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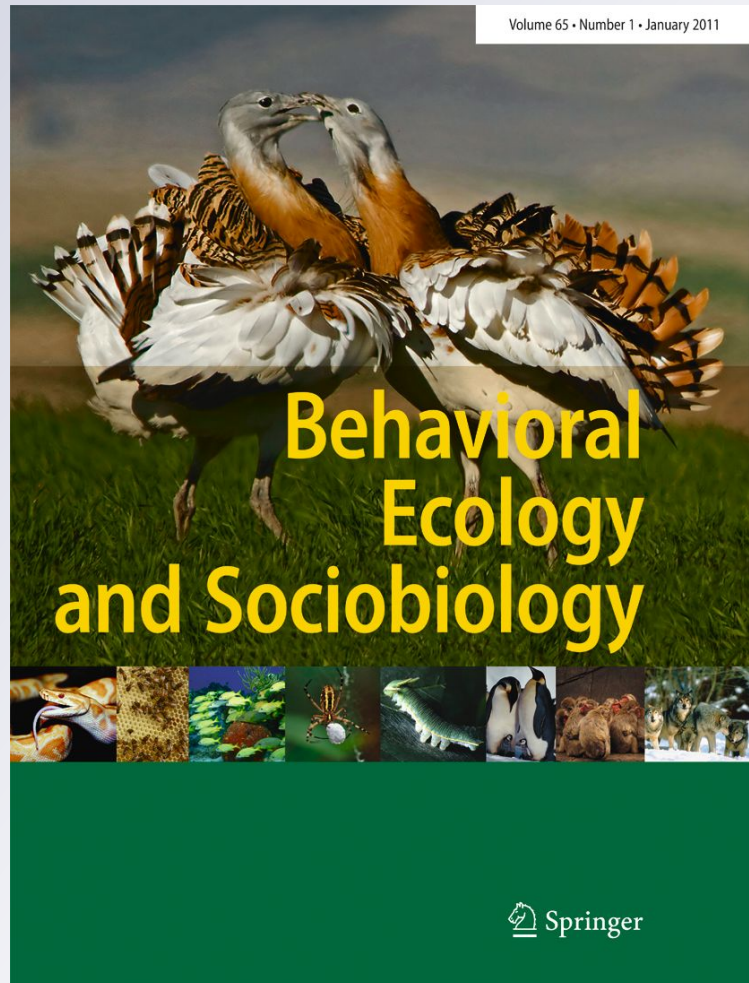
Behavioral Ecology and Sociobiology

ISSN 0340-5443

Behav Ecol Sociobiol

DOI 10.1007/s00265-011-1287-y

Volume 65 • Number 1 • January 2011



 Springer

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Women's self-perceived health and attractiveness predict their male vocal masculinity preferences in different directions across short- and long-term relationship contexts

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Received: 17 June 2011 / Revised: 24 October 2011 / Accepted: 25 October 2011
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Abstract Research has revealed that women's self-perceived attractiveness positively predicts preferences for male facial and vocal masculinity, particularly in the context of long-term relationships. Other research has demonstrated that women who perceive themselves to be less healthy prefer male masculinity more than do women who may be healthier. As self-perceived health may predict self-perceived attractiveness, previous findings may appear to be contradictory. Therefore, we compared the effects of self-perceived attractiveness and self-perceived health on vocal masculinity preferences in long- and short-term relationship contexts. We found that although self-perceived health and attractiveness were positively correlated, self-rated attractiveness positively predicted long-term vocal masculinity preferences, whereas self-rated health negatively predicted short-term vocal masculinity preferences. While health and attractiveness may share a common basis, here we show independent potentially adaptive relationships with preferences based on relationship context. Such preferences are potentially adaptive as (a) masculine men may pass on inheritable immunity to

infection to their offspring, which may be a relatively greater benefit for women in poor health; and (b) masculine men may be more likely to invest in relationships and offspring of relatively attractive women, decreasing the cost of choosing a masculine long-term partner for attractive women. These data resolve a potential conflict between health and attractiveness influences on the attractiveness of masculinity and highlight sophisticated individual differences in preferences.

Keywords Attractiveness · Voice · Face · Condition · Individual difference · Mate choice

Introduction

Vocal and facial masculinity are influenced by an influx of testosterone at puberty and, thus may be cues to the same underlying quality (for review, see Feinberg 2008). Indeed, at puberty, boys receive a large influx of testosterone, which interacts with growth hormones to produce a male voice pitch that is twice as low in fundamental frequency than is the average woman's voice pitch. This relationship between testosterone and voice pitch continues into adulthood (Dabbs and Mallinger 1999; Evans et al. 2006, 2008; Puts et al. 2011). It is important to note that if sexual dimorphism of body size were proportional to voice pitch, men would be on average, twice as tall as women, as men's voice pitch is twice as low as that of women (Titze 1994; Fitch and Giedd 1999; Fitch 2000; Fitch and Reby 2001; Evans et al. 2006; Rendall et al. 2007; Feinberg 2008).

