

TESTING IMMUNOCOMPETENCE EXPLANATIONS OF MALE FACIAL MASCULINITY

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Abstract. Currently the Immunocompetence Hypothesis dominates research into female attraction to male facial masculinity. Although studies have shown links between masculinity and possible indicators of health such as fluctuating asymmetry, preferences for facial masculinity do not co-vary with preferences for apparent health (BOOTHROYD et al. 2005). Here we build on that work with two studies. Study 1 addresses the concern that apparent health may not fully reflect long term immune function by investigating how masculinity preferences correlate with preferences for other potential indicators of ‘good genes’: symmetry and averageness. Study 2 investigated whether masculinity preferences were dependant upon the presence of other indicators of ‘good immunity’ in the face, by showing observers both symmetric and asymmetric masculinity stimuli. Across three samples, women’s masculinity preferences were inversely correlated with symmetry preferences, counter to prediction, and there were no consistent associations with apparent health or averageness. Results of Study 2 suggested that masculinity preferences may be enhanced in symmetric stimuli; however, these results appear to have been driven by a single stimulus, suggesting that more research is needed into the potential importance of initial stimulus properties when investigating masculinity preferences.

Keywords: facial attraction, mate choice, masculinity, symmetry, averageness, health

INTRODUCTION

There is an extensive literature documenting systematic variation in female preferences for sexual dimorphism/masculinity in male faces. Women seem to show the strongest preference for masculinity at times when they are most likely to conceive

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(e.g. PENTON-VOAK et al. 1999; PENTON-VOAK and PERRETT 2000; JOHNSTON et al. 2001; JONES et al. 2005; LITTLE et al. 2007) when explicitly asked to judge for a potential short term (i.e. sexual, not a longstanding relationship) partner and when they already have a committed long term partner (LITTLE et al. 2002). In sum, women seem most attracted (or possibly least averse) to male facial masculinity in contexts where we may suppose they are seeking a sexual partner, and when the genetic material of that partner is paramount.

These patterns of results are commonly explained with reference to the Immunocompetence Hypothesis (FOLSTAD and KARTER 1992) which proposes that androgen-related exaggerated characteristics demonstrate the strength of a male's immune system in the face of the immunosuppressive effects of androgens. Thus by choosing highly masculine sexual partners, females may be maximising the viability of their offspring via heritable immune function. Evidence put forward to support this view includes the finding that more masculine faces can appear more healthy (e.g. JOHNSTON et al. 2001; though, cf. BOOTHROYD et al. 2005) and that more masculine men tend to be more symmetrical, and suffer lower levels of upper respiratory illness (GANGESTAD and THORNHILL 2003; THORNHILL and GANGESTAD 2006; LITTLE et al. 2008a).

In contrast to these interpretations of evidence, however, BOOTHROYD et al. (2005) proposed that if women are indeed choosing facial masculinity on the basis of its links to immune function, then preferences for facial masculinity should correlate with preferences for other indicators of immune function such as apparent health (which relates to MHC heterozygosity: ROBERTS et al. 2005). Across four samples of women, Boothroyd et al. did not find any such correlation, which they argued failed to support an immunocompetence explanation. It is possible, however, that apparent facial health was an inappropriate choice of comparison variable. For instance, while preferences for masculinity seem to be driven, at least partly, by female testosterone levels (WELLING et al. 2007) and linked with short-term mating, preferences for apparent health seem to be linked with progesterone levels and may represent the need to avoid contagious individuals during pregnancy (JONES et al. 2005). Thus, apparent health may *primarily* be utilised as an indicator of current pathogen load, not broader immunocompetence. The first aim of this research, therefore, was to replicate Boothroyd et al.'s study using alternative facial indicators of long-term immune function; this shall be the focus of Study 1.

Another possible flaw in the work of BOOTHROYD et al. (2005), is the treatment of attraction to masculinity and attraction to healthiness as independent dimensions of preference. It may be argued that although masculinisation can be viewed as an indicator of a strong immune system (as it signals having withstood immunosuppression by testosterone), it may be that this is only true when combined with other indicators of good immunity. That is to say, masculinity may only be attractive (on the basis of immunocompetence) when it occurs alongside evidence that the testosterone required to produce the masculine appearance has indeed been successfully withstood. This possibility will be the focus of Study 2.

