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The Body and Face of Woman: One Ornament that Signals Quality?

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Evidence has accumulated in recent years supporting the hypothesis that both facial and bodily physical attractiveness in humans are certifications of developmental and hormonal health. Such evidence indicates that physical attractiveness is an honest or Zahavian signal of phenotypic and genetic quality. The hypothesis that physical beauty connotes health was first proposed by Westermarck and was discussed later by Ellis and Symons. It has been suggested that facial attractiveness in women is a deceptive signal of youth, unrelated to phenotypic and genetic quality. This sensory-bias or super-stimulus hypothesis is not supported by this study of men's ratings of the attractiveness of photographs of 92 nude women. Independent ratings of photographs of faces, fronts with faces covered, and backs of the same women are significantly, positively correlated. The correlation between the ratings of different photos implies that women's faces and external bodies comprise a single ornament of honest mate value, apparently constructed during puberty by estrogen and also probably by developmental adaptations for symmetry. Thus, women's physical attractiveness in face and body honestly signal hormonal and perhaps developmental health.

KEY WORDS: Developmental instability; Estrogen; Evolutionary psychology; Handicap principle; Hormones; Physical attractiveness; Sexual selection; Symmetry; Waist-to-hip ratio.

The salience of physical attractiveness in human everyday life in the West was well documented by the mid-1970s by research in social psychology. The physical attractiveness research boom in social psychology was set off by the study by Walster et al. (1966). On a whim, they assessed physical attractiveness, social skills, and intelligence by subjective impressions of students at the time when the students bought tickets to a dance at the University of

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Minnesota. The students were assigned randomly a date for the dance. Physical attractiveness of assigned partners was the only feature that predicted whether subjects liked their partner and wanted to date the partner again. The result was replicated and extended immediately by other researchers. Social psychologists then documented the importance of looks in human everyday life in the West. The bottom line on this vast research enterprise is that looks matter significantly whether considering how mothers treat their babies; one's job prospects, friendship and mateship opportunities, or salary; and how one is viewed by others. Attractive people get more attention and other investment from others and are viewed more positively in general. Perhaps the most robust and replicable finding in all of social psychology is that looks really matter (Jackson 1992; Jones 1996a; Thornhill and Gangestad 1993; Thornhill and Møller 1997).

The social psychologists studying physical attractiveness, however, did not ask or answer the ultimate question about the topic: Why do looks matter in the first place? Or, why are human brains designed by past Darwinian selection to infer that attractive people are more valuable social resources than less attractive people?

There were early evolutionary hypotheses about human bodily beauty. Charles Darwin (1871) himself did not attempt to explain the evolution of attractiveness judgements in humans or other animals. He assumed they existed and then he went on to emphasize their evolutionary consequences. In humans, these consequences, according to Darvin, involved the evolution of races and associated race-specific traits by sexual selection because features conferring attractiveness varied geographically in human evolutionary history. Westermarck (1921) proposed that sexual attractiveness judgements are species-typical features of human psychology that evolved by selection because attractiveness universally connotes fecundity and health, and thus attractive individuals conferred more reproductive potential on those who choose them as mates. In current terms, he was saying that physically attractive individuals have higher mate value, where value is in terms of effects of their greater fitness on survival and reproduction of mate choosers. Later, Ellis (1926) made the same suggestion as Westermarck about the evolutionary function of attractiveness judgments. Symons (1979) agreed with the importance of health and fertility in the judgments. He argued that the model proposed by Darwin, that preferences for attractiveness varied across human groups arbitrarily and thus without anchor to mate value, is incorrect. Symons also documented, as predicted by sexual selection theory, that men pay more attention to looks than women do, which has now been shown in many societies (for reviews, see Buss 1994; Grammer 1993; Jones 1996a). Symons also showed the power of female youth in men's attractiveness judgments, which also apparently is universal, as found and reviewed by Jones (1996a) (also see Buss 1994; Grammer 1993; Townsend 1998).

