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Partner characteristics associated with masculinity, health and maturity in male faces

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Abstract

This research investigated the partner characteristics that are attributed to male facial masculinity, and how these characteristics compare to those attributed to increased age or health in faces. We found that masculinity is perceived as reflecting heightened dominance, but reduced suitability as a long term partner. This is concordant with previous studies and supports the proposal that a masculinity preference could reflect attraction to dominance rather than immunocompetence. Increased health in faces was perceived as increasing dominance, wealth and pro-social traits (faithfulness, commitment, parenting, etc.), which weakens the widely held supposition that health is closely related to masculinity in facial attraction. Results regarding facial maturity were mixed across studies. Furthermore, Study 2 found that the perceived attributes of faces clustered into two dimensions; the first dimension being a ‘halo’ of all seven desirable traits (which varies with healthiness), and the second dimension being a perception of dominance and unsuitability as a partner (which varies with masculinity).

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1. Introduction

In recent decades, the study of physical attraction has been dominated by the evolutionary approach in which it is assumed that individuals are attracted to those who historically would have been beneficial to the individual's reproductive success. In terms of male facial attractiveness, a great deal of research has focussed on facial masculinity. Masculinity has been assumed to be of benefit to women because of its putative association with heritable immunity (i.e. good genes; known as the immunocompetence hypothesis), but also is believed to be associated with potential costs in terms of poor suitability as a long term partner (see e.g. Penton-Voak et al., 1999; Perrett et al., 1998; Thornhill & Gangestad, 1999).

Boothroyd et al. (2005) found that preferences for masculinity in male faces constructed using an identical methodology to that used in previous masculinity studies (Little, Burt, Penton-Voak, & Perrett, 2001; Penton-Voak et al., 1999; Perrett et al., 1998), did not relate to preferences for apparent facial health. Similarly, Rhodes, Chan, Zebrowitz, and Simmons (2003) found that although perceptions of masculinity and health related to each other in black and white male facial photographs, the relationship was independent of how attractive observers found the faces. Such results suggest that women do not necessarily select masculine faces on the basis of health cues and cast doubt on whether previous findings using similar stimuli (e.g. investigations of the effects of menstrual cycle, relationship status and own attractiveness on masculinity preference) can be explained by facial masculinity acting as a cue to men's heritable immunocompetence. Boothroyd et al. (2005) suggested instead that it may be beneficial to consider other personality and behavioral aspects of masculinity (e.g. dominance and investment).

There has been a limited amount of research into the behavior and personality traits perceived to be associated with masculinity. Perrett et al. (1998) found in both Caucasian and Japanese samples that masculinized male and female faces were perceived as more dominant, but less warm, emotional, honest and cooperative, and as poorer quality parents than average or feminized faces. Similarly, Johnston, Hagel, Franklin, Fink, and Grammer (2001) found that increasing masculinity increased perceptions of antisocial traits, while increasing femininity increased perceptions of pro-social traits. Moreover, both Swaddle and Reiersen (2002) and DeBruine et al. (2006) have found that increased masculinity (using a variety of methods in DeBruine et al's case) is associated with an increase in perceived dominance. These findings suggest that masculine faces signal dominance, but also a less pleasant personality, and lower suitability as a long term partner and parent.

There has also been research into the traits perceived to be related to facial maturity and neoteny/babyfacedness. McArthur (1985, see also McArthur and Apatow (1984)) found that neotenous faces were perceived as warmer, kinder, more honest and more naïve than mature faces. Keating, Mazur, and Segall (1981) also found that sexually mature faces of both sexes were perceived as more dominant, stronger and higher status than less sexually mature faces.

There has been very little attention paid to how perceptions of personality traits relate to apparent health of faces. This is surprising given that apparent health is an important determinant of attractiveness (e.g. Jones, Perrett, et al., 2005). As attractiveness has long been known to create a halo effect (e.g. Dion, Berscheid, & Walster, 1972), we may expect healthy looking faces to be ascribed a variety of positive traits. Indeed, attribution of negative personality characteristics to unhealthy individuals may be a proximate mechanism for increasing aversion to individuals who may be more likely to pass on diseases or parasites.

