The uvular/pharyngeal allophones of the St'át'imcets (Lillooet) gutturals: a phonetic study

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Varying uvular-pharyngeal articulation of St'át'imcets' guttural glides has long been noted, but previous work has not clarified whether the ʁ/ʕ variants are contextually determined or in free variation. This paper reports on an acoustic phonetic study into this issue. The findings indicate that the two types of variants are contextually determined: the pharyngeal realisations cooccur with labialisation and the uvular realisations occur elsewhere.

1 Introduction[1]

St'át'imcets (Lillooet) Salish has four guttural glides: /ʁ ʁ' ʁʷ ʁ'ʷ/. The articulation of these consonants is usually uvular, or slightly post-uvular (van Eijk 1997), but in certain forms, like ⟨ʕʷuj't⟩ 'to sleep', it is pharyngeal.[2] Previous work has so far not clarified whether the two variants are in free variation, or complementary distribution. This paper reports on an acoustic phonetic study designed to clarify this issue.

2 Phonetic investigation

2.1 Data and procedure

Twelve St'át'imcets carrier forms were used in the phonetic study. A first set, in (1), contains non-labialised gutturals. A second set, in (2), contains labialised gutturals. (Glosses and NA transcriptions of the carrier forms are from van Eijk 1987; glosses of forms not in that dictionary are as provided by

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[2] The transcriptions in this paper use slashes for underlying forms, '⟨ ⟩' for surface forms, and square brackets for phonetic forms, after Shahin (2002). A period marks a syllable boundaries. 'GLOT'= glottalisation morpheme; 'RED'= reduplicative morpheme.

my consultants.) These sets were used because an initial perceptual check indicated that it is labialised /ʁʷ ʁ'ʷ/ which have pharyngeal articulation. In the first three forms in each set of carrier forms, the guttural is syllable onset; it the other three forms per set, it is syllable coda. Onset vs. coda forms were used to check if syllable position is a factor in place of articulation. Otherwise, the segmental and prosodic contexts of the gutturals are diverse across the carrier forms.

(1) Carrier forms with non-labialised /ʁ(')/

a.	/ʁÆw'-Vn/ (NA: ʕáw'-ən)	{ʁæ.w'-ən}	'to gather people, things, (tr.)'
b.	/kÆ-n-ɬIʁ'-Æ/ (NA: ka-n-ɬíʕ'-a)	{kæ-n.-ɬɪ.ʁ'-æ}	'to swallow something (liquid) the wrong way, into one's windpipe'
c.	/wʁ-Vn/ (NA: wə́ʕ-ən)	{wɜ.ʁ-ən}	'to sort things out, to pick out the best, (intr., tr.)'
d.	/kÆ-n-ɬIʁ'-ɬkÆn-Æ/ {kæ-n.-ɬɪʁ'-ɬ.kæ.n-æ} (NA: ka-n-ɬíʕ'-ɬkan-a)		'I swallowed something the wrong way'
e.	/RED, GLOT, ɻIʁ-t͡ɬ'U/ {ɻɪ-'.-ɻɜʁ'.-t͡ɬ'u} (NA: zí-ʔ-zəʕ'-x̌'u)		'always'
f.	/GLOT, mʁ/ (NA: mə́-ʔ-əʕ')	{mɜ-'-ʁ'}	'(breaking) daylight'

(2) Carrier forms with labialised /ʁ(')ʷ/

a.	/lʁʷ-Vn/ (NA: lə́ʕʷ-ən)	{lə.ʕʷ-ən}	'to hide something (intr., tr.)'
b.	/ʁʷUj't/ (NA: ʕʷuy't)	{ʕʷuj't}	'to sleep'
c.	/lʁʷ-Ilx/ (NA: ləʕʷ-ílx)	{lə.ʕʷ-ilx}	'to hide oneself'

d.	/GLOT, k'Iʁʷ/ (NA: kí-ʔ-iʕ'ʷ)	{kɪ-'-ʕ'ʷ}	'to be run down, withered; to have t.b.'
e.	/k̓ʷʁʷ-p-ÆlwÆʃ/ {k̓ʷəʕʷ.-p-æl.wæʃ} (NA: q'ʷəʕʷ-p-álwas)		'pants slide down'
f.	/k̓ʷʁʷ-p/ (NA: q'ʷəʕʷ-p)	{k̓ʷəʕʷ-p}	'to slide down (clothing)'

