Patterns and timing of resonant glottalization in Nɬeʔkepmxcin

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In the recent literature exploring cross-linguistic patterns of resonant glottalization, an asymmetric timing pattern has been observed. Whereas resonants in coda position may be either pre- or postglottalized, documented cases of resonants in onset position are all preglottalized. The crucial question is whether this is an accidental gap, due to limited documentation of this rare class of segments, or whether this is a systematic gap, with the attendant implication that there should be a principled explanation for the absence of syllable-/word-initial postglottalized resonants in Universal Grammar. In this paper, an acoustic analysis of word-initial glottalized resonants in Nɬeʔkepmxcin provides clear evidence of postglottalization as the principal timing realization pattern. We conclude therefore that the previously observed gap is an accidental one. This independence of glottal timing in relation to oral articulators reinforces a theoretical conception of the relative independence of phonology and phonetic implementation.

1 Introduction[1]

In seeking to characterize constraints on the possible range of variation in human language, linguists regularly confront the fundamental question of whether a hitherto unobserved pattern is a systematic gap, and hence an appropriate property of Universal Grammar, or simply an accidental gap, based on our limited documentation and understanding of the world's 6912 or so languages (www.ethnologue.com). When an as yet unattested phenomenon pertains to the behaviour of a class of phonological segments, such as glottalized resonants, which are themselves relatively rare cross-linguistically,[2] then the task of filtering the accidental from the systematic faces the further challenge of being informed by an even more limited empirical

[1] Many thanks to Mandy Jimmie for her teachings, to Sonya Bird, Patrizia Bonaventura, Marion Caldecott, Bryan Gick, Sharon Hargus, and to participants at the 2005 ASA for helpful discussion, and to our šnuk^{w}e? Ian Ashley. We are very grateful to SSHRC (grant 410-2003-1903), to the Killam Foundation, and to the UBC Faculty of Arts for its support of the Nɬeʔkepmxcin classes through the First Nations Languages Program.
[2] For example, Maddieson's 1984 survey identifies 20 languages in his sample of 317 as having glottalized resonants in their inventory: that is, 6.3%.

database. Moreover, of the languages which have glottalized resonants, several are critically endangered and/or undergoing relatively rapid change which, in a number of cases, specifically involves the loss of glottalization on resonants.[3] Hence, research focussed on questions pertaining to apparent constraints on their phonetic realization and phonological behaviour is particularly timely.

The central question of theoretical interest here is whether, in the realization of glottalized resonants, there are systematic constraints on the relative timing of glottalization/laryngealization with respect to the oral place/manner articulation. Whereas one perspective of the phonetics-phonology interface holds that it is essentially seamless, with phonological patterns directly tied to properties of phonetic implementation or perception (e.g. Steriade 1997; Flemming 1999; etc.), an alternative position is that various phonological phenomena may be independent of phonetics, requiring instead reference to various kinds of prosodic or morphosyntax information (Kiparsky 1982; Howe and Pulleyblank 2001; Shaw in press; etc.). In the recent literature exploring cross-linguistic patterns of resonant glottalization (e.g. Plauché *et al.* 1998; Caldecott 1999; Howe and Pulleyblank 2001; Hargus 2005), it has been observed that timing is only semi-independent of distribution. Specifically, based on the language sample investigated, there is an asymmetric timing pattern. Whereas resonants in coda position may, on a language-specific basis, be either pre-glottalized (e.g. Sm'algyax (Dunn 1995), Montana Salish (Flemming *et al.* 1994), Lai (Plauché *et al.* 1998)) or post-glottalized (e.g. Yowlumne (Plauché *et al.* 1998), Kashaya (Pomoan; Buckley 1990, 1994), a parallel situation has not been documented for resonants in onset position. For the languages cited, in every case where glottalized resonants are permitted to occur in onset (syllable-initial, pre-vocalic) position, the resonants are pre-glottalized.[4] Howe and Pulleyblank (2001:70) state: "In fact, to our knowledge no language exists in which glottalised sonorants are consistently postglottalised prevocalically."

Thus, Howe and Pulleyblank (2001) identify a cross-linguistic gap, and the critical question is whether this a systematic or an accidental gap. If systematic, then it supports their conclusion that, at least in onset position, "[t]here is a correlation between syllabic position and the patterns of glottal timing" (2001:76). Alternatively, if this is an accidental gap, then the arguments for the independence of phonology from physiological and perceptual phonetic factors is reinforced even more strongly. In this paper, we argue, on the basis of acoustic phonetic evidence from Nɬeʔkepmxcin (a.k.a.

[3] For example, of the critically endangered languages of the Pacific Northwest, Upriver Halkomelem (Central Salish) lost resonant glottalization several generations ago (Elmendorf & Suttles 1960), although the Downriver hən̓q̓əmin̓əm̓ (Shaw et al 1999) and Island Hul̓q̓umin̓əm (Hukari & Peter 1995) dialects retain it. Glottalization on resonants is reportedly being lost in the speech of younger generations in Dididaht, Southern Wakashan (Gamble 1977); in Kwak'wala, Northern Wakashan (Goodfellow 1999); and in St'at'imcets/Lillooet Salish (Bird 2003, Bird and Caldecott 2004).

