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Women's preferences for male facial masculinity are not condition-dependent in a large online study

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Abstract: While several studies have found evidence for conditional-dependent effect on women's preferences for male masculinity, others have questioned the relative importance of these effects. In this study, we evaluated variation in women's preference for male facial masculinity in a forced-choice experiment. Nearly 1200 participants scored preference for manipulated photos and surface scans. Between-individual variation in preferences were relatively small, especially for the evaluation of the surface scans. Nevertheless, preferences from the evaluations of photos and scans correlated positively, indicating that both stimuli provide similar biological information. Only few condition-dependent variables correlated significantly with preference for masculinity, and not all in predicted directions. Stronger preference for masculine male faces – albeit only significant for the photos – with higher own women attractiveness was observed as expected. Yet, for perceived infectability, consistently across the photos and scans, a negative association with preference for masculine faces was observed, which is opposite to theoretical predictions. In addition, no effects of pathogen exposure, germ aversion (a correlate of disgust), relational status, preference for short term relationships and sociosexuality were detected. Thus, overall, our study is in line with recent large studies that also find only very weak condition-dependent effects, if any.

Keywords: woman preferences; masculinity; forced-choice experiment, context-dependent, repeatability

Introduction

In humans, male masculinity is regarded as a signal of 'genetic quality'. Nevertheless, women do not always favor more masculine traits. Indeed, women's preferences for masculine characteristics varies strongly among individuals. While several studies have found indications for context-dependent effects on the strength of choice for more masculine traits, the generality of these results have been questioned more recently [1]. face when choosing a mate, where higher masculinity would reflect "good genetic quality" while lower masculinity would reflect "good parental quality". The context-dependency is thought to have evolved to drive mate preferences being optimized in such a way that under conditions where 'genetic quality' matters most to increase women's fitness, preferences are biased towards more masculine traits. Support has been found for increased preferences for more masculine male faces when conception is likely [2], in the context of short term relationships [2,3,4], when women consider themselves relative attractive [5], when exposed to pathogen cues [6] and when women are more sensitive to pathogen disgust [7]. However, not all studies find strong and consistent context-dependent effects, and more recently, one study has suggested a much more prominent role for genetic variation where genetic variation accounted for 30 – 40% of the between-women variation in preferences for masculine faces compared to less than 1% contribution of the context-dependent factors [1]. In this study, the importance of context-dependent factors – including relational status, interest in long vs. short term relationships, pathogen exposure, pathogen disgust, self-perceived attractiveness, use of hormonal anticonception and willingness to engage in uncommitted sexual relationships – are investigated on the basis of a large scale online questionnaire with 1190 participants. In addition, we compare patterns for two types of stimuli, namely manipulated photos which are often used in this type of research (and which we obtained from the published literature), and manipulated surface scans of the face, without any texture skin color or details about eyebrows. The latter thus only focus on facial shape, while photos present a more natural looking stimulus for evaluation. We specifically estimate between-individual variation in preferences for masculinity and how much of this variation is explained by our context-dependent variables. Patterns observed for photos and scans are compared.

Materials and Methods

Participants and background information**:** We invited students from the University of Antwerp and Ghent, to participate to the online questionnaire via email and advertisement on student web fora. In total 1190 heterosexual women participated. Participants age (in years), relational status (in steady relationship or not), preferred type of relationship in the near future for women claiming not to be in a steady relationship (long term, short term or no relationship), use of hormonal anticonception (yes, no, no answer) and own attractiveness (on a scale from 1 to 10), were first obtained.

