The Distribution and Representation of Laryngeals
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1. Introduction

There have been various proposals on the representation of laryngeals. However, with respect to the specification of laryngeal node features, all standard analyses assume the presence of a laryngeal node feature, [constricted glottis] or [spread glottis] in the representation of /ʔ, h/ as shown in (1) (Clements 1985, Sagey 1986)[1]:

(1)

According to this view, /ʔ/ and /h/ share a laryngeal feature with glottalized and aspirated consonants, respectively. That being the case, they are predicted to pattern together in some phonological processes. For example, one of the most common phonological processes involving laryngeal features is laryngeal neutralization, whereby all laryngeal distinctions are lost in syllable-final position. If laryngeals are represented as in (1), it is predicted that they will tend to occur only in syllable-initial position as glottalized and aspirated consonants do. However, there is no systematic survey of the behavior of /ʔ, h/ with respect to laryngeal neutralization. The purpose of this paper is to examine the distribution of laryngeals and to relate it to their representations.

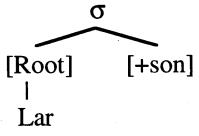
In order to address this issue of the representation of /ʔ, h/, I did a crosslinguistic survey of the distribution of laryngeals in about 30 American Indian languages. Based on the pattern of the distribution of laryngeals in the languages examined, I propose, first, that laryngeals may be better represented without laryngeal features. Secondly, I propose that their special pattern of distribution in coda position can be accounted for by the Coda Condition (Ito and Mester 1994), together with the assumption that laryngeals are placeless.

This paper is organized as follows: Section 2 examines the distribution of laryngeals as compared to that of laryngeally-marked consonants[2]. I suggest that representing laryngeals with laryngeal node features is not appropriate in some languages, by showing that there are languages in which /ʔ// /h/ pattern differently than laryngeally-marked consonants. In addition, I provide an Optimality Theoretic analysis for the distributional patterns. In section 3, I summarize the distribution of laryngeals in syllable position in the languages that have /ʔ, h/ without glottalized or aspirated consonants. Their special occurrence in coda position will be discussed. Section 4 concludes the paper.

2. The laryngeal constraint and /ʔ, h/

The most common phonological process involving laryngeal features is laryngeal neutralization, wherein all laryngeal distinctions are lost in syllable-final position. Lombardi (1991) accounts for this type of restriction of laryngeal feature occurrence by way of a positive constraint which states that laryngeal features are licensed in the following configuration:

(2)



This would predict that laryngeally-marked consonants tend to be restricted to syllable-initial position. In addition, if laryngeals are represented with laryngeal features, it is predicted that /ʔ/ and /h/ will show the same pattern of distribution as glottalized consonants and aspirated consonants, respectively or laryngeally-marked consonants as a whole in this respect. In this section, I examine the distribution of /ʔ, h/, comparing it with that of glottalized and aspirated consonants.

For the study of the distribution of laryngeals, phonological descriptions of approximately 30 American Indian languages have been examined. Among them, 15 languages have both laryngeals and laryngeally-marked consonants. These languages can be divided into two classes, according to the distributional difference between laryngeals and laryngeally-marked consonants. In one class, /ʔ/ and/ or /h/ show the same pattern of distribution as C' and/ or C^h (3a, 3b). In the other class, /ʔ/ and/or /h/ show a different pattern of distribution than C' and/ or C^h (3c). The languages in which /ʔ/ and/ or /h/ show the same pattern of distribution as C' and/ or C^h are further divided into two types. In one group of languages, laryngeals/ laryngeally-marked consonants occur only in syllable-initial position (3a). In the other languages, laryngeals/laryngeally-marked consonants occur both in syllable-initial and in syllable-final position (3b). The following summarizes each pattern of language and the distribution of /ʔ, h/ and glottalized/aspirated consonants:

