Acoustic Phonetics & Language Revitalization in the Hul'q'umi'num' Community

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Project Team and Support

- Hul'q'umi'num' Elders: Ruby Peter, Delores Louie, Merle Seymour
- SFU Masters in Linguistics of a First Nations Language (Hul'q'umi'num')
- Dr. Donna Gerdts, Simon Fraser University
- Dr. Sonya Bird, University of Victoria
- SSHRC, including Partnership Development Grant #890-2017-0026

SIMON FRASER UNIVERSITY

University of Victoria

Social Sciences and Humanities Research Council of Canada
Conseil de recherches en sciences humaines du Canada
Canada

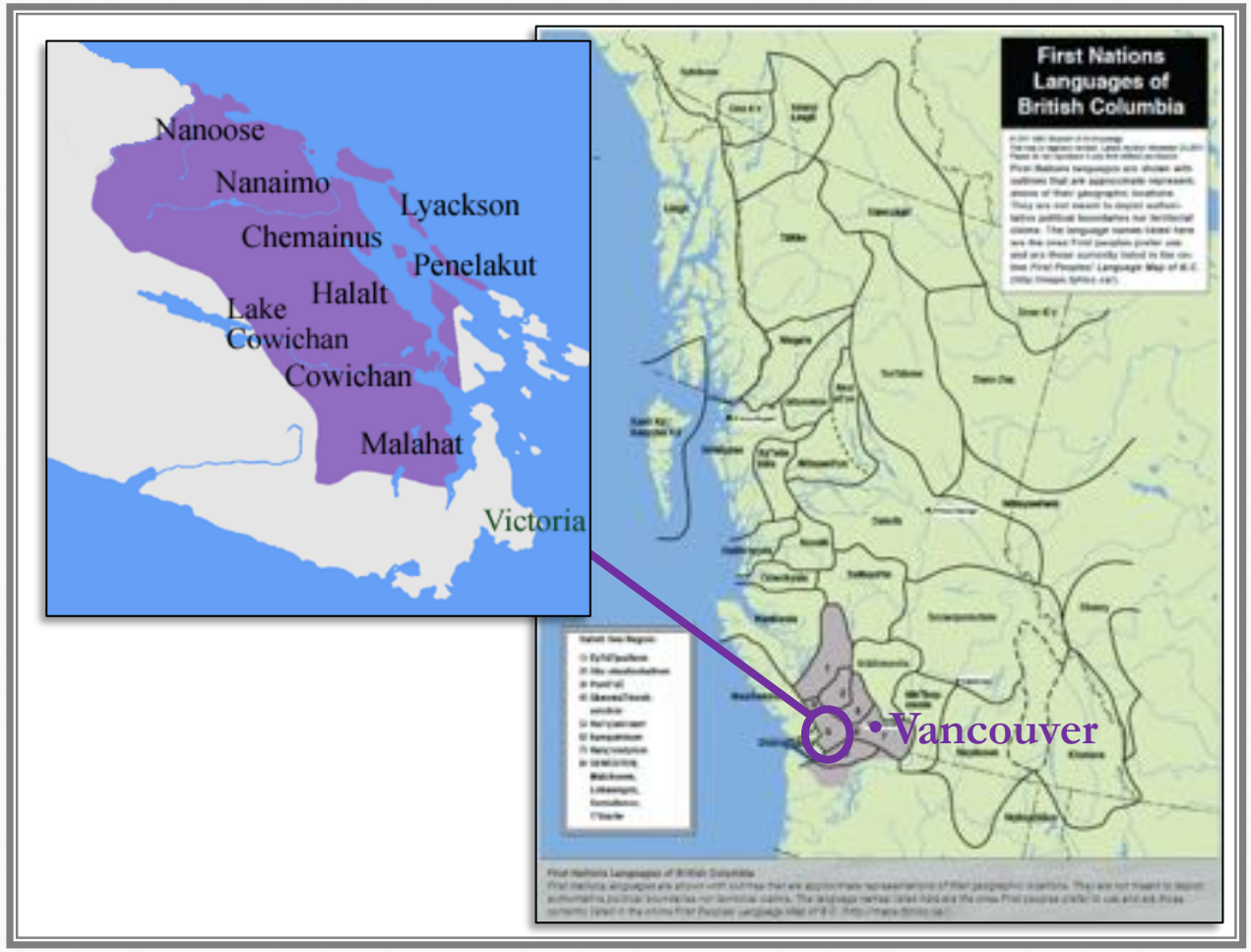
Overview

Production differences observed in vowel-glide sequences between Hul'q'umi'num' L1 and L2 speakers

Acoustic phonetic analysis reveals particular differences related to duration, formant trajectories, and acoustic intensity

Findings attributable to a variety of potential factors

Results offered to Hul'q'umi'num' community for use in ongoing language revitalization project



The Hul'q'umi'num' Language

- Hul'q'umi'num' territory extends along the western Salish Sea, on southeastern Vancouver Island and neighbouring islands
- Hul'q'umi'num' = "Island Halkomelem"

The Hul'q'umi'num' Language

- Salishan language, Central Salish branch
  - Four other branches: Tsamosan, Interior Salish, Bella Coola, Tillamook
  - Central & Tsamosan speakers often identified as "Coast Salish"
- Approximately 40 remaining first language speakers
- Over 200 fluent second language speakers and over 1,000 learners of all ages
- Many learners currently at intermediate levels of proficiency and ready to tackle the more complex aspects of the language, including pronunciation details

The Hul'q'umi'num' Revitalization Project

- Strong interest but limited resources in teaching & learning 'authentic' pronunciation