[4] Kwak'wala (Northern Wakashan) as in Lincoln & Rath (1980); Sm'algyax (Tsimshianic) as in Dunn (1995): Montana Salish (Southern Interior Salish) as in Flemming et al. (1994); Lai (Tibeto-Burman) as in Plauché *et al.* (1998); Nuu-chah-nulth (Southern Wakashan) as in Sapir (1938), among others; Yowlumne (Hokan) as in Newman (1944), Plauché (1998), among others.

Nlaka'pamux or Thompson River Salish), a Northern Interior Salish language, that the apparent cross-linguistic generalization reflects an accidental gap: in Nɬeʔkepmxcin, syllable-initial prevocalic resonants are regularly postglottalized. Because word-initial glottalized resonants are so infrequently attested, the present study focusses on documenting their properties.

The paper is organized as follows. Section 2 presents relevant background on the phonological status, distribution, and morpho-lexical functions of glottalized resonants in Nɬeʔkepmxcin. Section 3 discusses previous phonetic studies of timing and realization patterns of glottalized resonants cross-linguistically, and situates our research goals in this context. Section 4 details the methods of data collection, analysis, and summarizes the results, with exemplification of characteristic inter- and intra-speaker variation in modes of realization. In Section 5 we summarize our conclusions, with discussion of their implications for theoretical models of the phonetics-phonology interface.

2 Phonological properties of glottalized resonants

The phonological inventory of Nɬeʔkepmxcin, following the analysis of Thompson and Thompson (1992:3)[5], includes 9 contrastively glottalized resonants:

(1) C Inventory of Nɬeʔkepmxcin

p	t		ç	č	k	k^w	q	q^w	
ṗ	(ṫ)	x̌		ċ	ḳ	$ḳ^w$	q̇	$q̇^w$	ʔ
		ɬ	ṣ	š	x	x^w	χ	$χ^w$	h
m	n	l	z	y	ɣ	w	ʕ	$ʕ^w$	
ṁ	ṅ	l̓	ż	ẏ	ɣ̇	ẇ	ʕ̓	$ʕ̓^w$	

Our preliminary focus is restricted to the subset of glottalized resonants (/ṁ, ṅ, l̓, ẏ, ẇ/) which do not entail the additional articulatory complexity of the voiced resonant spirants (/z, ż, ɣ, ɣ̇/) and the pharyngeals (/ʕ, ʕ̓, $ʕ^w$, $ʕ̓^w$/).

2.1 Distribution of glottalized resonants

Several languages with glottalized resonants have significant restrictions on the contexts in which they may occur. For example, in Nuu-chah-nulth glottalized resonants occur only prevocalically, i.e. in onset position, whereas in Kashaya (Buckley 1990, 1994) they occur only postvocalically, in word-final or preconsonantal position, i.e. in codas. In contrast, glottalized resonants in Nɬeʔkepmxcin occur in a diverse range of environments, although some contexts are less frequently attested than others.

[5] Thompson & Thompson's /s/ and /c/ are represented here as their most common realizations [š] and [č] respectively; /ç/ and /ṣ/ are found in retraction contexts; their /x̣/ is here [χ]. ṫ is rare, limited to loanwords.

Although our present focus is on word-initial resonants, our basis of comparison derives from our broader research program (Shaw, Campbell, Ehrhardt, & McKay 2005) which investigates each of the following contexts, exemplified here with /m̓/ (underlined for ease of reference).[6]

(2) Context	Nɬeʔkepmxcin		gloss
a. Coda: word-final	ƙetním̓	TD842	fishing with a rod
	píχəm̓	TG6	hunt game
b. Coda: pre-C	ʔešnəm̓nám̓	TG6	blind
	mém̓ye	TD195	necklace (dim. beads)
c. Onset: intervocalic	húm̓eɬ	MJ	good-bye
d. Onset: post-C	ƛ̓eʔkm̓íx	TG130	always
e. Onset: word-initial	m̓əntéš	TD209	giving out (food)
	m̓ánxe	TD209	better give something!

2.2 Morpho-lexical functions of resonant glottalization

As evidenced in the phonological inventory in (1) above, glottalization on resonants is contrastive across all places of articulation, resulting in a fully complementary set of 9 oppositions in the resonant series. In terms of phonotactic distribution, resonant glottalization functions distinctively across the full range of diverse morphoprosodic contexts identified in (2), as illustrated by the lexical contrasts below:

(3) Context	Nɬeʔkepmxcin		gloss
a. Coda: word-final	píχəm	TG6	to lay boards, flooring
	píχəm̓	TG6	to hunt game
	qʷeẏ-	TD291	to talk
	qʷeẏ̓-	TD291	have stg ache; be in pain
b. Coda: pre-C	qʷən-qʷén-t	TD292	be poor; pitiful
	n-qʷén̓=xən	TD289	wetting dried roots
	n-ƙʷén̓-tən	TD129	appearance
c. Onset: intervocalic	péẏeʔ	TG5	one
	péẏ̓es	TG8	spread things out
d. Onset: post-C	cək-mín	TG121	axe, pick

[6] Data are cited with page reference from Thompson & Thompson 1992 (TG); Thompson & Thompson 1996 (TD); Jimmie 2002-04 (MJ); and otherwise from our own fieldnotes. Note the transcription here may differ in including non-optional schwas.

