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Original Article

Men's voice pitch influences women's trusting behavior☆

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ABSTRACT

Women tend to trust men with low-pitched voices as political leaders but trust men with high-pitched voices in mating scenarios. To elucidate the role of pitch in perceptions of trust, we used a one-decision variant of the trust game in which female participants were given the choice to trust males to divide the money, or to end the game, taking a smaller than equal sum. Male receivers were simulated using pitch-manipulated voice recordings. Women trusted raised pitch voices more than lowered pitch voices. These results suggest that although people with masculine voices are entrusted to lead our governments, people with masculine voices are not trusted to divide up financial resources equitably on a personal level.

1. Introduction

Trust is essential for social interactions. As such, it is important to understand how individuals decide whom to trust and to identify the cues in others that influence trusting behavior. We use social (Oosterhof & Todorov, 2009; Todorov, Pakrashi, & Oosterhof, 2009) and biological (DeBruine, 2002; Stirrat & Perrett, 2010; Wilson & Eckel, 2006) cues from others that may influence the likelihood of us trusting them. We use both vocal (Klofstad, Anderson, & Peters, 2012; O'Connor, Re & Feinberg, 2011; Tigue, Borak, O'Connor, Schandl, & Feinberg, 2011; Vukovic et al., 2011) and facial masculinity (Little, Roberts, Jones, & DeBruine, 2012; Perrett et al., 1998; Oosterhof & Todorov, 2009; Boothroyd, Jones, Burt, & Perrett, 2007; Stirrat & Perrett, 2010), when evaluating trustworthiness of an individual.

Earlier work on social perception suggested that we might trust attractive individuals because of an attractiveness-halo effect whereby what we find attractive is good (Dion, Berscheid, & Walster, 1972; Feingold, 1992). However, subsequent work has revealed that the picture is more complex than a simple stereotype. Another attribute that may be used to help evaluate trustworthiness in others is masculinity. Masculinity manifests across modalities in the face (Perrett et al., 1998), body (Little, Jones, & Burriss, 2007; Pawlowski & Jasienska, 2005), odor (Cornwell et al., 2004; Saxton, Lyndon, Little, & Roberts, 2008), and voice (Feinberg, 2008; Puts, 2005), and preferences for masculinity are correlated across several modalities (Feinberg, DeBruine, Jones & Little, 2008; O'Connor et al., 2011). Research shows that masculinity influences judgments of attractiveness but also may carry positive and negative connotations in different modalities and domains.

1.1. Voice pitch and trust

Prior work has demonstrated that men with lower pitched, more masculine voices (see Feinberg, Jones, Little, Burt, & Perrett, 2005) are perceived as more trustworthy leaders (Klofstad et al., 2012; Tigue et al., 2011) but as less trustworthy (i.e., more likely to cheat) romantic partners (O'Connor, Re & Feinberg, 2011) than men with more feminine (higher pitched) voices. Furthermore, Vukovic et al. (2011) found that women who perceived men with masculine voices as more attractive for short-term (e.g. single date, brief affair or one-night stand) relationships also perceived men with masculine voices as less trustworthy. Thus, work on voice pitch and trustworthiness is currently inconclusive or at least seems to be context dependent.

1.2. Other cues to vocal masculinity

Voice pitch is not the only acoustic feature that affects perceptions of masculinity (Feinberg et al., 2005). Formant frequencies, the resonant frequencies of the supralaryngeal vocal tract, also affect perceptions of masculinity (Feinberg et al., 2005) and may therefore influence perceptions of trust. Although large vocal tracts are associated with large body size (Fitch, 1997, 2000a, 2000b; Fitch & Giedd, 1999), it is currently unknown if people trust short or tall men more. Taller sounding people are rated as more dominant, and dominant individuals' faces tend to be

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perceived as better leaders (Re et al., 2012). Indeed, Knowles and Little (2016) found that people with larger apparent vocal tracts (i.e. lower formants) sounded more cooperative than people with shorter apparent vocal tracts. Cooperativeness and trust are interrelated (Knowles & Little, 2016).

1.3. Measuring trust using economic games

Stirrat and Perrett (2010) observed that in an economic game, players were more likely to trust less masculine men (as indexed by a face width-to-height ratio). However, face width-to-height ratio has later been exposed and is actually not a sexually dimorphic trait (Lefevre et al., 2012), although it is tied to perceived dominance (Stirrat & Perrett, 2010). Thus, there is equivocal evidence that masculinity affects trust in economic games. While it may be adaptive to select masculine men as leaders because of their ability to deal with difficult financial situations such as recession (Tigue et al., 2011), it may also be adaptive to distrust the same masculine men as committed romantic partners (Boothroyd et al., 2007; Vukovic et al., 2011) and to distribute financial resources in one-on-one interactions (Stirrat & Perrett, 2010).

Taken together, the results of past studies indicate that the relationship between men's voice and perceptions of trust and trustworthiness is complicated, not well understood, and often contradictory. One tool that economists design to shed light on more realistic trusting behavior is economic games. One game in particular, the trust game (Berg, Dickhaut, & McCabe, 1995), and its variants (see Johnson & Mislin, 2011) have been used for over a decade to study attitudes toward different traits in faces such as self-resemblance (DeBruine, 2002, 2005) and dominance (Stirrat & Perrett, 2010). Yet surprisingly, no studies have tested whether vocal masculinity influences behavior in the trust game.