- Popular pedagogical approaches don't emphasize pronunciation
- Descriptions of pronunciation rare & often inaccessible
- Few opportunities for learners to interact with fluent speakers

The Hul'q'umi'num' Revitalization Project

- Project goals:
  1. Document pronunciation features of L1 and L2 speakers
  2. Work with elders, teachers, learners to identify perceived challenges for learners
  3. Find ways to best overcome these challenges
- This study is part of the first project goal, documenting pronunciation differences

Research Questions

1. What kinds of differences exist between Hul'q'umi'num' L1 and L2 pronunciations of vowel-glide sequences?
2. From a technical standpoint, how best to document such differences?
3. How can such documentation contribute to pedagogy?

Participants & Recording Procedure

- 1 female L1 speaker, 15 female L2 speakers
- Ages: 20s to 60+
- Recordings made as part of a "pronunciation test" exercise (April 2018) with Hul'qumi'num' Language Academy students (SFU-based)
- *Repetition task*: elder and learners repeated each word twice in sequence
- Recordings made with: Audacity, Yeti USB microphone in cardioid mode, Apple iMac, saved as 48 kHz, 16-bit uncompressed .wav

Vowel/ Sequence	Word	
[ew]	/sqəʾlʾewʾ/	*beaver*
[ej]	/sq^{w}əʾmejʾ/	*dog*
[e]	/ʾleləmʾ/	*house*
[eː]	/ʾʔeːʾnθə/	*me*

Materials

- Single words selected for each desired vowel/sequence
  - Ideal phonetic environments not always available
- Monophthongal /e, eː/ included for comparison
- Apostrophes indicate glottalization
  - Plain glides unavailable
- N=240 tokens analyzed

Sample Tokens

01	02	03	04
/sqəʾlʾewʾ/	/sqʷəʾmejʾ/	/ʾleləmʾ/	/ʾʔeːʾnθə/
[ew]	[ej]	[e]	[eː]

Acoustic Analysis

Praat: token segmentation

- Praat script (Xu 2015) used to extract duration, and formant & intensity data at 5% intervals

