11

Laryngeal schizophrenia in Washo resonants

ALAN C. L. YU

1 Introduction

Resonants in Washo, a highly endangered North American language spoken in the area around Lake Tahoe in California and Nevada have three possible laryngeal settings: glottalized, voiceless (breathy) and modal (1).[1] Laryngealized (i.e. glottalized or voiceless) resonants are complex consonants involving both supralaryngeal and laryngeal articulations. A glottalized resonant such as [m̰], for example, involves two oral articulations—closure at the lips and lowering of the velum—as well as a sub-oral articulation resulting in creaky voice or a glottal constriction resulting in a complete glottal closure. Traditional phonemic analyses (Jacobsen 1964, 1996) assume that voiced and voiceless resonants are contrastive in the language while phonetic glottalized resonants (nasals and approximants) are surface realization of glottal stop plus sonorant sequences. Obstruents, on the other hand, are assumed to exhibit a full three-way laryngeal contrast, although plain obstruents are generally voiced intervocalically, while only the plain series is observed in word-final and pre-consonantal positions.

This paper reevaluates the treatment of laryngealized resonants in Washo in light of recent findings in Washo phonetics and phonology and phonological theory in general. We review phonological and morpho-phonological evi-

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dence in support of an analysis that recognizes a phonemic glottalized sonorant series in Washo.

The structure of this paper is as follows: we begin with a description of the distribution and phonetic realization of the different resonant types in Section 2. Previous analysis of laryngealized resonants is described in Section 3. Arguments for a uniform unitary segment analysis is given in Section 4. Complications for the unitary segment analysis are discussed and treated in Section 5. The conclusion appears in Section 6.

(1) Phonetic inventory of Washo[2]

plain	p/b	t/d	(ts/dz)	k/g	ʔ
plain		s	ʃ		h
aspirated	p^h	t^h		k^h	
glottalized	p’	t’	ts’	k’	
modal	m	n		ŋ	
voiceless	m̥	n̥		ŋ̥	
glottalized	(m̰	n̰		ŋ̰)	
modal	w	l	j		
voiceless	w̥	l̥	j̥		
glottalized	(w̰	l̰	j̰)		

2 Resonants and their distribution

Resonants in Washo include nasals, liquids and glides. Modal voiced resonants may occur in word-initial (2a), intervocalic (2b), word-final (2c), and pre-consonantal (2d) positions.

[2] The phonemic inventory of Washo according to Jacobsen (1964) excludes the segments in parentheses. Plain consonants are generally voiceless unaspirated, although they are often realized with voicing throughout the stop closure when surrounded by sonorants. Prevoicing may also be observed in word-initial positions but is highly variable. The alveolar plain stop is realized as a flap intervocalically. Depending on the dialect, [s] in one dialect (the variant represented here) corresponds to [θ] in the other. For the sake of uniformity, plain stops are generally transcribed below as plain unaspirated in the Washo examples. Voiced variants are shown only when spectrographic evidence are given, as in the case of Figure 4.

(2) Distribution of modal voiced resonants

a. Word-initial		b. Intervocalic	
ˈmaːku	‘sister’s child’	*ˈtsʼimːel*	‘beard’
ˈŋawŋaŋ	‘child’	*ˈtaːŋal*	‘house’
ˈnapʼːaʔ	‘bad’	*ˈtʼanːu*	‘human’
ˈlakʼːaʔ	‘one’	*ˈtilːek*	‘duck’
ˈwaːʃiw	‘Washo’	*ˈjewːeʃ*	‘long’
ˈjulːiji	‘he’s dead’	*ˈtʼiːjeliʔ*	‘big’
c. Word-final		**d. Pre-consonantal**	
ˈtawjatsʼim	‘smoke’	*timˈlaːjaʔ*	‘my wife’
ˈpojːoŋ	‘pine needle’	*ˈtʰaŋlel*	‘west’
*ˈʔutenkʰ*in	‘nighttime’	*ˈnentʼuʃu*	‘old woman’
ˈtsʼiːpel	‘louse’	*ˈhelmeʔ*	‘three’
ˈpʼisːew	‘ear’	*ˈpʼewlel*	‘east’