Testosterone expression is costly to immune function (Folstad and Karter 1992; Chen and Parker 2004). Therefore, among many species, males with masculine features may have immune systems strong enough to

Communicated by T. Bakker

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compensate for these costs and may be better able to develop masculine characteristics while maintaining good health (Zahavi 1975; Folstad and Karter 1992). Consistent with this proposal, male facial masculinity is positively correlated with indices of good long-term health (Rhodes et al. 2003; Thornhill and Gangestad 2006). Furthermore, symmetrical men (indicating higher developmental stability) tend to have relatively masculine (Thornhill and Gangestad 2006; Little et al. 2008; Van Dongen and Gangestad 2011) and healthier-looking (Jones et al. 2001) faces than do less symmetrical men. Men with lower pitched voices also are rated as more masculine and healthy than are men with higher pitched voices (Collins 2000; Feinberg 2004; Feinberg et al. 2005) and have higher mating (Puts 2005) and reproductive success (Apicella et al. 2007) than do men with higher pitched voices.

Research on individual differences in women's preferences for masculine faces and voices typically suggests that women's mate choice decisions reflect a world in which masculine men are less likely to invest in relationships and offspring than are feminine men (for review, see Feinberg 2008). Indeed, men with higher testosterone are less likely to invest in relationships and offspring than are men with lower testosterone (Gray et al. 2002, 2004; Gray 2003; Roney et al. 2006). This lack of investment on the part of masculine men may be modulated by women's attractiveness. Women who rate themselves as more attractive (Little et al. 2001; Little and Mannion 2006; Vukovic et al. 2008), who are rated more attractive by other men (Penton-Voak et al. 2003), and women who have attractive physical characteristics (Penton-Voak et al. 2003; Vukovic et al. 2010) typically show stronger preferences for masculine men as long-term partners than do less attractive women (Little et al. 2001; Penton-Voak et al. 2003). Women who prefer masculine voices also tend to prefer masculine faces and individual differences in preferences for vocal and facial masculinity are consistent across modalities (for reviews, see Feinberg 2008; Feinberg et al. 2008).

Women from geographic regions with high health-risk factors (DeBruine et al. 2010a, 2011), women who are particularly disgusted by pathogens (DeBruine et al. 2010b), and women exposed to photographs of pathogen contagion (Little et al. 2011a) have relatively strong facial masculinity preferences. As masculinity may be a cue to long-term health (Rhodes et al. 2003; Thornhill and Gangestad 2006), *heightened* preferences for masculinity in high pathogen-risk scenarios are potentially adaptive. It is reasonable to hypothesize that women use short-term relationships to evaluate whether men may be good choices in long-term partnerships (Buss and Schmitt 1993). Indeed, men may invest very little in short-term relationships, thus female choice of heritable of indirect benefits (e.g., cues to potential offspring health such as masculinity) might be

expected to be more important in short-term relationships than in long-term relationships (Li and Kenrick 2006; Li et al. 2011; Scheib 2001). Therefore, for women, any potential relationship between a women's own health and her masculinity preferences may be relatively stronger in short-term mating scenarios. Indeed, Jones et al. (2005) found that behaviors that may have evolved to minimize disease risks were more apparent when women judged men's attractiveness as short-term partners than when women judged men's attractiveness as long-term partners. Alternatively, given previous findings for women's own *attractiveness* and masculinity preferences (Little et al. 2001; Penton-Voak et al. 2003; Little and Mannion 2006; Vukovic et al. 2008, 2010) if attractive women consider themselves to be healthy, one might expect women who rate themselves as healthy to prefer masculine men more as long-term partners than women who rate themselves as less healthy.

Given that individual differences in preferences for masculine voices and faces have thus far been shown to be consistent (for reviews, see Saxton et al. 2006; Feinberg 2008; Feinberg et al. 2008; Fraccaro et al. 2010), we manipulated men's voices in pitch and collected women's preferences for potential long-term and short-term relationships. Women also rated their self-perceived attractiveness and self-perceived health. Following prior work (Little et al. 2001; Penton-Voak et al. 2003), we predicted that women's self-perceived attractiveness would positively predict preferences for vocal masculinity, especially for long-term relationships.

Materials and methods

All protocols for this study were approved by the McMaster Research Ethics Board.