R: statistical testing & modeling

- Generalized Additive Models (GAMs) used for statistical comparisons of dynamic non-linear patterns e.g. formant trajectories over time

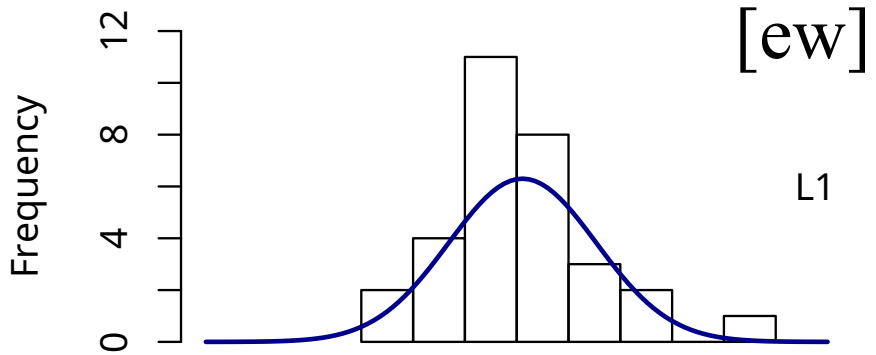
Results: Overview

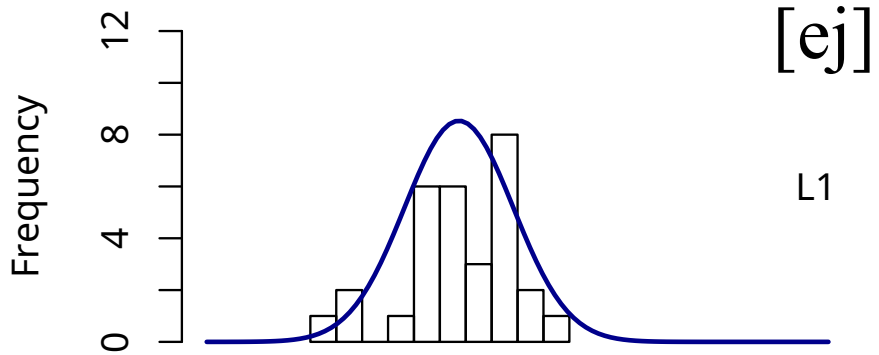
- Primary focus = vowel-glide sequences
- Three areas of comparison:
  1. Duration
  2. Formant trajectories
  3. Intensity contours

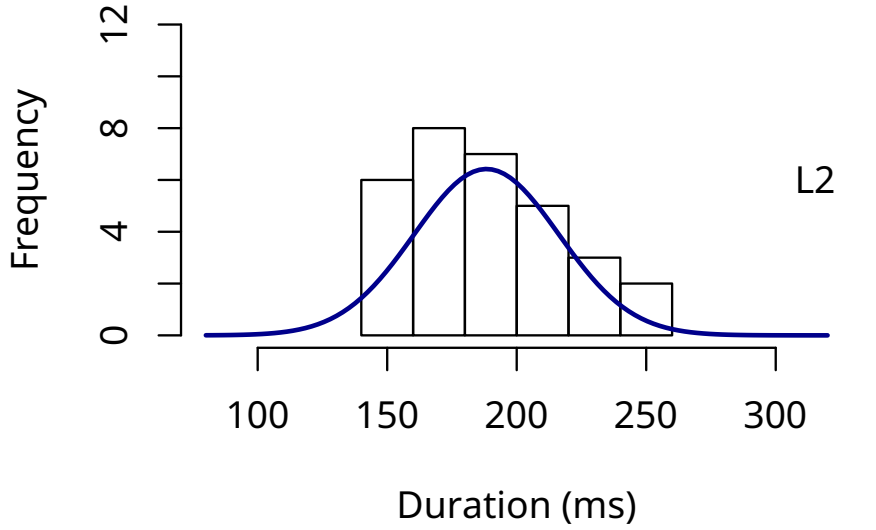
Vowel	L1 Duration (s.d.)	L2 Duration
[ew]	202.2 (28.5) ms	188.3 (28) ms
[ej]	177.3 (21) ms	153.5 (34.5) ms
[e]	160.8 (15.3) ms	163.2 (39.1) ms
[e:]	202.9 (28.4) ms	197.9 (45.4) ms

