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Sonority restricts laryngealized plosives in Southern Aymara

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Southern Aymara

Aymara (or Jaqi) is an Andean family of languages which includes Southern Aymara, Jaqaru, and Kawki (this one is almost extinct).

Currently, Southern Aymara is spoken in Southern Peru, Northern Chile and Western Bolivia.

FIGURE 1. Southern Aymara current extension (Cépeda 2011)

Inventories

The vowel and consonant inventory of Southern Aymara appear in the following two tables (Briggs 1993; Cerrón-Palomino 2000; Cépeda 2011).

(1)	VOWEL INVENTORY OF SOUTHERN AYMARA					
		Front		Back		
	High	i		u		
	Low		a			

(2)	CONSONANT INVENTORY OF SOUTHERN AYMARA					
		Labial	Alveolar	Palatal	Velar	Uvular
	Plain plosives	p	t	ʧ	k	q
	Aspirated plosives	p^h	t^h	$ʧ^h$	k^h	q^h
	Ejective plosives	p'	t'	ʧ'	k'	q'
	Fricatives		s		x	χ
	Nasals	m	n	ɲ		
	Laterals		l ɾ	ʎ		
	Glides	w		j	w	

Laryngealized plosives

Previous work: Rule-based approaches

Laryngealized plosives are always the first plosive in a root (Landerman 1994).

(3)	LEFTWARD ORIENTATION				
	a. [ʧ^{h}aqa] ‘to get lost’	(but *[ʧaq^{h}a])		c. [lap'a] ‘lice’	
	b. [k'uti] ‘flea’	(but *[kut'i])		d. [nak^{h}a] ‘to burn’	

Due to a diachronic simplification process (Cerrón-Palomino 2000), only homorganic plosives assimilate the laryngeal feature (Landerman 1994).

(4)	LARYNGEAL ASSIMILATION IN HOMORGANIC PLOSIVES				
	a. [ʧaʧa] ‘husband’	b. [k^{h}ak^{h}a] ‘mute’		c. [t'ant'a] ‘bread’	

However, peripheral varieties such as Moquegua Aymara show laryngeal assimilation (aspiration only) with heterorganic plosives (Cépeda 2011).

(5)	ASPIRATION ASSIMILATION IN HETERORGANIC PLOSIVES	
	a. [k^{h}uʧi]~[k^{h}uʧ^{h}i] ‘pig’	b. [t^{h}aki]~[t^{h}ak^{h}i] ‘road’

Previous work: Constraint-based approaches

Aspirated and ejective plosives form a class with respect to **long VOT** only in Quechua and Aymara (Gallagher 2012).

Homorganic plosives are allowed to co-occur in a root. There are **co-occurrence restrictions** for heterorganic segments specified with different laryngeal features (MacEachern 1999).

(6)	CO-OCCURRENCE RESTRICTIONS	
	a. **[t'alpʰa]** ‘wide’	(C‘…Cʰ with initial alveolar, palatal or velar)
	b. **[q'apʰi]** ‘fragrance’	(Uvulars precede labials)

When the same laryngeal feature is involved, laryngeal co-occurrence restrictions show a preference for **maximizing the perceptual differences** contrasting roots with other roots (Gallagher 2010, working on Cochabamba Quechua).

Dialects that the ban multiple laryngealized plosives have different constraint rankings from those that do not (Mackenzie 2013).

The goal of this talk

We propose a theoretical analysis of **the distribution of non-initial laryngealized plosives in Southern Aymara** that predicts their acceptability in novel roots.

The main observation is that laryngealized plosives have a **restricted distribution in non-initial position due to a phonotactic constraint involving the sonority of the root-initial segment**:

(7)	GENERALIZATION FOR THE DISTRIBUTION OF NON-INITIAL LARYNGEALIZED PLOSIVES
	Non-initial laryngealized plosives in Southern Aymara are less common in roots that begin with a plosive or a vowel, and are most frequent in roots that begin with a fricative, a nasal, a liquid or a glide.

