Articulatory Dynamics in a Tonal Language

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Introduction

- Tonal and non-tonal languages differ primarily in pitches, and the laryngeal system, jaw, and tongue play a role in this regard (Honda et al., 1999; Fromkin et al., 2014).

Need for the study

- Studies have used acoustical and physiological methods to gain insight into the variation in the laryngeal system for various tones in the Manipuri language (Shastri & Kumar, 2015; Moisik et al., 2014).
- However, no physiological study has reported the articulatory dynamics of any articulator, and hence, the present study assessed the tongue dynamics using Ultrasound.

Aim and Objectives

- To understand the tongue contours with objectives to obtain and compare the horizontal and vertical tongue dynamics across anterior, mid and posterior tongue regions between level and falling tonal counterparts.

Method

Participants

- 10 native speakers
- Above 18 years, with an equal number of males and females

- No history of cognitive, hearing, or speech-language and structural abnormalities

Materials

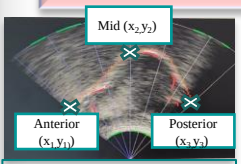
10 tonal words
(Singh, 2019; Devi & Das, 2021).

Tonal words	Level tone	Falling tone
1. Ee /i/	Blood	Thatch
2. Mee /mi/	People	Spider
3. Kang /kaŋ/	Mosquito	A kind of game
4. Thong /thoŋ/	Door	Bridge
5. Khong /khoŋ/	Leg	Canal
6. Sing /sIŋ/	Ginger	Firewood
7. Sam /sam/	A bamboo basket	Hair
8. Tai /taɪ/	Listen/hear	Fall
9. Ki /kI/	Fear	Tie
10. Lei /laɪ/	Flowers	Tongue

Instrumentation and Procedure

- The Mindray Ultrasound 6600 and Articulate Assistant Advanced (AAA) software were used to record and analyse the utterances at a 60-frame rate.
- The subject, after being seated comfortably on a chair, a long-handled 6.5MHz micro-convex transducer probe is positioned under the chin, followed by 10 repetitions of each stimulus.

Analysis



The anterior tongue is towards the right side, with x-axis tongue advancement and y-axis tongue height.

- Tongue contours were analysed in three points, i.e., tongue anterior, mid and posterior, where seven constant splines crossed the tongue contour at (x1, y1), (x2, y2) and (x3, y3) respectively.

Results

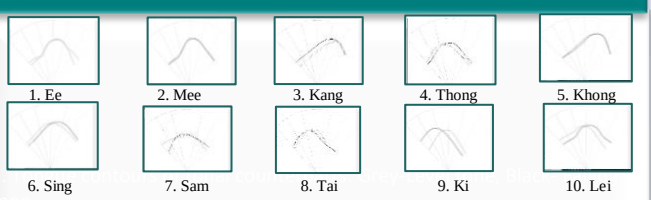


Figure 1. Tongue contours of tonal counterparts: Grey-Level tone, Black- Falling tone

Paired Samples Statistics

	Mean	Std. Deviation	Sig. (2-tailed)
MEANLXONE	366.75	16.11	0.68
MEANFXONE	371.83	19.80	
MEANLYONE	373.71	16.02	0.47
MEANFYONE	366.93	17.64	
MEANLXTWO	720.98	0.25	0.32
MEANFXTWO	715.98	10.04	
MEANLYTWO	680.90	48.50	0.09
MEANFYTWO	667.68	60.09	
MEANLXTHREE	1130.31	44.92	0.06
MEANFXTHREE	1145.27	36.34	
MEANLYTHREE	450.61	46.63	0.16
MEANFYTHREE	440.36	37.36	

- There were no significant differences in horizontal and vertical tongue dynamics between falling and level tonal counterparts.

Discussion and conclusion

- The present study provided insight into the involvement of articulatory dynamics in producing various tones of the Manipuri language.
- The retraction of the entire tongue contour for different vowels was seen in the present study, which is incongruent with Erickson et al.(2004) and Honda et al. (1999).
- However, their study indicated it as an association of pitch lowering; there were variations in tongue contours across vowels.
- Further investigation of vowel-specific at different positions with different consonants is required, as it is acoustically reasonable that retraction and lowering may unduly compromise for various vowels.

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