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A domain-specific opposite-sex bias in human preferences for manipulated voice pitch

Benedict C. Jones [a,*,†], David R. Feinberg [b,1,†], Lisa M. DeBruine [a], Anthony C. Little [c,2], Jovana Vukovic [a]

[a] School of Psychology, University of Aberdeen
[b] Department of Psychology, Neuroscience and Behaviour, McMaster University
[c] Department of Psychology, University of Stirling

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Women's preferences for masculine characteristics in men's voices and men's preferences for feminine characteristics in women's voices are thought to reflect adaptations that identify high-quality (e.g. healthy) mates. Consistent with this proposal, we found that men had stronger preferences than women for women's voices with raised pitch (i.e. feminized female voices) and that women had stronger preferences than men for men's voices with lowered pitch (i.e. masculinized male voices). Importantly, however, no such opposite-sex bias was evident for attributions of dominance to voices with raised and lowered pitch; men's and women's voices with lowered pitch were perceived to be more dominant than those with raised pitch and these effects were equivalent for male and female listeners. Collectively, our findings suggest that preferences for voice pitch may function, at least in part, to identify high-quality mates and show that opposite-sex biases in preferences for voice pitch cannot be explained simply by greater general sensitivity to manipulated pitch in opposite-sex voices than in own-sex voices.

Female preferences for male vocalizations at frequencies that are equal to or lower than the average for the species studied have been reported in many nonhuman species. For example, Ryan & Keddy-Hector (1992) observed female preferences for males with either average or lower than average vocalization frequencies in a variety of fish, insect and anuran species. Similar findings have also been reported for fallow deer, *Dama dama* (Vannoni & McElligott 2008), baboons, *Papio hamadryas* (Pfefferle & Fischer 2006) and grey partridge, *Perdix perdix* (Beani & Dessi-Fulgheri 1995). Such findings have led researchers to investigate the effect of voice pitch on attractiveness judgements of voices in humans (e.g. Collins 2000; Puts 2005; Feinberg 2008).

Studies of vocal attractiveness in humans have typically investigated preferences for voice pitch (reviewed in Feinberg 2008). Studies in which naturally occurring variation in voice pitch was correlated with attractiveness ratings of the voices have reported positive associations between pitch and attractiveness for women's voices (e.g. Collins & Missing 2003; Feinberg et al. 2008a) and negative associations between pitch and attractiveness for men's voices (e.g. Collins 2000). Consistent with these findings, studies in which pitch alone was manipulated in voice recordings have found that raising the pitch of women's voices (Feinberg et al. 2008a; Jones et al. 2008) and lowering the pitch of men's voices (Feinberg et al. 2005a, 2008b; Vukovic et al. 2008) increases vocal attractiveness.

The findings described above have generally been interpreted as evidence that vocal cues to men's and women's mate quality that are associated with pitch influence judgements of vocal attractiveness (reviewed in Feinberg 2008). In other words, it has been suggested that preferences for raised pitch in women's voices and lowered pitch in men's voices reflect adaptations for identifying high-quality (e.g. healthy, fertile) mates. This interpretation is consistent with studies showing that vocal attractiveness in men and women is associated with other putative indices of health and fertility (e.g. facial attractiveness, Collins & Missing 2003; low waist - hip ratio in women or high shoulder - hip ratio in men, Hughes et al. 2004; low fluctuating asymmetry, Hughes et al. 2002, 2008). Moreover, voice pitch itself is negatively associated with indices of

* Correspondence: B. C. Jones, School of Psychology, William Guild Building, Old Aberdeen Campus, University of Aberdeen, Aberdeen AB24 3FX, U.K.
E-mail address: ben.jones@abdn.ac.uk (B.C. Jones).
[1] D. R. Feinberg is at the Department of Psychology, Neuroscience and Behaviour (PNB), Psychology Building (PC), McMaster University, 1280 Main Street West, Hamilton, Ontario L8S 4K1, Canada.
[2] A. C. Little is at the Department of Psychology, University of Stirling, Stirling FK9 4LA, U.K.
[†] B.C.J. and D.R.F. contributed equally to this research.

