The Sounds of Triqui: quantitative approaches to language description and its ramifications for historical change

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What you say you hear vs. what you hear

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Can your ears deceive you? Unfortunately, yes.

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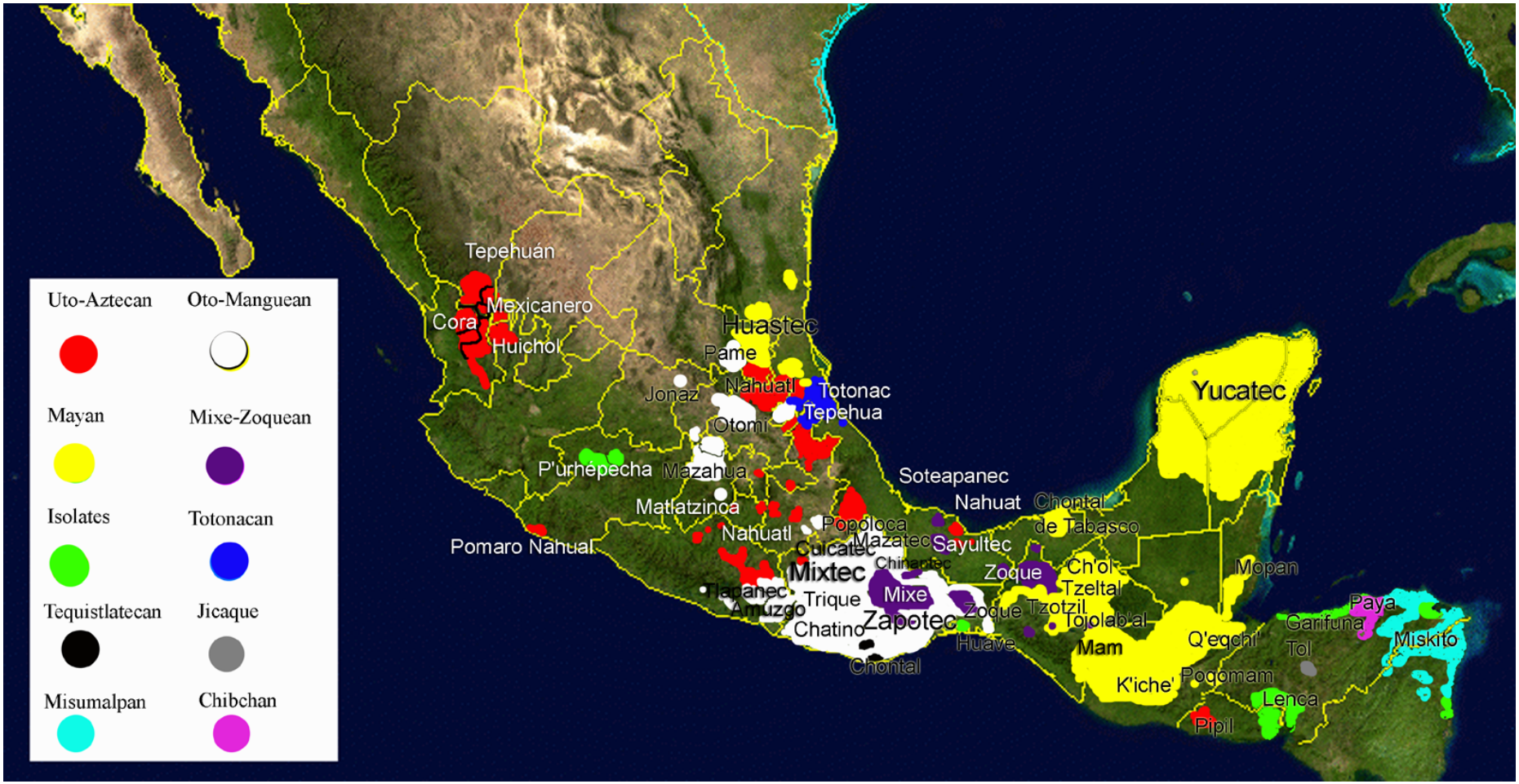
- Quantitative phonetic methods are crucial for accurate linguistic descriptions and for research in these languages.
- Such methods can uncover hidden details that improve our hypotheses regarding historical sound change.

