HORMONAL CONTRACEPTIVE USE AND PERCEPTIONS OF TRUST MODULATE THE EFFECT OF RELATIONSHIP CONTEXT ON WOMEN'S PREFERENCES FOR SEXUAL DIMORPHISM IN MALE FACE SHAPE

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Abstract. Women demonstrate stronger preferences for femininity when assessing men's attractiveness for long-term rather than short-term relationships. One explanation of this effect is that the pro-social traits associated with femininity are particularly important for long-term relationships. This explanation has recently been challenged, however, following null findings for effects of pro-social attributions on women's preferences for feminine long-term partners. A limitation of these latter analyses is that they did not consider hormonal contraceptive use, which is a factor that previous studies suggest affects mate preferences. In our study, we found that women not using hormonal contraceptives demonstrated stronger preferences for femininity in men's faces when assessing men as long-term partners than when assessing men as short-term partners. Moreover, this effect was most pronounced among women who perceived feminine men as particularly trustworthy. No equivalent effects were observed among women using hormonal contraceptives. These findings support the proposal that the effect of relationship context on women's face preferences occurs, at least in part, because women value pro-social traits more in long-term than short-term partners. Additionally, our findings suggest that both hormonal contraceptive use and individual differences in perceptions of pro-social traits modulate the effect of relationship context on women's face preferences.

Keywords: trust, masculinity, relationship context, condition-dependent preferences, hormones, faces

INTRODUCTION

Previous research has shown that masculine traits in male faces are positively associated with men's long-term health (RHODES et al. 2003; THORNHILL and GANG-

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Estad 2006). For example, Rhodes et al. (2003) found that masculinity ratings of images of men's faces were positively associated with estimates of their health from detailed medical records. More recently, Thornhill and Gangestad (2006) found that masculine facial proportions were negatively associated with incidence and duration of respiratory illness among men. While men possessing masculine facial cues appear to possess good health, other research suggests that masculine men also possess negative traits that are undesirable in a long-term partner. For example, masculine male faces are perceived as untrustworthy, emotionally cold and more likely to make bad parents compared to feminine male faces (Perrett et al. 1998). Additionally, masculine men are more interested in pursuing short-term relationships than relatively feminine men are, while feminine men report having had more long-term relationships than relatively masculine men (Rhodes, Simmons and Peters 2005). Collectively, these findings support the proposal that masculinity in men's faces signals both positive (e.g. good health) and negative (e.g. untrustworthy) traits.

How women resolve the trade-off between the possible benefits associated with choosing a masculine partner (e.g. increased offspring health; Rhodes et al. 2003; Thornhill and Gangestad 2006) and those associated with choosing a feminine partner (e.g. greater interest in long-term relationships; Rhodes, Simmons and Peters 2005) may vary according to the temporal context of the relationship sought (Gangestad and Simpson 2000; Little et al. 2002; Penton-Voak et al. 2003). Consistent with this proposal, Little et al. (2002) found that women demonstrated stronger preferences for feminine male faces when judging men's attractiveness as possible long-term partners than when judging men's attractiveness as possible short-term partners (see also Penton-Voak et al. 2003 and Penton-Voak et al. 1999). Little et al. (2002) proposed that this effect of relationship context on women's preferences for feminine versus masculine men occurs because the possible costs associated with choosing a masculine partner (e.g. low investment) are less pronounced for short-term relationships than long-term relationships, while the possible benefits associated with choosing a feminine partner (e.g. pro-social behaviour) are greater for long-term relationships than short-relationships (see also Penton-Voak et al. 2003 and Penton-Voak et al. 1999). Indeed, Roney et al. (2006) found that women's perceptions of men's interest in children were positively correlated with those men's attractiveness as long-term partners, but not as short-term partners. By contrast, women's perceptions of men's masculinity were positively correlated with those men's attractiveness as short-term partners, but not as long-term partners. While these findings appear to support Little et al.'s (2002) proposal, they are difficult to reconcile with Penton-Voak et al.'s (2007) finding that men's facial masculinity and interest in children, as measured by degree of child-directed speech, were positively correlated.

Luevano and Zebrowitz (2007) recently challenged the proposal that attributions of pro-social traits are important for the effect of relationship context on women's preferences for feminine versus masculine men. Luevano and Ze-

BROWITZ (2007) found that attributions of emotional warmth and parenting abilities to men's faces did not influence the effect of relationship context on women's attractiveness judgments of these men. In light of this finding, LUEVANO and ZEBROWITZ concluded that perceptions of pro-social traits do not play any role in the effect of relationship context on women's face preferences. Indeed, while there is considerable evidence that women show stronger preferences for masculine men as short-term partners than as long-term partners, there is no direct evidence implicating attributions of pro-social traits in the effect of relationship context on women's preferences for masculine versus feminine men.

