Do facial structural characteristics communicate information about health?*

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High levels of sex hormones may lower immunocompetence, making it difficult for a person's body to fight off infections. Facial characteristics that reveal high levels of sex hormones might signal the presence of a robust immune system. In men, high testosterone levels are associated with prominent cheekbones, wide jaw, and long chin. In women, high estrogen levels are associated with prominent cheekbones, narrow jaw, and short chin. We examined whether facial features associated with immunocompetence positively covary with health. Participants from 2 groups of university students (67 women, 34 men, in total) completed daily measures of psychological, emotional, and physical health over a one-month period. Physiological fitness was assessed via cardiac recovery time following exercise. A facial photograph of each participant was rated along several personality dimensions, activity level, and attractiveness. Using the photographs, we measured participants' jaw width, chin length, and cheekbone prominence. Results provide unimpressive evidence for the hypotheses that (1) women displaying an estrogenized face and (2) men displaying a testosteronized face are physiologically, psychologically, and emotionally healthier. Discussion highlights directions for future work on whether facial structural characteristics might communicate information about underlying health.

Keywords: human face, health, evolutionary psychology

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* We thank David Funder, Steve Gangestad, Charles Snowdon, Don Symons, Randy Thornhill, and two anonymous for many helpful comments on earlier drafts of this paper. Data collection for this study was supported, in part, by Research Scientist Development Award KO1-MH00704 and grant RO1-MH42057 from the National Institute of Mental Health. We thank Jody Randall and Stephen Owens for help with data collection, coding, and entry.

ISSN 1387–5337

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A growing empirical literature indicates that beauty is *not* in the eyes of the beholder. Perceptions of physical attractiveness are consistent across different social and racial groups, and across cultures, particularly when judgments of attractiveness focus on relatively less manipulatable features such as the structural characteristics of the face (e.g., Bernstein, Tsai-Ding, McClellan, 1982; Cunningham, 1986; Cunningham, Barbee, & Pike, 1990; Cunningham, Roberts, Barbee, Druen, & Wu, 1995; Maret & Harling, 1985; Morse, Gruzen, & Rice, 1976; Symons, 1995; Thakerar & Iwawaki, 1979).

The cross-cultural consistency of perceived facial attractiveness includes reliable differentiation of the attractive male and female face along several distinct features. Space limitations prevent a complete review of the complicated and not well understood relationships between hormone levels and facial structural features (see Behrents, 1990; Farkas, 1981; Merow & Broadbent, 1990; Tanner, 1978). Although the specific mechanisms by which the observed relationships between hormone titers and facial structural characteristics emerge are not well understood, these relationships nevertheless are apparent in the literature (see below). In what follows, we present a brief review of the relevant literature that helped to inform the current research.

Human facial bones develop differentially by sex at puberty in the areas of the cheekbones, jaw, and chin (Behrents, 1990; Farkas, 1981; Merow & Broadbent, 1990; Tanner, 1978; and see reviews in Johnston & Franklin, 1993; Johnston, Hagel, Franklin, Fink, & Grammer, 2001, and Symons, 1995). These structural features of the female face increase in size proportionate to body size. For pubescent boys, high levels of testosterone are associated with dramatic increases in the sizes of the cheekbones, jaw, and chin. High levels of estrogen, in contrast, are associated with diminished growth of cheekbones, jaw, and chin in pubescent females. Women with lower levels of estrogen therefore tend to develop larger cheekbones, a wider jaw, and a longer chin. In women with higher estrogen levels, prominent cheekbones are produced by default as the face is "estrogenized." High levels of estrogen are associated with diminished outward growth of the midregion of the female face, the region from brow ridge to the base of the nose. This produces cheekbones that appear prominent relative to the smooth, flat, now estrogenized midregion of the face. The midregion of the male face, in contrast, continues to grow outward, with the cheekbones growing disproportionately larger. The upshot is that, in pubescent human females, high levels of estrogen are associated with prominent cheekbones, a narrow jaw, and a shorter chin. In pubescent human males, high levels

of testosterone are associated with prominent cheekbones, a wider jaw, and a longer chin (Behrents, 1990; Farkas, 1981; Merow & Broadbent, 1990; Tanner, 1978; and see reviews in Johnston & Franklin, 1993; Johnston et al., 2001, and Symons, 1995).

The features that are associated with high estrogen in women and high testosterone in men are cross-culturally perceived as sexually attractive by members of the opposite sex. The attractive female face displays a smaller jaw and chin and more prominent cheekbones, whereas the attractive male face displays prominent cheekbones and a larger jaw and chin (Cunningham, 1986; Cunningham, Barbee, & Pike, 1990; Cunningham, et al., 1995; Johnston & Franklin, 1993; Grammer & Thornhill, 1994; Symons, 1995). These facial structural features are secondary sexual traits (Grammer & Thornhill, 1994; Thornhill & Gangestad, 1993).

There may be a link between resistance to infection and human secondary sexual characteristics displayed in the face (Grammer & Thornhill, 1994; Thornhill & Gangestad, 1993). High levels of sex hormones such as testosterone and estrogen may lower immunocompetence, which makes it difficult for the person to fight off parasitic infections (Folstad & Karter, 1992; Hamilton & Zuk, 1982; Hausfater & Thornhill, 1990; Wedekind, 1992; Zuk, 1992). The weight of the evidence suggests that, at high levels, sex hormones often — but not always — have immunosuppressive effects. Some research suggests that at normal to moderate levels, testosterone, estrogen, and other steroids can positively influence immune responsivity (e.g., Ahmed et al., 1999). To further complicate this picture, the nature of the relationships between steroid titers and immunocompetence varies with factors such as nutrition, and with the specific hormones, immune sub-systems, and pathogens investigated. These issues are reviewed in Ahmed and Talal (1990), Folstad and Karter (1992), Grossman (1985, 1989), Lahita (1990), and Schuurs and Verheul (1990).

If high levels of sex hormones weaken the immune system, then facial characteristics that are associated with high levels of sex hormones might signal the presence of a robust immune system (Folstad & Karter, 1992; Grammer & Thornhill, 1994). Prominent cheekbones, a wide jaw, and long chin are sexually attractive when displayed by a male face because they may signal an immune system that is strong enough to withstand the high levels of testosterone associated with these characteristics. Similarly, prominent cheekbones, a narrow jaw, and a short chin are sexually attractive when displayed by a female face because they may signal the operation of an immune system that can function effectively even under the high levels of estrogen associated with these features.

According to the parasite theory of sexual selection (Hamilton & Zuk, 1982; Zuk, 1992; reviewed in Cronin, 1991), "mate choice decisions include medical examinations of potential mates, and parasite-resistant organisms are preferred because they produce genetically resistant offspring or provide better parental care to the offspring" (Grammer & Thornhill, 1994, p. 233; for a broader review of the human mate selection literature, see Buss, 1994).

