Taller men are less sensitive to cues of dominance in other men

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Abstract

Male dominance rank, physical strength, indices of reproductive success, and indices of reproductive potential are correlated with masculine characteristics in many animal species, including humans. Accordingly, men generally perceive masculinized versions of men's faces and voices to be more dominant than feminized versions. Less dominant men incur greater costs when they incorrectly perceive the dominance of rivals. Consequently, it may be adaptive for less dominant men to be particularly sensitive to cues of dominance in other men. Since height is a reliable index of men's dominance, we investigated the relationship between own height and men's sensitivity to masculine characteristics when judging the dominance of other men's faces and voices. Although men generally perceived masculinized faces and voices to be more dominant than feminized versions, this effect of masculinity on dominance perceptions was significantly greater among shorter men than among taller men. These findings suggest that differences among men in the potential costs of incorrectly perceiving the dominance of rivals have shaped systematic variation in men's perceptions of the dominance of potential rivals.

Introduction

Sexually dimorphic traits, such as body size, are correlated with male dominance rank (Espmark, 1964; Isaac, 2005; Owen-Smith, 1993; Schuett, 1997; Yamane et al., 2006), fighting ability (Andersson, 1994; Owen-Smith, 1993), physical strength (Peters & Mech, 1975), and reproductive success (Le Boeuf & Reitter, 1988; McElligott, 2001; Poole, 1989; Schuett, 1997) in many non-human animal species. Sexually dimorphic characteristics other than body size are also correlated with male dominance rank in many species (Bakker & Sevenster, 1983; Coltman et al., 2002; Rohwer and Rohwer, 1978; Schafer & O'Neil Krekorian, 1983; Schaller, 1963). Collectively, findings such as these suggest that sexually dimorphic physical characteristics may play an important role in within-sex competition (Andersson, 1994).

Among human males, facial masculinity is positively correlated with indices of physical strength (Fink et al., 2007), reproductive potential (Rhodes et al., 2005), and dominance rank (Mueller & Mazur, 1996). Indeed, Sell et al. (2009) found that observers could accurately judge men's fighting ability and physical strength from facial photographs alone, potentially reflecting the association between facial masculinity and physical strength (Fink et al., 2007). Masculine characteristics in men's voices (e.g., low pitch) are positively correlated with men's reported reproductive success in natural fertility populations (Apicella et al., 2007) and with indices of reproductive potential in samples of undergraduate men (Puts, 2005). Consistent with these findings that link masculine facial and vocal cues to indices of men's dominance, masculinized versions of men's faces and voices are generally perceived as more dominant than feminized versions (Boothroyd et al., 2007; Feinberg et al., 2006; Jones et al., 2010a, 2010b; Main et al., 2009; Perrett et al., 1998; Puts et al., 2006, 2007).

Since competition between males can be extremely costly (e.g., there is a high risk of serious injury during fights between males, Andersson, 1994), it is likely that costs associated with incorrectly perceiving the dominance of rivals have shaped the mechanisms and processes that underpin perceptions of dominance. Indeed, fossil record evidence suggests that aggressive conflict among ancestral males may have been an important selection pressure (Manson & Wrangham, 1991; Keeley, 1996), potentially leading to adaptations that reduce the costs of aggressive conflicts (Sell et al., 2009). This being the case, less dominant men may be particularly sensitive to cues of dominance in other men, such as facial and vocal masculinity, because increased sensitivity to cues of dominance would reduce the likelihood of less dominant men incorrectly judging the dominance of potential rivals and, consequently, would reduce the costs they might otherwise incur during ill-judged conflicts with more dominant men. In other words, less dominant men may associate high dominance with masculine characteristics in other men more strongly than relatively dominant men do.

Height is positively correlated with men's reproductive success (e.g., Pawlowski et al., 2000), physical strength (e.g., Vaz et al., 2002), physical aggression (e.g., Archer & Thanzami, 2007), fighting ability (e.g., von Rueden et al., 2008), and social status (e.g., Hensley, 1993). Such findings suggest that, in addition to facial and vocal masculinity, height is a reliable index of male dominance (for a recent review see Buunk et al., 2008). Consequently, if less dominant men are particularly sensitive to cues of dominance in rivals, shorter men may be more likely to attribute dominance to masculinized versions of men's faces and voices than taller men are. While there have been many studies of variation in women's preferences for cues of dominance in men (for reviews see Fink & Penton-Voak, 2002; Jones, DeBruine et al., 2008; Thornhill & Gangestad, 2008), far less is known about the factors that might influence systematic variation in men's perceptions of other men's dominance.

