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Waist–hip ratio predicts women's preferences for masculine male faces, but not perceptions of men's trustworthiness

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ABSTRACT

Studies show that attractive women demonstrate stronger preferences for masculine men than relatively unattractive women do. Such condition-dependent preferences may occur because attractive women can more easily offset the costs associated with choosing a masculine partner, such as lack of commitment and less interest in parenting. Alternatively, if masculine men display negative characteristics less to attractive women than to unattractive women, attractive women may perceive masculine men to have more positive personality traits than relatively unattractive women do. We examined how two indices of women's attractiveness, body mass index (BMI) and waist–hip ratio (WHR), relate to perceptions of both the attractiveness and trustworthiness of masculinized versus feminized male faces. Consistent with previous studies, women with a low (attractive) WHR had stronger preferences for masculine male faces than did women with a relatively high (unattractive) WHR. This relationship remained significant when controlling for possible effects of BMI. Neither WHR nor BMI predicted perceptions of trustworthiness. These findings present converging evidence for condition-dependent mate preferences in women and suggest that such preferences do not reflect individual differences in the extent to which pro-social traits are ascribed to feminine versus masculine men.

1. Introduction

Masculine facial characteristics are positively associated with men's long-term health. For example, masculinity ratings of men's faces are positively associated with health as assessed from medical records (Rhodes, Chan, Zebrowitz, & Simmons, 2003) and masculine facial proportions are negatively associated with the incidence and duration of men's respiratory illnesses (Thornhill & Gangestad, 2006). Male facial masculinity is also correlated with symmetry, a potential signal of heritable developmental stability (Gangestad & Thornhill, 2003; Little et al., 2008). Additionally, women's preferences for masculinity and symmetry are correlated, suggesting both traits signal a common underlying quality (Little, Jones, DeBruine, & Feinberg, 2008). Thus, male masculinity is likely to signal genetic health, a trait that indirectly benefits women by resulting in healthier offspring.

While these findings suggest that male masculinity is associated with a trait that is desirable in a mate (i.e., good health), masculine facial cues are also associated with negative personality traits and behaviors that are not desirable in a mate. Masculine men are perceived as untrustworthy, emotionally cold and more likely to be bad parents than feminine men are (Boothroyd, Jones, Burt, & Perrett, 2007; Oosterhof & Todorov, 2008; Perrett et al., 1998). When asked about their past relationships, masculine men report more short-term relationships, while feminine men report more long-term relationships (Rhodes, Simmons, & Peters, 2005). Facial masculinity is associated with testosterone (Penton-Voak & Chen, 2004; Pound, Penton-Voak, & Surridge, 2009) and high-testosterone men are less likely to marry, more likely to divorce, and have more marital problems than lower-testosterone men (Booth & Dabbs, 1993), and are also less likely to feel a need to respond to infant cries than men with lower testosterone (Fleming, Corter, Stallings, & Steiner, 2002). Thus, male facial femininity signals prosocial traits, which directly benefit women by increasing paternal investment.

The findings described above support the proposal that women's preferences for masculine versus feminine men may reflect a trade-off between the benefits (e.g., increased offspring health) and costs (e.g., reduced commitment) associated with choosing a masculine partner (for reviews, see Fink & Penton-Voak, 2002; Gangestad & Simpson, 2000; Jones et al., 2008; Little, Jones, Penton-Voak, Burt, & Perrett, 2002). Differences in how women resolve this trade-off can lead to individual differences in masculinity

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preferences. For example, attractive women demonstrate stronger preferences for masculine men than relatively unattractive women do (Little, Burt, Penton-Voak, & Perrett, 2001; Little & Mannion, 2006; Penton-Voak et al., 2003; Vukovic et al., 2008). Such condition-dependent preferences will be adaptive if attractive women are better able to compete for and/or retain masculine partners than relatively unattractive women are (Little & Mannion, 2006; Little et al., 2001; Penton-Voak et al., 2003; Vukovic et al., 2008). In other words, if attractive women are more successful at winning high-quality, masculine partners, then less attractive women may avoid wasting mating effort by decreasing their attraction to masculinity.