The current research investigated how facial masculinity, apparent healthiness and age are related to attributions of characteristics that are important in potential partners. Based on previous findings, it was predicted that masculine faces would be perceived as more dominant, and therefore having more resources, than feminine faces, but would also be perceived as less likely to commit to and remain faithful in a relationship, ‘colder’ and as poorer parents. Younger faces can be predicted to look warmer than older faces, while older faces (which tend to look more masculine; Boothroyd et al., 2005) may be perceived as more dominant, but less faithful and committed than younger faces. We would expect healthy faces to be rated more positively on all desirable traits if there is an attractiveness halo effect of high apparent health. It is not clear, however, how healthiness will affect perceptions of personality once the attractiveness halo effect is controlled for (see Study 2).

2. Study 1

Study 1 was an experimental design which assessed how manipulations of facial characteristics affected perceptions of personality traits.

2.1. *Raters*

Participants were recruited via an opportunity sample of those passing through the laboratory website. Males (94) and females (76) judged the Set A male faces. Males (96) and females (69) judged the Set B male faces. Mean age was 29.4 years ($SD = 8.00$).

2.2. *Stimuli*

Study 1 used two stimulus sets previously developed by Boothroyd et al. (2005); employment of two stimulus sets allows replication across independent images. Set A faces consisted of three male composite faces (each composite was created from between 12 and 66 facial photographs; mean age of composites being 21.2–22.0 years) to which a series of ‘transformations’ were applied (Rowland & Perrett, 1995). Computer manipulation was used to increase and decrease (a) masculinity (50% of the average male–female shape difference in either direction), (b) apparent health (based on composites of the most and least apparently healthy individuals within a cohort), and (c) apparent age in each face (based on composites of older and younger faces; mean perceived age gap = 2.16 years). This created nine pairs of faces (masculinized and feminized; unhealthy, and healthy; older and younger; for each of the three original faces). Set B faces consisted of 18 male composite faces (each created from 10 facial photographs; mean age for all composites 21.0 years). Six were transformed on masculinity, six were transformed on health, and six were transformed on age (mean perceived age gap = 2.28 years), to create 18 pairs of faces in total.

2.3. *Procedure*

Participants completed the experiment via a web-based test. Stimulus pairs were presented side by side in a java applet, with a 0–7 scale underneath (see Boothroyd et al., 2005, for further details

of applet). Participants were asked to select which face was “more [of the trait] and how much more so” by clicking on a point on the scale (where 0 = strong choice for face on the left, 7 = strong choice for face on the right and 3.5 is the theoretical indifference point). Traits selected for judgement were three relating to dominance and resources (dominance, ambition and wealth), three relating to long term partner/father suitability (faithfulness, commitment and parenting) and warmth, a key central personality trait (following Asch, 1946). The precise phrasing was as follows; Which face is

- the most ambitious?
- the most likely to be committed to a long term partner? Would they stay with their partner if they had one?
- the most dominant? Someone who is socially dominant is able to strongly influence others and is someone others defer to.
- the most likely to be faithful to a long term partner?
- the better parent? If they were raising your children or your nieces/nephews, do you think they would do a good job?
- the warmest?
- the most wealthy? How much money do you think they have or are likely to earn?

Participants were presented with seven randomly ordered blocks of trials: one for each personality trait. Within each block, stimulus pairs were presented in a random order.

2.4. Results

Within each set of results, ratings for the three or six face pairs were collapsed for each trait rating. Each subject’s ratings were compared using Wilcoxon tests against a dummy variable in which all participants were assigned a score of 3.5, representing the indifference point where neither face was selected. Following statistical correction for multiple comparisons (Holm, 1979) there were no significant differences between the ratings of men and women for either stimulus set (prior to correction, each set had three significant results out of 21 comparisons, and men and women differed in extremity of decision, not direction); therefore male and female data was analysed together. All significant and marginal results are given here, and Wilcoxon statistics are given as a z -score of U , along with d score effect sizes. Results with $p > 0.1$ (2 tailed) are omitted. N for Set A tests was 170; N for set B tests was 165.

