

Original Article

The evolved psychology of voice: evaluating interrelationships in listeners' assessments of the size, masculinity, and attractiveness of unseen speakers[☆]

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Abstract

A growing body of research has examined how voice characteristics advertise personal dimensions relevant in mate competition and mate choice. This work has centered on two key voice features, namely, fundamental frequency (F_0) and formants (F_n), and has consistently found that speakers with low F_0 , low F_n , or both are rated as being larger, more masculine, and more attractive if men but less attractive if women. However, this consistency in listeners' perceptions is not matched by an equivalent consensus in how these mate-relevant dimensions are causally related or signaled by voice characteristics. Consequently, it is critical to test whether the strong correlations in listeners' perceptions reflect reliable causal relationships between these dimensions or, alternatively, whether they reflect some perceptual or cognitive nonindependence, for example, “what is large is masculine” and “what is small is feminine.” To test this latter possibility, we report detailed analyses of interdependence in listeners' ratings of perceived size, masculinity or femininity, and attractiveness of natural and manipulated voices of the opposite sex. We found strong correlations in listeners' ratings of all three dimensions, confirming past research. Principal component analysis corroborated these interrelationships but also revealed some independence in women's ratings of men's attractiveness and additional (but weaker) independence in men's ratings of women's size. We discuss possible implications for future research on the evolved psychology of voice and whether and how it reflects adaptive functional heuristics for discriminating mates.

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1. Introduction

There has been a recent surge in voice-related research in evolutionary psychology focused on the role that voice characteristics might play in advertising personal dimensions relevant in mate competition or mate choice (Feinberg, 2008). This trend is a natural outgrowth of the longer history of related research on the face, which is hypothesized to be a target of sexual selection and to play an important role in people's assessments of relevant characteristics of potential

rivals or mates (Fink & Penton-Voak, 2002; Perrett, 2010; Perrett et al., 1998; Rhodes, 2006). Both the voice and face are sexually dimorphic traits, and their development depends in part on pubertal exposure to hormones (e.g., testosterone) and, as such, might provide cues to an individual's health or quality (Feinberg, 2008; Gangestad & Scheyd, 2005; Thornhill & Gangestad, 1999).

Previous research on listeners' assessments of unseen speakers has produced a variety of interesting findings, among the most consistent being strong correlations in listeners' ratings of different mate-relevant dimensions, such as body size, masculinity or femininity, and overall attractiveness (Bruckert, Liénard, Lacrois, Kreutzer, & Leboucher, 2006; Collins, 2000; Feinberg, Jones, Little, Burt, & Perrett, 2005; Feinberg, DeBruine, Benedict, & Perrett, 2008; Hodges-Simeon, Gaulin, & Puts, 2010; Hughes, Dispenza, & Gallup, 2004; Jones, Feinberg, DeBruine, Little, & Vukovic, 2010). Specifically, men tend to rate small-sounding women as being

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more feminine and also as being more attractive, while women tend to rate men who sound bigger as being both more masculine and more attractive. These patterns certainly confirm lay intuitions and are commensurate with some theoretical predictions; however, they also conceal some fundamental ambiguities that need to be resolved.

1.1. Ambiguities in past voice-based research

The consistency observed in people's voice-based ratings of mate-relevant dimensions of unseen speakers is not matched by an equivalent consensus in our understanding of how the voice characteristics involved reliably signal these different dimensions. Research to date has focused on two independent voice traits, namely, voice fundamental frequency (F_0) and the pattern of voice resonances, or formants (F_n). Voice F_0 is closely associated with the percept of pitch and is traceable to the size and mass of the vibrating vocal folds of the larynx (Lieberman & Blumstein, 1988; Titze, 1994). The pattern of voice F_n is associated with the percept of timbre and results from the way laryngeally produced sounds are filtered by the cavities above the larynx (e.g., vocal tract and oral cavity) that leave a characteristic resonance imprint on the sounds produced (Ghazanfar & Rendall, 2008).

