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Contributions of the face and body to overall attractiveness

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Faces and bodies are thought to be signals of mate quality in humans. Most research on attractiveness has focused on faces or bodies separately, whereas our preferences have evolved based on both seen together. A fundamental requirement of studying face and body attractiveness independently is that there is no interaction between the two. This study is the first to investigate whether the interaction between rated attractiveness of the face and the body predicted ratings of overall attractiveness. We found that the face and body did not interact when an overall attractiveness judgement was made. We also investigated the independent contributions of rated attractiveness of the face and the body to ratings of overall attractiveness. Face and body attractiveness each made significant independent contributions to overall attractiveness in males and females. For both sexes, face attractiveness predicted overall attractiveness more strongly than did body attractiveness, and this difference was significant in males. The contributions of components of face and body attractiveness (symmetry, sexual dimorphism and averageness) to overall attractiveness were also examined using principal components analysis. A component associated with attractive traits in the male face, and in females both a face and body component, significantly predicted overall attractiveness. Our results validate the assumption that studying faces and bodies separately in the context of mate choice will produce biologically meaningful results and suggest that face and body attractiveness may convey potentially independent signals about an individual's mate quality.

Keywords: body attractiveness; face attractiveness; humans; mate choice

Human perceptions of attractiveness have been studied extensively, particularly in the context of mate choice (Thornhill & Gangestad 1999; Zebrowitz & Rhodes 2002; Grammer et al. 2003). Attractiveness enhances mating success in humans, suggesting that both attractive traits and preferences for those traits may be sexually selected (Rhodes et al. 2005). Evolutionary psychologists argue that perceptions of attractiveness are adaptations for finding a good-quality mate (reviewed in Thornhill & Gangestad 1999; Rhodes 2006), either because they identify high-quality individuals or because benefits can be gained by associating with attractive people because they are treated more favourably (the 'beauty is good' stereotype, Dion et al. 1972; Udry & Eckland 1984; Kalick et al. 1998). Alternatively, it has also been argued that perceptions of attractiveness evolved as a by-product of information-processing mechanisms (e.g. recognition or perception) in the brain (Enquist et al. 2002). It is also possible that these accounts are not mutually exclusive, and that both kinds of selection pressure may have shaped human preferences.

Perceptions of attractiveness have certainly evolved in the context of faces and bodies seen together, yet almost all of the research on attractiveness has investigated face or body attractiveness separately. This gives rise to two major issues that have not been addressed thus far. First, is there an interaction between faces and bodies, and second what contribution does each make to overall attractiveness? If there is an interaction between face and body attractiveness, then faces and bodies cannot meaningfully be studied separately and mate choice studies based solely on face or body attractiveness are fundamentally flawed. If there is no interaction, and the face and the body make independent contributions to overall attractiveness, then attractiveness studies based on only one of these components are valid, but more information could be gained from studying both. The size of each

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independent contribution is important. If, for example, one makes a large contribution to overall attractiveness, while the other contribution is very small, then this larger contributor may be a better focus for future mate choice studies.

Little is known about the contribution of face and body attractiveness to overall attractiveness (Henss 2000). Nothing is known about this relation in males and only two studies have examined it in females, both of which are weak methodologically (Mueser et al. 1984; Alicke et al. 1986). Mueser et al. (1984) used a small number of photographed individuals (hereafter referred to as 'models') and very few raters. They found that face attractiveness accounted for 28%, and body attractiveness 20%, of the total variance of overall female attractiveness. However, these contributions to overall attractiveness might have been underestimated because the analyses included only 15 female models and seven male raters per group (face, body or overall attractiveness). Alicke et al. (1986) used computer-manipulated images, mixing and matching faces and bodies, so the natural associations could not be examined. They combined three levels (low, medium and high) of face and body attractiveness, and had the resulting 27 images rated for attractiveness by males and females. Overall attractiveness ratings increased as face attractiveness and body attractiveness increased. While not specifically measuring the contributions of the face and the body to overall attractiveness, Alicke et al. (1986) found that overall attractiveness ratings were reduced considerably more when a highly attractive face was combined with an unattractive body, compared with an unattractive face/highly attractive body combination. This suggests that the body might be more important than the face as a component of overall attractiveness.

Our, aim in this study was to determine whether there is an interaction between face and body attractiveness when overall attractiveness judgements are made. To continue studying faces and bodies separately in the context of mate choice there must be no interaction between these two components. We also aimed to quantify the contributions of the face and the body to judgements of overall attractiveness of both females and males. We extended previous research by using unmanipulated photographs to avoid anomalies that may arise from mixing up heads and bodies (Alicke et al. 1986), and using large samples of both models and raters.

