



Original Article

The influence of voice pitch on perceptions of trustworthiness across social contexts



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ABSTRACT

Perceptions of trustworthiness are an important predictor of social outcomes, such as monetary exchanges, criminal sentencing, and the attainment of leadership roles. Higher testosterone levels predict both lower voice pitch and untrustworthy behavior, across economic and mating contexts. Here, we tested the influence of voice pitch on perceptions of trustworthiness across general, economic, and mating-related (mate poaching, infidelity) contexts. We found that the context of trust and the sex of the speaker both changed how voice pitch affected perceived trustworthiness. Listeners were more trusting of higher-pitched female voices in economic and mate poaching contexts, but trusted lower-pitched female voices more in general. Listeners were more trusting of higher-pitched male voices in economic and mating-related contexts, and also tended to perceive higher-pitched male voices as more trustworthy in general. Listeners' attributions of trustworthiness were generally unrelated to perceptions of attractiveness from similarly-pitched voices, indicating that trust-related attributions were independent of preferences for higher- or lower-pitched voices. Furthermore, perceptions of general trustworthiness were associated with perceptions of economic trust, but were not consistently associated with perceptions of mating-related trust. These findings provide evidence that voice pitch alone is sufficient to influence trust-related perceptions, and demonstrates that listeners use voice pitch as a cue to trustworthy behavior.

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1. Introduction

Trust is a fundamental component of human sociality (Bateson, 1988), and has broad implications for exchanges between individuals across social contexts. Individuals who are perceived as trustworthy are preferred in leadership roles (Chen, Jing, & Lee, 2014; Little, Roberts, Jones, & DeBruine, 2012), are entrusted with more money in economic games (Ewing, Caulfield, Read, & Rhodes, 2015; van't Wout & Sanfey, 2008), and receive less severe sentences for criminal offenses (Wilson & Rule, 2015). The same hormones associated with individual differences in trustworthy behavior are also implicated in the development of adult vocal characteristics (see section 1.1). In the present study, we examine whether listeners' attributions of trustworthiness are influenced by voice pitch across different social contexts.

1.1. The relationship among voice pitch, hormones, and behavior

Voice pitch is the perceptual correlate of fundamental frequency (f_0) and/or the corresponding harmonics, which is equivalent to the rate of vocal fold vibration (Titze, 1994). Assuming equal tension, larger vocal folds vibrate more slowly than do smaller vocal folds, and are therefore capable of producing lower frequencies than are smaller vocal folds

(Titze, 1994). At puberty, testosterone causes the vocal folds to increase in mass, thus lowering voice pitch (Harries, Hawkins, Hacking, & Hughes, 1998). Due to relatively higher levels of pubertal testosterone among males than females, this change results in an adult male voice pitch (120 Hz) that is on average half that of the mean adult female voice pitch (220 Hz) (Childers & Wu, 1991). Voice pitch continues to be negatively related to men's testosterone levels through adolescence (Hodges-Simeon, Gruven, & Gaulin, 2015) and into adulthood (Cartei, Bond, & Reby, 2014; Dabbs & Mallinger, 1999; Evans, Neave, Wakelin, & Hamilton, 2008; Hodges-Simeon et al., 2015; Puts, Apicella, & Cárdenas, 2012).

If voice pitch influences perceptions of trustworthiness, it may do so owing to associations between hormone levels and behavior. Men with relatively high testosterone levels act more punitively with other players in economic games (Burnham, 2007), and return less money to senders in the trust game (Takagishi, Takahashi, & Yamagishi, 2011). Men who possess facial cues of relatively higher levels of testosterone are more likely to exploit their partner's trust in economic games (Stirrat & Perrett, 2010). Men with relatively higher testosterone levels are also more likely to report a higher number of extra-pair sex partners (Booth & Dabbs, 1993; Fisher et al., 2009, 2012). Therefore, men with higher levels of testosterone, and hence, lower-pitched voices, may be less trustworthy in both economic and in mating-related contexts.

Similarly to men, women with relatively higher levels of testosterone return less money to senders in the trust game (Takagishi et al.,

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2011), suggesting that women with higher levels of testosterone may be less trustworthy in economic contexts. However, women's trait levels of estrogen, rather than testosterone, appears to be associated with lower trustworthiness in the context of mating. For instance, women with higher levels of estrogen report a greater future likelihood of adulterous behaviors (Durante & Li, 2009). Women who possess cues to relatively higher estrogen levels, such as feminine waist-to-hip ratios (Jasienska, Ziomkiewicz, Ellison, Lipson, & Thune, 2004), also report a higher number of extra-pair partners than do other women (Hughes & Gallup, 2003). Therefore, whereas women with relatively higher testosterone levels and lower-pitched voices may be less trustworthy in economic contexts, women with higher estrogen levels and higher-pitched voices may be less trustworthy in mating contexts.

1.2. Perceptions of general trustworthiness

There are mixed results on how voice pitch influences perceptions of general trustworthiness. Some research finds that relatively higher-pitched, feminine-sounding male voices are perceived as more trustworthy than are lower-pitched, masculine-sounding voices (McAleer, Todorov, & Belin, 2014). Yet, other research finds that lower-pitched voices are perceived as more trustworthy than are higher-pitched voices, among both male (Tigue, Borak, O'Connor, Schandl, & Feinberg, 2012) and female speakers (Klofstad, Anderson, & Peters, 2012). Furthermore, other studies have failed to detect a significant effect of male voice pitch on perceptions of trustworthiness (Klofstad et al., 2012; Vukovic et al., 2011). Therefore, the influence of male voice pitch on perceptions of trustworthiness in general is equivocal.

