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# Voice Pitch

Chapter · January 2017

DOI: 10.1007/978-3-319-16999-6\_1414-2

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## Voice Pitch

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### Synonyms

Vocal fundamental frequency; Voice depth

### Definition

The perceived degree of height or depth of the voice.

### Introduction

Pitch is the most salient property of the voice and describes its “highness” or “lowness” (Titze 2000). The perception of pitch is influenced by multiple acoustic parameters such as amplitude and resonant (or formant) frequencies; however, the primary determinant of pitch is fundamental frequency ( $F_0$ ), the rate of vocal fold vibration during phonation (Titze 2000). Indeed, pitch and  $F_0$  are often used as though they are nearly synonymous, though the former is a perceptual feature whereas the latter describes the physical properties of the sound waveform.

## Voice Pitch Variation and Modulation

Between-individual variation in habitual speaking  $F_0$  is contingent upon differences in vocal fold length and thickness, but individuals also modulate their pitch, both consciously and unconsciously, across contexts. In many animal species, voice pitch is lowered to signal aggressive potential and raised to signal deference, and this pattern is also apparent across languages in the use of lowered pitch for commands and raised pitch to indicate questions (Ohala 1984). A person might deliberately modulate pitch to convey a specific impression, such as lowering pitch when assuming a leadership role, or pitch might involuntarily rise with increasing tension on the vocal folds during stressful situations (Puts et al. 2006).

Habitual voice pitch is also one of the most sexually differentiated secondary sex traits in humans. During sexual maturation, the influx of androgens in males triggers a disproportionate growth of the vocal folds, leading men to have longer (by approximately 60%) and thicker vocal folds than women (Titze 2000). These anatomic changes produce an adult sex difference in  $F_0$  of around five to six standard deviations (Puts et al. 2012).

### Sexual Selection and Voice Pitch

The decrease in male voice pitch at puberty and its associations with mating success (Puts et al. 2006)

and reproductive success (Apicella et al. 2007) suggest a role of sexual selection favoring lower pitch in men. Across anthropoid primates, males tend to evolve lower frequency vocalizations relative to females during evolutionary transitions to polygyny, where male mating competition is intense, and reduced  $F_0$  sexual dimorphism tends to evolve during transitions to monogamy (Puts et al. 2016).

In humans, heterosexual women also tend to prefer men's voices that are lower than average in pitch (Feinberg et al. 2005), especially when the women are in the fertile phase of the ovulatory cycle (Puts 2006) and are rating the voices for a short-term sexual relationship as opposed to a long-term, committed one (Puts et al. 2016). Women may exhibit this pattern of preferences in part because a low male voice pitch signals the possession of genes that increase immune system function (Feinberg et al. 2005). In two studies, low male  $F_0$  was associated with high testosterone and low cortisol levels, a hormonal regime that has previously been linked to immunocompetence (Puts et al. 2016).

While low  $F_0$  may have evolved in men partly because of its function in mate attraction, low  $F_0$  more effectively increases other men's perceptions of a man's social and especially physical dominance (Puts et al. 2007, 2016). In one study, men also modulated their voice pitch according to their perceptions of relative dominance, raising their  $F_0$  when speaking to a competitor whom they perceived as dominant to them and lowering  $F_0$  when they perceived themselves to be more dominant (Puts et al. 2006). Thus, it appears likely that a low  $F_0$  may have been favored primarily for its role in male intrasexual competition and to have played a relatively smaller role in mate attraction. Associations between a low male  $F_0$  and taller stature, higher testosterone, and lower cortisol, as well as evidence that men lower their  $F_0$  when they perceive themselves to be dominant, suggest that low  $F_0$  is a valid, if modest, indicator of men's threat potential to other men.

At the same time, higher-pitched female voices may have been shaped by male mate choice. Although female  $F_0$  does not exhibit a change at puberty as in men, men rate women's voices that

have been experimentally raised in  $F_0$  as being more attractive than the same voices with  $F_0$  lowered (Jones et al. 2010). However, this effect may be due to demand characteristics or to the conflation of  $F_0$  with timbre (measured by formant frequencies); when other acoustic parameters were statistically controlled in a multiple regression model, women's formant frequencies predicted their vocal attractiveness to men, but  $F_0$  did not (Puts et al. 2016).

## Conclusion

In sum, voice pitch is used in communication across animals to signal dominance and deference, perhaps because a low pitch increases apparent size (Ohala 1984; Puts et al. 2016). Given this social function and possible associations with immune function, it is perhaps not surprising that voice pitch would play a role in mate attraction and same-sex rivalry.

## Cross-References

- ▶ [Animal Signaling](#)
- ▶ [Dominance in Humans](#)
- ▶ [Nonverbal Indicators of Dominance](#)
- ▶ [Ovulatory Shifts in Psychology](#)
- ▶ [Sex Differences](#)
- ▶ [Sexual Selection](#)
- ▶ [Vocal Attractiveness](#)
- ▶ [Vocal Indicators of Dominance](#)

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