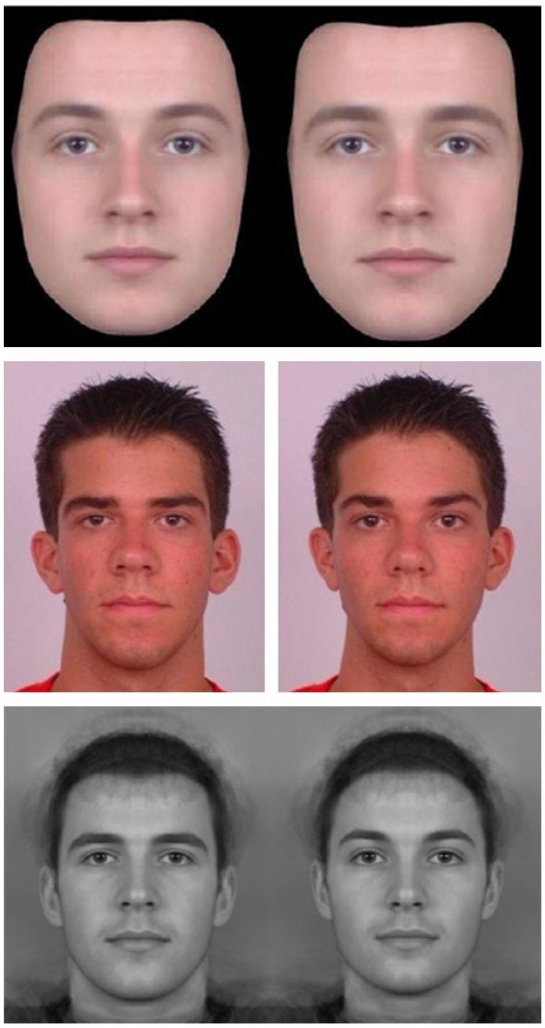

Figure 1: Stimuli used from three published papers, where from top to bottom, the right, left and left photo is more masculine.

Preference for facial masculinity**:** Preference for masculinity was measured with a standard forced choice test, a technique commonly used in this type of research [1]. Participants were shown two stimuli of the same face side by side, one of which was manipulated to be more masculine, the other less masculine. The left-right order was randomized. Participants were asked to rate which face they found more attractive on an 8-point scale (1= left is much more attractive, 8 = right is much more attractive; 4= left is slightly more attractive, 5 = right is slightly more attractive). Two types of stimuli were shown, manipulated pictures available from the literature and manipulated surface scans. Three sets of pictures were shown. We used a male set of pictures from [6,8,9] (Figure 1 (top panel).

In addition, participants rated manipulated facial surface scans. These scans were part of the Caesars dataset (http://store.sae.org/caesar/). This dataset contains approximately 2000 European males and females aged between 18 and 65 years. First, a statistical shape model was built from 346 Dutch males, 346 Dutch females, 346 Italian males and 346 Italian females [10]. From this entire dataset, we then selected 364 males and 374 females aged between 18 and 30 years old having a normal BMI (20-25). Next, the shape sexual dimorphism was modelled using a linear discriminant analysis, of which a heat map is shown in Figure 2 (top panel), and a gender score was calculated for each subject in this dataset. In total, 6 scans with varying degree of masculinity were selected and manipulated to become more and less masculine with 0.5 standard deviation units using the linear discriminant function. An example of such manipulated scans is shown in Figure 2 (bottom panel).

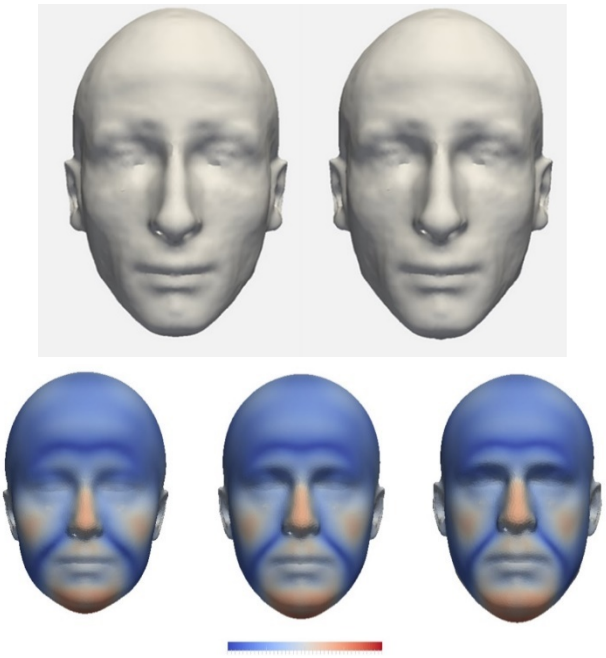

Figure 2: Top: Shape differences along the feminine-masculine dimension on the basis of surface scans of the face. Blueish color reflects small sexual dimorphism while the orange and reddish color reflect areas of high sexual dimorphism. **Bottom:** Example of manipulated scans presented to the participants, where the right scan is more masculine.