The forms were tape recorded from three adult native speakers of the Lower St'át'imcets dialect, AA, aged 63 years, HD, aged 55 years, and LC, aged 52 years. Two tokens of each form were recorded from each speaker (except for (1a), of which tokens were recorded only from HD and LC). Recording was in a soundbooth using a Marantz P420 taperecorder and a professional quality microphone. The signals were loaded onto computer at 22.05 kHz sampling rate and analysed using *Multi-Speech 3700*®. Measurement procedures were as described in Shahin (2002).

2.2 Findings

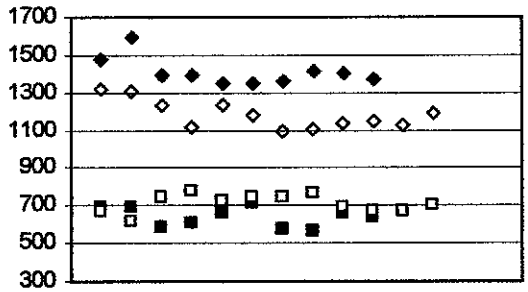
Figure 1 presents the F_1 and F_2 values of the non-labialsed vs. labialised tokens. As seen, for all three speakers F_1 of the labialised tokens is generally higher than that of the non-labialised tokens; F_2 is lower.

The mean F_1 and F_2 values, showing the higher $F_1$and lower F_2, are presented in Table 1. The standard deviation of the tokens in the table reflect the diverse segmental and prosodic contexts in which the tokens occurred.

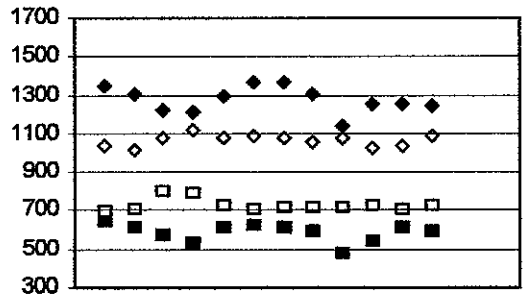
The higher F_1 and lower F_2 of the labialised tokens indicates that the non-labialised tokens were produced with uvular articulation, and the labialised tokens with pharyngeal articulation. A check of the mean F_1 and F_2 values in Table 1 with the F_1 and F_2 values predicted for uvular vs. pharyngeal gutturals in Table 2 (from Shahin 2002) shows that the formant values of the non-labialised tokens are in line with expectations for uvular gutturals. The formant values of the labialised tokens are in line with expectations for pharyngeal gutturals.

The only difference found between guttural tokens in onset vs. coda position was that, for all three speakers, the tokens in coda position had a lower standard deviation of especially F_2 than those in onset position, suggesting that target place of articulation might be achieved more closely in coda position.

Figure 2 presents waveforms, wideband spectrograms and narrowband spectra of two near minimal pair carrier forms, one with a non-labialised guttural, one with a labialised guttural. The lower F_2 of the labialised token is clear seen. (In the figure, F_1 of the labialised token is actually slightly lower than F_2 of the non-labialised token. This could be due to coarticulation of the labialised token with the preceding vowel.)



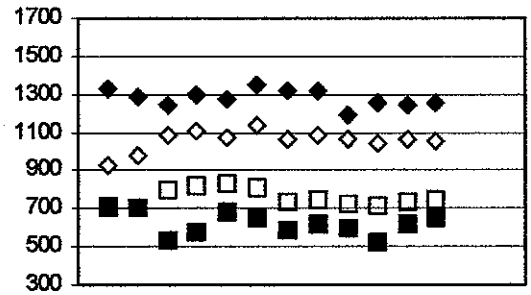
a. AA



Legend:

- F_2 non-labialised
- F_2 labialised
- F_1 non-labialised
- F_1 labialised

b. HD



c. LC

Figure 1. F_1 and F_2 of non-labialised and labialised tokens of St'át'imcets gutturals (speakers AA, HD, and LC).