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men's reproductive success in both natural fertility populations and university undergraduate samples (Puts 2005; Apicella et al. 2007) and is positively correlated with conception risk during the menstrual cycle in young adult women (Bryant & Haselton 2009) and with women's facial femininity (Feinberg et al. 2005b).

If preferences for sexually dimorphic pitch in human voices reflect adaptations for identifying high-quality mates, one might expect manipulating pitch to have greater effects on judgements of the attractiveness of opposite-sex voices than on judgements of own-sex voices. Indeed, such opposite-sex biases in attractiveness judgements are thought to be strong evidence for mate choice-relevant explanations of attractiveness judgements (see e.g. Rhodes 2006; Little & Jones 2003 and Little et al. 2008 for discussion of this issue). Jones et al. (2008) and Feinberg et al. (2008a) have previously reported that men have stronger preferences than women for women's voices with raised pitch. Similarly, Feinberg et al. (2008b) reported that women have stronger preferences than men for men's voices with lowered pitch. Such opposite-sex biases in preferences for voice pitch could reflect opposite-sex biases in attraction to masculinized men's voices and feminized women's voices. Alternatively, such opposite-sex biases could simply reflect greater general sensitivity to manipulated pitch in opposite-sex voices than own-sex voices. Distinguishing between these two explanations of opposite-sex biases in voice preferences is therefore important for our understanding of the processes and mechanisms that influence vocal attractiveness.

We tested for further evidence of an opposite-sex bias in preferences for voice pitch by comparing men's and women's preferences for recordings of men's and women's voices that were raised (i.e. feminized) or lowered (i.e. masculinized) in pitch. To investigate whether the opposite-sex bias observed in previous studies was simply due to greater general sensitivity to manipulated pitch in opposite-sex voices than own-sex voices, we also tested for an equivalent opposite-sex bias when men and women judged the dominance of our voice stimuli. An opposite-sex bias for judgements of attractiveness, but not dominance, would suggest that opposite-sex biases in preferences for voice pitch are not simply due to greater sensitivity to manipulated pitch in opposite-sex than own-sex voices. Previous studies have shown that lowering pitch in men's voices reliably increases perceptions of dominance (e.g. Puts et al. 2006).

Both Penton-Voak et al. (2001) and Feinberg et al. (2008b) have suggested that heterosexual men's ratings of other men's attractiveness may simply reflect perceptions of competitors' dominance. If men's attractiveness ratings of men's voices are functionally equivalent to perceptions of their dominance, then we would expect manipulating men's voice pitch to have equivalent effects on men's perceptions of the dominance and attractiveness of other men. In light of this, we conducted additional analyses that compared the effects of manipulating pitch in men's and women's voices on men's and women's perceptions of the dominance and attractiveness of these voices.

METHODS

Participants

Eight hundred participants (400 men, 400 women; mean age ± SD = 25.65 ± 4.84 years) took part in the study. Participants were selected for stating a preference for opposite-sex, rather than own-sex, romantic partners when asked to indicate the preferred sex of their romantic partner prior to the study (i.e. all participants were heterosexual).

