

# Human preferences for facial masculinity change with relationship type and environmental harshness

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**Abstract** In humans (*Homo sapiens*), sexual dimorphism in face shape has been proposed to be linked to quality in both men and women. Although preferences for high-quality mates might be expected, previous work has suggested that high quality may be associated with decreased investment in partnerships. In line with a trade-off between partner quality and investment, human females have been found to prefer higher levels of masculinity when judging under conditions where the benefits of quality would be maximised and the costs of low investment would be minimised. In this study, we examined facultative preferences for masculinity/femininity under hypothetical high and low environmental harshness in terms of resource availability in which participants were asked to imagine themselves in harsh/safe environments.

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We demonstrate that environmental harshness influences preferences for sexual dimorphism differently according to whether the relationship is likely to be short or long term. Women prefer less-masculine male faces and men prefer less-feminine female faces for long-term than short-term relationships under conditions of environmental harshness. Such findings are consistent with the idea that high-quality partners may be low investors and suggest that under harsh ecological conditions, both men and women favour a low-quality/high-investment partner for long-term relationships. For short-term relationships, where investment is not an important variable, preferences for sexual dimorphism were similar for the low and high environmental harshness conditions. These results provide experimental evidence that human preferences may be contingent on the environment an individual finds itself inhabiting.

**Keywords** Attractiveness · Strategy · Ecology · Masculinity/femininity · Harsh/safe

## Introduction

Evolutionary approaches to human attractiveness have documented several traits that are proposed to be attractive across individuals and cultures, potentially reflecting species-wide “universal” preferences. These include preferences for facial traits such as sexual dimorphism and symmetry (Thornhill and Gangestad 1999). Alongside such general preferences, studies and reviews have pointed to how the evolutionary theory can also be consistent with individual differences in facial preferences (Little et al. 2001, 2002a,b,c; Little and Perrett 2002).

Previous studies have examined the preference for masculine and feminine traits in faces showing that, at

least in women, preferences can change between individuals according to condition (self-perceived and rated attractiveness; Little et al. 2001; Penton-Voak et al. 2003) and partnership status (Little et al. 2002a), within individuals according to hormonal fluctuations (menstrual cycle; Penton-Voak et al. 1999) and within individuals according to the temporal context of relationship (short vs long term; Little et al. 2002a). Women prefer relatively more masculine-faced males when they think of themselves as attractive, when they already have a partner, at peak fertility in the menstrual cycle and when rating for short-term relationships. These findings have been interpreted as consistent with ideas that masculinity in male faces is associated with good genes, i.e. they advertise genetic quality (Thornhill and Gangestad 1999), as these are conditions under which we might expect women to be most attentive to potentially heritable genetic benefits.

Like masculinity in men, researchers have proposed that femininity in human female faces may be a cue to heritable fitness benefits and therefore relate to attractiveness (Perrett et al. 1998). Femininity of the face shape is also associated with youth (Perrett et al. 1998), and so preferences may also reflect male attention to youth, linked to fertility and fecundity (Buss and Barnes 1986). So far, there is consistent evidence that men prefer feminine female faces (Cunningham 1986; Jones and Hill 1993; Grammer and Thornhill 1994), but little work has been conducted on individual differences in male preferences.

So why do women show individual differences in their attraction to masculinity? The answer may lie in a trade-off between the genetic quality of the male and the investment he makes in the relationship and towards any resultant offspring—high-quality males may invest less in each partner (and offspring) and so may not make ideal long-term partners in a species such as humans with extended parental investment (Burley 1986; Møller and Thornhill 1998). The quality of a partner may also influence an individual's own level of parental investment; for example, female birds have been found to invest more in offspring when partnered with high- as opposed to low-quality mates (Burley 1986; Møller and Thornhill 1998). Thus far, studies have documented individual differences based on factors intrinsic to the choosing individuals (e.g. physical attractiveness), but we may also expect variation according to extrinsic ecological conditions that influence the relative value of high parental investment vs good-gene/high-fertility benefits from partners.