(3)

a. languages in which both /ʔ, h/ and C'/ C^h occur only in syllable-initial position

	syllable-initial				syllable-final			
	ʔ	C'	h	C^h	ʔ	C'	h	C^h
NE Maidu	✓	✓	✓	n/a	*	*	✓	n/a
Tojolabal	✓	✓	✓	n/a	*3	*	✓	n/a
Cuzco Inca	✓	✓	✓	✓	*	*	*	*
Yuchi[4]	✓	✓	✓	✓	*	*	*	*

✓: occurrence *: non-occurrence
n/a: non-existence in the inventory

b. languages in which both /ʔ, h/ and C'/C^{h} occur both in syllable-initial and syllable-final position

	syllable-initial				syllable-final			
	ʔ	C'	h	C^{h}	ʔ	C'	h	C^{h}
Tsotsil	✓	✓	✓	n/a	✓	✓	✓	n/a
Mayan Chontal	✓	✓	✓	n/a	✓	✓	✓	n/a
Hokan Chontal	✓	✓	✓	n/a	✓	✓	✓	n/a

c. languages in which /ʔ, h/ show different pattern of distribution than that of C'/ C^{h}

	syllable-initial				syllable-final			
	ʔ	C'	h	C^{h}	ʔ	C'	h	C^{h}
Washo	✓	✓	✓	✓	✓	*	✓	*
Tolowa	✓	✓	✓	✓	✓	m', n'[5]	✓	*
Tewa	✓	✓	✓	n/a	✓	*	✓	n/a
Kiowa-Apache	✓	✓	✓	✓	✓	*	✓	*
Navaho	✓	✓	✓	✓	✓	*	✓	*
Slave	✓	✓	✓	✓	✓	*	✓	*
Siona	✓	✓	✓	n/a	✓	*	*	n/a
Tututni	✓	✓	✓	✓	✓	*	✓	*

2.1. Laryngeal constraint type

2.1.1 Distribution and representation

In Northeastern Maidu, Tojolabal, the Cuzco dialect of Inca and Yuchi, laryngeal features are restricted to syllable-initial position. Northeastern Maidu (Shipley 1956) has the following consonant inventory: /p, t, c, k, b, d, p', t', c', k', ʔ, s, h, m, n, l, w, y/. The following consonants occur only syllable-initially: /b, d, p', t', c', k', ʔ/. That is, /ʔ/ and glottalized consonants (/p', t', c', k'/) are limited to syllable-initial position. In addition, voiced obstruents (/b, d/) are also limited to syllable-initial position. This suggests that the laryngeal constraint is active in this language.

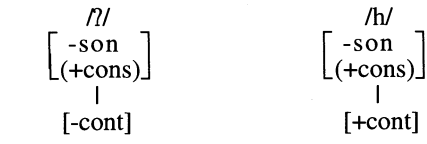
Tojolabal (Supple and Douglass 1949) has the following consonant inventory: /p, t, k, t^{s}, č, p', t', k', t^{s}', č', ʔ, s, š, h, m, n, l, r, w, y/. Any consonant except glottalized consonants (/p', t', k', t^{s}', č'/) and /ʔ/ may occur as the first member of word-medial biconsonantal clusters, which means that glottalized consonants and /ʔ/ occur only in syllable-initial position.

It is noteworthy that /h/ does occur in syllable-final position in Northeastern Maidu and Tojolabal. If /h/ is represented with a laryngeal node, it is predicted not to occur in syllable-final position according to the laryngeal constraint proposed by Lombardi. It seems to be a case in which the laryngeal constraint has to refer to a specific laryngeal feature such as [constricted glottis]. However, restricting the laryngeal constraint so that it applies to a specific feature does not capture the

generalization that all laryngeal features are neutralized in syllable-final position. For example, in Northeastern Maidu, voiced stops as well as glottalized consonants are not allowed in syllable-final position, which suggests that the laryngeal constraint applies to all laryngeally-marked consonants.

