

Original Article

Pathogen disgust predicts women's preferences for masculinity in men's voices, faces, and bodies

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Recent studies suggest that pathogen-related factors may contribute to systematic variation in women's preferences for masculinity in men's faces. However, there is very little evidence for similar correlations between pathogen-related factors and women's preferences for masculinity in other domains (e.g., men's voices or bodies). Consequently, we conducted a series of studies to examine whether pathogen disgust (assessed using Tybur et al's Three Domains of Disgust Scale) predicts individual differences in women's preferences for masculine characteristics in men's voices, bodies, and faces. We also tested if pathogen disgust predicts individual differences in measures of women's actual mate choices in the same way. We observed positive correlations between women's pathogen disgust and their preferences for masculinity in men's voices (Study 1) and faces and bodies (Study 2). We also observed positive correlations between women's pathogen disgust and their masculinity ratings of both their current and ideal romantic partners (Study 3). Each of these correlations was independent of the possible effects of women's sexual and moral disgust. Together, these findings suggest that individual differences in pathogen disgust predict individual differences in women's masculinity preferences across multiple domains and may also predict individual differences in their actual mate choices. *Key words:* mate preferences, pathogens, sexual dimorphism. [*Behav Ecol*]

INTRODUCTION

Masculine characteristics in men are positively correlated with various measures of good health, including infrequent illness (Thornhill and Gangestad 2006), general health scores derived from analyses of medical records (Rhodes et al. 2003), low levels of urinary markers of oxidative stress (Gangestad et al. 2010), upper body physical strength (Fink et al. 2007), and symmetric features (Gangestad and Thornhill 2003; Thornhill and Gangestad 2006; Little et al. 2008b; but see also Koehler et al. 2004). Additionally, salivary testosterone levels in men are positively correlated with their antibody response to a hepatitis B vaccine (Rantala et al. 2012), which is a direct measure of immune function. Consistent with these findings for correlations between indices of men's masculinity and measures of their health, several studies have reported that increasing masculine characteristics in images of men's faces causes them to appear healthier (Johnston et al. 2001; Scarbrough and Johnston 2005; Scott et al. 2008; but see also Boothroyd et al. 2005) and physically stronger (Jones et al. 2010a).

Although the findings described in those studies suggest that masculine men possess traits that women might value in a potential mate (i.e., good health and strength), masculine men

also possess traits that women are likely to find unappealing in a long-term romantic partner. For example, masculine men show stronger preferences for short-term, uncommitted romantic relationships than do relatively feminine men (Rhodes et al. 2005; Boothroyd et al. 2008), are more likely to cheat on their romantic partners (Hughes and Gallup 2003), and are less willing to share resources fairly (Price et al. 2010). Moreover, masculine men are perceived as bad parents, untrustworthy, and emotionally cold (Perrett et al. 1998) and more likely to cheat on their romantic partners (O'Connor and Feinberg 2012) than are feminine men. Additionally, men with higher salivary testosterone levels report investing less time and fewer resources in their partners and offspring (Gray et al. 2002). Together, these findings suggest that there is a trade-off between the advantages and disadvantages to women who choose a masculine mate; women's reproductive fitness may benefit from choosing a healthy or strong masculine mate, but could also be adversely affected by choosing such a mate because he may be less willing to invest resources in his romantic partner and offspring (Gangestad and Simpson 2000; Fink and Penton-Voak 2002; Little et al. 2011c). Women's preferences for masculine versus feminine men may, therefore, depend on the relative weighting they assign to the possible advantages and disadvantages of choosing a masculine mate (Gangestad and Simpson 2000; Fink and Penton-Voak 2002; Little et al. 2011c).

Several recent studies suggest that the resolution of the trade-off between the costs and benefits of choosing a masculine mate can be influenced by pathogen-related factors (see Little et al. 2011c and Tybur and Gangestad 2011 for reviews

