

## Women's physical and psychological condition independently predict their preference for apparent health in faces

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### Abstract

Physical condition (e.g., health, fertility) influences female mate preferences in many species, with females in good condition preferring “higher quality” (e.g., healthier) mates. In humans, condition may comprise both physical (e.g., health and fertility) and psychological factors (e.g., stress, anxiety, and depression). We found that women with low waist-to-hip ratios (indicating health and fertility) or who scored low on anxiety, depression, and stress measures expressed greater attraction to composite male (but not female) faces with color and texture cues associated with apparent health than did women with relatively high waist-to-hip ratios or who scored relatively high on the anxiety, depression, and stress measures. These effects of physical and psychological condition were independent and were not mediated by women's perceptions of their own attractiveness. Our findings

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indicate that women's physical and psychological conditions both contribute to individual differences in face preferences.

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## 1. Introduction

One of the most robust findings in studies of human attractiveness is the high level of agreement among individuals on what is an attractive face (see [Langlois et al., 2000](#) for a meta-analytic review). In many species, however, individual differences in mate preferences are evident. For example, female sticklebacks (*Gasterosteus aculeatus*) and guppies (*Poecilia reticulata*) in good physical condition are more likely to prefer cues to immunocompetence in males than are relatively poor condition females ([Bakker, Kunzler, & Mazzi, 1999](#); [Lopez, 1999](#)). Such condition-dependent preferences are potentially adaptive if only females in good physical condition are able to obtain the healthiest mates. As the face plays an important role in human mate choice ([Miller & Todd, 1998](#); [Thornhill & Gangestad, 1999](#)), women's own condition may influence their preferences for male faces with characteristics that are thought to be indices of immune system strength and health (e.g., symmetry and masculinity; [Gangestad & Simpson, 2000](#); [Thornhill & Gangestad, 1999](#)).

Consistent with this proposal, [Little, Burt, Penton-Voak, and Perrett \(2001\)](#) reported positive relationships between women's ratings of their own attractiveness and the extent to which they preferred male faces with symmetric and masculine shapes. [Penton-Voak et al. \(2003\)](#) replicated the finding of [Little et al.](#) regarding female preferences for sexual dimorphism in male face shape using independent measures of female physical condition (waist-to-hip ratio and other-rated facial attractiveness, see [Miller & Todd, 1998](#)). Although psychological factors (e.g., anxiety, depression, and stress) might also reflect female condition, and psychological factors are known to influence physical health (for a review, see [Brunner & Marmot, 1999](#)), possible relationships between women's psychological condition and their face preferences have not yet been investigated.

Visible skin condition is positively associated with indices of men's genotypic health (e.g., MHC heterozygosity, [Roberts et al., 2005](#)), phenotypic health (e.g., pallor during illness, [Roujeau, 2001](#)), and facial attractiveness ([Jones, Little, Burt, & Perret, 2004](#); [Roberts et al., 2005](#)). In women, a low waist-to-hip ratio is associated with an attractive body shape ([Singh, 1993](#)), medical health ([Singh, 1993](#), for a review), and fertility ([Jasienska, Ziomkiewicz, Ellison, Lipson, & Thune, 2004](#)). Given the above, we investigated if women with low waist-to-hip ratios expressed stronger attraction to apparent health in faces than did women with relatively high waist-to-hip ratios. We also tested if women who scored low on assessments of anxiety, depression, and stress expressed stronger attraction to apparent health in faces than did women who scored relatively high on these measures. As the effects of psychological and physical conditions on face preferences could be mediated by women's beliefs about their own attractiveness, the possible effects of self-rated attractiveness were also

investigated. Stimuli (composite male and female faces) were manipulated in color and texture cues associated with apparent health and did not differ in symmetry or masculinity of 2D shape.

## 2. Methods

### 2.1. Stimulus manufacture

Male and female faces with raised and lowered visible skin conditions were manufactured in the following stages:

1. Digital face images of 60 men and 60 women captured
2. Images rated for apparent health with hairstyle and clothing masked
3. Composite faces manufactured with the mean color, texture, and shape of the 20 male faces rated least healthy (the “unhealthy” male composite), the 20 male faces rated most healthy (the “healthy” male composite), the 20 female faces rated least healthy (the “unhealthy” female composite), and the 20 female faces rated most healthy (the “healthy” female composite)
4. Six male and six female base faces manufactured (each base face a composite of three faces of the same sex randomly selected from the sample)
5. Color and texture differences between healthy and unhealthy composites of the same sex calculated (see [Tiddeman et al., 2001](#), for technical methods)

Each base face was transformed by  $\pm 30\%$  of the color and texture differences between the healthy and unhealthy composites (male base faces transformed using male composites, female base faces transformed using female composites). Examples of base faces with raised and lowered visible skin condition (i.e., color and texture cues associated with apparent health) are shown <http://www.abdn.ac.uk/~psy411/figures/EHB2005/>.

