



Fundamental frequency in affective and neutral prosody

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AIMS AND METHODS

The present study aimed to find out:


- whether affective and neutral prosody impacts mean speaking F_0 in linguistic units of different complexity;
- whether F_0 differs in words, phrases, and continuous speech produced in neutral, happy, and angry prosody.

Methods:

Ten professional actors (5 males and 5 females) recorded nine voice samples (4 words, 4 phrases, one paragraph). Each linguistic unit was pronounced in neutral, happy and angry intonation. Each voice stimulus was recorded three times. In total, a pool of 810 voice samples was acquired.

Six experts assessed all recorded voice samples to choose the samples where the affective component of the voice (subjectively perceived as the most emotional or the most neutral voice depending on either affective or neutral condition) was most prominent. As a result of the auditory perceptual assessment, 270 highest-ranked voice samples were obtained.


All selected voice samples were analysed by the software PRAAT v. 6.1.31. and the script Vocal fundamental frequency, v. 02.04 (Phonanium, 2019). SPSS v. 28.0 (IBM SPSS Statistics) was used for the statistical data analysis.





SHORT INTRODUCTION

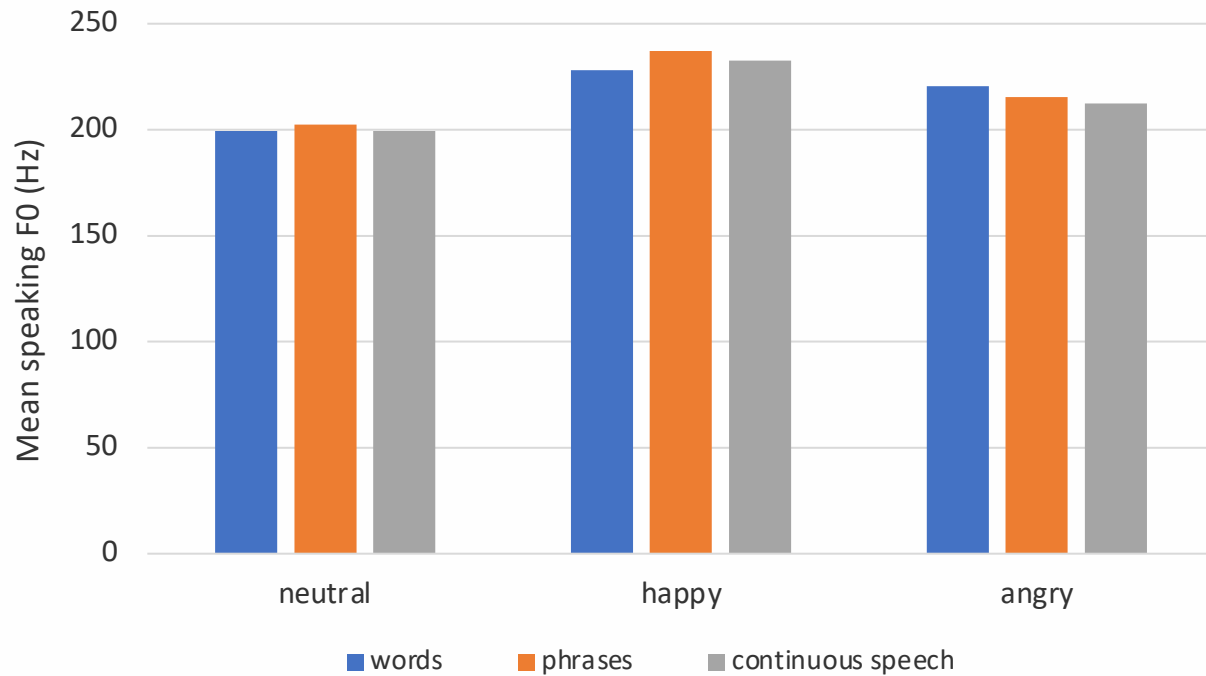
Each emotional state can be characterised by a specific acoustic profile (Hammerschmidt & Jurgens, 2007). Fundamental frequency (F_0) is an acoustic parameter that reflects biomechanical characteristics of vocal folds and is sensitive to affective (aversive and hedonistic) emotional states (Baken & Orlikoff, 2000; Hammerschmidt & Jurgens, 2007). The negative emotions expressed in the voice are accompanied by increased muscular activation. In contrast, positive and neutral emotions have resulted in fewer physiological changes (van Mersbergen et al., 2017).



