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Correlated preferences for facial masculinity and ideal or actual partner's masculinity

Lisa M. DeBruine[1,*], Benedict C. Jones[2], Anthony C. Little[3], Lynda G. Boothroyd[4], David I. Perrett[1], Ian S. Penton-Voak[5], Philip A. Cooper[6], Lars Penke[7,8], David R. Feinberg[9] and Bernard P. Tiddeman[10]

[1]*School of Psychology, University of St Andrews, St Andrews KY16 9AJ, UK*
[2]*School of Psychology, University of Aberdeen, Aberdeen AB24 2UB, UK*
[3]*School of Biological Sciences, University of Liverpool, Crown Street, Liverpool L69 7ZB, UK*
[4]*Department of Psychology, University of Durham, South Road, Durham DH1 3LE, UK*
[5]*Department of Experimental Psychology, University of Bristol, Bristol BS8 1TN, UK*
[6]*Department of Psychology, Neuroscience and Behaviour, McMaster University, Hamilton, Ontario L8S 4K1, Canada*
[7]*Institute of Psychology, Humboldt University, Rudower Chaussee 18, 12489 Berlin, Germany*
[8]*International Max Planck Research School LIFE, Max Planck Institute for Human Development, Lentzeallee 94, 14195 Berlin, Germany*
[9]*Department of Psychology, Harvard University, Boston, MA 02115-1613, USA*
[10]*School of Computer Science, University of St Andrews, St Andrews KY16 9SX, UK*

Studies of women's preferences for male faces have variously reported preferences for masculine faces, preferences for feminine faces and no effect of masculinity–femininity on male facial attractiveness. It has been suggested that these apparently inconsistent findings are, at least partly, due to differences in the methods used to manipulate the masculinity of face images or individual differences in attraction to facial cues associated with youth. Here, however, we show that women's preferences for masculinity manipulated in male faces using techniques similar to the three most widely used methods are positively inter-related. We also show that women's preferences for masculine male faces are positively related to ratings of the masculinity of their actual partner and their ideal partner. Correlations with partner masculinity were independent of real and ideal partner age, which were not associated with facial masculinity preference. Collectively, these findings suggest that variability among studies in their findings for women's masculinity preferences reflects individual differences in attraction to masculinity rather than differences in the methods used to manufacture stimuli, and are important for the interpretation of previous and future studies of facial masculinity.

Keywords: masculinity; femininity; sexual dimorphism; faces; computer graphics

1. INTRODUCTION

Previous studies of females have reported both general preferences for male faces with masculinized proportions (Johnston *et al.* 2001; Penton-Voak *et al.* 2001) and general preferences for male faces with feminized proportions (Perrett *et al.* 1998; Penton-Voak *et al.* 1999; Little *et al.* 2001, 2002; Rhodes *et al.* 2003*a*). Other studies have found no overall preference for masculinity (Swaddle & Riersen 2002; Cornwell *et al.* 2004). Methodological differences have been put forward as an explanation (Johnston *et al.* 2001; Swaddle & Riersen 2002; Fink *et al.* 2005; Rhodes 2006), although diverse methodologies produce similar results for female face preferences. Alternatively, individual differences (e.g. attractiveness, partnership status) affect masculinity preferences (Little *et al.* 2001, 2002; Penton-Voak *et al.* 2003), and differences in the average characteristics of study populations may explain differences among studies.

Facial masculinity is thought to signal heritable immunity to infectious disease, because only men with strong immune systems are able to withstand the immunosuppressant effects of high levels of circulating testosterone necessary to develop masculine features (see Thornhill & Gangestad (1999) for a review). Although this proposal remains controversial, recent studies have demonstrated that masculinity of male facial appearance is positively associated with circulating levels of testosterone (assessed from saliva samples; Penton-Voak & Chen 2004) and negatively associated with incidence of past health problems (assessed from medical records; Rhodes *et al.* 2003*a*). While many theories of attraction propose that men with masculine features might be attractive to women due to hypothesized preferences for men displaying cues

* Author for correspondence (lisa@debruine.info).

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to good genes for immunocompetence (Thornhill & Gangestad 1999), women's preferences for masculine male faces appear to be highly variable (see Penton-Voak & Perrett (2000) for a review). Aversions to masculinity may reflect perceived 'costs' associated with preferring masculine partners, such as unwillingness to invest care and resources in partners or offspring (Mazur & Booth 1998; Perrett *et al.* 1998; Gangestad & Simpson 2000). Indeed, Gray *et al.* (2002) reported that men with high circulating levels of testosterone spend less time with their partners and offspring than men with relatively low levels of testosterone do.