STUDY 1

As discussed above, it is possible that the primary function of apparent health within mate choice is to guide individuals away from unhealthy partners who carry a risk of contagion. There are, however, other features of facial appearance which have been suggested to be indicators of, or associated with, *long term* health (i.e. general resistance to pathogens) and genetic quality.

Fluctuating asymmetry has long been considered to be an indicator of the degree to which an individual has withstood environmental assaults, including pathogens, during development. More symmetric individuals report less respiratory illness (THORNHILL and GANGESTAD 2006), and those with more symmetric faces have healthier-looking skin (JONES et al. 2004). Thus, although symmetry may indicate resistance to a wide variety of environmental damage, it appears it may in part demonstrate good immunity. Similarly, facial averageness (the extent to which ones facial proportions resemble the population means) has been suggested as an indicator of 'good genes'. Observer ratings of facial 'distinctiveness' (the opposite of averageness) have been associated with poorer health (RHODES et al. 2001a), suggesting that averageness may indicate immune function. Furthermore, more average faces are considered attractive (e.g. LANGLOIS, ROGGMAN and MUSSELMAN 1994; RHODES et al. 2001b; LITTLE and HANCOCK 2002).

New evidence has suggested that symmetry preferences may indeed correlate with masculinity preferences (LITTLE et al. 2008b), which the authors interpreted as showing that both indicated mate quality. In the current study, by also examining averageness and health preferences, alongside masculinity and symmetry, we hope to more clearly establish whether women's preferences for male masculinity represent preferences for heritable immunity.

Study 1 utilised two populations: one recruited online (which represents a wider range of participants, and more generalisable sample), and the other recruited from undergraduates (who were tested under more controlled conditions).

Stimuli: Set A

48 Caucasian Durham University students (24 male; mean age = 19.7 years) were photographed in portrait view under standardised conditions. Four composite 'base' faces images were formed from six randomly selected male faces using the image processing package Psychomorph (ROWLAND and PERRETT 1995; TIDDEMAN et al. 2001). Composites were created by calculating average 2D coordinates of 179 facial landmarks and average RGB colouration at each pixel. These base face images were then 'transformed' by being manipulated along four multi-dimensional continua represented by exemplar facial images:

- *Sexual dimorphism*: 50% of the difference between the average of all male faces and the average of all female faces was applied to the faces, creating masculinised and feminised versions of image.
- *Averageness*: base faces were made 100% symmetric and then 50% of the difference between themselves and the average of all male faces was applied, creating versions of each face which were closer to, or further from, the population mean dimensions.
- *Symmetry*: base faces were warped into the shape of a real face, chosen at random from within that base group, in order to create real fluctuating asymmetry (since FA is lost in averages). Faces were then warped into perfect symmetry, to create one half of each pair. Finally the difference between the ‘individual’ faces and the symmetric versions was used to create images representing 136% of real asymmetry, as the second half of each image pair.
- *Apparent health*: the two exemplars used were a composite of faces rated by observers as most healthy-looking and a composite of faces rated as least healthy-looking from a St Andrews student cohort (as previously used by BOOTHROYD et al. 2005). 50% of the difference between these composites was applied to the base faces, creating a healthy-looking and unhealthy-looking version of each.

There were thus 16 pairs of face images in total. For masculinity, averageness and symmetry, colour and texture were held constant while only 2-D shape was changed. For apparent health, colour and texture were also changed. Sample male image pairs can be seen in *Figure 1*.



Figure 1. Samples of Study 1 stimulus pairs. From top to bottom: Masculinity (sexual dimorphism); Averageness; Symmetry; Apparent health. Positive transforms on the left, negative on the right

Procedure

Sample 1a. 184 heterosexual women aged 16–35 (mean = 25.4, s.d. = 4.7 years) were recruited through the laboratory website and rated their preferences for all stimuli pairs on an eight-point scale from strongly prefer one face (0 = strong preference for feminine, asymmetric, distinctive, unhealthy) to strongly prefer the other face (7 = strong preference for masculine, symmetric, average, healthy). Because of a programming error, only 67 women rated the symmetry stimuli. Order of pairs and left-right alignment was randomised.

Sample 1b. 102 heterosexual undergraduate females aged 18–26 (mean = 20.1, s.d. = 1.2 years) were recruited by word of mouth and completed the same test as Sample 1a on university computers.

