A preliminary ultrasound study of the retroflex contrast in Drenjongke

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Introduction

- Drenjongke is a Tibeto-Burman language spoken in Sikkim, India (Fig. 1) "Bhutia", "Lhoke" or "Sikkimese"

- Spoken by about 80,000 speakers in Sikkim

- Phonetics of Drenjongke have been studied in [4], [5], [6], [7] but many characteristics need further studies.

- **Goal of this study:**
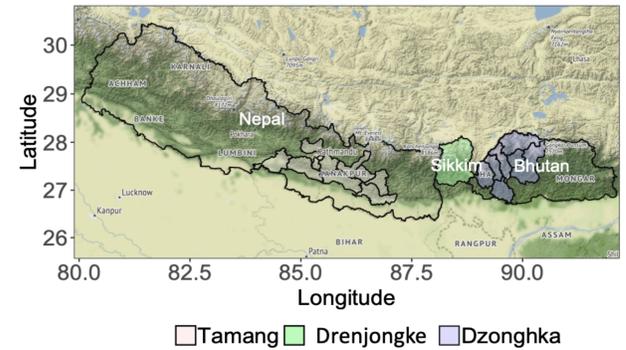 Observe the articulatory characteristics of retroflexes in Drenjongke.

Fig 1. Languages of the Himalaya

Drenjongke stops

- Drenjongke has a four-way laryngeal contrast: voiceless, aspirated, voiced and devoiced [2].

	aspirated	voiceless	voiced	devoiced
VOT	long	short	negative	variable
F0	high	high	low	low
F1	high	low	low	high

- It is observed in four major places of articulation: labial, alveolar, retroflex and velar.

- The devoiced category has a positive voice onset time (VOT), but lower fundamental frequency (F0) [6].

- In this study we examine the place difference between alveolar and retroflex for the four laryngeal categories.

Methods

- Data was collected in July 2019 in Gangtok, Sikkim, India.

- Participants wore a head-stabilizer, to which the ultrasound probe was placed under the chin. The Articulate Instrument system was used to collect data.

- Stimuli were syllables from the Drenjongke syllabary that begin with target consonants for this study:

	Voiceless	Aspirated	Voiced	Devoiced
Alveolar	ta	t^ha·	da	d'a
Retroflex	ʈa	t^ha	ɖa	ɖ'a

- Each item was repeated seven times

- Measurements were obtained by semi-automatically tracing the tongue position in frames that immediately precede the release for a plosive. The tongue trace data were then exported for an SSANOVA analysis [3], [8], [9].

Results of the SSANOVA analysis

- Retroflexion

  1. Compared to alveolars, the tongue body of retroflex consonants is placed in a higher position, suggesting that the tongue is raised.
  2. The tongue body is also more advanced in retroflexes.

- Laryngeal contrast

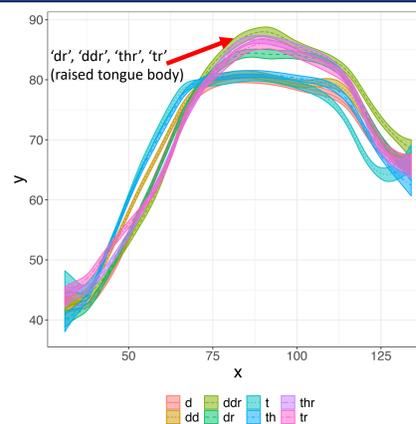 1. The tongue root is lower in voiced plosives, but maintains the retroflex difference (cf. [1])

Fig. 3 Tongue traces of speaker 106 by consonant type: alveolars vs. retroflexes. The tongue back is on the left side.
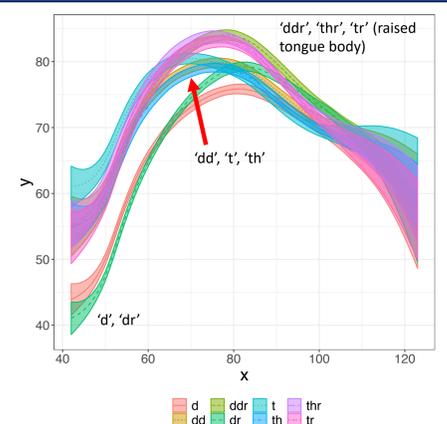
Fig.4 Tongue traces of speaker 108 by consonant type: alveolars vs. retroflexes. The tongue back is on the left side.

	Voiceless	Aspirated	Voiced	Devoiced
Alveolar	't'	'th'	'd'	'dr'
Retroflex	'tr'	'thr'	'dr'	'ddr'

Conclusion

- Individual differences emerge in the articulation of the retroflex consonants:
  - Speaker 106 displays enhanced contrast in the tongue body for retroflexion, but not for the laryngeal contrast.
  - Speaker 108 shows evidence of both the laryngeal contrast and retroflexion in the tongue shape.
- Future studies with more speakers will shed light on which of these two patterns is more common.

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