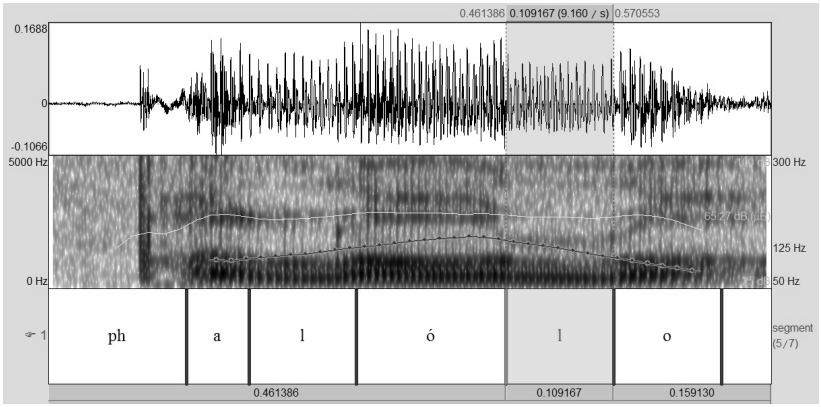

Figure 1. Waveform and spectrogram for the word [p^haˈ$lolːo$] ‘there is a blister’. The light thin line in the spectrogram indicates intensity level and the thick dotted line f_0.

Voiceless resonants (*m̥*, *n̥*, *ŋ̥*, *j̥*, *l̥*, *w̥*) occur in prevocalic positions and never in coda positions (3). Phonetically, voiceless resonants are never fully voiceless. Consider the resonants in Figures 1 and 2. Figure 1 illustrates the typical acoustic realization of modal voiced liquids in Washo. The word, [p^haˈlolːo] ‘there is a blister’, contains two laterals, one in pretonic and the other in posttonic position. The liquids show regular periodicity throughout the duration of the modal resonant, with sustained intensity and steady and smooth f_0 movement.[3] In contrast, a voiceless resonant typically begins with a period of

[3] For ease of comparison, in this and all subsequent figures, the lexical item used, whenever possible, will contain more than one instance of the resonant type of interest. The targeted post-

breathiness (approximately the first 30–50% of the segment), with concomitant reduction in intensity and pitch, and is followed by the resumption of modal voicing for the rest of its duration (see Figure 2). To reflect the phasing relationship between laryngeal configurations, voiceless resonants will be repesented from here on with a superscripted aspiration symbol before their corresponding modal resonant symbol, rather than with the voicelessness diacritic (e.g., ^{h}m vs. $m̥$). Auditorily and acoustically, voiceless resonants are clearest (with robust and audible breathiness) in pre-tonic position; the period of breathiness is often weak elsewhere, especially after a long stressed vowel.

(3) Distribution of voiceless resonants

Word-initial

ˈʰmuʔuʃi	‘he’s running’
ˈʰleːʔi	‘I am’
ˈʰwaːʔi	‘he’s the one who’s doing it’
ˈʰjaːmi	‘that’s what he’s talking about’

Intervocalic

tiˈʰmaːʃ	‘my face’
ˈmeːʰlu	‘old man”
tiˈʰwaːʔi	‘I’m the one who’s doing it’
tiˈʰjaːmi	‘that’s what I’m talking about’

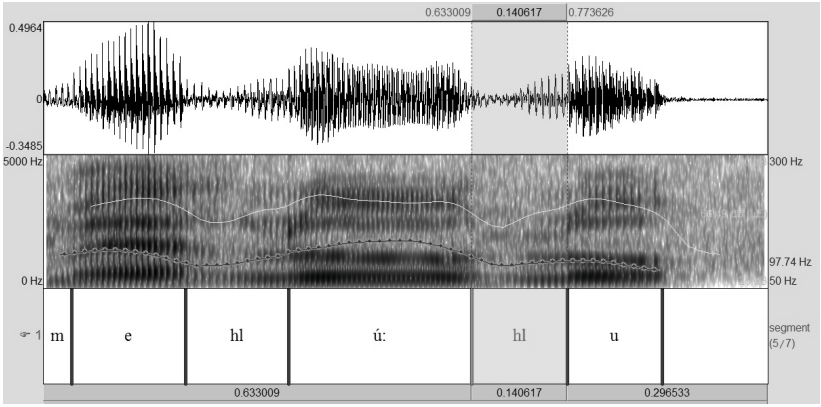

Figure 2. Waveform and spectrogram for the word [meˈʰluːʰlu] ‘old men’.