Results

Sample 1a. Preliminary analyses comparing the pattern of preference scores against that expected by chance showed that participants preferred significantly femininised, average and healthy versions of the faces (all $t > 2.0$, all $p < 0.05$, see *Table 1* for details) but no significant preference was found for the symmetry stimuli ($t_{183} = 0.529$).

Table 1. Results of one-sample t -tests for overall preferences for each facial trait; results were compared against 3.5, the midpoint of the 8-point relative preference scale

	Sample 1a df = 183			Sample 1b df = 101		
	t	Mean difference	d	t	Mean difference	d
Masculinity	2.013*	-0.197±0.17	-0.298	0.929	-0.110±0.24	0.185
Symmetry	-0.529	0.039±0.14	0.078	0.796	0.076±0.19	0.158
Averageness	6.946***	0.523±0.14	1.027	8.581***	0.642±0.15	1.708
Heath	14.377***	1.207±0.16	2.125	12.162***	1.150±0.19	2.420

* $p < 0.05$, *** $p < 0.001$

Correlation analyses showed a significant negative association between women's preferences for masculinity and their preference for symmetry ($r_s = -0.320$, $n = 67$, $p < 0.01$) and also a significant positive correlation between their preference for symmetry and for averageness ($r_s = 0.377$, $n = 67$, $p < 0.01$); i.e. women who preferred higher levels of symmetry in male faces preferred lower levels of facial masculinity and higher levels of averageness. There were no other significant correlations between women's preferences (see *Table 2* for statistics).

Table 2. Inter-correlations between facial trait preferences. Results from Sample 1a above the diagonal, results from Sample 1b below the diagonal. Ns are given in brackets

	Masculinity	Symmetry	Averageness	Health
Masculinity		-0.320** (67)	-0.097 (184)	0.106 (184)
Symmetry	-0.179 ^a (102)		0.377** (67)	0.105 (67)
Averageness	-0.208* (102)	0.142 (102)		-0.036 (184)
Health	-0.081 (102)	0.076 (102)	0.047 (102)	

* $p < 0.05$, ** $p < 0.01$ ^a $p < 0.1$

Sample 1b. There were significant preferences for averageness and health in male faces (both $t > 8.5$, $p < 0.001$) but no significant preference for either face when rating the masculinity and symmetry pairs (both $t < 0.1$, $p > 0.1$; see *Table 1* for details).

There was a significant negative association between women's masculinity preferences and their preferences for averageness ($r_s = -0.208$, $n = 102$, $p < 0.05$) and a trend for a negative relationship between their masculinity and symmetry preferences ($r_s = -0.179$, $n = 102$, $p = 0.07$), such that the more participants preferred male facial masculinity, the less they preferred averageness and symmetry. There were no other significant correlations (see *Table 2* for details).

Discussion

The aim of Study 1 was to replicate and extend the first study of BOOTHROYD et al. (2005), to address whether preferences for male facial masculinity correlated with other, perhaps more robust, indicators of good immunity. Not only were previous results, regarding a lack of correlation between masculinity and apparent health preferences, replicated for a fifth and sixth time, using a third set of stimuli, but there was furthermore evidence that women's male facial masculinity preferences may be *negatively* correlated with other long term health indicators, such as symmetry and averageness.

This negative correlation is particularly surprising – far more so than any lack of correlation, given that there is evidence for symmetry preferences showing some similar patterns to masculinity preferences (for instance, greater preferences for symmetry at ovulation: LITTLE et al. 2007, and amongst high mate value women: PENTON-VOAK et al. 2003), which is not the case with apparent health preferences, and furthermore that LITTLE et al. (2008b) found a positive correlation between symmetry and masculinity preferences when women viewed male faces. There are two key differences between the current study and LITTLE et al. (2008b). First, the