Pathogen exposure, perceived vulnerability to disease and the Sociosexual-orientation Inventory**:** Participants were randomly exposed to pictures holding cues of potential disease threat using the pictures in [11] just prior to scoring the stimuli of masculinized/feminized pictures and scans. At the end of the questionnaire, perceived vulnerability to disease was scored using a 15-item self-report instrument [12]. Sociosexuality was assessed using the 9-item revised SOI questionnaire [13]. We first tested for associations with the total score, and if this was statistically significant, the importance of the three sub-scales – sociosexual behavior, attitude and desire – was investigated as well.

Perceived vulnerability to disease has been shown to consist of two subscales, namely believes about one's own susceptibility to infectious diseases (further called perceived infectability) and emotional discomfort in context that connote an especially high potential for pathogen transmission (further called germ aversion) [12]. To assess if in our population, these two subscales were also present, we performed a factor analysis and constructed a biplot. In this plot, the 15 different items are labelled on the basis of their established link with perceived infectability (PI) and germ aversion (GA) [12]. This analysis confirmed the existence of these two dimensions (Fig.3) which will be used as explanatory variables modeling preferences for masculinity.

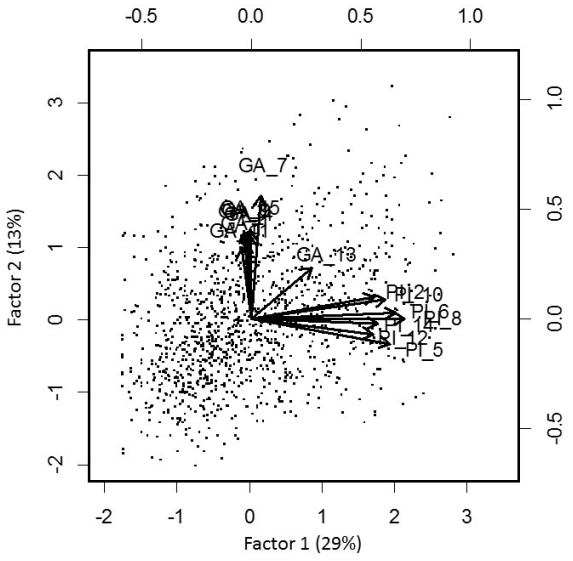

Figure 3: Biplot of the factor analysis of the 15-item questionnaire on perceived vulnerably to disease. Items were label with a prefix of PI for questions related to perceived infectability and GA for questions related to germ aversion [12].

To evaluate if the SOI total score indeed provides information on the willingness of individuals to engage in uncommitted (short-term) relationships, we first compared SOI total among the 4 possible relational categories (steady, not steady looking for long term, not steady and not looking for relationship), expecting a higher score for women looking for short term relationships. There was a significant difference between the four groups ($F_{3,1186}$=49.6, p<0.0001), with the highest score for women not in a steady relationship and looking for short term relationships (mean = 3.0, SE=0.09), compared to the other groups (steady: mean = 2.29, SE=0.03; not steady looking for long term: mean = 2.20, SE=0.02; not steady not looking for relationship: mean = 2.12, SE=0.04). Thus, as expected, single women who claimed to be interested in a short term relationship scored higher on the SOI total score.

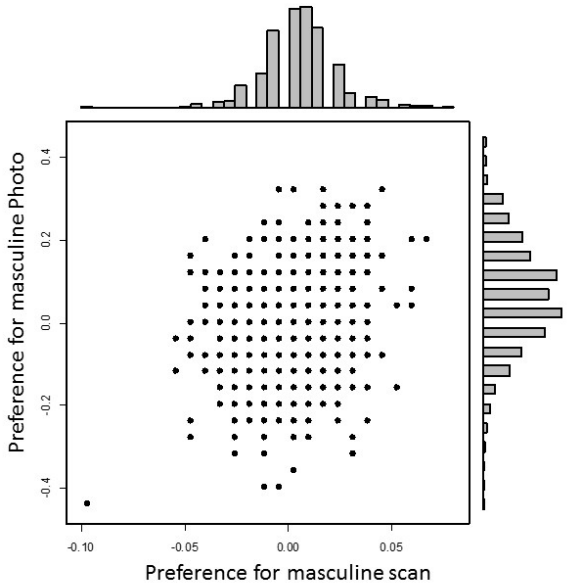

Figure 4: Association between women-specific preferences for facial masculinity on the basis of manipulated photos and scans. The association was significantly positive (r=0.19, t_{1188} = 6.48, p<0.0001)). Marginal distributions are presented as histograms.