While some researchers have questioned the importance of the link between waist–hip ratio (WHR) and women's mate quality (Swami & Furnham, 2008, chaps. 5 and 6; Tovée, Furnham, & Swami, 2007), many studies have shown that WHR is associated with women's attractiveness (Penton-Voak et al., 2003; Singh, 1993), health (Singh, 1993), and fertility (Wass, Waldenstrom, Rossner, & Hellberg, 1997). Low WHR is also associated with enhanced cognitive test scores for both women and their offspring and low WHR protects offspring against cognitive problems associated with teen births (Lassek & Gaulin, 2008). Additionally, women with a low WHR are considered particularly feminine (Furnham, Swami, & Shah, 2006) and possess a hormone profile associated with fertility (Jasienska, Ziomkiewicz, Ellison, Lipson, & Thune, 2004). Although preferences for WHR may vary across different judgment contexts (Schmalt, 2006; Swami & Furnham, 2008; Swami, Jones, Einon, & Furnham, 2009) previous research has demonstrated that UK undergraduates typically prefer low to high WHR when judging women's attractiveness (Furnham et al., 2006; Toveé, Reinhardt, Emery, & Cornelissen, 1998; Toveé, Maisey, Emery, & Cornelissen, 1999). Consistent with the proposal that women's preferences for masculine men are influenced by their own physical condition and/or attractiveness (Little & Mannion, 2006; Little et al., 2001; Penton-Voak et al., 2003; Vukovic et al., 2008), women with a low (i.e., feminine, healthy and attractive) WHR demonstrate stronger preferences for masculine men than women with a relatively high (i.e., masculine, unhealthy and unattractive) WHR do (Penton-Voak et al., 2003; see also Jones et al., 2005b for an equivalent finding for women's preferences for healthy-looking men).

Although some researchers have emphasized the role of WHR in women's body attractiveness (e.g., Singh, 1993), other researchers have suggested that body mass index (BMI) is a better indicator of female attractiveness (e.g., Swami & Tovée, 2005; Toveé, Hancock, Mahmoodi, Singleton, & Cornelissen, 2002; Toveé et al., 1999). Optimal BMI is a better predictor than WHR of sexual attractiveness and fertility (Toveé et al., 1998) and women with an optimal BMI are also considered to be particularly feminine (Furnham et al., 2006; Johnson & Tassinary, 2007). While the relative importance of BMI and WHR in determining women's body attractiveness is highly debated, it is uncontroversial that both BMI and WHR influence women's attractiveness to some degree (Furnham et al., 2006; Toveé et al., 1998, 1999). However, the association between BMI and condition-dependent preferences for masculinity has never been investigated. Indeed, Penton-Voak et al. (2003) emphasized that a limitation of their study showing an association between women's WHR and masculinity preferences was that they did not compare the effects of WHR and BMI on women's preferences for masculine men. Thus, it is important to ascertain whether this previous association between WHR and masculinity preferences is explained or moderated by BMI.

As noted earlier, attractive women may demonstrate stronger preferences for masculine men because their attractiveness allows them to offset the costs associated with choosing a masculine partner (Little & Mannion, 2006; Little et al., 2001; Penton-Voak et al., 2003; Vukovic et al., 2008). In other words, attractive women may be better able to compete for, retain, and/or replace masculine partners. Alternatively, attractive women may perceive masculine men to have more positive personality traits than relatively unattractive women do if attractive women are treated differently than relatively unattractive women by masculine men (e.g., masculine men are more fair, attentive, and committed). This latter hypothesis would be supported if attractive women perceive masculine men to be both more attractive and to possess more prosocial traits than relatively unattractive women do. Trustworthiness is a positive social trait that correlates highly with a number of other perceived characteristics that are relevant to mate choice (e.g., responsibility, emotional stability, sociability, care, intelligence, confidence; Oosterhof & Todorov, 2008). Thus, in the current study we investigated attributions of both attractiveness and trustworthiness to masculine male faces. While previous research has demonstrated condition-dependent preferences for masculinity in men's faces and voices, we know of no previous research that has investigated if measures of women's own physical condition also predict the extent to which they ascribe pro-social traits to masculine men. This is somewhat surprising, since such tests may provide insight into the psychological processes that underpin condition-dependent masculinity preferences. Indeed, while Johnston, Hagel, Franklin, Fink, and Grammer (2001) emphasized that variation in women's preferences for masculine men, but not attributions of pro-social traits to masculine men, varied systematically during the menstrual cycle, we know of no equivalent tests for condition-dependent perceptions of masculine men.