stimuli here were all drawn from the same population of faces, and were all cropped and masked in an identical fashion, while Little et al. utilised separate sets of stimuli, and used unmasked symmetry stimuli; thus masking the symmetry stimuli could have changed the results and may moreover be the reason for the lack of symmetry preference in Sample 1b. The second difference is that while Little et al.'s participants preferred masculinity in male faces overall, the current samples preferred femininity or had no preference. As such the results presented here remain consistent with Little et al.'s in that Sample 1a showed a preference for symmetry which correlated with their preferred direction of male dimorphism: femininity. Studies investigating the overall preference for sexual dimorphism have previously found mixed results with some studies finding a preference for more feminine faces (e.g. PERRETT et al. 1998; PENTON-VOAK et al. 1999) while others find a preference for more masculine faces (e.g. JOHNSTON et al. 2001; DEBRUINE et al. 2006). Such differences between studies may either be because of random sample variation in participant circumstances or variation in the stimuli. Either way the effect is that either more masculine or more feminine faces are more preferred generally. These results thus show that symmetry preferences correlate with other directional preferences, and are therefore likely to be a sexually selected trait, but they do not support a specifically immunocompetence interpretation of Little et al.'s results.

In this sample, we have attempted to maintain maximal variation between women in various factors of mating strategy, in order to increase the likelihood of detecting co-variation. Consequently, we have not controlled for known systematic variation such as menstrual cycle phase and cannot investigate whether such effects exist in this sample. It may be, therefore, that other (as yet unidentified) individual differences in preferences are masking adaptive co-variation. However, this would still beg the question of how masculinity preferences are varying beyond any potential variance ascribable to immunity preferences, if such immunity-based variance is so very adaptive. As such, these results continue to undermine an immunocompetence understanding of facial masculinity preferences.

Finally, it should be noted that there are some differences between the two samples' results, such that averageness preferences are related to symmetry preferences in Sample 1a, and masculinity preferences in Sample 1b. These differences may represent systematic differences between online and laboratory samples, such as socioeconomic profile or motivational state (although previous studies have found consistent results in related studies: e.g. BOOTHROYD et al. 2005; JONES et al. 2005), or may alternatively reflect random variation in the sampling. As it is not possible to determine which without further data collection, these particular results should be viewed cautiously and are not considered below.

STUDY 2

As discussed in the introduction, it may be erroneous to view facial masculinity as a single linear variable. Rather, when women viewed masculinity, they may consider it in conjunction with other facial traits. An immunocompetence view of masculinity would predict that masculinity as a signal of immunocompetence would be undermined (or negated) by coincident signals of poor long term health. Masculinity would be expected to be more attractive when features of poor health (i.e. evidence that testosterone has unduly damaged immune function) are absent.

Therefore, in this study, we consider the potential interactions between facial masculinity and facial symmetry in attractiveness. Although apparent facial health does indeed relate to genetic influences on immune function, it may (as discussed above) primarily serve to indicate *current* health. In contrast, facial masculinity may relate to current testosterone only intermittently (POUND et al. 2008), and is perhaps more likely to reflect *pubertal* testosterone in particular (e.g. VERDONCK et al. 1999). Therefore a putative signal of *long-term* immune function, which may indicate resistance to immunosuppression during puberty, should be more important than a feature which seems to primarily reflect *current* pathogen load.

For this reason, symmetry was selected as the variable to be manipulated alongside masculinity. If masculinity is indeed an immunocompetence indicator, we would predict that women's preferences for male facial masculinity should be stronger when viewing symmetric faces than asymmetric faces. If, however, women's preferences for masculinity are primarily driven by behavioural considerations unrelated to health cues, we would not expect any differences in the strength of masculinity preferences between symmetric and asymmetric stimuli.

Study 2 again used two samples, the first collected from an undergraduate class (Sample 2a) and the latter from online recruitment through the experimenter's website (Sample 2b).

Stimuli

Set B: The symmetry stimuli from Set A were further manipulated in terms of sexual dimorphism, using an identical procedure to that used for the masculinity stimuli in Study 1. This produced 4 pairs of asymmetric masculinity stimuli, and 4 pairs of symmetric masculinity stimuli. Sample pairs are shown in *Figure 2*.

Set C: A further 55 Durham University undergraduates and postgraduates (28 female; mean age 21.1 years) were photographed under standardised conditions, and average male and female faces were produced using Psychomorph. The average male was then each warped into the shape of 5 different, randomly selected, individual male faces (thus the resulting images had the individual's shape, but the average male's colour and texture), and the images produced were then warped to produce perfectly symmetrical and 127% asymmetrical face images using an identi-

cal procedure to Study 1 (although a slightly lower degree of asymmetry was used to prevent unsightly artefacts in some images). These symmetric and asymmetric versions of each face were then manipulated in terms of sexual dimorphism, as above, using the average male and female from this stimulus set.