To test how research on perceptions of trust extends to a behavior in economic games, we tested whether men's voice pitch and apparent vocal tract length influenced women's trusting behavior in the trust game. We used a one-decision variant of the trust game based on that used by DeBruine (2002), in which the female sender was given the choice to trust the male receiver or to end the game. The male players in our experiment were simulated using voice recordings that we manipulated in pitch and vocal tract length. All women were informed before the experiment that neither their counterparts nor the money involved was real.

Here, we test two opposing hypotheses on perceptions of trust from the voice. On one hand, research on politics, leadership, economic policy, and cooperation suggests that men with lower pitched voices and lower formants (longer apparent vocal tracts) are perceived as more trustworthy and/or cooperative sounding than men with higher pitched voices and/or higher formants (shorter apparent vocal tracts) (Klofstad et al., 2012; Knowles & Little, 2016; Stirrat & Perrett, 2010; Tigue et al., 2011). On the other hand, feminine male vocal (i.e. high pitch) and facial features are perceived as more honest, cooperative, and/or trustworthy than masculine male vocal (i.e. low pitch) and facial features in romantic and neutral contexts (Boothroyd et al., 2007; Knowles & Little, 2016; Perrett et al., 1998; Vukovic et al., 2011). If men with potentially masculine faces are relatively more likely to exploit people in economic games (Stirrat & Perrett, 2010), we predict that women will trust voices with masculine vocal features less than they will trust voices with feminine vocal features in the trust game.

2. Methods

2.1. Participants

Thirty-seven female undergraduates participated in the experiment (*mean age* = 18.59 years, *SD* = 1.54) and received course credit for participation.

2.2. Stimuli collection

We obtained voice recordings of 6 male undergraduates (*mean age* = 19.17 years, *SD* = 1.83 years) speaking the word, "hello". Voices were selected from a larger pool of voices to span the normal range of men's voices once manipulated (Feinberg, DeBruine, Jones, & Perrett, 2008; Feinberg et al., 2006; O'Connor, Pisanski, Tigue, Fraccaro, & Feinberg, 2014). The men's voices were recorded in an anechoic sound-attenuated booth (Whisper Room SE 2000) with a Sennheiser MKH 800 microphone using the cardioid pickup pattern. Audio recordings were digitally encoded with an M-Audio Fast Track Ultra at 96 kHz sampling rate and 32-bit amplitude quantization using Adobe Soundbooth CS5 3.0 and saved in waveform audio file format (.wav). Prior to any manipulation, the original mean pitch of the voices used as stimuli was 113.37 Hz, *SD* = 12.31 Hz.

2.3. Voice pitch manipulation

We manipulated the pitch of each voice stimulus to create a higher pitched and lower pitched version of each voice using the Pitch-Synchronous Overlap Add (PSOLA, France Telecom) method in Praat software (Boersma & Weenink, 2012). This method selectively manipulates fundamental frequency and related harmonics (the physical basis for pitch perception) while holding all other features of the acoustic signal relatively constant (Feinberg et al., 2005). We raised or lowered voice pitch by 0.5 equivalent rectangular bandwidth (ERB) of the baseline pitch, which corrects for the difference between perceived pitch and actual fundamental frequency (Apicella & Feinberg, 2009; Feinberg, DeBruine, Jones, & Perrett, 2008; Jones, Feinberg, DeBruine, Little, & Vukovic, 2008; Jones, Feinberg, DeBruine, Little & Vukovic, 2010; Vukovic et al., 2008). After manipulation, each of the voices that we lowered in pitch (*mean pitch* = 93.11 Hz, *SD* = 7.78 Hz) was lower than each of the voices that we raised in pitch (*mean pitch* = 131.92 Hz, *SD* = 8.39 Hz).

2.4. Formant manipulation

In Praat acoustic phonetics software (Boersma & Weenink, 2012), we independently manipulated formant frequencies as a whole to simulate differences in the length of the supralaryngeal vocal tract of each voice stimulus. We first re-sampled the sound either 15% above or below the original sampling rate, which raised or lowered all frequencies by 15%, and then manipulated the fundamental frequency back to the baseline level using PSOLA, leaving only the formant frequencies shifted as described in Feinberg et al. (2005), which is the same technique implemented in the "change gender" button in Praat. Using this technique, we created two versions of each voice stimulus: one with formant frequencies 15% lower than the original (lengthened apparent vocal tract) and one with formant frequencies 15% higher than the original (shortened apparent vocal tract).

The above manipulations produced 4 versions (raised pitch, lowered pitch, shortened apparent vocal tract, and lengthened apparent vocal tract) of each of the 6 original voices, for 24 unique stimuli total. We normalized the amplitude of each stimulus to 70 dB RMS SPL, using Praat (Boersma & Weenink, 2012). We used 6 original voices because prior studies on perception of voice pitch in humans using 4–6 voices (Feinberg et al., 2005; Feinberg, DeBruine, Jones, & Little, 2008; Jones, Feinberg, DeBruine, Little, & Vukovic, 2010; Vukovic et al., 2008) have found similar effects to those using hundreds of voices (Feinberg, DeBruine, Jones, & Perrett, 2008; Puts, Apicella, & Cárdenas, 2012; Puts, Gaulin, & Verdolini, 2006).

2.5. Procedure

At the start of the experiment, each participant was presented with instructions on a computer screen describing the trust game and