First, 60 white male (age:  $M=20.6$ ,  $S.D.=1.3$ , range=18–30 years) and 60 white female (age:  $M=20.38$ ,  $S.D.=1.1$ , range=19–24 years) color face images were captured under diffuse flash lighting with neutral expression and hair off the face. With hairstyle and clothing masked, the male faces were then rated by 15 white participants (age:  $M=23.3$ ,  $S.D.=2.7$ , range=19–30 years, 8 males) for health on a 1 (low)–7 (high) point scale (interrater agreement, Cronbach’s Alpha,  $\alpha=.81$ ). A different eight white raters (age:  $M=22.5$ ,  $S.D.=2.77$ , range=17–26 years) rated the female faces under identical conditions and using the same 1–7 scale (interrater agreement,  $\alpha=.82$ ). Ratings were of full color images.

Next, two “healthy” composites were manufactured with the average shape, color, and texture information of the 20 images with the highest health ratings from the male (the “healthy” male composite) and female image sets (the “healthy” female composite; see [Tiddeman et al., 2001](#), for computer graphic methods). Two “unhealthy” composites were also manufactured with the average shape, color, and texture information of the 20 images with the lowest health ratings from the male (the “unhealthy” male composite) and female

(the “unhealthy” female composite) image sets. Each composite was then made symmetric by averaging the original version with its mirror-reflected version.

Six male ‘base faces’ were created by combining random sets of 3 of the 60 male face images, and 6 female base faces were created by combining random sets of 3 of the 60 female images. Each of the male base faces was then transformed in color and texture by  $\pm 30\%$  of the difference between the “healthy” and “unhealthy” male composites (see Tiddeman et al., 2001, for methods and a discussion of composite-based transformation techniques for use in face research). Female base faces were transformed in the same way using the female composites. It was these 12 pairs of transformed base faces (6 males, 6 females) that were used to assess preferences for apparent health in faces. Each face pair comprised a “healthy” and “unhealthy” version of one base face. Faces in each pair differed in surface cues to apparent health but were matched in terms of identity and 2D face shape. Examples of male and female face pairs used in the study are shown in <http://www.abdn.ac.uk/~psy411/figures/EHB2005/>.

## 2.2. Stimulus calibration

To check that our stimuli captured cues to apparent health, the 12 pairs of faces (6 males, 6 females) were presented on-screen using a two-alternative forced choice paradigm to 81 female participants (all aged 18 years, all undergraduate student volunteers at the University of Colorado). Face pairs were shown in full color, in a random order, and were interspersed with filler trials. Participants were asked to choose the face in each pair that looked healthier. For male and female faces, the proportion of trials on which the healthy version was chosen was calculated separately. Analyses (one sample *t* tests comparing the proportion of trials on which the healthy version was chosen with chance, i.e., 50%) indicated that the versions of the faces with raised apparent health were judged healthier than the versions with lowered apparent health (male faces:  $t=6.317$ ,  $df=80$ ,  $p<.001$ ; female faces:  $t=9.611$ ,  $df=80$ ,  $p<.001$ ). This indicates that our facial stimuli captured cues to apparent health.

## 2.3. Participants

Sixty-nine heterosexual women (age:  $M=19.76$ ,  $S.D.=1.365$ , range=17–23 years; all undergraduate students at the University of St Andrews) participated in the study in return for payment (£4 per hour pro rata).

## 2.4. Procedure

The 12 face pairs varying in apparent health were presented on-screen using a forced choice paradigm, in a fully randomised order and interspersed with filler trials. Faces were presented in full color. Filler trials were 12 face pairs (6 males) that did not differ in visible skin condition. Women responded to the question, “Which of these individuals is more attractive?” Participants reported their age, completed the Hospital Anxiety and Depression Scale (a 14-item questionnaire with anxiety and depression subscales; Johnston, Weinmann, & Wright, 1995; Zigmond & Snaith, 1983), and responded to the questions “How would you rate your

current level of stress?” and “Please rate yourself in terms of attractiveness” (1=very low to 7=very high). Waist and hip circumferences were also measured.

