



Salivary cortisol and pathogen disgust predict men's preferences for feminine shape cues in women's faces

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ABSTRACT

Recent studies suggest that individuals who are particularly concerned about infectious diseases show stronger preferences for exaggerated sex-typical characteristics in potential mates' faces. However, these studies have generally investigated individual differences in women's mate preferences and relied on questionnaires to assess disease-related concerns. Here we show that men's scores on the pathogen disgust subscale of the Three Domains of Disgust Scale are positively correlated with their preferences for femininity in women's faces and that this relationship is independent of the possible effects of both sexual and moral disgust. We then show that men with higher trait (i.e., average) salivary cortisol, a biomarker for immunosuppression, have stronger preferences for femininity in women's faces. Finally, we show that pathogen disgust is correlated with partnered men's femininity ratings of both their actual and ideal romantic partner. Together, these findings suggest that disease-related factors are important for individual differences in men's mate preferences.

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1. Introduction

Several lines of evidence suggest that exaggerated sex-typical facial characteristics (i.e., masculine characteristics in men's faces and feminine characteristics in women's faces) are positively correlated with indices of good health and dominance (reviewed in Little et al., 2011a; Puts et al., 2012). For example, individuals displaying more exaggerated sex-typical facial characteristics report fewer past health problems (e.g., Thornhill and Gangestad, 2006). Additionally, men with higher levels of testosterone, a correlate of men's facial masculinity in several studies (e.g., Penton-Voak and Chen, 2004; Roney et al., 2006), tend to possess more efficient immune systems (Rantala et al., 2012), while women with higher levels of estrogen, a correlate of facial femininity in women (Law Smith et al., 2006), tend to be in good physical health (e.g., van Anders, 2010). Consistent with these findings for measures of actual health, masculinized versions of men's faces are perceived to be healthier than feminized versions (e.g., Johnston et al., 2001; Scott et al., 2008; but see also Boothroyd et al., 2005) and

feminized versions of women's faces are perceived to be healthier than masculinized versions (e.g., Johnston et al., 2001; Moore et al., 2011; Scott et al., 2008). Men displaying masculine facial characteristics are also physically stronger than their relatively feminine peers (Fink et al., 2007) and masculine men and women tend to be perceived as being physical stronger and more dominant than feminine men and women (e.g., Jones et al., 2010). Collectively, this work then suggests that exaggerated sex-typical facial characteristics are valid cues to men's and women's health and that masculine facial characteristics signal men's and women's dominance.

Although individuals displaying exaggerated sex-typical physical characteristics are preferred as mates in many non-human species (see, e.g., Clutton-Brock, 2009; Emlen, 2008 for reviews), the relationship between these characteristics and facial attractiveness in humans can be variable (reviewed in Little et al., 2011a). Concerns about infectious disease are one factor that may be important for this variability (DeBruine et al., 2010a; Tybur and Gangestad, 2011); individuals who are particularly concerned about infectious diseases may show stronger preferences for potential mates displaying exaggerated sex-typical characteristics due to the direct benefits (e.g., reduced risk of contracting illnesses) and/or indirect benefits (e.g., increased offspring health) thought to be associated with choosing a healthy mate (DeBruine et al., 2010a; Little

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et al., 2011b; Tybur and Gangestad, 2011). Consistent with this proposal, women who report particularly strong disgust reactions to scenarios describing possible sources of pathogens, a measure hypothesized to reflect individual differences in vulnerability to disease (Tybur et al., 2009), also tend to show particularly strong preferences for masculine characteristics in men's faces (DeBruine et al., 2010a). Importantly, this relationship between pathogen disgust and women's masculinity preferences occurred independently of the possible effects of sexual or moral disgust, suggesting that it is not simply due to individual differences in general disgust sensitivity (DeBruine et al., 2010a). These findings have recently been replicated and extended to women's preferences for masculine characteristics in men's voices and bodies (Jones et al., in press). Other work has also found that women who rated their own health to be relatively poor showed particularly strong preferences for masculine characteristics in men's voices, at least when assessing men's attractiveness for hypothetical short-term relationships (Feinberg et al., 2012). While these findings suggest that women's vulnerability to disease may be positively correlated with individual differences in their preferences for masculine men (but see also Scott et al., 2008), other studies have suggested that measures of vulnerability to disease also predict population-level differences in women's masculinity preferences (DeBruine et al., 2010b, 2011, 2012a); women in geographic regions with poorer health (e.g., regions with higher pathogen loads or higher mortality rates due to communicable diseases) tend to show stronger preferences for masculine characteristics in men's faces (DeBruine et al., 2010b, 2011, 2012a; but see also Brooks et al., 2011). Consistent with interpretations of these findings that emphasize a potential causal effect of vulnerability to disease on mate preferences, priming concerns about pathogens increases both women's (Little et al., 2011b; Watkins et al., 2012) and men's (Little et al., 2011b) preferences for exaggerated sex-typical facial characteristics in potential mates.