The degree of harshness and uncertainty in the resource availability of the environment an individual inhabits is a salient cue we might expect to influence the trade-off between a high-investing partner and one with good genes, as it is known to influence reproductively important outcomes and processes such as the age of childbearing,

sperm concentration and quality, coital frequency, menstrual and hormonal cyclicity, fertility, birth rates and breast milk supply (Campbell and Wood 1994; Hill and Hurtado 1996; Wilson and Daly 1997; Ellison 2001).

Under conditions of ecological harshness (e.g. low resource availability and predictability), a preference for an investing partner via a low mating effort/high parental investment strategy may be adaptive, whereas under conditions of relatively low environmental harshness (e.g. high resource availability and predictability), a choice for 'good genes' via a high mating effort/low parental investment strategy may be a better strategy (e.g. Mace 2000; Geary et al. 2004). For example, in 'harsh' environments, having a stable partner may be of increased importance, particularly for women during pregnancy, as the resources to raise a child may be scarce or difficult to acquire; thus, two parents providing the resources necessary for offspring survival and eventual reproduction may be better than one. Likewise, safe environments may favour the choice of good genes, as an individual can acquire the resources they need themselves; essentially, there may be little gain in terms of offspring survival/reproduction by the additional effort of a second parent.

Alternatively, in a harsh environment, extrinsic mortality is greater, and thus the probability of offspring survival and eventual reproduction decreases. Consequently, there may be few benefits in attracting an attentive/investing partner, as individuals may maximise their reproductive output by focusing on acquiring good genes for their offspring to be able to thrive in the hostile environment (e.g. Belsky et al. 1991; Chisholm 1996). However, when environments are low in harshness and uncertainty (e.g. resources are relatively stable and predictable), the probability of offspring survival and eventual reproduction is greater, and thus choosing an investing partner aids in channelling those resources to the care of a relatively few, high-quality, competitive offspring (Belsky et al. 1991; Chisholm 1996).

Studies examining the influence of ecological conditions have indicated that when hypothetical environments are lower in harshness, men and women, via questionnaires, report desiring a longer-term relationship and place greater importance on a partner who wants to have children, is ready to help with the day-to-day child-rearing activities, has a steady job with a reliable income and is hardworking, dependable, responsible and trustworthy as well as placing more importance on a partner's physical attractiveness than when environments are higher in harshness (Cohen 2004).

Other research has shown that when resources such as food are abundant, men prefer a more slender woman, whereas when food is scarcer, a preference for a heavier woman is seen (Anderson et al. 1992). This again demonstrates that men take into account the environment in the choice of a partner—traits are of differential importance under different conditions.

Results from these studies indicate that the ecological condition is a potentially important determinant of mate preferences. The current, Internet-based study examined the interplay of environmental harshness (safe/harsh) and temporal context (short/long) on masculinity/femininity preferences in both men and women.

We hypothesised that if high-quality partners are less likely to invest/more likely to desert them in long-term relationships, the following may occur:

1. Women would prefer more feminine-faced men in harsh environments than in safe environments.
2. Men would prefer more masculine-faced women in harsh environments than in safe environments.

This pattern of preference would increase the likelihood of investment in environments where it would be most likely needed. For short-term relationships, given that investment and desertion are not issues, we hypothesised that there would be no difference between preferences in harsh/safe environmental conditions.

## Materials and methods

### Participants

Female participants were split by oral-contraceptive use, as this has been found to impact on evolutionary relevant preferences (Wedekind et al. 1995; Penton-Voak et al. 1999; Little et al. 2002a). Sixty-four women who reported not using oral contraception (50 white, 9 East Asian, 4 Indian/Pakistan, 1 Hispanic, mean age=24.4, SD=6.8), 44 women who reported using oral contraception (38 white, 3 Indian/Pakistan, 2 East Asian, 1 Black, mean age=22.5, SD=4.5) and 90 males (75 white, 6 East Asian, 6 Indian/Pakistan, 2 Black, 1 Hispanic, mean age=24.1, SD=6.7) took part in the study. All participants were selected on the basis of being 17–45 years of age and reporting to be heterosexual or bisexual (bisexual individuals were included, as opposite-sex faces are appropriate in mate choice; two women and one man reported bisexuality). Participants were volunteers and were recruited via a link to the online study from <http://www.alittlelab.com> and from the University of Liverpool's online poster system. The website is linked from several UK online general news sites, and so the participants are from a variety of backgrounds, academic and non-academic.