The interesting fact about Tojolabal and Maidu is that they do not have aspirated consonants in their consonant inventories. Bessell (1993) claims that /ʔ, h/ are represented with laryngeal features only when there are phonological reasons for the presence of phonation features such as inventory contrast or reference in phonological rule. Therefore, according to her, when there is no phonological reason for the presence of phonation features in the language, laryngeals are represented as follows:

(4)



Representing /h/ with a laryngeal node gives the wrong prediction that it will pattern together with /ʔ/ and C' in its distribution. Note, however, that Maidu and Tojolabal do not have aspirated consonants in their inventories. Therefore, following Bessell, I propose that /h/ is represented as a placeless continuant without a laryngeal node, unlike /ʔ/, in Tojolabal and Maidu. If so, the laryngeal constraint does not apply to /h/, which will account for the distributional fact of /h/. In addition, /h/ patterns as the other fricatives in Tojolabal in that it may occur as the first member of onset clusters along with /s/ and /š/. If /h/ is represented with a laryngeal node, the fact that /h/ patterns as continuants rather than as other laryngeally-marked segments will not be accounted for.

On the other hand, in the Cuzco dialect of Inca, /h/ is also restricted to syllable-initial position along with /ʔ/ and C'/C^{h}. The Cuzco dialect of Inca (Rowe 1950) has aspirated consonants in the phonemic inventory, which means that [spread glottis] is used as phonation feature. Therefore, /h/ in the Cuzco dialect of Inca is represented with a laryngeal node and it accounts for the fact that /h/ patterns as other laryngeally-marked consonants.

2.1.2. Optimality Theoretic analysis

In this section, I analyze the laryngeal neutralization phenomena in the framework of Optimality Theory. I adopt the constraint-based approach of Optimality Theory, since it accounts for the languages which do not show laryngeal alternations as well as those which do. Lombardi (1994) suggests the following laryngeal alignment constraint:

(5) Align-Left (Laryngeal node, Syllable)

This constraint which requires that the laryngeal node occur at the left edge of a syllable, together with the interaction with the Faithfulness constraints, provides two types of laryngeal distribution; 1. syllable-initially restricted laryngeal distribution; 2. unrestricted distribution. That is, if the constraint Align-Left dominates MAX-IO, the effect of the laryngeal constraint is visible. On the other

hand, if it is dominated by MAX-IO, the effect of the laryngeal constraint is not visible. Thus, in Northeastern Maidu, Tojolabal, and the Cuzco dialect of Inca, Align-Left is ranked above MAX-IO. The following tableau illustrates the constraint interaction resulting in laryngeal neutralization:

(6) Align-Left (Laryngeal node, σ) >> MAX-IO

/huk'/ 'one'	Align-Left (Lar, σ)	MAX-IO
a. huk'	*!	
---> b. huk		*

The following is the example from Maidu:

(7)

/juhju/ 'quail'	Align-Left (Lar, σ)	MAX-IO
----> a. juhju		
b. juju		*

The occurrence of /h/ in syllable-final position in (7a) does not violate the constraint Align-Left, since /h/ does not have a laryngeal node in this language. Therefore, (7a) is chosen as the optimal output.

2.2. No Restriction type

There are languages in which /ʔ, h/ and glottalized consonants can occur both in syllable-initial and in syllable-final position. Tsotsil, Mayan Chontal, and Hokan Chontal belong to this type.

Tsotsil (Weathers 1947) is a member of the Mayan family, which has the following consonant inventory: /b, p, t, k, c, č, ʔ, p', t', k', c', č', m, n, s, š, h, v, y, l, r/. Glottalized consonants as well as /ʔ/ and /h/ can occur in syllable-final position. As the first member of biconsonantal onset clusters, /h, s, š, č, c/ may occur. The examples are cm, hn, sn, šm and čm. This indicates that /h/ patterns as other fricatives.

Mayan Chontal (Keller 1959) has the following consonant inventory: /p, t, k, p', t', k', b, d, g, ʔ, c, č, c', č', s, š, h, w, y, m, n, l, r/. Glottalized consonants occur both in syllable-initial and in syllable-final position (#__, V__V, VC__V, V__CV and __#). The distribution of /ʔ, h/ is exactly the same as that of glottalized consonants.