It is against this historical setting of a major effect of physical attractiveness on human everyday life and some interesting preliminary evolutionary hypothesizing that researchers only recently have initiated a serious effort to understand the evolution of both bodily beauty and bodily beauty judgments. This recent research emphasizes four modern sexual selection hypotheses offered to explain the evolution of attraction and attractiveness (Andersson 1994). Darwin's ideas were later extended

by R.A. Fisher and thereby made into a theory for the evolution of adaptations of attractiveness and attraction. In Fisher's view, as in Darwin's, the attractive feature connotes sexual attractiveness only and preference for the feature evolves because it leads to attractive offspring who are, in turn, preferred. The Fisherian sexual selection mechanism is sometimes called "arbitrary mate choice," because sexual selection favors features that do not correlate with fitness except in terms of attractiveness to the opposite sex. Good-genes sexual selection is a second hypothesis with a long history, it goes back to A.R. Wallace (Cronin 1991), who co-discovered natural selection with Darwin, and later was expanded by Williams (1966), Trivers (1972), Hamilton and Zuk (1982), and others. In this case, attractive individuals not only have greater mating success, but they have higher fitness in other domains, such as survival, growth development, and parasite resistance. A third hypothesis is that mate preferences evolved because they led to gaining mates who are better providers of nonheritable benefits, often called direct or material benefits (parental care, protection, avoidance of contagions, etc.). The fourth idea is sensory bias, in which mate preference arises as an incidental effect of another preference adaptation unrelated to mating and then causes evolution in the opposite sex. As an example, consider the red jungle fowl, the species ancestral to domestic chickens. The sensory bias idea would suggest that a foraging preference in females, say, for red berries, led coincidentally to hen's mate preference for red combs. The preference then would be viewed as giving rise to selection on males for redder combs and thus bright-red and larger combs, which display more red because of their size.

The good-genes and good-provider theories have been made compelling by the addition of ideas about the evolution of honest or uncheatable signals. Accordingly, it would be in the reproductive interests of all males to present themselves as healthy and fertile individuals and as good providers to females, but only the truthful males can so present themselves—because a given increment of display costs the truly fit relatively less than their less fit sexual competitors. And mate choosers are expected to be selected to only or primarily pay attention to physical traits that honestly advertise mate value. There is considerable support for honest signaling in the literature of sexual and other social signals (for review, see Johnstone 1997; Zahavi and Zahavi 1997).

Jones (1996a) favors the sensory bias theory of sexual selection as an explanation for human female facial attractiveness. Jones (1996a) shows that relatively neotenous female faces, i.e., faces that appear to be younger than the actual age of the face based on certain facial proportions—small lower jaw and nose, and large lips—are rated as more attractive by male raters from five populations. He also found that female models have neotenous faces compared to female undergraduates. Furthermore, his experimental change of facial features toward increased neoteny resulted in higher ratings. Finally, neoteny does not make men's faces more attractive. Jones's evolutionary interpretation is this: in human evolutionary history, it was adaptive for adult males to prefer youthful facial features because of the strong association between youth and fertility in adult females, and individual females who signaled supernormal youth in the face therefore had an advantage in female–female competition for desirable male mates. Men's preference for facial markers of high,

age-related fecundity was a sensory bias that selected for neoteny in female faces; neoteny is then a supernormal cue of youth, not a cue of actual phenotypic and genetic quality. Jones (1996b) does acknowledge, however, the plausibility of the hypothesis that female facial attractiveness may provide information about female phenotypic and genetic quality over and above the information it provides about age.

Other physical-attractiveness researchers agree that women's faces are attractive when they posses small lower facial features, especially gracile jaw, and large lips. However, these researchers see these attractive features as displaying, in addition to youth-based fecundity, mate value in the form of relatively greater phenotypic and genetic quality, especially through high estrogen level and accompanying low testosterone levels (Barber 1995; Cunningham 1986; Johnston and Franklin 1993; Miller and Todd 1998; Perrett et al. 1994, 1998; Symons 1995a, 1995b; Thornhill and Gangestad 1993; 1996; Thornhill and Møller 1997). These attractive estrogen-facilitated facial features also may connote nullipary because of changes in them with parity (Symons 1995a). Symons (1995b) has emphasized that he would expect selection to have favored males in human evolutionary history who perceived indicators of true mate value, not supernormal stimuli without mate value, as beautiful. Symons's hypothesis about selection reflects the criticism that arises from honest signal theory—the handicap principle (Zahavi and Zahavi 1997). Signals will evolve to be honest because selection on mate choosers to use true fitness indicators in mate choice generates selection for competitive displayers that signal honestly. Jones (1996a) discusses this criticism of his supernormal stimulus interpretation. He suggests that honest signals oftentimes will be the end result of signal selection, but that some dishonesty can creep in and be maintained for considerable periods of evolutionary time, and, in general, dishonest signals characterize human physical beauty. The counterargument to this is that reproductive stakes involved in mate choice are high, and selection will always act strongly for detection of true mate value.