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, U.K. Recordings were made using an Audio-Technica (www.audio-technica.com) AT4041 microphone in a quiet room using Soundforge recording software (www.sonycreativesoftware.com), in mono, and at a sampling rate of 44.1 kHz with 16-bit amplitude quantization. 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. 2008b; Jones et al. 2008; Vukovic et al. 2008). 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 & Weenink 2001) to ±0.5 ERBs (equivalent rectangular bandwidths) of the original frequency. This PSOLA method has been used successfully in other human voice attractiveness studies (Feinberg et al. 2006, 2008a, b; Puts et al. 2006; Jones et al. 2008; Vukovic et al. 2008) and in studies of voice quality, dominance and mate preferences among other mammalian species (Reby et al. 2005; Ghazanfar et al. 2007). While the PSOLA method alters voice pitch, other aspects of the voice are perceptually unaffected (Feinberg et al. 2005a, 2008a, b). The manipulation performed here is roughly equivalent to ±20 Hz in this particular sample (Table 1), but takes into account the fact that pitch perception is on a log-linear scale in comparison to the natural frequencies (i.e. Hz, 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 men's attractiveness ratings of women's voices and women's attractiveness ratings of men's voices in previous studies (Feinberg et al. 2005a, 2006, 2008a, b; Jones et al. 2008; Vukovic et al. 2008). After manipulation, amplitudes were scaled to a constant presentation volume using the RMS (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): six pairs of men's voices and six pairs of women's voices.

Procedure

Of the 400 male participants and the 400 female participants, 100 men and 100 women were randomly allocated to each of the four conditions (attractiveness judgements of men's voices,

Table 1
Descriptive statistics (means and SD) for voice stimuli used in our study

Sex of voice	Pitch manipulation	Mean pitch in ERBs (SD)	Mean pitch in Hz (SD)
Male	Raised	4.21 (0.54)	149.6 (23.9)
Male	Lowered	3.33 (0.6)	114.6 (25.3)
Female	Raised	6.32 (0.33)	251.7 (18.5)
Female	Lowered	5.42 (0.35)	208.1 (16.7)

Voices were raised or lowered by ±0.5 ERBs (equivalent rectangular bandwidths) of the original frequency. This manipulation is roughly equivalent to ±20 Hz, but takes into account that pitch perception is on a log-linear scale in comparison to the natural frequencies (see Stevens 1998).

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attractiveness judgements of women's voices, dominance judgements of men's voices, or dominance judgements of women's voices).

In the 'judgements of men's attractiveness' condition, participants were played the six pairs of male voices (each pair consisting of raised- 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- 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. 2008a, b; Jones et al. 2008; Vukovic et al. 2008). The same methodology was also used in the 'judgements of women's attractiveness' condition, except the pairs of voices consisted of the six pairs of female voices (each pair consisting of raised- and lowered-pitch versions of the same speaker).

In the 'judgements of men's dominance' condition, participants were played the six pairs of male voices (each pair consisting of raised- and lowered-pitch versions of the same speaker) and were asked to choose the voice in each pair that sounded more dominant. As in the attractiveness judgement conditions, pairs of voices were presented in a fully randomized order and the order in which the raised- and lowered-pitch voices in each pair were presented was also fully randomized. The same methodology was also used in the 'judgements of women's dominance' condition, except the pairs of voices consisted of the six pairs of female voices (each pair consisting of raised- and lowered-pitch versions of the same speaker).

The study was run online. Previous studies have shown that online tests of voice preferences produce patterns of results that are identical to laboratory-based tests (e.g. Feinberg et al. 2008a, b). All participants gave informed consent and all methods and procedures were approved by the School of Psychology (University of Aberdeen) Ethical Review Committee. Data from repeat IP addresses were not recorded, ensuring that no participant included in the data set had participated twice, had judged both men's and women's voices, or had judged both dominance and attractiveness. Although it is possible that participants in online studies may not necessarily report demographic information (e.g. their sex or age) accurately, such misreporting is unlikely to differ systematically between conditions and, consequently, is unlikely to bias our findings systematically.

Initial Processing of Data

For each of the 200 participants (100 men, 100 women) who judged the attractiveness of men's voices, we calculated the proportion of trials (out of six) on which the male voice with lowered pitch was chosen as the more attractive. Corresponding values were also calculated for each of the 200 participants (100 men, 100 women) who judged the attractiveness of women's voices.