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of these studies). These studies have noted that the potential direct and indirect benefits associated with choosing a healthy mate may be greater in circumstances where pathogen stress is more pronounced, suggesting that pathogen-related factors will influence women's mate preferences. Consistent with this proposal, regional differences in health measures and pathogen load predict women's preferences for masculine characteristics in men's faces; women in regions with poorer health or higher pathogen loads tend to show stronger preferences for masculine men (DeBruine et al. 2010a; 2011; see also DeBruine et al. 2012). Consistent with these findings for population-level differences in masculinity preferences, women who report higher levels of pathogen disgust (assessed using the Three Domains of Disgust Scale [TDDS], Tybur et al. 2009), but not moral or sexual disgust, show stronger preferences for masculinity in men's faces (DeBruine et al. 2010c). Women who rate their own health to be relatively poor also show stronger preferences for masculine characteristics in men's voices, at least when judging men's attractiveness for hypothetical short-term relationships (Feinberg et al. 2012). Although these correlations could be mediated by variables that were not considered in the studies (see, e.g., Brooks et al. 2011), two recent priming experiments (each using a different methodology) recently demonstrated that priming women's concerns about pathogens increased their preferences for masculine men (Lee and Zietsch 2011; Little et al. 2011b). These findings indicate that concerns about pathogens can directly modulate women's masculinity preferences.

To date, studies linking pathogen disgust to individual differences in women's preferences for masculine men have focused, exclusively, on women's judgments of men's facial attractiveness. Noting this fact, Park et al. (2012) recently suggested that establishing whether pathogen disgust predicts attractiveness judgments in domains other than facial attractiveness would be an important next step in understanding the role of pathogen-related factors in human mate preferences. Moreover, other researchers have expressed skepticism about the proposed correlation between pathogen-related concerns and women's masculinity preferences (Scott et al. 2012). In light of these points, we investigated the relationships between pathogen disgust and women's preferences for masculinity in men's voices (Study 1) and faces and bodies (Study 2). As in prior work on this topic (DeBruine et al. 2010c), individual differences in women's pathogen, sexual, and moral disgust were assessed using Tybur et al.'s (2009) TDDS.

Previous studies reported that partnered women's masculinity ratings of their actual romantic partner were positively correlated with the strength of their preferences for masculine characteristics in men's faces (DeBruine et al. 2006; DeBruine 2012). Additionally, Burriss et al. (2011) reported that women's preferences for masculine characteristics in men's faces were positively correlated with their actual romantic partners' ratings of their own masculinity. Although these findings suggest that women's mate preferences may well predict their mate choices, many researchers have emphasized that research is needed on the extent to which factors that have been shown to predict women's preferences for masculine mates also predict their actual partner choices (e.g., Penton-Voak 2011; Puts et al. 2012; Scott et al. 2012). Consequently, we also investigated whether individual differences in pathogen disgust predicted partnered women's ratings of the masculinity of both their actual and ideal romantic partners (Study 3).

STUDY 1

In Study 1, we investigated the relationships between 1) individual differences in women's pathogen, moral, and sexual disgust and 2) their preferences for masculinized (i.e.,

lowered-pitch) versus feminized (i.e., raised-pitch) versions of recordings of men's voices. Given previous findings for pathogen disgust and women's preferences for facial masculinity (DeBruine et al. 2010c), we predicted that pathogen disgust would be positively correlated with women's masculinity preferences and that this relationship would be independent of the possible effects of sexual and moral disgust.

Methods

Participants

A total of 291 women (mean age = 22.71 years, standard deviation [SD] = 4.51 years) took part in this online study. They were recruited by following links to online attractiveness research from social bookmarking websites, such as stumble-upon.com. Previous research has established that online studies of vocal attractiveness produce similar patterns of results to studies that were conducted in the laboratory (e.g., Feinberg et al. 2008; Jones et al. 2010b). About 71% of our participants were from North America, 10% were from mainland Europe, 12% were from the United Kingdom, and 7% were from other regions.

Voice stimuli

First, recordings of six men and six women speaking the vowel sounds "eh" as in bet, "ee" as in see, "ah" as in father, "oh" as in note, and "oo" as in boot were randomly selected from a sample of recordings of 158 individuals' speech. All individuals recorded were young, white adult undergraduate students at the University of St. Andrews. Recordings were made using an Audio-Technica AT4041 microphone in a quiet room using Soundforge recording software, in mono, and at a sampling rate of 44.1 kHz with 16-bit amplitude quantization. Next, we manufactured two versions of each voice recording: a version with raised voice pitch (i.e., a feminized version) and a version with lowered voice pitch (i.e., a masculinized version).