In the current study, we investigated the relationship between men's height and sensitivity to masculine characteristics when judging the dominance of men's faces and voices. We predicted that male participants' height would be negatively correlated with the extent to which they attributed high dominance to masculine men, which would present evidence for potentially adaptive systematic variation in men's perceptions of the dominance of their rivals. In addition to considering the possible effects of height on perceptions of men's dominance, we also investigated the relationship between men's perceptions of their own dominance and sensitivity to facial and vocal cues of dominance in other men.

Methods

Voice stimuli

First, recordings of 10 men saying "Hi, I'm a student" were made using an Audio-Technica AT4041 microphone in a quiet room. Recordings were made in mono, using Soundforge recording software, at a sampling rate of 44.1 kHz, and with 16-bit amplitude quantization. Next, we manufactured two versions of each voice recording: a version with lowered voice pitch (i.e., a masculinized version) and a version with raised voice pitch (i.e., a feminized 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, 2007) to +/- 0.5 ERBs (equivalent rectangular bandwidths) of the original frequency. This PSOLA method has been used successfully in other studies of human voice perception (Feinberg et al., 2005, 2006, 2008a, 2008b; Jones et al., 2008b; Jones et al., 2010a; Puts et al., 2006; Vukovic et al., 2008) and in studies of voice quality and dominance in 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., 2005, 2008a, 2008b; Jones et al., 2010a). The manipulation performed here is roughly equivalent to +/- 20Hz in this particular sample, and takes into account the fact that pitch perception is on a log-linear scale in comparison to the natural frequencies (i.e., Hz, Traunmüller, 1990). The ERB scale was used here because of its better resolution at human average speaking frequencies than the tonotopic Bark, semitone, or Mel scales (Traunmüller, 1990). A manipulation roughly equivalent to 20Hz was used because it has been shown to be sufficient to alter perceptions of voices in prior studies (Feinberg et al., 2005, 2006, 2008a, 2008b; Jones et al., 2008b; Jones et al., 2010a; Vukovic et al., 2008). Indeed, manipulating the pitch of male voices using these methods has been shown to reliably alter perceptions of vocal masculinity, such that voices with lowered pitch are perceived to be more masculine than voices with raised pitch (Feinberg et al., 2005). After manipulation, amplitudes were scaled to a consistent presentation volume using the RMS (root-mean-squared) method.

This process created ten pairs of voices in total (each pair consisting of raised-pitch and lowered-pitch versions of the same recording). The mean fundamental frequency of the feminized versions was 142.8 Hz (SD=16.4 Hz). The mean fundamental frequency of the masculinized versions was 104.6 Hz (SD=15.3 Hz).

Face stimuli

Following previous studies of systematic variation in perceptions of masculine versus feminine faces (Buckingham et al., 2006; DeBruine et al., 2006, in press; Jones et al., 2005, 2007, 2010b; Penton-Voak et al., 1999; Little et al., 2005; Welling et al., 2007, 2008), we used prototype-based image transformations to objectively manipulate sexual dimorphism of 2D shape in digital face images.

Here, 50% of the linear differences in 2D shape between symmetrized versions of the male and female prototypes were added to or subtracted from face images of 10 young White adult men. This process creates masculinized and feminized versions of the individual face images that differ in sexual dimorphism of 2D shape and that are matched in other regards (e.g., identity, skin color and texture, Rowland & Perrett, 1995). Examples of masculinized and feminized face images are shown in Figure 1.

INSERT FIGURE 1 AROUND HERE

This process created 10 pairs of images in total, each pair consisting of a masculinized and a feminized version of the same individual. Previous studies have demonstrated that this method for manipulating masculinity of 2D face shape affects perceptions of facial masculinity in the predicted manner (DeBruine et al., 2006; Jones et al., 2007, 2010b; Welling et al., 2007, 2008).