In their study, LUEVANO and ZEBROWITZ (2007) did not consider possible effects of hormonal contraceptive use on women's perceptions of men's faces. This is potentially an important limitation of LUEVANO and ZEBROWITZ'S (2007) study, since LITTLE et al. (2002) found that only women who were not using hormonal contraceptives demonstrated stronger preferences for femininity in men's faces when assessing men as long-term partners than when assessing men as short-term partners. Women who were using hormonal contraceptives did not show this effect of relationship context on face preferences (LITTLE et al. 2002). LITTLE et al. (2002) noted that hormonal contraceptive use may disrupt (or 'dampen') systematic variation in women's preferences for feminine versus masculine men because women using hormonal contraceptives are in a hormonal state similar to pregnancy and, consequently, are unable to realise the benefits that are thought to be associated with choosing a masculine mate (i.e. increased offspring health). Indeed, FEINBERG et al. (2008) have also recently reported systematic variation in women's masculinity preferences among women who were not using hormonal contraceptives but not among women who were using hormonal contraceptives (see also PENTON-VOAK et al. 1999 and CORNWELL et al. 2004). It is possible, therefore, that controlling for effects of hormonal contraceptives will reveal an interaction between the extent to which women attribute pro-social traits to feminine men and the effect of relationship context on women's preferences for facial sexual dimorphism that was not apparent in LUEVANO and ZEBROWITZ'S (2007) study.

In light of the above, we investigated whether attributions of a pro-social trait (trustworthiness) modulate the effect of relationship context on women's preferences for sexual dimorphism in men's faces. We investigated perceptions of trustworthiness in our study as an example of a pro-social trait, since perceived trustworthiness is thought to play a central role in social behaviour (see, e.g., DEBRUINE 2002, 2005) and because systematic variation in the extent to which women attribute trustworthiness to feminine male faces has previously been reported (BUCKINGHAM et al. 2006). Additionally, the traits *trustworthy*, *caring*, *responsible*, *sociable* and *emotionally stable* all load onto the same principal component with loadings of .94, .90, .91, .91 and .93, respectively (OOSTERHOF and TODOROV 2008). Although our study investigates perceived trustworthiness and not behavioural trustworthiness, previous studies have emphasised the importance of perceived trustworthiness

as a social cue that influences decision-making (van't Wout and Sanfey 2008; Yamgishi et al. 2003).

Following Little et al. (2002), we predicted that women not using hormonal contraceptives would generally demonstrate stronger preferences for femininity in men's faces when assessing men as long-term partners than when assessing men as short-term partners. Additionally, however, we also predicted that the extent to which such women perceived feminine men as trustworthy would be positively associated with the extent to which they preferred feminine men as long-term partners, but not the extent to which they preferred feminine men as short-term partners. Such data would present converging evidence that the relationship context for which men's attractiveness is judged affects women's preferences. More importantly, such data would also suggest that this effect of relationship context occurs, at least partly, because women perceive feminine men as possessing pro-social traits.

Additionally, and again following Little et al. (2002), we did not predict an effect of relationship context on face preferences among women who were currently using hormonal contraceptives. Moreover, since Feinberg et al. (2008) found that systematic variation in women's face preferences did not occur among women using hormonal contraceptives (see also Cornwell et al. 2004; Penton-Voak et al. 1999), we did not predict positive associations between trustworthiness attributions and either short or long-term preferences among women who were using hormonal contraceptives. Such data would present converging evidence that hormonal contraceptive use disrupts the effect of relationship context on women's preferences for sexual dimorphism in men's faces and present the first direct evidence that hormonal contraceptive use also alters the importance that women attach to pro-social traits in long-term partners. This latter finding would also be noteworthy since it would suggest that Luevano and Zebrowitz (2007) found no effect of pro-social traits on women's preferences for feminine men as long-term partners because they did not consider the effects of hormonal contraceptive use.

It is well established that people tend to automatically ascribe positive personality traits to physically attractive individuals (the 'halo effect', see Dion, Berscheid and Walster 1972, for a review). Consequently, positive associations between the extent to which women prefer feminine men as long-term partners and the extent to which women perceive feminine men as trustworthy might occur simply because of such halo effects. In light of this issue, we also assessed the extent to which women judged feminine men to be physically attractive and controlled for the effects of these preferences when testing for positive associations between women's judgments of men's trustworthiness and their attractiveness as long- and short-term partners. If the expected positive association between preferences for feminine men as long-term partners and trustworthiness judgments of feminine men among women not using hormonal contraceptives were to remain significant when controlling for judgments of physical attractiveness, then we could conclude that the positive association was not simply due to an attractiveness halo effect.

It is likely that hormonal contraceptive use will be associated with other factors that may affect women's face preferences (LITTLE et al. 2002; FEINBERG et al. 2008; VUKOVIC et al. 2008). For example, women who are using hormonal contraceptives may be more interested in pursuing long-term versus short-term relationships than women who are not using hormonal contraceptives and may also differ in their partnership status (partnered versus unpartnered) and self-perceived attractiveness. Consequently, we controlled for these factors in our analyses to investigate whether possible effects of hormonal contraceptive use can be explained by between-groups differences in these factors.