In the current study, we measured women's WHR and BMI in order to determine the extent to which these different body measurements predict masculinity preferences. As WHR has been previously found to be associated with masculinity preferences (Penton-Voak et al., 2003), we predicted that it would do so in the current study. Additionally, in the current study, we also tested if another measure of female quality (BMI) also predicts women's masculinity preferences and if any effects of BMI explain the association between WHR and masculinity preferences. Finally, we also assessed women's perceptions of the trustworthiness of masculine versus feminine male faces in order to determine if condition-dependent responses to masculinity previously demonstrated for attractiveness judgments (Little & Mannion, 2006; Little et al., 2001; Penton-Voak et al., 2003; Vukovic et al., 2008) also occur for judgments of men's trustworthiness.

Finding that WHR and/or BMI predict perceptions of both the attractiveness and trustworthiness of masculine male faces would suggest that attractive women do not perceive the same costs as relatively unattractive women do to choosing a masculine partner (i.e., attractive women do not think masculine men are untrustworthy). However, finding that WHR and/or BMI predict the attractiveness of masculine male faces, but not their trustworthiness, would suggest that attractive women believe they can offset the costs of choosing a masculine partner (e.g., by being able to replace a partner more quickly).

2. Methods

2.1. Participants

Participants were 42 women aged 18–26 years ($M = 19.8$, $SD = 1.93$) who were not using any form of hormonal contraceptive. Participants self-identified their ethnicity; 32 identified as Caucasian, 5 as East Asian (e.g., Chinese), 4 as West Asian (e.g., Indian), and 1 as African. All participants were Undergraduate students at the University of Aberdeen who were participating in the study in return for course credit.

2.2. Stimuli

Masculinized versions of digital face images of 20 young adult White males were manufactured by adding 50% of the linear differences in 2D shape between symmetrized male and female prototype faces. Feminized versions of these same male identities were created in the same way, this time by subtracting 50% of the linear differences in 2D shape between the prototypes (Fig. 1). These methods follow previous studies (e.g., Little et al., 2002; Penton-Voak et al., 2003) that have manipulated sexual dimorphism in face images. These manipulations have been shown to affect judgments of both masculinity and dominance of the face images in the predicted way (i.e., masculinized versions are perceived as more masculine and more dominant than feminized versions, DeBruine et al., 2006; Welling et al., 2007), and have been shown to produce preferences that are equivalent to those when other methods for manipulating masculinity in face images are used (DeBruine, Jones, Smith, & Little, in press). Furthermore, preferences for masculinity assessed using these methods are positively related to the reported masculinity of women's romantic partners (DeBruine et al., 2006) and preferences for masculinity in other domains, such as preferences for putative male pheromones (Cornwell et al., 2004) or masculine male voices (Feinberg, DeBruine, Jones, & Little, 2008). These findings are noteworthy because they suggest that women's preferences for masculinized male faces are indicative of their preferences for masculine men more generally.

2.3. Procedure

Participants completed two short face perception tests, the order of which was fully randomized. In one test, women were shown 20 pairs of men's faces (each pair consisting of a masculinized and feminized version of the same individual) and were asked to choose the face in each pair that was the more attractive (Fig. 1). Participants repeated this task in a second test in which they were instructed to choose the face in each pair that they considered the more trustworthy. Note that the same pairs of faces were used in both of the face perception tests and that trial order, the side of the screen on which any particular image was shown and test order (attractiveness or trustworthiness) were each fully randomized.

In addition, participants' height and weight were measured in order to calculate body mass index (BMI), and waist and hip circumference was measured in order to calculate waist–hip ratio (WHR). All measurements were taken in the laboratory and were not self-reported. Height was measured with a wall-mounted height chart and weight was measured using a floor scale. Waist and hip circumference were measured using a fabric tape measure. Following Penton-Voak et al. (2003), waist measurements were taken just above the navel and hip measurements were taken at the anterior superior iliac spine (the bony prominence at the front of the hips).