	ƛ̓e?k-m̓íx	TG130	always
e. Onset: word-initial	y̓em	TD526	feel affection
	y̓e	TG161	good
	y̓en	TD527	sense

As well, there are a number of morphological processes in the Nɬe?kepmxcin grammar which are marked, either exclusively or in conjunction with affixation/vowel change, by glottalization of underlyingly plain resonants. As is the case with cognate processes in a number of other Salish languages, Thompson and Thompson observe that "it is thus far impossible to predict which of several possible resonants in a form will be affected" (1992:114). Nonetheless, this function is not rare; examples illustrating its use in marking the 'specializing extension' function are cited in (4.a), and data showing resonant glottalization as concomitant with the 'diminutive', 'affective', and 'repetitive' are seen in (4.b-d):

(4) a. Specializing extension: [CG] on resonant (TG 1992:114)

kən	to help
kn=éyt	helper, assistant
kn̓=éyt	midwife

b. Diminutive: CV- Redup[7] + [CG] on resonant (TG 1992:89)

kən-t-és	s/he helps him/her
s-ká-kn̓	companion, partner, wife

c. Affective: Ce-/Cə Redup + [CG] on resonant (TG 1992:116)

wík-m	s/he sees (someone); has a vision
wə- wík-m̓	s/he has hallucinations

d. Repetitive: [e?] + [CG] on resonant (TG 1992:117)

ɬəc-	to stack [root]
ɬc-əm	to stack, pile up (things)
ɬəc-ɬ[e?]c-əm̓	keep stacking, piling up (things)

[7] Thompson and Thompson (1992:89) analyze the diminutive as a post-tonic –C infix, whereas here following Shaw 2005 it is treated as a pre-tonic CV- prefix.

3 Previous phonetic studies and current goals

As documented elsewhere in the expanding phonetic literature on this relatively rare class of segments (e.g. Shank & Wilson (2000), Caldecott (2005) for Nuu-chah-nulth; Caldecott (1999), Bird & Caldecott (in press) for St'at'imcets; Avelino and Maddieson (2005) for Lowland Oaxaca Chontal; Gordon (1996) for Hupa; Flemming et al (1994) for Montana Salish), the articulatory and acoustic realization of glottalization with resonants may vary not only cross-linguistically, but also language-internally, depending on a range of factors including prosodic context, rate of speech, genre (e.g. citation vs. conversational mode), etc. In the context of evaluating the relative laryngeal/oral timing properties of glottalized resonants in Nɬe?kepmxcin with respect to the cross-linguistic observation discussed in §1 (viz., that glottalized resonants in prevocalic position are consistently preglottalized), it is important therefore to identify the characteristic acoustic parameters of both inter- and intra-speaker variation in Nɬe?kepmxcin. The previous literature provides two somewhat convergent, somewhat divergent perspectives on this.

The Carlson, Esling, and Harris (2004; henceforth CE&H) laryngoscopic and acoustic study of the broad class of glottal/pharyngeal segments in Nɬe?kepmxcin concludes that "phonetic glottal stop [?] occurs ... as a component of the glottalized resonant series", and that there was "no systematic difference between the nature of [?] used for secondary glottalization as in /m'/, which could therefore be represented phonetically as [m?]" (2004:61). Further, from their study of duration relationships where they found that "glottalized resonants are about one and a half times longer than plain resonants", they conclude (2004:65) "it is clear that glottalized resonants are a sequential combination of the resonant plus [?]". CE&H summarize their observations as follows: "In the glottalized resonants in Nlaka'pamux, a moderate glottal stop occurs after the resonant. Periods of laryngealization (creaky voice or harsh voice phonation), preceding or following the glottal stop, can also occur." (2004:66) Their conclusion, then, from both laryngoscopic and acoustic evidence, is that the timing relation is consistently realized as post-glottalized. Our study aims to broaden the empirical base for understanding the behaviour of glottalized resonants in two principal ways. First, CE&H's results were drawn on the basis of citation forms elicited from a single female speaker of the Lytton dialect. Our study tests these conclusions against a significantly larger database with two other female speakers from this same dialect area (see discussion in §3.2 below). Secondly, the data presented in CE&H's paper does not specifically address the properties of glottalized resonants in onset position. The central question focussed on here is whether postglottalization also occurs prevocalically, most particularly in word-initial onsets.