METHODS

Stimuli

Masculinised versions of digital face images of 10 young adult White men were manufactured by adding 50% of the linear differences in 2D shape between symmetrised male and female prototype faces (*Figure 1*). Feminised versions of these
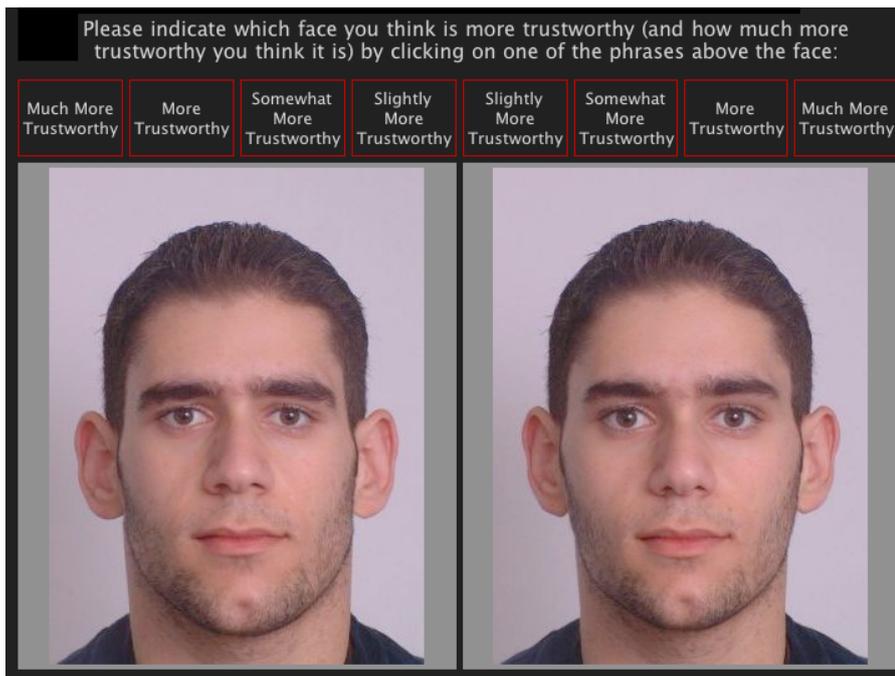
Figure 1. Examples of masculinised (left) and feminised (right) face images used in our study and the interface used to assess perceptions of trustworthiness. Similar interfaces were used to assess short- and long-term preferences

same male identities (*Figure 1*) were created in the same way, this time by subtracting 50% of the linear differences in 2D shape between the prototypes. These methods for manipulating masculinity–femininity in face images have been used in many previous studies (e.g. Little et al. 2002; Penton-Voak et al. 2003), have been shown to affect masculinity and dominance judgments of the face images in the predicted way (i.e. masculinised versions are perceived as more masculine and more dominant than feminised versions, DeBruine et al. 2006; Perrett et al. 1998; Welling et al. 2007), and have been shown to produce preferences that are equivalent to those when other methods for manipulating masculinity in face images are used (DeBruine et al. 2006). Furthermore, preferences for masculinity assessed using these methods are positively related to the reported masculinity of women's romantic partners (DeBruine et al. 2006) and preferences for masculinity in other domains (e.g. preferences for putative male pheromones, Cornwell et al. 2003; preferences for masculine male voices, Feinberg et al. 2008).

MANIPULATION CHECK

To establish that our stimuli differed in perceived masculinity, 35 women (*Mean age* = 22.42 years, *SD* = 6.33 years) were shown the 10 pairs of male face images (each pair consisting of a masculinised and a feminised version of the same individual) and were asked to indicate which face in each pair was the more masculine. Participants chose the masculinised version as the more masculine significantly more often than the chance value of 50% (one sample t-test: $t(34) = 23.22$, $p < .001$; $M = 93.8\%$, $SEM = 1.8$), confirming that we had manipulated the perceived masculinity of the male faces to be used in our study in the intended manner.

Procedure

Women ($N = 147$, ages: $M = 19.92$ years, $SD = 3.55$ years) completed four short face perception tests, the order of which was fully randomised.

In one test, women were shown 10 pairs of men's faces (each pair consisting of a masculinised and feminised version of the same individual) and were asked to choose the face in each pair that was the more trustworthy and to indicate the strength of this preference by choosing from the response options 'much more trustworthy', 'more trustworthy', 'somewhat more trustworthy' and 'slightly more trustworthy'. The side of the screen on which any particular image was shown and the order of trials were fully randomised. Participants repeated this task in a second test, but this time were instructed to choose the face in each pair that they considered the more attractive for a short-term relationship (choosing from the response options 'much more attractive', 'more attractive', 'somewhat more attractive' and 'slightly more attractive'). In a third test, participants again repeated this procedure,

this time choosing the face in each pair that they considered the more attractive for a long-term relationship (choosing from the same response options that had been used to assess preferences in the short-term context). In a fourth test, women repeated this task once more, this time choosing the face in each pair that they considered the more physically attractive. This method has previously been used to assess women's preferences for masculine men and perceptions of their trustworthiness (e.g. BUCKINGHAM et al. 2006). Note that the same pairs of faces were used in each of the four face perception tests and that trial order, the side of the screen on which any particular image was shown and test (i.e. block) order were each fully randomised.