Masculinized and feminized versions of voices were manufactured by raising and lowering pitch using the pitch-synchronous overlap add (PSOLA) algorithm in Praat (Boersma and Weenink 2007) to ± 0.5 equivalent rectangular bandwidths (ERBs) of the original frequency. This PSOLA method has been used successfully in other human voice attractiveness studies (e.g., Feinberg et al. 2005, 2008; Puts et al. 2006; Jones et al. 2008, 2010b; Vukovic et al. 2008, 2010) and in studies of voice quality and mate preferences among other mammalian species (e.g., Reby et al. 2005; Ghazanfar et al. 2007). Although the PSOLA method alters voice pitch, other aspects of the voice are perceptually unaffected (e.g., Feinberg et al. 2005). The manipulation performed here is roughly equivalent to ± 20 Hz in this particular sample, but takes into account the fact that pitch perception is on a log-linear scale in comparison to the natural frequencies (i.e., Hertz; Stevens 1998). The ERB scale was used here because of its better resolution at human average speaking frequencies than the tonotopic Bark, semitone, or Mel scales (Stevens 1998). A manipulation roughly equivalent to 20 Hz was used because it has been shown to be sufficient to alter attractiveness ratings of voices in previous studies (e.g., Feinberg et al. 2005, 2008; Jones et al. 2008, 2010b; Vukovic et al. 2008, 2010). After manipulation, amplitudes were scaled to a constant presentation volume using the root-mean-squared method.

This process created 12 pairs of voices in total (each pair consisting of raised-pitch and lowered-pitch versions of the same recording): 6 pairs of men's voices and 6 pairs of women's voices. The number of voices used in our study is similar to those used in previous studies that assessed preferences for masculinized and feminized voices (e.g., Feinberg et al. 2008;

Jones et al. 2008, 2010b; Vukovic et al. 2008, 2010). Previous studies have shown that manipulating voice pitch using these methods reliably alters perceptions of vocal masculinity–femininity in the intended manner (e.g., Feinberg et al. 2005, 2008). These voice stimuli have been used in previous vocal attractiveness research (Jones et al. 2010b).

Three Domains of Disgust Scale

This 21-item measure, developed by Tybur et al. (2009), asks participants to rate each of 21 actions using a 7-point scale (0 = not at all disgusting, 6 = extremely disgusting). The actions are divided into three domains: moral disgust (e.g., deceiving a friend), sexual disgust (e.g., hearing two strangers having sex), and pathogen disgust (e.g., stepping on dog poop). The order of questions is randomized between participants. The subscales of the TDDS each have very good test–retest reliability more than 12 weeks (Olatunji et al. 2012).

Procedure

Women were played the six pairs of male voices (each pair consisting of raised-pitch and lowered-pitch versions of the same speaker) and were asked to choose the voice in each pair that was more attractive. Pairs of voices were presented in a fully randomized order, and the order in which the raised-pitch and lowered-pitch voices in each pair were presented was also fully randomized. This method has been used to assess voice preferences in previous studies (Feinberg et al. 2008; Jones et al. 2008, 2010b; Vukovic et al. 2008, 2010) and produces results for male vocal attractiveness that are similar to those observed when the attractiveness of masculinized and feminized voices are rated individually (e.g., Feinberg et al. 2005). Each woman also completed Tybur et al.'s (2009) TDDS. The order in which women completed the TDDS and voice preference test was fully randomized. The TDDS has been shown to have excellent internal and external validity (Tybur et al. 2009).

Initial processing of data

For each woman, we calculated the proportion of trials on which she chose lowered-pitch (i.e., masculinized) versions of men's voices as the more attractive. We also calculated women's scores on the pathogen ($M = 26.25$, $SD = 7.42$), sexual ($M = 20.10$, $SD = 8.85$), and moral ($M = 26.67$, $SD = 7.95$) disgust subscales of the TDDS, following the procedure described by Tybur et al. (2009).