There is considerable evidence for the theory that body beauty is a certification of health in that the three major categories of physical features that influence facial and body attractiveness—age markers, hormone markers, and developmental stability (indexed by body bilateral symmetry)—all pertain to phenotypic and genotypic health (Thornhill and Gangestad 1996; Thornhill and Møller 1997). In regard to age and genotypic health, a relatively youthful face or body may display relatively few negative heritable effects of senescence.

Despite theoretical arguments that honest signals are expected to be the rule and despite the empirical support for an important role of honest signals in human attractiveness and attraction, further research should consider and test the supernormal stimulus hypothesis for female facial beauty and the related hypothesis that human beauty is evolved by the Fisherian process (also see Barber 1995). The hypothesis that the quality Jones calls "neoteny" actually signals true mate value would be supported if neoteny in women correlates positively with looks (as it does) and simultaneously covaries positively with relatively high performance of women in domains other than female sexual attractiveness, such as fecundity, survival, developmental health, or immunocompetence. There is some evidence that the attractive-

ness of women's facial hormone markers (jaw and lips) correlate with developmental health measured as facial symmetry (Gangestad and Thornhill 1997). Some of the predicted relationships would need to be tested in traditional societies. Immunocompetence is highly relevant because the steroid reproductive hormones appear to negatively impact immune function (see review in Folstad and Karter 1992). Thus, markers of high estrogen may reliably signal an immune system of such high quality that it can deal with the handicap of high estrogen (see Thornhill and Møller 1997). Also, there is evidence that estrogen's by-products are toxic in the body (Service 1998). Thus, markers of estrogen may honestly signal ability to cope with toxic metabolites. Ellison (in press) has found that current estrogen levels in saliva correlate positively with conception probability across women when age is controlled and thus estrogen-based phenotypic effects may honestly signal current fertility.

Another prediction from the honest signaling idea, and the one examined in this paper by ratings of attractiveness of photographs of nude women, is that men's independent attractiveness ratings of faces, nude body fronts without face, and nude body backsides of women will be positively correlated with one another when age or other features that may affect attractiveness are factored out. That is, attractive faces are predicted to go along with attractive fronts and backs within individual women.

Adults forms of the human female breasts, buttocks, and thighs arise at puberty and adolescence under the facilitation of estrogen, and these features influence attractiveness judgments (Jones 1996a; Singh 1993). Thus, breasts and buttocks are secondary sex traits that are signals like the estrogen-facilities facial secondary sexual features mentioned previously (small lower face and large lips).

Jones argues that secondary sexual traits of women involved in attractiveness are selected to be exaggerations, i.e., dishonest signals. In the case of nonfacial features, such as buttocks, waist-to-hip ratio, and breasts, he argues that attractive expression in these features may dishonestly signal maturity. We emphasize, however, that Jones (1996a) does recognize the plausibility of the hypothesis that nonfacial secondary sex traits signal honestly. Low et al. (1987) have proposed that women's body fat storage in the breasts, hips, and thighs are deceptive signals of fecundability and lactation ability.

From the hypotheses of Jones and Low et al., there is no reason to expect deceptive signals to co-occur significantly on the same body. That is, facial attractiveness is not expected to correlate with attractiveness of the rest of the body. The hypothesis that phenotypic and genetic quality is signaled through the body, however, gives a straightforward falsifiable prediction about the correlations between attractiveness ratings of different body portions. Given that attractiveness of women is assessed by people, including men, in relation to the appearance of face, front, and back, and given that all three body portions contain evolved signals, the attractiveness of the three body portions is expected to covary positively, according to the hypothesis that beauty is a certification of an individual's phenotypic and genetic quality. According to this hypothesis, women sexually compete by allocation to the various features of the face and body that matter in attractiveness based on underlying individual differences in phenotypic and genetic quality. This hypothesis allows

for some tradeoffs between sexual signaling traits (face and buttocks) depending on society-specific factors, but even with tradeoffs, the attractiveness of the three body parts should covary positively as long as all three parts matter in attractiveness judgments.

METHODS

Nude photographs of 92 Caucasian women, ranging in age from 18 to 30 years (mean 23), were taken by Akira Gomi. The women responded to Gomi's advertisement in the *Los Angeles Times*, were paid about $50 U.S., and signed a consent form allowing their photographs to be used commercially or in scientific studies. Gomi obtained each subject's age by self-report, and body weight, height, and waist and hip circumference by measurement. Breast size was measured by Gomi as the circumference of the chest at the breasts. Waist-to-hip (WHR) of a women is her waist circumference divided by hip circumference (Singh 1993, 1995). Body mass index (BMI) of a women is her weight in kilograms divided by the square of her height in meters. BMI is the standard medical measure of degree of obesity.