Although women's preferences for masculine male faces appear highly variable, variation is predicted by evolutionary theory. Attraction to masculine male faces is stronger during the fertile phase of the menstrual cycle (i.e. the late follicular phase) than in other phases (Penton-Voak *et al.* 1999, 2001; Johnston *et al.* 2001). It is also stronger when women judge the attractiveness of male faces for short-term relationships than for long-term relationships (Little *et al.* 2002; Penton-Voak *et al.* 2003). This latter effect is particularly pronounced for judgements made by women with a partner (Little *et al.* 2002) and also by relatively unattractive women, as attractive women may be better placed to offset the costs associated with preferring a masculine primary partner (Little *et al.* 2001; Penton- Voak *et al.* 2003). Oral contraceptive use disrupts many of these correlations (Penton-Voak *et al.* 1999; Little *et al.* 2002). In addition to these sources of individual differences in face preferences, many researchers have proposed that differences in the methods used to manufacture stimuli for the assessment of attraction to faces also contribute to variation among studies in women's preferences for sexual dimorphism in male faces (Johnston *et al.* 2001; Swaddle & Riersen 2002; Valenzano *et al.* 2004; Fink *et al.* 2005; Rhodes 2006).

(a) *Methods for manipulating masculinity*

Facial masculinity preferences have been assessed using three main methods of defining a masculinity–femininity dimension: sexual dimorphism, perceived masculinity and pubertal development.

Perrett *et al.* (1998) and others (Penton-Voak *et al.* 2001; Cornwell *et al.* 2004) have used the differences in shape between prototype male and female faces to manufacture face stimuli varying in sexual dimorphism. Using this method, adding a positive multiple of the female to male differences increases the masculinity of a subject's facial image, while adding a negative amount increases their femininity. Many researchers have criticized this method, stating that manipulating the appearance of face images using a continuum defined by male and female prototypes does not necessarily reflect changes to facial appearance that are due to the influence of testosterone (Meyer & Quong 1999; Swaddle & Riersen 2002).

Johnston *et al.* (2001) have suggested that the technique developed by Perrett *et al.* (1998), which assumes that an extreme masculine face shape can be generated by a linear extrapolation of the differences between male and female average faces, may not be valid because between-sex differences in facial shape are the result of bone growth caused by complex interactions between growth hormone, androgens and oestrogen (Tanner 1978; Grumbach 2000). Johnston *et al.* (2001) transformed the shape and colour along a three-part continuum defined by female and male student faces and male model faces perceived as particularly masculine, finding that women generally preferred masculine male faces. Perceived masculinity has been found to correlate positively with salivary testosterone levels (Penton-Voak & Chen 2004).

To address similar criticisms of Perrett *et al.*'s (1998) methods for manipulating masculinity in male faces, Swaddle & Riersen (2002) manipulated the shape of male faces using data from studies of face proportion change during puberty (e.g. Enlow 1990). While this influenced the perceived dominance of the faces, the manipulations did not influence face preferences.

Because no study has previously compared women's preferences for face stimuli manufactured in these different ways, it remains unclear whether differences in preferences among studies using the methods of Perrett *et al.* (1998), Swaddle & Riersen (2002) or Johnston *et al.* (2001) reflect individual differences in women's face preferences or are a consequence of differences in the methods used to manipulate the appearance of face images.

In an effort to establish if variability in face preferences among studies that used different methods to manipulate the masculinity of male face images is due to differences in the methods used or due to individual differences in women's face preferences, here we tested the interrelationships among women's preferences for male face images that had been transformed in appearance using the differences in shape between male and female prototypes (*sensu* Perrett *et al.* 1998), the differences in shape between prototypes manufactured from pre- and post-pubertal male faces (a method derived from Swaddle & Riersen 2002) and the differences between prototypes manufactured from male faces that were perceived (by independent raters) as particularly masculine or feminine in appearance (a method derived from Johnston *et al.* (2001)). If variation among studies in their findings for women's preferences for masculine male faces reflects individual differences in face preferences, then attraction to masculine faces manufactured from these three methods will be positively inter-related. If this is not the case, it would suggest that variation among studies in their findings for women's preferences for masculine male faces reflects differences in the methods used to manipulate face images.