While voiceless resonants can appear post-vocalically, they are found only after a long stressed vowel or a short unstressed one (4). Voiceless resonants

tonic resonant is always highlighted. Segmentation and phonetic transcription is given at the bottom of each spectrogram.

never appear after a long unstressed vowel since long vowels are only found in stressed positions. We shall return to the restriction against voiceless resonants after a short unstressed vowel in Section 5.2.

(4) Distribution of intervocalic voiceless resonants

After short vowel

tiˈʰmaːʃ	'my face'
tiˈʰwaːʔi	'I'm the one who's doing it'

After long vowel

ˈmeːʰlu	'old man'
ˈtʼaːʰjaŋi	'he's hunting'

Glottalized resonants (*ṁ̥*, *ṅ̥*, *ŋ̥̇*, *l̥̇*, *j̥̇*, *ẇ*) are found word-initially, intervocalically, word-finally, and in pre-consonantal positions (5). However, not all possible glottalized resonants are attested in word-final and preconsonantal positions. The majority of pre-consonantal glottalized resonants consist of *Vjˀ* and *Vlˀ* sequences. The *Vjˀ* sequence is often derived from the root *-ájˀ* 'away, out of the way, discarded'.

(5) Distribution of glottalized resonants 1

a. Word-initial

ˈˀmiːkiji	'he sees you'
ˈˀnukʼːupi	'it's no good'
ˈˀŋaŋːaʔ	'pillow'

b. Intervocalic

ˈŋaˀmiŋ	'baby"
taˈˀmoˀmoʔ	'woman'
pʰaˈˀloˀlo	'butterfly'

c. Word-final

ˈpalˀ	'cheek'
tiˈkojˀ	'my father'
gaˈhajˀ	'throw it away!'

d. Pre-consonantal

tikumˈjojˀli	'I am tired'
kitˈpʼajˀla	'on his cheek'
tiˈjajˀli	'I cut it'

Phonetically, glottalized resonants have different realizations depending on their location within the word. Word-initially and intervocalically, glottalized resonants show pre-glottalization, which can be realized, albeit rarely, with a full glottal stop or, more commonly, with creakiness during the initial portion of the resonant and, in the case of medial resonants, the end portion of the preceding vowel or sonorant if such a segment is present. Glottalization is strongest in post-tonic positions, as evidenced by the different acoustic realizations of the pre- and post-tonic glottalized resonants in Figure 3. That is, glottalization is generally very weak in pretonic positions (e.g., slight drop in intensity and f_0) and is often undetectable; robust creakiness is observed in the post-tonic resonant, as evidenced by the sudden drop in intensity and irregularity in the glottal pulse intervals and f_0 realization. In word-final (Figure 4) and pre-consonantal (Figure 5) post-tonic positions, these resonants are realized with post-glottalization, which generally means there is strong creakiness during the later portion of the resonant. Word-final and pre-consonantal

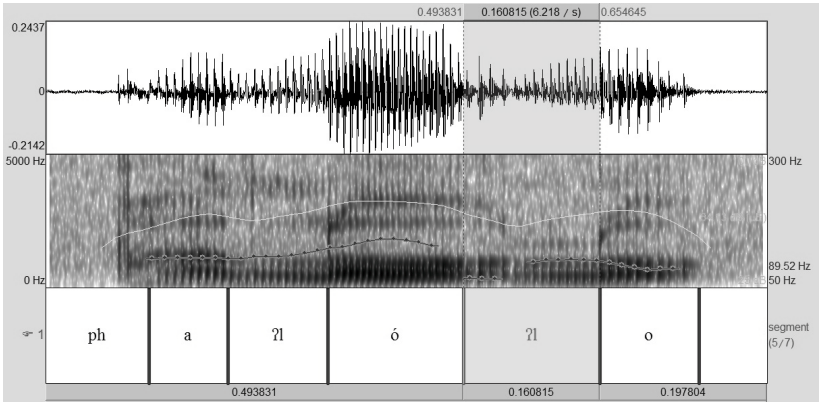

Figure 3. Waveform and spectrogram for the word [pʰaˈʔloʔlːo] ‘butterfly’.