Digital images of the photos were presented on a 17-inch computer screen using 4D Runtime Macintosh software for viewing by each rater. The picture were first presented individually for 5 seconds and sequentially to each rater to give the rater an overview of the photos. Immediately after this preview, each rater was presented with the photos for rating. A rater examined each photo as long as he needed for a judgment. Each rater conducted ratings privately without anyone else in the room. Photo order in presentations was randomized initially, but all raters of a set of photos saw the same order in both the preview and actual rating aspects. Rating was on a 1–7 scale of attractiveness, where 7 is most attractive and 1 is least. Opposite sex attractiveness ratings of facial photographs are known to be related positively to romantic and sexual interest in the person depicted (Grammer 1993; Quinsey et al. 1996).

Three different picture poses of each subject were rated for attractiveness: face only, front of body from head to knee with head and hair blocked out, and back from head to knee bend. The photos are of high quality and ideal for obtaining attractiveness ratings. They were standardized by Gomi for size, distance to the camera, and lighting within and across each of the three types. Facial photos are with neutral expression and faces appear to have little make-up on them. Body photos were with standardized posture (standing upright, arms extending down the sides of the body with the feet a few inches apart) and perpendicular orientation to the camera.

Each of the three sets of pictures of each subject were rated by men who self-reported their age (mean age 25 years, range 19–55) and ethnicity. Each rater rated only one of the three sets. Each set was rated by 10 men in each country; thus, there were 30 raters in Vienna and 30 raters in New Mexico. The New Mexico ratings were used to examine the cross-cultural generality of the attractiveness ratings. All Viennese raters identified themselves as Caucasian, but U.S. raters showed a mixture of self-reported ethnic backgrounds: Oriental (3), Hispanic (5), American Indian (3), and Caucasian (19).

All statistical tests reported are one-tailed when the direction of a relationship is predicted; otherwise, tests are two-tailed. $p = .05$ is used to designate statistical significance.

RESULTS

Descriptive statistics for the sample of women subjects are shown in Table 1.

The mean attractiveness ratings between the Austrian and U.S. men showed high correlations (Pearson's) for all three types of photographs: facial attractiveness, $r = .81$; front, $r = .89$; back, $r = .92$; all $N = 92$, and p (one-tailed) $< .00005$. The mean ratings of each of the three picture forms correlate significantly positively with one another for each of the two groups of raters (all $N = 92$, p one-tailed): Vienna: face and front, $r = .29$, $p = .0022$; face and back, $r = .30$, $p = .0015$; front and back, $r = .61$, $p < .00005$. U.S.A.: face and front, $r = .25$, $p = .009$, face and back, $r = .31$, $p = .0013$; front and back, $r = .67$, $p < .00005$. Thus, the correlations between the two groups of raters for each of the three picture types are similar and do not differ significantly (all p [two-tailed] $> .8$). The r or average r values for the various self-reported ethnic groups of the American raters for each of the three picture types are very similar (all p [two-tailed] $> .5$). Subsequent results are reported for Austrian and American raters combined, because it is established that high correlations exist between the two groups of raters and between the ethnic groups of Americans, and correlation coefficients for picture types are not significantly different. The combined ratings of the three sets of pictures are as follows: face and back, $r = .33$, $p = .0006$; face and front, $r = .30$, $p = .002$; back and front, $r = .67$, $p < .00005$. The latter correlation is significantly greater than the former two correlations (both $.025 < p$ [two-tailed] $< .05$).

Correlations between attractiveness of the three types of photos and breast size, age, BMI, WHR, and waist and hip circumference are shown in Table 2. Facial attractiveness ratings show negative but insignificant correlations with BMI, and breast, waist, and hip size, and a small, insignificant, positive correlation with WHR. Frontal attractiveness ratings are significantly, negatively related to BMI and

Table 1. Sample Statistics

Variable	Mean ± SD
Height (cm)	166.74 ± 6.64
Weight (kg)	53.81 ± 5.28
Age (years)	23.02 ± 2.55
Breast size (cm)	88.57 ± 4.64
Hip circumference(cm)	89.88 ± 4.70
Waist circumference (cm)	64.32 ± 4.02
Waist-to-hip ratio	.72 ± .04
Facial attractiveness	3.94 ± .80
Front attractiveness	3.77 ± .85
Back attractivenss	3.64 ± 1.12
Body mass index	19.36 ± 1.70