Roadmap

- We offer a descriptive account of the distribution of non-initial laryngealized plosives in Büttner & Condori's (1984) dictionary.
- We propose a stringent constraint family for the sonority hierarchy in root-initial segments, and generate a MaxEnt Grammar model (Wilson 2006). We show that these constraints are not enough to replicate the lexical statistics.
- We postulate a positional constraint related to the leftward orientation for laryngeal features in Southern Aymara. With this constraint, the model improves its predictions.
- We compare this model with one generated by the UCLAPL (Hayes & Wilson 2008), whose constraints do not necessarily target the sonority hierarchy.
- We finally offer the conclusions of this study.

The lexicon study

FIGURE 2 shows a **sonority curve** for the distribution of laryngealized plosives in 1,968 disyllabic roots were extracted from **Büttner & Condori's (1984)** dictionary of Puno Southern Aymara (Peru):

- **Plosive**-initial roots **(8%)**
- **Fricative**-initial roots **(37%)**
- **Nasal**-initial roots **(34%)**
- **Glide**-initial roots **(24%)**
- **Vowel**-initial roots **(9%)**

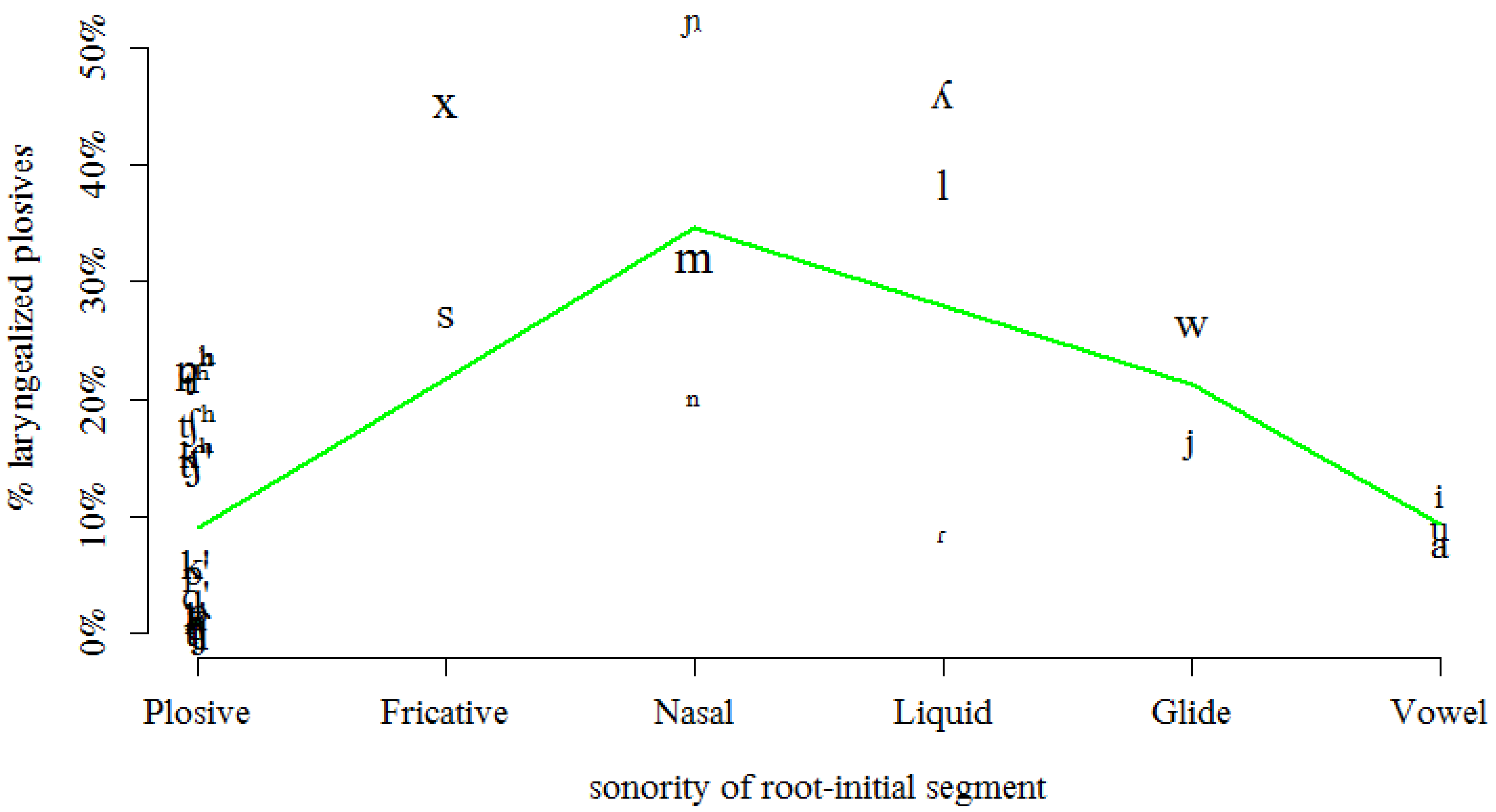

FIGURE 2. Observed percentage of non-initial laryngealized plosives for each root-initial segment

Root-initial sonority hierarchy

In Southern Aymara, onsetless syllables are largely dispreferred and only appear in root-initial position (Cerrón-Palomino 2000; Cépeda 2011).