Several traits have been widely associated with attractiveness in humans, most notably symmetry, averageness and sexual dimorphism (masculinity in males, femininity in females; reviewed in Rhodes 2006). Ratings of symmetry, averageness and sexual dimorphism are significantly correlated with measurements of those same traits in faces (Rhodes & Tremewan 1996; Koehler et al. 2004; Simmons et al. 2004). Thus, ratings reflect the actual degree to which each trait is present, at least in faces. We also investigated which attractive face and body traits drive overall attractiveness judgements, by examining the associations of these attractive traits with overall attractiveness.

METHODS

Raters

Twenty-four (12 male, 12 female) Caucasian students at the University of Western Australia participated, after informed consent, in return for course credit or remuneration of travel costs. Male and female raters were aged 18–25 years ($\overline{X} \pm \mathrm{SD} = 20.1 \pm 2.6$ years, $N = 12$) and 17–27 years (18.9 ± 2.8 years, $N = 12$), respectively.

Stimuli

We obtained coloured, front-view face, body (no head) and full-length (head and body) digital photographs from the Facelab Database (School of Psychology, University of Western Australia; see Rhodes et al. 2005 for details; $N = 80$ females, 84 males). Photographs were taken under symmetric lighting conditions from a fixed distance of 190 cm. In these photographs, posers wore shorts and a t-shirt, stood with arms relaxed at their sides and adopted a neutral facial expression. Full-length and body images were presented at 450 pixels in height (width varying). Faces were presented surrounded by a black oval mask (outer dimensions 320×420 pixels) that covered most of the hair. All images were presented at a resolution of 72 pixels per inch.

Procedure

We asked participants to rate opposite-sex, full-length photographs for overall attractiveness on a seven-point Likert scale (1 = not attractive at all; 7 = very attractive). The photographs were presented in random order on a computer screen and remained visible until a response was given. Ratings of recognized individuals were removed from the data set. Inter-rater reliability was high with Cronbach alphas of 0.85 and 0.92 for male and female raters, respectively. We calculated a mean overall attractiveness rating for each individual by averaging the ratings given by each of the 12 opposite-sex raters (female models: $\overline{X} \pm \mathrm{SD} = 3.1 \pm 0.8$; male models: 3.1 ± 1.0).

Separate face and body ratings of attractiveness, masculinity/femininity, symmetry and averageness were taken from Rhodes et al. (2005).

The research was approved by the University of Western Australia Human Research Ethics Committee.

RESULTS

Table 1 shows descriptive statistics for ratings of face and body attractiveness, averageness, symmetry and masculinity/femininity.

A preliminary analysis of Pearson correlations between all variables is given in the Appendix. While numerous significant correlations were found, the following is a summary of those that are central to this study. For males, face and body attractiveness were significantly correlated with overall attractiveness but not with each other. Face and body sexual dimorphism (masculinity) were significantly

Table 1. Average values ± SE for attractiveness variables

Attractiveness variable	Males (N=84)	Females (N=80)
Overall attractiveness	3.1±0.1	3.1±0.4
Face		
Attractiveness	3.0±0.1	3.2±0.1
Symmetry	3.9±0.1	4.3±0.1
Sexual dimorphism*	4.3±0.1	3.9±0.1
Averageness	3.3±0.1	3.2±0.1
Body		
Attractiveness	3.4±0.1	3.6±0.1
Symmetry	4.3±0.1	4.6±0.1
Sexual dimorphism*	4.2±0.1	4.1±0.1
Averageness	3.5±0.1	3.3±0.1

Ratings are opposite-sex ratings, i.e. ratings of males made by females and ratings of females made by males.
*Masculinity in males, femininity in females.

correlated with each other, and face sexual dimorphism was also significantly correlated with overall male attractiveness. Face symmetry, sexual dimorphism and averageness in males were significantly correlated with face attractiveness. Male body attractiveness was significantly correlated with body averageness and body sexual dimorphism, but not body symmetry.

For females, face and body attractiveness were significantly correlated with each other and with overall attractiveness. Female face attractiveness was significantly correlated with face symmetry, averageness and sexual dimorphism (femininity). Female body attractiveness was significantly correlated with face and body sexual dimorphism, but not with body symmetry or averageness. Significant correlations were also found between overall female attractiveness and face and body sexual dimorphism.