Results

A one-sample t -test comparing the proportion of trials on which women chose the masculinized voice as the more attractive with the chance value 0.5 showed that women chose masculinized versions of men's voices significantly more often than they chose feminized versions ($t(290) = 17.21$, $P < 0.001$, $M = 0.73$, standard error of mean [SEM] = 0.01, $d = 1.02$). A regression analysis was then conducted, in which the proportion of trials on which masculinized voices were preferred was entered as the dependent variable and scores on the pathogen, sexual, and moral disgust subscales were entered as predictors. This analysis revealed a positive relationship between pathogen disgust and women's preferences for masculinity in men's voices ($t = 2.31$, standardized $\beta = 0.14$, $P = 0.022$). By contrast, the corresponding relationships for sexual ($t = -0.08$, standardized $\beta = 0.01$, $P = 0.94$) and moral ($t = 1.41$, standardized $\beta = 0.08$, $P = 0.16$) disgust were not significant. Including participant age as an additional predictor did not alter this pattern of results (see [Supplementary Materials](#)).

STUDY 2

In Study 2, we investigated the relationships between individual differences in women's pathogen, moral, and sexual disgust and their preferences for masculinity in men's faces and bodies. We predicted that pathogen disgust would predict women's masculinity preferences for both types of stimuli and that this relationship would be independent of the possible effects of sexual and moral disgust.

Methods

Participants

Participants in the main study were 48 women (mean age = 24.61 years, $SD = 6.44$ years), recruited in the same way as the participants in Study 1. Previous work has demonstrated that women's judgments of the attractiveness of men's faces and bodies in online studies are very similar to those observed in laboratory tests (e.g., Little et al. 2007; Feinberg et al. 2008). About 75% of our participants were from North America, 10% were from mainland Europe, 6% were from the United Kingdom, and 9% were from other regions.

Face and body stimuli

First, we randomly selected 40 standardized images of young white men's faces and 40 standardized images of young white men's bodies (torsos) from larger image sets. These face and body image sets were of different individuals to ensure that similar patterns of results for individual differences in women's preferences for masculinity in men's bodies and faces could not be explained by individual differences in preferences for specific individuals. Face and body images were each taken under standardized lighting conditions, against a constant background, and showed individuals in front-on pose. Face images had neutral expressions and direct gaze. All individuals photographed were between 18 and 25 years of age.

Next, two different groups of 20 women (40 women in total; mean age = 22.98 years; $SD = 5.26$ years) were each shown either the face or body images and were asked to rate the masculinity of these images using a 1 (very feminine) to 7 (very masculine) scale. The order in which images were shown was fully randomized. Inter-rater agreement for these masculinity ratings, as indicated by Cronbach's α , was high for both image categories (both >0.89). The four most masculine images (high masculinity images) and four least masculine images (low masculinity images) in each image category were then selected using the average masculinity rating for each image and were used as stimuli for the main study. None of the women who provided masculinity ratings took part in the main study. The mean masculinity rating for "high masculinity" faces was 5.24 ($SD = 0.22$) and for "low masculinity" faces was 3.18 ($SD = 0.15$). The mean masculinity rating for high masculinity bodies was 5.77 ($SD = 0.27$) and for low masculinity bodies was 2.53 ($SD = 0.30$).

Procedure

Participants were shown all possible pairings of the four "high masculinity" faces versus the four "low masculinity" faces (16 pairs in total) and were asked to indicate which image in each pair was more attractive. Participants were also shown all possible pairings of the four "high masculinity" bodies versus the four "low masculinity" bodies (16 pairs in total) and were asked to indicate which image in each pair was more attractive. Participants also indicated the strength of these preferences by choosing from the options "much more attractive," "more attractive," "somewhat more attractive," and "slightly more attractive." All 32 pairs of images were presented within

a single block of trials, within which trial order and the side of the screen on which any image was shown were fully randomized. This technique is very similar to that used to assess facial masculinity preferences by DeBruine et al. (2010c) in their Study 2 (see also, e.g., Little et al. 2008a). Each woman also completed Tybur et al's (2009) TDDS. The order in which women completed the attractiveness tests and the TDDS was fully randomized.

Initial processing of data

Following previous studies of masculinity preferences (e.g., Boothroyd et al. 2005; Welling et al. 2008), responses on the masculinity preference tests were coded using this 0 (very strong preference for feminine image) to 7 (very strong preference for masculine image) scale:

- 0 = feminine image rated "much more attractive" than masculine image
- 1 = feminine image rated "more attractive" than masculine image
- 2 = feminine image rated "somewhat more attractive" than masculine image
- 3 = feminine image rated "slightly more attractive" than masculine image
- 4 = masculine image rated "slightly more attractive" than feminine image
- 5 = masculine image rated "somewhat more attractive" than feminine image
- 6 = masculine image rated "more attractive" than feminine image
- 7 = masculine image rated "much more attractive" than feminine image

Two scores were then calculated for each participant: the average preference for masculinity when judging the attractiveness of men's faces and the average preference for masculinity when judging the attractiveness of men's bodies. These scores were used in subsequent analyses, along with the scores for the pathogen ($M = 29.02$, $SD = 6.14$), sexual ($M = 21.96$, $SD = 8.51$), and moral ($M = 26.44$, $SD = 9.70$) disgust subscales of the TDDS (calculated following Tybur et al. 2009).