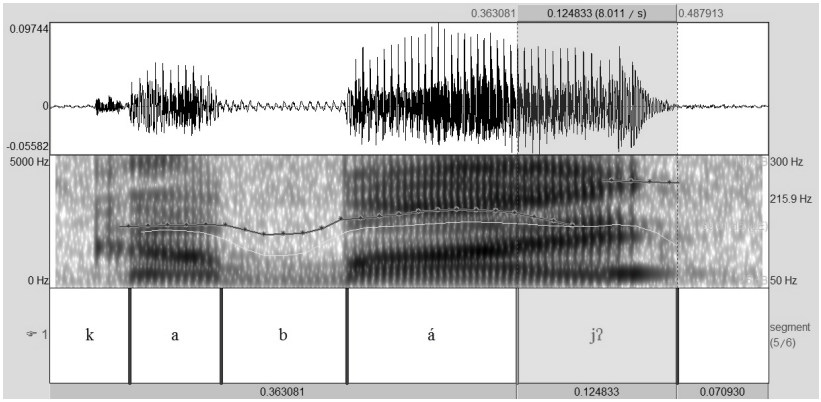

Figure 4. Waveform and spectrogram for the word [kaˈbajʔ] ‘take it off’. N.B. Glide segmentation is notoriously difficult and given here only for general guidance.

glottalized resonants are not found after an unstressed vowel. This type of variable glottalization in resonants has been reported in variety of languages, such as Yowlumne (Plauché et al. 1998) and Kwak’wala (Howe & Pulleyblank 2001). The difference in phasing relationship between glottalization and the resonant depending on the position of the resonants has been argued to be a consequence of perceptual optimization (Silverman 1997, but see Howe & Pulleyblank 2001). To indicate this difference in pre- and post-glottalization, the Washo examples from (5) and onward will be transcribed with the superscripted glottal stop notation (i.e. ^{ʔ}R or $R^{ʔ}$), instead of the $\dot{R}$ notation shown in (1).

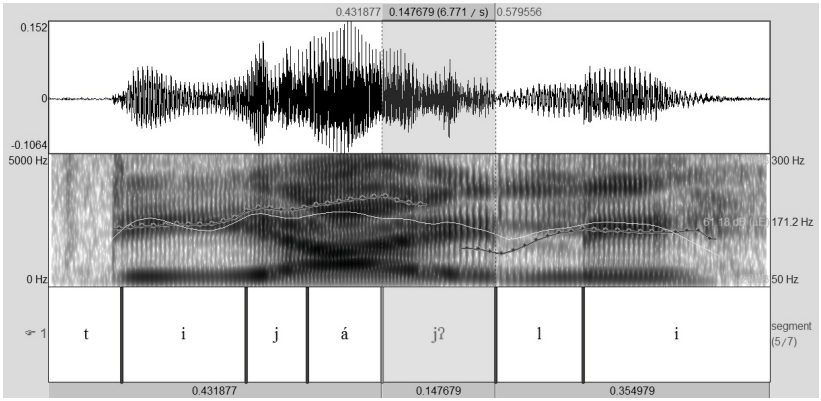

Figure 5. Waveform and spectrogram for the word [tiˈjajʔli] 'I cut it'.

3 Previous analysis

The previous analysis of Washo phonology advocates a distinct treatment for voiceless and glottalized resonants (Jacobsen 1964, 1996). Phonemically, glottalized resonants are treated as sequences of glottal stop and modal resonant while voiceless resonants are seen as underlyingly unitary segments. The main argument for this diverging treatment comes from the issue of contrast. Jacobsen (1964: 78) argues that "[i]t is not possible to analyze the voiceless resonants as clusters of voiced resonants either preceded or followed by /h/, as such clusters also occur in contrast to the voiceless resonants".

