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

Qandeel Hussain
qandeel_hussain@ncsu.edu
Department of English (Linguistics Program), North Carolina State University, Raleigh

In the current phonetic literature, Voice Onset Time (VOT) and F0 have been widely used to classify different stop laryngeal categories (e.g., voiceless unaspirated vs. voiced unaspirated). In their cross-linguistic study on the voicing distinctions among the world's languages, Lisker and Abramson (1964) introduced three types of VOT: (a) short voicing lag (Thai voiceless unaspirated /p/), (b) long voicing lag (Thai voiceless aspirated /pʰ/), and (c) voicing lead (Thai voiced unaspirated /b/). These three measures of VOT are generally used to distinguish any type of stops. However, many studies have shown that VOT does not categorize the voiced unaspirated, voiced aspirated, and voiced implosive stops (Abramson & Whalen, 2017; Davis, 1992; Hussain, in press; Lisker & Abramson, 1964). Other studies have proposed that F0 onsets of the following vowels are better descriptors of stop laryngeal categories than VOT (Kirby & Ladd, 2016). 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).

Ten participants (five representing each language) were recruited from different cities across Pakistan. The mean age of the participants was 31 years (Sindhi) and 22.2 years (Siraiki). The participants were presented a list of nonsense CV words, where word-initial C represented all the stop contrasts in a given language (Table 1), followed by a long vowel /a/ (e.g., Sindhi: /pa/, /pʰa/, /ba/, /bʰa/, /ɓa/ etc.). The target nonsense words were presented to the participants in a modified Perso-Arabic script. Each target nonsense word was repeated five times. A portable Zoom H6 digital voice recorder with a built-in microphone was used to make audio recordings (44.1 kHz, encoded in 16 bit). A total of 1,225 tokens were segmented in Praat (Boersma & Weenink, 2014). Fourteen tokens were excluded due to background noise, mispronunciations, spirantization of voiced velar stops, and missing repetitions. F0 was measured from the first half of the following vowel /a/ (0%-50%). VOT of the voiceless (un)aspirated stops was segmented from the onset of stop release burst to the first glottal pulse of the following vowel /a/ (Abramson & Whalen, 2017). VOT of the voiced (un)aspirated and implosive stops was segmented from the onset of voiced closure to the onset of the stop release burst (ibid).

Figure 1 presents F0 trajectories (first row) and VOTs (second row) of the word-initial stops in Sindhi and Siraiki. The results indicated that, in both languages, the categories of voiceless unaspirated and voiceless aspirated stops had much higher F0 onsets than all the three voiced categories ((un)aspirated and implosives). Among the three voiced categories, the voiced implosive stops were characterized by 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. But all the three voiced categories ((un)aspirated and implosives) that were characterized by voicing lead VOTs, overlapped with each other. The results of the current study indicate that the acoustic correlates of stop laryngeal categories are multi-dimensional. There is no single acoustic correlate (VOT or F0) that can reliably differentiate all the stop laryngeal categories of Indo-Aryan languages.

Table 1. Stop laryngeal contrasts of Sindhi and Siraiki.

	Places of Articulation				
Languages	*Labial*	*Dental*	*Retroflex*	*Palatal*	*Velar*
Sindhi	p pʰ b bʱ ɓ	t̪ t̪ʰ d̪ d̪ʱ	ʈ ʈʰ ɖ ɖʱ ɗ	ʧ ʧʰ ʤ ʤʱ ʃ	k kʰ g gʱ ɠ
Siraiki	p pʰ b bʱ ɓ	t̪ t̪ʰ d̪ d̪ʱ ɗ	ʈ ʈʰ ɖ ɖʱ ɗ	ʧ ʧʰ ʤ ʤʱ ʃ	k kʰ g gʱ ɠ

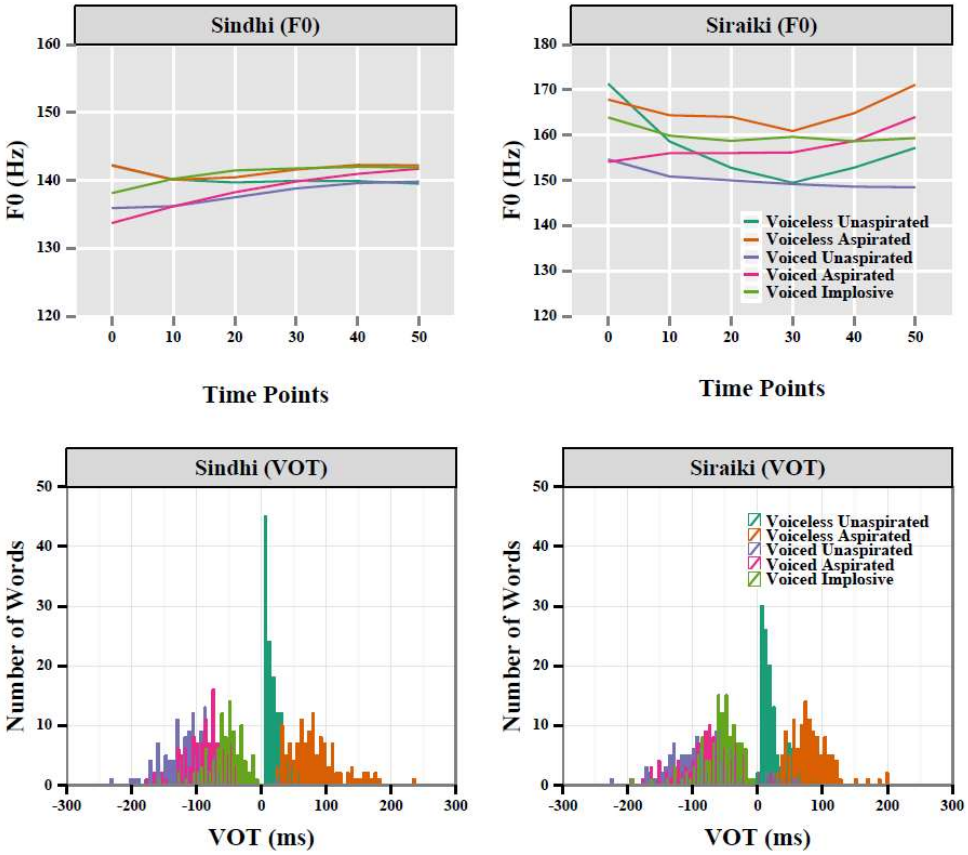

Figure 1. F0 trajectories (first row) and VOTs (second row) of five stop laryngeal categories in Sindhi and Siraiki (collapsed across places of articulation). X-axes on the first row represent different time points of the following vowel (0%-50%).

References

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