BMI ranged from 17.5 to 29.7 kg/m^2 (M = 22.3 kg/m^2, SD = 2.95). These values are within the underweight (15–19 kg/m^2), normal (20–24 kg/m^2), and overweight (25–30 kg/m^2) categories as defined by Bray (1978) and no participants were in the emaciated (<15 kg/m^2) or obese (>30 kg/m^2) categories. Perceptions of body attractiveness are linearly related to BMI within this range (Toveé et al., 1998, 1999). WHR ranged from 0.66 to 0.88 (M = 0.74, SD = 0.05); these values are similar to the range reported in Toveé et al. (1998) of .68–.90 and perceptions of body attractiveness are linearly related to WHR within this range (Toveé et al., 1998, 1999). BMI and WHR were not significantly correlated (r = .26, p = .10).

3. Results

Following previous studies of variation in women's masculinity preferences (DeBruine et al., 2006), an attractiveness score for each participant was calculated as the proportion of 20 trials on which the masculine face was chosen as more attractive than the feminine face. Following previous studies of the perception of masculine versus feminine men's trustworthiness (Buckingham et al., 2006), a trustworthiness score was calculated as the proportion of trials on which the masculine face was chosen as more trustworthy than the feminine face. Kolmogorov–Smirnov tests did not detect significant deviation from normality (attractiveness score: Z = 0.59, p = .88; trustworthiness score: Z = 1.00, p = .28).

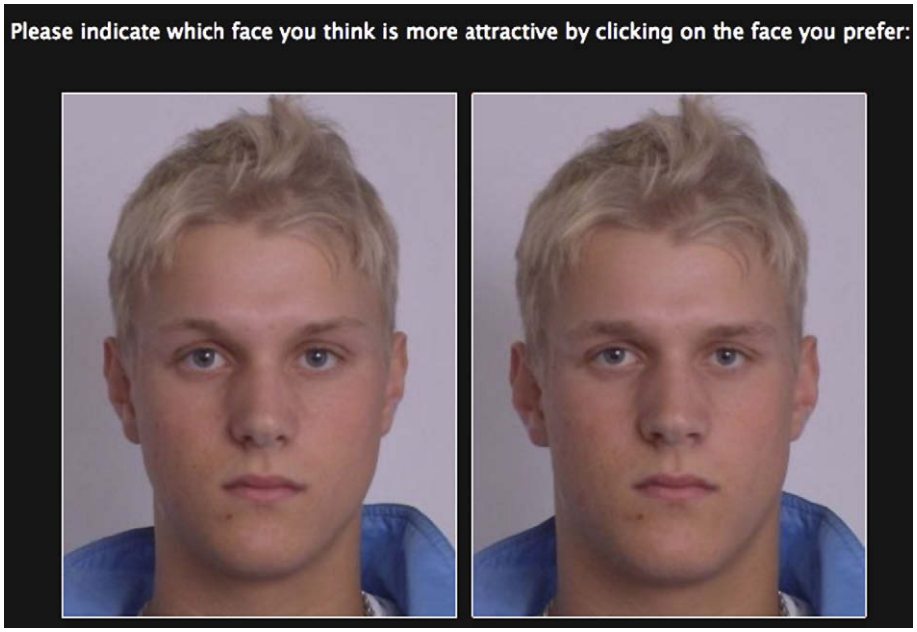

Fig. 1. The interface used to test masculinity preferences. Participants chose the more attractive face from pairs of feminized (left) and masculinized (right) versions of the same identity.

On average, women chose the masculine face as more attractive than the feminine face 42% of the time (SD = 24%) and as more trustworthy than the feminine face 38% of the time (SD = 23%). One-sample t-tests show that women preferred feminine to masculine faces ($t(41) = 2.22$, $p = .032$, $d = 0.34$) and perceived feminine faces to be more trustworthy than masculine faces ($t(41) = 3.40$, $p = .002$, $d = 0.52$). Attractiveness and trustworthiness scores were positively correlated ($r = .31$, $p = .045$).

The relationship between preference for masculinity and women's body measurements was analyzed using linear regression [dependent variable: *attractiveness score*; independent variables: age, BMI, WHR]. The overall model was not significant ($F(3, 38) = 1.75$, $p = .17$) and the adjusted R^2 equaled .052. All following analyses report standardized betas. The attractiveness score was predicted by WHR ($t = -2.12$, $p = .041$, $beta = -.34$) such that preferences for masculine faces were associated with low (i.e., attractive) WHRs. Neither BMI ($t = 1.34$, $p = .19$, $beta = .21$) nor age ($t = -0.76$, $p = .45$, $beta = .12$) predicted masculinity preferences.

