

Ultrasound Overlay Videos and their Application in Indigenous Language Learning and Revitalization

Heather Bliss, Strang Burton, Bryan Gick

The University of British Columbia

Acknowledgements

- We gratefully acknowledge that we are on the unceded territory of the Musqueam, Squamish, and Tsleil-Waututh First Nations
- Sincere thanks to Noreen Breaker, Lou Claxton, Ashlee Cooper, Natalie Creighton, Shirlee Crowshoe, Emmeline Felix, Nick Henry, Tiffany Joseph, Katia Olsen, and Elizabeth Phillips for sharing their languages with us
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Ultrasound in L2 acquisition



- L2 learners make use of both auditory and **visual** information to acquire new sounds
- Ultrasound has been demonstrated to be an effective tool for facilitating visualization of the articulatory processes involved in speech production
- With ultrasound, learners can...
 - ... directly observe their articulator movements
 - ... compare them with those of an instructor or native speaker
 - ... make articulatory adjustments to improve their pronunciation
- Challenges:
 - Best used in one-on-one contexts or with small groups
 - Interpreting the displays requires specialized knowledge



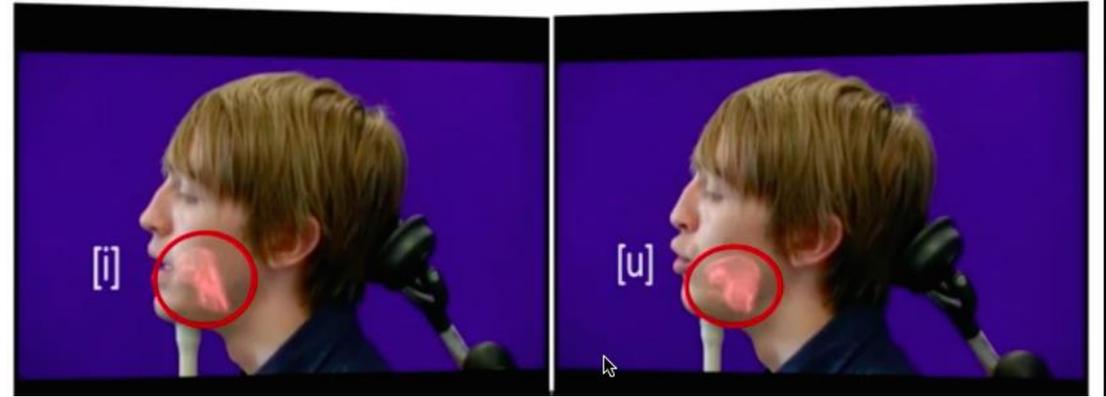
Meeting the challenges

- **Ultrasound overlay videos**

- combine ultrasound images of tongue movement in speech with external profile views of a speaker's head
- accessible and interpretable to a broader audience
- can be used in online, blended, and/or flexible learning paradigms

- **Video library (enunciate.arts.ubc.ca)**

- 91 videos, corresponding to each sound in the IPA
- Intended users: university-level linguistics students and learners of widely studied languages such as Japanese, French, Spanish, German, etc..



Ultrasound overlay videos for Indigenous languages

- Unexpected outcome
 - Broad and unsolicited interest from First Nations communities and allies
 - Recognition of the potential benefits of using this technology in Indigenous language learning and revitalization
- Our response: Customization
 - Developing strategies to streamline the overlay process
 - e.g., Custom-made software package to automate ultrasound overlay
- This talk: **Case studies** on our work-in-progress on developing ultrasound overlay video resources for Indigenous languages in West Canada

Case Study #1: Halq'eméylem (Coast Salish)

- One L1 speaker (Elizabeth Phillips)
- Rich consonant inventory, including plain, ejective, and labialized obstruents at various places of articulation.
 - Many contrasts that are challenging for learners (mostly L1 English)
 - We recorded near-minimal pairs that highlight the challenging contrasts



Photo credit: Cara McKenna, APTN

Contrast	Word 1	Word 2
Plain/Ejective	tá:l qwélqwel	t'á:l qw'él
Alveolar/Dental	tale	th'ále
Velar/Uvular	k'ák'elha	q'áq'el



kweltó:l
“to wrestle”



qwát
*“to drill a
hole”*

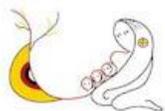
- The intention is to use the resulting ultrasound overlay videos in the production of digital storybooks for language teaching purposes

Case Study #2: Secwepemc (Interior Salish)

- Rich phonetic inventory that poses challenges for learners
- Splatsin Tsm7aksaltn has produced a resource that exemplifies the sounds of the language with words from the Eastern dialect
- Ultrasound overlay videos will supplement these resources