### 2.5. Initial data processing

The proportion of trials on which the faces with raised apparent health were preferred was calculated separately for male and female faces. Self-rated current stress, the anxiety subscale of the Hospital Anxiety and Depression Scale, and the depression subscale of the Hospital Anxiety and Depression Scale were positively interrelated (all  $r > .418$ ,  $N=69$ , all  $p < .001$ ). Factor analysis was used to reduce these three variables to a single component that explained 62.39% of the total variance in stress, anxiety, and depression scores (stress:  $r = .758$ , anxiety:  $r = .815$ , depression:  $r = .796$ ). We reverse scaled this component and labelled it “psychological condition” (high score=low stress, anxiety, and depression). Waist-to-hip ratios were also calculated ( $M=0.80$ ,  $S.D.=0.057$ , range=0.67–0.92).

## 3. Results

One-sample  $t$  tests (comparing preferences with chance) indicated that women generally preferred faces with raised apparent health (male faces:  $t=5.509$ ,  $df=68$ ,  $p < .001$ ; female faces:  $t=5.741$ ,  $df=68$ ,  $p < .001$ ).

We analysed preference for apparent health in male faces with linear regression (dependent variable: proportion of trials on which health was preferred for male faces; independent variables entered using the enter method: waist-to-hip ratio, age, psychological condition, and self-rated attractiveness). The overall model was significant (adjusted  $r^2 = .100$ ,  $F=2.890$ ,  $df=68$ ,  $p = .029$ ). Waist-to-hip ratio ( $\beta = -.238$ ,  $t = -2.059$ ,  $p = .044$ ) and psychological condition ( $\beta = .256$ ,  $t = 2.173$ ,  $p = .044$ ) were independently related to preference for apparent health in male faces. Women with low waist-to-hip ratios or who were in good psychological condition expressed stronger attraction to apparent health in male faces than did women with high waist-to-hip ratios or who were in relatively poor psychological condition. There were no effects of age ( $\beta = .090$ ,  $t = 0.776$ ,  $p = .441$ ) or self-rated attractiveness ( $\beta = .128$ ,  $t = 1.090$ ,  $p = .280$ ).

Preferences for apparent health in female faces were analysed in the same way. By contrast with our findings for male faces, the overall model was not significant (adjusted  $r^2 = .002$ ,  $F=1.036$ ,  $df=68$ ,  $p = .396$ ) and there were no independent effects of any of the independent variables (all absolute  $\beta$  values  $< .184$ , all absolute  $t$  values  $< 1.516$ , all  $p > .135$ ).

There were no significant relationships between the independent variables (all  $p > .328$ ).

## 4. Discussion

Although women generally preferred faces with raised apparent health to faces with lowered apparent health, systematic variation in women’s preference for apparent health in male faces was also observed. Women with low waist-to-hip ratios expressed stronger

attraction to apparent health in male faces, but not female faces, than did women with relatively high waist-to-hip ratios. This finding complements those from earlier studies in which positive relationships between estimates of women's physical condition and their preferences for male faces with masculine and symmetric shapes were observed (e.g., Little et al., 2001; Penton-Voak et al., 2003). Independent of the effect of waist-to-hip ratio, women who scored low on the anxiety, depression, and stress measures demonstrated stronger preferences for apparent health in male faces than did women who scored relatively high on the anxiety, depression, and stress measures. Again, this relationship between women's condition and their preferences for apparent health in faces was observed for judgments of male faces but not for judgments of female faces. In addition to the effect of physical condition, psychological condition also appears to contribute to individual differences in women's preferences for male faces. Both the effect of waist-to-hip ratio and that of psychological condition were independent of women's beliefs about their own attractiveness.

Color and texture cues to apparent health in male faces (e.g., skin tone and evenness of complexion; Jones et al., 2004) signal both genotypic (Roberts et al., 2005) and phenotypic (Roujeau, 2001) health. Our findings therefore suggest that women's physical and psychological conditions are positively related to their preference for healthy potential mates. This systematic variation in health preference is potentially adaptive if only women who are in good condition (physically and psychologically) are able to obtain the healthiest mates. Condition-dependent preferences for healthy males could yield reproductive benefits by optimising mating effort (e.g., reducing mate search time) while simultaneously allowing for pursuit of the healthiest mate that is attainable. Given the high attractiveness of healthy-looking individuals, the condition-dependent preferences we report here may contribute to the similarity in the attractiveness of partners (see Feingold, 1988). By contrast, with previous studies where matching for attractiveness in partner choice was observed when there was an actual possibility of rejection by the partner, but not when there was no opportunity for rejection to occur (Huston, 1973; Walster, Aronson, Abrahams, & Rottman, 1966), the condition-dependent preferences we report here suggest that matching for attractiveness is also evident on preference tests where there is no possibility of actual rejection.