Stimuli

We recorded six undergraduate men (aged 18–24 years) speaking the first (neutrally valenced) sentence of the Rainbow Passage, “When the sunlight strikes raindrops in the air, they act as a prism and form a rainbow” (Fairbanks 1960) using an Audio-Technica AT4041 cardioid condenser microphone in a quiet room. Voices were encoded digitally at 44.1 kHz sampling rate and 16-bit amplitude quantization. Voices were then manipulated in pitch by ± 0.5 ERBs (equivalent rectangular bandwidths) using Praat acoustic phonetics software (Boersma and Weenink 2010). This manipulation is similar to a ± 20 Hz manipulation with a center frequency of 120 Hz (the average male voice pitch; Childers and Wu 1991) and has been used successfully in other voice attractiveness studies (Feinberg et al. 2008; Jones et al. 2010). When

manipulated, voices spanned the normal range of male voice pitch (94–160 Hz, mean \sim 130 Hz). While the PSOLA method alters voice pitch, other aspects of the voice are unaffected (e.g., speech rate, formant frequencies; Feinberg et al. 2005). The ERB scale was used here because of its better resolution at human average speaking frequencies than the tonotopic Bark scale, the semitone (Western music) scale, or the Mel scale (Traunmüller 1990). After pitch manipulation, voices were normalized to a constant root-mean-square (RMS) amplitude.

Participants

Forty-three undergraduate female students (32 of whom were not using hormonal contraceptives during or 3 months prior to data collection) participated in this study and received extra credit in their psychology course for participation. All participants were naïve to experimental hypotheses.

Procedure

In separate randomized blocks, women were played the six pairs of voices in a randomized order and were asked to choose which voice in each pair was the more attractive for a short-term relationship or long-term relationship. The order in which lowered and raised-pitch voices in each pair were played was fully randomized. Following previous studies of the effect of relationship context on women's mate preferences (Little et al. 2001, 2002; Penton-Voak et al. 2003; Puts 2005; Little and Mannion 2006; Vukovic et al. 2008; Little et al. 2011b), long-term and short-term relationships were defined as follows:

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.

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).

Following the playback portion of the experiment, participants rated their self-perceived attractiveness and self-perceived health. These measures were assessed on a 1–7 scale (1=very unhealthy/very unattractive, 7=very healthy/very attractive). Age was self-reported. We calculated the number of trials in which women chose the masculine

voices as more attractive than feminine voices for both potential short-term partners and long-term partners separately.

Statistical methods

First, to test for general effects of relationship context on masculinity preferences, we used independent sample *t*-tests comparing women's relative preferences for vocal masculinity in short and long-term contexts. Next, to test for a general relationship between self-perceived attractiveness and self-perceived health (and as a test for colinearity for future statistical models), we used Pearson correlations. Finally, to assess the within-subject relationships among temporal context, self-perceptions of health and attractiveness, and masculinity preferences, we conducted a repeated-measures ANCOVA. For all statistical tests, $\alpha=0.05$.

Results

Women preferred masculine voices as both potential short-term ($t_{42}=4.26$, $p<0.0001$, $M=4.26$, $SEM=0.249$) and long-term partners ($t_{42}=5.039$, $p<0.0001$, $M=4.396$, $SEM=0.249$). Women's self-perceived attractiveness was positively correlated with their self-perceived health ($r_{43}=0.345$, $p=0.023$).

Next, we used an ANCOVA to test for effects of self-rated health and self-rated attractiveness on short- and long-term vocal masculinity preferences. We observed a main effect of relationship context on masculinity preferences whereby women preferred masculine voices more in the short-term mating context than in the long-term mating context (Fig. 1; $F_{1,40}=5.396$, $p=0.025$). Self-perceived

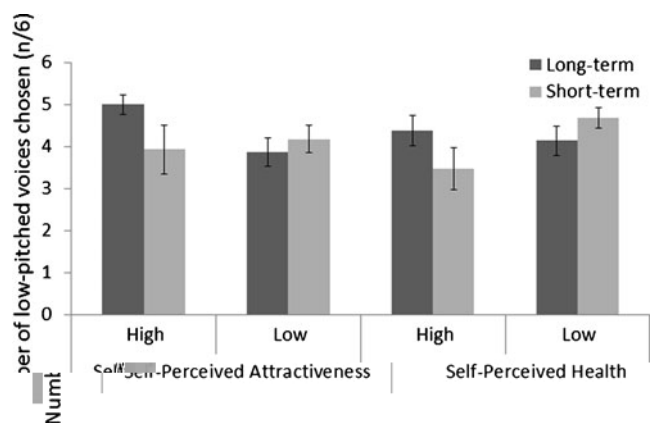


Fig. 1 Self-rated attractiveness and self-rated health predict vocal masculinity preferences in opposing directions across relationship contexts. Here, self-perceived attractiveness and health are represented by a median split of the data into high and low groups. Darker bars represent preferences for vocal masculinity in a long-term context. Lighter bars represent preferences for vocal masculinity in a short-term context. Error bars represent ± 1 standard error