The second major reference to this issue in the literature is in Thompson and Thompson's extremely insightful grammar. Based primarily on auditory observation, Thompson and Thompson (henceforth T&T) comment: "Resonants... present difficulties in the area of perceiving laryngealization ... These effects can become very elusive in allegro speech, especially in unstressed syllables." (1992:4) We concur! Nonetheless, T&T's perceptions are very astute. First, their observations parallel CE&H's subsequent phonetic results regarding the presence of a post-resonant full glottal closure in syllable-

final (and word-final) position: "In careful speech laryngealized resonants are abruptly cut off by a glottal stop in syllable-final ... positions." (1992:4) Secondly, however, in the subsequent portion of this same citation, T&T note that in other prosodic contexts, resonant glottalization admits a greater range of possible modes of realization: "In careful speech laryngealized resonants ... are interrupted by a glottal stop or creaky voice production in prevocalic positions." (1992:4)

This observation, then, relates to the central research question: the timing pattern(s) in prevocalic position. Further, of particular interest here is their behaviour in *word*-initial position, since not only are glottalized resonants a rare segmental class cross-linguistically, but their occurrence in word-initial position is even rarer. That is, a number of languages (e.g. Yowlumne (Newman 1944; Steriade 1999); Hupa (Golla 1970); Nez Perce (Aoki 1970)) which have contrastively glottalized resonants in their phonological inventory are subject to a distributional restriction against their occurrence in word-initial position. Because Nɬeʔkepmxcin allows the full range of glottalized resonants to appear in initial position, it constitutes a valuable empirical resource. Moreover, as discussed in our Introduction (§1), of the languages which do permit word-initial glottalized resonants, *all* of the other documented cases in the literature report localization of laryngealization to the beginning of the sonorant. One possibility is that the apparent absence of word-initial post-glottalized resonants is a systematic gap, with attendant theoretical implications for what constraints govern the phonology-phonetics interface. The alternative possibility, however, is that this is an accidental gap. As Ladefoged and Maddieson (1996:111) remark, "There is obviously room for further language-specific variation in the way that these oral and laryngeal gestures are related to each other, but the documentation is not yet very extensive."

Based on our own initial auditory impressions, Nɬeʔkepmxcin was a serious candidate for filling this gap. Indeed, Thompson and Thompson explicitly identify the 'careful' pronunciation of initial laryngealized resonants as post-glottalized (1992:4):

> Laryngealized resonants are uncommon in word initial position; however, they do occur. In this position there is considerable variation of production; in careful renditions they are decomposed into syllabic resonant followed by [ʔ], so that, for example, /m'ɬ-/ is realized as [mˌʔɬ-], /y'ɬ-/ as [(ʔ)iʔɬ-], etc.

Our principal research objective, therefore, was to examine acoustic evidence relevant to the hypothesis that word-initial glottalized resonants in Nɬeʔkepmxcin are realized as post-glottalized.

4 Methods

In order to investigate the relative timing of oral and laryngeal events in glottalized resonants found in word-initial/pre-vocalic position, acoustic samples of both modal and glottalized resonants in a variety of morpho-prosodic contexts were examined, according to the methodology detailed below.

4.1 Data Collection

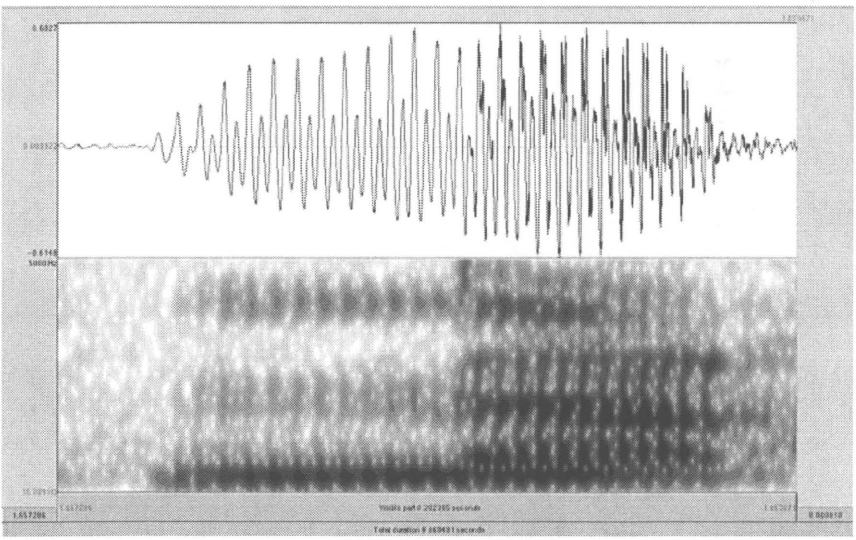
Between September 2004 and April 2005, sample sets of acoustic data including both plain and glottalized forms of /l, m, n, w, y/ in varying contexts were collected. (Plain resonants were included for the purpose of comparison.) The data were recorded in independent sessions from 2 female native speakers of the Lytton dialect of Nɬeʔkepmxcin, ages 55-65. Forms were elicited orally, based on English translations from the Thompson and Thompson dictionary (1996), grammar (1992), from pedagogical materials from Jimmie (2003-4), as well as from speech samples contributed by our native speaker collaborators. Our research collaborators repeated each word or phrase at least twice, usually several times. The data were recorded on a Marantz solid state digital recorder and then transferred to a Macintosh Powerbook G4 for analysis.