To determine the relative contributions of the face and body to overall attractiveness, we conducted separate multiple regression analyses for males and females with ratings of overall attractiveness as the dependent variable and ratings of face and body attractiveness and an interaction term (face attractiveness × body attractiveness) as the independent variables (Table 2). Both regression models were highly significant, accounting for 35.3% ($F_{3,80} = 14.53$, $P < 0.0001$) and 41.8% ($F_{3,76} = 18.22$, $P < 0.0001$) of the variance in male and female overall attractiveness, respectively. Face and body attractiveness were both significant predictors of overall attractiveness in males and females. The interaction between face and body attractiveness did not predict overall attractiveness in either model (Table 2). Facial attractiveness was a numerically stronger predictor than body attractiveness in both sexes. Standardized betas for face and body attractiveness were compared using Cohen & Cohen's (1983) test for a difference between two independent correlation coefficients, which converts each coefficient to a Z score and compares these values. Face attractiveness was a significantly stronger predictor of overall attractiveness than body attractiveness in males, but not in females (males: $Z = 2.12$, $P = 0.033$; females: $Z = 1.08$, $P = 0.281$).

We also wanted to assess the contribution of the various rated components of face and body attractiveness to overall attractiveness. Multiple regression analyses can be limited by multicollinearity between the predictor variables (see Appendix). We therefore conducted a principal components analysis (PCA) to derive a set of independent predictor variables. Separate PCAs for males and females were conducted. We found two factors that captured face and body attractiveness, respectively. Together they accounted for 49.9% (males) and 49.4% (females) of the total variance in the variables (Table 3). The first principal component (PC1) in the male PCA was a body attractiveness factor that loaded significantly on body attractiveness, body sexual dimorphism and body averageness. It accounted for 29.7% of the variation. The second principal component (PC2) in the male PCA was primarily associated with attractive face traits and loaded significantly on face attractiveness and face sexual dimorphism. It represented 20.2% of the sample variance. Conversely, in the female PCA, PC1 was primarily associated with face traits (face attractiveness, symmetry and sexual dimorphism) and accounted for 30.4% of the variance, while PC2, accounting for 19.0% of the variance, was associated mainly with body traits (body attractiveness, symmetry, sexual dimorphism and averageness), as well as one face trait (face averageness).

These two components, along with an interaction variable (PC1 × PC2) were entered as predictors of overall attractiveness in multiple regression analyses for males and females separately. These variables combined to account for 32.2% of the variance in male overall attractiveness ($F_{3,80} = 12.6$, $P < 0.0001$) and 38.0% of the variance in female overall attractiveness ($F_{3,76} = 15.5$, $P < 0.0001$). The face component, PC2, was the only significant predictor of overall attractiveness in males. Both the face and

Table 2. Multiple regression models: face and body attractiveness as predictors of overall attractiveness

	Male attractiveness				Female attractiveness			
Predictor variable	B±SE	ß	t_{81}	P	B±SE	ß	t_{77}	P
Face attractiveness	0.608±0.107	0.517	5.67	<0.0001	0.372±0.076	0.468	4.89	<0.0001
Body attractiveness	0.287±0.111	0.235	2.58	0.012	0.346±0.101	0.322	3.42	0.001
Face×Body attractiveness	0.076±0.123	0.055	0.61	0.542	−0.031±0.097	−0.030	−0.32	0.747

Variables are centred around their means for interaction terms. Male interaction term: (face attractiveness − 3.034) × (body attractiveness − 3.429); female interaction term: (face attractiveness − 3.159) × (body attractiveness − 3.642).

Table 3. Principal components analysis of attractive traits in the face and body for males and females

	Component (males)		Component (females)	
	1	2	1	2
Face				
Attractiveness	−0.087	0.856*	0.901*	0.005
Symmetry	0.167	0.471	0.641*	−0.044
Sexual dimorphism	−0.037	0.795*	0.895*	0.084
Averageness	0.147	0.371	0.351	0.602*
Body				
Attractiveness	0.835*	0.216	0.477	0.570*
Symmetry	0.131	0.297	0.085	0.420*
Sexual dimorphism	0.790*	0.204	0.123	0.551*
Averageness	0.827*	0.048	0.142	0.602*

*For each component, variables that had loadings greater than 70% of the largest loading were considered to be significant contributors to that component (Mardia et al. 1979).

body components significantly predicted female overall attractiveness (Table 4). The interaction component did not significantly predict overall attractiveness in either males or females.