### Face preference stimuli

The faces were ten pairs of composite male images, one masculinised, one feminised (see Fig. 1 for example images). Original images were 50 young adult male photographs taken under standard lighting conditions and



**Fig. 1** Examples of feminised (*left*) and masculinised (*right*) female and male faces

with a neutral expression. The composite images were made by creating an average image made up of five randomly assigned individual facial photographs. This technique has been used to create composite images in previous studies (Benson and Perrett 1993; Tiddeman et al. 2001; Little and Hancock 2002). Faces were transformed on a sexual dimorphism dimension using the linear difference between a composite of all 50 men and an equivalent composite of 50 young adult women, following previous methods (Perrett et al. 1998). These composites were made symmetric before the transforms. Transforms represented  $50\% \pm$  the difference between these two composites. Composite faces are representative of the average traits of the faces within them, reducing idiosyncratic differences between faces and reducing asymmetry. These factors make composite faces useful in addressing the effects of manipulations on a small number of faces, as they ensure the effects are relevant for more faces than were actually presented.

### Procedure

Participants were asked on screen to complete a questionnaire gathering information on sex (female/male), age (age

in years), sexuality (heterosexual/bisexual/homosexual), self-perceived attractiveness (Rate your physical attractiveness: marked on a 7-point scale from 1—unattractive to 7—very attractive), partnership status (Do you have a current partner? Yes/no) and for women, the date of their last menstruation (How many days ago did your last period of menstruation [menstrual bleeding] start?) and hormonal contraceptive use (Do you currently use a hormonal contraceptive [e.g. pill, injection, patch]? Yes/no). After completing this socio-demographic questionnaire, the ten pairs of masculine and feminine faces were presented. Participants saw only opposite-sex faces (using their reported sex from the questionnaire), which they rated under one of four conditions—long-term/harsh, long-term/safe, short-term/harsh, short-term/safe (see below for scenarios and term descriptions). These were randomly determined, and participants were asked to imagine what they would prefer given the hypothetical safe or harsh scenario. Faces were then shown as pairs with both order and side of presentation randomised. Participants were asked to choose the face of the pair that they found most attractive, and clicking a button underneath the chosen face moved on to the next face trial. On each page, participants could click to view the scenario and term they were supposed to be rating for.

#### Scenarios and term descriptions

One of two ecological scenarios (written by Cohen and Belsky; from Cohen 2004) were presented to participants before they rated faces for attractiveness, as follows:

- Safe: “You are single, have a university degree, and do not have any children. Your parents and siblings are supportive and you get along well with them. You live in a neighbourhood that is generally safe, relatively clean, quiet and well maintained. Your neighbours are OK, either friendly or keeping to themselves. You have a stable job; as far as you can tell you will remain employed for the foreseeable future. In general, you are happy at work and get along well with your boss and co-workers. Your job provides you with a steady income that meets your needs satisfactorily. You own your own flat and are able to pay your mortgage on time. You have some savings and/or investments and look forward to a reasonably secure future.”
- Harsh: “You are single and you have no children. You left school at 16 years of age, which didn’t make your parents very happy, but that didn’t really matter since you didn’t get along with them anyway. In fact, you still don’t get along with them and barely get along with your siblings. At best, your family relationships could be described as distant and at worst conflicted.