2.4.1. Set A faces

Masculine male faces were rated as significantly, more dominant ($z = 6.28, p < 0.001, d = 1.10$), less faithful ($z = 4.39, p < 0.001, d = 0.72$) and less warm ($z = 5.21, p < 0.001, d = 0.31$) than feminine male faces. They were also rated as worse parents ($z = 2.02, p = 0.04$) but this became non-significant once Holm’s correction was applied (adjusted alpha = 0.013).

Older faces were rated as significantly more ambitious ($z = 3.08, p < 0.01, d = 0.49$), more committed ($z = 3.00, p < 0.01, d = 0.47$), more dominant ($z = 7.56, p < 0.001, d = 1.42$), better parents ($z = 2.86, p < 0.01, d = 0.45$), and wealthier ($z = 4.69, p < 0.001, d = 0.77$) than younger male

faces. They were also rated as less warm ($z = 2.09$, $p = 0.04$) but this became non-significant following Holm's correction (adjusted alpha = 0.025).

Healthy male faces were rated as significantly more ambitious ($z = 6.96$, $p < 0.001$, $d = 1.26$), more committed ($z = 5.43$, $p < 0.001$, $d = 0.92$), more dominant ($z = 4.78$, $p < 0.001$, $d = 0.79$), more faithful ($z = 5.77$, $p < 0.001$, $d = 0.99$), better parents ($z = 7.59$, $p < 0.001$, $d = 1.43$), warmer ($z = 8.04$, $p < 0.001$, $d = 1.57$) and wealthier ($z = 7.11$, $p < 0.001$, $d = 1.30$) than unhealthy male faces.

2.4.2. Set B faces

Masculine male faces were rated as significantly more dominant ($z = 4.71$, $p < 0.001$, $d = 0.79$), less faithful ($z = 6.74$, $p < 0.001$, $d = 1.23$), worse parents ($z = 6.74$, $p < 0.001$, $d = 1.23$), less warm ($z = 7.11$, $p < 0.001$, $d = 1.33$) and less wealthy ($z = 2.49$, $p < 0.05$, $d = 0.4$) than feminine male faces. They were also rated as less committed ($z = 2.17$, $p = 0.03$) but this became non-significant following Holm's correction (adjusted alpha = 0.017).

Older male faces were rated as significantly more ambitious ($z = 6.43$, $p = 0.001$, $d = 1.16$), more committed ($z = 4.09$, $p < 0.001$, $d = 0.67$), more dominant ($z = 6.41$, $p < 0.001$, $d = 1.15$), more faithful ($z = 4.82$, $p < 0.001$, $d = 0.81$), better parents ($z = 6.78$, $p < 0.001$, $d = 1.24$), warmer ($z = 5.71$, $p < 0.001$, $d = 0.99$) and wealthier ($z = 5.96$, $p < 0.001$, $d = 1.05$) than younger male faces.

Healthy male faces were rated as significantly more ambitious ($z = 6.46$, $p < 0.001$, $d = 1.16$), more committed ($z = 6.09$, $p < 0.001$, $d = 1.08$), more dominant ($z = 3.00$, $p < 0.01$, $d = 0.48$), more faithful ($z = 6.36$, $p < 0.001$, $d = 1.14$), better parents ($z = 9.45$, $p = 0.001$, $d = 2.17$), warmer ($z = 9.22$, $p < 0.001$, $d = 2.06$) and wealthier ($z = 8.37$, $p < 0.001$, $d = 1.72$) than unhealthy male faces.

3. Study 2

Study 1 clearly showed differences between the characteristics attributed to masculine faces and healthy faces. The perceptual link between facial health and all traits may simply reflect an attractiveness halo effect, given that apparent health and attractiveness of faces are positively related (e.g. Jones, Perrett, et al., 2005). Therefore, the purpose of Study 2 was to investigate the links between facial appearance and personality while controlling for attractiveness. A correlational design was utilized which allowed for partial correlation analyses. Furthermore, a third stimulus set was used (Set C) which consisted of individual male facial photographs.

3.1. Stimuli

Study 2 also used two sets of stimuli: Set B, as used in Study 1, and Set C which consisted of facial photographs of 58 male St Andrews University students (mean age = 21.3 years, SD = 3.2) photographed under standardized lighting conditions. For presentation purposes, the Set C stimuli were aligned to match on pupil location and cropped to show face and hair only.

