Coronal fricatives among L1 and L2 Hul’q’umi’num’ speakers

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1 Introduction

Hul’q’umi’num’ (Central Salish) is spoken along the Salish sea on the southeastern side of Vancouver Island and the adjacent Gulf Islands in British Columbia (BC), Canada. Hul’q’umi’num’ has fewer than forty L1 speakers but increasing numbers of L2 speakers of all ages, with the language revitalization movement rapidly gaining momentum across Hul’q’umi’num’ territory [1]. The research project reported on here is part of a SSHRC-funded community-university partnership to support L2 speakers fine-tune their pronunciation and achieve what they think of as “authentic” pronunciation [2].

Hul’q’umi’num has 37 consonants, including a robust series of coronal fricatives: /ɬ, s, ʃ, θ/. The goal of this project is to examine the acquisition trajectories of these fricatives by L2 learners and compare them to L1 speech.

2 Method

2.1 Participants

Two Hul’q’umi’num’ L1 speakers (both female: H1L1 & H2L1) and three L2 speakers (2 female, 1 male: H1L2, H2L2, & H3L2) took part in our study. The L1 speakers were born in 1932 and 1941, respectively. The L2 speakers were aged 30-50.

2.2 Procedure & Analysis

Data come from a pronunciation test that were carried out in 2016 and again in 2019, in Duncan, BC. Both times, the test was conducted in groups that included an Elder, an instructor/researcher, and 2-3 learners. One learner performed the test while the other(s) monitored the audio recorder. They switched roles after completion of the test.

Each word on the pronunciation test was first read by the Elder and then repeated by the learner. This was done twice for each word on the list. Recordings were made in Audacity with a Yeti USB microphone connected directly to a laptop computer.

All of the coronal fricatives /ɬ, s, ʃ, θ/ were represented in the pronunciation test, in a range of syllable and word positions. The dataset included a total of 148 L1 tokens and 222 L2 tokens. In some cases, learners either mispronounced the target sound or the target word was accidently skipped (52 tokens, or approximately 14%), leading to a total of 370 tokens analysed, including 114 /s/ tokens, 64 /ʃ/, 137 /ɬ/, and 55 /θ/.

We segmented the fricatives in Praat [3] and extracted the four spectral moments – center of gravity (COG), standard deviation (SD), skewness, and kurtosis [4] – at 10 equally spaced intervals over the time-course of each target segment. Our analysis included a total of 7 data sets, 1 for each L1 speaker and 2 for each L2 speaker (1 for 2016 and 1 for 2019). In R [5], we used GAMMs to analyze each fricative’s median COG trajectory, comparing L2 speakers to each other and to L1 speakers. Based on [6], we compared COG in CV and VC position, but found no noticeable differences, so omitted syllable position effects from our analysis. Additionally, we performed a principal components analysis (PCA) using median value of each spectral measure at vowel midpoint to investigate how all four spectral moments contributed to distinguishing fricatives from one another.

3 Results

3.1 COG Results

Figure 1 presents the COG results for the L1 speakers, H1L1 and H2L1. The results revealed different COG peak values and trajectories for most segments. Most significant was the difference between H1L1 and H2L1 for /θ/: H1L1 had a much lower peak COG (~4,000 Hz) with a gradual increase until 75% duration, while H2L1 had a sharp increase to ~8,000 Hz at 25% and a gradual increase after that to ~9,000 Hz at 75%. COG differences indicate an inter-dental fricative (/θ/) for H1L1 and a dental one for H1L2 (closer to [s̪]), reflective of dialectal variation previously documented by other Hul’q’umi’num’ and Coast Salish scholars [6, 7]. H1L1 had no significant COG difference between /ɬ, ʃ/, but H2L1 had lower COG and a flatter trajectory from /ʃ/ compared to /ɬ/.

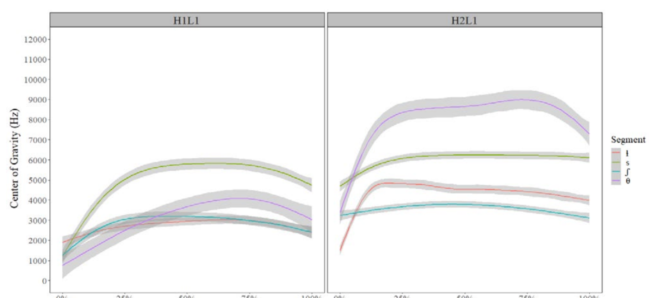

Figure 1: Dynamic COG measures for H1L1 (left) and H2L1 (right). /ɬ/ is orange, /s/ is green, /ʃ/ is blue, and /θ/ is purple.

Figure 2 presents the dynamic COG measures for H1L2, H2L2, and H3L2 for 2016 and 2019. H1L2 showed a lowering of COG in 2019 compared to 2016 for /ɬ, ʃ, θ/, along with a general compression of the COG space; /s/ revealed no significant change. H2L2 also had a compression in COG space, but it was the result of an increase in COG for /ɬ, ʃ, θ/ and a decrease of /s/ in 2019 compared to 2016. All learners had a relatively low COG for /θ/ in 2016, similar to H1L1. In 2019, H3L2’s /θ/ was closer to H2L1; their COG for /ɬ/ was also higher in 2019 compared to 2016, generating a shift towards H2L1 overall, at least for these two fricatives. Neither H1L2 nor H2L2 had clear shifts from one L1 speaker to the other from 2016 to 2019.