A few investigators have examined the social-perceptual consequences of particular facial structural traits. People attribute psychological, emotional, and physiological health to women with faces displaying prominent cheekbones, short chin, and narrow jaw (Cunningham, 1986; Grammer & Thornhill, 1994; and see Eibl-Eibesfeldt, 1989, for a review of related work on the communicative value of facial features and expressions). Cunningham (1986) found that women with estrogenized faces, compared to those without the associated features, were judged by men to be more intelligent, more sociable, more assertive, more fertile, and likely to have fewer medical problems. Grammer and Thornhill (1994) found that women judged men displaying testosteronized faces as healthier than men without the facial testosterone markers. Similarly, men perceived women displaying estrogenized faces as healthier than women whose facial structures did not display such features. The psychological, affective, and physical health attributions people make on the basis of facial traits may reveal an understanding, however cryptic or outside of awareness, of the process and products of sexually selected pathogen resistance (Grammer & Thornhill, 1994; Thornhill & Gangestad, 1993).

According to the parasite theory of sexual selection, an estrogenized and testosteronized face signals physiological health and vitality in women and men, respectively. People do *attribute* greater physical health and vitality to men and women whose faces display high levels of the sex-appropriate hormones. People also attribute greater psychological and emotional health to women displaying facial structural signals of high estrogen, and to men displaying facial structural signals of high testosterone. One goal of the present study was to examine whether men and women displaying facial features associated with high levels of testosterone and estrogen, respectively, report greater physiological, psychological, and emotional health. We are not aware of previous research that has examined the predicted relationships between sex-differentiated facial structure and actual psychological and physical health.

We present analyses of data from two independent groups of university students (67 women and 34 men, in total). Participants completed daily measures of psychological, emotional, and physical health over a 2-month

period. Participants' cardiovascular fitness was assessed via cardiac recovery time following vigorous exercise. A head-and-shoulders photograph of each participant was rated by two independent groups of participants along various dimensions, including several personality dimensions, activity level, and attractiveness. Finally, on the basis of the photograph, we measured each participant's jaw width, chin length, and cheekbone prominence.

The goals of this study include attempts to replicate the findings that (a) prominent cheekbones positively covary with judgments of facial attractiveness for both men and women; (b) a wide jaw and long chin are judged as attractive in a male face, whereas a narrow jaw and short chin are judged as attractive in a female face; and (c) men and women displaying testosteronized and estrogenized faces, respectively, are judged to have greater physical, psychological, and affective health. Additionally, we hypothesize that women displaying an estrogenized facial structure — prominent cheekbones, short chin, and narrow jaw — are physiologically, psychologically, and emotionally healthier than women with non-estrogenized faces. Similarly, we hypothesize that men displaying a testosteronized facial structure — prominent cheekbones, wide jaw, and long chin — are physiologically, psychologically, and emotionally healthier than men with non-testosteronized faces.

This study drew upon two archival data sets in which a large number of variables were assessed on two groups of intensively assessed participants. The fact that the data files on these participants included their photographs gave us the opportunity to measure the size of several facial structural features and to obtain observer ratings. The idea for the present investigation admittedly came after the original data sets were collected, and so we had no input on what data were collected. Nevertheless, the volume of data obtained on each participant allowed us to select many variables for analysis that were relevant to our hypotheses. In addition, many other variables were examined in a relatively exploratory manner. Because so little is known about the actual participant characteristics associated with facial structural features, we felt that such exploratory analyses were warranted. Whenever possible, however, we tested for replication across the two samples. Previous reports present different analyses using these data. Shackelford and Larsen (1997), for example, reported analyses of the relationship of facial symmetry to health. The present research reports new analyses of the relationships of facial structural characteristics with facial attractiveness and health.

Methods

Participants

Two samples of participants were involved in this investigation. Sample 1 included 41 women and 16 men with a mean age of about 20 years (age range: 18 to 23) enrolled in a semester-long independent study course at a large mid-western university. Sample 2 included 26 women and 18 men with a similar age structure as Sample 1. Sample 2 participants were enrolled in a semester-long independent study course at a medium-sized mid-western university. Participants in both samples received credit toward their grades based on participation in weekly class meetings, the completion of assignments, and the writing of a final term paper.

Materials and Procedure

Psychological inventories

Participants in both samples completed a variety of standard psychological inventories over the course of the semester. These inventories are established in the literature and exhibit acceptable levels of reliability and validity. The students in Sample 1 completed the following measures: the Mood Survey (MS; Underwood & Froming, 1980); the Beck Depression Inventory (BDI; Beck, 1967); the Eysenck Personality Questionnaire (EPQ; Eysenck, Eysenck, & Barrett, 1985); the Narcissistic Personality Inventory (NPI; Raskin & Hall, 1979); Emotionality, Activity level, Sociability, Impulsivity (EASI 3; Buss & Plomin, 1975); and the Emotional Control Questionnaire (ECQ; Roger & Nesshover, 1987).

Participants in Sample 2 completed the following inventories: the MS, the EPQ, the EASI 3, the ECQ, the Affect Intensity Measure (Larsen & Diener, 1987); the Marlowe-Crowne Social Desirability Scale (Crowne & Marlowe, 1964); Fenigstein, Scheier, and Buss' (1975) measures of Private Self-Consciousness, Public Self-Consciousness, and Social Anxiety; and the Minnesota Multiphasic Personality Inventory (Hathaway & McKinley, 1942).

Daily reports

Participants in each sample completed a report of daily moods and physical symptomatology. Identical copies of this form were completed twice daily for a period of four consecutive weeks during the regular academic semester. Each

participant completed one form at the midpoint of his or her day, reporting on experiences during the first half of the day. A second report was completed close to the students' normal bedtime, which covered the second half of the day. The experimenters stressed accurate recording of daily experiences. Students were told that any form not completed within a 2-hr window of time should be discarded. Experimenters collected daily reports on a weekly basis. Compliance with the daily reporting task was excellent, with over 90% of participants completing 100% of the reports.

Participants in both samples rated a set of mood adjectives selected to represent each octant of the circumplex model of emotion (Larsen & Diener, 1992). The student's emotional experience was rated on a 7-point Likert scale ranging from 0 (not at all) to 6 (extremely much). Students were provided with a written definition of each mood adjective (taken from Webster's *New Collegiate Dictionary*) for daily referral.

Students in both samples used a checklist to indicate the occurrence of a variety of physical symptoms. For Sample 1, this checklist included headaches, trouble concentrating, runny nose, stomach or gastrointestinal trouble, muscle aches, sore throat or coughs, backaches, and jitteriness. For Sample 2, a slightly different list of symptoms was used. Participants indicated the degree to which they had trouble getting to sleep and staying asleep the previous night, with 0 = Not at all and 4 = Extremely. The symptom checklist employed by Sample 2 participants included headaches, trouble concentrating, runny nose or congestion, nausea/upset stomach, muscle soreness, sore throat, backaches, nervousness, shortness of breath, temper outbursts, and hot or cold flashes.

Cardiovascular fitness.