In the same vein, Jacobsen (1964) rejects the unitary segment analysis for glottalized resonants based on the observation that there is no contrast between glottalized resonants (-*ʔR*-) and clusters of a glottal stop followed by a voiced resonant (-*ʔR*-).[4] Glottal stops, which are found initially (6a)[5] and finally (6b), may also appear before (6c) and after obstruents (6d), in contrast to ejectives ([ˈtʼapʼːɨɬ] 'its tail', [ˈpikʼːus] 'cradle basket'), which do not appear before another consonant. Jacobsen (1964) found no evidence that glottalized

[4] We return to the issue of contrast between glottalized resonants and glottal stop + resonant sequences in Section 5.3.

[5] Word-initial glottal stops in Washo have two origins. All words begin with a consonant in Washo. Underlyingly vowel-initial words are realized with a glottal stop when no consonantal prefix is attached. There are, however, roots that begin with an underlying initial glottal stop. The existence of underlying root-initial glottal stop is evidenced in prefixal allomorph selection. For example, the first-person pronominal prefix has two allomorphs, *ti-* and *l-*. Underlying vowel-initial roots take the *l-* variant (/aʃːaŋ/ 'to bleed' → [ˈʔaʃːaŋi] 'he's bleeding', [ˈlaʃːaŋi] 'I am bleeding'), while roots that begin with a consonant, including those beginning with a glottal stop, take the *ti-* variant (/jaliʔ/ 'stand' → [tiˈjalːiʔi] 'I am standing'; /ʔaːka/ → [tiˈʔaːkaji] 'I am scraping (paint)').

resonants could contrast with clusters of a glottal stop followed by a voiced resonant.

(6) Distribution of glottal stop

a. Word-initial

ˈʔajːɨs	'antelope'
ˈʔoːkal	'mountain sheep'

b. Word-final

ˈtimːeʔ	'water'
ˈtsʼalːiʔ	'cottontail rabbit'

c. Preconsonantal

taˈlaʔka	'on the mountain'
ˈmaʔka	'on the wood'

d. Post-consonantal

kitˈʔiːsa	'his older sister'
kitˈʔaːtʼu	'his older brother'

Considerations of contrastivity aside (we shall revisit this issue in Section 6), there is ample evidence in support of a uniform treatment of voiceless and glottalized resonants in Washo. This is the topic of the next section.

4 A unified treatment of laryngealized resonants

4.1 Two strands of evidence

In this section, we argue for a unified treatment of laryngealized resonants. In particular, we contend that glottalized resonants, like voiceless resonants, are best viewed as unitary segments, based on distributional and morpho-phonological evidence.

4.2 Distributional evidence

Washo has no word-initial clusters, at least in the native lexicon. As Jacobsen (1964: 117) noted, "[t]he only initial consonant clusters occur in indigenous words are of the type /ʔ/ plus voiced resonant. All other examples are found in loanwords from English". Word-final clusters and word-medial triconsonantal sequences are likewise impossible in Washo. When such sequences are derived due to morphological concatenation, /ɨ/ is epenthesized in between the first two consonants in such a sequence (7). Note that the post-tonic consonant before the epenthetic vowel is also lengthened as a result of post-gemination (see Section 5.2 for more discussion).

(7) Vowel insertion

Root		Prevocalic		Before C/word-final	
-alŋ-	'arm'	*ˈtʾalŋa*	'on her arm'	*ˈlalːɨŋlu*	'with my arm'
-aʃk-	'back'	*ˈkaʃka*	'on its own back'	*ˈtʾaʃːɨk*	'her back'
-iʃm-	'to sing'	*ˈʔiʃmi*	'he's singing'	*ˈkeʃːɨm*	'sing!'

The only exception to this ban of triconsonantal sequences is when the medial consonant is a glottal stop and when at least one of the flanking consonants is a resonant (8).[6]

(8) Distribution of glottalized resonants 2[7]

kitˈʔmaːʃ	'his pinenut territory'
ˈkʾawʔlak	'a type of owl'
teʔilˈʔjɨnɨjɨni	'varicolored'
ʔumˈʔŋaŋːaʔ	'your pillow'

Under a bi-consonantal sequence analysis, the distribution of glottalized resonants is anomalous from the perspective of Washo phonotactics. On the other hand, by treating glottalized resonants (5) as unitary segments, a more uniformed phonotactic description of the native Washo lexicon is obtained.