4.2 Analysis

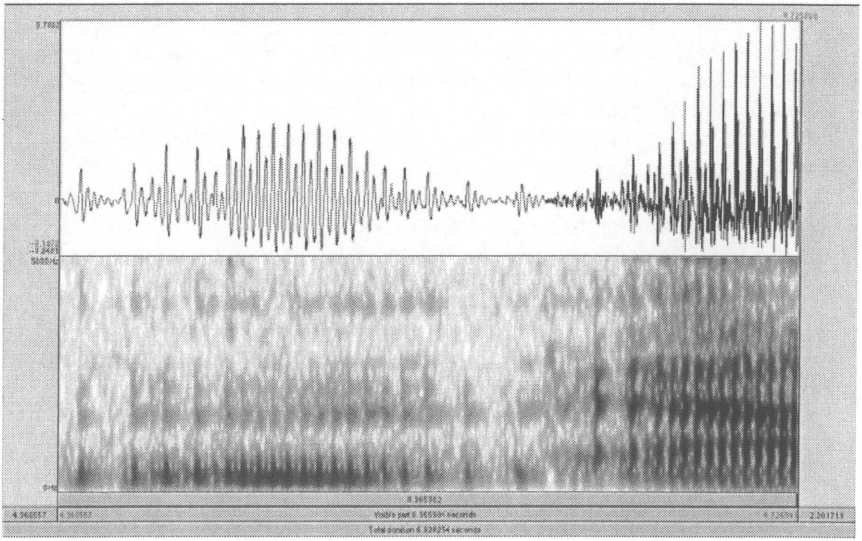
Only resonants which were perceived by two trained transcribers as glottalized were included in the analysis and any tokens which were unclear due to background noise or other factors were excluded. An example of a modal (non-glottalized) resonant compared to a glottalized one is given in figure 1 below.

(5) Figure 1: Modal vs glottalized /n/ (Subject 2)

a. Modal /na/



b. Glottalized (laryngealized) /n̰a/



One speaker produced 60 clear word-initial glottalized resonant forms, and the other 46. More specific information on the number of words and tokens included for each sound for each speaker is given in Table 1 in (6) below.

(6) **Table 1.** Number of samples per segment per speaker

	l̰	m̰	n̰	w̰	y̰	Total
Speaker 1						
total # of tokens	11	15	15	10	11	62
# of words analyzed	1	3	2	2	3	11
# of tokens excluded		2				2
Speaker 2						
total # of tokens	5	5	14	11	13	48
# of words analyzed	1	1	3	2	2	9
# of tokens excluded			2			2

Each instance of the resonant was examined individually in Praat (v.4.3.02) for the cues to glottalization described below, and the location, relative to the resonant, of each cue observed to be present was recorded. Notably, following Bird and Caldecott (in press), we expanded the binary categorization of pre-/post- to include an intermediary characterization of simultaneous/synchronous ("thru" in Table 2 below) and/or medial realization of glottalization cues.

The data were analyzed with reference to the following cues to glottalization: the presence or absence of a full glottal closure (stop); the presence or absence and direction of a pronounced irregularity or rise in pitch; and/or a significant drop in intensity; and the presence or absence of creaky voice/laryngealization apparent in the waveform; or in the spectrogram.

In terms of temporal sequencing, the data were classified with reference to one or more cues appearing at the onset of modal phonation (pre-glottalized), the offset (post-glottalized), and/or synchronous or medial realization of glottalization cues.

4.3 Results

Confirming auditory perceptions, our preliminary results show that Nɬeʔkepmxcin glottalized resonants in word-initial position are most frequently post-glottalized. Percentages of tokens for each speaker which were pre-glottalized, post-glottalized, glottalized in the middle of the resonant and glottalized throughout are given in Tables 2 and 3 below.

(7) Timing of glottalization in word-initial resonants

Table 2: Speaker 1

S1 (60)	pre	mid	post	mid / post
l̓			11/11	
m̓			13/13	
n̓		1/15	11/15	3/15
w̓	1/10		9/10	
y̓			11/11	
totals	1	1	55	3
percent of total (60)	1.67%	1.67%	91.67	5.0%

Table 3: Speaker 2

S2 (46)	pre	pre / thru	post	thru	pre & post	thru / post	mid / post
l̓	4/5	1/5					
m̓			5/5				
n̓			8/12	1/12	3/12		
w̓	4/11		3/11	2/11		2/11	
y̓			10/13			2/13	1/13
totals	8	1	26	3	3	4	1
percent of total	17.4%	2.17%	56.52%	6.52%	6.52%	8.7%	2.17%