You live in a neighbourhood that is dirty and noisy. The community areas are not well maintained and some areas are even dangerous. Your neighbours are generally unfriendly or keep to themselves but a few are quite nasty and you don’t like running in to them, which is sometimes unavoidable. You recently lost your job because of a combination of economic cutbacks as well as conflicts with your boss and co-workers. You only started this job a few months ago, and so are faced with unemployment yet again. From your previous job searches, you know that work is limited and you have no idea when you will be employed again. You rent a flat that needs repairs, but the landlord has refused to fix the problems, partly because you owe back rent. And this is not the only bill that has gone unpaid.”

Participants were also presented with definitions of short- and long-term relationships (written by Little), which were provided before rating for each condition, as follows:

- Short-term: “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.”
- Long-term: “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).”

## Results

### Female preferences

For women, a one-sample *t* test against chance (50%) revealed there were significant preferences for masculine male faces in both those not using oral contraception (mean preference=+30%, SD=2.4,  $t_{63}=6.7$ ,  $p<0.001$ ) and those using oral contraception (mean preference=+30%, SD=2.6,  $t_{43}=5.2$ ,  $p<0.001$ ).

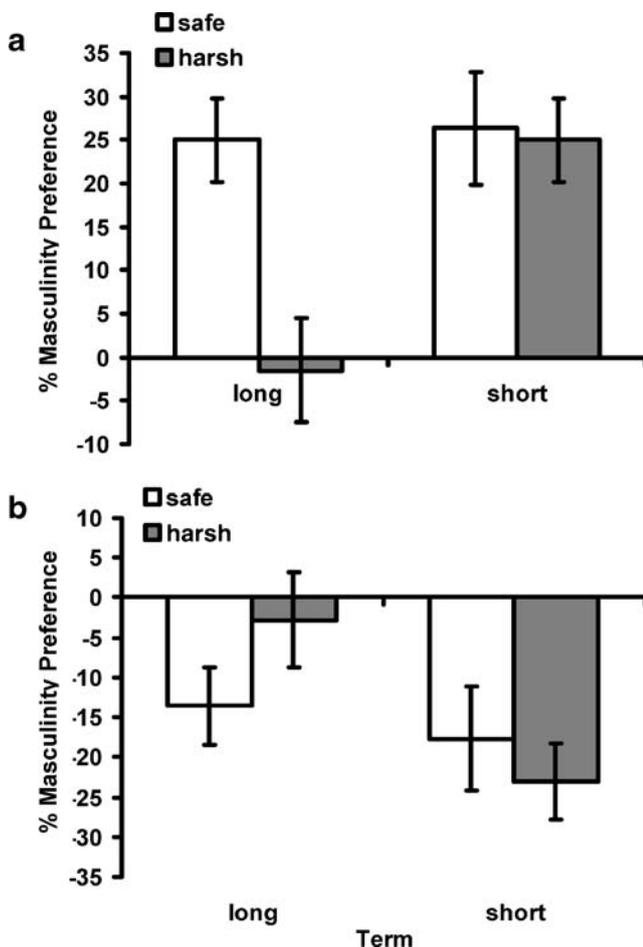
For those not using oral contraception, a univariate analysis of variance (ANOVA) with masculinity preference as the dependent variable and ‘scenario’ (safe/harsh) and ‘term’ (long/short) as the between-participant variables revealed significant main effects of both the scenario

( $F_{1, 60}=6.3, p=0.015$ ) and term ( $F_{1, 60}=6.3, p=0.015$ ), but these two main effects were qualified by a significant higher-order interaction between the scenario and term ( $F_{1, 60}=5.1, p=0.028$ ). Although women preferred more masculine faces when considering a partner in the safe scenario than in the harsh scenario (+36 vs +12%) and when rating for a short-term relationship than for a long-term relationship (+36 vs +12%), the interaction between these two factors indicated that the impact of the scenario on masculinity preference was most prominent when rating for long-term relationships (see Fig. 2). More specifically, whereas faces were rated similarly across safe and harsh conditions when female participants were assigned to the short-term relationship condition, substantially greater preferences for masculine faces emerged when women were assigned to the long-term relationship condition and were making ratings under the assumption that they lived in a safe rather than harsh context.

Previous studies have noted variation in masculinity preference according to age, self-perceived attractiveness, partnership status and menstrual-cycle phase (Little et al.