4.3 Evidence from reduplication

Washo employs partial reduplication to denote plurality in nouns and pluractionality in verbs (Jacobsen 1964, Winter 1970, Yu 2006). The reduplicant (underlined) is generally CV in shape. The left edge of the reduplicant must coincide with the left edge of the stressed syllable (9). In other words, the reduplicant must be part of the stressed syllable and the onset of the reduplicant must be the onset of the stressed syllable.

(9) Plural reduplication

Singular	Plural	Gloss
ˈtaʔa	*taˈʔaʔa*	'mother's brother'
ˈʔelːel	*ʔeˈlelːel*	'mother's father'
ˈkewːe	*keˈwewːe*	'coyote'
ˈpɨkʾːɨ	*pɨˈkʾɨkʾːɨ*	'grandmother's sister'
ˈsukʰːuʔ	*suˈkʰukʰːuʔ*	'dog'

Since stress, which is a property of stem, falls predominantly on the penultimate syllable, the reduplicant appears infixing on the surface. The infxal nature of this reduplicative process is most obvious when the reduplicative stem contains a medial consonantal sequence, as in the example in (10a). From the perspective of the present discussion, what is noteworthy about the data

[6] See Section 5.3 for more discussion on word-final clusters in Washo.

[7] In order to maintain transcription uniformity throughout the paper, the glottal stop of interest is given here in the raised notation, rather than in Jacobsen's *C?C* format.

in (10) is the fact that the shape of the reduplicant remains CV. The medial consonant sequence is not copied as part of the reduplicant. For example, the plural of *ˈʔewʃiʔ* 'father's brother' is *ʔeˈʃiwʃiʔ*, not **ʔeˈwʃiwʃiʔ*. This pattern extends to the voiceless resonants, as illustrated in (10b).[8] The only exception to this generalization once again would have come from glottal resonants. If *ʔR* were treated as a consonant sequence, the whole sequence would have to be copied (10c), which is against the general morpho-phonological pattern of this process.

(10) Reduplication with stems with internal consonant sequences

	Singular	Plural	Gloss
a.	*ˈʔewʃiʔ*	*ʔeˈʃiwʃiʔ*	'father's brothers'
	ˈnentˈuʃ	*neˈtˈuntˈuʃu*	'old women'
	ˈsaksak	*saˈsaksak*	'father's father's bother'
b.	*ˈmeːʰlu*	*meˈʰluːʰlu*	'old men'
	(*jeːʰlu*)	*jeˈʰluːʰlu*	'elders'
c.	*ˈŋaʔmiŋ*	*ŋaˈʔmiʔmiŋ*	'baby'
	taˈʔmoʔmoʔ	*taʔmoˈʔmoʔmoʔ*	'woman'
	pʰaˈʔloʔlo	*pʰaʔloˈʔloʔlo*	'butterfly'

Given the exceptional behavior of glottalized resonants under a consonant sequence analysis, a unitary segment anaysis is more desirable if an economical and uniform treatment is to be achieved. There are, however, two apparent complications to the unitary segment analysis for all laryngealized resonants. This is the topic of the next section.

5 Some complications for the single-segment analysis

5.1 Two cases of mistaken identity

There are two main complications to the unitary segment analysis of laryngealized resonants in Washo, both involving what appear to be instances of segmental fission (Blevins 2003). In this section, we confront these two problems head-on and provide explanations for their seemingly exceptional behavior.

5.2 Segmental fission to the rescue

The first complication concerns the distribution of voiceless resonants. Recall that Jacobsen argues against treating voiceless resonants as clusters of voiced resonants either preceded or followed by /h/ because such clusters also occur in contrast to the voiceless resonants. This characterization is not entirely ac-

[8] This word for *jeˈʰluːʰlu* 'elders' is always attested in the plural; the singular form is given in parentheses to indicate that it is the presumed singular counterpart, but is not attested in our corpus.

curate, however. Sequences of *h* + resonant have a very restricted distribution and they appear in a predictable way. While *h* + resonant sequences are attested (e.g., [ˈlahla] 'in my leg', [waˈmahmi] 'it's cloudy'), they are found only after a short stressed vowel, precisely the position where voiceless resonants are banned. The segment /h/ is not found in word-final or preconsonantal positions elsewhere in the language. Thus, the fact that preconsonantal /h/ is only observed before a resonant after a short stressed vowel—the very environment where voiceless resonants are never found—strongly suggests that voiceless resonant and /h/ + resonant clusters are in complementary distribution and that they should be treated as allophones to the same phoneme. How might an /h/+resonant sequence be related to a voiceless resonant?