Hokan Chontal (Waterhouse and Morrison 1950) has the following consonant inventory: /f', c', č', L', k', ʔ, f, s, š,, x, p, t, c, tʸ, č, k, b, d, r, g, m', n', ñ', l', w', N, ɬ, ɬʸ, Y, W, m, n, ñ, r, ř, l, lʸ, y, w/. Glottalized consonants and voiceless sonorants as well as /ʔ, h/ can occur both in syllable-initial and syllable-final position. They also occur as a member of word medial triconsonantal clusters such as nk'm, nk'l, nk'w, nk'p, yʔtʸ. This suggests that the laryngeal constraint is not active in this language.

As seen above, in these languages, laryngeal features do not obey any specific constraint on distribution. Therefore, the constraint MAX-IO dominates Align-Left (Lar, σ) in this type of language so that Align-Left (Lar, σ) does not have any effect. This constraint ranking is opposite to the one in languages that

show the laryngeal neutralization effect. The following illustrates the constraint interaction which results in the appearance of the optimal output[6]:

(8) Mayan Chontal: MAX-IO >> Align Left (Lar, σ)

a.

/yuʔ/ 'kind of nut'	MAX-IO	Align-Left (Lar, σ)
----> a. yuʔ		*
b. yu	*!	

b.

/nok'/ 'cloth'	MAX-IO	Align-Left (Lar, σ)
----> a. nok'		*
b. nok	*!	

With the higher ranking of MAX-IO, the first candidates in (8a) and (8b) which have a laryngeal node on the right edge of a syllable are optimal, although they violate the constraint Align-Left.

2. 3. Laryngeals without a laryngeal node

There are languages in which /ʔ, h/ show a different pattern of distribution than that of laryngeally-marked consonants. That is, in some languages /ʔ, h/ occur in syllable-final position, while aspirated and glottalized consonants do not. The examples are Washo, Tolowa (Smith River Athapaskan), Tewa (Santa Clara dialect), Kiowa-Apache, Navaho, Slave, Siona and Tututni (Oregon Athapaskan).

Washo (Jacobsen 1958) has the following consonant inventory: /p, t, k, b, d, g, p', t', k', s, š, h, m, n, ŋ, M, N, Ŋ, w, l, y, W, L, Y/. Syllable-finally, the following consonants may occur: /p, t, k, ʔ, s, š, h, m, n, ŋ, w, l, y/. That is, voiced and glottalized obstruents and voiceless sonorants, which I assume to be underlyingly aspirated following Mester and Ito (1989), do not occur syllable-finally. All consonants excluded from syllable-final position are laryngeally-marked consonants. On the other hand, /ʔ, h/ occur in syllable-final position. This is a case where the laryngeal feature of the glottal stop or /h/ shows a different pattern of distribution than that of laryngeally-marked consonants.

Tututni (Golla 1976) has the following consonant inventory: /t, č, b, d, ǯ, g, g^w, ʔ, t', ƛ', c', c^r', č', k', k^w', ɬ, s, s^r, š, x, x^w, h, m, n, l, y, ɣ, $ɣ^w$/[7]. Syllables are of three types: open, closed by a non-laryngeal consonant, closed by a laryngeal consonant (ʔ, h) or by a cluster that includes a laryngeal. Non-laryngeal consonants found in syllable-final position include, /m, d, n, ɬ, s, š, g/, and /g^w/. Clusters such as /ʔd, ʔs, ʔs^r, ʔl, ʔg, ʔg^w, nʔ, mʔ, lʔ/ as well as the single segments /ʔ/ and /h/ occur in syllable-final position. On the other hand, glottalized consonants (t', ƛ', c', c^r', č', k', k^w') and aspirated consonants (t, č) do not occur in syllable-final position, which suggests that the laryngeal constraint is active.

