

PRODUCTION TASKS OF RETROFLEXES

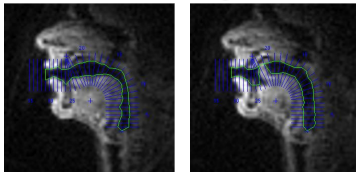
- Traditional view of retroflex consonants: maneuver-based production task (curling back of tongue tip for post-alveolar contact)
- Is goal of production based on maneuvering of articulators or the constrictions created by these articulators?
- Constriction-based task for retroflexes predicts variation in their achievement according to environment/state of vocal tract

DATA

- Speakers: three male, one female
- Carrier word form: pV_Vm, vowels /a/, /u/, /i/
- Target consonants: /d/ and /ɟ/
- Five repetitions for speakers 1, 2, and 3; three repetitions for speaker 4

IMAGE ACQUISITION & ANALYSIS

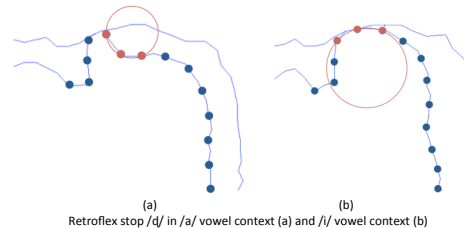
- Real-time MRI with view of entire vocal tract
- Temporal resolution: 33.18 frames per second
- Spatial resolution: 68 x 68 pixels (200 x 200 mm)
- Lay grid of ~30 lines orthogonal to vocal tract



- Air/tissue boundaries for upper and lower surfaces of vocal tract found for each gridline

MEASURING TONGUE CURVATURE

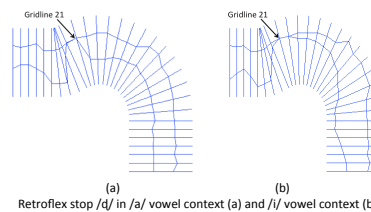
- Downsample tongue contour to fourteen evenly spaced points
- Calculate radius of circle passing through each set of three contiguous points along tongue



- Curvature score = $\frac{100}{\text{radius}}$
- Negative curvature score if circle lies outside plane of tongue (a)
- Positive curvature score if circle lies within plane of tongue (b)

RESULTS: CONSTRICTION LOCATION

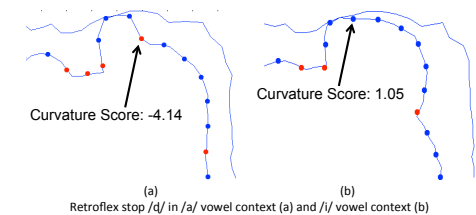
Constriction location does not vary between vowel contexts by more than one gridline (5-6 mm) (exception: speaker 1)



RESULTS: TONGUE SHAPING

- Little or no negative curvature (curling) along tongue blade during production of retroflex consonants in high front /i/ context
- Substantial negative curvature along tongue blade during production of retroflex consonants in back /a/ and /u/ contexts

Speaker	Mean Curvature Scores		
	/a/ Context	/u/ Context	/i/ Context
1	-6.27	-4.50	-0.77
2	-1.14	-0.79	0.30
3	-3.88	-4.37	0.77
4	-2.52	-1.98	-0.76
Mean	-3.56	-3.01	-0.044



CONSTRICTION-BASED TASKS

- Retroflex consonants in Tamil characterized by post-alveolar constriction achieved either through retroflexion or bunching
- Stable constriction location: post-alveolar constriction task remains the same
- Variable tongue configuration during formation of constriction: maneuvering to achieve a task is not specified