$N = 92$ women.

breast and waist sizes, and marginally with WHR. Back attractiveness shows significant negative correlations with BMI, breast size, WHR, and waist size. Age is not significantly correlated with facial, front, or back attractiveness, presumably because of the relatively narrow age range in the sample. We examined waist and hip circumferences in addition to WHR because it has been suggested that waist and hip size may confound the relationship between WHR and body attractiveness reported by Singh (1993, 1995) (see Tassinary and Hansen 1998). The correlations we found between waist circumference and front and back attractiveness ratings were larger, but not significantly larger, than the correlations between WHR and the same ratings.

Partial correlation analysis was used to determine if the significant correlations between attractiveness ratings of the three picture poses reported would remain significant when potential confounds known to influence attractiveness in this or other studies are statistically controlled. Face and back attractiveness are significantly, positively correlated when WHR, age, and BMI are partialled out (partial $r = .30$, $.0015 < p$ [one-tailed] $< .0025$). The results are virtually identical when waist and hip sizes are both included as a substitute for WHR in a partial correlation analysis. Face and front attractiveness are correlated (partial $r = .27$, $.006 < p$ [one-tailed] $< .01$) with WHR, age, BMI, and breast size partialled out. The partial correlation is identical when waist and hip sizes replace WHR. Breast size is controlled because it is a significant predictor of frontal attractiveness, as mentioned. Back and front attractiveness are correlated (partial $r = .60$; p [one-tailed] $< .0005$) with WHR, age, BMI, and breast size controlled, and the same partial r is found with waist and hip sizes replacing WHR.

Partial correlation analysis had little effect on the relationships between face and back, face and front, and back and front. None of the zero-order correlations and their respective partial correlations are statistically (two-tailed) significantly different (all $p > .5$). The partial correlations of face and back and face and front are not significantly different (both p [two-tailed] $> .5$). However, both these relationships are significantly smaller than the correlation of back and front (p [two-tailed] $< .05$). As expected, when these data were subjected to multiple regression analysis, essentially identical results are found.

Table 2. Correlations (r) of Traits with Attractiveness Ratings of Viennese and American raters

	Facial attractiveness	Front attractiveness	Back attractiveness
Age	−.079	.037	−.064
Body mass index	−.168	−.349	−.525
		($p = .0003$)	($p < .0001$)
Breast size	−.149	−.215	−.292
		($p = .035$)	($p = .002$)
Waist-to-hip ratio	.013	−.162	−.242
		($p = .067$)	($p = .009$)
Waist	−.050	−.277	−.366
		($p = .007$)	($p = .0003$)
Hip	−.072	−.158	−.178
		($p = .132$)	($p = .09$)

All $N = 92$.

DISCUSSION

There is similarity among men in attractiveness judgments of women's faces and nude bodies. There is a sizable literature of cross-cultural studies of facial attractiveness judgments that shows significant correlations in these judgments across societies (reviewed in Cunningham et al. 1995; Jones 1996a; Jones and Hill 1993). Thus, the cross-cultural facial results in this study are not any surprise or novelty. To our knowledge, however, attractiveness ratings of bodies across cultures using photographs have not been conducted before. Singh (1993, 1995) has found evidence that, cross-culturally, there is a higher aesthetic value placed on low, rather than high, WHR values of women (but see Tassinary and Hansen 1998). Singh used line drawings of women's bodies in which WHR was varied. The men in our study (30 Austrians and 30 Americans) rated high-quality computerized photographs of nude, young women (18–30 years old). The Austrian men were ethnically identical by self-report, but the New Mexico men reported ethnic diversity. The men in the two groups ranged in age from 19–55 years old. Despite this variation in ethnicity and age, independent rating of the back views ($r = .92$), front views ($r = .89$, face and head masked), and face only ($r = .81$) showed high correlations between American and Austrian men, and American patterns did not differ significantly on the basis of ethnicity.