Following previous studies of the effect of relationship context on women's face preferences (e.g., DEBRUINE 2005; LITTLE and MANNION 2006; LITTLE et al. 2007; PENTON-VOAK et al. 2003), long-term and short-term relationships were defined as follows:

Long-term relationship: You are looking for the type of person who would be attractive in a long-term relationship. Examples of this type of relationship would include someone you may want to move in with, someone you may consider leaving a current partner to be with, and someone you may, at some point, wish to marry (or enter into a relationship on similar grounds as marriage).

Short-term relationship: You are looking for the type of person who would be attractive in a short-term relationship. This implies that the relationship may not last a long time. Examples of this type of relationship would include a single date accepted on the spur of the moment, an affair within a long-term relationship, and possibility of a one-night stand.

Participants reported whether or not they were currently using any form of hormonal contraception by responding to the question, "Are you using any hormonal contraceptives? If so, what kind?" and choosing from the options *no*, *oral contraceptive (e.g. the pill)*, *injection (e.g. Depo-Provera)*, *patch (e.g. Ortho-Evra)*, *implant (e.g. Norplant)*, or *other*. Eighty-one participants indicated that they were using some form of hormonal contraceptives and the remaining 66 participants indicated that they were not. The percentage of women who were not using any form of hormonal contraceptive (~44%) is very similar to the corresponding percentage in another sample of undergraduate women at the University of Aberdeen (~47%, VUKOVIC et al. 2008) and in an internet sample of 2,895 women between the ages of 20 and 25 years (~45%, JONES et al. 2005). Participants also indicated whether their ideal relationship was a short- or long-term relationship using a 1 (short-term) to 7 (long-term) scale, reported their current partnership status (partnered versus unpartnered), and rated their own attractiveness using a 1 (very unattractive) to 7 (very attractive) scale. 84 women reported that they currently were in a romantic relationship. The remaining 63 women were single.

All participants were Undergraduate students at the University of Aberdeen who were participating in the study in return for course credit.

INITIAL PROCESSING OF DATA

Following Buckingham et al. (2006), responses were coded using the following 0–7 scale:

    0 = masculine face rated 'much more attractive' or 'much more trustworthy'
    1 = masculine face rated 'more attractive' or 'more trustworthy'
    2 = masculine face rated 'somewhat more attractive' or 'somewhat more trust-worthy'
    3 = masculine face rated 'slightly more attractive' or 'slightly more trustworthy'
    4 = feminine face rated 'slightly more attractive' or 'slightly more trustworthy'
    5 = feminine face rated 'somewhat more attractive' or 'somewhat more trust-worthy'
    6 = feminine face rated 'more attractive' or 'more trustworthy'
    7 = feminine face rated 'much more attractive' or 'much more trustworthy'

For each participant, four different scores were calculated: the average coded response for the short-term face preference test, the average coded response for the long-term face preference test, the average coded response for the trustworthiness test, and the average coded response for the physical attractiveness preference test. It was these four average scores for each participant that were used in subsequent analyses.

RESULTS

One-sample t-tests

Following previous studies of women's perceptions of masculine versus feminine men that have used similar paradigms (DeBruine et al. 2006; Little et al. 2001; Little and Mannion 2006; Penton-Voak et al. 2003; Perrett et al. 1998; Welling et al. 2007), we used one-sample t-tests to assess the effects of femininity–masculinity on women's judgments of men's faces in each condition. These one-sample t-tests comparing scores on each face perception test with what would be expected by chance alone (i.e. 3.5) showed that women using hormonal contraceptives perceived feminine men as more trustworthy than masculine men ($t(80) = 7.54$, $p < .001$, $d = 0.841$). However, women using hormonal contraceptives did not prefer feminine men to masculine men for either long-term ($t(80) = 0.87$, $p = .389$, $d = 0.101$) or short-term relationships ($t(80) = –0.37$, $p = .714$, $d = 0.033$), or when judging men's general physical attractiveness ($t(80) = –0.33$, $p = .743$, $d = 0.045$).

    One-sample t-tests also showed that women not using hormonal contraceptives perceived feminine men as more trustworthy than masculine men ($t(65) = 5.94$, $p <$

.001, $d = 0.737$). These analyses also showed that women not using hormonal contraceptives preferred feminine men more than masculine men for long-term relationships ($t(65) = 2.07$, $p = .042$, $d = 0.258$), but not for short-term relationships ($t(65) = 0.41$, $p = .723$, $d = 0.125$), or when judging men's general physical attractiveness ($t(65) = 0.95$, $p = .346$, $d = 0.047$).

Means and standard deviations for these analyses are given in *Table 1*.