The relationship between the perceived trustworthiness of masculinity and women's body measurements was analyzed using a second linear regression [dependent variable: *trustworthiness score*; independent variables: *age, BMI, WHR*]. The overall model was not significant ($F(3, 38) = 0.65$, $p = .59$) and the adjusted R^2 equaled −.027. This analysis revealed no significant effects for age, BMI or WHR (all unsigned ts < 1.01, ps > .32, unsigned $beta$s < .17).

Although ethnicity may influence WHR and BMI (Swami et al., 2009), our results are not changed by limiting analyses to the 32 Caucasian women. The linear regression for these 32 Caucasian women showed that attractiveness judgments are predicted by WHR ($t = -2.32$, $p = .028$, $beta = -.42$), but not BMI ($t = 1.08$, $p = .29$, $beta = .20$) or age ($t = -.008$, $p = .99$, $beta = -.001$). Trustworthiness judgments were not predicted by WHR, BMI, or age (all $t < 1.3$, $p > .20$, $beta < .24$).

4. Discussion

Here we found that women with a low (i.e., feminine, attractive) waist–hip ratio (WHR) demonstrated stronger preferences for masculine men than did women with a relatively high (i.e., masculine, unattractive) WHR. Importantly, this effect remained significant when controlling for body mass index (BMI), suggesting that the relationship between WHR and masculinity preferences reported here and in Penton-Voak et al. (2003) do not reflect the effects of BMI. This association between WHR and masculinity preferences is consistent with other reports of condition-dependent preferences, whereby attractive women showed stronger preferences for masculine men than relatively unattractive women did (Little & Mannion, 2006; Little et al., 2001; Penton-Voak et al., 2003; Vukovic et al., 2008) and whereby women with low WHR demonstrated stronger preferences for healthy-looking men than women with relatively high WHR did (Jones et al., 2005b). Such condition-dependent preferences based on WHR would be adaptive if masculine men demonstrated increased preferences for feminine women, such that less feminine women could avoid wasting mating effort by decreasing their preference for masculinity. Indeed, some evidence suggests that masculine men do have a stronger preference for feminine women than relatively less masculine men do (Jones et al., 2007).

The lack of an association between BMI and women's masculinity preferences may have been influenced by our relatively small sample size. However, our sample size was sufficient to observe an association between WHR and masculinity preferences, even when non-Caucasian participants were excluded from the analysis.

Although previous findings suggest that BMI is a better predictor of women's attractiveness and, potentially, fertility than WHR (Swami & Tovée, 2005; Toveé et al., 1999, 2002; but see Zaadstra et al., 1993), here we found that WHR was a better predictor of women's masculinity preferences than BMI. WHR may be a better predictor of women's masculinity preferences because WHR and BMI relate to hormone levels and fertility in different ways. For example, while breast size, a physical trait relating to variations in BMI (i.e., body-fat distribution), is correlated with estradiol (Jasienska et al., 2004), WHR ratio is correlated with both estradiol and progesterone (Jasienska et al., 2004). Thus, our finding that WHR is a better predictor of women's masculinity preferences than BMI is consistent with research suggesting that progesterone levels are a better predictor of masculinity preferences than estrogen levels (Jones et al., 2005a; Puts, 2006; Welling et al., 2007; see Jones et al., 2008 for a review).

As noted in our introduction, WHR may predict women's masculinity preferences because attractive women are less likely to ascribe negative personality characteristics (e.g., untrustworthiness) to masculine men than relatively unattractive women are. However, while WHR predicted the strength of women's attraction to masculine men, WHR did not predict judgments of these men's trustworthiness. Thus, attractive women do not appear to demonstrate stronger preferences for masculine men than do relatively unattractive women because attractive women perceive masculine men to be more trustworthy. We suggest that attractive women may show less aversion to masculine men because they can offset the costs of choosing a masculine partner by being able to replace or retain a partner more easily than unattractive women can. Further research on condition-dependent preferences may test this hypothesis more directly. That WHR predicted women's preferences for masculine versus feminine men, but not the extent to which women perceived masculine men to be more trustworthy than feminine men, shows that the association between WHR and women's masculinity preferences is not due to a possible general response bias whereby attractive women may simply be more (or less) attentive to men's faces when making social judgments.