(8)	ROOT-INITIAL SONORITY HIERARCHY
	Plo > Fri > Nas > Liq > Gli > Vow

Categories in a scale such as the sonority one in (8) can be conflated in constraints that stand in a subset relation with respect to their violation marks. That is, they can be expressed in a **stringency hierarchy** (De Lacy 2003). Accordingly, the corresponding stringent constraint family can be postulated as in (9):

(9)	STRINGENT CONSTRAINT FAMILY FOR ROOT-INITIAL SONORITY
	*{VOW}, *{VOW, GLI}, *{VOW, GLI, LIQ}, *{VOW, GLI, LIQ, NAS}, *{VOW, GLI, LIQ, NAS, FRI}, *{VOW, GLI, LIQ, NAS, FRI, PLO}

Sonority and non-initial laryngealized plosive

The stringent constraint family for root-initial sonority in (9) can combine with the occurrence of a non-initial laryngealized plosive in Southern Aymara, as proposed in (10):

(10)	STRINGENT CONSTRAINT FAMILY FOR NON-INITIAL LARYNGEALIZED PLOSIVE
	*{VOW}LAR *{VOW, GLI}LAR *{VOW, GLI, LIQ}LAR *{VOW, GLI, LIQ, NAS}LAR *{VOW, GLI, LIQ, NAS, FRI}LAR *{VOW, GLI, LIQ, NAS, FRI, PLO}LAR

Stringent constraints in MaxEnt Grammar

Using the **MaxEnt Grammar Tool** (Wilson 2006), we trained a MaxEnt weighted constraint model on the Southern Aymara lexicon using the stringent constraint family in (10).

The model was unable to replicate the curve in FIGURE 2, as shown in FIGURE 3. The acceptability of internal laryngealized plosives **did not drop from medium- to low-sonority initial segments.**