Here, we contend that the complementary distribution between voiceless resonants and /h/ + resonant sequences in post-tonic position follows from more general properties of stress realization in Washo. Stressed syllables in Washo must be heavy (Yu 2006; cf. Hyman 1985), meaning that the stressed syllable must contain either a long vowel (11a) or a short vowel (11b) followed by a coda consonant (i.e. CVV or CVC). When the stressed syllable does not contain a long vowel and the post-tonic consonant is not followed by a hetero-organic consonant, the post-tonic consonant is geminated (11b). A geminated consonant is on average about 50% longer than its singleton counterpart (Yu 2008).

(11) Distribution of singletons and geminates

a.	V:C		b.	VC:	
	ˈjaːsaʔ	'again'		*ˈjasːaŋi*	'it's hot'
	ˈwaːʃiw	'Washo'		*ˈtaʃːaŋ*	'blood'
	ˈpaːmuʃ	'muskrat'		*ˈtamːuʔ*	'skirt'
	ˈʔaːni	'red ant'		*ˈtʰanːiw*	'Miwok'
	ˈkʼaːŋi	'it's roaring'		*ˈkʰaŋːa*	'cave'
	ˈwaːlaʃ	'bread'		*ˈʃalːaʔ*	'pitch'
	ˈpʼaːwa	'in the valley'		*ˈtawːal*	'buckberry'
	timˈlaːjaʔ	'my wife'		*ˈʔajːis*	'antelope'

In light of the evidence for post-tonic gemination, the fact that after a short stressed vowel, only /h/ + resonant sequence is found, and never a voiceless resonant, suggests that the appearance of the so-called /h/ + resonant sequence is a consequence of post-tonic gemination. Recall that nonmodal phonation in voiceless resonants never extends over the entire laryngealized segment; nonmodal phonation (breathiness) always precedes modal phonation. Due to a stress-to-weight requirement in Washo (Yu 2006), the post-tonic segment is lengthened if the stressed vowel is underlyingly short. What is different between a complex segment, like a voiceless resonant, and other simple segments is that, when a voiceless resonant is lengthened, the window of breath-

iness phonation is timed in such a way that it appears to decouple, perhaps completely, from the modal resonant. The gemination-induced phase separation between non-modal and modal phonations thus gives the impression of a sequence of a glottal fricative followed by a resonant with modal phonation.

5.3 Echo vowel insertion

The other, perhaps more serious, complication concerns the existence of glottalized resonants that correspond to genuine glottal stop + resonant sequence. For example, the glottalized glide in *taˀwa* 'in the lake' appears as modal voice when the word occurs without a suffix, *ˈtaʔaw* 'lake'(see also (12b)). The vowel that separates the glottal stop from the modal resonant comes from a process of echo vowel insertion. That is, the vowel that intervenes between the glottal stop and the following consonant is always a copy of the vowel preceding the glottal stop (12a); the echo vowel is inserted when the glottal + consonant sequence appears word-finally.[9]

(12) Distribution of echo vowel insertion; echo vowel is bolded

a.	*taˈlaʔka*	'on the mountain'	*taˈlaʔ**a**k*	'mountain'
	ˈteʔka	'on the rock'	*ˈteʔ**e**k*	'rock'
	ˈmaʔka	'on the wood'	*ˈmaʔ**a**k*	'wood, stick'
	tʼiʔpa	'at his navel'	*ˈʔiʔ**i**p*	'navel'
b.	*ˈtaˀwa*	'in the lake'	*ˈtaʔ**a**w*	'lake'
	wesˈkʼiˀmi	'it's windy'	*weˈkʼiʔ**i**m*	'wind'

Echo vowel insertion specifically targets glottal stop + consonant sequences. As shown in (13), other consonant sequences are broken up via the insertion of /ɨ/ (see also (7)).