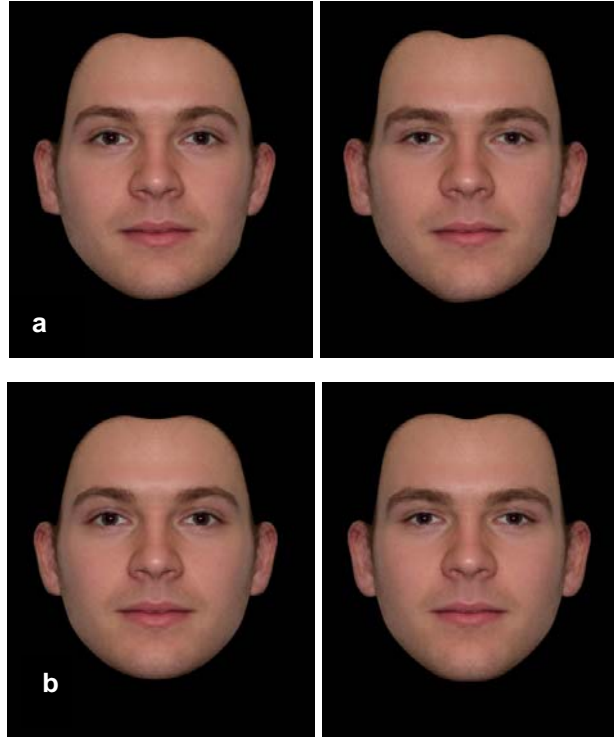


Figure 2. Sample asymmetric (a) and symmetric (b) masculinity pairs from Study 2

Procedure

Sample 2a. 115 female undergraduates aged 18–22 completed the study as part of a practical class. Most students participated using university computers, although a minority used their home PCs. Participants were presented with the Set B stimuli in masculinised–feminised pairs, and asked to indicate which they found most attractive and the extent of their preference using an identical procedure to Study 1.

Sample 2b. 1122 heterosexual women aged 16–29 (mean age = 23.4, s.d. = 3.5) were recruited via the laboratory website. Following a questionnaire in which they gave their demographic information, they rated their preferences for the masculinised versus the feminised versions of each face for both Set B and Set C stimuli, in

an identical manner to Sample 2a. They also rated their preferences for the symmetric versus the asymmetric versions of each face. Pairs of faces which varied in masculinity and in symmetry were shown in the same block of trials; the order of trials and left-right position of face images was randomised throughout.

Results

Sample 2a. Participants showed no overall preference for the masculinised or feminised male faces ($t_{114} = 1.547$, mean = 0.18, SE = 0.12). There was a significant difference between symmetric and asymmetric stimuli such that women preferred higher levels of masculinity in symmetrical male faces than asymmetric male faces ($t_{114} = 2.385$, $p < 0.05$, $d = 0.45$). However, when preferences for each face pair were examined separately, the significant effect seemed to be driven solely by the stimuli created from one base face, labelled 'Face 2' ($t_{114} = 2.405$, $p < 0.05$, $d = 0.45$). There were no other significant differences (see *Table 3*). Furthermore, when the results were analysed using the faces as the unit of analysis, mean masculinity preferences were not significantly stronger for either the symmetric or asymmetric versions of each face ($t_3 = 1.382$).

Table 3. Results of Study 2: Preference for masculinity in symmetric vs asymmetric stimuli, broken down by base face; mean ranked attractiveness and masculinity of original base faces (1 = highest rank)

Base face	Sample 2a df = 114			Sample 2b df = 1121			Rankings of original faces	
	Mean difference & 95% CI	<i>t</i>	<i>d</i>	Mean difference & 95% CI	<i>t</i>	<i>d</i>	Attractiveness	Masculinity
1	0.183±0.46	0.786	0.147	0.125±0.14	1.777 [†]	0.106	4.1	3.1
2	0.539±0.42	2.540*	0.476	0.334±0.16	4.116***	0.246	1.5	3.8
3	0.252±0.49	1.029	0.193	0.031±0.16	0.385	0.023	3.1	6.2
4	0.052±0.36	0.291	0.054	0.132±0.15	1.695 ^{††}	0.101	3.1	5.9
5				0.054±0.10	1.027	0.061	8.2	6.3
6				0.033±0.13	0.515	0.031	4.8	8.1
7				0.030±0.12	0.489	0.029	5.5	5.9
8				0.007±0.10	0.143	0.009	6.5	2.1
9				-0.054±0.10	-1.044	-0.06	8.2	3.9
All faces	0.257±0.21	2.385*	0.447	0.077±0.04	3.442**	0.206		