2001, 2002a,b,c; Penton-Voak et al. 1999). To control for these variables, we conducted a second ANOVA entering the same variables as above but adding age, number of days since last menstruation and self-perceived attractiveness as covariates and ‘having a partner’ (yes/no) as a between-participant factor. The effects of the scenario ( $F_{1, 53}=8.2, p=0.006$ ) and the term ( $F_{1, 53}=4.8, p=0.033$ ) and the interaction between the scenario and term ( $F_{1, 53}=5.7, p=0.021$ ) remained significant. The only additional significant effect was an interaction between the partner and scenario ( $F_{1, 53}=5.7, p=0.021$ , all other  $F_{1, 53}<3.3, p>0.076$ ), indicating that the shift for the scenario was most prominent for those with partners. We draw no strong conclusions other than that the effects of the scenario and the term and the interaction between them are robust to controlling for other influences on masculinity preferences.

For women using oral contraception, a univariate ANOVA with masculinity preference as the dependent variable and ‘scenario’ (safe/harsh) and ‘term’ (long/short) as the between-participant variables revealed no significant main effects or interaction (all  $F_{1, 40}<1.5, p>0.24$ ).



**Fig. 2** Percent preferences for facial masculinity ( $\pm$ SE of mean) according to scenario (safe/harsh) and term (long/short) in females (a) and males (b)

#### Male preferences

For men, a one-sample *t* test against chance (50%) revealed there were significant preferences for feminine female faces (mean preference = -14%,  $SD=1.8, t_{89}=-7.2, p<0.001$ ).

A univariate ANOVA with masculinity preference as the dependent variable and ‘scenario’ (safe/harsh) and ‘term’ (long/short) as the between-participant variables revealed no significant main effect of the scenario ( $F_{3, 86}=0.6, p=0.46$ ), a significant main effect of the term ( $F_{1, 86}=11.4, p<0.001$ ) and a significant interaction between the scenario and term that qualified the main effect of the term ( $F_{1, 86}=5.1, p=0.027$ ). Although men preferred more feminine faces when rating for a short-term relationship than for a long-term relationship (20 vs 08% feminine), the significant scenario  $\times$  term interaction indicated that for long-term relationships, men preferred more feminine faces in the safe than in the harsh condition but preferred more feminine faces for short-term relationships in the harsh than in the safe condition (see Fig. 2). Examining Fig. 2, it appears that, similar to women, male preferences for femininity change between long- and short-term relationships mainly for the harsh condition, and ratings for the safe condition remain similar.

As in female analysis, a second ANOVA entering the same variables as above but adding age and self-perceived attractiveness as covariates and ‘partner’ (yes/no) as a between-participant factor was conducted. The effects of the term ( $F_{1, 80}=10.2, p=0.002$ ) and the interaction between the scenario and term ( $F_{1, 80}=4.1, p=0.048$ ) remained significant. No other effects were significant (all  $F_{1, 80}<1.7, p>0.20$ ).

In a final ANOVA, we examined the three-way interaction among the sex, term and scenario by entering both male and female (only those not using oral contraception) data and adding ‘sex’ as a between-participant factor. To do this, an opposite-sex preference score was computed so that preferences for women represented masculinity and preferences for men represented femininity. This revealed no significant interaction ( $F_{1, 146}=0.5, p=0.48$ ), indicating a similar-sized and equivalent effect in men for femininity and women for masculinity.

## Discussion

The current study demonstrates that both men and women take into account imagined cues to environmental harshness in their face preferences and that harshness interacts with the short- vs long-term status of the relationship being considered. Both women and men appeared to favour more extreme phenotypes in their short-term preferences. For women, only long-term preferences interacted with the environmental harshness, with those presuming themselves to be residing in harsh environments preferring more feminine faces than those randomly assigned to the safe-environment condition. For men, for long-term relationships, more feminine female faces were preferred under the safe condition and more masculine in the harsh environment, whereas for short-term relationships, the reverse was true: Feminine female faces were preferred under the harsh conditions and more masculine in safe environments. Like women, men appeared to differ most in their preferences when considering a harsh environment.