(13) Distribution of default vowel insertion

-alŋ-	'to lick'	*ˈkʼalŋi*	'he's licking it'	*ˈkalɨŋ*	'lick it!'
-iʃm-	'to sing'	*ˈʔiʃmi*	'he's singing'	*ˈkeʃɨm*	'sing!'
-alŋ-	'arm'	*ˈtʼalŋa*	'on her arm'	*ˈlalɨŋlu*	'with my arm'
-aʃk-	'back'	*ˈkaʃka*	'on his own back'	*ˈtʼaʃɨk*	'her back'

Functionally, both echo vowel epenthesis and default vowel insertion prevent the formation of word-final consonant clusters. To this end, it is noteworthy that there exist words with glottalized resonants in Washo that do not appear to trigger echo vowel epenthesis (14).[10]

[9] It is unclear if the glottal stop participates in consonant gemination in the context of the inserted echo vowel. As noted earlier, glottal stops are often realized as creakiness. The glottal stop that occurs in the echo vowel context is no exception. Since vowel length is never contrastive before a glottal stop, there is unfortunately no way to establish whether the glottal stop or interval of creakiness is lengthened or not.

[10] Recall that post-glottalized resonants are positional allophones of the preglottalized resonants; see Section 2.

(14) Word-final glottalized resonants

ˈkojˀ	'father'
kaˈʰmojˀ	'run away!'
gaˈlajˀ	'wipe it!'
pʾalˀ	'cheek'

How should we reconcile the fact that there exist some word-final glottalized resonants that trigger echo vowel epenthesis (12) while others do not (14)? Here, we propose that glottalized resonants in Washo come from two sources. The type of surface final glottalized resonants seen in (14) are best treated as unitary segment, considering the fact that Washo generally does not tolerate word final consonant clusters. The type of surface glottalized resonants that corresponds to echo-vowel separable consonant sequences must be treated as underlying glottal stop + resonant sequences. Thus the underlying form for 'father' is /koj̇/, with a unitary glottalized resonant, while the underlying form for 'lake' would be /taʔw/, which has an underlying glottal stop + glide sequence.

6 Conclusion

As Hyman's work often reminds us, it is only through a close examination of the patterning in language that a deeper understanding of the underlying system is revealed. The analysis of laryngealized resonants in Washo presented in Jacobsen (1964), which advocated for distinct treatments between voiceless resonants and glottalized resonants, relies on the fact that voiceless resonants contrast with *h* + resonant sequences, while glottalized resonants do not contrast with *ʔ* + resonant sequences. This observation, to be sure, was highly insightful. Yet, it misses the mark as it fails to take into account the behavior of the rest of the system. That is, voiceless resonants can be shown to be in complementary distribution with *h* + resonant sequences; the allophonic realization of voiceless resonants as *h* + resonant sequences can be explained by independently motivated requirements of stress realization in the language. On the other hand, glottalized resonants can be shown to be in contrast with *ʔ* + resonant sequences based on evidence from echo vowel epenthesis.

(15) Phonemic inventory in Washo

plain	p	t		k	ʔ
aspirated	p^h	t^h		k^h	
glottalized	p’	t’	ts’	k’	
plain		s	ʃ		h
modal	m	n		ŋ	
voiceless	m̥	n̥		ŋ̊	
glottalized	m̰	n̰		ŋ̰	
modal	w	l	j		
voiceless	w̥	l̥	j̊		
glottalized	w̰	l̰	j̰		

The uniform treatment of laryngealized resonants in Washo advocated in this paper (i.e. the existence of both unitary glottalized resonants and voiceless resonants in the language) has significant ramifications for our understanding of the Washo phonemic system. In particular, the proposed phonemic inventory (see (15)) is far more symmetric than the one proposed in Jacobsen 1964. That is, rather than a reduced set of laryngeal contrasts in the resonants (see sounds not in parentheses in (1)), the three-way laryngeal contrast in the obstruents (i.e. plain vs. aspirated vs. glottlized) now finds analog in both the nasals as well as the approximant series (i.e. modal vs. voiceless vs. glottalized).

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