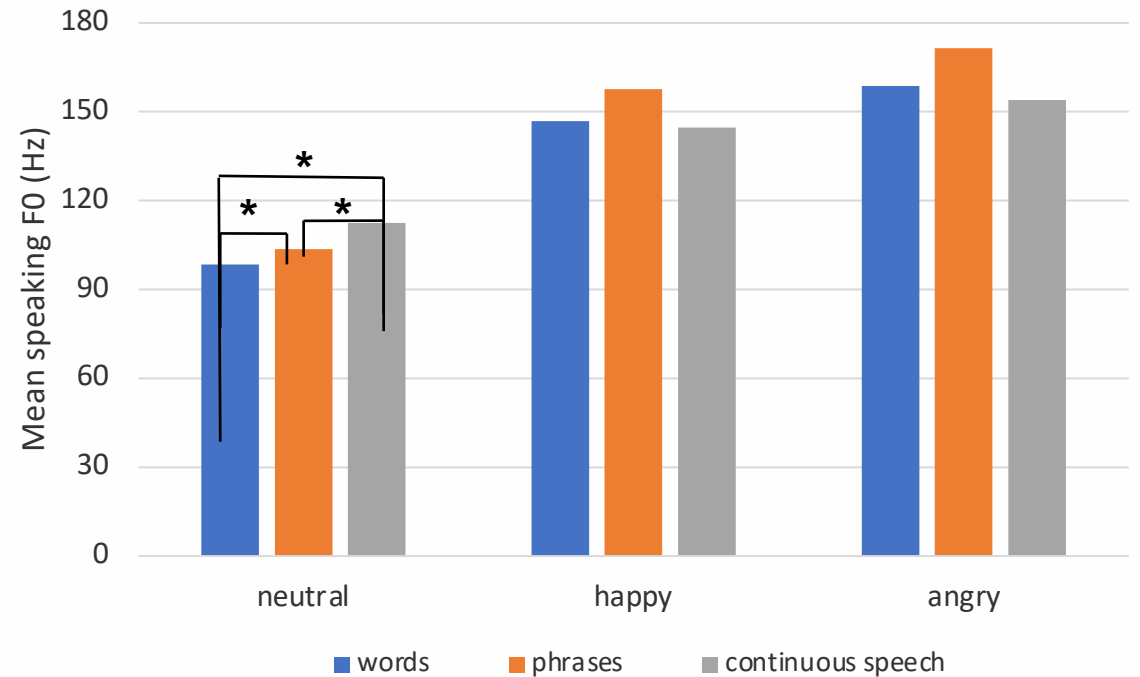
RESULTS I

The impact of neutral and affective prosody on F_0 in linguistic units of different complexity

Females (n = 5)



Males (n = 5)



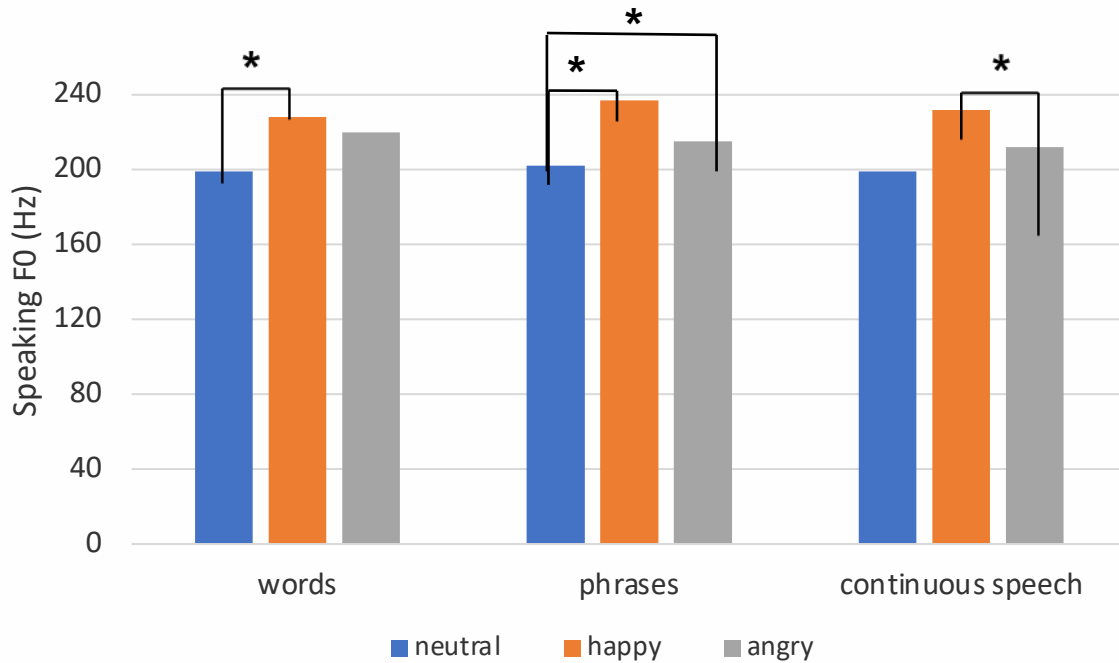
Statistically significant F_0 differences between neutrally spoken words, phrases and continuous speech for males