The vignettes present a generally harsh vs a generally safe environment, and each contains multiple cues to “resource availability/scarcity.” We focus on the general, not specific, aspects of the environment as a proof that humans can take into account environmental variables in partner choice. In the future, it would be interesting to examine the effect of different environmental aspects, such as food availability vs parasite prevalence, on preferences. Gangestad et al. (2006) discussed the influence of parasites on preferences and have shown, for example, that parasite prevalence is positively related to the strength of preference for attractive partners in men and women. This work was correlational, however, and the data here provide a useful first step in addressing how experimentally manipulated cues to the environment influence preference.

Ecological harshness affects a variety of factors associated with mating (Campbell and Wood 1994; Hill and Hurtado 1996; Wilson and Daly 1997; Ellison 2001), and here our results elucidate the role that environmental harshness in terms of available resources can have on facial preferences. In women, it appears that safe environments

may allow them to choose men who are of high genetic quality but who may not be the most investing partners, and as we might expect, this is only an issue when it comes to rating for long-term relationships. In short-term partners, paternal investment from that partner is minimal, and so the worth of masculine-featured males, associated with low investment but potentially high genetic quality, appears similar for both harsh and safe environments. In line with previous studies, we found that those reported using an oral contraceptive did not show these potentially adaptive preferences (Wedekind et al. 1995; Penton-Voak et al. 1999; Little et al. 2002a), further highlighting the role of this variable in mate-choice research.

The results from men are similar to the results from women but in reverse on the scales, swapping masculinity preference for femininity preference when seeking a long-term relationship under harsh vs safe conditions. A preference for potentially lower-quality women for long-term relationships in harsh environments suggests that men may also face a trade-off in their choice of partner in terms of quality and investment/potential desertion. For men, harshness had the opposite effect for short-term relationships (i.e. higher-quality/feminine women were preferred in harsh environments than in safe).

The data are consistent then with the theoretical reasoning on the trade-off between acquiring investment from a partner and the quality of a partner (Burley 1986; Møller and Thornhill 1998; Mace 2000; Little et al. 2001, 2002a; Geary et al. 2004). A harsh environment appears to promote a strategy wherein individuals favour lower-quality but high-investing individuals for their long-term relationships but, at least for males, favour cues to fertility/good genes for their short-term partners in terms of facial preferences. It is also possible that safe environments promote stable pair bonds, and then high-quality mates can be stable long-term partners. This appears less likely than the alternative given research that suggests high-quality partners will exhibit lower commitment to partnership, and there is no strong theoretical reason to believe this behaviour would change in a safe environment. We also note that individuals may moderate their own levels of investment in their offspring in reaction to their partner’s quality (Burley 1986; Møller and Thornhill 1998), and this may factor into their preferences, although possibly such effects may only become apparent after partner choice has taken place.

As a methodological point, although we use self-report data for factors such as oral-contraceptive use, we have no reason to doubt their validity, and the significant effects we show mean that the imagined context does indeed influence the preference.

Previous work has shown that in women, those with high self-perceived attractiveness have greater preferences for masculinity in male faces than those with lower self-

perceived attractiveness. Potentially, the different scenarios may impact on such self-perceptions providing a mechanism for environmental contingent effects. Although we note this as a possibility, the effect of scenario remained when self-perceived attractiveness was controlled, and the effects of environment on cognition are likely to be many and are a rich ground for further study.

In summary, we have showed that the temporal context of relationship interacts with environmental cues in determining face preferences of both men and women. Demonstrating environmental effects in humans is novel, adding another variable that can generate individual differences in preferences that can operate alongside between-individual differences. The same person in a different environment may then demonstrate variable preferences. That environmental cues may impact on facial preferences may help explain the mixed findings for facial masculinity preferences observed for male faces (Thornhill and Gangestad 1999; Little et al. 2002b) and demonstrates that male preferences for female faces can also potentially be strategically variable.

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