Statistical analyses**:** The scores for preference for masculinity were transformed such that high values indicate a preference for more masculine traits and that an average of zero indicates no preference. These scores were used as dependent variable in linear mixed models. Analyses were performed separately for the photos and scans as stimuli and for all stimuli combined. In a first set of models (Null models), individual was treated as random effects and no explanatory variables were added. On the basis of these models, we estimated the overall preference for masculinity (significance of intercept) and the repeatability of this preference (between-individual variation divided by the sum of the between-individual variation and residual variation). From these two null models of photos and scan stimuli, we obtained the individual-specific preferences as the Best Linear Unbiased Prediction (BLUP) estimates of the random effects. We tested for a correlation between these two to establish the repeatability across the two types of stimuli (photo and scan) using Pearson's correlation.

Finally, all explanatory variables (age, own attractiveness, perceived infectability, germ aversion, SOI total, hormonal anticonception use, relational status, and preferred type of relationship (nested within relational status)) were added to the null models and tested for their significance and adjusting p-values for multiple testing using a Bonferroni correction. The repeatability of these full models was also calculated to obtain an estimate of the amount of between-individual variation in preference for masculinity was explained by the context-dependency incorporated in the fixed effects part of the model.

Table 1: Tests of associations between explanatory variables and women's preference for masculine faces. The overall intercept estimates the average score (0 = no preference, positive values indicate preference for more masculine faces) without correcting for any of the covariates. Between-women variation in preferences of the null and final model as well as the proportion of variation explained are provided. Significant effects after Bonferroni correction (i.e., multiply all p-values by 10, the number of tests) (*: p<0.05; **: p<0.01; ***: p<0.001) are highlighted in bold.

Explanatory variable	Photos	Scans	all
Pathogen exposure (Yes vs. No)	0.02 (0.05)	-0.01 (0.02)	-0.004 (0.021)
Own attractiveness	**0.06 (0.02)***	0.01 (0.01)	0.006 (0.008)
Age	**0.04 (0.01)*****	0.01 (0.01)	0.002 (0.004)
Perceived infectability	**-0.09 (0.03)***	**-0.03 (0.01)***	**-0.033 (0.014)***
Germ aversion	0.06 (0.03)	0.01 (0.01)	0.012 (0.013)
SOI Total	-0.08 (0.06)	0.05 (0.02)	0.053 (0.022)
Relation (No vs. Yes)	0.09 (0.06)	-0.01 (0.02)	-0.077 (0.026)
Future relationship (Short vs. Long)	-0.07 (0.14)	-0.06 (0.06)	-0.048 (0.054)
Future relationship (No vs. Long)	-0.00 (0.09)	-0.01 (0.04)	-0.017 (0.036)
Hormonal anticonception use (No vs. Yes)	-0.04 (0.07)	0.04 (0.03)	**0.073 (0.026)***
Overall preference for masculinity (intercept of null model)	-0.15 (0.03)***	-0.10 (0.01)***	-0.21 (0.07)***
Repeatability null model	17.2%	2.05%	6.6%
Repeatability final model	16.1%	1.91%	6.4%
Proportion of between-female variation explained by model	6%	7%	3%

Results

Descriptive statistics: Of the 1190 heterosexual women participants, 657 (55%) reported to be in a steady relationship. Of the 533 (45%) others, 333 (62%) reported to be looking for a long term relationship, 56 (11%) for a short term relationship and 144 (27%) were not looking for a relationship at the time of the questionnaire. Overall, 863 (73%) of the woman participants reported using hormonal anticonception. This proportion was higher in women in a steady relationship (87%), compared to those not in a steady relationship (55%). The average age equaled 21.6 years (standard deviation=2.85) and ranged between 18 and 30 years.