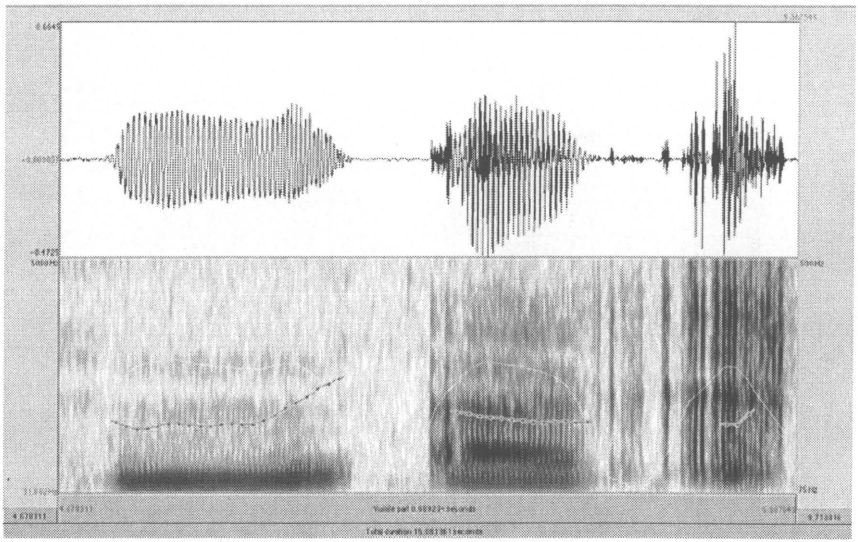
From these results, it is clear that post-glottalization is the standard mode of realization for Speaker 1. Combining the "post" and "mid/post" categories, 97%

of her word-initial resonants are postglottalized. Even for Speaker 2, whose data were considerably more diverse, postglottalization is the dominant pattern.

4.4 Modes of realization: inter- and intra-speaker variation

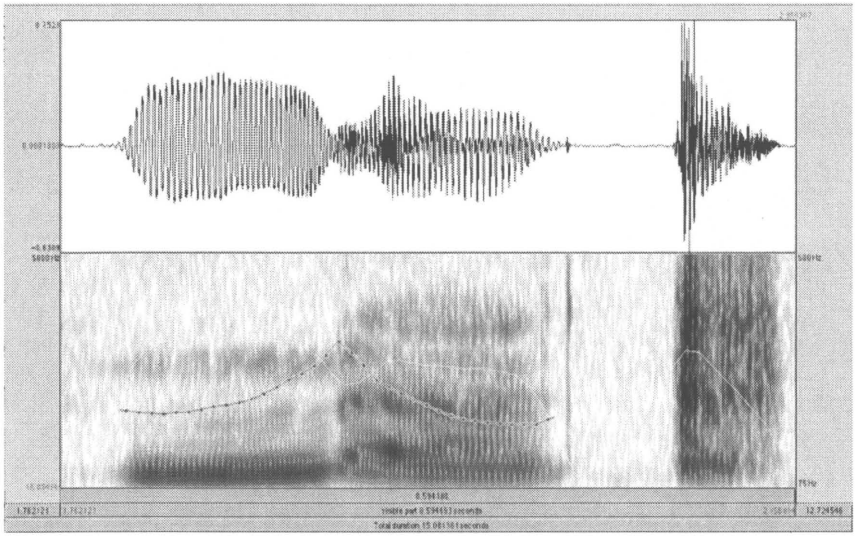
A considerable amount of variation was observable both across tokens from the same speaker and across speakers for the same resonant in an identical target word. This is exemplified by the forms in (8) which show two different productions of the word /n̓aq̓/ 'rotten' from Speaker 1 and one from Speaker 2. The difference between a careful speech production and a more normal speech production within a single speaker is shown in (8.a) and (8.b), with the decomposition of the glottalized resonant into a sequence of resonant + glottal stop noted in Thompson and Thompson evident in the careful speech form. Comparing (8.b) to (8.c) highlights the very different modes of realization that can be seen across speakers. The form in (8.b) is a very clear example of the pitch rise and intensity drop instantiation which was common in Speaker 1's glottalized resonants, while the laryngealization evident in (8.c) is more typical of Speaker 2's productions.

(8) a. Figure 2: Speaker 1 /n̓aq̓/ Careful Speech



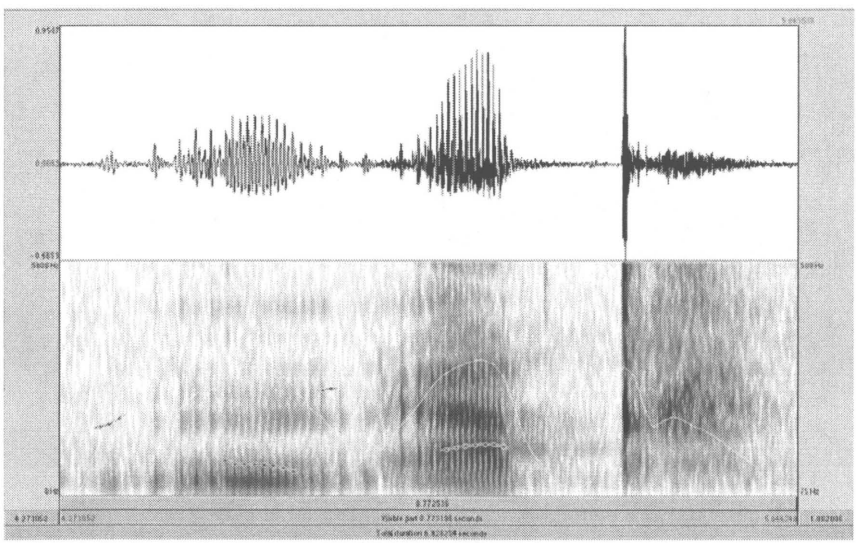
[n n̓ ʔ a q̓]