Results

One-sample t -tests comparing masculinity preferences with the chance value of 3.5 showed that women generally demonstrated significant preferences for masculine faces ($t(47) = 5.86$, $P < 0.001$, $M = 4.54$, $SEM = 0.18$, $d = 0.85$) and bodies ($t(47) = 7.32$, $P < 0.001$, $M = 4.86$, $SEM = 0.19$, $d = 1.05$). Consistent with previous work (e.g., Little et al. 2011a), women's preferences for masculine men's bodies were stronger than their preferences for masculine men's faces ($t(47) = 2.04$, $P = 0.047$, $d = 0.29$) and masculinity preferences in these two domains were positively and significantly correlated ($r = 0.63$, $N = 48$, $P < 0.001$).

Masculinity preferences were then analyzed using an analysis of covariance, with the within subject factor *characteristic judged* (face and body) and *pathogen, moral, and sexual disgust* scores as covariates. This analysis revealed the predicted main effect of *pathogen disgust* ($F(1,44) = 5.41$, $P = 0.025$, $\eta^2 = 0.11$) and no other significant effects (all $F < 1.60$, all $P > 0.21$, all $\eta^2 < 0.04$). Pathogen disgust was positively and significantly correlated with women's masculinity preferences when judging the attractiveness of both men's faces ($r = 0.40$, $N = 48$, $P = 0.005$) and bodies ($r = 0.33$, $N = 48$, $P = 0.024$). These correlations were also significant when we controlled for the possible effects of participant age (see [Supplementary Materials](#)).

STUDY 3

In Study 3, we investigated the relationships between individual differences in women's pathogen, moral, and sexual disgust and the rated masculinity of their actual and ideal romantic partners. Given that individual differences in pathogen disgust appear to predict masculinity preferences and because mate preferences are thought to predict mate choices, it follows that pathogen disgust should be positively correlated with the rated masculinity of both women's actual and ideal romantic partners.

Methods

Participants

Heterosexual women who reported currently having a romantic partner ($N = 1498$; age: $M = 22.12$ years, $SD = 3.17$ years) or not having a romantic partner ($N = 1349$; age: $M = 21.34$ years, $SD = 2.84$ years) were recruited using the same procedure as in Studies 1 and 2. About 69% of our participants were from North America, 11% were from mainland Europe, 11% were from the United Kingdom, and 9% were from other regions.

Procedure

In the partnership questionnaire, women first indicated whether or not they were currently in a romantic relationship. Women who indicated that they were not in a romantic relationship rated the masculinity of their ideal romantic partner using a 1 (much less masculine than average) to 7 (much more masculine than average) scale. Women who indicated that they were in a romantic relationship rated both the masculinity of their ideal romantic partner and the masculinity of their actual romantic partner using 1 (much less masculine than average) to 7 (much more masculine than average) scales. Masculinity ratings of actual and ideal romantic partners assessed in this way have both been shown to correlate well with women's preferences for masculinized versus feminized versions of men's faces (DeBruine et al. 2006; DeBruine 2012). Other research also suggests that women can judge men's masculinity somewhat accurately (e.g., Welling et al. 2007).

In addition to rating the masculinity of their actual and ideal romantic partners, partnered women rated the nature of the romantic relationship that they were currently in, their commitment to the relationship, and their happiness with the relationship using 1 (short-term/much less committed than average/much less happy than average) to 7 (long-term/much more committed than average/much more happy than average) scales. Principle components analysis showed that these three ratings loaded on to a single factor (labeled the "relationship quality factor") that explained ~64% of the variance in scores. Each of the three component variables was positively correlated with this factor (all $r > 0.70$).