In Navaho (Sapir and Hoijer 1967), there is a three-way contrast of plain voiceless, voiceless aspirated and glottalized stops and affricates. Glottalized sonorants /m', n', y'/ also occur. Syllable-finally, only plain voiceless consonants /d, g/ and /s, z, š, ž, ɬ, l, n, ʔ, h/ are allowed. That is, laryngeally- marked consonants occur only in syllable-initial position. However, /ʔ, h/ may occur in

syllable-final position. This is also true in Kiowa-Apache (Bittle 1963). In Kiowa-Apache, although there is a three-way contrast among plain voiceless, voiceless aspirated and glottalized stops syllable-initially, only plain voiceless stops occur in syllable-final position. In addition, /ʔ, h/ are allowed in syllable-final position.

In Tewa (Hoijer and Dozier 1949), the following consonants occur: /b, d, r, g, p, t, tʸ, k, kʷ, ʔ, p', t', k', kʷ', m, n, nʸ, v, f, ɵ, s, š, x, xʷ, w, y, h, hʷ/. Syllable-finally, only /ʔ, h/ and /n/ are allowed. This language shows not only that /ʔ, h/ show a different pattern of distribution than laryngeally-marked consonants, but that they are uniquely allowed in coda position excluding other consonants. In this language, a special condition for the coda consonant seems to be required. Slave (Rice 1989) and Siona (Wheeler and Wheeler 1962) are also the cases where only /ʔ/ (and /h/) is (are) allowed in coda position. The special occurrence of laryngeals as coda consonant will be discussed again in section 3.

All of these languages show that laryngeals behave differently than laryngeally-marked segments with respect to the laryngeal neutralization. Lombardi (1991) argues that the laryngeal constraint can be further restricted in some languages so that it applies to the specific class of segments such as obstruents. For example, in Tolowa, glottalized obstruents are restricted to syllable-initial position, whereas glottalized nasals (/m', n'/) and /ʔ, h/ occur in syllable-final position. In order to account for this, she suggests that the laryngeal constraint applies only to obstruents, assuming that /ʔ, h/ are sonorants in this language. However, whether /ʔ, h/ act as sonorants in this language should be considered. In addition, her proposal still cannot account for languages such as Washo and Navaho. As seen above, in Washo and Navaho, both laryngeally-marked obstruents and laryngeally-marked sonorants are not allowed in syllable-final position.

If laryngeals are represented with a laryngeal node, it cannot be explained that laryngeals are not restricted to syllable-initial position in these languages. Therefore, I propose that laryngeals are represented without a laryngeal node in these languages as in (4), repeated in the following:

(9)

If laryngeals are represented without a laryngeal node feature as in (9), they are not subject to the laryngeal constraint. In other words, their occurrence in syllable-final position does not violate the constraint Align-Left (Laryngeal Node, Syllable). Therefore, the fact that they are allowed in syllable-final position can be explained. This suggests that laryngeals are represented without a laryngeal node even when phonation features are used in the language.

To summarize the discussion so far, I have shown that representing laryngeals with a laryngeal node may give a wrong prediction on the distributional pattern of laryngeals. Therefore, I have proposed that laryngeals are represented without a laryngeal node in some languages. This suggests that the proper representations of laryngeals should be based on their phonological behaviors in the language.

3. The distribution of /ʔ, h/ with respect to syllable structure

In this section, I will examine the distribution of laryngeals in syllable position in languages which have both /ʔ/ and /h/, but not laryngeally-marked consonants. From the observation of the distribution of these segments, the following generalizations are obtained: first, laryngeals are preferred as a coda consonant in some languages; second, /h/ tends to be restricted to syllable-initial position. I propose that the Coda Condition (Ito and Mester 1994), which is motivated by facts of syllable structure conditions in many other languages, can account for the special occurrence of laryngeals in coda position, together with the assumption that laryngeals are placeless.