Procedure

Fifty male participants (Mean age=20.36 years, SD=2.58 years), all of whom were heterosexual undergraduate students at the University of Aberdeen, took part in the study. Each participant completed two dominance perception tests; one that involved judging the dominance of men's voices and another that involved judging the dominance of men's faces.

In the voice perception test, participants listened to the ten pairs of voices (each pair consisting of a masculinized and feminized version of the same voice) and were instructed to indicate which voice in each pair sounded more dominant. For each pair of voices, participants also indicated whether they thought the more dominant voice sounded 'much more dominant', 'more dominant', 'somewhat more dominant', or 'slightly more dominant' than the less dominant voice. The order in which pairs of voices were played was fully randomized, as was the order in which the masculinized and feminized versions in each pair were played.

In the face perception test, participants were shown ten pairs of faces (each pair consisting of a masculinized and feminized version of the same face) and were instructed to indicate which face in each pair looked more dominant. As in the voice perception test, participants also indicated whether they thought the more dominant face in each pair appeared 'much more dominant', 'more dominant', 'somewhat more dominant', or 'slightly more dominant' than the less dominant face. The order in which these pairs of faces were shown was fully randomized, as was the side of the screen on which the masculinized and feminized versions were presented. Participants were instructed to simply indicate which voice or face was more dominant, rather than judging social and physical dominance separately, because Puts et al. (2006) previously found that masculinizing men's voices increases perceptions of both social and physical dominance.

In addition to completing the face and voice perception tests, each participant's height was measured in centimetres (to the nearest five millimetres) and each participant rated his own dominance using a 1 (not very dominant) to 7 (very dominant) scale.

The order in which participants completed the voice perception test, the face perception test, rated their own dominance, and had their height measured was fully randomized across participants.

Initial processing of data

Responses on the face and voice dominance perception tests were coded using the following scale:

0 = feminized stimuli judged much more dominant than masculinized stimuli
1 = feminized stimuli judged more dominant than masculinized stimuli
2 = feminized stimuli judged somewhat more dominant than masculinized stimuli
3 = feminized stimuli judged slightly more dominant than masculinized stimuli
4 = masculinized stimuli judged slightly more dominant than feminized stimuli
5 = masculinized stimuli judged somewhat more dominant than feminized stimuli
6 = masculinized stimuli judged more dominant than feminized stimuli
7 = masculinized stimuli judged much more dominant than feminized stimuli

For each participant, we calculated his average dominance sensitivity score on the face perception test and his corresponding score on the voice perception test.

Results

Initial analyses

One-sample t-tests comparing responses on each of the dominance perception tests with what would be expected by chance alone (i.e., 3.5) showed that participants perceived the masculinized stimuli to be more dominant than the feminized stimuli in both the face ($t(49)=8.44$, $p<.001$, $M=4.46$, $SEM=0.11$) and voice ($t(49)=12.40$, $p<.001$, $M=4.88$, $SEM=0.11$) perception tests. Taller men tended to rate their own dominance higher than shorter men did, although this correlation was not significant ($r=.25$, $N=50$, $p=.085$).

Participant height and dominance sensitivity

To investigate the effect of height on perceptions of dominance, scores on the two dominance perception tests were first analyzed using ANCOVA [within-subjects factor: *domain* (face, voice); covariates: *participant age*, *participant height*]. This analysis revealed a significant main effect of *participant height* (F(1,47)=4.18, p=.046) and no other significant effects (all F<0.55, all p>.46).

A regression analysis with *mean dominance sensitivity score* as the dependent variable and both *participant age* and *participant height* as predictors showed that *participant height* was negatively correlated with sensitivity to cues of dominance (beta=-.29, t=-2.05, p=.046, Figure 2) and that there was no significant relationship between *participant age* and *mean dominance sensitivity score* (beta=-.10, t=-0.74, p=.46). An additional analysis revealed no significant quadratic relationships between *mean dominance sensitivity score* and either *participant age* or *participant height* (both p>.16).