Oto-Manguean languages

There are roughly 177 Oto-Manguean languages (Lewis et al., 2013), making it the largest stock in the Americas.



Itunyoso Triqui (IT)

- Spoken in the town of San Martín Itunyoso, in Oaxaca, Mexico. It is one of three Triqui variants (Itunyoso, Copala, Chicahuaxtla).
- Original fieldwork since 2004, with a focus on the phonetics and phonology, both from a descriptive perspective and from an experimental perspective.

Phonological inventory

IT possesses 39 consonants and 8 vowels /i, e, a, o, u, ĩ, ã, ũ/.

	Bilabial	Dental	Alveolar	Post-alveolar	Palatal	Retroflex	Velar	Labialized Velar	Glottal
Stop	p	t, tː					k, kː	k^w, k^wː	ʔ
Pre-Nasalized Stop	mb		nd ʔnd				ŋg ʔŋg	$ŋg^w$	
Affricate				tʃ, tʃː		ʈʂ, ʈʂː			
Nasal	m, mː ʔm		n, nː ʔn						
Pre-Stopped Nasal					cn				
Tap			ɾ ʔɾ						
Fricative	β, βː ʔβ	s		ʃ					h
Approximant					j, jː ʔj				
Lateral Approximant			l, lː ʔl						

Phonological structure

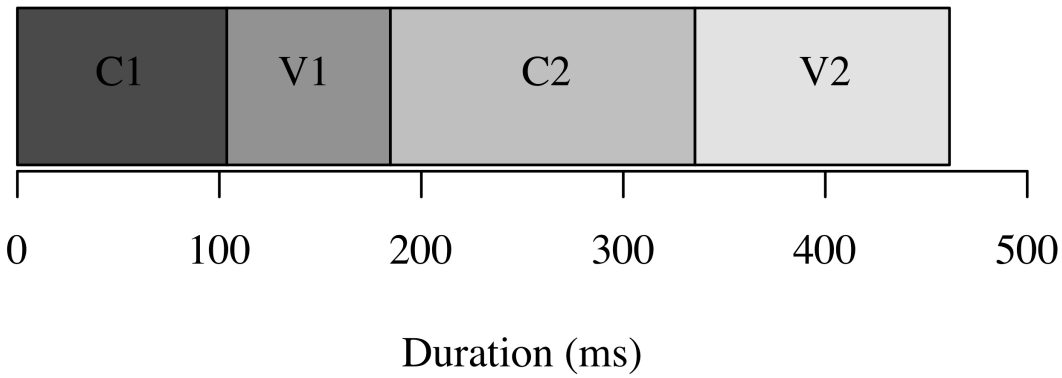
- Consonant system contains glottalized consonants, prenasalized consonants, and a contrast between fortis and lenis consonants.
- Lexicon of 1,885 words; 1/4 are monosyllabic, 3/4 polysyllabic
- Syllables may only contain a /ʔ/ or /h/ coda: /nːeʔ^3/ '*straw rope*', /nːeh^3/ '*toothless*', /nːe^3/ '*plough*'.
- There are nine lexical tones which contrast in word-final syllables, but only level tones occur in non-final syllables. There is no tone sandhi (DiCanio, 2008).

