

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 ら '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



Ultrasound Overlay: Procedure

1. Double-Simultaneous Recording



Ultrasound
probe

Ultrasound Overlay: Procedure

1. Double-Simultaneous Recording



Video Camera

Ultrasound Overlay: Procedure

1. Double-Simultaneous Recording



Audio
Recording



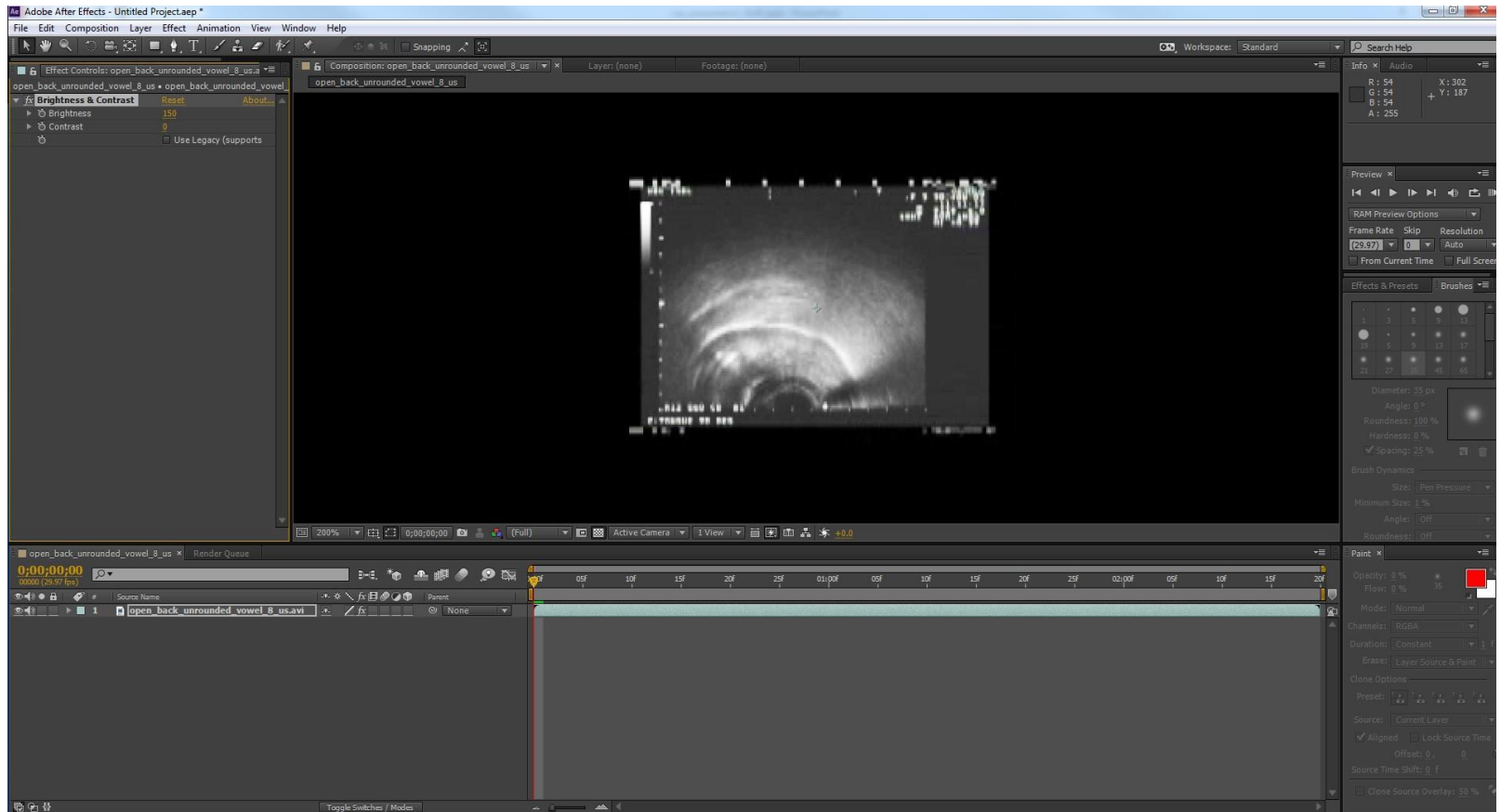
Ultrasound Overlay: Procedure

2. Trimming/Alignment of Face Video and Ultrasound



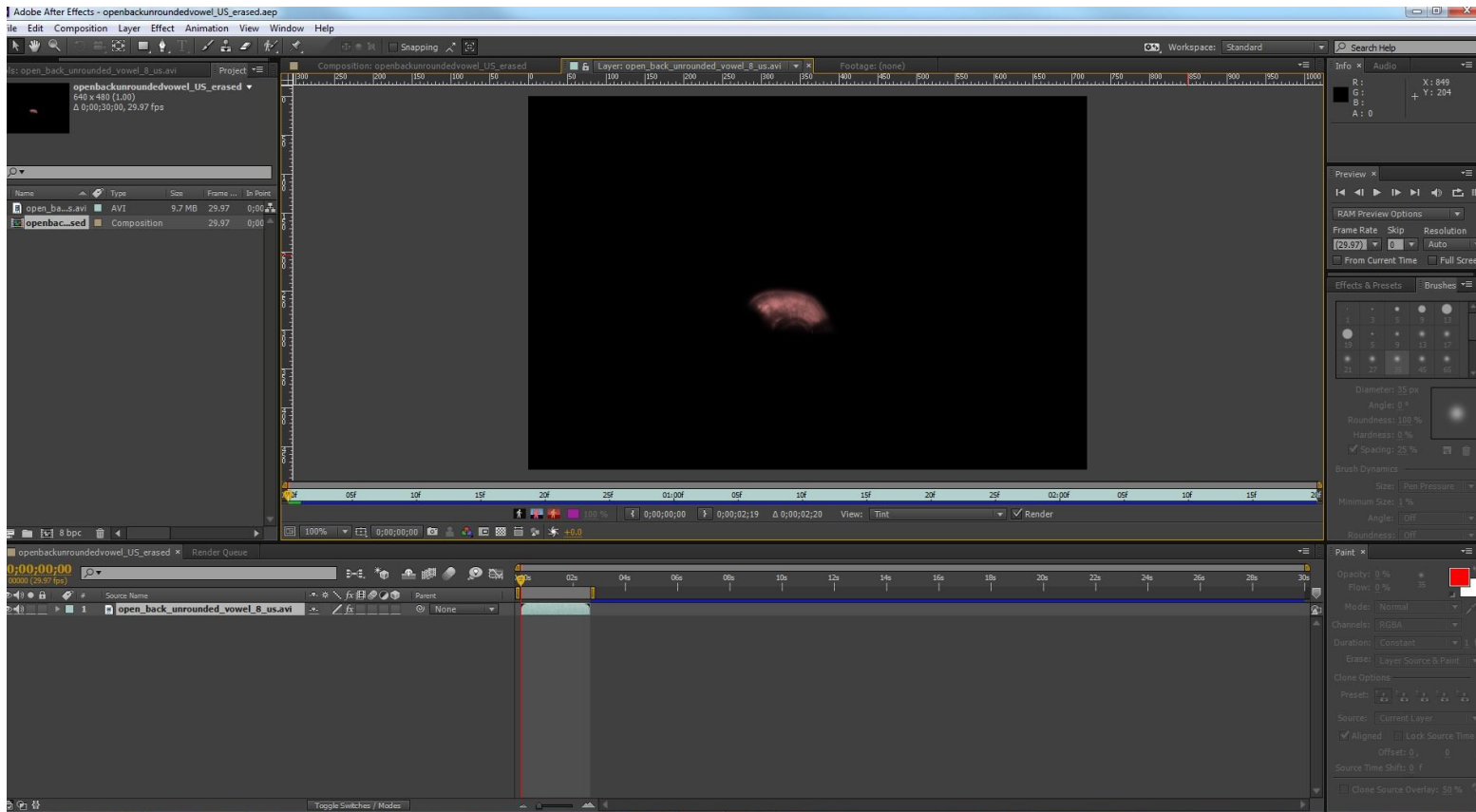
Ultrasound Overlay: Procedure

3. Erasing and colouring ultrasound image



Ultrasound Overlay: Procedure

3. Erasing and colouring ultrasound image



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

Home / Linguistics / The IPA Chart / Consonants (Pulmonic)

Consonants (Pulmonic)

[Linguistics Home](#) [Definitions](#)

All English Sounds are highlighted in green. Please note that some pages may be incomplete.

	Bilabial		Labiodental		Dental		Alveolar		Postalveolar		Retroflex		Palatal		Velar		Uvular		Pharyngeal		Glottal		