Repeatabilities and rreferences for masculinity: For both stimuli (photos and scans) and all combined, women showed a slight but highly significant preference for less masculine traits (Table 1). The effect was strongest when all stimuli were analyzed simultaneously. The repeatability was almost a tenfold higher for photos compared to scans (Table 1). Nevertheless, masculinity preferences of both types of stimuli were significantly correlated (Fig.4) indicating that they reflect comparable underlying biological preferences of facial aspects. Of all explanatory variables, age, own attractiveness and perceived significantly explained variation in preferences for masculinity in photos (Table 1, Fig. 5). For perceived infectability, the association was – contrary to a priori expectations – negative, where women with a low score showed no preference for more masculine or feminine faces, while women with a high score showed significant preference for less masculine traits (i.e., confidence band not including zero, Fig.5). The association with age was positive where younger women showed preference for less masculine faces, while the older women showed a slight preference for the more masculine version of the photos (Fig. 5). For own attractiveness, the association was as positive, as expected, with no significant preference for masculine traits in women with high perceived own attractiveness, and a significant preference for less masculine photos for women who experienced themselves as unattractiveness (Fig. 5). All explanatory variables together explained 6% of the between-individual variation in preferences for masculinity (Table 1).

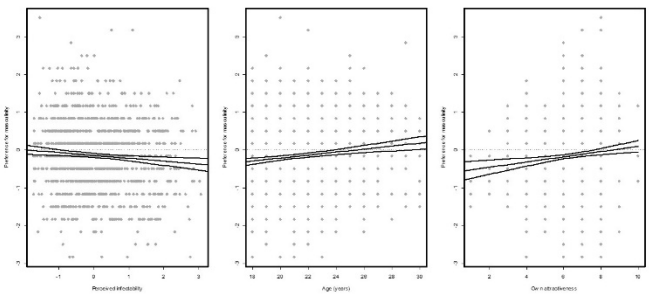

Figure 5: Graphic representation of the three significant associations between preference for masculinity in photos and context dependent explanatory variables (Table 1). Raw data and estimated regression lines with 95% confidence bands are

presented. Strength of associations were 1.0% for perceived infectability, 1.4% for age and 0.7% for own attractiveness.

Variation in preferences for masculinity on the basis of the scans was only significantly explained by perceived infectability and the association was highly comparable to that found for photos (Table 1, Fig. 6). Indeed, the association was again – contrary to expectations – negative, where women with a low score showed no preference for more masculine or feminine faces, while women with a high score showed significant preference for less masculine traits (Fig.6). All explanatory variables together explained 11% in the between-individual variation of masculinity preferences (Table 1).

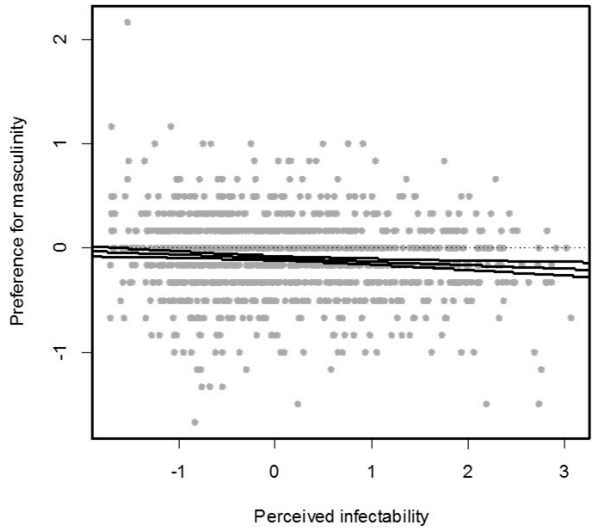

Figure 6: Graphic representation of the only significant association between preference for masculinity in scans and a context dependent explanatory variables (Table 1). Raw data and estimated regression line with 95% confidence bands is presented. The strength of association was 0.8%.