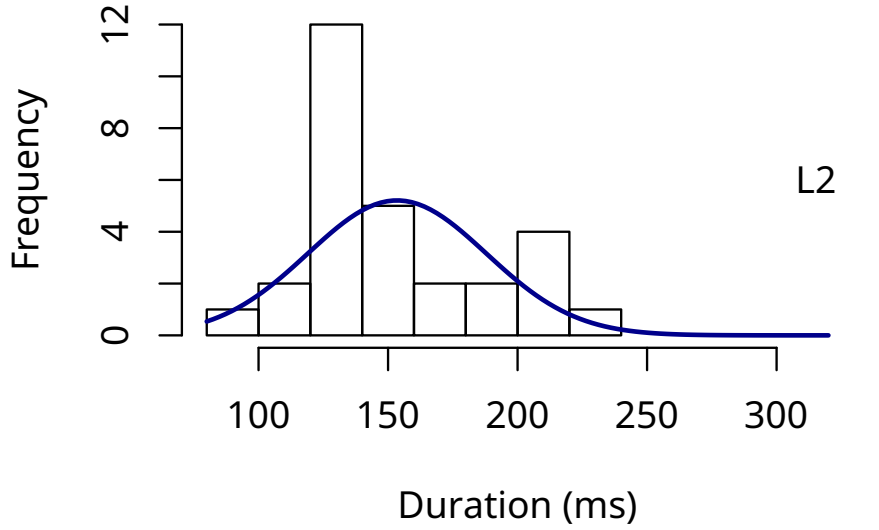
Duration

- L2 learners produce less extreme durations
- [ej, ew, e:] are shorter
- [e] is (slightly) longer