DISCUSSION

Attractiveness is important in human mate choice. However, most studies have investigated face attractiveness and body attractiveness separately, while our preferences have evolved based on the whole (face and body together). This study showed that rated face and body attractiveness contribute independently and substantially, with no interaction, to overall female and male attractiveness. For females in our study, rated face attractiveness and rated body attractiveness accounted for 47% and 32% of the variance in overall attractiveness (Table 2). These are higher than the values of 28% and 20%, respectively, obtained by Mueser et al. (1984) with a very small sample of models, consistent with our suggestion that their low sample size may have led to underestimates of these contributions. For males, rated face and body attractiveness, respectively, accounted for 52% and 24% of the variance in overall attractiveness (Table 2). Our study is the first to measure the independent contributions of the face and body to overall male attractiveness. Importantly, face and body attractiveness did not significantly interact in predicting overall attractiveness in males or females. These results are critical because they confirm and quantify the assumption that the face and body both contain independent cues to overall attractiveness. Thus, even though our preferences have evolved by viewing the whole person, overall attractiveness judgements are based on separate, unique contributions of the face and body, with no interaction between the two. Previous studies have generally studied faces and bodies separately. For example, Rhodes et al. (2005) showed that face and body attractiveness (separately) are each associated with sexual behaviour. Our study provides evidence that results such as these are biologically relevant: no interaction between face and body attractiveness means that each can be meaningfully studied independently of the other.

Surprisingly, the variance in overall attractiveness explained by the sum of rated face attractiveness and rated body attractiveness was modest (35–42%). We established that the unexplained variance was not due to an interaction between predictors. Some of the unexplained variance may be caused by differences in the presentation of the photographs. There was a notable size difference in the presentation of the face stimuli depending on whether they were presented separately or together (as a whole), i.e. the faces were much larger when presented alone on the screen than when presented as part of a whole. This allowed a more detailed assessment to be made of the face-only image, compared with the whole image. In addition, face photos were masked, with hair cues removed, whereas the whole body (head included) photos were shown with hair. It is also possible that the whole images are processed holistically, and so are more than the simply the sum of two parts (Reed et al. 2003).

Thornhill & Gangestad (1993) proposed that attractiveness preferences have evolved to facilitate the detection of a high-quality mate, favouring healthy, parasite-resistant individuals. Thus, physical attractiveness is thought to be an honest indicator of genotypic and phenotypic quality. If this is true, then our results confirm the often-held assumption that the face and the body both contain cues to mate quality in both males and females. The rated attractiveness of the face was a stronger predictor of overall attractiveness than was rated attractiveness of the body and this difference was significant for male attractiveness. This may partly be because the face is simply more salient than the body because of its important role in human social interactions, given its display of facial expressions of

Table 4. Multiple regression models: attractive traits in the face and body as predictors of overall attractiveness

	Male attractiveness				Female attractiveness			
Predictor variable	B±SE	ß	t_{76}	P	B±SE	ß	t_{71}	P
Face component	0.582±0.096	0.561	6.07	<0.0001	0.439±0.073	0.562	6.02	<0.0001
Body component	0.101±0.096	0.098	1.06	0.293	0.143±0.071	0.183	2.02	0.047
Face component body component	−0.057±0.093	−0.057	−0.61	0.541	0.060±0.067	0.083	0.89	0.376

For males the face component is PC2 and the body component is PC1. For females the face component is PC1 and the body component is PC2.

emotion, eye gaze cues to the direction of attention and lip movements associated with speech. This may be particularly relevant for women who are better than men at both expressing emotion (Palermo & Coltheart 2004) and recognizing facial expressions (Hall 1978). This finding might also be partly attributed to the fact that the bodies were clothed and the faces unadorned. If we had presented naked bodies it is possible the body contribution would have increased, consistent with Alicke et al.'s. (1986) suggestion that bodies were more important than faces when they presented faces with bodies in bathing suits. However, studies of mate choice are as much about current behaviour as they are about that of our early human ancestors. It is therefore more relevant to present clothed bodies in an experimental setting because it more accurately reflects how bodies are viewed when making present-day mate choice decisions.

Thornhill & Grammer (1999) reported a moderate association (0.30) between face and body attractiveness for a sample of female models who volunteered to pose naked. Our results extend this result to a (clothed) female student sample ($r = 0.326$), but not to a male student sample ($r = 0.134$). Thornhill & Grammer (1999) interpreted the association between face and body attractiveness as evidence that the face and body form a single condition-dependent ornament, arguing that face and body attractiveness would not be associated if they did not reflect condition. However, we suggest that a moderate association could arise from individual differences that are unrelated to condition, such as differences in grooming. Our results also suggest that face and body attractiveness are not a single ornament. If they are, then they should have loaded on the same factor in a principal components analysis, but they did not. Instead, relatively distinct face and body attractiveness components emerged from the PCA for both female and male attractiveness. Further evidence that the face and body do not form a single ornament comes from our findings that a large amount of the variance in face and body attractiveness remains unshared and that rated attractiveness of each makes independent contributions to overall attractiveness. We speculate that bodies and faces may reflect different aspects of mate quality. The body may be more responsive to lifestyle choices, such as exercise, fashion and grooming. Face structure, however, may be a more stable and honest indicator of heritable aspects of mate quality.