* $p < 0.05$ (Wilcoxon Signed Rank test)

RESULTS II

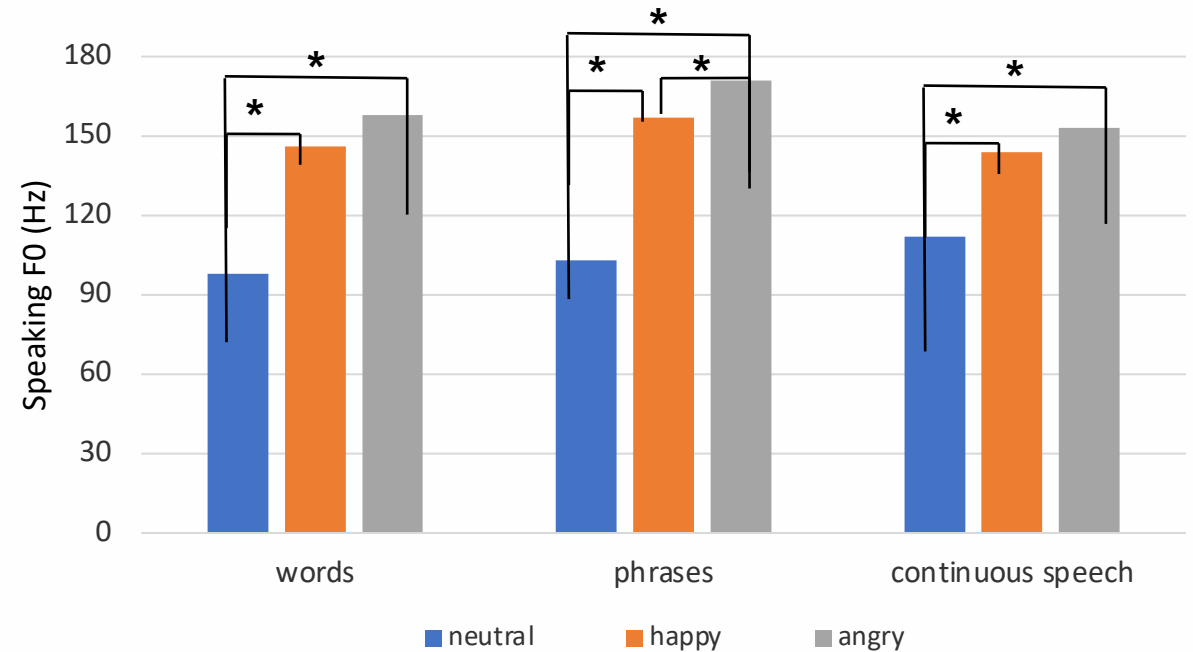
F₀ in words, phrases, and continuous speech produced in neutral, happy, and angry intonation

Females (n = 5)



- In females, neutral prosody F₀ significantly differed from 1) happy F₀ for words and phrases and 2) angry F₀ for phrases
- In addition, happy F₀ significantly differed from angry F₀ for continuous speech

Males (n = 5)




- In males, neutral prosody F₀ significantly differed from both types of affective prosody F₀ for all linguistic units
- In addition, happy F₀ significantly differed from angry F₀ for phrases

* p < 0.05 (Wilcoxon Signed Rank test)



CONCLUSIONS

- The results showed that affective prosody did not impact mean speaking F_0 in linguistic units of different complexity, such as words, phrases, and continuous speech.
 - The affective prosody increased speaking F_0 .
 - The differences in F_0 between neutral and affective prosody were observed in all components of linguistic hierarchy, from single words to continuous speech.
 - At the same time, differences in F_0 between happy and angry emotions were observed in a continuous speech in females and phrases in males.
 - Words and sentences are used in daily communication, and voice is the tool delivering it to the listeners. The recognition of the role of emotions in vocal output can improve the understanding of functional voice disorders.
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 2. Baken, R.J. & Orlikoff, R.F. (2000). *Clinical measurement of speech and voice* (2nd ed.). San Diego, CA: Singular Publishing Group.
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