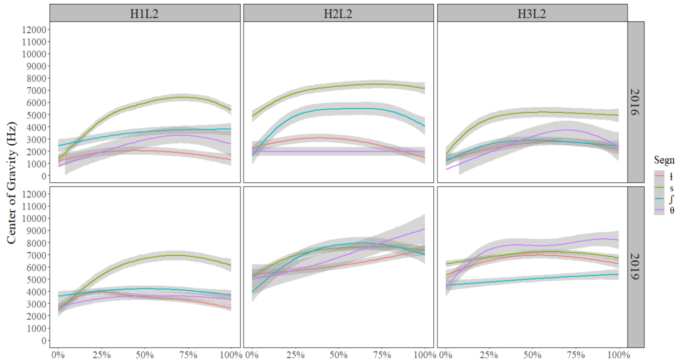

Figure 2: Dynamic COG measures for H1L2 (left), H2L2 (center), and H3L2 (right) in 2016 (top) and 2019 (bottom). /ɬ/ is orange, /s/ is green, /ʃ/ is blue, and /θ/ is purple.

3.2 PCA Results

Figure 3 presents the PCA individuals for H1L1 and H2L1. The data revealed that the acoustic space formed by the four spectral moments creates an isosceles trapezoidal shape. For both speakers, two segments were much closer together than the other segments. For H1L1, it was /ɬ, θ/, but for H2L1, it was /ɬ, ʃ/. The placement of /θ/ in particular reflects the COG results across speakers (Figure 1). For both speakers, skewness and kurtosis played a major role in dimension 1, but H1L1 also had a strong contribution from SD, while H2L1 had a strong contribution from COG instead. For both H1L1 and H2L1, the weakest measure in dimension 1 was the strongest for dimension 2, COG for H1L1 and SD for H2L1, while the remaining spectral moments had a weak contribution to dimension 2.

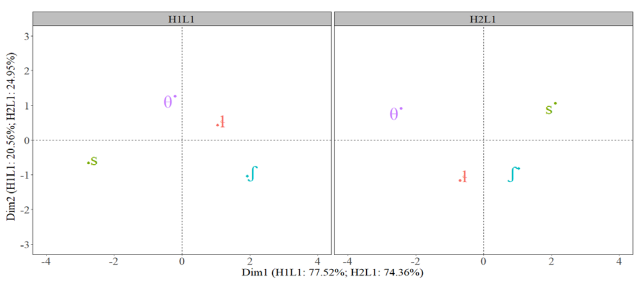

Figure 3: PCA Individuals for H1L1 (left) and H2L1 (right). /ɬ/ is orange, /s/ is green, /ʃ/ is blue, and /θ/ is purple.

Similar to the L1 speakers, each of the learners had two segments that were closer to each other than the others, although they often changed from 2016 to 2019. For example, Figure 4 shows that H2L2 had /ɬ, ʃ/ closer in 2016 (similar to H2L1) and /ɬ, θ/ in 2019 (similar to H1L1).

We observed a similar contribution pattern for L2 speakers as for L1 speakers, but there were differences. Specifically, in 2016 all speakers had large contributions on dimension 1 for skewness, kurtosis, and one of SD or COG. But in 2019, we observed that H2L2 had large contributions of kurtosis, SD, and COG for dimension 1 and a large contribution from skewness to dimension 2.

4 Discussion

The data revealed that both L1 and L2 Hul'q'umi'num' speakers produce sound contrasts in their own way, although the overall acoustic distributions of the coronal fricatives share similarities. H1L1 and HlL2 differed most substantially in their realization of /θ/, reflecting dialectal differences between them. While learners' fricatives differed in 2016 and 2019, there is no clear pattern of moving towards more L1-like realizations as a whole. Perhaps this is because L1 speakers do not provide consistent models, differing even amongst themselves. At least one learner, H3L2, seems to have shifted, becoming more similar to H2L1 than to H1L1 over time. It would be interesting to look into such shifts further, to determine whether and how much individual L1 speaker models affect the speech of L2 learners.

Overall, the data supports the notion that L2 speakers can acquire novel segments, even as adults, and that L2 speakers arrange their acoustic space to achieve a similar dispersion as L1 speakers, even though they may do this in different ways, by manipulating different acoustic parameters.

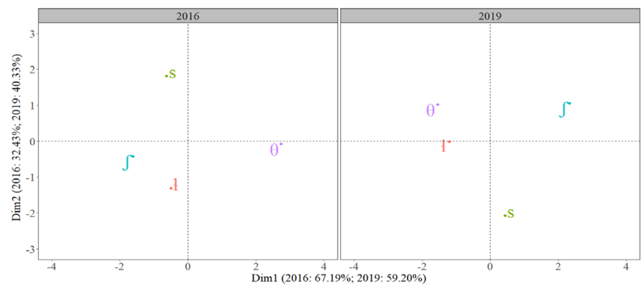

Figure 4: PCA Individuals for H2L2 in 2016 (left) and 2019 (right). /ɬ/ is orange, /s/ is green, /ʃ/ is blue, and /θ/ is purple.

Acknowledgments

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