INSERT FIGURE 2 AROUND HERE

Self-rated dominance and dominance sensitivity

Next, we investigated the relationship between scores on the two dominance perception tests and *self-rated dominance* using ANCOVA [within-subjects factor: *domain* (face, voice); covariates: *participant age*, *self-rated dominance*]. This ANCOVA revealed no significant effects (all F<1.10, all p>.30). An additional analysis revealed no significant quadratic relationships between dominance sensitivity and either *self-rated dominance* or *participant age* (both p>.21).

Participant height, self-rated dominance and dominance sensitivity

Finally, we compared the effects of *participant height* and *self-rated dominance* on scores on the dominance perception tests in a final ANCOVA [within-subjects factor: *domain* (face, voice); covariates: *participant age*, *participant height, self-rated dominance*]. This analysis revealed a significant main effect of *participant height* (F(1,46)=4.72, p=.035) and no other significant effects (all F<0.79, all p>.38).

We conducted a regression analysis with *mean dominance sensitivity score* as the dependent variable and *participant age, self-rated dominance* and *participant height* as predictors. This analysis showed that *participant height* was negatively correlated with sensitivity to cues of dominance (beta=-.32, t=-2.17, p=.035) and that there were no significant relationships between *participant age* and *mean dominance sensitivity score* (beta=-.11, t=-0.77, p=.45) or *self-rated dominance* and *mean dominance sensitivity score* (beta=.12, t=0.80, p=.43). An additional analysis revealed no significant quadratic relationships between dominance sensitivity and *self-rated dominance, participant age* or *participant height* (all p>.23).

Discussion

Previous research has demonstrated correlations between sexually dimorphic physical characteristics and indices of male dominance in non-human animal species (e.g., Owen-Smith, 1993; Isaac, 2005; Peters & Mech, 1975; Espmark, 1964; Le Boeuf & Reitter, 1988). Other research has demonstrated correlations between sexually dimorphic characteristics and indices of both men's actual dominance (Archer & Thanzami, 2007; Fink et al., 2007; Mueller & Mazur, 1996; Vaz et al., 2002; von Rueden et al., 2008) and their perceived dominance (Boothroyd et al., 2007; Jones et al., 2010a, 2010b; Main et al., 2009; Perrett et al., 1998; Puts et al., 2006, 2007). Consistent with these findings, we found that men generally perceived masculinized versions of men's faces and voices to be more dominant than feminized versions.

Although the men in our study generally perceived masculinized versions of men's faces and voices to be more dominant than feminized versions, we also observed systematic variation in men's perceptions of the dominance of other men (i.e., potential rivals). As we had predicted, relatively short men were more sensitive to masculine cues when judging the dominance of other men's faces and voices than taller men were. Many previous studies have presented evidence that height is positively correlated with indices of dominance in men (for a recent review see Buunk et al., 2008). Thus, the effect of male height on sensitivity to cues of male dominance that was observed in our study may reflect the greater costs (e.g., increased risk of serious injury and loss of status) that will be incurred by less dominant men if they incorrectly perceive the dominance of rivals.

The negative correlation between height and men’s sensitivity to cues of dominance in potential rivals that was observed in the current study is consistent with Buunk et al. (2008). When participants were asked to imagine their partner flirting with a dominant male, Buunk et al. (2008) found that taller men were less jealous of these male rivals than shorter men. Our findings extend Buunk et al’s work by demonstrating that men’s height is related to individual differences in fundamental perceptions of the dominance of rivals, in addition to variation in behavioral responses that may be elicited by dominant men (i.e., jealousy). Moreover, our findings raise the possibility that the inverse relationship between height and men’s jealousy of dominant men (Buunk et al., 2008) may partly reflect systematic variation among men in their sensitivity to physical cues of other men’s dominance.

Although taller men tended to rate themselves as more dominant than shorter men, the effect of height on dominance perception was independent of men’s beliefs about their own dominance. In other words, a relatively objective index of men’s dominance (i.e., height) was a better predictor of dominance sensitivity than men’s beliefs about their own dominance. This pattern of results suggests that greater sensitivity to dominance among shorter men is unlikely to reflect a conscious or deliberate strategy. Indeed, findings for other potentially adaptive aspects of social perception (e.g., attraction to symmetric individuals, Little & Jones, 2006; Perrett et al., 1999) have also demonstrated this apparent dissociation between awareness and behavior (see also, e.g., Smith et al., 2009). Individual differences among men in their experience of aggressive conflicts with other men (e.g., number of previous conflicts and rate of success in such conflicts) may nonetheless contribute to the negative association between height and men’s dominance sensitivity that we observed. Indeed, the nature of past experiences in aggressive conflicts appears to mediate the relationship between male body size and dominance rank in some non-human animal species (e.g., Schuett, 1997).

