Ultrasound-Enhanced Multimodal Approaches to Pronunciation Teaching and Learning

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Second Language (L2) Pronunciation

• A key thing for learners to master as part of communicative competence

• However
  – It’s hard to teach
  – There usually isn’t enough classroom time
  – Experimental research on good techniques is lacking (see e.g., Munro & Derwing 2015)
L2 Pronunciation: Articulation Challenges

• Learners often have to infer how articulation works in unfamiliar sounds, e.g.,
  – English L1 speakers learning Japanese -confirm- ‘ra’
  – English L1 speakers learning velar [x] or uvular [χ] fricatives

• Often difficult to extrapolate what articulation might be from acoustic input only (e.g., Wilson & Gick 2006)
L2 Pronunciation: Multimodal Teaching Tools

• Tools that involve more than one sense modality – e.g., hearing and sight – can help with the articulation learning difficulty

• Ultrasound provides a particularly useful way of visualizing articulations
  – Safe
  – Non-invasive
  – Quick
  – Increasingly affordable
The eNunciate Project

• A collaboration between the Linguistics department and the Japanese language program (Asian Studies department) at UBC
• Developing multimodal pronunciation teaching/learning resources
• Key feature: Ultrasound Overlay Videos

http://enunciate.arts.ubc.ca/
Ultrasound Overlay: Procedure

1. Double-Simultaneous Recording
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2. Trimming/Alignment of Face Video and Ultrasound
Ultrasound Overlay: Procedure

3. Erasing and colouring ultrasound image
Ultrasound Overlay: Procedure

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Ultrasound Overlay: Procedure

4. Overlaying ultrasound and video
Ultrasound Overlay: Procedure

5. Final result

Video of Voiceless Uvular Fricative
eNunciate Shared Content

• Introductory Videos
  – Introduction to Phonetics
  – Introduction to Ultrasound in Phonetics
eNunciate Linguistics Content

• Clickable IPA Charts
  – Pulmonic Consonants (non-pulmonic in progress)
  – Vowels
Voiceless Alveolar Stop (Lower-case T)

Instructions:
Articulator: tip of the tongue
Point of Articulation: alveolar ridge
Manner of Articulation: (Oral) Stop – A complete closure is made between the articulator and the point of articulation. Since the oral passage is blocked, air pressure builds up in the mouth. When the closure is stopped, an abrupt release occurs.
Voice: voiceless – vocal folds are apart and are not vibrating.
eNunciate Japanese Content

• Clickable Hiragana Chart
• Instructional Videos
  – Challenging Sounds (informed by learners’ L1s)
  – Intonation
• Practice Videos
  – Challenging Sounds
eNunciate Japanese Content: Influence of Learners’ L1s

L1 Chinese

Voiced vs. Voiceless

L1 Korean

Voiced vs. Voiceless

Za vs. Ja

Tsu vs. Chu
eNunciate Japanese Content: Influence of Learners’ L1s

L1 Cantonese
  Shi vs. Si

L1 English
  Japanese R
  Tsu vs. Su
  Rya, Ryu, Ryo
Implementation in Linguistics

- Currently being used in 4 introductory- and upper-level (phonetics-oriented) Linguistics courses
  - 100 (Introduction to Language and Linguistics)
  - 101 (Languages of the World)
  - 200 (Linguistic Theory and Analysis I)
  - 313 (Introduction to Linguistic Phonetics and Speech Science)
Implementation in Japanese

• Used in Japanese 102/103 (Beginning Japanese IIA/B) (Summer 2015)
  – Responses very positive!

• Currently being used in Japanese 102 (Fall 2015)
  – Three sections: traditional pronunciation instruction (shadowing, practice with audio), eNunciate (watch videos and do practice), eNunciate + ultrasound feedback session
Currently In Progress:
Biovisual Feedback Tools

• Real-time tools to provide feedback on both prosody and articulation accuracy
• “research on adult second language acquisition indicates that corrective feedback from teachers, peers or native speakers makes adult learners notice the discrepancies between their output and the L2...an awareness which mere exposure to the L2 does not guarantee.” (Neri et al. 2002)
L2 Pronunciation: Visual Feedback

- Over the past half-century, using various kinds of visual feedback to enhance L2 pronunciation learning has been explored
  - Prosody/intonation feedback (e.g., Vardanian 1964; de Bot 1980; Chun et al. 2008)
  - Ultrasound feedback for articulation (e.g., Gick et al. 2008; Pillot-Loiseau et al. 2015)
Biovisual Feedback Tools
For Prosody and Articulation

• Online prosody visualizer
  – Currently a number available through software packages, but nothing online

• Real-time interactive tongue visualizer using ultrasound overlay videos
  – To be implemented in a pronunciation station using portable ultrasound
Future Directions

- Expanding to more languages
- Creating a pronunciation resource hub for UBC
- Mobile real-time interactive tongue visualizer?
Thank You!
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References


References