Table 1. Means and standard deviations for each condition.
Scores could range from 0 to 7 (chance equals 3.5)

	Women not using hormonal contraceptives	Women using hormonal contraceptives
Attractiveness for a short-term relationship	3.53 (0.64)	3.48 (0.61)
Attractiveness for a long-term relationship	3.66 (0.62)	3.57 (0.69)
General physical attractiveness	3.57 (0.56)	3.48 (0.44)
Trustworthiness	4.06 (0.76)	4.08 (0.69)

ANCOVAs

Responses on the trustworthiness test, short-term relationship preference test, and long-term relationship preference test were analyzed using ANCOVA [within-subjects factor: *relationship context* (short-term, long-term); between-subjects factor: *hormonal contraceptive use* (yes, no); covariate: *trustworthiness test score*]. This analysis revealed a significant main effect of *hormonal contraceptive use* ($F(1,143) = 5.33$, $p = .022$, partial eta-squared = .036), a significant interaction between *hormonal contraceptive use* and *relationship context* ($F(1,143) = 6.52$, $p = .012$, partial eta-squared = .044), and a significant interaction between *hormonal contraceptive use* and *trustworthiness test score* ($F(1,143) = 6.21$, $p = .014$, partial eta-squared = .042). However, all of these effects were qualified by the predicted significant interaction among *relationship context*, *hormonal contraceptive use,* and *trustworthiness test score* ($F(1,143) = 7.03$, p = .009, partial eta-squared = .047).

To interpret the significant three-way interaction among *relationship context*, *hormonal contraceptive use,* and *trustworthiness test score*, we carried out separate ANCOVAs for women who were using hormonal contraceptives and women who were not using hormonal contraceptives. These ANCOVAs were each identical in design to our main analysis but did not include the between-subjects factor *hormonal contraceptive use*.

The ANCOVA for women who were using hormonal contraceptives revealed no significant effect of *relationship context* ($F(1,79) = 2.19$, $p = .143$, partial eta-

squared = .027). The interaction between *relationship context* and *trustworthiness test score* was also not significant ($F(1,79) = 1.58$, $p = .213$, partial eta-squared = .020). The main effect of *trustworthiness test score* was not significant ($F(1,79) = 2.92$, $p = .091$, partial eta-squared = .036), although women's preferences for feminine partners tended to be negatively related to the extent to which they perceived feminine men to be trustworthy (correlation between trustworthiness test score and average femininity preference collapsed across relationship context: $r = -0.19$, $N = 81$, $p = .091$).

The ANCOVA for women who were not using hormonal contraceptives revealed a significant main effect of *relationship context* ($F(1,64) = 4.12$, $p = .047$, partial eta-squared = .060), whereby feminine men were preferred more for long-term relationships ($M = 3.66$, $SD = 0.62$) than short-term relationships ($M = 3.53$, $SD = 0.64$). A main effect of *trustworthiness test score*, whereby participants who perceived feminine men as particularly trustworthy also generally considered them to be more attractive, approached significance ($F(1,64) = 3.56$, $p = .064$, partial eta-squared = .053). These main effects were qualified, however, by the predicted interaction between *trustworthiness test score* and *relationship context* ($F(1,64) = 5.34$, $p = .024$, partial eta-squared = .077). Separate ANCOVAs for short-term and long-term relationship contexts showed that there was a significant effect of *trustworthiness test score* when women judged men's attractiveness as hypothetical long-term partners ($F(1,64) = 9.48$, $p = .003$, partial eta-squared = .129), but not when women judged men's attractiveness as hypothetical short-term partners ($F(1,64) = 0.01$, $p = .99$, partial eta-squared < .001). Follow-up analyses using Pearson's correlations showed that the significant effect of *trustworthiness test score* when women judged men's attractiveness as hypothetical long-term partners reflects a positive relationship between trustworthiness test score and femininity preference ($r = 0.36$, $p = .003$). No equivalent correlation was observed for the short-term context ($r = 0.00$, $p = .99$).

Since Luevano and Zebrowitz (2007) found no effect of pro-social attributions on the effect of relationship context when they did not consider effects of hormonal contraceptive use, we repeated our initial ANCOVA, this time without the between-subjects factor *hormonal contraceptive use*. This analysis revealed no significant effects (all $F(1,145) < 1.3$, all $p > .27$, all partial eta-squared < .009).

ADDITIONAL ANALYSES

We conducted a partial correlation analysis to establish whether the positive association between preference for feminine long-term partners and trustworthiness test scores among women not using hormonal contraceptives was simply due to the tendency to ascribe trustworthiness to attractive individuals. Among women not using hormonal contraceptives, trustworthiness test scores were significantly and positively related to preferences for femininity in long-term partners when controlling

for the strength of these women's general physical attraction to feminine men ($r = 0.27$, $p = .027$). This significant correlation suggests that the positive association between preference for feminine long-term partners and trustworthiness test scores among women not using hormonal contraceptives that we reported previously does not simply reflect an attractiveness halo effect.