Our findings demonstrate that taller (i.e., more dominant) men are less sensitive to cues of dominance in other men. Thus, our findings suggest that differences among men in the potential costs of incorrectly perceiving the dominance of rivals have shaped systematic variation in dominance perception. Many previous studies have demonstrated potentially adaptive variation in women’s preferences for dominant men (Fink & Penton-Voak, 2002; Gangestad & Simpson, 2000; Jones et al., 2008a; Little et al., 2002). By contrast with these findings for women’s mate preferences, our study emphasizes potentially adaptive variation in men’s perceptions of other men’s dominance. Further research on this issue may provide important insights into the mechanisms and processes through which intra-sexual selection (i.e., male-male competition) has shaped male dominance perception.

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Figure 1.

Figure 1. Examples of masculinized (left) and feminized (right) face images used to assess men's perceptions of facial dominance in our study.

Figure 2.

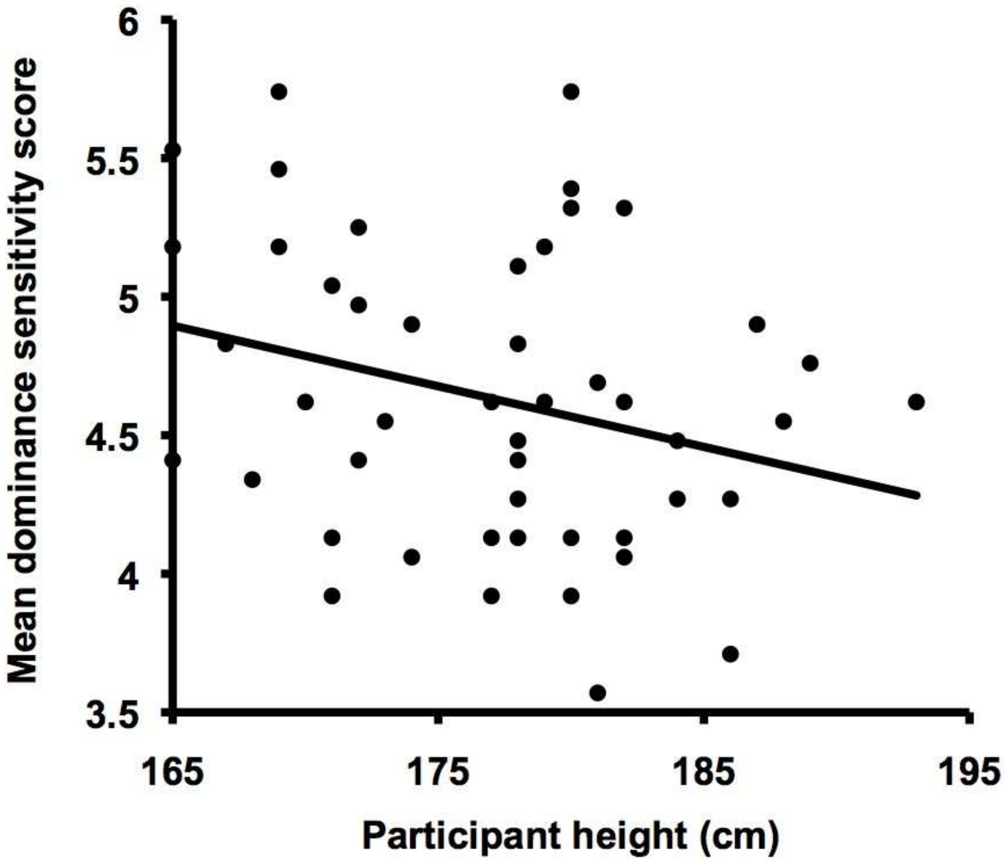

Figure 2. The negative relationship between men's height and their sensitivity to cues of dominance in other men.