All women also completed Tybur et al's (2009) TDDS and each woman's scores on the pathogen ($M = 27.19$, $SD = 6.97$), sexual ($M = 21.55$, $SD = 8.64$), and moral ($M = 26.45$, $SD = 8.47$) disgust subscales were calculated (following Tybur et al. 2009). The order in which women completed the partnership questionnaire and the TDDS was fully randomized.

RESULTS

First, we analyzed partnered women's ratings of the masculinity of their actual partner using regression analysis. Masculinity ratings were entered as the dependent variable and pathogen, moral, and sexual disgust scores were entered as predictors. This analysis revealed a positive and significant

relationship between women's ratings of their partner's masculinity and pathogen disgust ($t = 3.21$, standardized $\beta = 0.09$, $P < 0.001$). By contrast, the corresponding relationships for sexual ($t = 0.03$, standardized $\beta < 0.01$, $P = 0.98$) and moral disgust ($t = 1.04$, standardized $\beta = 0.03$, $P = 0.30$) were not significant. A virtually identical pattern of results was also observed when partnered women's masculinity ratings of their ideal partner were entered as the dependent variable: women's ratings of the masculinity of their ideal partner were positively correlated with pathogen disgust ($t = 3.69$, standardized $\beta = 0.10$, $P < 0.001$), but not sexual ($t = -0.21$, standardized $\beta = -0.06$, $P = 0.84$) or moral disgust ($t = 0.64$, standardized $\beta = 0.02$, $P = 0.52$). Repeating these analyses with age and/or the relationship quality factor as additional predictors did not alter these patterns of results (see [Supplementary Materials](#)).

Next, we used a similar regression analysis to analyze unpartnered women's ratings of the masculinity of their ideal partner. These ratings were positively and significantly correlated with pathogen disgust ($t = 3.85$, standardized $\beta = 0.11$, $P < 0.001$), but not sexual ($t = -1.75$, standardized $\beta = -0.05$, $P = 0.081$) or moral disgust ($t = -0.31$, standardized $\beta = -0.01$, $P = 0.75$), echoing the pattern seen for partnered women's masculinity ratings of their actual and ideal partners. Again, repeating these analyses with age as an additional predictor did not alter this pattern of results (see [Supplementary Materials](#)).

DISCUSSION

Pathogen disgust was positively correlated with women's masculinity preferences when judging the attractiveness of men's voices (Study 1) and when judging the attractiveness of men's faces and bodies (Study 2). Moreover, and as we had predicted, the positive correlations were independent of the possible effects of women's sexual and moral disgust. These findings complement [DeBruine et al. \(2010c\)](#) and extend their findings for facial masculinity and pathogen disgust to two other domains of men's attractiveness (voice and body attractiveness). That pathogen disgust predicted women's preferences for masculinity in men's voices, faces, and bodies in such similar ways supports the proposal that male masculinity in multiple domains advertises common underlying information about men's mate qualities (e.g., [Feinberg 2008](#); [Fink et al. 2010](#)). On this point, we note that the correlated preferences for masculinity in men's faces and bodies that was observed in Study 2 also support this proposal (see also, e.g., [Feinberg et al. 2008](#); [Little et al. 2011a](#); [O'Connor et al. 2012](#)).

In Study 3, we found that partnered women's pathogen disgust, but not sexual or moral disgust, was positively correlated with their ratings of the masculinity of their actual partner. These results suggest that the link between pathogen disgust and masculinity preferences observed in [DeBruine et al. \(2010c\)](#) and Studies 1 and 2 might also extend to women's actual mate choices. Many researchers have recently expressed concern that the computer-based tests that are commonly used to investigate women's mate preferences (and the factors that predict individual differences in these preferences) may not necessarily predict actual mate choices (e.g., [Penton-Voak 2011](#); [Puts et al. 2012](#); [Scott et al. 2012](#)). Although we agree that investigating the relationship between partner preference and choice is important for our understanding of interpersonal attraction, findings such as these contribute to a growing literature suggesting that concerns about the ecological validity of laboratory studies of human mate preferences may be misplaced (see also, e.g., [DeBruine et al. 2006](#); [Burriss et al. 2011](#); [Rhodes et al. 2011](#); [DeBruine 2012](#)).