Information on cardiovascular fitness was collected on participants from both samples via measurements of cardiac recovery time. Upon arrival to the laboratory, participants read a consent form informing them that exercise at moderate exertion would be required and inquired about various health conditions that could be aggravated by participating in the study. Participants with any of these conditions were not allowed to participate in the study. No participants reported any medical conditions that would put them at risk during exertion and all participants consented to participate.

To assess aerobic fitness in terms of cardiac recovery time, it is necessary to elevate participants' heart rates. Sample 1 participants rode a bicycle ergometer for 1 min at a moderately high exertion level (maintaining a speed of 11mph [17.71 km/hr] at a tension setting sufficient to expend 245 W). Participants in

Sample 2 quickly stepped up and down a 2-foot (.61 m) step for 1 min. Both procedures resulted in significant elevations in heart rate.

Heart rate was monitored on a Grass Model 7D polygraph. A photoplethysmograph was attached to the participant's thumb to monitor the pulse wave. Signals were routed to a Grass 7P4 cardiotachometer to detect the rising slope of each pulse wave, with the Schmitt trigger adjusted to record heart rate in beats/min. Continuous output was obtained during the entire experiment by having the heart rate signal recorded on a moving strip chart.

Following the 1min exertion, participants were seated in a comfortable chair and allowed to fully recover. During this period, heart rate was continuously monitored. In Sample 1, aerobic fitness was assessed in terms of the slope of the cardiac recovery curve (Boutcher, 1990). Heart rates were averaged every 15 s for 6 min. A linear regression was fit to the resulting 24 data points, and the slope of the regression line was calculated. A steep regression slope indicates faster recovery time, and hence better aerobic fitness, than a less steep slope. For Sample 2, aerobic fitness was assessed in terms of the time it took a participant's heart rate to return to that participant's baseline level (Knapik, Jones, Reynolds, & Staab, 1992). Because aerobic fitness was assessed with a different metric in each sample, we standardized fitness scores within each sample prior to analyses.

Observer ratings of photographs.
A head-and-shoulders color photograph was taken of all Sample 1 participants, and all but one of the Sample 2 participants. Participants were not given any instructions as to facial expression, head orientation, or, for example, whether glasses should be worn for the photograph. Uniformity of these photographs was unintentionally achieved, however, because with few exceptions participants did not smile, looked directly at the camera (e.g., no head tilt), and did not wear glasses. Photographs were taken at approximately 1 m from the participant. Negatives were developed into 4 in. × 6 in. (10.16 cm × 15.24 cm) color photographs and 1 in. × 1-in. (2.54 cm × 2.54 cm) color slides. The slides of Sample 1 participants were rated on several dimensions by an independent group of raters (18 men and 19 women, mean age about 19 years). The raters participated in exchange for credit toward their grade in an introductory psychology course at a large mid-western university. The raters assessed the photographs of Sample 1 participants on the following bipolar dimensions: Unhappy – Happy, Unattractive – Attractive, Sluggish – Active, Introverted – Extroverted, Unreliable – Reliable, Disagreeable – Agreeable, Emotionally Stable – Emotionally Unstable, Unintelligent – Intelligent. The first adjective in the

pair was assigned a value of -4, the second a value of +4, with 0 defining the midpoint of the Likert scale separating the terms. The ratings were standardized across all participants in Sample 1.

A second group of raters (18 men and 40 women, mean age about 19 years) assessed the slides of Sample 2 participants on the same dimensions as Sample 1 participants, with the exception of "Intelligence." The dimensions were rated in a bipolar format, and ratings were standardized across all Sample 2 participants.

Cheekbone prominence, chin length, and jaw width.

Our measurement system is similar to measurement systems employed by other researchers, including Cunningham and his colleagues (Cunningham, 1986; Cunningham, Barbee, & Pike, 1990; Cunningham et al., 1995), and Grammer and Thornhill (1994). We first enlarged the 4 in. × 6-in. (10.16 cm × 15.24 cm) photographs to 8.5 in. × 11 in. (21.59 cm × 27.94 cm) via a standard color copier. The first author and a research assistant performed each of the following tasks jointly, such that each task required 100% agreement between the two persons before it was considered complete. We first placed a sheet of graphical transparency paper cross-hatched with 20 squares/inch (approximately 8 squares/cm) on top of the photograph such that a secondary horizontal axis was by definition aligned with the center of the left pupil, cutting simultaneously through the center of the right pupil. We defined the vertical axis as that line perpendicular to and intersecting at the calculated midpoint of the line anchored by the left and right pupil centers. We defined the primary horizontal axis as tangent to the lowermost point at the base of the chin (i.e., the plane defined by the structural merging of the left and right mandibles).

Employing a water-soluble marker, we consensually marked bilateral points for several features, including cheekbone width (points marking most prominent point of right and left cheekbone) and jaw width (points marking most prominent point of right and left jaw). Additional points were placed to mark (1) the midpoint of the line defining the lower boundary of the lower lip, (2) the midpoint of the line defining the base of the chin, and located along the primary horizontal axis, and (3) the point marking the midpoint of the actual or estimated hairline.

Cheekbone prominence was measured as cheekbone width divided by jaw width. Chin length was measured as the distance from point (1) to point (2) divided by the distance from point (2) to point (3). Jaw width was defined as width of jaw (see above) divided by the distance from point (2) to point (3).

Results

Although the current study included two independent samples of participants and two independent sets of observers, none of our samples exceeded $N = 41$ when analyses were broken down by sex of participant. At the risk of increased Type I error, we consider the results of our correlational analyses in terms of effect size, in addition to implementing standard statistical interpretation logic. Each correlation can be considered an effect size index. For a bivariate correlation coefficient, an effect size provides information about the magnitude of the relationship between two variables in standard deviation units. According to Cohen (1988), correlations between .10 and .29 represent *small* effect sizes, between .30 and .49 represent *medium* effect sizes, and between .50 and 1.0 represent *large* effect sizes. Correlations representing medium or large effect sizes are underlined in Tables 1 and 2. In presenting our results, we refer only to correlations achieving medium or large effect size.

Tables 1 and 2 present the results of correlational analyses for Samples 1 and 2, respectively. We present the results for the three facial characteristics in turn, for Sample 1 and then Sample 2, beginning with cheekbone prominence. We then present the results for chin length and close with a presentation of the results for jaw width. Within the context of presenting the results for each facial characteristic, we present the results for men and women, rather than presenting the results by sex in separate sections. We organize our presentation of the results according to the domains of health depicted in Tables 1 and 2.

Table 1. Correlations of facial characteristics with psychological, emotional, and physiological variables, and with observer ratings of photographs: Sample 1.

