

# Effects of Acoustic Parameters on Perception of Lexical Pitch Accents

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## 1. Introduction

- Non-native listeners often fail to discriminate contrasts of acoustic parameters of a phoneme if the phoneme is not used contrastively in their language.  
E.g: English speakers' difficulties with Hindi retroflex and dental stops (Werker et al. 1981).
- Iverson et al. (2003) found that one's native language alters perception but does not permanently preclude non-native listeners from perceiving contrasts between acoustic parameters.
- Very few studies investigated the perception of acoustic properties of **lexical pitch accents** (Wu et al. 2012). With the present study, I aimed to fill this gap by asking whether F0 acoustic parameters influence the perception of lexical pitch accents by non-native listeners.

## 2. Methodology

- I explored whether English (5)  
Chinese (2) } naïve participants;  
Persian (2)  
Serbian (2)

could contrast Serbian lexical pitch accents by relying on robust F0 acoustic parameters, **alignment** and **height** (as per Grice et al. 2017).

- English – stress-language
  - Chinese – tonal language
  - Persian – stress or pitch-accent language
  - **Serbian – pitch accent language**
- } different word-prosodic typology

- To that end, participants carried out an AX discrimination task in PsychoPy on spoken sentences recorded by two Serbian speakers. The sentences are listed below, and the target items are bolded.

1. Ovo je **linija** crvene boje. ('This is a red line.')
2. Ovo je **malina** crvene boje. ('This is a red raspberry.')
3. Ovo je **jalov** rad. ('This is the work of poor quality.')
4. Ovo je **javani** rad. ('This is a public work.')

- In Praat, I generated three additional versions of the original sentences, which involved modifications of the F0 peak alignment and height. Hence, there were four acoustic parameters that participants discriminated between:

1. Original (unmodified)
2. Alignment (moved F0 peak left or right)
3. Height (increased F0 peak height)
4. Alignment and Height (both parameters modified)

## 3. Results

- Data were analyzed with Generalized Estimating Equation (GEE), which is a data analysis method used for unbalanced and correlated data.
- Dependent variables were accuracy scores and reaction times, while the independent variables were **acoustic parameters** and **language groups**.

### Acoustic Parameters

- F0 alignment and F0 height were found to be reliable predictors of accuracy scores ( $\chi^2(9) = 123$ ,  $p < .001$ ) and reaction times ( $\chi^2(9) = 148$ ,  $p < .001$ ).

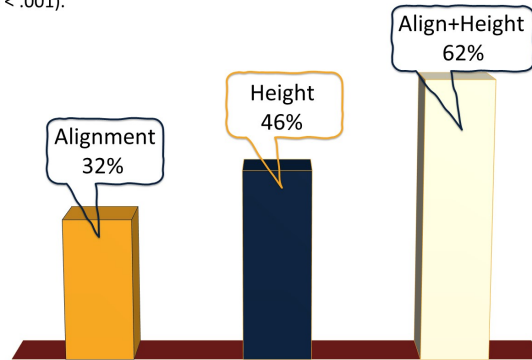


Figure 1. The percent correct on AX discrimination task

Table 1. The summary of the results obtained from the GEE model

Pairs	B	SE	$\chi^2$	p-value
Alignment - Height	-1.52	0.33	20.9	< 0.001
Alignment - Alignment+Height	-1.89	0.42	19.9	< 0.001
Height - Alignment+Height	-1.93	0.35	30.1	< 0.001

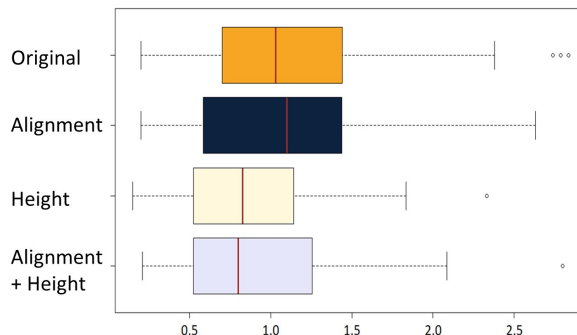


Figure 2. Reaction times per Acoustic Parameter

## Language Groups

- Based on **reaction times**, participants belonging to different language groups did not perform significantly different from each other.
- Based on **accuracy scores**, Persian listeners exhibited reliably lower scores than English and Serbian participants, while no differences were revealed between the rest of the groups.

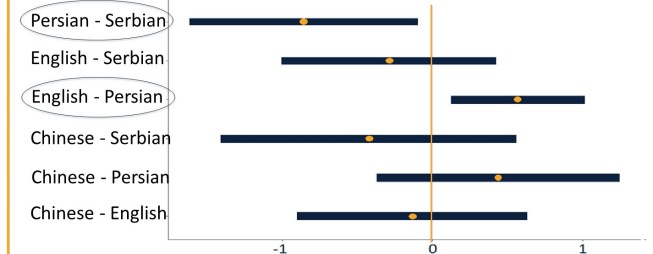


Figure 3. Confidence intervals of pairwise comparisons of EMMs

## 4. Conclusion

1. Listeners retain the ability to make distinctions between underlying acoustic parameters of unfamiliar lexical pitch accent categories (Werker & Tees 1984, Iverson et al. 2003).
2. Listeners are more sensitive to F0 height than to F0 alignment which yields greater perceptual prominence (observed by Grice et al. 2017, too).
3. Results obtained from Persian listeners suggest that the levels of processing of acoustic parameters are altered by one's native language inasmuch as acoustic contrasts that are allophonic in one's native language, but contrastive in a non-native language, are more difficult to perceive (Lively et al. 1993, p. 1253, Sadeghi 2008).

## 5. References

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