



# F0 Acoustic Parameters Effects on Discrimination of Lexical Pitch Accents

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## 1 Introduction

- Robust acoustic parameters used to contrast pitch accent categories are F0 alignment and F0 height (Dilley and Heffner 2013, Kügler and Gollrad 2015, Grice et al. 2017).
- Problem1:** These pitch accent F0 parameters are important for signalling post-lexical pitch accents, but it has remained unclear whether the same F0 parameters would facilitate the perception of lexical pitch accents.
- Problem 2:** Very few studies investigated the perception of F0 acoustic parameters of lexical pitch accents by non-native listeners.

## 2 Present Study

- RQ1:** Is F0 height a robust parameter in perception of lexical pitch accents?
- RQ2:** To what extent are **non-native** listeners sensitive to F0 alignment and F0 height used to express lexical pitch accents?

## 3 Methodology

- Stimuli:
  - Four sentences in Serbian. Each carried a target lexical pitch accent.
  - Each target lexical item was manipulated so that F0 alignment and F0 height were altered, resulting in four versions of the stimuli:
    - Original
    - Alignment
    - Height
    - Alignment + Height
- Participants:
  - Speakers of English, Mandarin, and Persian - naïve non-native listeners.
  - Speakers of Serbian – native listeners.

## 5 Discussion

- RQ1:** Is F0 height a robust parameter in perception of lexical pitch accents?
  - F0 height** is a more robust parameter to Serbian lexical pitch accents than F0 alignment. F0 height significantly affected the reaction times, and the listeners were quicker to respond to the F0 height contrasts.
- RQ2:** To what extent are non-native listeners sensitive to F0 alignment and F0 height parameters of lexical pitch accents?
  - English and Mandarin are almost equally sensitive to Serbian lexical pitch accents as Serbian speakers. This aligns with some of the previous research on stress discrimination (Cutler 2008).
  - High-sensitivity levels could be attributed to Mandarin and English speakers' ability to perceive highly robust F0 cues to contrast tones and pitch accents, respectively.
  - Persian speakers' lower-sensitivity levels to manipulated F0 acoustic parameters could be because they are relying on **duration** rather than F0 parameters (Sadeghi 2011).

## 3 Methodology

- Word prosodies:
  - English – stress-accented language:
    - F0 alignment and F0 height, duration and intensity are important acoustic parameters of stress and pitch accents (Plag et al. 2011).
  - Mandarin – tone language
    - F0 height, slope, and direction indicate tone contrasts (Tupper et al. 2020).
  - Persian – (stress-accented language)
    - Duration is the most robust correlate of stress (Sadat-Tehrani 2009).
- Procedure:
  - AX discrimination task in PsychoPy3
- Data analysis
  - Generalized Estimating Equation (GEE) & Signal Detection Theory
  - Accuracy and Reaction Times were dependent variables, and F0 Parameters was an independent variable

## 4 Results

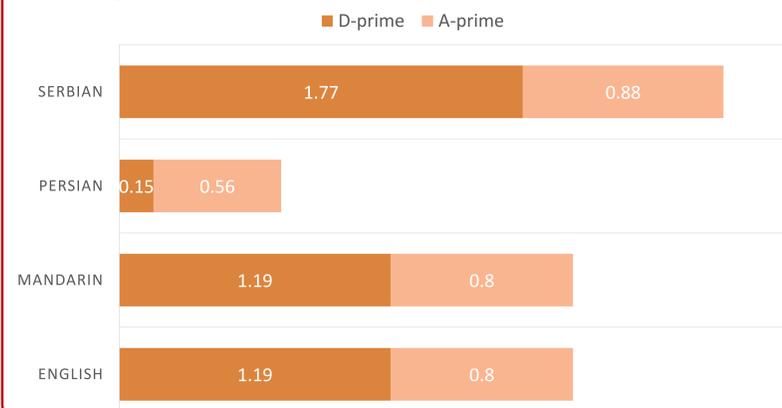
- GEE model summary on *Accuracy scores*

F0 parameters	B	SE	z-score	p-value
Alignment	- 2.656	0.51	15.8	< 0.01*
Height	- 1.946	0.49	27.2	< 0.01*
Alignment+Height	- 1.236	0.54	5.25	0.022*

- GEE model summary on *Reaction times*

F0 parameters	B	SE	z-score	p-value
Alignment	- 0.051	0.147	0.12	0.732
Height	- 0.246	0.115	4.58	0.032*
Alignment+Height	- 0.175	0.117	2.26	0.133

- Signal Detection Theory output



## References

- Cutler, A. (2009). Greater sensitivity to prosodic goodness in non-native than in native listeners. *The Journal of the Acoustical Society of America*, 125(6), 3522-3525.
- Dilley, L. C., & Heffner, C. (2013). The role of F0 alignment in distinguishing intonation categories: evidence from American English. *Journal of Speech Sciences*, 3(1), 3-67.
- Grice, M., Ritter, S., Niemann, H., & Roettger, T. B. (2017). Integrating the discreteness and continuity of intonational categories. *Journal of Phonetics*, 64, 90-107.
- Kügler, Frank, and Anja Gollrad. 2015. Production and perception of contrast: The case of the rise-fall contour in German. *Frontiers in psychology* 6, 1254.
- Plag, I., Kunter, G., & Schramm, M. (2011). Acoustic correlates of primary and secondary stress in North American English. *Journal of Phonetics*, 39(3), 362-374.
- Sadat-Tehrani, N. (2009). The alignment of L+ H\* pitch accents in Persian intonation. *Journal of the International Phonetic Association*, 39(2), 205-230.
- Sadeghi, V. (2011). Acoustic Correlates of Lexical Stress in Persian. In *ICPhS* (pp. 1738-1741).
- Tupper, P., Leung, K., Wang, Y., Jongman, A., & Sereno, J. A. (2020). Characterizing the distinctive acoustic cues of Mandarin tones. *The Journal of the Acoustical Society of America*, 147(4), 2570-2580.