	Cheekbone *prominence*		Chin *length*		Jaw *width*	
	Women	*Men*	*Women*	*Men*	*Women*	*Men*
Psychological variables						
Number of friends	.57*	.58	.21	.07	-.52	-.82*
MS – Hedonic level	.02	-.34	.21	.35	-.04	.27
MS – Hedonic variability	.42	-.22	-.02	-.10	-.30	.38
Beck Depression	-.32	-.27	-.01	-.02	.45	.56
EPQ – Extraversion	.24	-.26	.38*	-.48	-.34	.40
EPQ – Neuroticism	.10	.34	-.14	-.03	-.17	-.43
EPQ – Psychoticism	.59*	-.45	.04	.13	-.58*	.69*
EPQ – Lie	-.14	-.15	-.15	-.33	.13	.21
NPI – Entitlement	.24	.35	.08	-.59	-.23	-.04
NPI – Leadership	.52	-.52	.26	-.37	-.19	.45
NPI – Superiority	.47	.07	.26	-.13	-.16	.08
NPI – Self-Admiration	.18	-.21	.08	-.15	-.27	-.07
NPI – General narcissism	.56*	-.11	.20	-.45	-.32	.10
EASI 3 – Emotionality	.31	-.04	.01	-.18	-.31	.05
EASI 3 – Fear	-.03	.44	-.16	.31	.19	-.39
EASI 3 – Anger	.50	.41	-.04	-.31	-.45	-.08
EASI 3 – Tempo	.05	-.35	-.13	-.26	.04	.07
EASI 3 – Vigor	-.10	.12	.22	.31	.13	-.21
EASI 3 – Sociability	.43	-.24	.27	-.36	-.47	.06
EASI 3 – Inhibited	.32	.24	.12	-.62*	-.46	-.11
EASI 3 – Decision time	.25	-.15	.16	.34	-.09	.24
EASI 3 – Sensation seeking	.40	-.48	-.04	-.27	-.37	.36
EASI 3 – Perseverance	-.34	.06	-.09	.50	.25	.18
EASI 3 – Impulsivity	.44	-.12	.06	.10	-.48	.35
EASI 3 – Activity	-.01	-.13	.02	-.34	.09	-.09
EASI 3 – General emotionality	.32	.41	-.07	-.06	-.24	-.22
ECQ – Rehearsal	.04	.21	-.11	-.32	.08	-.26
ECQ – Emotional inhibition	-.40	-.37	-.16	.24	.38	.22

[a] Cardiovascular fitness is the inverse of cardiac recovery time following a brief period of vigorous exercise.
[b] During a brief period of vigorous exercise; measured in beats/min.

Note. For chin length, *N* (Women) = 41, *N* (Men) = 16; for cheekbone prominence and jaw width, *N* (Women) = 40, *N* (Men) = 10. MS = Mood Survey; EPQ = Eysenck Personality Questionnaire; NPI = Narcissistic Personality Inventory; EASI 3 = Emotionality, Activity Level, Sociability, Impulsivity; ECQ = Emotional Control Questionnaire. According to Cohen (1988), correlations between .10 and .29 represent *small* effect sizes, between .30 and .49 represent *medium* effect sizes, and equal to or greater than .50 represent *large* effect sizes. Correlations representing medium or large effect sizes are underlined.

*$p \leq .05$ (two-tailed)

Table 1. (Continued)

	Cheekbone *prominence*		Chin *length*		Jaw *width*	
	Women	*Men*	*Women*	*Men*	*Women*	*Men*
ECQ – Anger control	.56*	.56	.13	.51	.46	.64
ECQ – Benign control	-.16	-.04	.02	-.08	-.17	.40
Emotions experienced						
Drowsy	-.07	.68*	.21	.10	-.08	-.45
Elated	.25	-.37	.16	.59*	-.31	-.20
Excited	.11	.45	.04	.43	-.11	-.23
Unhappy	-.55*	.28	.30	.22	.70*	.02
Nervous	-.58*	.21	.24	.34	.39	.06
Irritated	-.52	.00	.30	.38	.50	-.33
Depressed	-.48	.21	.24	.07	.48	.37
Wild	.60*	-.06	.20	.34	-.55*	-.17
Distressed	-.64*	.17	.22	.12	.59*	.18
Enthusiastic	-.01	.34	.08	.51*	-.10	-.29
Happy	.00	.00	.34*	-.18	.03	-.14
Quiet	.55*	.19	.50*	.40	.61*	.16
Hostile	-.27	.25	.27	.44	.25	-.09
Envious	-.09	-.03	.32*	.26	.06	.15
Worried	-.40	.86*	.07	.10	.55*	-.63*
Calm	-.49	.28	.08	-.17	.41	-.01
Grouchy	-.66*	-.06	.35*	-.45	.55*	.36
Still	-.43	.40	.35*	-.14	.45	-.10
Lonely	-.48	.12	.46*	.42	.37	.19
Jealous	-.11	-.10	.30	.33	.14	.24
Dull	-.40	.44	.29	.17	.33	-.24
At rest	-.48	.45	.32*	-.05	.22	-.13
Sluggish	-.51	.61	.36*	.20	.29	.12
Tranquil	-.24	.39	.35*	-.37	-.09	-.09
Angry	-.37	.07	.35*	.23	.26	.12
Tense	-.46	.84*	.20	.42	.49	-.43
Physiological complaints						
Headaches	-.05	.00	.30	.10	.09	.26
Runny or stuffy nose	.67*	.19	.10	-.13	-.60*	.12
Upset stomach/GI trouble	-.42	-.18	.12	-.30	.50	.35
Muscle soreness, cramps, aches	-.13	.04	.16	-.33	.25	.03
Sore throat or cough	.43	.01	.10	-.15	-.49	.40
Trouble concentrating/loss of interest	-.34	.15	.13	.41	.38	.11
Backache	-.46	-.03	.12	.12	.62*	.04
Jittery	-.31	.16	.05	.32	.45	-.04
Cardiovascular fitness$_a$	-.32	-.01	.17	-.08	.63*	.06
Maximum heart rate$_b$	-.05	-.62	.33*	-.36	-.30	.65*

Table 1. (Continued)

	Cheekbone *prominence*		Chin *length*		Jaw *width*	
	Women	*Men*	*Women*	*Men*	*Women*	*Men*
Observer ratings from photograph						
Happiness	-.23	-.41	-.32*	.22	.25	.04
Attractiveness	.29	.01	-.19	.46	-.25	-.37
Activity level	.01	-.16	-.36*	.27	.15	-.19
Extraversion	-.13	-.33	-.24	.31	.25	-.12
Conscientiousness	-.21	-.57	-.31*	.28	.21	.36
Agreeableness	-.36	-.48	-.37*	.18	.26	.16
Emotional stability	-.31	-.28	-.25	.28	.33	-.11
Intelligence	-.31	-.43	-.25	-.12	.21	.22

Table 2. Correlations of facial characteristics with psychological, emotional, and physiological variables, and with observer ratings of photographs: Sample 2.