3.2. Raters

Fifteen women and 12 men (mean age = 21.9 years, $SD = 2.4$) rated the Set B images for their personality traits, apparent age, health and masculinity, while 19 women and 13 men (mean age = 26.4 years, $SD = 7.0$) independently rated the Set B images for attractiveness. All Set B raters were undergraduates and postgraduates at St Andrews University. Set C faces were rated by 10 women and 8 men (mean age = 28.4 years, $SD = 8.9$) who were recruited through staff and students at Durham University.

3.3. Procedure

Raters were given separate blocks of trials (one each for the seven personality traits, plus masculinity, healthiness, apparent age and attractiveness) in a random order, except for those who rated the Set B faces for attractiveness who were given only one block of trials. For the trait and physical appearance ratings, participants were asked to rate from 1 to 7 the extent to which that face exhibited the trait concerned, while for apparent age, participants were asked to estimate the age of the face. Order of stimuli within each ratings block was randomized. Participation was conducted in the laboratory on identical computers. Data were averaged together by stimulus such that each face in each stimulus set had a mean score for each perceptual characteristic. Inter-rater agreement was acceptable to excellent (Cronbach's alphas range: 0.65–0.92) except for ratings of commitment and faithfulness in Stimulus Set B where agreement was very low (alphas below 0.2); ratings for commitment and faithfulness for Set B should therefore be treated with caution.

3.4. Results

3.4.1. Set B faces

The Set B ratings of physical appearance were validated by comparing the perceived masculinity, health and age of the respective face pairs. As found by Boothroyd et al. (2005), masculinized faces were perceived as significantly more masculine looking than feminized faces ($t_{10} = 2.44$, $p < 0.05$, $d = 1.54$); 'healthy' faces appeared more healthy than 'unhealthy' faces ($t_{10} = 4.35$, $p = 0.001$, $d = 2.75$); and 'older' faces were estimated as being older than 'younger' faces ($t_{10} = 3.19$, $p = 0.01$, $d = 2.02$).

Due to the nature of the data (one score per characteristic, per face), the problems of multiple tests were avoided by entering the faces' scores for the seven personality traits into a principal components analysis, thus reducing the number of variables (eigenvalues below 1 and correlation coefficients below 0.4 were suppressed during the analysis; see Table 1 for zero-order correlations). Only two factors emerged; as seen in Table 2, Factor 1 consists of all the traits save dominance; as such, it can possibly be characterized as general desirability. Contrastingly, ambition and dominance load positively onto Factor 2, while commitment and faithfulness load negatively; Factor 2 can therefore be seen as indicating 'alpha male' type characteristics (social dominance, and lack of interest in long term relationships).

Perceived healthiness and attractiveness of the faces correlated positively with Factor 1 ($r_{36} = 0.907$ and $r_{36} = 0.822$, respectively, both $p < 0.001$) such that the more attractive or healthy

Table 1
Inter-correlations between physical ratings and perceived personality for Set B faces (below the diagonal) and Set C faces (above the diagonal)

	1	2	3	4	5	6	7	8	9	10	11
1 Age		0.13	0.650***	0.179	0.332*	-0.102	0.516***	-0.103	0.316*	0.02	0.363**
2 Health	-0.238		0.183	0.864***	0.596***	0.288*	0.608***	0.065	0.708***	0.670***	0.575***
3 Masculinity	0.502**	0.074		0.253 [†]	0.227	-0.188	0.680***	-0.357**	0.229 [†]	-0.023	0.129
4 Attractive	-0.337*	0.844***	-0.151		0.610***	0.234 [†]	0.658***	0.039	0.696***	0.642***	0.581***
5 Ambition	0.003	0.792***	0.119	0.728***		0.321*	0.668***	0.123	0.630***	0.356**	0.856***
6 Commit	-0.314	0.288*	-0.017	0.353*	0.321*		0.016	0.704***	0.648***	0.565***	0.395**
7 Dominance	0.467**	0.297 [†]	0.619***	0.172	0.545***	-0.043		-0.317*	0.511***	0.198	0.625***
8 Faithful	-0.354*	0.485**	-0.395*	0.423*	0.285 [†]	0.360*	-0.208		0.457***	0.412***	0.264*
9 Parent	-0.258	0.880***	-0.037	0.802***	0.726***	0.496*	0.273	0.544***		0.717***	0.672***
10 Warmth	-0.275	0.712***	-0.307 [†]	0.690***	0.558***	0.505**	0.029	0.538***	0.785***		0.305*
11 Wealth	-0.216	0.852***	0.069	0.831***	0.870***	0.430**	0.383*	0.349*	0.853***	0.683***	

* $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$; and [†] $p < 0.1$.