	-V	+V	-V	+V	-V	+V	-V	+V	-V	+V	-V	+V	-V	+V	-V	+V	-V	+V	-V	+V	-V	+V	
Plosive	p	b					t	d					ʈ	ɖ	c	ɟ	k	g	q	ɢ		ʔ	
Affricate												tʃ	dʒ										
Nasal		m		ɱ				n					ɳ	ɲ		ŋ		ɴ					
Trill								r										ʀ					
Tap or Flap				v				r					ɽ										
Fricative	ɸ	β	f	v	θ	ð	s	z	ʃ	ʒ	ʂ	ʐ	ç	ʝ	x	χ	ħ	ʁ		ħ	ʕ	h	ɦ
Lateral fricative								ɬ	ɮ														
Approximant		(w)		ɸ				ɹ					ɻ	j		ɰ	(w)						
Lateral approximant								l					ɭ	ʎ	ʟ								

-V Voiceless consonant +V Voiced consonant English sounds Shaded areas denote articulation judged impossible

Current chart, a derivative version of the original IPA, was created with permission from the International Phonetic Association. For more information on copyright and Creative Commons Licensing, please visit here.

eNunciate Linguistics Content

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eNunciate!

ARTS Home About Japanese Linguistics

Home / t

/t/ Voiceless Alveolar Stop (Lower-case T)

[← Go Back to Chart](#)

till petunia bat



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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