This similarity among men suggests that men have a preference for a rather narrow range of overall body and facial type in a potential mate. We predict that the ratings of these pictures would be significantly correlated across all human societies and that the correlation would be significant in both sexes and across age groups (juvenile, young adult, old adult) within any society. Although people are predicted to see women's physical attractiveness similarly, men are expected to see it in relation to sexual interest and romance, women in relation to social allies and sexual competitors, and children in relation to social allies. Thornhill and Gangestad (1993) proposed that human physical attractiveness is a an honest or Zahavian signal of phenotypic and genetic quality. Accordingly, they argued that people everywhere will value physical beauty in mates and other social allies and in relatives. There are voluminous data for physical attractiveness positively affecting mate choice decisions and motivations to form other social alliances and increasing support for bodily beauty being a significant factor in social cognition related to nepotism (Thornhill and Furlow 1998; Thornhill and Gangestad 1993, 1996; Thornhill and Møller 1997).

We conclude that men, in general, see women's bodies similarly in terms of physical attractiveness. We emphasize that an important factor affecting cross-cultural attractiveness judgments is the BMI, the standard medical measure of obesity in the West. As Anderson et al. (1992) have shown, body fat is attractive in societies in which food resources are limiting and not storable. In this study, the rating of all three picture forms (face, back, and front) is negatively correlated with the BMI, and front and back attractiveness significantly so, as anticipated for Western societies in which most women have access to plenty of calories. This is not so imply that these men saw thin women as most attractive. The most attractive women had consider-

able hip and thigh fat and resemble the female form in the intermediate body fat drawings of Singh (1993). Breast size is significantly, positively correlated with body weight ($r = .33$, p [two-tailed] $= .001$) in this study. Breast size is negatively correlated with attractiveness in all three picture types (insignificantly in faces), presumably because of the positive correlation of breast size with weight. Age of a woman is not a predictor of attractiveness in this study, probably as a result of the limited age range of the women.

Although we predict that attractiveness ratings of each of the three picture types (face, back, and front) will show significant correlation across human societies, we also would predict more specifically that between-society correlations of each of the two body photos would be reduced where body fat highly predicts health, youth, and high status. D. Symons (personal communication, September 1998) feels that such an ecological setting would potentially eliminate the intersociety correlation for front or for back. We are suggesting that the correlation will weaken but remain significant when fat honestly signals health, youth, and status.

WHR and waist and hip circumference are negatively related to frontal and back attractiveness, and waist and WHR show the strongest relationships. WHR and waist and hip sizes do not significantly predict facial attractiveness. If WHR is a general marker of phenotypic quality, as suggested by Singh (1993, 1995), there should be a significant negative relationship between it and other attractiveness scores. More research is needed on the relationship between WHR and waist and hip sizes and body and facial attractiveness.

Beyond the cross-cultural similarity of ratings, a second major finding in this study is the correlation in attractiveness between the three types of women's pictures when the picture types are independently rated by different men. To our knowledge, this is the first report of this pattern. The ratings of the three types of pictures correlate positively and significantly with one another in the Austrian as well as the American ratings. In the two sets of ratings combined, back and front ratings correlate significantly higher ($r = .67$) than face and back ($r = .33$) or face and front ($r = .30$). Similar results are seen in each of the two regional ratings. Similar correlation statistics are found when age, BMI, and other variables are controlled. Thus, to a significant extent, attractive faces, backs, and fronts covary within individual women, but this pattern is not perfect, especially when considering facial attractiveness as a predictor of front and back attractiveness ratings.

Some of the discordance in ratings of facial attractiveness among raters may arise from variation in use of facial make-up, if men's attitudes about women's use of make-up is variable. Dissimilarity among ratings of body pictures may arise from differences in men's socioeconomic backgrounds and thus their priority of female fat deposits on the body. Cunningham et al. (1995) have emphasized that lower socioeconomic men give relatively higher aesthetic value to female body fat. Not knowing the socioeconomic backgrounds of our raters, we cannot test for an effect of this variable on disparity in men's judgments of the three poses. Overall, our raters are college students. There may be, however, some variation in socioeconomic background. Also, among male college students, there may not be enough socioeconomic diversity to give a valid test of its effect on the judgments.

That attractiveness ratings of women's faces, backs, and front correlate positively suggests that the adult female body form is, to an important extent, a single sexual advertisement or ornament. The term "ornament" here follows the definition in the general sexual selection literature (e.g., Andersson 1994). An ornament is an elaborate trait that functions in competition for mates. On initial inspection, such traits often seem to have no functional significance other than attractiveness to the opposite sex (e.g., the peacock's tail). On study, however, ornaments often are found to function in honest signaling of phenotypic and genetic quality. Across single-ornament bird species, there is evidence that the ornament typically is a reliable signal of individual phenotypic condition, but in multiple-ornament bird species, condition is less tightly tied to ornamentation (Møller and Pomiankowski 1993). We propose that features of women's face and external body, both back and front, collectively comprise a single ornament that honestly signals hormonal health and associated variables, such as immunocompetence and possibly developmental health as well.