Table 2
Factor loadings for perceived personality traits in Study 2

	Stimulus Set B		Stimulus Set C	
	Factor 1	Factor 2	Factor 1	Factor 2
Ambition	0.836	0.419	0.805	0.431
Commit	0.576	−0.408	0.708	−0.554
Dominance		0.847	0.556	0.750
Faithfulness	0.573	−0.574	0.493	−0.760
Parent	0.942		0.926	
Warmth	0.841		0.700	
Wealth	0.921		0.833	

a face, the more it was perceived as displaying desirable characteristics, while perceived masculinity and age correlated positively with Factor 2 ($r_{36} = 0.601$, $p < 0.001$; $r_{36} = 0.508$, $p < 0.01$, respectively) such that more masculine and older faces were perceived as having more ‘alpha’ traits and less likely to be a faithful and committed partner. There were no other significant correlations (see Table 3 for details). Importantly, the relationship between rated health and Factor 1 scores remained strong even after attractiveness was controlled for ($r_{33} = 0.697$, $p < 0.001$; all other correlations, or lack of, also remained; see Table 3 for details), indicating that the tendency to ascribe positive characteristics to healthy faces could not be explained solely by an attractiveness halo effect. Similarly, partialling apparent age out of the masculinity correlations and vice versa did not affect the results.

3.4.2. Set C faces

Principal components analysis of the seven personality ratings revealed two factors which were strikingly similar to the factors for Set B (see Table 2). Factor 1 consisted of all traits, all loading positively (whereas for Set B, dominance was not included in Factor 1) and can therefore again be characterized as general desirability as a partner. Factor 2 was almost an exact repeat of Factor 2 for Set B and can again be interpreted as indicating alpha male traits.

Attractiveness, perceived healthiness and perceived age of the faces all correlated positively with Factor 1 ($r_{58} = 0.700$, $p < 0.001$; $r_{58} = 0.710$, $p < 0.001$; and $r_{58} = 0.278$, $p < 0.05$, respectively)

Table 3
Correlations between perceived facial appearance and personality factors for Study 2

	Stimulus Set B				Stimulus Set C			
	Zero-order correlations $N = 36$		Controlling for attractiveness $df = 33$		Zero-order correlations $N = 58$		Controlling for attractiveness $df = 55$	
	Factor 1	Factor 2	Factor 1	Factor 2	Factor 1	Factor 2	Factor 1	Factor 2
Attractiveness	0.822**	0.019			0.700**	0.296*		
Masculinity	−0.042	0.601**	0.146	0.611**	0.148	0.552**	−0.042	0.517**
Health	0.907**	0.038	0.697**	0.042	0.710**	0.24	0.292*	−0.033
Age	−0.231	0.508**	0.086	0.546**	0.278*	0.412**	0.217 ^S	0.382**,\$\$

* $p < 0.05$; ** $p < 0.01$; and ^{S/\$\$} became significant/non-significant once masculinity was controlled for.

Table 4
Summary of results

	Study 1						Study 2		
	Ambition	Commitment	Dominance	Faithfulness	Parenting skill	Warmth	Wealth	General desirability	Alpha male
Masculinity		– ^a	+	–	–	–	– ^a		+
Age	+	+	+	+ ^a	+	+/-	+		+
Health	+	+	+	+	+	+	+	+	

+ indicates a positive relationship between facial manipulation (rows) and perceived personality trait (columns).
– indicates a negative relationship.