One potential explanation for these conflicting findings may be that perceptions of trustworthiness are tied to listener's voice pitch preferences. Generally, voices which are perceived as attractive are also perceived as trustworthy (Rezlescu et al., 2015). Lower-pitched male voices are rated as both more attractive and as more trustworthy than are higher-pitched male voices (Tigue et al., 2012). Vukovic et al. (2011) found that women who preferred lower-pitched male voices more as a long-term than as a short-term mates also perceived lower-pitched male voices as relatively trustworthy. Therefore, perceptions of lower-pitched voices as trustworthy could potentially be due to a halo effect (Feingold, 1998), where attractive voices are perceived positively on other personality attributes (Zuckerman & Driver, 1989).

1.3. Perceptions of mating-related trustworthiness

The influence of voice pitch on perceptions of trustworthiness may also be clarified by examining the specific social contexts of trustworthiness judgements. When perceptions of trustworthiness are examined within a mating-related context, highly sex-typical voices (i.e., higher-pitched voices among women, lower-pitched voices among men) tend to be perceived as less trustworthy than less sexually dimorphic voices. Specifically, lower-pitched male voices and higher-pitched female voices are perceived as more likely to commit infidelity than are other voices (O'Connor, Pisanski, Tigue, Fraccaro, & Feinberg, 2014; O'Connor, Re, & Feinberg, 2011). When asked to select who they would prefer to accompany their romantic partner on a weekend trip, men chose higher-pitched male voices and women chose lower-pitched female voices (O'Connor & Feinberg, 2012). Therefore, lower-pitched male voices and higher-pitched female voices are perceived as less trustworthy in mating contexts by both potential mates and same-sex rivals.

Although the above suggests that highly sex-typical voices are perceived as less trustworthy in mating contexts, it is unclear whether perceptions of same-sex voices as intrasexual rivals reflect trust-related perceptions or reflect perceptions of the attractiveness of such individuals. A more specific measure of mating-related trust for same-sex individuals would be perceptions of mate poaching, a sexual strategy which could be attempted regardless of one's desirability to the opposite-sex.

Here, it may be that both men and women with lower-pitched voices are perceived as more likely to mate poach. This is because relatively higher levels of testosterone are associated with both lower voice pitch (Cartei et al., 2014; Dabbs & Mallinger, 1999; Evans et al., 2008; Hodges-Simeon et al., 2015; Puts et al., 2012) and increased mating effort (for review see Roney & Gettler, 2015). For example, women in polyamorous relationships have relatively higher levels of testosterone in comparison to women who are single or in monogamous relationships (van Anders, Hamilton, & Watson, 2007). Men with higher levels of testosterone report a higher number of sex partners than do other men (Peters, Simmons, & Rhodes, 2008; Pollet, van der Meij, Cobey, & Buunk, 2011). Therefore, if individuals with relatively higher levels of testosterone are more likely to mate poach as a result of increased mating effort, then listeners may be less trusting of lower-pitched same-sex voices in mating contexts.

1.4. The social context of trustworthiness

Ratings of general trustworthiness are formed spontaneously, with high inter-rater agreement (for review see Todorov, 2008), but it is unclear whether perceptions of general trustworthiness are readily applied to specific social contexts. Trust-based exchanges have an underlying framework that is applicable across different social contexts:

“Trust” is inherently a matter of the beliefs that one agent has about the behavior of another. An action that is trusting of another is one that creates the possibility of mutual benefit, if the other person is cooperative, and the risk of loss to oneself if the other person defects. [(p.263, Cox, 2004)]

This definition of trust reflects some economic exchanges, such as the trust game (Berg, Dickhaut, & McCabe, 1995), but also exchanges in other social contexts, such as romantic scenarios. For instance, if *A* believes that *B* is romantically faithful, but *B* is unfaithful (i.e., defects), then *A* may incur fitness costs resulting from infidelity, such as the loss of protection and provisioning (Geary & Byrd-Craven, 2004). This scenario may also be applied to the context of mate poaching. Romantic relationships are very often public information, and mate poaching can be perceived as a violation of social norms where coupled individuals are “off the market.” If *A* believes *C* will not attempt to poach his/her mate, but *C* does attempt to mate poach (i.e., defects), then *A* may lose his/her current mate or experience increased paternity uncertainty (Geary & Byrd-Craven, 2004). In the present study, we use these two scenarios of infidelity and mate poaching to examine perceptions of mating-related trustworthiness.

Examining perceptions across different social contexts of trust, such as economic exchanges or mate selection, could clarify the influence of voice pitch on trust-related perceptions. In economic contexts, individuals who are rated as highly trustworthy in general also sent more money in economic games in which the return of any money is not guaranteed (van't Wout & Sanfey, 2008). In the context of mate selection, Rhodes, Morley, and Simmons (2013) did not find evidence for a relationship between perceptions of trustworthiness and attributions of infidelity to faces. Therefore, perceptions of general trustworthiness appear to be associated with economic trust, but may be distinct from perceptions of mating-related trust. In the present study, we examine whether this pattern is also observed when examining trust-related perceptions of voices varying in pitch.

1.5. The present study

We examined whether voice pitch influences perceptions of trustworthiness in an economic context, in a mating context, and in an unspecified context (general trustworthiness). In order to test whether voice pitch influences economic trust, participants took part in a modified version of the trust game (Berg et al., 1995) wherein listeners

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