For each of the 200 participants (100 men, 100 women) who judged the dominance of men's voices, we calculated the proportion of trials (out of six) on which the male voice with lowered pitch was chosen as the more dominant. Corresponding values were also calculated for each of the 200 participants (100 men, 100 women) who judged the dominance of women's voices.

These values are summarized in Fig. 1 and were used in subsequent analyses. Note that each of the participants provided only one data point for use in analyses (i.e. the proportion of trials on which they chose masculinized voices in the condition to which they were randomly assigned). Previous research on voice preferences has calculated scores in this way (Feinberg et al. 2008a, b; Jones et al. 2008). All analyses were carried out using SPSS version 15 (SPSS Inc., Chicago, IL, U.S.A.) and two-tailed P values are reported for each analysis.

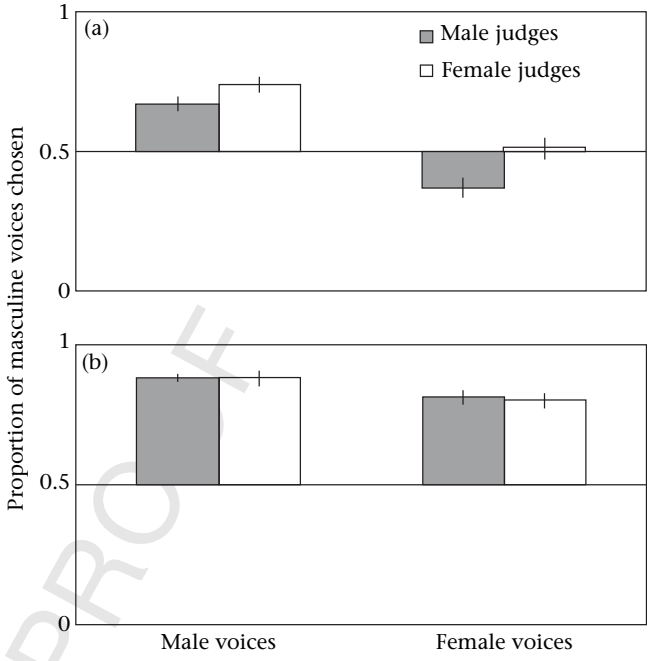

Figure 1. Mean scores and SEMs for perceptions of (a) attractiveness and (b) dominance by sex of voice and sex of judge (i.e. sex of participant). Masculine voices are those with lowered pitch. One hundred men and 100 women made each type of judgement.

RESULTS

Men's Voices: Attractiveness Judgements

An ANCOVA [dependent variable: proportion of masculinized voices chosen as more attractive; between-subjects factor: sex of participant (male, female); covariate: participant age] revealed the predicted significant main effect of sex of participant ($F_{1,199} = 4.54$, $P = 0.034$), whereby women chose male voices with lowered pitch more often than men (women: mean ± SEM = 0.74 ± 0.02; men: 0.67 ± 0.02). There was no significant main effect of participant age ($F_{1,199} = 0.10$, $P = 0.76$). This pattern of results was also obtained when an arcsine transform was applied to the dependent variable.

One-sample t tests comparing the proportion of trials on which male voices with lowered pitch were chosen as more attractive with what would be expected by chance alone (i.e. 0.5) showed that both men ($t_{99} = 7.47$, $P < 0.001$, mean ± SEM = 0.67 ± 0.02) and women ($t_{99} = 11.24$, $P < 0.001$, 0.74 ± 0.02) preferred men's voices with lowered pitch to those with raised pitch.

Women's Voices: Attractiveness Judgements

An ANCOVA [dependent variable: proportion of masculinized voices chosen as more attractive; between-subjects factor: sex of participant (male, female); covariate: participant age] revealed the predicted significant main effect of *sex of participant* ($F_{1,199} = 12.09$, $P < 0.001$), whereby men had stronger preferences than women for raised pitch in women's voices (men: mean ± SEM = 0.37 ± 0.03; women: 0.51 ± 0.03). There was no significant main effect of participant age ($F_{1,199} = 0.18$, $P = 0.67$). This pattern of results was also obtained when an arcsine transform was applied to the dependent variable.