b. Figure 3: Speaker 1 /n̓aq̓/ Normal Speech



[n n̓ a q̓]

c. Figure X: Speaker 2 /n̓aq̓/ Normal Speech



[n̓ n n̓ a q̓]

With regards to CE&H's claim that resonants could be considered a sequenc in our data only 37.1% (33 / 89) of post-glottalized resonant tokens analysed had a complete and sustained glottal closure, the rest did not. For Speaker 1 this realization was in evidence 39.7% of the time and for Speaker 2 it was 32.3%.

5 Discussion and conclusions

The principal goal of this study is to expand the empirical foundation for cross-linguistic generalizations regarding the relative timing of glottalization on resonants. In the recent literature exploring these issues, an asymmetric timing pattern has been observed. Specifically, whereas resonants in coda position may be either pre- or postglottalized, previously documented cases of resonants in onset position are all preglottalized (Howe & Pulleyblank 2001). The crucial question this observation raises is whether this is an accidental gap, due to limited documentation of this rare class of segments, or whether this is a systematic gap, with the attendant implication that there should be a principled explanation for the absence of syllable-/word-initial postglottalized resonants in Universal Grammar. Several researchers have noted that "in the most typical case, glottalized sonorants realize their creak primarily at the beginning (often shared with the preceding vowel) in prevocalic position, but shift their creak towards the end when they do not precede a vowel" (Gordon & Ladefoged:12), and have advanced various phonetically-grounded hypotheses to provide an explanatory basis for this. Our major finding in this paper is that an acoustic analysis of word-initial glottalized resonants in Nɬeʔkepmxcin provides clear evidence, despite some inter- and intra-speaker variability, of postglottalization as the principal timing realization pattern.

From this, we draw two main conclusions. First, we conclude that the previously observed gap is an accidental one. Nɬeʔkepmxcin is a language of a type not represented in the previous cross-linguistic surveys of the distribution and timing of glottalized resonants. Significantly, glottalized resonants are contrastive in word-initial position in Nɬeʔkepmxcin, and our acoustic results verify Thompson and Thompson's (1992) auditory description of the phonetic realization of these segments as postglottalized. The significance of this result serves to reinforce the crucial importance of research and documentation on critically endangered languages such as Nɬeʔkepmxcin, whose richly complex oral heritage is currently so seriously on the verge of loss. Our second conclusion relates to the fact that, with the evidence that the principal mode of timing realization for resonants in Nɬeʔkepmxcin is postglottalized, the cross-linguistic generalization is now symmetric: although phonetically grounded conditions and markedness constraints undoubtedly play important roles, the basic generalization is that glottal timing is independent of oral articulation in the phonetic realization of glottalized resonants in both onset and coda positions.

References

Aoki, H. 1970. A note on glottalized consonants. *Phonetica* 21: 65-75.

Avelino, Heriberto, and Ian Maddieson. 2005. Glottalized consonants in Oaxaca Chontal. Paper presented at the 149th ASA, Vancouver, B.C.

Bird, Sonya. 2003. The phonetics of St'at'imcets glottalised resonants. Paper presented at ICSNL 38, Lillooet, B.C.

Bird, Sonya. and Marion Caldecott. 2004. Glottalization in St'at'imcets: A change in progress. Poster presented at ASA 147, New York, NY.

Bird, Sonya. and Marion Caldecott. In press. Timing differences in St'at'imcets Glottalised Resonants: Linguistic or Bio-mechanical? *Proceedings of AICSST 10.*

Buckley, Eugene. 1990. Glottalized and aspirated sonorants in Kashaya. *Occasional Papers on Linguistics, Southern Illinois University 15.*

Buckley, Eugene. 1994. *Theoretical aspects of Kashaya phonology and morphology.* Stanford: CSLI.

Caldecott, Marion. 1999. *A comparison of glottalized resonants in Sənčaθən and Sťáťimcets.* MA thesis, University of British Columbia.

Caldecott, Marion G. 2005. Glottalization cues of Nuu-chah-nulth glottalized resonants. Poster presented at the149th ASA. Vancouver, BC.