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$, [†] $p = 0.08$, ^{††} $p = 0.09$

Sample 2b. Participants showed overall significant preferences for the feminised faces over the masculinised faces ($t_{1121} = 16.771$, $p < 0.001$, mean = -0.39, SE = 0.02), and for the symmetric faces over the asymmetric faces ($t_{1121} = 19.696$,

$p < 0.001$, mean = 0.33, SE = 0.02). Furthermore, as in Study 1, masculinity preferences were negatively correlated with overall symmetry preferences, regardless of the level of symmetry of the masculinised face pairs (symmetric: $r_{1121} = -0.173$, $p < 0.001$; asymmetric: $r_{1121} = -0.219$, $p < 0.001$).

Participants showed significantly stronger masculinity preferences when viewing symmetric male stimuli than asymmetric male stimuli ($t_{1121} = 3.442$, $p < 0.001$, $d = 0.21$). However, the significant effect was again driven by Face 2 ($t_{1121} = 4.116$, $p < 0.001$, $d = 0.25$) with no other significant differences in women's preferences for the individual faces, although there were trends for two other face images, labelled Face 1 and Face 4 ($t_{1121} = 1.781$, $p = 0.082$ and $t_{1121} = 1.695$, $p = 0.090$ respectively; for all results see *Table 2*).

When the results were analysed by face, there was a trend for the masculinised version of each face to be more preferred when the symmetrical versions of the face stimuli were shown, rather than the asymmetrical versions ($t_8 = 2.063$, $p = 0.07$, $d = 1.46$); however, this became non-significant when Face 2 and Face 1 were removed ($t_6 = 1.626$).

Furthermore, when the female participants' symmetry preferences were broken down and examined at the level of individual faces, women significantly preferred the symmetric version of each of the face stimuli whether masculinised or feminised (all $t > 3.8$, all $p < 0.001$) with the exception of the masculinised Face 2 pair and the feminised version of Face 1, where no preference was shown ($t_{1121} = 0.688$ and $t_{1121} = 1.060$ respectively). It therefore appears that Face 2, and to a lesser extent Face 1, represent an anomaly in comparison with the rest of the stimuli.

DISCUSSION

The purpose of Study 2 was to investigate whether women showed a stronger preference for masculinity in male faces in the presence of other visible cues to good long term health. However, when the data were considered on a stimulus-by-stimulus basis, we could not preclude there being no such effect. Furthermore, examining the confidence intervals of the mean differences (*Table 2*) shows that although Sample 2a may have a significant 'true' mean (the upper bounds of the CIs all reach the mean for Face 2), this is not likely to be the case for Sample 2b (where the upper bounds of the CIs generally do not begin to approach that magnitude; see ABERSON 2002, for a discussion of the reporting of null effects). While the experimental hypothesis of this study was not a critical test of the immunocompetence approach to male masculinity, a significant result may have served to explain the null effects seen in Study 1 and by BOOTHROYD et al. (2005). As it is, the null results in Study 2 currently allow the critiques of the Immunocompetence Hypothesis made on the basis of the correlational studies to stand.