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One-sample t tests comparing the proportion of trials on which female voices with lowered pitch were chosen as more attractive with what would be expected by chance alone (i.e. 0.5) showed that men ($t_{99}=-5.00$, $P<0.001$, mean ± SEM = 0.37 ± 0.03), but not women ($t_{99}=-0.06$, $P=0.95$, 0.51 ± 0.03), preferred women's voices with raised pitch to those with lowered pitch.

Men's Voices: Dominance Judgements

An ANCOVA [dependent variable: proportion of masculinized voices chosen as more dominant; between-subjects factor: sex of participant (male, female); covariate: participant age] revealed no significant effects of sex of participant ($F_{1,199}=0.04$, $P=0.84$) or participant age ($F_{1,199}=0.07$, $P=0.80$). This pattern of results was also obtained when an arcsine transform was applied to the dependent variable.

One-sample t tests comparing the proportion of trials on which male voices with lowered pitch were chosen as more dominant with what would be expected by chance alone (i.e. 0.5) showed that both men ($t_{99}=22.33$, $P<0.001$, mean ± SEM = 0.88 ± 0.01) and women ($t_{99}=27.69$, $P<0.001$, 0.88 ± 0.02) chose men's voices with lowered pitch more often than they chose those with raised pitch.

Women's Voices: Dominance Judgements

An ANCOVA [dependent variable: proportion of masculinized voices chosen as more dominant; between-subjects factor: sex of participant (male, female); covariate: participant age] revealed no significant effects of sex of participant ($F_{1,199}=0.13$, $P=0.72$) or participant age ($F_{1,199}=2.37$, $P=0.13$). This pattern of results was also obtained when an arcsine transform was applied to the dependent variable.

One-sample t tests comparing the proportion of trials on which female voices with lowered pitch were chosen as more dominant with what would be expected by chance alone (i.e. 0.5) showed that both men ($t_{99}=16.00$, $P<0.001$, mean ± SEM = 0.81 ± 0.02) and women ($t_{99}=14.70$, $P<0.001$, 0.80 ± 0.02) chose women's voices with lowered pitch more often than they chose those with raised pitch.

Comparing Perceptions of Attractiveness and Dominance

For men's judgements of men's voices, an ANCOVA [between-subjects factor: judgement (attractiveness, dominance); covariate: participant age] revealed a significant main effect of judgement ($F_{1,199}=52.92$, $P<0.001$), whereby lowering voice pitch had a greater effect on men's perceptions of the dominance of men's voices than on the attractiveness of men's voices (Fig. 1). There was no significant effect of participant age ($F_{1,199}=0.66$, $P=0.42$). A corresponding analysis for women's judgements of men's voices also revealed a significant main effect of judgement ($F_{1,199}=34.13$, $P<0.001$), whereby lowering voice pitch had a greater effect on women's perceptions of the dominance of men's voices than on the attractiveness of men's voices (Fig. 1). There was no significant effect of participant age ($F_{1,199}=0.61$, $P=0.44$). These patterns of results were also obtained when an arcsine transform was applied to the dependent variables.

For men's judgements of women's voices, an ANCOVA [between-subjects factor: judgement (attractiveness, dominance); covariate: participant age] revealed a significant main effect of judgement ($F_{1,199}=182.75$, $P<0.001$), whereby raising voice pitch increased perceptions of the attractiveness of women's voices while lowering voice pitch increased perceptions of the dominance of women's voices (see Fig. 1). The effect of participant age was not significant ($F_{1,199}=0.20$, $P=0.66$). A corresponding analysis for women's judgements of women's voices also revealed a significant main effect of judgement ($F_{1,199}=79.42$, $P<0.001$), whereby lowering voice pitch increased women's perceptions of the dominance of women's voices while manipulating pitch had no effect on women's perceptions of the attractiveness of women's voices (Fig. 1). The effect of participant age was not significant ($F_{1,199}=1.82$, $P=0.18$).