(b) *Validating preferences for masculinity*

Variation in preferences for masculinity may not be peculiar to judgements of face images, but may be indicative of preferences for a masculine partner. Preferences for masculinity in the separate domains of face (Penton-Voak *et al.* 1999), voice (Feinberg *et al.* 2006; Puts 2005) and behaviour (Gangestad *et al.* 2004) are influenced in the same way by menstrual cycle phase. Additionally, Cornwell *et al.* (2004) found that attraction to masculine male faces was positively associated with attraction to a putative male sex pheromone. Although many theories of attraction suggest that face preferences reflect mate preferences more generally, we know of no studies that have explicitly tested for a relationship

between face preferences and actual partner characteristics.

To examine whether masculinity preferences can relate to real world partner choice, we tested for a relationship between preferences for masculine faces as assessed by an experiment and ideal partner masculinity as reported in a questionnaire. Additionally, we tested for a relationship between preferences for masculine faces and actual partner masculinity (as reported in a questionnaire) in partnered women. As preferences for masculinity and age in faces are positively related (Cunningham *et al.* 1990; Boothroyd *et al.* 2005) and masculine faces appear older than feminine faces (Perrett *et al.* 1998; Boothroyd *et al.* 2005), we also tested for relationships between masculinity preference and ideal or actual partner age.

2. MATERIAL AND METHODS

(a) *Stimulus manufacture*

Six individual male faces (ages 17–19) were masculinized and feminized using prototype-based computer graphic transformations (Tiddeman *et al.* 2001). Faces were transformed in shape (sexual dimorphism and pubertal development methods) or shape, colour and texture (perceived masculinity method) relative to the differences between two composite prototype faces, one 'masculine' and one 'feminine'. The computer algorithm changed either the shape alone or the shape, colour and texture of an individual face by 50% of the shape, or the shape, colour and texture difference between the two prototype faces, respectively. For example, if the masculine prototype face has thinner lips compared to the feminine prototype face, then masculinizing an individual face will cause the lips to become thinner. Note that this is not the same as morphing an individual face towards or away from a male or female face. A male face that is more masculine than average will be even more masculine than it originally was after *transforming* the face relative to male and female prototypes. In contrast, a hyper-masculine male face would be more feminine than it originally was after *morphing* towards an average male face. Further details of the methods and computer algorithms used to transform faces in shape and colour can be found in Rowland & Perrett (1995); details of texture transformation are given in Tiddeman *et al.* (2001).

Three different pairs of prototype faces were used to masculinize and feminize the individual male faces by altering their (i) sexual dimorphism, (ii) perceived masculinity or (iii) pubertal development. All prototypes were made symmetric by averaging the composite face with its miror-image, preventing the transformations from altering symmetry.

The sexual dimorphism method (figure 1*a*) used a composite of 20 male faces (mean age = 19.5, s.d. = 2.3) and a composite of 20 female faces (mean age = 18.4, s.d. = 0.7). The perceived masculinity method (figure 1*b*) used a composite of 20 male faces rated as particularly masculine (mean age = 19.5, s.d. = 3.1) and a composite of 20 male faces rated as particularly feminine (mean age = 19.4, s.d. = 3.6). These sets were also matched for age. Masculinity ratings were done by 20 independent raters (10 males). The pubertal development method (figure 1*c*) used a composite of 13 post-pubescent male faces (mean age = 20.0, s.d. = 2.6) and a composite of 13 pre-pubescent male faces (mean age = 8.46, s.d. = 0.52). All face images were taken in the same room under the same lighting.

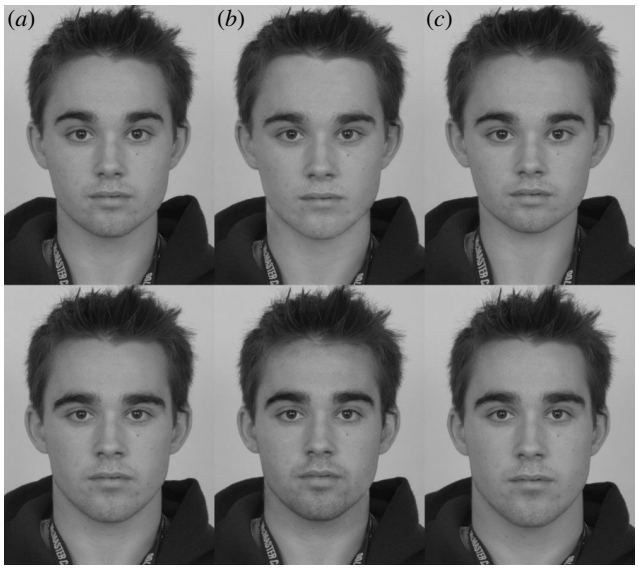

Figure 1. Pairs of faces transformed to be 50% more feminine (top row) or masculine (bottom row) using three different transformation endpoints: (*a*) adult female and male composites, (*b*) composites of male faces rated as particularly feminine or masculine and (*c*) boys and young men. See electronic supplementary material, appendix A for a high resolution colour version of this image.