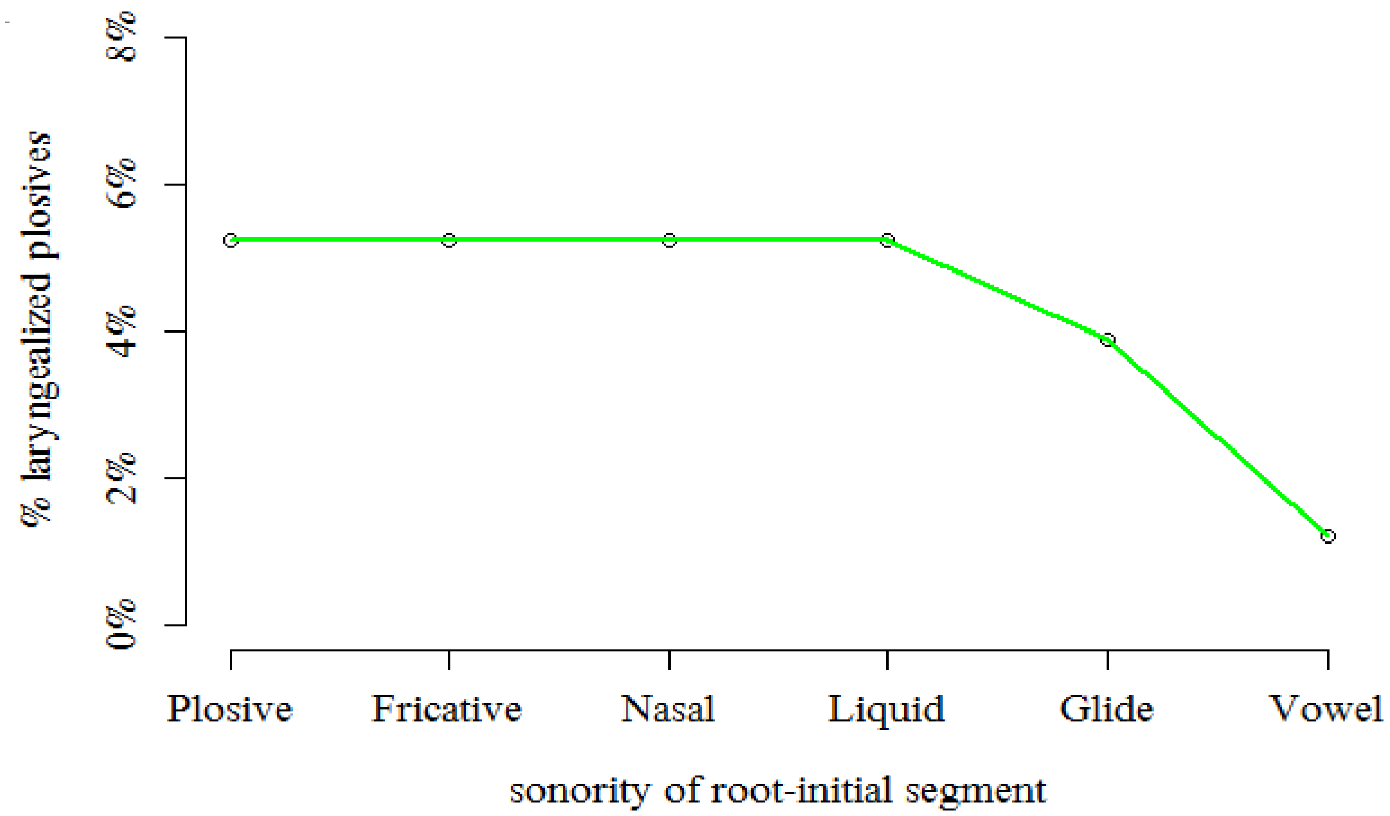

FIGURE 3. Prediction for non-initial laryngealized plosives for the whole lexicon using stringent constraints only

Adding a positional constraint

The stringent constraint family for the distribution of non-initial laryngealized plosives in (10) is not enough.

The low probability for root-initial plosives to co-occur with non-initial laryngealized plosives can be captured by and a restriction on the position of the laryngeal features in a root (the **leftward orientation**). We adapt a constraint from McCarthy (2003) and postulate the following:

(11)	COINCIDE
	Assign one violation mark to every laryngeal features not occurring on the leftmost plosive.

Stringent constraints + COINCIDE

We trained a new MaxEnt weighted constraint model on the Southern Aymara lexicon using the stringent constraint family in (10) and the positional constraint in (11).

The predictions of this analysis are shown in FIGURE 4. **The model matches the lexical statistics very closely and generates the expected sonority curve**.