3.1. Special coda

Laryngeal neutralization, which Lombardi (1991) argues to be a result of a positive well-formedness constraint, the Laryngeal Constraint (a laryngeal node is only licensed in a particular syllabic configuration) would predict that /ʔ, h/ along with glottalized and aspirated segments tend to be restricted to syllable-initial position. In section 2, I have suggested that laryngeals are represented without laryngeal node features in some languages. However, if the laryngeal constraint reflects phonetics, it may be predicted that laryngeals also tend to be restricted to syllable-initial position as other laryngeally-marked consonants. The following table shows the (non-) occurrences of laryngeals in syllable-initial and syllable-final position:

(10) Table 1: distribution of /ʔ, h/ in terms of position in syllable

	syllable- initial		syllable- final	
	/ʔ/	/h/	/ʔ/	/h/
Huichol	✓	✓	✓	*
Cuicateco	✓	✓	✓	*
Keresan	✓	✓	✓	*
Amahuaca	✓	✓	✓[8]	*[9]
Arapaho	✓	✓	✓	✓
Usila Chinantec	✓	✓	✓	*[10]
Zoque	✓	✓	✓	✓
Slave	✓	✓	✓	✓
Pame (Otomi)	✓	✓	✓	*
Cheyenne	✓	✓	✓	✓[11]
Cofan	✓	✓	✓	*
Siona	✓	✓	✓	*
Tenango Otomi	✓	✓	*	*[12]

With the exception of Tenango Otomi (Blight and Pike 1976), which has only open syllables, in all languages, /ʔ/ occurs both in syllable-initial and syllable-final position. In addition, a closer look at the distribution of other consonants in these languages will tell us that /ʔ/ (and /h/) tend(s) to be preferred over other

consonants in coda position. In other words, there are languages where /ʔ/ (and /h/) is (are) the only segment(s) that occur(s) in syllable-final position. Cuicateco, Cheyenne, Tewa, Slave, Siona and Cofan belong to this type.

In Cheyenne, only /ʔ/ and /h/ occur syllable-finally among other consonants. In Cuicateco, in slow speech, /ʔ/ is the only consonant that occurs finally in the utterance. In this language, all the syllables are open or end in /ʔ/. In Tewa (Santa Clara dialect), only /ʔ/, /h/ and /n/ occur in syllable-final position. The allophones of /n/ in syllable-final position are: [m] when followed by a bilabial, [n] when followed by an alveolar, and [ŋ] when followed by any other consonants. This suggests that /n/ is not specified with place (placeless) or place-linked with the following consonant. In Slave, only /ʔ, h/ and /y/ can occur in syllable-final position. In Siona and Cofan (Borman 1962), only /ʔ/ occurs as a coda consonant.

This special ocurrence of /ʔ/ or /h/ in syllable-final position in these languages can be dealt with by means of the Coda Condition. Ito and Mester (1994) suggest that the Coda Condition can be formalized as an alignment constraint requiring consonants to be left-aligned with syllables as follows:

(11) Align-C: Align-Left (CPlace, σ)

I propose that these Special coda type languages can be considered to have the Coda Condition. I also assume that laryngeals are placeless. The Coda Condition dominates MAX-IO in this type of language where only placeless consonants are allowed in coda position.

(12) Align-C: Align-Left (CPlace, σ) >> MAX-IO

Tewa: /buʔ/ 'town'	Align-C: Align-Left (CPlace, σ)	MAX-IO
-----> buʔ		
bu		*!

Since /ʔ/ and /h/ are assumed to be placeless, their appearance in syllable-final position does not violate this Align-C constraint. However, the output candidates which have other consonants in syllable-final position get marks (*). That is, the Coda Condition, which is motivated by facts of syllable structure condition in many other languages, can account for the special occurrence of laryngeals in coda position, together with the assumption that laryngeals are placeless.

To summarize, the comparison of the occurence of other consonants in coda position with that of /ʔ/ shows that /ʔ/ has a special property as a syllable-final element. That is, /ʔ/ tends to be preferred to other consonants as a syllable-final consonant. This special coda type can be explained in terms of the Coda Condition.