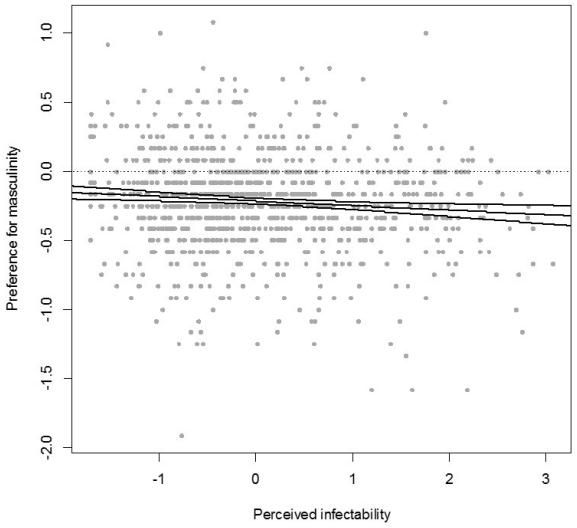

Figure 7: Graphic representation of the only significant association between preference for masculinity and perceived infectability (Table 1). Raw data and estimated regression line with 95% confidence bands is presented. The strength of association was 0.95%.

Finally, for all stimuli combined, we found a significant contribution of perceived infectability and use of hormonal anticonception (Table 1). Women who did not use hormonal anticonception showed a less strong preference for less masculine traits (Table 1). Nevertheless, for women not taking hormonal anticonception, the preference score equaled -0.18 (SE=0.06) and differed significantly from zero (t13=-2.26, p=0.02) indicating that these women also preferred the less masculine versions of the scans and photos. The association between perceived infectability and preference for masculinity was again negative (Table 1) and women showed a significant preference for less masculine stimuli for all values of perceived infectability, yet a stronger preference for lower masculinity when perceived infectability was higher (Fig. 7).

Discussion

Several studies have proposed an adaptive explanation for variation in women's preferences for masculinity in facial traits, where women increase their preference for higher male masculine features in contexts where greater 'genetic quality' over greater 'parental quality' is desired to increase inclusive fitness. On the other hand, larger more recent studies question this theory [1]. In this study, studied context-dependent explained 3 to 6%. We found evidence for effects of perceived infectability, a measure of believes about one's own susceptibility to infectious diseases [12], women's own attractiveness and use of hormonal anticonception. In addition, no effect of pathogen exposure, germ aversion (a correlate of disgust) relational status, interest in short term relationships and sociosexuality was detected.

As predicted, preferences for less masculine traits were observed in women who rated themselves as relatively unattractive, while women who rated themselves as attractive showed no preference. However, this effect could only be demonstrated when manipulated photos were rated, and not for the scans nor for all stimuli combined. Nevertheless, associations were – albeit weakly – in the expected direction when scans were evaluated as well. The interpretation is thus that the context-dependency of the choice switches from no preference for less masculine stimuli in women who rate themselves as unattractive and thus presumed 'better parental quality'. When analyzing all stimuli together, women not taking hormonal anticonception showed a preference for the more masculine versions of the scans and photos.

The most consistent association between a context-dependent variable and preference for masculinity across photos and scans was an unexpected negative correlation with perceived

infectability. Women who consider themselves as more likely to become infected prefered more feminine male faces. Previous studies did not investigate perceived infectability, yet, found correlations with pathogen disgust [7]. However, our study did not show any associations between preference and germ aversion, a factor which showed relatively strong correlations with disgust [12]. Together with the absence of any effect of exposure to pathogen cues on preference for masculinity in our study, our results do not support any evidence that pathogens influence female mate choice in our population. It is unlikely that the negative results are the result of a lack of power, since 1190 individuals participated in this study. Indeed, the power to detect a correlation coefficient of 0.10 (i.e., coefficient of determination of 1%) with a sample size of 1190 equals 93%. It is important to note, however, that among-individual variation in preferences when manipulated surface scans of the face were used as stimuli was much smaller compared to the photos. This indicates that when presenting variation in shape only, the variation in masculinity is less obvious for the participants. This could also implicate that shape variation alone does not evoke the same mate preferences. Alternatively, a manipulation of 0.5 standard deviation units may simply not generate the same visual differences compared to photos. Nevertheless, the between-women variation in masculinity preferences as estimated from scans and photos, did correlate positively – albeit fairly weakly – suggesting that, at least in part, the preferences measured by both stimuli did reveal similar mate preferences in these women. It thus seems important that future studies not only focus on the relative importance of different context-dependent factors but also on which aspects of morphological masculinity affect women mate preferences.

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