One of the most consistent findings is that listeners rate unseen speakers as being larger if their voices are characterized by low F_0 , low F_n , or both (Bruckert et al., 2006; Collins, 2000; Collins & Missing, 2003; Feinberg, Jones, Little et al., 2005; Greisbach, 1999; Rendall, Kollias, Ney, and Lloyd, 2007; Smith, Patterson, Turner, Kawahara, & Irino, 2005; Van Dommelen & Moxness, 1995). However, these two voice traits are not, in fact, equally good predictors of body size. Both voice F_0 and F_n differ consistently between adult men and women, who often do differ in size. However, within age–sex classes, which are where assessments of rivals or potential mates are most relevant, most studies have found no reliable correlation between F_0 and body size (Collins & Missing, 2003; Evans, Neave, & Wakelin, 2006; Künzel, 1989; Majewski, Hollien, & Zalewski, 1972; Rendall et al., 2005; Sell et al., 2010; Van Dommelen & Moxness, 1995), although Puts, Apicella, and Cardenas (2011) recently reported a positive relationship between F_0 and height in adult men that might be attributed to the comparatively large sample ($n=175$) used in this study. In contrast, F_n tends to correlate better with body size variation within adult men and within adult women (Collins & Missing, 2003; Greisbach, 1999; González, 2004; Rendall et al., 2005), likely because of an associated correlation with overall vocal tract length (Fitch, 2000). Hence, for individuals assessing the size of potential rivals or mates (i.e., making within-sex body size judgements), the cues provided by F_n appear much more reliable than those provided by F_0 .

Similar ambiguities characterize voice-based ratings of masculinity and femininity. Listeners consistently rate speakers of either sex with low F_0 , low F_n , or both as

being more masculine or less feminine (Bralley, Bull, Gore, & Edgerton, 1978; Collins, 2000; Feinberg, Jones, Little et al., 2005; Feinberg et al., 2008). However, here again, the two voice traits are not equally reliable predictors of masculinity and femininity (Coleman, 1976). Although there are differences in the average value of both F_0 and F_n between the sexes, the magnitude of the differences is widely divergent: there is a twofold difference in voice F_0 between men and women, with very little overlap in the distributions of the two sexes, but a difference of only 15%–20% in voice F_n between men and women, with considerable overlap in the distributions of the sexes (Bachorowski & Owren, 1999; Peterson & Barney, 1952; Rendall et al., 2005).

At the same time, there is evidence that some of the variation in F_0 within adults of both sexes is influenced by sex-specific hormones (Abitol, Abitol, & Abitol, 1999; Dabbs & Mallinger, 1999; Evans, Neave, Wakelin, & Hamilton, 2008; Puts, Apicella et al., 2011), with no similarly direct connection between sex-specific hormones and variation in F_n within sexes (but see Bruckert et al., 2006). Because hormonally mediated changes in voice F_0 in men at puberty are also associated with a small secondary descent of the larynx that slightly increases overall vocal tract length, it is possible that F_n cues could also signal variable masculinity (Fitch & Giedd, 1999). However, there is as yet no direct evidence that the extent of this secondary laryngeal descent varies as a function of varying testosterone profiles or that it varies at all among men. Hence, for individuals assessing masculinity or femininity within sexes, the cues provided by F_0 appear to be more reliable and salient than those provided by F_n .

1.2. Dissecting the problem

Understanding the adaptive basis of voice-based assessments of prospective mates or rivals thus entails three interrelated issues, depicted graphically in Fig. 1. First, what are the principled causal relationships among the frequently studied dimensions of body size, masculinity or femininity, and perceptions of attractiveness? Are larger men truly more masculine than shorter men? Are smaller women inherently more feminine than larger women? Second, to what extent are these mate-relevant dimensions reliably manifest in the voice? And third, irrespective of the principled causal relationships involved, how are the different mate-relevant dimensions perceived and interpreted by listeners?

We need answers to all three issues. There is active research on the first two, and so, in this paper, we focus specifically on the third issue, namely, establishing the interdependence in listeners' perceptions of mate-relevant dimensions. The importance of this particular emphasis lies in helping to better establish what exactly it is about potentially evolved voice preferences that requires explanation. For example, if it turns out that, despite the consistently correlated nature of listeners' perceptions of different mate-relevant dimensions, listeners are in fact able to rate the different

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