Research Question: Does online visual biofeedback improve learners' ability to produce non-native contrasts more than targeted phonetic instruction alone?

Methods

Syllable repetition task
- Audio of VCV and CV syllables by a native Marathi speaker
- Targeted C contrast: dental [ɖ] vs. retroflex [ʈ]
- V: [i, u, a]
- Participants instructed to repeat audio "as best as you can"

14 participants
- Native speakers of English with no experience of languages with dental/retroflex contrast
- Randomized into three experimental conditions: A (control), B (phonetic instruction) and C (visual biofeedback)

Ultrasound
- Ultrasound SonixTablet with C9-5/10 microconvex transducer
- Transducer secured under participants' chin using a stabilization headset
- Sagittal ultrasound recorded at 107fps with hardware synchronized audio

Results Overview

In keeping with previous literature, while increased phonetic training helps learners improve discrimination ability in non-native contrast production, the addition of visual feedback may provide learners with even greater improvement, at least in the short-term.

- Nearly all participants improved contrast production during the posttest compared to baseline pretest syllable repetition task.
- Improvement in condition B (visual biofeedback) greater than in A (control)
- Improvement in condition C (visual biofeedback) greater than in B

Future directions

Application to L2 pedagogy
- Are some types of contrasts more easily trained using visual feedback or phonetic instruction than others?
- Is the articulatory contrast that our participants are learning truly a dental vs. retroflex contrast, or are they simply learning to make some contrast?
- Acoustic analysis: in what way are the contrasts acoustically distinct?
- Auditory/perceptual analysis: do speakers of a language with the contrast perceive the contrast?
- Long term effects: do participants retain their ability to produce the contrast?

Analysis

Data post-processing
- Syllable productions marked for acoustic stop release in Praat (Boersma and Weenink, 2016)
- Principal Components Analysis run on ultrasound frames from point of stop release, using raw (non-interpolated) ultrasound data

Contrast improvement calculation (within subject)
- A Linear Discriminant Analysis (LDA) was trained on first 4 PC loadings from the PCA, labelled by place of articulation (dental vs. retroflex)
- LDA used to classify articulations as dental or retroflex, and discriminability calculated as proportion correct place identification
- Degree of improvement calculated as difference in proportion discriminability between pretest and posttest

References