[ew]
L1
Frequency
0
4
8
12

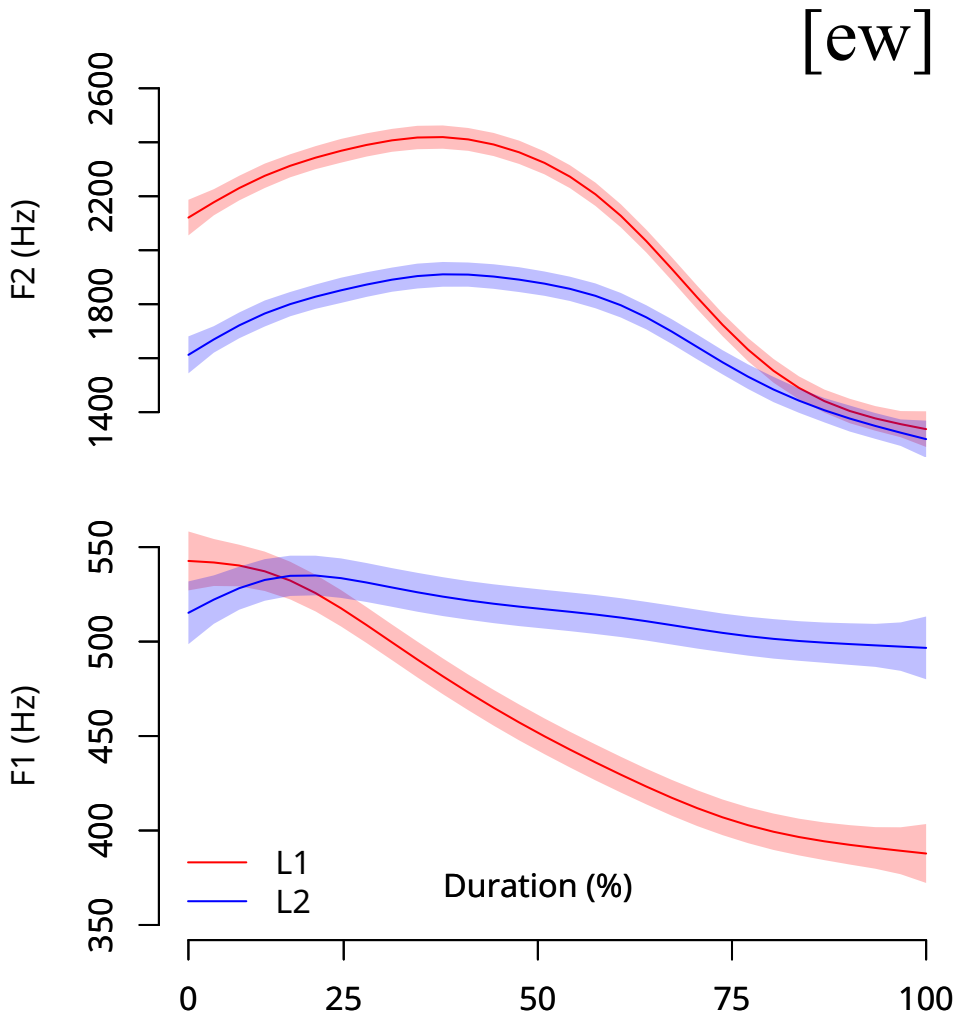

[ej]
L1
Frequency
0
4
8
12

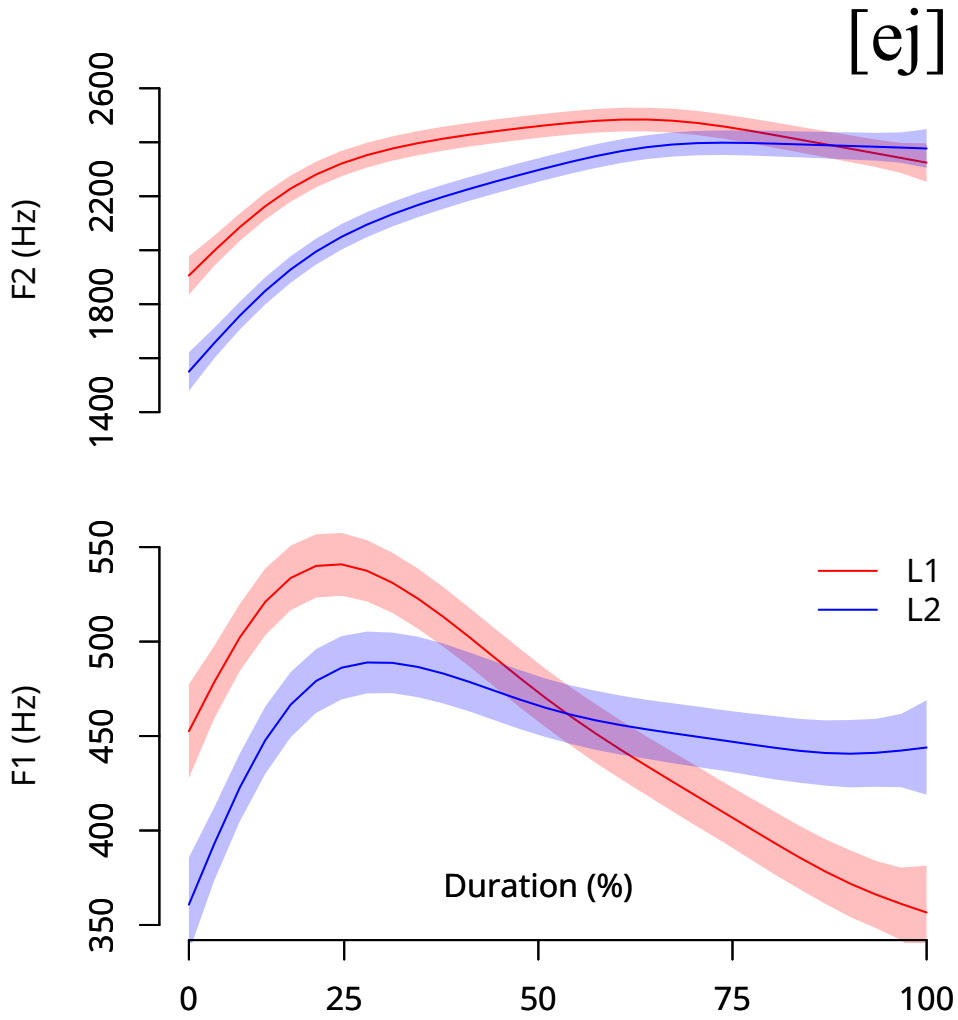

L2
Frequency
0
4
8
12
100
150
200
250
300
Duration (ms)


L2
Frequency
0
4
8
12
100
150
200
250
300
Duration (ms)

Formant Trajectories

- Focusing on V-G sequences, formant trajectory comparisons show clear differences between L1 & L2 speakers
- Differences occur throughout the formant trajectories in various ways
- Overall, targets in V-G sequences are closer together for L2 vs. L1 speakers, especially with respect to height (F1)
- L2 speakers show shallower transitions between vowel and glide targets


[ew]
F2 (Hz)
2600
2200
1800
1400
F1 (Hz)
550
500
450
400
350
L1
L2
Duration (%)
0
25
50
75
100