	Cheekbone *prominence*		Chin *length*		Jaw *width*	
	Women	*Men*	*Women*	*Men*	*Women*	*Men*
Psychological variables						
MS – Hedonic level	.12	-.36	.09	-.12	-.38	-.62*
MS – Hedonic variability	.28	.06	-.17	-.13	-.54*	-.35
EPQ – Extraversion	.00	-.06	.32	.07	.05	-.78*
EPQ – Neuroticism	.02	-.13	.08	.24	.39	-.33
EPQ – Psychoticism	-.28	.61*	.17	.11	.06	-.14
EPQ – Lie	.41	.17	-.07	-.50*	.08	-.02
EASI 3 – Emotionality	.07	-.21	-.13	.12	.09	-.57*
EASI 3 – Fear	.27	-.21	.23	.23	.47	.40
EASI 3 – Anger	-.02	-.09	.06	.16	.16	-.53
EASI 3 – Tempo	-.19	-.34	.10	.26	.64*	-.56*
EASI 3 – Vigor	.07	-.27	.42*	.13	.39	-.52
EASI 3 – Sociability	.17	-.36	.02	-.07	-.14	-.49
EASI 3 – Inhibited	.05	-.06	.14	.44	-.10	-.18
EASI 3 – Decision time	.04	.41	.42*	.33	-.24	-.35
EASI 3 – Sensation seeking	.25	-.05	.19	-.13	-.37	-.12
EASI 3 – Perseverance	.10	-.06	-.18	.38	-.05	.18
EASI 3 – Impulsivity	.20	.09	.26	.43	-.38	-.18
EASI 3 – Activity	-.09	-.35	.28	.22	.64*	-.61*
EASI 3 – General emotionality	.14	-.20	.08	.20	.33	-.45
ECQ – Rehearsal	-.08	-.06	-.26	.40	.31	.07
ECQ – Emotional inhibition	.15	.33	.03	.37	-.02	.53
ECQ – Anger control	.44	-.20	-.12	-.10	.22	.61*
ECQ – Benign controly	-.02	-.37	-.43*	-.11	.00	.31
Affect Intensity (AIM)	-.09	-.07	.06	.04	.39	-.67*
Marlowe-Crowne	.66*	-.12	-.12	-.23	.26	-.03
Private self-consciousness	.16	-.23	.09	-.20	.59*	-.33
Public self-consciousness	.09	-.12	.07	-.11	.63*	-.16
Social anxiety	.03	-.12	.01	.46	.51*	.17
MMPI – Lie	.10	-.27	-.38	-.39	.11	-.14
MMPI – Fake good	-.06	-.18	.20	-.27	.33	.13

[a] Cardiovascular fitness is the inverse of cardiac recovery time following a brief period of vigorous exercise.

Note. For chin length, *N* (Women) = 26, *N* (Men) = 18; for cheekbone prominence and jaw width, *N* (Women) = 15, *N* (Men) = 13. MS = Mood Survey; EPQ = Eysenck Personality Questionnaire; EASI 3 = Emotionality, Activity Level, Sociability, Impulsivity; ECQ = Emotional Control Questionnaire; AIM = Affect Intensity Measure; MMPI = Minnesota Multiphasic Personality Inventory. According to Cohen (1988), correlations between .10 and .29 represent *small* effect sizes, between .30 and .49 represent *medium* effect sizes, and equal to or greater than .50 represent *large* effect sizes. Correlations representing medium or large effect sizes are underlined.

*$p \leq .05$ (two-tailed)

Table 2. (Continued)

	Cheekbone *prominence*		Chin *length*		Jaw *width*	
	Women	*Men*	*Women*	*Men*	*Women*	*Men*
MMPI – Hysteria	-.46	-.18	.15	.16	.33	-.15
MMPI – Depression	.16	.00	-.17	-.10	.04	.22
MMPI – Hypochondriasis	-.46	-.18	.15	.16	.33	-.15
MMPI – Psychopathic deviance	.03	.35	.23	.02	.08	.23
MMPI – Masculinity/Femininity	.05	.01	-.03	-.49*	.25	-.36
MMPI – Paranoia	.07	-.23	.05	-.39*	.00	-.15
MMPI – Psychasthenia	-.02	-.14	.30	-.20	.61*	.12
MMPI – Schizophrenia	-.07	-.09	.35	-.41	.41	.21
MMPI – Mania	.09	-.13	.37	-.16	.29	.03
MMPI – Social introversion	.30	.15	-.28	.04	.09	.31
Emotions experienced						
Happy	.18	-.43	.29	.12	-.59*	-.41
Joyful	.10	-.31	.45*	-.12	-.16	-.17
Unhappy	-.42	.05	.41*	-.40	.20	.52
Bored	.00	.02	.29	-.46	.17	.32
Relaxed	.22	-.22	.04	-.14	-.68*	-.04
Enjoyment/Fun	.08	-.11	.54*	.02	-.10	-.13
Productive	.18	-.57*	.33	-.01	.18	-.06
Peppy	-.04	-.12	.44*	.00	.06	-.33
Euphoric	-.14	.14	.46*	-.21	-.03	-.33
Pleased	-.06	-.27	.51*	.05	.05	-.16
Lonely	-.13	-.22	.14	-.04	.59*	-.07
Energetic	-.01	-.12	.51*	-.35	.01	.01
Calm	.25	-.14	-.03	-.13	-.73*	-.06
Suprised	-.28	-.13	.44*	-.25	.25	.08
Physiological complaints						
Trouble getting to sleep	-.24	-.33	.36	-.29	.28	.42
Trouble staying asleep	-.09	-.40	.19	-.55*	.28	-.09
Headaches	-.41	-.28	.17	.04	.38	-.55*
Trouble concentrating	.08	-.22	.23	.11	.49	-.30
Runny nose or congestion	.20	-.20	.00	.26	-.02	-.27
Nausea/Upset stomach	-.26	.02	.37	.33	.17	-.42
Muscle soreness	-.08	-.21	.10	.27	.33	-.37
Sore throat	.16	.03	.17	.23	-.01	-.32
Backache	-.25	-.13	.01	.23	.29	-.26
Nervousness	-.10	-.15	.31	.22	.44	-.43
Shortness of breath	-.09	.02	.34	.29	.14	-.04
Temper outburst	-.32	-.14	-.11	.19	.61*	-.38
Hot or cold flashes	-.44	.16	-.13	-.40	.58*	.39
Cardiovascular fitness$_a$	.02	-.41	.10	-.19	.25	.00

Table 2. (Continued)

	Cheekbone *prominence*		Chin *length*		Jaw *width*	
	Women	*Men*	*Women*	*Men*	*Women*	*Men*
Observer ratings from photograph						
Happiness	.36	-.28	.06	.06	-.20	-.30
Attractiveness	.11	-.26	-.12	-.23	-.42	-.50
Activity level	.51*	-.45	-.13	-.11	-.43	-.50
Extraversion	.44	-.31	.06	.04	-.04	-.49
Conscientiousness	-.22	-.52	-.03	-.33	-.27	.15
Agreeableness	.36	-.48	-.01	-.25	-.46	-.30
Emotional stability	.08	-.37	-.19	-.23	-.22	-.48

Cheekbone prominence

Psychological variables

Sample 1 men and women with more prominent cheekbones reported having more friends than do men and women with less prominent cheekbones. Sample 1 and 2 men with more prominent cheekbones reported a lower hedonic level than men with less prominent cheekbones. Sample 1 women with more prominent cheekbones reported greater hedonic variability, but this finding was not replicated for Sample 2 women. Sample 1 men and women with more prominent cheekbones tended to be less depressed, as revealed by scores on the Beck Depression Inventory. Sample 1 men with more prominent cheekbones showed a tendency toward neuroticism, but this finding is not replicated in Sample 2. Sample 1 men with more prominent cheekbones scored lower on EPQ psychoticism (impulsivity), whereas Sample 2 men with more prominent cheekbones scored higher on psychoticism. Sample 1 women with more prominent cheekbones scored higher on psychoticism, but this finding is not replicated for Sample 2 women.

