; Rhodes, 2006).

The obtained correlation between PF and body attractiveness is unusually high (r=.43, after controlling for confounds). In a meta-analysis of the relationships between adult attractiveness and various positive traits and life outcomes (Langlois et al., 2000), the strongest average effect size was r=.36 (for attractiveness and occupational success), which probably overestimates the correlation in the population (Hönekopp, Becker, & Oswald, 2006). The mean effect size obtained by Langlois et al. was only r=.18. The strength of the attractiveness-fitness relationship obtained here suggests that signalling physical fitness may be one of the key functions of male attractiveness. Certainly, various other facets of men's mate value are predominantly signalled by behavior and not by attractiveness (e.g., Miller, 2000). Our data do not answer the question as to how important physical fitness is relative to such other facets of male mate value (e.g., relationship commitment, creativity). Moreover, we believe that, in large parts of the world, men's performance-related physical fitness has ceased to contribute to their mate value. This is because life is hardly physically demanding in industrialized societies, levels of violence are low as compared to ancestral times (Keeley, 1996), and performance-related fitness is largely independent from health (Bouchard & Shepard, 1992).

We did not find a relationship between PF and facial attractiveness. This is surprising because such a relationship has been found in a smaller female sample before (Hönekopp et al., 2004). We can only speculate about what causes this apparent sex difference. The demands of pregnancy and lactation on the female body and intersexual selection pressure to signal fertility may limit the capability of female body attractiveness to signal physical fitness. This may have promoted a signalling of physical fitness via the face. Our finding that body attractiveness but not facial attractiveness signals men's physical fitness challenges the idea that faces and bodies signal the same aspects of mate value and thus comprise a single ornament (Grammer, Fink, Moller, & Thornhill, 2003; Thornhill & Grammer, 1998; Thornhill & Gangestad, 1999). We also found that body attractiveness was a better predictor of men's self-reported mating success than their facial attractiveness. In sum, these findings suggest that studying body attractiveness, which has received much less attention than facial attractiveness so far, can greatly advance our understanding of human mating.

We found that physically fit men had greater self-reported mating success than their less fit peers (eventhough the young age of our participants limited the variance in self-reported mating success). Although the relationship appears to be weak ($r_S \approx .20$), small effects accumulate across generations and can thus have a strong impact on evolution (Geary, 2005). The relationship between men's PF and their lifetime number of sex partners (r_S=.23) was mediated by their body attractiveness. This suggests that this relationship depends more on female choice than on intrasexual selection.

The current study is not without limitations. First, the stimuli in our study provided information different from those women can access in real life. Dynamic aspects were missing altogether. On the other hand, the full body could be viewed, which usually occurs only in intimate relationships. Overall, the stimuli may have provided less information than is accessible in real life. This would implicate that the "true" effects, being based on richer information, are even larger than those obtained here. Second, we investigated attractiveness standards only within a single culture. Thus, we cannot rule out that the preference for the bodies of physically fit men is rooted in Western culture. Some of the indirect evidence regarding physical fitness and attractiveness in men discussed before stems from Chinese participants (Fan et al., 2005). This suggests that our findings are not restricted to Western culture. Nonetheless, replications of our results in different cultures seem highly desirable.

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