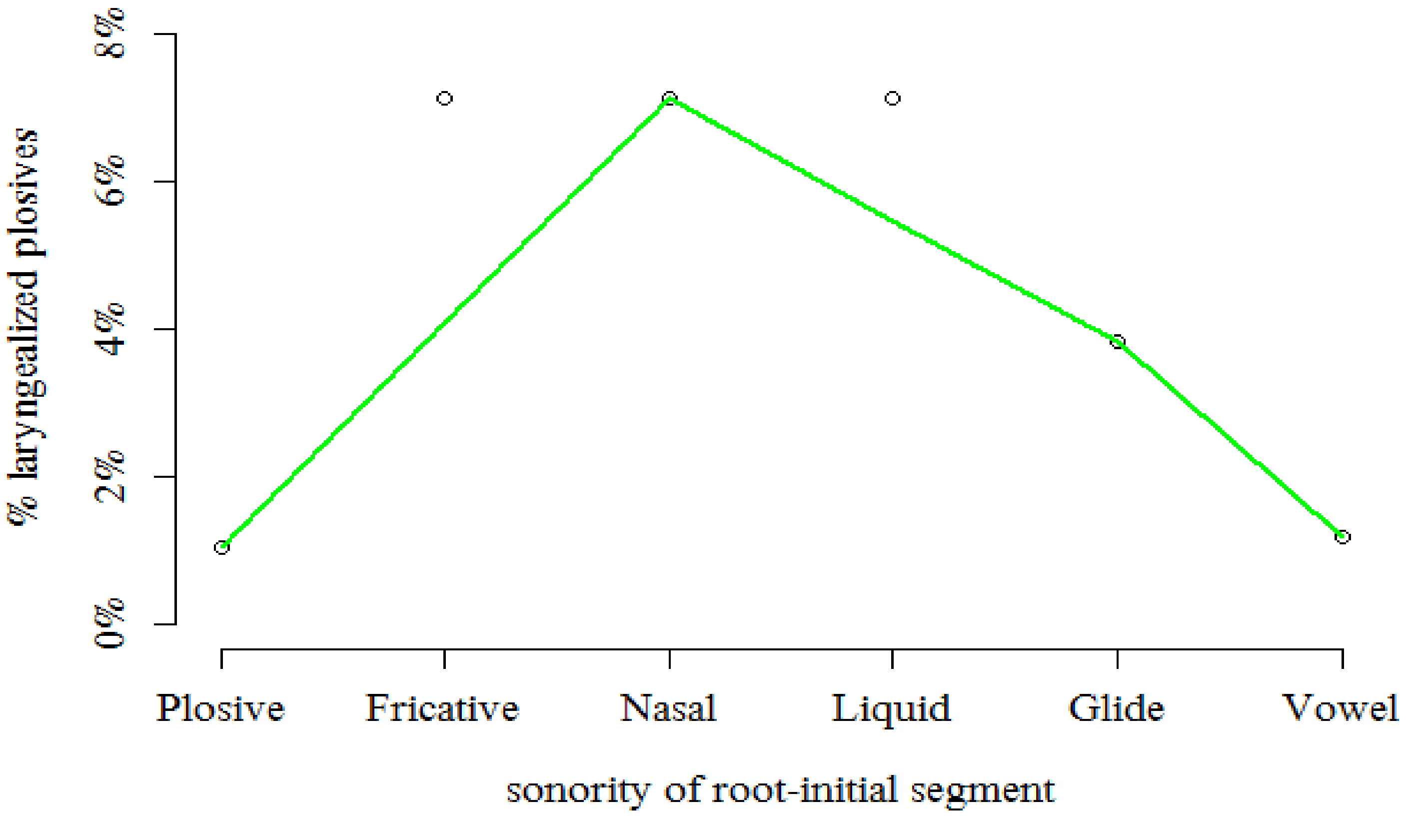

FIGURE 4. Prediction for non-initial laryngealized plosives for the whole lexicon using stringent constraints + COINCIDE

A UCLAPL model

We also used the **UCLA Phonotactic Learner** (Hayes & Wilson 2008) and trained a phonotactic model on the Southern Aymara lexicon and a testing list of 16,866 real and nonce disyllabic roots.

Reporting on the **difference in probability between roots with laryngealized and non-laryngealized consonants**, non-initial laryngealized plosives are predicted to be less probable in roots that begin with a **plosive (-9%)**, a **fricative (-7%)** or a **vowel (-7%)**.

The UCLAPL predictions can generate the sonority curve but not as precisely as the model we proposed in FIGURE 4.

Conclusions

We have identified a previously unknown generalization on the distribution of non-initial laryngealized plosives in Southern Aymara roots:

(12)	GENERALIZATION
	Laryngealized plosives are restricted with both low- and high-sonority initial segments, and are more freely attested with medium sonority initial segments.

By using stringent constraints for the sonority hierarchy and a restriction on the position of the laryngeal features in a root, we have offered an analysis that predicts the acceptability of non-initial laryngealized plosives in novel roots.

We are currently preparing to test these predictions with a nonce word rating task with native Southern Aymara speakers in Puno (Peru).

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Thank you!

¡Yusulupay!

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