attractiveness predicted masculinity preferences (Fig. 1; $F_{1,40} = 5.359$, $p = 0.026$), but this effect did not interact with relationship context ($F_{1,40} = 0.351$, $p = 0.557$). Self-perceived health predicted short-term vocal masculinity preferences more than it predicted long-term vocal masculinity preferences; Fig. 1) ($F_{1,40} = 5.364$, $p = 0.026$). No other effects were significant (all $F < 1.747$, all $p > 0.193$). Adding hormonal contraceptive use as a between-subject factor did not qualitatively alter this pattern of significant results. Pearson correlations describe the directions of the aforementioned effects. Self-rated attractiveness was significantly correlated positively with long-term ($r_{43} = 0.361$, $p = 0.017$), but not short-term ($r_{43} = 0.098$, $p = 0.531$) vocal masculinity preferences. Conversely, self-rated health was significantly correlated negatively with short-term ($r_{43} = -0.323$, $p = 0.035$), but not significantly correlated positively with long-term ($r_{43} = 0.200$, $p = 0.198$) vocal masculinity preferences.

Discussion

We found that self-perceived health and self-perceived attractiveness had different effects on women's vocal masculinity preferences. Women who thought they were more attractive had stronger preferences for masculinity than did women who thought themselves less attractive. The finding is in line with previous work that has found the same result in vocal and facial masculinity preferences (Little et al. 2001; Little and Mannion 2006; Vukovic et al. 2008). By contrast with this effect, we also found that women who thought they were less healthy preferred masculinity more in potential short-term partners than did women who thought they were healthier. Our research suggests that self-perceived health is an index of one's perception of likelihood of infection, rather than a synonym for self-perceived attractiveness and then is in line with the recent research demonstrating that in situations of high-perceived pathogen risk, preferences for masculinity are stronger (DeBruine et al. 2010a, b, 2011; Little et al. 2011a).

Women's self-perceived attractiveness positively predicted vocal masculinity preferences, supporting previous findings in both voice (Vukovic et al. 2008) and face (Little et al. 2001; Little and Mannion 2006) preferences. Such preferences are potentially adaptive if masculine men are more likely to invest in relationships and offspring of relatively more attractive women (Little et al. 2001; Penton-Voak et al. 2003; Feinberg et al. 2006; Little and Mannion 2006; Feinberg 2008; Feinberg et al. 2008; Vukovic et al. 2008).

Little et al. (2011a) demonstrated that exposure to visual cues to contagion only altered preferences for opposite-sex faces; thus, it is likely that preferences for masculine characteristics function to ensure offspring born in environ-

ments high in pathogen levels have strong enough immune systems to survive. Indeed, in a natural fertility population, with little to no access to modern medicine, men with lower-pitched voices tend to have more surviving offspring than do men with higher-pitched voices (Apicella et al. 2007). Here, women who thought they were less healthy preferred masculinity more in short-term partners. Thus, such preferences are potentially adaptive because this may aid the acquisition of healthy genes to be passed to offspring. Women can potentially use their own health status as a measure of their environment's health risk and adapt their preferences accordingly. Future research should investigate the relative roles of acute versus long-term health assessments.

We found a general effect of relationship context on masculinity preferences. Women preferred low voice pitch more in the context of a potential short-term relationship than in the context of a potential long-term relationship. Given that masculine men invest less in relationships and offspring than do feminine men, women's heightened preferences for masculinity in short-term relationships may be adaptive when women cannot secure both investment and potentially good genes for healthy offspring from the same man (Feinberg et al. 2006). This supports prior research finding the same for vocal and facial masculinity (Little et al. 2002, 2011b; Puts 2005).

In summary, while self-perceived attractiveness and self-perceived health are positively correlated with each other, these two putative measures of underlying mate quality have separable and opposing effects on vocal masculinity preferences in different contexts. Mating effort is a finite resource, thus it is potentially adaptive to restrict mate-search criteria to those choices that may be most fruitful. Indeed, women who thought they were unhealthy tended to prefer masculine men as short-term partners more than did women who thought they were healthy. Such preferences are potentially adaptive as male masculinity may be a cue of inheritable immunity to infection (Rhodes et al. 2003; Thornhill and Gangestad 2006; DeBruine et al. 2010a, b, 2011; Little et al. 2011a). Women who thought they were attractive tended to prefer masculine men more than did women who thought they were relatively less attractive. Such preferences may be adaptive if masculine men are more likely to invest in the offspring and relationships with relatively attractive women (for review, see Feinberg 2008).

Acknowledgements This research was funded by grants awarded to David R. Feinberg by the Social Sciences and Humanities Research Council of Canada, Canada Foundation for Innovation, and The Ministry of Research and Innovation of Ontario. All protocols for this study were approved and conducted in accordance with the McMaster Research Ethics Board. The authors declare no conflicts of interest with funding bodies.

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