Pathogen disgust, together with exposure to pathogen cues, appears to be positively correlated with women's preferences for putative cues of good versus poor health in potential mates. In many nonhuman species, however, parasitized females become *less* choosy, possibly because they have become less able to invest resources in mate search (reviewed in, e.g., [Cotton et al. 2006](#)). Although these results for human and nonhuman mate preferences initially appear to be inconsistent, this is not necessarily the case. For example, pathogen disgust need not necessarily covary with women's attractiveness and/or physical condition. Indeed, previous studies have reported *positive* correlations between measures of women's physical attractiveness/condition and their preferences for masculine men (e.g., [Little et al. 2001](#); [Penton-Voak et al. 2003](#); [Vukovic et al. 2008, 2010](#)). Moreover, when women's perceptions of their own physical attractiveness were experimentally manipulated, their mate preferences changed in line with these patterns ([Little and Mannion 2006](#)). This latter result is noteworthy here because it suggests that the relationships between measures of own physical attractiveness/condition on women's mate preferences may be a consequence of women's perceptions of their own market value, rather than a consequence of their physical condition *per se*. Additionally, the link between pathogens and mate preferences in women may differ from that seen in other species because humans have a relatively slow life history, which may alter the nature of the relationship between mate preferences and concerns about pathogens by reducing the costs associated with delaying mate choice ([Tybur and Gangestad 2011](#)). Empirical tests of these and other possibilities may illuminate the reasons for differences in the nature of the relationship between concerns about pathogens and mate preferences in humans and the effects of parasitization on mate preferences that have been observed in some other species.

In common with [DeBruine et al. \(2010c\)](#), we found positive correlations between pathogen disgust and masculinity preferences (Studies 1 and 2). We intend the term "masculinity preferences" to refer to stronger preferences for masculine men *relative* to feminine men. In our forced-choice paradigms, individual differences in these *relative* preferences could come about because of increased attraction to masculine men in some women and/or increased aversions to feminine men in some women. Indeed, we note here that, using a different study design that allowed the correlations between pathogen disgust and absolute preferences to be assessed (attractiveness ratings of individual faces), [Park et al. \(2012\)](#) recently showed that individual differences in participants' pathogen disgust were negatively correlated with their attractiveness ratings of unattractive faces and uncorrelated with their ratings of attractive faces. Although Park et al.'s findings raise the possibility that pathogen disgust increases women's aversions to feminine men, rather than increasing the likelihood that they will select masculine mates, other work suggests that priming women's concerns about pathogens increases approach-oriented responses to attractive opposite-sex individuals, rather than altering responses to unattractive opposite-sex individuals ([Cantu et al. 2012](#)).

Some researchers have previously suggested that findings for individual differences in attractiveness judgments of images of men's faces in which masculine characteristics were experimentally manipulated may not necessarily generalize to other measures of women's masculinity preference (e.g., may not generalize to preferences for unmanipulated face images *rated* as particularly masculine versus those rated as particularly feminine, see, e.g., [Rhodes 2006](#) and [Rennels et al. 2008](#)). However, some recent research has already demonstrated that individual differences in women's preferences

for perceived masculinity and experimentally manipulated masculinity in men's faces can be very similar (e.g., Little et al. 2008a; DeBruine et al. 2010c). The findings we report in this study add to the evidence for this proposal by showing that pathogen disgust predicts women's preferences for experimentally manipulated masculinity in men's voices (Study 1) and perceived masculinity in men's faces and bodies (Study 2) in ways that are virtually indistinguishable from the results that have been reported for experimentally manipulated sexually dimorphic shape cues in images of men's faces (DeBruine et al. 2010c, Study 1).

Various studies have presented data implicating pathogen-related factors in women's preferences for masculinity in men's faces (DeBruine et al. 2010a, 2010c, 2011; Little et al. 2011c). In the current studies, we both replicated and extended DeBruine et al's (2010c) work on pathogen disgust and facial masculinity, finding that pathogen disgust was positively correlated with women's preferences for masculinity in men's voices, faces, and bodies. We also presented evidence that pathogen disgust might also predict women's actual partner choices in a similar way. These findings 1) highlight the similarities in the effects of pathogen disgust on both women's preferences for male masculinity in multiple domains (i.e., men's voices, faces, and bodies) and their perceptions of their actual partner's masculinity, and 2) underline the possible importance of pathogen-related factors for human mating systems.

SUPPLEMENTARY MATERIAL

Supplementary material can be found at <http://www.beheco.oxfordjournals.org/>

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