

# Voice Onset Time (VOT) and F0 of (im)plosives in Sindhi and Siraiki

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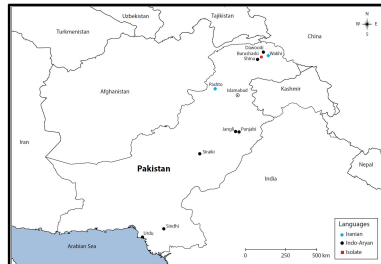
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## Background

- Voice Onset Time (VOT) and F0 have been widely used to classify different stop laryngeal categories (e.g., voiceless unaspirated vs. voiced unaspirated).
- Lisker and Abramson (1964): (a) short voicing lag (Thai voiceless unaspirated /p/), (b) long voicing lag (Thai voiceless aspirated /p<sup>h</sup>/), and (c) voicing lead (Thai voiced unaspirated /b/).
- These three measures of VOT are generally used to distinguish any type of stops.
- VOT does not categorize the voiced unaspirated, voiced aspirated, and voiced implosive stops (Abramson & Whalen, 2017; Davis, 1992; Lisker & Abramson, 1964).
- F0 onsets of the following vowels are better descriptors of stop laryngeal categories than VOT (Kirby & Ladd, 2016).
- Most of these studies are based on the major European languages.

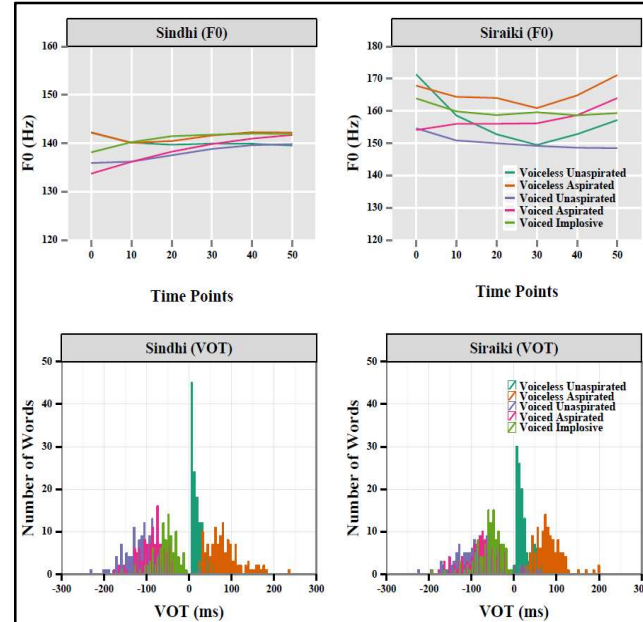


- Little or no data from languages with rich stop laryngeal categories.
- The aim of the current study is to investigate whether VOT and F0 reliably differentiate the stop laryngeal categories of (im)plosives in two scarcely documented Indo-Aryan languages, Sindhi and Siraiki.

## Methods

- Ten participants (five representing each language).
- Nonsense CV words: Sindhi /pa/, /p<sup>h</sup>a/, /ba/, /b<sup>h</sup>a/, /ba/ (five repetitions).
- 1,225 tokens were segmented in Praat (Boersma & Weenink, 2014).
- F0 was measured from the first half of the following vowel /a/ (0%-50%).
- VOT of the voiceless (un)aspirated stops: onset of stop release burst to the first glottal pulsing of the following vowel /a/ (Abramson & Whalen, 2017).
- VOT of the voiced (un)aspirated and implosive stops: onset of voiced closure to the onset of the stop release burst (ibid).

## Results



- Higher F0 onsets in voiceless (un)aspirated stops than three voiced categories.
- Voiced implosive stops showed higher F0 onsets than voiced (un)aspirated stops.
- In Siraiki, there were no clear patterns of F0 onsets in the two voiced (un)aspirated categories.
- However, both categories seemed to be well-differentiated from the mid-point (50%) of the following vowel.

- In both languages, voicing lag VOT was a reliable descriptor of the voiceless unaspirated and voiceless aspirated stops.
- VOT of the three voiced categories ((un)aspirated and implosives) overlapped.
- The acoustic correlates of stop laryngeal categories are multi-dimensional.

## Discussion & Remaining Issues

- There is no single acoustic correlate that can reliably differentiate *all* the stop laryngeal categories.
- Generalizations made based on data from major languages may, in some cases, have to be revised by providing data from smaller languages.
- Articulatory correlates of voicing and aspiration?

**References:** Abramson, A. S., & Whalen, D. H. (2017). Voice Onset Time (VOT) at 50: Theoretical and practical issues in measuring voicing distinctions. *Journal of Phonetics*, 63, 75–86; Boersma, P., & Weenink, D. (2014). Praat: Doing phonetics by computer. Version 6.0.30; Davis, K. (1994). Stop voicing in Hindi. *Journal of Phonetics*, 22, 177–193; Kirby, J. P., & Ladd, D. R. (2016). Effects of obstruent initial stops: Acoustical measurements. *Word*, 23, 384–422.

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