Our findings show that WHR, but not BMI, predicts women's preferences for masculinity in men's faces, but not women's perceptions of masculine men's trustworthiness. Since WHR is an indicator of women's health, attractiveness and reproductive potential, these findings are consistent with previous studies demonstrating condition-dependent preferences among women (Jones et al., 2005b; Little & Mannion, 2006; Little et al., 2001; Penton-Voak et al., 2003; Vukovic et al., 2008). Importantly, that WHR predicted women's preferences for masculine men, but not women's perceptions of masculine men's trustworthiness, suggests that condition-dependent preferences show a degree of domain-specificity, whereby attractive women show enhanced perceptions of masculine men's attractiveness, but not enhanced perceptions of positive traits in general. Such domain-specificity provides insight into the mechanisms and processes that underpin condition-dependent preferences and evinces adaptive design in women's judgments of men's attractiveness.

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References

Booth, A., & Dabbs, J. (1993). Testosterone and men's marriages. *Social Forces, 72*, 463–477.

Boothroyd, L. G., Jones, B. C., Burt, D. M., & Perrett, D. I. (2007). Partner characteristics associated with masculinity, health and maturity in male faces. *Personality and Individual Differences, 43*, 1161–1173.

Bray, G. A. (1978). Definition, measurement, and classification of the syndromes of obesity. *International Journal of Obesity, 2*, 99–112.

Buckingham, G., DeBruine, L. M., Little, A. C., Welling, L. L. M., Conway, C. A., Tiddeman, B. P., et al. (2006). Visual adaptation to masculine and feminine faces influences generalized preferences and perceptions of trustworthiness. *Evolution and Human Behavior, 27*, 381–389.

Cornwell, R. E., Boothroyd, L. G., Burt, D. M., Feinberg, D. R., Jones, B. C., Little, A. C., et al. (2004). Concordant preferences for opposite-sex signals? Human pheromones and facial characteristics. *Proceedings of the Royal Society of London B, 271*, 635–640.

DeBruine, L. M., Jones, B. C., Little, A. C., Boothroyd, L. G., Perrett, D. I., Penton-Voak, I. S., et al. (2006). Correlated preferences for facial masculinity and ideal or actual partner's masculinity. *Proceedings of the Royal Society of London B, 273*, 1355–1360.

DeBruine, L. M., Jones, B. C., Smith, F. G., & Little, A. C. (in press). Are attractive men's faces masculine or feminine? The importance of controlling confounds in face stimuli. *Journal of Experimental Psychology: Human Perception and Performance.*

Feinberg, D. R., DeBruine, L. M., Jones, B. C., & Little, A. C. (2008). Correlated preferences for men's facial and vocal masculinity. *Evolution and Human Behavior, 29*, 233–241.

Fink, B., & Penton-Voak, I. S. (2002). Evolutionary psychology of facial attractiveness. *Current Directions in Psychological Science, 11*, 154–158.

Fleming, A. S., Corter, C., Stallings, J., & Steiner, M. (2002). Testosterone and prolactin are associated with emotional responses to infant cries in new fathers. *Hormones and Behavior, 42*, 399–413.

Furnham, A., Swami, V., & Shah, K. (2006). Female body correlates of attractiveness and other ratings. *Personality and Individual Differences, 41*, 443–454.

Gangestad, S. W., & Simpson, J. A. (2000). The evolution of human mating: Trade-offs and strategic pluralism. *Behavioral and Brain Sciences, 23*, 573–587.

Gangestad, S. W., & Thornhill, R. (2003). Facial masculinity and fluctuating asymmetry. *Evolution and Human Behavior, 24*, 231–241.

Jasienska, G., Ziomkiewicz, A., Ellison, P. T., Lipson, S. F., & Thune, I. (2004). Large breasts and narrow waists indicate high reproductive potential in women. *Proceedings of the Royal Society of London B, 271*, 1213–1217.

Johnson, K. L., & Tassinary, L. G. (2007). Interpersonal metaperception: The importance of compatibility in the aesthetic appreciation of bodily cues. In V. Swami & A. Furnham (Eds.), *The body beautiful: Evolutionary and socio-cultural perspectives*. London: Macmillan.