Sample 1 men with more prominent cheekbones reported greater feelings of entitlement. Sample 1 women with more prominent cheekbones reported feeling a greater sense of leadership, whereas the reverse was true for Sample 1 men with more prominent cheekbones. Sample 1 women with more prominent cheekbones were generally more narcissistic and reported greater feelings of superiority, in particular.

Sample 1 women with more prominent cheekbones were angrier, more sociable, more inhibited, more sensation seeking, less perseverant, more

impulsive, and more generally emotional than were Sample 1 women with less prominent cheekbones. None of these relationships were replicated, however, for Sample 2 women. Sample 1 men with more prominent cheekbones reported more fearfulness, more anger, lower physiological and psychological tempos, were less sensation seeking, and more generally emotional, relative to Sample 1 men with less prominent cheekbones. Sample 2 men with more prominent cheekbones also recorded a lower tempo, were less sociable, obsessed less when making important decisions, and reported a lower activity level, relative to Sample 2 men with less prominent cheekbones.

Sample 1 women and men with more prominent cheekbones reported less emotional inhibition, whereas Sample 2 men with more prominent cheekbones reported more emotional inhibition. Sample 1 men and women with more prominent cheekbones reported greater anger control, but these findings were not replicated for Sample 2 men or women. Sample 2 women with more prominent cheekbones recorded greater social desirability concerns than did Sample 2 women with less prominent cheekbones. Sample 2 women with more prominent cheekbones scored as less hysterical, less hypochondriacal, and more socially introverted than did women with less prominent cheekbones. Sample 2 men with more prominent cheekbones scored higher on the MMPI scale of Psychopathic Deviance.

Emotional experience

Sample 1 women with more prominent cheekbones felt less unhappy, less nervous, less irritated, less depressed, more wild, less distressed, less quiet, less worried, less calm, less grouchy, less still, less lonely, less dull, less at rest, less sluggish, less angry, and less tense than did Sample 1 women with less prominent cheekbones. The finding with regard to unhappiness is replicated for Sample 2 women. Sample 1 men with more prominent cheekbones, relative to Sample 1 men with less prominent cheekbones, reported feeling more drowsy, more elated, more excited, more enthusiastic, more worried, more still, more dull, more at rest, more sluggish, more tranquil, and more tense. Sample 2 men with more prominent cheekbones reported feeling less happy, less joyful, and less productive than did Sample 2 men with less prominent cheekbones.

Physiological complaints

Sample 1 women with more prominent cheekbones reported more difficulty with a runny or stuffy nose than did women with less prominent cheekbones, but this finding is not replicated for Sample 2 women. Sample 1 women with

more prominent cheekbones complained less of an upset stomach or gastrointestinal trouble, reported less difficulty concentrating and less loss of interest, and complained less of backaches and jitteriness; however, these women complained more of a sore throat or cough than did Sample 1 women with less prominent cheekbones. Sample 2 women with more prominent cheekbones reported fewer headaches, fewer temper outbursts, and fewer hot or cold flashes. Sample 2 men with more prominent cheekbones reported less difficulty getting to sleep or staying asleep than did Sample 2 men with less prominent cheekbones. Sample 1 women and Sample 2 men with more prominent cheekbones demonstrated less cardiovascular efficiency. Finally, the maximum heart rate of Sample 1 men with more prominent cheekbones was higher than for Sample 1 men with less prominent cheekbones.

Observer ratings of photographs

Sample 1 women with more prominent cheekbones were rated as less agreeable, less emotionally stable, and less intelligent, relative to women with less prominent cheekbones. Sample 2 women with more prominent cheekbones were rated as happier, more active, more extraverted, and more agreeable than Sample 2 women with less prominent cheekbones. Sample 1 men with more prominent cheekbones were rated as less happy, less extraverted, less conscientious, less agreeable, and less intelligent than were men with less prominent cheekbones. Sample 2 men with more prominent cheekbones were rated as less active, less extraverted, less conscientious, less agreeable, and less emotionally stable than were men with less prominent cheekbones.

Chin length

Psychological variables

Sample 1 women with shorter chins were less extraverted than women with longer chins. Sample 2 women with shorter chins also were less extraverted, reported greater vigor, were less impulsive when making important decisions, and were less emotionally impulsive, as revealed by their lower scores on the Benign Control subscale of the ECQ. Sample 2 women with shorter chins were more hysterical and hypochondriacal, but less socially introverted than Sample 2 women with longer chins.

Sample 1 men with longer chins were happier, less extraverted, scored lower on the EPQ Lie scale (measuring social naiveté), tended not to operate according to a narcissistic sense of entitlement or leadership, and were generally less

narcissistic, relative to Sample 1 men with shorter chins. Sample 1 men with longer chins were more fearful, less angry, less vigorous, less sociable, less inhibited, more impulsive, more perseverant, less active, engaged in less obsessive emotional rehearsal, and had better anger control than Sample 1 men with shorter chins. Sample 2 men with longer chins scored lower on the EPQ Lie scale and MMPI Lie scale, were more inhibited, took more time to make important decisions, were more perseverant, were more impulsive, engaged in more emotional rehearsal, were more emotionally inhibited, were more socially anxious, scored lower on the MMPI Masculinity/Femininity scale, and were less paranoid and less schizophrenic.

Emotional experience

Sample 1 men with longer chins reported feeling more elated, more excited, more nervous, more irritated, more wild, more enthusiastic, more quiet, more hostile, less grouchy, more lonely, more jealous, less tranquil, and more tense than Sample 1 men with shorter chins. Sample 2 men with longer chins reported feeling less unhappy, less bored, and less energetic than Sample 2 men with shorter chins. Sample 1 women with shorter chins reported feeling less unhappy but also less happy, less irritated, less quiet, less envious, less grouchy, less still, less lonely, less jealous, less at rest, less sluggish, less tranquil, and less angry than did Sample 1 women with longer chins. Sample 2 women with shorter chins, relative to women with longer chins, reported feeling less joyful, less unhappy, less enjoyment, less productive, less peppy, less euphoric, less pleased, less energetic, and less surprised over the 1-month study period.

Physiological complaints

Sample 1 men with longer chins reported fewer episodes of an upset stomach, less muscle soreness, and fewer muscle cramps or aches than did men with shorter chins. Sample 1 men with longer chins also reported more trouble concentrating and more jitteriness than did men with shorter chins. Also, Sample 1 men with longer chins displayed a lower maximum heart rate than did men with smaller chins. Sample 2 men with longer chins reported less difficulty staying asleep, complained more often of an upset stomach, but complained of fewer hot or cold flashes than did Sample 2 men with shorter chins.