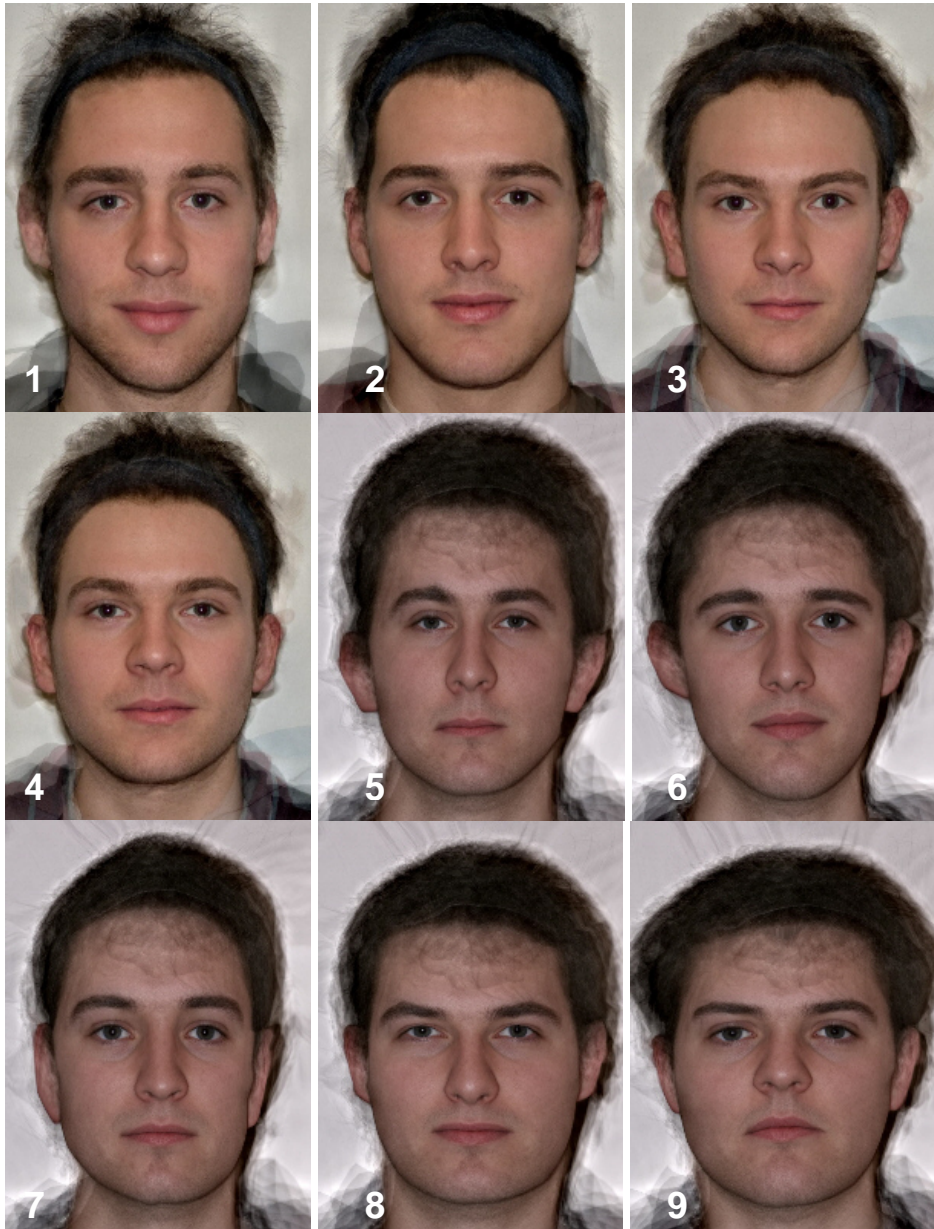


Figure 3. All base faces used for transforms. (Faces 1–4 were used in Stimulus Sets A & B, Faces 5–9 were used in Set C)

It is worth noting, however, that the case of stimulus Face 2, which showed a significant effect across both samples, suggests that there may be other prerequisites required to affect women's masculinity preferences. Post-hoc rankings of all original stimulus faces (see *Figure 3*) by 17 observers (8 female; mean age = 28.5 years, SD = 3.3) showed that Face 2 was ranked as significantly the most attractive base face ($F_{8,128} = 42.879$, $p < 0.001$; post-hoc test with next nearest face: $p < 0.05$), though it was neither the most nor the least masculine (see *Table 3* for mean ranks for all faces). Further research can seek to determine whether initial stimulus attractiveness interacts with experimental manipulations such as masculinisation, or whether the current results simply represent an anomalous outlier image.