The effects of estrogen in development of the signal-related secondary sexual features of women's faces and bodies would give rise to a consistent external signal throughout the face and body. The view that women's bodies tend to be a single sexual ornament is supported by the endocrinological knowledge that estrogen facilitates the development of the adult female face, waist, hips, buttocks, and thighs during the same general period of the life history (puberty/adolescence) (Johnston and Franklin 1993; Singh 1993; Symons 1995a; Thornhill and Gangestad 1996). The influence of estrogen in building the adult female fat deposits in the buttocks and thighs, WHR, breasts, and lips is well established (see references just cited). Also, estrogen apparently facilitates the maturation of the facial bones, which affects lower face length and jaw size in women, features that show sexual dimorphism in humans. Estrogen apparently caps the growth of certain facial bones in a way similar to its growth-capping effect on long bones at puberty. Female facial bones that are known to influence female facial attractiveness judgments (e.g., mandible) grow at puberty much less than other bony structures involved in the pubertal growth spurt (Baughan et al. 1979). [For a discussion of estrogen's effects on nonfacial bones, see Carani et al. (1997)].

Research continues to indicate that estrogen effects in the phenotype honestly signal health. Steroids are known to negatively affect immunocompetence (Folstad and Karter 1992; Thornhill and Møller 1997). Estrogen is strongly implicated in certain female cancers (Ellison, in press), suggesting that it interferes with homeostasis of the body. Furthermore, estrogen metabolites may be general metabolic toxins (Service 1998). A beautiful female body and face would seem to imply an inherent ability to deal with the devastating effects of the high estrogen required to make the estrogen-related beauty during development. Although a beautiful female body and face would indicate adequate estrogen for ovulation and reproduction, it appears that female bodily beauty signals phenotypic and genetic quality overall or at least these qualities in domains related to survival, disease resistance, and developmental health.

One body-wide single signal does not rule out the possibility of tradeoffs among parts of the signal during individual women's development. This is, if signal-

ing with attractive buttocks wins more female sexual competitions than signaling with faces, but faces still matter, and if this has been a consistent features of human evolutionary history, then developmental tradeoff mechanisms might have evolved. Jones (1996a) presents evidence for some cross-cultural variation in the relative importance in attractiveness judgments of breasts versus buttocks and thighs. Steatopygia might reflect such a tradeoff in estrogen effects. Large fat deposits on the buttocks and thighs may honestly signal resource accrual and thus the ability to ovulate and lactate, or they may signal a digestive system free of parasites that interfere with fat transport from the digestive system, as apparently is the case for certain colors in male bird ornaments (Gray 1996). If female–female sexual competition is won primarily by buttocks, selection would favor the ability to divert estrogen effects to the buttocks and away from other estrogen-based parts on the sexual signaling system, such as the face and breasts. Tradeoffs among estrogen-facilitated parts may be one factor that reduces the correlations in attractiveness ratings between faces and the other two photo poses of individual women.

That facial attractiveness ratings correlated with rating of the front (without head) and back picture poses across women implies that all poses carry some of the same information. We have focused on the role of hormone-dependent bodily and facial markers in this regard. Empirical studies show that developmental stability or symmetry, and thus developmental health, is important in attractiveness ratings of women's faces and breasts [see discussion of various studies in review by Møller and Thornhill (1998)]. There is considerable evidence that developmental stability marks fertility and hormonal and general health in women (Thornhill and Møller 1997). Thus, like hormone signals, developmental stability signals have a positive relationship to performance under natural selection.

The hypothesis of Jones (1996a) [also Low et al. (1987)] that women's facial attractiveness is a supernormal stimulus of youthfulness without any mate value other than attractiveness to the opposite sex does not seem to predict the existence of positive correlations between attractiveness ratings of the different parts of the same women. Specifically, the hypothesis suggests that attractive expression of nonfacial body signals of women, such as breasts and buttocks, are deceptive exaggerations of maturity, not neoteny. It does not seem reasonable, therefore, to expect the cooccurrence of neotenous and mature physical features in individual women. Only the hypothesis that women vary in phenotypic and genetic quality and that this variation is manifested honestly to a significant extent throughout the external body and face in women's sexual competition can easily account for the positive covariance between ratings of face and different body points. D. Jones (personal communication, September 1998) suggested that positive covariation of attractive features within individual women potentially could arise from positive assortative mating for attractiveness, and regardless of whether signals are deceptive or honest. We emphasize, however, that the honest signal hypothesis requires the result of within-female covariation, whereas the sensory bias hypothesis might only be able to incorporate the covariation under certain conditions of assortative mating. Also, the sensory bias hypothesis is a less parsimonious explanation for covariation within females in attractiveness because of the evidence that face and body attractiveness reflects hormonal and developmental health and thus phenotypic and genetic quality.