We compared women who did and did not use hormonal contraceptives on self-rated attractiveness, preference for long-term versus short-term relationships (reported as ideal type of relationship), and current relationship status. Women using hormonal contraceptives reported greater interest in long-term relationships ($M = 6.07$, $SD = 1.25$) than women who were not using hormonal contraceptives ($M = 5.56$, $SD = 1.54$; $t(145) = 2.23$, $p = .027$, d = 0.37). These groups of women did not differ in their self-rated attractiveness, however ($t(145) = 0.09$, $p = .93$, d = 0.01). Women using hormonal contraceptives were more likely to be in a relationship (73%) than were women not using hormonal contraceptives (38%; $Z = 4.25$, $p < .001$).

In light of the above, we repeated the initial ANCOVA [within-subjects factor: *relationship context* (short-term, long-term); between-subjects factor: *hormonal contraceptive use* (yes, no); covariate: *trustworthiness test score*] with *partnership status* (partnered, unpartnered) as an additional between-subjects factor and *interest in short-term versus long-term relationships* as an additional covariate. We also included *self-rated attractiveness* as a covariate in order to test for a positive association between self-rated attractiveness and masculinity preference (see, e.g., LITTLE et al. 2001) and to test whether this association is independent of the possible effects of interest in short-term versus long-term relationships. Including these additional factors did not alter the significant interaction among *relationship context*, *hormonal contraceptive use* and *trustworthiness test score* ($F(1, 140) = 6.94$, $p = .009$, partial eta-squared = .047). However, there were significant main effects of both *self-rated attractiveness* ($F(1, 140) = 3.87$, $p = .05$, partial eta-squared = .027) and *interest in short-term versus long-term relationships* ($F(1, 140) = 5.08$, $p = .026$, partial eta-squared = .035). Women who rated themselves as being particularly attractive reported weaker preferences for feminine men than women who rated themselves as being relatively unattractive (correlation between *self-rated attractiveness* and average femininity preference: $r = –.15$). Women who reported particularly strong preferences for long-term relationships reported particularly strong preferences for feminine men (correlation between *self-rated attractiveness* and average femininity preference: $r = .15$).

DISCUSSION

Consistent with LITTLE et al. (2002), we found that preferences for femininity in men's faces were stronger for long-term relationships than for short-term relationships among women reporting no use of hormonal contraceptives. Also consistent

with LITTLE et al. (2002), we observed no effect of relationship context on face preferences among women reporting hormonal contraceptive use. Additionally, we found that women perceived feminine men to be more trustworthy than masculine men, replicating previous findings for perceptions of men's trustworthiness (e.g. PERRETT et al. 1998).

Although we found that women not using hormonal contraceptives showed stronger preferences for feminine men as long-term partners than as short-term partners, this effect of relationship context interacted with the extent to which women perceived feminine men to be trustworthy. As we predicted, the extent to which women not using hormonal contraceptives attributed trustworthiness to feminine men's faces was positively associated with preferences for feminine men as long-term partners, but was not associated with preferences for feminine men as short-term partners. This is consistent with LITTLE et al.'s (2002) trade-off account of the effect of relationship context on women's face preferences (see also GANG-ESTAD and SIMPSON 2000 and PENTON-VOAK et al. 2003), which suggests that stronger preferences for feminine men as long-term partners occurs, at least in part, because the benefits of choosing a partner who possesses pro-social traits (e.g. a feminine partner) are more pronounced for long-term relationships than for short-term relationships. The positive association between trustworthiness judgments and long-term preferences for feminine men, together with the absence of an equivalent association for short-term preferences, therefore support LITTLE et al.'s (2002) and PENTON-VOAK et al.'s (2003) explanation of the effect of relationship context on women's face preferences. Among women who were not using hormonal contraceptives, the association between trustworthiness judgments and preferences for feminine men as long-term partners remained significant when we controlled for the effects of judgments of physical attractiveness. This latter finding is noteworthy since it suggests that the association does not simply reflect a tendency to attribute positive traits to physically attractive individuals (i.e. the association is not simply due to an attractiveness halo effect, DION, BERSCHEID and WALSTER 1972).

While the extent to which women not using hormonal contraceptives attributed trustworthiness to feminine male faces was positively associated with women's preferences for feminine men as long-term partners, but not short-term partners, no similar relationships were observed among women using hormonal contraceptives. This absence of systematic variation in women's masculinity preferences among women using hormonal contraceptives is consistent with CORNWELL et al. (2004) and FEINBERG et al. (2008), who also found that systematic variation in women's masculinity preferences occurred among women who were not using hormonal contraceptives but did not occur among women who were using hormonal contraceptives. It remains unclear, however, whether the absence of systematic variation in masculinity preferences among women using hormonal contraceptives is a direct consequence of the hormonal effects of hormonal contraceptive use or due to hormonal contraceptive use being associated with traits or behaviours that might mask variation in face preferences. For example, sexual experience and/or visual experi-

ence with men, both of which are known to affect face preferences (e.g. BUCKING-HAM et al. 2006; CORNWELL et al. 2006), may covary with hormonal contraceptive use.