(b) *Stimulus calibration*

Seventy-six women (mean age = 26.4, s.d. = 9.3) validated the faces' perceived masculinity and 49 women (mean age = 20.8, s.d. = 5.4) showed that, as in previous research (Perrett *et al.* 1998), the faces differed in perceived dominance. Calibration was done using a two-alternative forced choice paradigm, where participants chose the more masculine or dominant from each pair of the masculinized and feminized versions of each identity. Since each of the six original face identities was manipulated in the same way for each method, participants were treated as the unit of analysis. For all three methods, the masculinized face was perceived as more masculine (one-sample *t*-tests: all $t_{75} > 65.4$, $p < 0.001$) and more dominant (all $t_{48} > 14.6$, $p < 0.001$) than the feminized face (see table 1). Three hundred twenty-four women (mean age = 24.0, s.d. = 7.3) were asked to choose the more attractive face from each pair. For all three methods, the masculinized face was perceived as the more attractive (all $t_{323} > 10.8$, $p < 0.001$).

(c) *Participants*

Participants in the preference test were 124 women (a subset of the 324 women who completed the masculinity preference test reported previously) between the ages of 16 and 30 (mean age = 21.9, s.d. = 3.51), who reported a heterosexual preference and completed a questionnaire about partner preferences.

(d) *Procedure*

Facial masculinity preference was assessed using a two-alternative forced choice paradigm, where the masculinized and feminized versions of one face identity were presented on a computer screen at the same time and participants were asked to indicate which was the more attractive by clicking on the face. The six identities were shown in each of the three transformation methods, totaling 18 trials presented in

Table 1. Mean frequency (per cent) with which the masculinized face was chosen as the more masculine, dominant or attractive face for three methods of manipulating masculinity.

	masculinity ($n=76$)		dominance ($n=49$)		attractiveness ($n=324$)	
method	mean (%)	s.d. (%)	mean (%)	s.d. (%)	mean (%)	s.d. (%)
sexual dimorphism	98.2	6.43	89.5	18.9	66.0	26.7
perceived masculinity	99.8	1.92	87.0	15.7	73.0	25.7
pubertal development	99.2	4.63	91.2	19.3	66.8	21.7

Table 2. Correlations (Pearson's r) among masculinity preferences using the three methods of masculinity transformation: sexual dimorphism (SD), perceived masculinity (PM), pubertal development (PD) and their first principal component (PC). (Correlations are also shown between facial masculinity preferences assessed by the different transformation methods and ideal or partner's actual masculinity. $^{*}p<0.001$, $^{**}p<0.005$, $^{***}p<0.03$.)

method	perceived masculinity	pubertal development	principal component	ideal masculinity	partner masculinity
SD	0.677^{*}	0.634^{*}	0.898^{*}	0.361^{*}	0.360^{**}
PM	—	0.538^{*}	0.856^{*}	0.258^{**}	0.140
PD	—	—	0.834^{*}	0.201^{***}	0.273^{***}
PC	—	—	—	0.319^{*}	0.302^{***}

randomized order. Participants also completed a questionnaire where they were asked to indicate their sex, age, their ideal partner's sex, age and masculinity. Participants were also asked whether or not they had a partner and, if so, their partner's sex, age and masculinity. Ideal partner and actual partner's masculinity were assessed using a seven-point Likert scale ranging from 'much less masculine than average' to 'much more masculine than average'. The definition of masculinity was left open and could include masculinity in multiple domains (e.g. face, body, voice and behaviour). The participant was the unit of analysis for all analyses.

3. RESULTS

One-sample t-tests (compared to 50%) demonstrated that women preferred the masculinized face more often than the feminized face when the faces were transformed using the sexual dimorphism method (mean = 67%, $t_{123}=6.85$, $p<0.001$), the perceived masculinity method (mean = 74%, $t_{123}=10.03$, $p<0.001$) and the pubertal development method (mean = 67%, $t_{123}=9.16$, $p<0.001$).

Facial masculinity preferences for all three methods were significantly correlated (all $r>0.53$, $n=124$, $p<0.001$), so we entered the data into a principal components analysis which revealed a single component (explaining 74.5% of variance). This factor was used in further analyses as an overall measure of facial masculinity preference (See table 2).