GENERAL DISCUSSION

In order to further investigate the role of male sexual dimorphism in facial attractiveness judgements two studies were performed. The major finding from the first study, replicated in the second, was a negative relationship between the level of masculinity preferred by participants and their preference for other possible indicators of health. Such a finding suggests that masculinity is not simply interpreted as an indicator of health, as might be expected from the Immunocompetence Hypothesis. Since this finding was unexpected given much of the current literature, a second study was performed to ascertain whether facial masculinity might be preferred to a greater extent in the presence of other facial cues suggesting health (ie. symmetrical as opposed to asymmetrical faces). Overall, women were found to prefer greater levels of masculinisation in the more symmetrical male faces than in the less symmetrical male faces but on closer observation of the data, this effect was found to be driven by a single face stimulus.

As previously noted, the negative correlation found here between the level of masculinity preferred and the level of other cues to health preferred by participants is puzzling given a recent study by LITTLE et al. (2008b) in which a positive correlation was found between level of masculinity preferred and level of symmetry preferred. Such a difference between the two studies is especially surprising given the similarities in the methods employed. One notable difference between the two studies is the finding of an overall preference for slightly feminine male faces here and a slightly masculine male face by Little et al. As noted by Little et al. and DEBRUINE et al. (2006), previous studies of the level of male facial masculinity preferred by female participants have found varying results with many finding female participants preferring slightly feminine faces and others finding preference for slightly masculine faces or no preference. A possible explanation of the varying findings is that the male and female face images used in the different experiments vary in relative attractiveness. For instance, if one group happens to use male faces which are (relatively) more attractive than the female faces in their transform then a slightly masculine face might be more likely to be found attractive in comparison to an ex-

periment in which the male to female transform is derived from faces in which the female face images are slightly more attractive. In such circumstances, an individual who was more choosy would be expected to select the more masculine face as more attractive (when generally more masculine faces are preferred) or the more feminine male face (when generally more feminine than average faces are preferred). Such a scenario explains our results and that of previous experiments including Little et al. but suggests that in comparison to other subtle factors which mediate the variation between experiments, any effect of masculinity as a cue to health is dwarfed. Furthermore, it would suggest that both the negative correlation found between symmetry preference and masculinity found here, and the positive correlation found by Little et al. are both the result of some individuals being generally more choosy than others rather than showing any preference for masculinity *per se*. Thus, the current studies seem to show a lack of support for the Immunocompetence Hypothesis.

Alternatively, one might argue that male masculinity is a 'unique case'. While alternative potential indicators of immune function such as apparent health are viewed by observers as being associated with a raft of positive character attributes (BOOTHROYD et al. 2007), masculinity is generally viewed as being associated with undesirable characteristics for a long term partner (PERRETT et al. 1998; JOHNSTON et al. 2001; BOOTHROYD et al. 2007) and is associated with greater self-reported mating effort by males (BOOTHROYD et al. 2008). Therefore, we might suggest that women's masculinity preferences are highly constrained (i.e. they may only select for masculinity where long term investment is not important) in a manner which preferences for other immunocompetence indicators are not. The counter to this argument is that higher male symmetry has been shown to be associated with higher mating effort (SIMPSON et al. 1999), higher physical aggression (FURLOW, GANGESTAD and ARMIJO-PREWITT 1998) and lower cooperativeness (ZAATARI and TRIVERS 2007), in a similar manner to masculinity and/or testosterone, and thus women's preferences for symmetry should show similar constraint. However, it should be noted that research into *perceptions* of personality/behaviour and facial symmetry have thus far found inconsistent results (FINK et al. 2006; NOOR and EVANS 2003; SHACKLEFORD and LARSEN 1997), which is not the case with attributions to masculinity. Thus women's *perceptions* may not reliably link symmetry with any undesirable traits, and thus not act to constrain their preferences.

Overall, therefore, the current studies are unable to support the Immunocompetence Hypothesis, when investigating *women's* masculinity preferences, rather than *men's* masculinity. Arguably, investigating women's masculinity preferences as they operate, rather than investigating the correlates of masculinisation in men (which may not necessarily form the basis for women's choices), gives us the clearest evidence on why women make the choices they do. If this is the case, then the Immunocompetence Hypothesis should be treated cautiously (although we need not by any means abandon the notion of 'good genes'; rather we might focus on alternative indirect benefits; see e.g. BOOTHROYD et al. 2007). However, as discussed

above, there may be alternative reasons for the lack of support seen here, and further research is needed to investigate initial stimulus properties and to what extent perceptions of personality traits may act to constrain preferences.

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