While the design of our study does not allow the conclusion that hormonal contraceptive use directly affects women's preferences, we did show that the effect of hormonal contraceptive use was independent of effects of women's self-rated attractiveness, current relationship status and interest in short-term versus long-term relationships. As far as we are aware, this finding is the first to suggest that, although women using and not using hormonal contraceptives do differ in their interest in short-term versus long-term relationships, between-groups differences in sexual strategy do not fully explain effects of hormonal contraceptive use on women's face preferences. The significant effects of self-rated attractiveness and interest in short- versus long-term relationships that we observed are consistent with previous studies showing that women's self-rated attractiveness is positively associated with the strength of their preferences for masculine men (LITTLE et al. 2001; LITTLE and MANNION 2007) and previous studies in which women's interest in short-term relationships was positively associated with their preferences for masculine men (WAYNFORTH, DELWADIA and CAMM 2005; PROVOST, TROJE and QUINSEY 2008). We emphasise here, however, that our measure of interest in short-term versus long-term relationships reflected women's ideal type of relationship, rather than the type of relationship they are currently seeking. While it is likely that these two constructs would be highly correlated, these are not necessarily synonymous.

LUEVANO and ZEBROWITZ (2007) have previously reported that perceptions of pro-social traits do not influence the effect of relationship context on women's preferences for feminine versus masculine men. On the basis of these null findings, LUEVANO and ZEBROWITZ (2007) concluded that attributions of pro-social traits do not play any role in the effect of relationship context on women's preferences for masculine versus feminine men. Their study did not, however, consider possible effects of hormonal contraceptive use on women's perceptions of men's faces. In our study, we found that the extent to which women attributed trustworthiness to feminine men interacted with the effect of relationship context among women not using hormonal contraceptives, but not among women who were using hormonal contraceptives. These findings suggest that the null findings for effects of pro-social attributions reported by LUEVANO and ZEBROWITZ (2007) may be a consequence of not considering the effects of hormonal contraceptive use on women's perceptions of men's faces. Consistent with this view, we did not find any effects of attributions of trustworthiness in our study unless we considered the effects of hormonal contraceptive use in our analyses. While we investigated a different trait than those investigated by LEUVANO and ZEBROWITZ (2007), our findings show that a pro-social attribution (trustworthiness) that is highly correlated with other pro-social attributions (e.g. caring, responsible, sociable and emotionally stable; OOSTERHOF and TODOROV 2008) modulates the effect of relationship context only in women who are not using hormonal contraceptives. Moreover, our findings show that such

modulation is only apparent when the effects of hormonal contraceptive use are considered.

Our findings confirm previous research showing that women's preferences for sexual dimorphism in male face shape are sensitive to the temporal context of the relationship for which men's attractiveness was assessed (Little et al. 2002; Penton-Voak et al. 2003). Our findings also show, however, that this effect of relationship context is modulated by hormonal contraceptive use and, among women not using hormonal contraceptives, interacts with individual differences in the extent to which women perceive feminine men as trustworthy. Only women who reported no use of hormonal contraceptives showed a significant effect of relationship context on face preferences (see also Little et al. 2002) and, among these women, the extent to which feminine men were found to be trustworthy predicted preferences for feminine men as long-term, but not short-term, partners. This latter finding emphasises the importance of pro-social attributions for the effect of relationship context on women's preferences for masculine versus feminine men, which is consistent with Penton-Voak et al.'s (2003) and Little et al.'s (2002) trade-off explanation. More fundamentally, our findings present novel evidence for individual differences in the effect of relationship context on women's mate preferences and highlight the importance of considering possible effects of hormonal contraceptive in studies of social perception.

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REFERENCES

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

Cornwell, R. E., Jones, B. C., Boothroyd, L., Feinberg, D. R., Law Smith, M. J., Moore, F. R., DeBruine, L. M., Stirrat, M., Pitman, R., Whiten, S. & Perrett, D. I. (2004): Hormones and preferences for pheromones and facial characteristics. *Hormones and Behavior*, 46, 129–129.

Cornwell, R. E., Law Smith, M. J., Boothroyd, L. G., Moore, F. R., Davis, H. P., Stirrat, M., et al. (2006): Reproductive strategy, sexual development and attraction to facial characteristics. *Philosophical Transactions of the Royal Society B-Biological Sciences*, 361, 2143–2154.

DeBruine, L. M. (2002): Facial resemblance enhances trust. *Proceedings of the Royal Society of London B*, 269, 1307–1312.

DeBruine, L. M. (2005): Trustworthy but not lust-worthy: Context-specific effects of facial resemblance. *Proceedings of the Royal Society of London B*, 272, 919–922.

DEBRUINE, L. M., JONES, B. C., LITTLE, A. C., BOOTHROYD, L. G., PERRETT, D. I., PENTON-VOAK, I. S., COOPER, P. A., PENKE, L., FEINBERG, D. R. & TIDDEMAN, B. P. (2006): Correlated preferences for facial masculinity and ideal or actual partner's masculinity. *Proceedings of the Royal Society of London B*, 273, 1355–1360.