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## References

- Bakker, T. C., Kunzler, R., & Mazzi, K. (1999). Condition-related mate choice in sticklebacks. *Nature*, 401, 234.
- Brunner, E., & Marmot, M. (1999). Social organisation, stress and health. In M. Marmot & R. Wilkinson (Eds.), *Social determinants of health* (pp. 17–44). Oxford, UK: Oxford University Press.



- Feingold, A. (1988). Matching for attractiveness in romantic partners and same-sex friends: A meta-analysis and theoretical critique. *Psychological Bulletin*, 104, 226–235.
- Gangestad, S. W., & Simpson, J. A. (2000). The evolution of human mating: Trade-offs and strategic pluralism. *Behavioral and Brain Sciences*, 23, 573–644.
- Huston, T. L. (1973). Ambiguity of acceptance, social desirability and dating choice. *Journal of Experimental Psychology*, 9, 32–42.
- Jasienska, G., Ziomkiewicz, A., Ellison, P. T., Lipson, S. F., & Thune, I. (2004). Large breasts and narrow waists indicate reproductive potential in women. *Proceedings of the Royal Society of London, Series B*, 271, 1213–1217.
- Johnston, M., Weinmann, J., & Wright, S. (1995). *Measures in health psychology: A user's portfolio*. Windsor, UK: NFER-Nelson.
- Jones, B. C., Little, A. C., Burt, D. M., & Perrett, D. I. (2004). When facial attractiveness is only skin deep. *Perception*, 33, 569–576.
- Langlois, J. H., Kalakanis, L., Rubenstein, A. J., Larson, A., Hallam, M., & Smoot, M. (2000). Maxims or myths of beauty? A meta-analytic and theoretical review. *Psychological Bulletin*, 126, 390–423.
- Little, A. C., Burt, D. M., Penton-Voak, I. S., & Perrett, D. I. (2001). Self-perceived attractiveness influences human preferences for sexual dimorphism and symmetry in male faces. *Proceedings of the Royal Society of London, Series B*, 268, 39–44.
- Lopez, S. (1999). Parasitised female guppies do not prefer showy males. *Animal Behaviour*, 57, 1129–1134.
- Miller, G. F., & Todd, P. M. (1998). Mate choice turns cognitive. *Trends in Cognitive Sciences*, 2, 190–198.
- Penton-Voak, I. S., Little, A. C., Jones, B. C., Burt, D. M., Tiddeman, B. P., & Perrett, D. I. (2003). Measures of female condition influence preferences for sexual dimorphism in faces of male *Homo sapiens*. *Journal of Comparative Psychology*, 117, 264–271.
- Roberts, S. C., Little, A. C., Gosling, L. M., Perrett, D. I., Carter, V. S., Jones, B. C., et al. (2005). MHC-heterozygosity and human facial attractiveness. *Evolution & Human Behavior*, 3, 213–226.
- Roujeau, J. C. (2001). Clinical criteria and risk factors. *Annales de Dermatologie et de Venereologie*, 128, 376–381.
- Singh, D. (1993). Body shape and women's attractiveness: The critical role of waist-to-hip ratio. *Human Nature*, 4, 297–321.
- Thornhill, R., & Gangestad, S. W. (1999). Facial attractiveness. *Trends in Cognitive Sciences*, 3, 452–460.
- Tiddeman, B. P., Burt, D. M., & Perrett, D. I. (2001). Prototyping and transforming facial textures for perception research. *IEEE Computer Graphics and Applications*, 21, 42–50.
- Walster, E., Aronson, V., Abrahams, D., & Rottman, L. (1966). Importance of physical attractiveness in dating behaviour. *Journal of Personality and Social Psychology*, 4, 508–516.
- Zigmond, A. S., & Snaith, R. P. (1983). The Hospital Anxiety and Depression Scale. *Acta Psychiatrica Scandinavica*, 67, 361–370.