Analyses by Items

In our previous analyses, individual judges served as our unit of analysis. However, some researchers have suggested that it may be more appropriate for individual stimuli, rather than individual participants, to serve as the unit of analysis in experiments where multiple subjects judged the same stimuli (see Kroodsma et al. 2001). Consequently, we conducted such 'by-items' analyses to establish whether the effects observed in our previous analyses generalize to corresponding by-items analyses. First, we calculated the proportion of participants who chose the lowered-pitch (i.e. masculinized) version for each pair of voices presented. These scores were calculated separately for each condition and separately for male and female subjects. Given that $N=6$ for each of the comparisons, we used nonparametric tests.

For judgements of attractiveness, Wilcoxon signed-ranks tests for related data showed that women chose male voices with lowered pitch more often than men ($Z=2.20$, $P=0.028$) and that men chose female voices with raised pitch more often than women ($Z=2.20$, $P=0.028$). Corresponding analyses for dominance judgements revealed no such opposite-sex biases (male voices: $Z=0.37$, $P=0.72$; female voices: $Z=0.73$, $P=0.46$). Additionally, male and female participants were more likely to choose male voices with lowered pitch when judging men's dominance than when judging their attractiveness (male subjects: $Z=2.20$, $P=0.028$; female subjects: $Z=2.20$, $P=0.028$) and were also more likely to choose female voices with lowered pitch when judging women's dominance than when judging their attractiveness (male subjects: $Z=2.20$, $P=0.028$; female subjects: $Z=2.21$, $P=0.027$). These findings are consistent with those of our ANCOVAs, demonstrating that our findings are not a by-product of issues that may arise when multiple participants judge the same stimuli and individual subjects serve as the unit of analysis.

DISCUSSION

We found that both men and women judged men's voices with lowered pitch (i.e. masculinized voices) as more attractive than men's voices with raised pitch (i.e. feminized voices). These preferences for masculinized men's voices are consistent with findings from previous studies showing attraction to masculine characteristics in men's voices (Collins 2000; Feinberg et al. 2005a, 2008b; Jones et al. 2008; Vukovic et al. 2008). Although both men and women had significant preferences for men's voices with lowered pitch, women had stronger preferences than men for low pitch in men's voices (see also Feinberg et al. 2008a). For judgements of the attractiveness of women's voices, men judged women's voices with raised pitch to be more attractive than women's voices with lowered pitch. These findings for male preferences for feminized women's voices are consistent with previous studies demonstrating male preferences for feminine traits in women's voices (Collins & Missing 2003; Feinberg et al. 2008a; Jones et al. 2008). In our study, women did not show a significant preference for women's voices with either lowered or raised pitch (see also Jones et al. 2008) and men had significantly stronger preferences than women

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for women's voices with raised pitch (see also Feinberg et al. 2008a).