Johnston, V. S., Hagel, R., Franklin, M., Fink, B., & Grammer, K. (2001). Male facial attractiveness: Evidence for a hormone-mediated adaptive design. *Evolution and Human Behavior, 22*, 251–267.

Jones, B. C., DeBruine, L. M., Little, A. C., Conway, C. A., Welling, L. L. M., & Smith, F. G. (2007). Sensation seeking and men's face preferences. *Evolution and Human Behavior, 28*, 439–446.

Jones, B. C., DeBruine, L. M., Perrett, D. I., Little, A. C., Feinberg, D. R., & Law Smith, M. J. (2008). Effects of menstrual cycle phase on face preferences. *Archives of Sexual Behavior, 37*, 78–84.

Jones, B. C., Little, A. C., Boothroyd, L. G., DeBruine, L. M., Feinberg, D. R., Law Smith, M. J., et al. (2005a). Commitment to relationships and preferences for femininity and apparent health in faces are strongest on days of the menstrual cycle when progesterone level is high. *Hormones and Behavior, 48*, 283–290.

Jones, B. C., Little, A. C., Boothroyd, L. G., Feinberg, D. R., Cornwell, R. E., DeBruine, L. M., et al. (2005b). Women's physical and psychological condition independently predict their preference for apparent health in faces. *Evolution and Human Behavior, 26*, 451–457.

Lassek, W. D., & Gaulin, S. J. C. (2008). Waist–hip ratio and cognitive ability: Is gluteofemoral fat a privileged store of neurodevelopmental resources? *Evolution and Human Behavior, 29*, 26–34.

Little, A. C., Burt, D. M., Penton-Voak, I. S., & Perrett, D. I. (2001). Self-perceived attractiveness influences human female preferences for sexual dimorphism and symmetry in male faces. *Proceedings of the Royal Society of London B, 268*, 39–44.

Little, A. C., Jones, B. C., DeBruine, L. M., & Feinberg, D. R. (2008). Symmetry and sexual-dimorphism in human faces: Interrelated preferences suggest both signal quality. *Behavioral Ecology, 19*, 902–908.

Little, A. C., Jones, B. C., Penton-Voak, I. S., Burt, D. M., & Perrett, D. I. (2002). Partnership status and the temporal context of relationships influence human female preferences for sexual dimorphism in male face shape. *Proceedings of the Royal Society of London B, 269*, 1095–1103.

Little, A. C., Jones, B. C., Waitt, C., Tiddeman, B. P., Feinberg, D. R., Perrett, D. I., et al. (2008). Symmetry is related to sexual dimorphism in faces: Data across culture and species. *PLoS One, 3*, 2106.

Little, A. C., & Mannion, H. D. (2006). Viewing attractive or unattractive same-sex images affects preferences for sexual dimorphism in opposite-sex faces. *Animal Behaviour, 72*, 981–987.

Oosterhof, N. N., & Todorov, A. (2008). The functional basis of face evaluation. *Proceedings of the National Academy of Sciences of the USA, 105*, 11087–11092.

Penton-Voak, I. S., & Chen, J. Y. (2004). High salivary testosterone is linked to masculine male facial appearance in humans. *Evolution and Human Behavior, 25*, 229–241.

Penton-Voak, I. S., Little, A. C., Jones, B. C., Burt, D. M., Tiddeman, B. P., & Perrett, D. I. (2003). Female condition influences preferences for sexual dimorphism in faces of male humans (Homo sapiens). *Journal of Comparative Psychology, 117*, 264–271.

Perrett, D. I., Lee, K. J., Penton-Voak, I. S., Rowland, D. R., Yoshikawa, S., Burt, D. M., et al. (1998). Effects of sexual dimorphism on facial attractiveness. *Nature, 394*, 884–887.

Pound, N., Penton-Voak, I. S., & Surridge, A. K. (2009). Testosterone responses to competition in men are related to facial masculinity. *Proceedings of the Royal Society of London B, 276*, 153–159.

Puts, D. A. (2006). Cyclic variation in women's preferences for masculine traits – Potential hormonal causes. *Human Nature, 17*, 114–127.

Rhodes, G., Chan, J., Zebrowitz, L. A., & Simmons, L. W. (2003). Does sexual