The findings described above suggest that factors related to vulnerability to disease predict, and potentially directly influence, preferences for exaggerated sex-typical characteristics in potential mates' faces. However, prior work on this topic has generally focused on investigating variability in women's mate preferences. Although Little et al. (2011b) demonstrated that priming with pathogen cues increases men's preferences for feminine female faces, suggesting that variation in environmental cues to disease may influence men's mate preferences, it is still important to establish if naturally occurring differences in disease-related factors that occur *between* individuals also predict men's preferences for exaggerated sex-typical characteristics in women's faces. To address this issue, Study 1 and Study 2 investigated the relationship between individual differences in men's pathogen disgust and their preferences for feminized versus masculinized versions of women's faces. We assessed individual differences in pathogen, moral, and sexual disgust sensitivity using Tybur et al.'s (2009) Three Domains of Disgust Scale (*sensu* DeBruine et al., 2010a). Following DeBruine et al.'s (2010a) findings for disgust sensitivity and women's judgments of men's facial attractiveness, we predicted that men's pathogen disgust would be positively correlated with their preference for femininity in women's faces and that this relationship would be independent of the possible effects of men's moral or sexual disgust.

A further limitation of prior work on the relationship between disease-related factors and variation in mate preferences is the reliance on questionnaires to assess vulnerability to disease. Consequently, it is unclear if more objective measures of vulnerability to disease, such as biomarkers for immunosuppression, predict mate preferences in ways that are consistent with this prior work. To address this potentially important limitation, Study 3 investigated the relationship between men's trait (i.e., average) levels of salivary

cortisol and their preference for feminized versus masculinized versions of women's faces. Cortisol plays an important, but complex, role in regulating the immune system (see Martin, 2009; Sapolsky et al., 2000 for comprehensive reviews). For example, the first wave of glucocorticoids produced in stress responses have both stimulating and inhibitory effects on immunity (Chrousos, 1995; Reichlin, 1993) and both infectious and noninfectious stressors can trigger immune activation (Harbuz and Lightman, 1992; Morrow et al., 1993). However, this activation is typically relatively short-lived (Sapolsky et al., 2000). Where levels of glucocorticoids are elevated for relatively long periods of time, however, such as days or even weeks, they tend to have immunosuppressive effects, such as inhibition of the synthesis, release, and efficacy of mediators that promote immune reactions (see Sapolsky et al., 2000; Martin, 2009). Since these latter results suggest that high trait (i.e., average) levels of salivary cortisol will likely be a biomarker for immunosuppression, we predicted that men with relatively high trait cortisol would show particularly strong preferences for feminine women.

In these three initial studies, we also investigated men's judgments of the attractiveness of feminized versus masculinized versions of men's faces. Given that Little et al. (2011b) demonstrated that priming men's concerns about pathogens altered their preferences for feminine women, but not feminine men, we predicted that neither pathogen disgust nor trait levels of cortisol would predict individual differences in men's preferences for feminized versus masculinized versions of men's faces.

Many researchers (e.g., Puts et al., 2012) have recently highlighted the importance of investigating whether factors that predict individual differences in attractiveness judgments of opposite-sex stimuli also predict individual differences in other measures of mate preferences, such as the characteristics of participants' actual romantic partners. Consequently, in Study 4 we investigated the relationship between partnered men's pathogen disgust and their femininity ratings of both their actual and ideal romantic partner. As in Studies 1 and 2, we predicted that men reporting higher levels of pathogen disgust would report both having more feminine actual partners and desiring more feminine ideal partners and that these relationships between pathogen disgust and femininity preferences would be independent of the possible effects of moral and sexual disgust.

2. Study 1

Study 1 investigated the relationships between men's preferences for feminized versus masculinized versions of faces and their scores on the pathogen, moral, and sexual disgust subscales of Tybur et al.'s (2009) Three Domains of Disgust Scale.

2.1. Methods

2.1.1. Participants

Sixty-three white heterosexual men (mean age = 23.16 years, SD = 4.70 years) participated in this laboratory-based study. All of these men were undergraduate students, postgraduate students, or staff at the University of Aberdeen.

2.1.2. Stimuli

The methods we used to manufacture stimuli to assess perceptions of the attractiveness of feminized versus masculinized versions of men's and women's faces have been used in many previous studies (e.g., DeBruine et al., 2006; Perrett et al., 1998; Welling et al., 2007, 2008). Responses to stimuli manufactured using these methods are known to be very similar to responses to stimuli manufactured using other methods for manipulating sexually dimorphic characteristics in face images (e.g., DeBruine et al., 2006, 2010c).

First, we manufactured a female prototype (i.e., average) face by using specialist software (Tiddeman et al., 2001) to average the shape, color, and texture information from images of 50 young white women's faces. A male prototype face was also manufactured in this way by averaging the shape, color, and texture information from images of 50 young white men's faces. The 100 individual face photographs (50 female and 50 male) were taken under standardized lighting conditions and against

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