Collectively, our findings for attractiveness judgements of men's and women's voices suggest an opposite-sex bias in men's and women's preferences for voice pitch. Men reported stronger attraction than women to feminized women's voices and women showed stronger attraction than men to masculinized men's voices. Previous studies have reported associations between men's and women's vocal attractiveness and putative indices of health and fertility (Collins & Missing 2003; Hughes et al. 2002, 2004, 2008). Other studies have reported that voice pitch itself is negatively correlated with indices of men's reproductive success/potential (Puts 2005; Apicella et al. 2007) and is positively correlated with women's fertility during the menstrual cycle (Bryant & Haselton 2009) and with women's facial femininity (Feinberg et al. 2005b). Together with these findings, the opposite-sex bias in attraction to raised and lowered voice pitch that we observed is consistent with the proposal that preferences for voice pitch reflect, at least in part, adaptations for identifying high-quality mates (reviewed in Feinberg 2008). The opposite-sex biases in preferences for voice pitch were evident in analyses where individual subjects served as the unit of analysis and analyses where stimulus items served as the unit of analysis. This is noteworthy since some researchers have suggested that it may not be appropriate to carry out by-subjects analyses of data where all participants responded to the same stimuli (Kroodsma et al. 2001). Additionally, stronger preferences for raised pitch when men judge women's voices and stronger preferences for lowered pitch when women judge men's voices have been reported in studies using different sets of stimuli (Feinberg et al. 2008a; Jones et al. 2008), suggesting that the opposite-sex biases observed in the current study are not peculiar to the specific sample of voices that we used.

We also tested for an equivalent opposite-sex bias in attributions of dominance to voices manipulated in pitch. This comparison was carried out to test whether the opposite-sex bias that we observed for attractiveness judgements simply reflects an opposite-sex bias in sensitivity to manipulated pitch in voices (i.e. greater sensitivity to manipulated pitch in opposite-sex than own-sex voices). Previous studies have reported that lowering the pitch of men's voices increases perceptions of dominance (e.g. Puts et al. 2006). We replicated this effect of lowered pitch for both men's and women's perceptions of the dominance of men's voices and also found that both men and women perceived women's voices with lowered pitch to be more dominant than women's voices with raised pitch. By contrast with the opposite-sex bias we observed for attractiveness judgements, however, we found no evidence for an opposite-sex bias in the effect of voice pitch on perceptions of dominance.

That an opposite-sex bias in preferences for voice pitch was observed for attractiveness judgements of voices, but not for perceptions of dominance, suggests that the opposite-sex bias in attractiveness judgements is not simply due to an opposite-sex bias in sensitivity to manipulated voice pitch generally. If dominance plays a key role in sexual selection (Darwin 1871), especially in species such as *Homo sapiens* where even the winners of male - male competition must often still be chosen by females in order to acquire a mate, determining the dominance of males would be expected to be of relatively equal importance to both sexes. Our findings for men's and women's dominance attributions to men's voices support this proposal.

We found that lowering the pitch of men's voices had a significantly greater effect on men's perceptions of the dominance of men's voices than on men's perceptions of the attractiveness of men's voices. That manipulating the pitch of men's voices did not have identical effects on men's perceptions of the attractiveness and dominance of other men suggests that men's preferences for masculine characteristics in other men does not simply reflect perceptions of dominance, as has previously been suggested (Penton-Voak et al. 2001; Feinberg et al. 2008b). While our findings show that men's attractiveness judgements of other men and perceptions of those men's dominance are not identical, our findings do not clarify the motivations that underpin men's judgements of the attractiveness of other men. Investigation of this issue is likely to be an interesting and fruitful topic for future research. Further research is also needed to clarify whether perceptions of dominance when listening to voices reflect attributions of physical dominance or attributions of social dominance.

In summary, our findings present further evidence that voice pitch is an important cue for both attractiveness judgements and perceptions of dominance. Men's voices with lowered pitch are perceived as more attractive and more dominant than those with raised pitch. Women's voices with raised pitch are perceived as more attractive, but less dominant, than those with lowered pitch. Consistent with previous studies, we also found that men had stronger preferences than women for raised pitch in women's voices while women had stronger preferences than men for lowered pitch in men's voices. Importantly, however, no such opposite-sex bias occurred for perceptions of dominance, suggesting that opposite-sex biases in judgements of voices are sensitive to the type of judgement made. This context-sensitive opposite-sex bias in perceptions of voices supports the proposal that preferences for voice pitch reflect, at least in part, adaptations that identify high-quality mates and cannot be explained by more general mechanisms, such as greater sensitivity to pitch manipulations in opposite-sex voices.

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