Carlson, Barry F., John H. Esling, and Jimmy G. Harris. 2004. A Laryngoscopic Phonetic Study of Nlaka'pamux (Thompson) Salish Glottal Stop, Glottalized Resonants, and Pharyngeals. In D. Gerdts and L. Matthewson, eds. *Studies in Salish Linguistics in Honor of M. Dale Kinkade.* UMOPL 17.

Dunn, John A. 1995. *Sm'algyax: a reference dictionary and grammar for the Coast Tsimshian language.* Juneau: Sealaska Heritage Foundation.

Elmendorf, William W., and Wayne Suttles. 1960. Pattern and Change in Halkomelem Salish Dialects. *Anthropological Linguistics* 2.7:1-32.

Flemming, Edward, Peter Ladefoged and Sarah Thomason. 1994. The phonetic structures of Montana Salish. *UCLA Working Papers in Phonetics* **87**. 1-33.

Gamble, Geoffrey. 1977. Nootkan glottalized resonants in Nitinat: a case of lexical diffusion. In William S.-Y. Wang (ed.) *The lexicon in phonological change.* The Hague: Mouton. 266-278.

Golla, Victor. 1970. Hupa grammar. University of California, Berkeley Ph.D. dissertation.

Goodfellow, Anne Marie. 1999. *Language, culture, and identity: social and cultural aspects of language change in two Kwak'wala-speaking communities.* Unpublished Ph.D. thesis, UBC.

Gordon, Matthew. 1996. The phonetic structures of Hupa. *UCLA Working Papers in Phonetics* 93:164-187.

Gordon, Matthew, and Peter Ladefoged. Phonation types: a cross-linguistic overview.

Hargus, Sharon. 2005. Distribution and Timing of Glottalized Nasals in Athabaskan. UBC Colloquium Presentation.

Howe, Darin. 1996. Lenition and glottalization in Nuuchahnulth. Paper presented at ICSNL 31, UBC.

Howe, Darin, and D. Pulleyblank. 2001. Patterns and timing of glottalisation. *Phonology* 18 2001. 45-80.

Hukari, Thomas, and Ruby Peter (eds.) *Hul'qumi'num' Dictionary.* Duncan, B.C.: Cowichan Tribes.

Kingston, John. 1985. *The phonetics and phonology of the timing of oral and glottal events.* Ph.D. dissertation, UCB.

Ladefoged, Peter, and Ian Maddieson 1996. *The sounds of the world's languages.* Cambridge, Mass. & Oxford: Blackwell.

Maddieson, Ian. 1984. *Patterns of sounds.* Cambridge: Cambridge University Press.

Newman, Stanley 1944. *Yokuts language of California.* New York: Viking Fund.

Plauché, Madelaine C. 1998. Glottalized sonorants in Yowlumne (Yawelmani). In A.R. Doran, T. Majors, C.E. Mauk and N. Merchant Goss (eds.), *Texas Linguistics Forum 41: Proceedings of the 1998 Texas Linguistics Society Conference,* Austin: Texas Linguistics Society. 133-45.

Plauché, Madelaine C., Rosemary Beam de Azcona, Rungpat Roengpitya, and William F. Weigel. 1998. Glottalized sonorants: a phonetic universal? *BLS* **24**. 381-389.

Sapir, Edward. 1938. Glottalized continuants in Navaho, Nootka, and Kwakiutl (with a note on Indo-European). *Language* **14**. 248-274.

Shank, Scott, and Ian Wilson. 2000. Acoustic evidence for ʕ as a glottalized pharyngeal glide in Nuu-chah-nulth. In S. Gessner & S. Oh (eds.), *Proceedings of ICSNL 35.* Vancouver: UBCWPL 185-197.

Shaw, Patricia A. in press. Inside access: : The Prosodic Role of Internal Morphological Constituency." In Kristin Hanson and Sharon Inkelas, eds. *The Nature of the Word: Essays in honor of Paul Kiparsky.* Cambridge: MIT Press.

Shaw, Patricia A. 2005. Non-adjacency in Reduplication. In Bernhard Hurch, ed. *Studies in Reduplication.* Berlin: Mouton de Gruyter. Pp. 159-208.

Shaw, Patricia A., Fiona Campbell, Flora Ehrhardt, & Patricia McKay. 2005. Glottalized resonants in Nɬeʔkepmxcin (Thompson River Salish). Poster presented at the 149th ASA, Vancouver.

Shaw, Patricia A., Susan J. Blake, Jill Campbell, & Cody Shepherd. 1999. Stress in hən̓q̓əmin̓əm̓ (Musqueam) Salish. In *Proceedings of the WSCLA,* UBCWPL 2: 131-163.

Silverman, Daniel. 1997. *Phasing and recoverability.* New York: Garland.

Steriade, Donca. 199. Phonetics in phonology: the case of laryngeal neutralization. *UCLA Working Papers in Phonology* 3: 25-146.

Thompson, Laurence C., and M. Terry Thompson. 1992. *The Thompson Language.* Missoula: UMOPL 8.

Thompson, Laurence C., and M. Terry Thompson. 1996. *Thompson River Salish Dictionary.* UMOPL 12.

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