FirstVoices
Splatsin (Eastern dialect) Community Portal



YouTube
Search

Sounds of the Secwépemc Language
The Splatsín Dialect

0:05 / 32:17

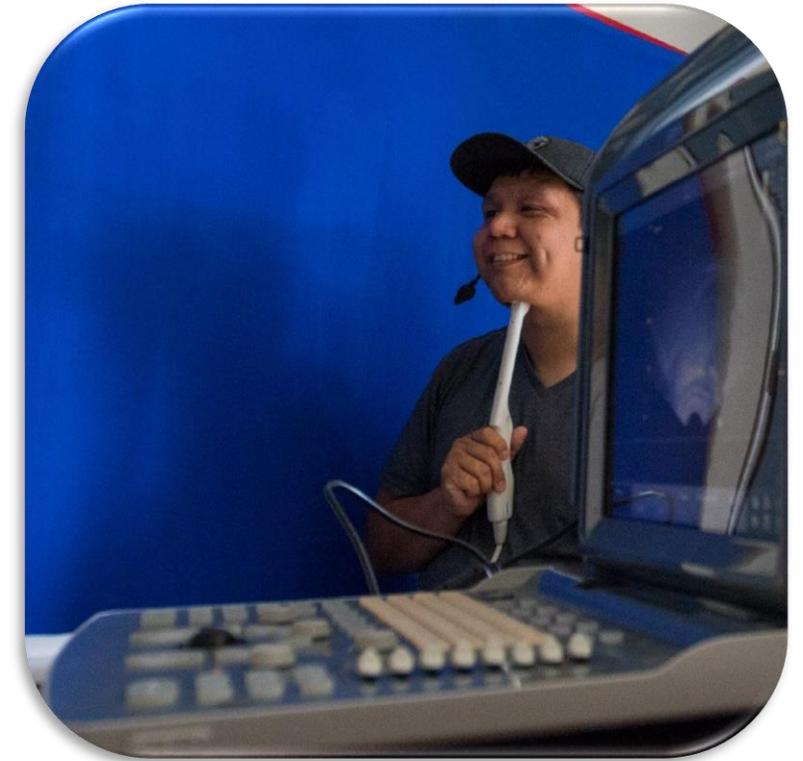
Splatsin - Sounds of the Secwepemc Language
Splatsin Tsm7aksaltn



- We are collaborating with the community to develop ultrasound overlay videos
- Not only a teaching tool, the videos can inform our understanding about the **phonetic inventory** of the language
- Ultrasound can help clear up some confusion about under- or mis-documented sounds
 - e.g., **orthographic “r”** is described as velar (same place of articulation as “k”)
 - but early impressions from ultrasound suggest otherwise (uvular/pharyngeal)

Case Study #3: SENĆOŦEN (Northern Straits Salish)

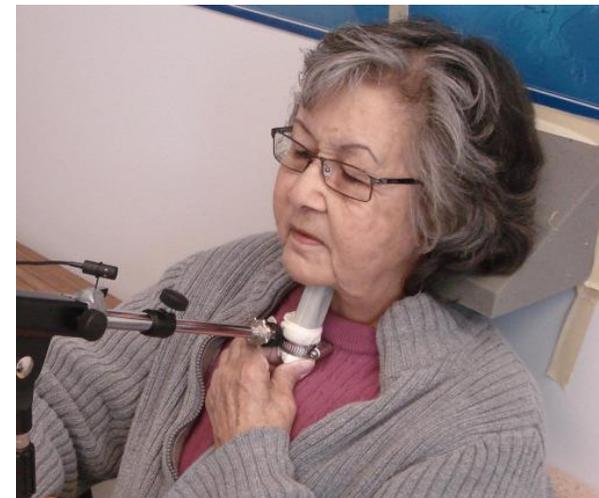
- Few L1 speakers, but vibrant language revitalization program, including language nest & immersion school
- Pronunciation regarded as important; learners need to develop “SENĆOŦEN muscles” [3]



Collaboration and capacity-building

- We are working with language apprentices to create ultrasound overlay videos
- This project aims to build capacity and expertise for language resource development within the community
- Apprentices selected words that illustrated challenging sounds and clusters, as well as early vocabulary such as numerals
- Recorded productions of one L1 speaker, four advanced adult learners (the apprentices), and two children in the immersion program
- Resulting educational resource is intended for use by parents whose children are in the immersion program

Case Study #4: Blackfoot (Plains Algonquian)



- Focus: **word-final vowels** /-a/ and /-i/
 - Seen as emblematic of language loss
 - Assumed to be absent in the grammars of younger speakers and/or disappearing from certain dialects [4, 6]
- **Variation** across speakers
 - *Voiceless*
 - *“Soundless”* -- for some speakers, the vowels are articulated but inaudible [7]
 - *“Ghosts”* -- for other speakers, they are not articulated at all, but are nevertheless phonologically active
- This variation – and the fact that they are auditorily “weak” – makes the vowels challenging for learners
- We are developing ultrasound overlay videos with speakers of **three dialects** in order to help learners understand the range of variation in pronunciation

Discussion

- Challenges of pronunciation learning can be compounded for Indigenous languages
 - scarcity of resources (including small numbers of speakers)
 - pressures faced by heritage learners to preserve their ancestral language in an authentic way
 - latent speakers may be inhibited due to perceived concerns with their pronunciation, particularly in the presence of elders
- Ultrasound overlay videos
 - ...may give learners a new way to learn pronunciation
 - ...create documentation for future generations

Future Directions

- Evaluation

- Few studies evaluating effectiveness of ultrasound overlay videos in L2 learning
- No studies on their effectiveness in Indigenous language learning

- Other languages

- Expressions of interest from communities and allies for the following languages:
 - Heiltsuk
 - Hul'q'umi'num'
 - Kwak'wala
 - Skwxwu7mesh



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