		F_1	F_2	s.d. F_1	s.d. F_2
AA	non-labialised	639	1411	53	73
	labialised	712	1183	47	74
	difference between labialised and non-labialised	+137	-223		
HD	non-labialised	585	1276	48	67
	labialised	726	1065	34	31
	difference between labialised and non-labialised	+141	-211		
LC	non-labialised	620	1278	60	46
	labialised	757	1055	45	56
	difference between labialised and non-labialised	+73	-228		

Table 1. Mean and standard deviation (s.d.) of F_1 and F_2 of non-labialised and labialised tokens of St'át'imcets gutturals, and difference between F_1 and F_2 of labialised vs. non-labialised tokens (speakers AA, HD, and LC).

	F_1	F_2
ʁ	450 - 700	1300 - 1900
ʕ	700 - 950	700 - 1300

Table 2. Predicted F_1 and F_2 of uvular ʁ and pharyngeal ʕ

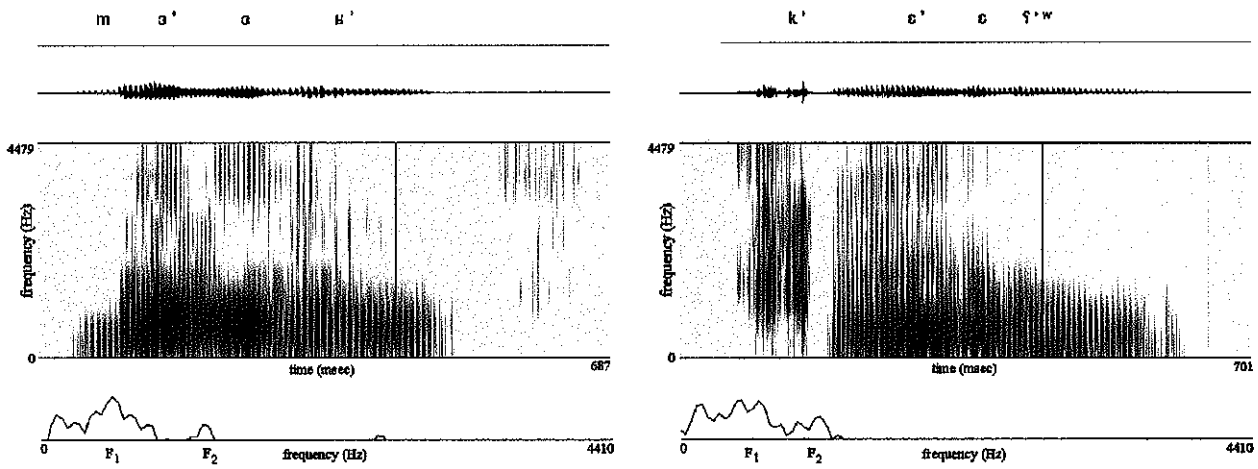


Figure 2. Waveforms, wideband spectrograms and narrowband spectra of one token each of /GLOT, mʁ/ {mɜ-'-ʁ'} [mɜ'ɜʁ'] '(breaking) daylight' and /GLOT, k'Iʁʷ/ {k'ɪ-'-ʕ'ʷ} [k'ɛ'ɛʕ'ʷ] 'to be run down, withered; to have t.b.', showing lowered F_2 for labialised /ʁʷ/ {ʕ'ʷ} (speaker HD). (Spectra taken at the points indicated by the vertical lines.) [ʁ'] in the token of {mɜ-'-ʁ'}: F_1 = 569, F_2 = 1260; [ʕ'ʷ] in the token of {k'ɪ-'-ʕ'ʷ}: F_1 = 543, F_2 = 1012.

3 Conclusion

The aim of this acoustic study was to determine whether the uvular and pharyngeal variants of the St'át'imcets gutturals occur in free variation or complimentary distribution. The findings reported here indicate that they are in complementary distribution. The pharyngeal variants cooccur with labialisation and the uvular variants occur elsewhere. That is, /ʁ ʁ'/ are uvular, /ʁʷ ʁ'ʷ/ are pharyngeal. A connection between labialisation and lowness has been recorded elsewhere for Salish (e.g., Hukari 1978). The complimentary distribution identified in this study implies that the pharyngeal variants are outputs of the phonology, and part of the St'át'imcets surface consonantal inventory. Theoretical account of them is left for work elsewhere.

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