DION, K., BERSCHEID, E. & WALSTER, E. (1972): What is beautiful is good. *Journal of Personality and Social Psychology*, 24, 285–290.

FEINBERG, D. R., DEBRUINE, L. M., JONES, B. C. & LITTLE, A. C. (2008): Correlated preferences for men's facial and vocal masculinity. *Evolution and Human Behavior,* 29, 233–241.

GANGESTAD, S. W. & SIMPSON, J. A. (2000): The evolution of human mating: Trade-offs and strategic pluralism. *Behavioral and Brain Sciences,* 23, 573–644.

JONES, B. C., PERRETT, D. I., LITTLE, A. C., BOOTHROYD, L., CORNWELL, R. E., FEINBERG, D. R., TIDDEMAN, B. P., WHITEN, S., PITMAN, R. M., HILLIER, S. G., BURT, D. M., STIRRAT, M. R., LAW SMITH, M. J. & MOORE, F. R. (2005): Menstrual cycle, pregnancy and oral contraceptive use alter attraction to apparent health in faces. *Proceedings of the Royal Society of London B*, 272, 347–354.

LITTLE, A. C., JONES, B. C., PENTON-VOAK, I. S., BURT, D. M. & PERRETT, D. I. (2002): Partnership status and the temporal context of relationships influence human female preferences for sexual dimorphism in male face shape. *Proceedings of the Royal Society London B*, 269, 1095–1100.

LITTLE, A. C. & MANNION, H. (2006): Viewing attractive or unattractive same-sex individuals changes self-rated attractiveness and face preferences in women. *Animal Behaviour*, 72, 981–987.

LITTLE, A. C., COHEN, D. L., JONES, B. C. & BELSKY, J. (2007): Human preferences for facial masculinity change with relationship type and environmental harshness. *Behavioral Ecology and Sociobiology*, 61, 967–973.

LUEVANO, V. X. & ZEBROWITZ, L. A. (2007): Do impressions of health, dominance, and warmth explain why masculine faces are preferred more in a short-term mate? *Evolutionary Psychology,* 5, 15–27.

OOSTERHOF, N. N. & TODOROV, A. (2008): The functional basis of face evaluation. *Proceedings of the National Academy of Science, USA*, 105, 11087–11092.

PENTON-VOAK, I. S., LITTLE, A. C., JONES, B. C., BURT, D. M. & PERRETT, D. I. (2003): Measures of human female condition predict preferences for sexually dimorphic characteristics in men's faces. *Journal of Comparative Psychology,* 117, 264–271.

PERRETT, D. I., LEE, K. J., PENTON-VOAK, I. S., ROWLAND, D. R., YOSHIKAWA, S., BURT, D. M., HENZI, S. P., CASTLES, D. L. & AKAMATSU, S. (1998): Effects of sexual dimorphism on facial attractiveness. *Nature*, 394, 884–887.

PROVOST, M. P., TROJE, N. F. & QUINSEY, V. L. (2008): Short-term mating strategies and attraction to masculinity in point-light walkers. *Evolution and Human Behavior*, 29, 65–69.

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 B*, 270, S93–S95.

RHODES, G., SIMMONS, L. & PETERS, M. (2005): Attractiveness and sexual behavior: Does attractiveness enhance mating success? *Evolution and Human Behavior,* 26, 186–201.

RONEY, J. R., HANSON, K. N., DURANTE, K. M. & MAESTRIPIERI, D. (2006): Reading men's faces: Women's mate attractiveness judgments track men's testosterone and interest in infants. *Proceedings of the Royal Society of London B,* 273, 2169–2175.

THORNHILL, R. & GANGESTAD, S. W. (2006): Facial sexual dimorphism, developmental stability, and susceptibility to disease in men and women. *Evolution and Human Behavior*, 27, 131–144.

VAN'T WOUT, M. & SANFEY, A. G. (2008): Friend or foe: The effect of implicit trustworthiness judgments in social decision-making. *Cognition*, 108, 796–803.

Vukovic, J., Feinberg, D. R., Jones, B. C., DeBruine, L. M., Welling, L. L. M., Little, A. C. & Smith, F. G. (2008): Self-rated attractiveness predicts individual differences in women's preferences for masculine men's voices. *Personality and Individual Differences*, 45, 451–456.

Waynforth, D., Delwadia, S. & Camm, M. (2005): The influence of women's mating strategies on preference for masculine facial architecture. *Evolution and Human Behaviour*, 26, 409–416.

Welling, L. L. M., Jones, B. C., DeBruine, L. M., Conway, C. A., Law Smith, M. J., Little, A. C., Feinberg, D. R., Sharp, M. A. & Al-Dujaili, E. A. S. (2007): Raised salivary testosterone in women is associated with increased attraction to masculine faces. *Hormones and Behavior*, 52, 156–161.

Yamgishi, 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.