^a Set B faces only.

such that the more attractive, healthier or older a face, the more it was perceived as displaying socially desirable characteristics. Perceived attractiveness, masculinity and age correlated with Factor 2 ($r_{58} = 0.296$, $p < 0.05$; $r_{58} = 0.552$, $p < 0.001$; and $r_{58} = 0.412$, $p \leq 0.001$, respectively) such that more attractive, and particularly more masculine and older faces, were perceived as having more ‘alpha’ traits and less likely to be a faithful and committed partner. As before, the relationship between rated health and Factor 1 scores remained after attractiveness was controlled for ($r_{55} = 0.292$, $p < 0.05$). The correlation here between perceived age and Factor 1, which had been absent in the data for Stimulus Set B, disappeared once attractiveness was controlled for, leaving a pattern of results which matched the partial correlations for Set B (see Table 3, for details); however, further controlling for perceived masculinity restored the correlation between apparent age and Factor 1 ($r_{58} = 0.316$, $p < 0.05$), and removed the correlation between apparent age and factor 2 ($r_{58} = -0.081$). Controlling for apparent age did not affect the masculinity correlations.

4. Discussion

4.1. Overall results

The results of both studies are summarized in Table 4 above. In general, increased apparent health was linked with an increase in perceptions of all seven traits (with socially desirable traits being ascribed to healthy individuals) even after controlling for attractiveness, but was not associated with any dominance/commitment trade-off in Study 2. Increased apparent age lead to an increase in perceptions of wealth, ambition, commitment, dominance, faithfulness and parenting skill, but had a mixed effect on warmth in Study 1 and also (once attractiveness and masculinity were controlled for) on the Study 2 factors. Increased apparent masculinity was associated with an increase in ‘alpha male’ traits and a decrease in suitability as a partner in both studies.

4.2. Masculinity

As predicted, across both studies male facial masculinity was associated with higher levels of perceived dominance, but lower perceptions of commitment and fidelity within a long term relationship. This supports previous research into masculine vs. feminine faces (see Section 1). It is

also concordant with Perusse (1993) behavioral data showing that high status men are less likely to settle into a long term relationship and tend to have more sexual partners, and Mazur and Michalek (1998) data showing a link between testosterone in males and marital problems. Apparent facial health, however, was associated with increased attribution of all socially desirable traits and was not linked to ‘commitment versus dominance’ in Study 2. These results further support Boothroyd et al. (2005) contention that women’s preferences for male facial masculinity do not operate on the same basis as their preferences for an arguably less ambiguous sign of immuno-competence, namely apparent health.

These data therefore lend more weight to the hypothesis suggested by Boothroyd et al. (2005), that the advantages of masculinity may best be viewed in the context of dominance as a ‘sexy-son’ trait. Weatherhead and Robertson (1979) use a polygyny threshold model to argue that if a male can produce sons who will go on to have high reproductive success, then females will be more likely to engage in polygynous relationships with such a male. Thus, with this strategy, females may be willing to ‘sacrifice’ full paternal investment for increased inclusive fitness through their male offspring, by selecting a more masculine male partner. In Western (non-polygamous) society, this willingness to sacrifice paternal investment may be seen as women’s willingness to engage in short term relationships and perhaps long term affairs.

This concept of masculinity being a ‘sexy-son’ trait can be further tested by assessing whether facial masculinity, dominance, number of potential conceptions (as in Perusse, 1993) and number of *sons’* potential conceptions are all positively related in men. Although there is evidence for several inter-correlations (e.g. Mueller & Mazur, 1997; Perrett et al., 1998; Perusse, 1993), data that link them all together are lacking.

4.3. Health

Healthy faces were perceived as possessing all seven traits significantly more than unhealthy faces in both studies. Thus healthier faces appeared not only more dominant (which may well have positive aspects, such as helping individuals acquire resources), but were also perceived as more wealthy, ambitious, faithful, committed, warmer and as better parents, even after controlling for any possible attractiveness halo effects in Study 2. Importantly, healthiness was not related to the ‘alpha male’ factor in Study 2 which appears to represent a trade-off between dominance and relationship investment. This suggests that from a mate-choice perspective, there are no apparent perceived costs to choosing a healthy male face (in stark contrast to masculine male faces). It is therefore far less surprising that when women are making decisions between healthy and unhealthy male faces, they can do so in ways which are strikingly different to the way they make choices between masculine and feminine faces (see e.g. Boothroyd et al., 2005; Jones, Little, et al., 2005).