D. Symons (personal communication, August 1998) suggested that the covariation in attractiveness ratings of the different poses of the same women might be explained as a result of facially attractive women exercising or dieting more than facially unattractive women. In this scenario, positive feedback connected with facial attractiveness results in facially attractive women creating their attractive bodies through exercise and diet. This may account for some of the effect we found, but it is unlikely to be a complete explanation because of the evidence that face and body attractiveness reflects phenotypic and genetic quality. As Symons points out, attractive women are predicted to engage in more mating effort in the form of face and body upkeep than are unattractive women. The honest signal hypothesis predicts that the correlation we found will exist when exercise and dieting effects are controlled (e.g., in a partial correlation analysis).

There are numerous additional predictions of the hypothesis that women's beauty is an honest signal of phenotypic and genetic quality that could be examined in future research. We mentioned in the introduction this hypothesis' prediction that women's beauty will be correlated with health and survival in the natural human environment. The study by Kalick et al. (1998) of the relationship between facial attractiveness rated from pictures and health records of urban Californians does not show a significant relationship, perhaps because the availability of modern medicine and abundant nutrition disrupt the pattern that has existed consistently throughout human evolutionary history. Kalick et al. (1998) and Grammer and Thornhill (1994) have shown that attractiveness ratings of facial pictures are positively correlated with health attributions to the pictured people by raters, which implies, as predicted, that humans infer health from attractiveness. We predict that studies of immune function itself, rather than health records or survival, will yield positive relationships between attractiveness and immunocompetence, even in modern societies. Møller et al. (in press) have shown by meta-analysis that variation in immunocompetence among individuals is a much better predictor of sexual ornamentation in a wide variety of vertebrates and invertebrates than variation in current level of parasitism. This was predicted by Møller et al. because investigators interested in sexual ornaments often study one or a few parasites that are conveniently assessed. There is no reason to suspect that parasitological studies so conducted, or human health histories in the study by Kalick et al., examine theoretically relevant parasite species. Immune function, on the other hand, is unquestionably a theoretically relevant variable, as it certainly relates to defense against important diseases, whatever they may be in recent evolutionary history.

The sensory bias hypothesis may be primarily valid as a concept to explain the evolutionary origins of mate preferences. It cannot explain, however, mate preference adaptations that are designed by historical selection for choosing mates of genetic and phenotypic quality. It is reasonable to hypothesize that jungle fowl hen's preference for mates with a large, red comb may have originated as an incidental effect of an adaptation for choosing red food items. It is not reasonable to suggest that hen's current preference for red combs is an incidental effect of any adaptation because of the evidence that hens have a special-purpose preference adaptation for assessing comb color as a potential mate's health and thereby obtaining a healthy father for offspring (Ligon et al. 1990; Zuk et al. 1992). Additional research on

women's facial beauty could focus on obtaining more data on information that men process in facial attractiveness judgments. The honest signal hypothesis, as outlined herein, predicts that information about health (hormonal, developmental, and immunological) will be fundamentally important in these judgments. The sensory bias hypothesis predicts that markers of youth will be the key variables and any effect of health is spurious. Data to date support the honest signal hypothesis [see reviews in Thornhill and Møller (1997) and Møller and Thornhill (1998)]. The honest signal hypothesis does not have a prediction about age effects in the judgments. It predicts that among prepartum, 21-year-old females, men's attractiveness judgments of their faces and bodies will focus on information about health. Thus, when age effects and parturition effects are controlled, men are predicted to use indicators of phenotypic and genetic quality in physical attractiveness judgments.

An honest signal hypothesis dealing with age effects in attractiveness judgments also should be developed. We would anticipate that age-related cues in attractiveness judgments are those cues that reliably correlated with fertility in females in human evolutionary history [also see Symons (1979, 1995a)]. That is, age or youth per se does not affect men's sexual attraction. Instead, the cues involved are tied causally to fertility in evolutionary historical settings. This perspective would predict that men's conceptions of age and physical beauty are distinct.

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