Symmetry, averageness and sexual dimorphism (masculinity/femininity) have each been associated with attractiveness in the face and/or body (reviewed in Rhodes 2006), but their roles in overall attractiveness judgements have not been investigated before this study. Principal components analyses of attractive traits in the face and body yielded distinct body and face attractiveness components. For males, only the face component (associated with facial attractiveness and sexual dimorphism) significantly predicted overall attractiveness, suggesting that significantly more cues were drawn from the face than from the body (specifically from masculine facial features), when a full-length male photo (face/head and body visible) was presented to females. The expression of masculine facial traits (secondary sexual characteristics) may reflect an effective immune system and resistance to diseases or parasites because hormones that are responsible for the development of these traits may compete with the immune system (Hamilton & Zuk 1982; Folstad & Karter 1992; Gangestad & Buss 1993; Rhodes et al. 2003). The male body component (comprising body attractiveness, sexual dimorphism and averageness) did not predict overall attractiveness. In contrast, rated face and body attractiveness both predicted overall male attractiveness, although face attractiveness was the stronger predictor. The use of independent face and body components, obtained by PCA, appears to have amplified this difference in contribution of the face and body to overall male attractiveness. There may also be other attractive body trait(s), not assessed in these analyses, which explain the contribution of rated body attractiveness to overall male attractiveness. A more specific measurement such as shoulder-to-hip ratio might have been a useful inclusion. Shoulder-to-hip ratio, in males, is associated directly with androgen levels and significantly associated with sexual behaviours (Hughes & Gallup 2003) suggesting that women may use this ratio in their assessment of partner choice.

For females, the face component was associated with face attractiveness, symmetry and sexual dimorphism, and the body component was associated with body attractiveness, symmetry, sexual dimorphism and averageness. The body component was also associated with face averageness. Both components were significant predictors of overall attractiveness and the interaction term was not a significant predictor. Therefore, all of the attractive traits used as variables in the female PCA (captured either by PC1 or by PC2) were used by male raters when making overall female attractiveness judgements. Symmetry, sexual dimorphism and averageness reflect developmental stability, immunohandicaps and prototypical configuration, respectively (Grammer et al. 2003) and could give males information about a female's genotypic and phenotypic quality and reproductive capability (Grammer et al. 2003; Rhodes 2006).

This study is the first to show that the interaction between face and body attractiveness does not predict overall attractiveness. This was true both for rated face and body attractiveness and for independent components of face and body attractiveness obtained using principal components analysis. Furthermore, we have shown that rated face and body attractiveness both make independent contributions to overall attractiveness. These results are important because they substantiate the often-held assumption that studying faces and bodies separately in the context of mate choice is a valid approach. To the extent that perceptions of attractiveness influence mate choice, it is overall attractiveness that drives choices. Mate choice studies that are based on only face or body attractiveness will yield biologically meaningful results, but would be improved by including both elements.

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Appendix

Table A1. Zero-order correlations between all variables

		Face				Body			
	Overall attractiveness	Attractiveness	Symmetry	Sexual dimorphism†	Averageness	Attractiveness	Symmetry	Sexual dimorphism†	Averageness
Overall attractiveness	1	0.544***	0.102	0.457***	0.203	0.304**	0.113	0.211	−0.008
Face									
Attractiveness	0.567***	1	0.247*	0.549***	0.277*	0.134	0.155	0.055	−0.018
Symmetry	0.192	0.464***	1	0.179	0.155	0.168	0.040	0.165	0.102
Sexual dimorphism†	0.534***	0.828***	0.443***	1	0.056	0.149	0.143	0.254*	−0.097
Averageness	0.177	0.224*	0.066	0.174	1	0.100	0.026	0.072	0.184
Body									
Attractiveness	0.478***	0.326**	0.146	0.339**	0.034	1	0.182	0.619***	0.537***
Symmetry	0.052	0.076	0.136	0.049	−0.119	0.116	1	0.041	0.093
Sexual dimorphism†	0.225*	−0.022	−0.141	0.152	−0.032	0.499***	-0.052	1	0.464***
Averageness	−0.012	−0.0004	0.004	0.026	0.341**	−0.003	-0.215	−0.021	1

$N = 84$ males, 80 females. Correlations for males (rated by females) are above the diagonal, and correlations for females (rated by males) are below.
*$P < 0.05$; **$P < 0.01$; ***$P < 0.001$.
†Masculinity in males, femininity in females.