Sample 1 women with shorter chins, relative to women with longer chins, reported fewer headaches and displayed a lower maximum heart rate following vigorous exercise. Sample 2 women with shorter chins reported less difficulty getting to sleep, complained less of nausea or an upset stomach, and reported

less nervousness and less shortness of breath than did women with longer chins.

Observer ratings of photographs

Sample 1 women with shorter chins were rated as happier, more active, more conscientious, and more agreeable than Sample 1 women with longer chins. Sample 1 men with longer chins were rated as more attractive and more extraverted than were men with shorter chins. Sample 2 men with longer chins were rated as less conscientious than were Sample 2 men with shorter chins.

Jaw width

Psychological variables

Sample 1 men and women with wider jaws reported having fewer friends than did Sample 1 participants with narrower jaws. Sample 1 men with wider jaws scored as more depressed than Sample 1 men with narrower jaws. Sample 1 men with wider jaws were more extraverted, less neurotic, and more psychotic (impulsive) than men with narrower jaws. Sample 2 men with wider jaws recorded a lower hedonic level, less hedonic variability, less extraversion, and less neuroticism than did Sample 2 men with narrower jaws.

Sample 1 men with wider jaws scored higher on the Leadership scale of the Narcissistic Personality Inventory, reported less fearfulness, greater sensation seeking and impulsivity, less ability to control expressions of anger, and less control of impulses than did Sample 1 men with narrower jaws. Sample 2 men with wider jaws reported less emotionality, greater fearfulness, less anger, a lower tempo, less vigor, less sociability, a lower activity level, and less general emotionality than Sample 2 men with narrower jaws. Sample 2 men with wider jaws also reported more emotional inhibition, better anger control, better impulse control, lower affect intensity, and less private self-consciousness than men with narrower jaws. Finally, Sample 2 men with wider jaws scored in the masculine direction on the Masculinity/Femininity scale of the MMPI, and scored as more socially introverted than did men with narrower jaws.

Sample 1 women with narrower jaws recorded greater emotional variability, were less depressed, more extraverted, and scored higher on EPQ psychoticism (impulsivity). Sample 1 women with narrower jaws recorded greater narcissism, greater emotionality, more anger, poorer anger control, and were more sociable, more inhibited, more sensation seeking, and more impulsive than women with wider jaws. Sample 2 women with narrower jaws recorded a higher hedonic level and greater hedonic variability than did women with wider jaws.

Sample 2 women with narrower jaws also displayed less neuroticism, less fear, a lower tempo, less vigor, greater sensation seeking, greater impulsivity, a lower activity level, and less general emotionality. Sample 2 women with narrower jaws reported less emotional rehearsal, lower affect intensity, less private and public self-consciousness, and less social anxiety. Finally, and looking at the results for the MMPI scales, women with narrower jaws, were less likely to "fake good," were less hysterical, less hypochondriacal, displayed less psychasthenia, and scored lower on the Schizophrenia sub-scale.

Emotional experience

Sample 1 men with wider jaws reported feeling less drowsy, less irritated, more depressed, less worried, more grouchy, and less tense than men with narrower jaws. Sample 2 men with wider jaws reported feeling less happy, more unhappy, more bored, less peppy, and less euphoric than men with narrower jaws. Sample 1 women with narrower jaws reported feeling more elated, less unhappy, less nervous, less irritated, less depressed, more wild, less distressed, less quiet, less worried, less calm, less grouchy, less still, less lonely, less dull, and less tense than did women with wider jaws. Replicating findings for Sample 1 women, Sample 2 women with narrower jaws reported feeling happier, more relaxed, less lonely, and calmer than Sample 2 women with wider jaws.

Physiological complaints

Relative to Sample 1 men with narrower jaws, Sample 1 men with wider jaws complained more often of an upset stomach, sore throat or cough, and recorded a higher maximum heart rate following the exercise period. Sample 2 men with wider jaws reported more trouble getting to sleep, but also reported fewer headaches, less difficulty concentrating, fewer episodes of nausea or an upset stomach, less muscle soreness, fewer sore throats, less nervousness, fewer temper outbursts, and more frequent hot or cold flashes, relative to Sample 2 men with narrower jaws.

Sample 1 women with narrower jaws complained more often of a runny nose or congestion, but complained less often of an upset stomach, reported less trouble concentrating, and reported fewer backaches and less jitteriness than did women with wider jaws. Sample 2 women with narrower jaws reported fewer headaches, less trouble concentrating, less muscle soreness, fewer temper outbursts, and fewer hot or cold flashes, relative to women with wider jaws.

Observer ratings of photographs

Sample 1 men with wider jaws were judged to be less attractive and more conscientious than men with narrower jaws. Sample 2 men with wider jaws were rated as less happy, less attractive, less active, less extraverted, less agreeable, and less emotionally stable than Sample 2 men with narrower jaws. Sample 1 women with narrower jaws were rated as less emotionally stable than women with wider jaws. Sample 2 women with narrower jaws were rated as more attractive, more active, and more agreeable than women with wider jaws.

Discussion

The present research had several goals. We sought to replicate the finding that (a) prominent cheekbones and ratings of attractiveness positively covary for both men and women; (b) a wide jaw and long chin are judged to be attractive when displayed by a male face, whereas a narrow jaw and short chin are judged to be attractive when displayed by a female face; and (c) men and women displaying testosteronized and estrogenized faces, respectively, are attributed with greater psychological, emotional, and physiological health.

Across the two samples, we found a small positive relationship between cheekbone prominence and attractiveness for female faces, but a small negative relationship for male faces. One possible reason why we did not replicate the positive association between cheekbone prominence and attractiveness ratings is that once the samples were broken down by sex of participant, the largest cell included only 41 participants. One consequence of the relatively small sample sizes is that the power of the statistical tests is lowered, in some cases perhaps to the extent that a significant effect is not detected or even detectable (Cohen, 1988). Because accurate facial measurements are so meticulous and time-consuming, studies involving such measurements have historically used a smaller sample size than is statistically desirable (e.g., Cunningham, 1986; Cunningham, Barbee & Pike, 1990; Cunningham et al., 1995). As computer programs for measuring facial characteristics (e.g., Johnston & Franklin, 1993, Johnston et al., 1999; Grammer & Thornhill, 1994) become available, facial-metrics will be less tedious, and larger samples can and should be employed.

A second possible reason for our failure to replicate the attractiveness-cheekbone prominence association for both men and women is that, unlike other studies documenting that relationship (e.g., Cunningham, 1986; Cunningham, Barbee & Pike, 1990; Cunningham et al., 1995; Grammer &

Thornhill, 1994), participants in the present study were not rated for attractiveness by opposite-sex raters only, due to small sample sizes. The present study is the only of which we are aware that employs both same-sex and opposite-sex raters to determine the relationship of several facial characteristics to ratings of attractiveness and other interpersonal dimensions. Future research employing much larger samples of same-sex and opposite-sex raters should be conducted to clarify the relationship of cheekbone prominence to attractiveness.