[ej]
F2 (Hz)
2600
2200
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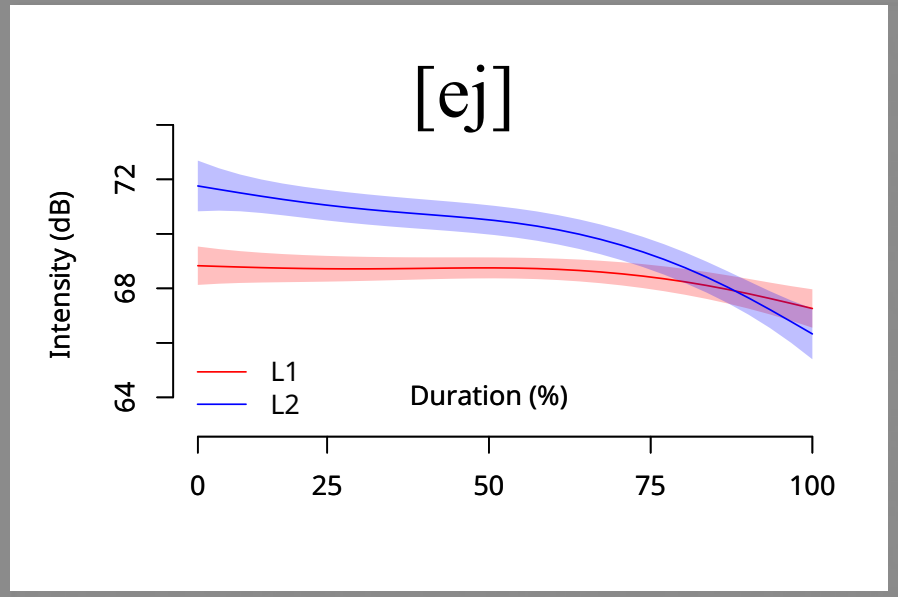