(a) *Ideal masculinity preference*

Linear regression was used to assess the relationship between ideal masculinity preference (as assessed on a seven-point scale) and measured facial masculinity preference. The effects of participant age and their stated ideal partner's age were also assessed. The model was significant ($F_{3,120}=5.18$, $p=0.002$) and the only significant predictor of facial masculinity preference was ideal masculinity preference ($B=0.296$, $t=3.54$, $p=0.001$). Participant's age ($B=0.04$, $t=0.78$, $p=0.44$) and ideal partner's age ($B=-0.01$, $t=-0.20$, $p=0.84$) did not significantly predict facial masculinity preference.

(b) *Actual partner's masculinity*

Linear regression was also used to assess the relationship between partner's perceived masculinity (as assessed on a seven-point scale) and measured facial masculinity preference for the 69 women with a male partner. The effects of participant's age and partner's age were also assessed. The model was not quite significant ($F_{3,65}=2.46$, $p=0.070$) and, again, the only significant predictor of facial masculinity preference was partner's perceived masculinity ($B=0.224$, $t=2.42$, $p=0.018$). Participant's age ($B=0.01$, $t=0.29$, $p=0.77$) and partner's age ($B=0.01$, $t=-0.26$, $p=0.80$) did not significantly predict facial masculinity preference.

4. DISCUSSION

Preferences for facial masculinity were assessed using three different techniques for manipulating masculinity in face images and all three techniques were inter-related and produced consistent preferences. Techniques manipulating face shape (sexual dimorphism and pubertal development) produced the same results as the technique manipulating both face shape and colour (perceived masculinity). This suggests that the differences in general preference for masculinity in male faces found in various studies are more likely to result from individual differences among the participants than from differences in the techniques used to manipulate facial masculinity.

Although the construction of our stimuli was not identical to previous work on preferences for facial masculinity, we do show that stimuli made from masculinity continua based on male/female differences (*sensu* Perrett *et al.* 1998; Penton-Voak *et al.* 1999), pre-pubertal male/post-pubertal male differences (*sensu* Swaddle & Riersen 2002) and perceived masculine male/perceived feminine male differences (*sensu* Johnston *et al.* 2001) produce the same preferences in the same population.

Here we also demonstrated that preferences for facial masculinity are predicted by stated preference for masculinity in an ideal partner and also by an actual partner's rated masculinity. These relationships were not

explained or qualified by the participant's own age or partner's age, providing evidence against the idea that masculinity preferences solely reflect preferences for maturity versus youth (e.g. Cunningham *et al.* 1990), at least gauged from stated preference for ideal partner age. The results of this study cannot be explained as the product of a general response bias (whereby a general tendency to use extreme or moderate points on a rating scale causes a false correlation), because facial masculinity preference was assessed using a forced-choice design.

We did not examine the sources of individual variation in preferences for masculinity, but we did examine whether or not preferences for facial masculinity are predictive of ratings of ideal and actual partner's masculinity. The causal direction of the relationship we found is not known. Women might have masculine partners because they prefer masculine men for any of various reasons such as own attractiveness (Little *et al.* 2001), oral contraceptive use (Penton-Voak *et al.* 1999; Little *et al.* 2002), or other sources of individual differences in face preferences not yet determined to influence masculinity preferences. Alternatively, women who demonstrate strong preferences for facial masculinity might do so because they have more experience with masculine men. Visual experience with faces of a certain type has been shown to increase normality perceptions of and preferences for similar faces (Rhodes *et al.* 2003*b*; Webster *et al.* 2004; Little *et al.* 2005).

Although it has been suggested that variability among studies in the general face preferences they report may partly be due to the use of different methods to manipulate masculinity in male face images (Johnston *et al.* 2001; Swaddle & Riersen 2002; Fink *et al.* 2005; Rhodes 2006), our findings do not support this proposal. Indeed, the directions of preferences for masculinity were the same for all three methods considered here. These preferences were positively inter-related and loaded onto a single factor when analysed using principal components analysis. Furthermore, that stated masculinity preference and actual partner masculinity were positively related to facial masculinity preferences (tested by each of the methods) supports the proposal that variability among women in their preferences for masculine male faces reflects attraction to an underlying quality that is potentially expressed in different ways (e.g. a masculine face shape, or a masculine face colour and texture). Although the pubertal development method necessarily also transformed facial age, the lack of a relationship between ideal/actual partner's age and facial masculinity preference or ideal/actual partner's masculinity suggests that variability among women in their preferences for masculine males does not primarily reflect individual differences in their preference for youth. Overall, our findings are important for the interpretation of findings from previous studies.

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