We replicated the finding that long chins are attractive when displayed by a male face for one sample but not the other. For neither of our samples did we replicate the finding that a short chin is attractive when displayed by a female face. For one of our samples, we replicated the finding that a narrow jaw is attractive when displayed by a female face. The relationship between chin length and attractiveness was negative for the second sample of women, but did not reach Cohen's (1988) medium effect size.

For neither of the samples did we replicate the finding that a wide jaw is an attractive male facial feature. Instead, men with wider jaws in both samples were judged to be *less* attractive. It is not clear why the present results so clearly diverge from previous work documenting a positive relationship between jaw width and facial attractiveness in men. The measure of jaw width we employed is similar to measurements secured in previous work. One methodological difference of the present study, relative to previous work on facial structural features and perceived attractiveness, is that our assessments of perceived attractiveness were collapsed across sex of rater, whereas previous work has secured independent attractiveness judgments from same-sex and opposite-sex raters. For the present study, small sample size prohibits examination of independent attractiveness ratings provided by same-sex and opposite-sex raters. Given that few previous studies have documented a positive relationship between men's jaw width and perceived attractiveness, future work should attempt to replicate this result, with the added constraint that independent attractiveness judgments be secured from same-sex and opposite-sex targets.

We tested two hypotheses about the health signal value of cheekbone prominence, chin length, and jaw width. These hypotheses were derived from the parasite theory of sexual selection, which proposes that sexual selection favors characteristics that "honestly" display parasite resistance. In humans, as in other species, elevated levels of sex hormones are associated with the development of secondary sexual traits. Because high levels of sex hormones, especially testosterone and estrogen, may decrease immunocompetence, secondary sexual traits that are associated with high levels of these hormones

might accurately and honestly signal a robust immune system (see the Introduction for a brief review of this research).

We hypothesized that women displaying an estrogenized face — prominent cheekbones, short chin, and narrow jaw — would be physiologically, psychologically, and emotionally more robust than women whose faces reveal relatively low levels of estrogen. Similarly, we hypothesized that men displaying a testosteronized face — prominent cheekbones, wide jaw, and long chin — would be physiologically, psychologically, and emotionally healthier than men whose faces reveal relatively low levels of testosterone. Overall, the results provide little support for either hypothesis.

The most noteworthy findings are those that obtain across both samples. In both samples, men with more prominent cheekbones were more emotionally stable and less impulsive than men with less prominent cheekbones. Women in both samples with more prominent cheekbones reported feeling greater happiness over the 1-month study period than did women with less prominent cheekbones. Women in both samples with more prominent cheekbones reported fewer physical symptoms than did women with less prominent cheekbones.

In both samples, women with a shorter chin were less impulsive. Across both samples, men with a longer chin recorded less social naiveté and greater perseverance than did men with a shorter chin. Across both samples, men with a longer chin reported greater happiness and enthusiasm than did men with a shorter chin. In contrast, women with a longer chin, and across both samples, experienced less happiness and greater anxiety than did women with a shorter chin. Across both samples, men with a longer chin complained of fewer physical ailments than did men with a shorter chin. In contrast, women with a longer chin, and across both samples, reported more physical complaints than did women with a shorter chin.

Across both samples, women with a narrower jaw recorded greater emotional stability, less inhibition, and less anxiety than did women with a wider jaw. In contrast, men in both samples with a wider jaw recorded greater emotional stability and less anxiety than did men with a narrower jaw. Women with a narrower jaw experienced less depression, less irritability, and more happiness over the 1-month study period than did women with a wider jaw, across both samples. In contrast, men in both samples with a wider jaw reported less irritability than did men with a narrower jaw. Across both samples, women with a narrower jaw reported fewer physical symptoms than did women with a wider jaw.

This investigation is unique and makes a contribution to the literature, as it is the only study of which we are aware to move beyond social judgments of people with particular facial characteristics. Although we provided results pertaining to the social judgments made about men and women with prominent cheekbones, wide jaw, or a small chin, we also collected data pertaining to the actual psychological, emotional, and physiological health of people with particular facial structural features.

Another strength of this investigation is embodied in the use of multiple methods. Rather than rely exclusively on single-session self-report measures, as is characteristic of much psychological research, participants in this study also completed daily reports of their emotional and physical well being. Additionally, we collected physiological data on each participant to assess cardiovascular fitness. We took each participant's photograph and had these photographs rated along several health, personality, and emotional well being dimensions by two independent groups of raters. Finally, rather than ask a new set of raters to provide gross judgments of cheekbone prominence, jaw width, and chin length, we developed a scoring system and measured these facial characteristics, accurate to 1/20 of an inch. The strengths of this paper notwithstanding, we should point out several important limitations of this research that must be overcome in future investigations.

A key limitation of the present study is small sample size. When analyses were conducted by sex of participant, no more than 41 participants per cell remained. It is imperative that the present investigation be replicated with a much larger sample size. Additionally, it would be useful to include a more diverse group of participants in these and related investigations. Our samples consisted largely of young men and women attending prestigious American universities. The parasite theory of sexual selection and its derivative hypotheses should apply equally well, however, to American university students and Zimbabwean cattle-herders. Because participants in the current research likely received high quality health care and nutrition during development, individual differences in immunocompetence may have been obscured, thwarting clean tests of the hypothesized relationships. In this case also, future work will benefit by testing the hypothesized relationships on samples varying more widely on dimensions such as the quality of health care and nutrition during development.

Another limitation of the current research is related to the uncertain ecological validity of the facial measurements. Previous work has used similar techniques of fine-grained measurements secured from facial photographs (e.g., Shackelford & Larsen, 1997) to yield results that are consistent with the results

of data collected by other methodologies (e.g., Grammer & Thornhill, 1994). Nevertheless, we think it would be useful to document empirically that the measurement techniques we use yield values that approximate anthropometric measurements secured on "living" participants.

In addition to attempting replication of the current findings with larger and more diverse samples, future research could test whether other human facial structural features known to be secondary sexual traits might function as reliable signals of psychological, affective, and physical health status. For example, several investigators (e.g., Cunningham, 1986; Cunningham, et al., 1995; Johnston & Franklin, 1993) have found that proportionately large eyes are perceived to be sexually attractive by male raters judging female faces. Johnston and Franklin (1993) also found that men perceive full lips as sexually attractive when displayed by a female face. Rounded, full lips are associated with high levels of estrogen (Tanner, 1978), and this may be true for proportionately large eyes. Large eyes and full lips might signal physiological health and vitality in women, and may concomitantly signal psychological and emotional robustness.

In conclusion, the current research provides limited and mostly unimpressive, inconclusive evidence regarding the hypothesis, derived from the parasite theory of sexual selection, that facial structural features judged to be attractive may provide information about the health and robustness of the person displaying those facial traits. Facial structural characteristics may communicate information about health, but future research that addresses the limitations discussed above is needed before clear conclusions can be drawn.

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Accepted: January 14, 2003