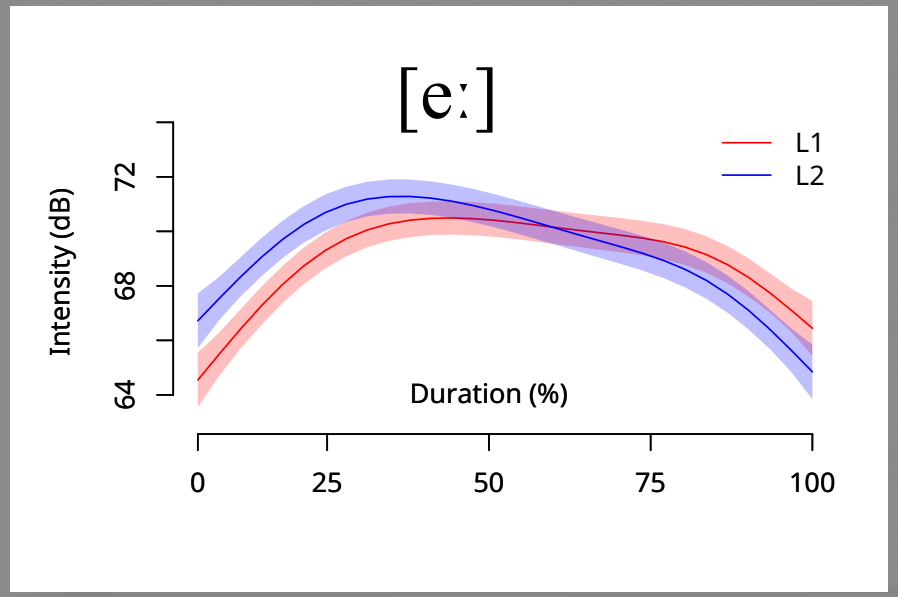
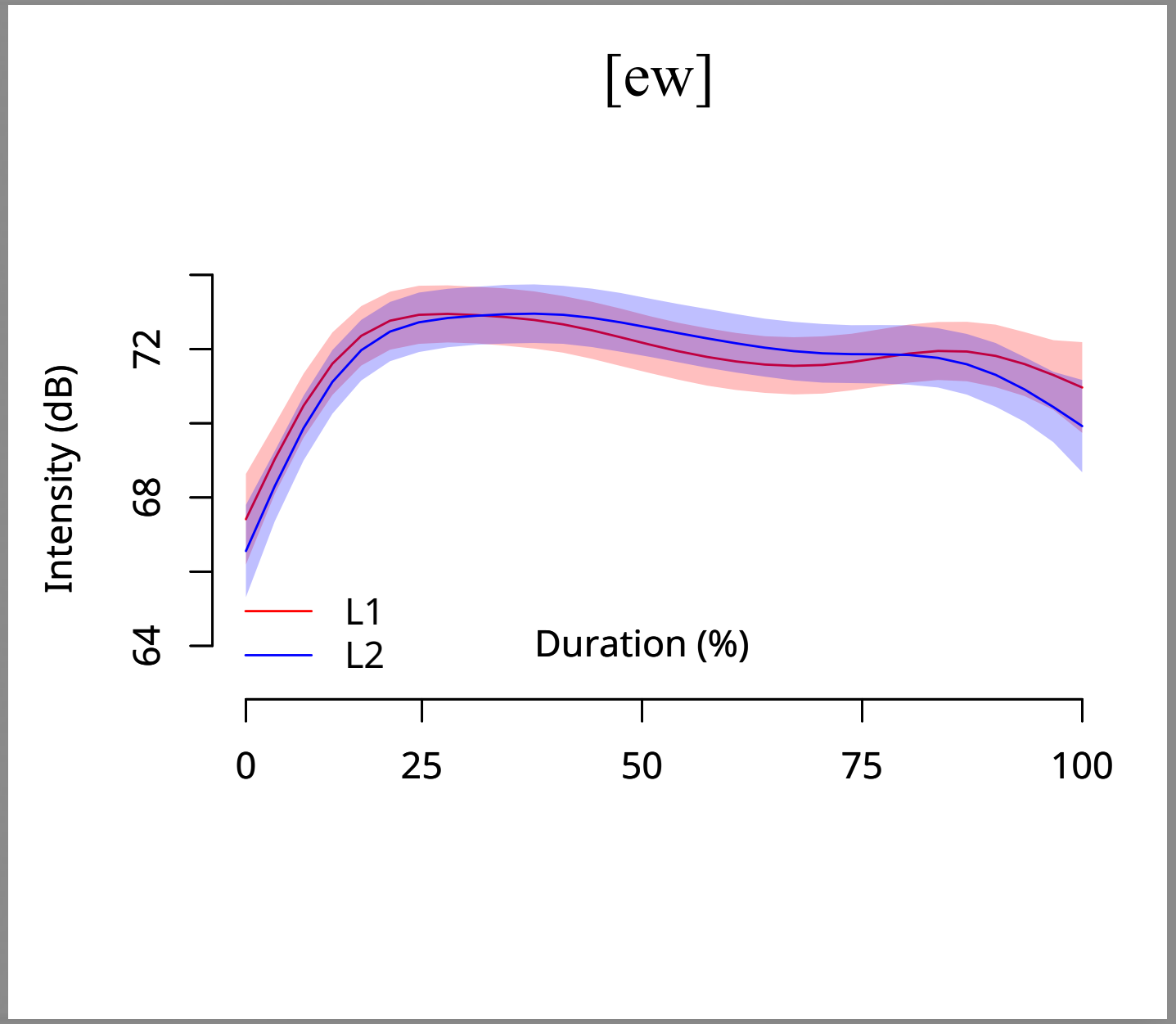
F1 (Hz)
550
500
450
400
350
L1
L2
Duration (%)
0
25
50
75
100