It is important to consider the potential accuracy of the personality attributions made to healthy faces here. There is evidence for accuracy in judgements of honesty and cooperativeness from facial photographs (e.g. Berry & Wero, 1993; Bond, Berry, & Omar, 1994; Yamagishi, Tanida, Mashima, Shimoma, & Kanazawa, 2003), however, such research is not extensive and self-other concordance in personality judgements at zero-acquaintance is mixed (e.g. Kenny, Albright, Malloy, & Kashy, 1994; but see Penton-Voak, Pound, Little, & Perrett, 2006) and may in any case result from the self-fulfilling prophecy (whereby the stereotype drives the development of the

behavior). There is, however, evidence that personality traits, such as high agreeableness, conscientiousness and openness to experience are related to better reported health (Korotkov & Hanah, 2004). Although these personality traits do not directly relate to the traits studied here, it may be fair to loosely equate agreeableness with warmth and to link dominance with extraversion. In which case, the ratings made by our participants may well reflect valid perceptions rather than merely stereotypes (although this does not provide any explanation of the causal link between apparent health and personality).

4.4. *Maturity*

Although previous research had shown strong visual similarity between facial age and masculinity (e.g. Boothroyd et al., 2005), these data suggest that the two traits are not necessarily perceived as signalling the same partner characteristics; facial age was perceived as pro-social in Study 1 and in Set C in Study 2 once the effects of attractiveness and masculinity were controlled for. This therefore suggests that there are multiple facets of facial age. Although older faces may be viewed more positively than younger faces (particularly perhaps in this study because the ‘older’ faces would have been nearer most raters’ own ages than the ‘younger’ faces), the fact that they look more masculine may sometimes (as seen in the real faces in Study 2) drive an overall perception of older faces being more ‘alpha male’ than younger faces. Future research could attempt to further address any interaction between masculinity and maturity in face perception; for instance using longitudinal photograph sets in order to consider how actual aging affects perceptions, versus individual differences in sexual dimorphism.

4.5. *Trait clusters*

It is important to acknowledge the results of Study 2, in which both sets of raters, using different stimulus sets (one set being manipulated facial images, the other being real facial images), produced almost identical factors in a principal components analysis. In particular, the structure of Factor 2 in both analyses suggests that there is a very strong covariation between dominance and unsuitability as a partner, as these traits are perceived by observers. Although the ratings of commitment and faithfulness for Stimulus Set B showed very poor inter-rater agreement, the strong similarity in Factor 2 between the two sets allows us to be more confident in the results for Set B. Further research could explore the extent to which these two factors (general desirability and ‘alpha maleness’) are important in explaining variation in attraction to masculinity.

Finally, it is important to highlight that the faces used in this study were those of undergraduate students aged between 18 and 22, and may not entirely reflect the role of masculinity, healthiness and especially facial maturity in the wider population; further research should address these issues in a more generalizable sample of faces. Overall, the research presented here has shown in three separate stimulus sets, using two different methodologies, that male facial masculinity is perceived to be associated with traits unsuitable for a long term partner (but still perhaps beneficial for a short term partner because of possible sexy-son effects), while facial health is perceived as indicating traits which make suitable long term partners. This may go some way to explaining discrepancies in female preference for health and masculinity (Boothroyd et al., 2005; Jones, Little, et al., 2005).