However, the comparison of the distribution of /ʔ/ in syllable position with that of /h/ shows that /h/ is more restricted in occurrence with regard to the position in the syllable. In Keresan (Spencer 1946), all consonants, with the exception of /h/, occur regularly in word initial, medial, and final position. This means that all consonants occur in syllable initial and final position and that only /h/ is excluded in syllable-final position, since all final syllables are closed in this language. In Amahuaca (Osborn 1948), /ʔ/ and all fricatives except /h/ occur in syllable-final position. /h/ does not pattern with other fricatives in that it does not occur syllable-finally. In Huichol (McIntosh 1945) and Pame Otomi (Gibson 1956), /h/ is

uniquely excluded in syllable-final position, while /ʔ/ is allowed. Therefore, a more specific constraint which applies only to /h/, for example, the following constraint which requires that /h/ be left-aligned with a syllable, is needed in these languages:

(13) Align-Left (h, σ)

This constraint is ranked above MAX-IO in these languages where /h/ is not allowed in syllable-final position. The limited occurrence of /h/ might be due to its phonetics such that it is perceptually weak in syllable-final position. This calls for further research.

4. Conclusion

In this paper, I have examined the distribution of laryngeals and accounted for their patterns of distribution by referring to their representations. I have shown that representing laryngeals with laryngeal node features is misleading in that it would give a wrong prediction for their patterns of distribution. Therefore, I have proposed that laryngeals should be represented without laryngeal features in some languages. This may suggest that the laryngeal features that laryngeals are assumed to have are different from those which laryngeally-marked consonants have (i.e. phonation features). That is, the larynx may work as a place of articulation in /ʔ, h/, while it works as the source of phonation. However, in order to provide their proper representation, more studies on their phonetic properties and various phonological behaviors are required.

The other thing that needs further research regarding laryngeals and laryngeal features is the relationship of the laryngeal features that laryngeally-marked obstruents have and those which laryngeally-marked sonorants have. That is, the different behaviors that laryngeally-marked obstruents and sonorants with respect to the laryngeal constraint as seen in the case of Tolowa, suggest that phonation features have different effects according to which class of segments they are realized on. This may be related to phonetics. The study of laryngeals in this paper suggests that the incorporation of phonetic aspects into phonological rules (constraints) is necessary in order to provide a proper explanation for the distributional pattern of laryngeals and laryngeal features.

Notes

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1. There has been disagreement regarding the specification of major class features. However, I will not go into detail about this in this paper. For the detailed discussion of this issue, see Bessell (1993).
2. Following Lombardi (1991) I assume that plain voiceless obstruents and voiced sonorants are the segments laryngeally unmarked. Therefore, voiced/glottalized/ aspirated obstruents and glottalized/voiceless sonorants belong to the class of laryngeally-marked segments.
3. Even if, /ʔ/ cannot be syllable-final within a word, it can be syllable-final at the edge of a word. Lombardi (1994) provides an analysis for languages that show word-final exceptionality.

4. There is no closed syllable in this language.
5. In this language, glottalized sonorants are allowed in syllable-final position, whereas glottalized obstruents are not allowed.
6. I assume that /ʔ/ is represented with a laryngeal node in this language, since the laryngeal feature [constricted glottis] is otherwise used for inventory contrast. However, this does not affect the analysis, because the laryngeal constraint is not active in this language.
7. In this language, /t, č/ are voiceless aspirated and /b, d, ǯ, g, g^w/ are voiceless unaspirated.
8. The other stops do not occur in syllable-final position. Only fricatives (except /h/) occur syllable-finally. /ʔ/ does not pattern with other stops in that it does occur syllable-finally.
9. /h/ does not pattern with other fricatives in that it does not occur syllable-finally.
10. Only /ʔ/ can occur syllable-finally. Skinner (1962) analyzes it as the final member of complex peak.
11. Only /ʔ/ and /h/ can occur syllable-finally.
12. There is no closed syllable in this language.

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