Intensity Contours

- General trend for intensity to drop off sooner for L2 speakers
- Both [ew] and [eː] exhibit two intensity peaks for L1, one prior to 50% duration and one after 75%, suggestive of two distinct components
- [ej] does not exhibit an obvious "two-peak" pattern


[ej]
Intensity (dB)
64
68
72
L1
L2
Duration (%)
0
25
50
75
100


[eː]
Intensity (dB)
64
68
72
L1
L2
Duration (%)
0
25
50
75
100


[ew]
Intensity (dB)
64
68
72
L1
L2
Duration (%)
0
25
50
75
100

Summary

- **Duration**: L2 relative vowel-to-vowel durations similar to L1, but mean per-vowel durations briefer than L1, most substantially for [ej]
- **Formant trajectories**: L2 V-G sequences less transitional than L1—more retracted during nucleus (F2) and raise less during the glide (F1)
- **Acoustic intensity**: L2 match L1 production fairly well, but intensity drop-off tends to be steeper and occur slightly earlier
- **Overall**: L2 V-G sequences tend to be shorter, less transitional, and with earlier drop-offs in intensity—in short, **learner's productions are more reduced**

Discussion

- The general pattern is suggestive of several potential explanations:

1. Expected generational/age speech differences
2. L1 instructors hyper-articulating in a teaching-learning context
3. L2 learners hypo-articulating under influence of English
    - Most of the community are English L1 speakers
4. Language contact (English–Hul'q'umi'num') effects in younger bilinguals

Community Feedback

- A version of this talk was presented to Dr. Donna Gerdts (SFU) and the Hul'q'umi'num' Language and Culture Collective
- The Hul'q'umi'num' speakers, including one L1 elder, indicated results matched their perceptions of production differences between L1 & L2
- They indicated interest and support in having these results promoted via academic conferences to raise awareness of Hul'q'umi'num' language, including use of (anonymized) audio recordings

Future Work

- Develop improved methodology, including the use of more well-matched tokens and non-glottalized segments
- Comparison of bilingual pronunciations in both Hul'q'umi'num' & English
- More direction from elders/teachers in other specific areas of phonetic difference between L1 & L2 speakers worth examining
- Community interest in larger-scale project to document phonetic characteristics of the full sound system of Hul'q'umi'num'

Thank you!

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