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References

- Asch, S. E. (1946). Forming impressions of personality. *Journal of Abnormal and Social Psychology*, *41*, 258–290.
- Berry, D., & McArthur, L. (1985). Some components and consequences of a babyface. *Journal of Personality and Social Psychology*, *48*, 312–323.
- Berry, D., & Wero, J. F. (1993). Accuracy in face perception: A view from ecological psychology. *Journal of Personality*, *61*, 497–520.
- Bond, C. F., Berry, D. S., & Omar, A. (1994). The kernel of truth in judgements of deceptiveness. *Basic and Applied Social Psychology*, *15*, 523–534.
- Boothroyd, L. G., Jones, B. C., Burt, D. M., Cornwell, R. E., Little, A. C., Tiddeman, B. P., et al. (2005). Facial masculinity relates to facial age, but not facial health. *Evolution and Human Behavior*, *26*, 416–431.
- 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 B-Biological Sciences*, *273*, 1355–1360.
- Dion, K. K., Berscheid, E., & Walster, E. (1972). What is beautiful is good. *Journal of Personality and Social Psychology*, *24*, 285–290.
- Holm, S. (1979). A simple sequentially rejective Bonferroni test procedure. *Scandinavian Journal of Statistics*, *6*, 65–70.
- Johnston, V., Hagel, R., Franklin, M., Fink, B., & Grammer, K. (2001). Male facial attractiveness: Evidence for hormone-related adaptive design. *Evolution and Human Behavior*, *22*, 251–267.
- Jones, B. C., Little, A. C., Boothroyd, L., DeBruine, L. M., Feinberg, D. R., Smith, M. J. L., et al. (2005). 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., Perrett, D. I., Little, A. C., Boothroyd, L., Cornwell, R. E., Feinberg, D. R., et al. (2005). Menstrual cycle, pregnancy and oral contraceptive use alter attraction to apparent health in faces. *Proceedings of the Royal Society B-Biological Sciences*, *272*, 347–354.
- Keating, C. F., Mazur, A., & Segall, M. (1981). A cross-cultural exploration of the physiognomic traits of dominance and happiness. *Ethology and Sociobiology*, *2*, 41–48.
- Kenny, D. A., Albright, L., Malloy, T. E., & Kashy, D. A. (1994). Consensus in interpersonal perception – Acquaintance and the Big-5. *Psychological Bulletin*, *116*, 245–258.
- Korotkov, D., & Hannah, T. E. (2004). The five-factor model of personality: Strengths and limitations in predicting health status, sick-role and illness behaviour. *Personality and Individual Differences*, *36*, 187–199.
- 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 Series B-Biological Sciences*, *268*, 39–44.
- Mazur, A., & Michalek, J. (1998). Marriage, divorce and male testosterone. *Social Forces*, *77*, 315–330.
- McArthur, L. Z., & Apatow, K. (1984). Impressions of baby-faced adults. *Social Cognition*, *2*, 315–342.
- Mueller, U., & Mazur, A. (1997). Facial dominance in Homo sapiens as honest signal of male quality. *Behavioral Ecology*, *8*, 569–579.
- Penton-Voak, I. S., Perrett, D. I., Castles, D. L., Kobayashi, T., Burt, D. M., Murray, L. K., et al. (1999). Menstrual cycle alters face preference. *Nature*, *399*, 741–742.
- Penton-Voak, I., Pound, N., Little, A. C., & Perrett, D. I. (2006). Personality judgements from natural and composite facial images: More evidence for a “kernel of truth” in social perception. *Social Cognition*, *24*, 607–640.
- Perrett, D. I., Lee, K. J., Rowland, D., Yoshikawa, S., Burt, D. M., Henzi, S. P., et al. (1998). Effects of sexual dimorphism on facial attractiveness. *Nature*, *394*, 884–887.

- Perusse, D. (1993). Cultural and reproductive success in modern societies: Testing the relationship at the proximate and ultimate levels. *Behavioral and Brain Sciences*, 16, 267–322.
- Rhodes, G., Chan, J., Zebrowitz, L. A., & Simmons, L. W. (2003). Does sexual dimorphism in human faces signal health? *Proceedings of the Royal Society of London Series B-Biological Sciences*, 270, S93–S95.
- Rowland, D. A., & Perrett, D. I. (1995). Manipulating facial appearance through shape and color. *IEEE Computer Graphics and Applications*, 15, 70–76.
- Swaddle, J., & Reiersen, G. (2002). Testosterone increases perceived dominance but not attractiveness. *Proceedings of the Royal Society of London Series B-Biological Sciences*, 269, 2285–2289.
- Thornhill, R., & Gangestad, S. (1999). Facial attractiveness. *Trends in Cognitive Sciences*, 3, 452–460.
- Weatherhead, P. J., & Robertson, R. J. (1979). Offspring quality and the polygyny threshold: The sexy son hypothesis. *American Naturalist*, 113, 201–208.
- Yamagishi, T., Tanida, S., Mashima, R., Shimoma, E., & Kanazawa, S. (2003). You can judge a book by its cover – Evidence that cheaters may look different from cooperators. *Evolution and Human Behavior*, 24, 290–301.