Tone in Itunyoso Triqui

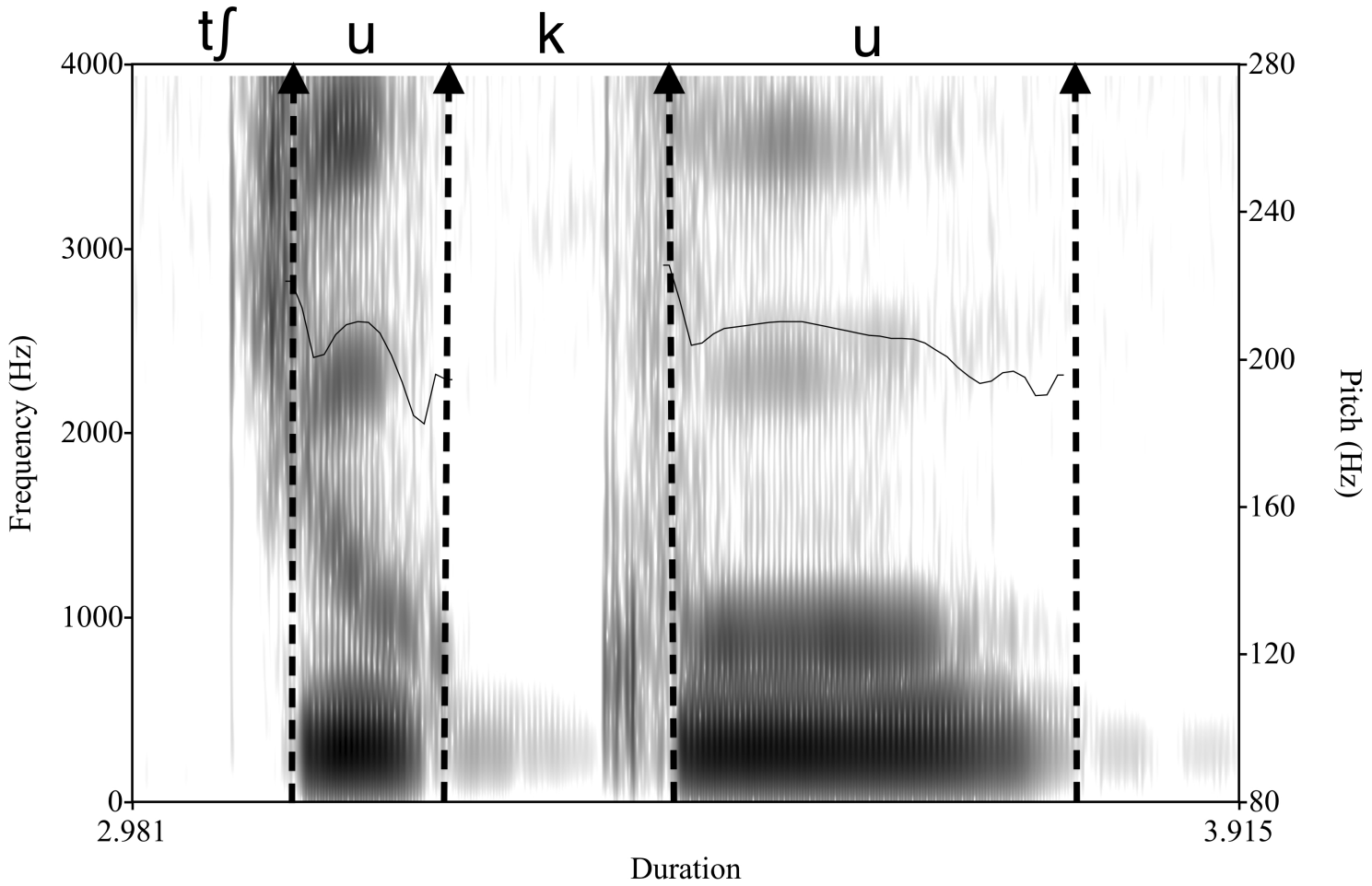
Tone	IPA	Gloss	Tone	IPA	Gloss
4	βːe^{4}	'*hair*'	43	liˀ^{43}	'*small*'
3	nːe^{3}	'*plough*'	32	nːe^{32}	'*water*'
2	nːe^{2}	'*to lie (tr.)*'	31	nːe^{31}	'*meat*'
1	nːe^{1}	'*naked*'	45	joɦ^{45}	'*my forehead*'
			13	jo^{13}	'*light, quick*'

Stress in Triqui

- In addition to tone, Itunyoso Triqui has word-final stress.
- Stress is realized phonologically by distributional differences. Many sounds occur only on final syllables, including nasal vowels, laryngeals, prenasalized stops, and contour tones. Fewer sound types occur on non-final syllables.
- Final syllables are also phonetically longer than non-final syllables (DiCanio, 2010).



Example: /tʃu^{3}ku^3/ '*animal*'



Note that the tone is held constant here across syllables.

Fortis-Lenis contrast

In monosyllabic words, there is a contrast between lenis (t) and fortis (tː) consonants.

	IPA	Gloss		IPA	Gloss
t	tãʔ^{3}	'*corncob*'	tː	tːãh^{3}	'*spine*'
k	kãh^{1}	'*naked*'	kː	kːãh^{3}	'*sandal*'
k^{w}	k^{w}eh^{3}=sih^{3}	'*he jumped*'	k^{w}ː	k^{w}ːẽh^{3}	'*pus*'
m	mã^{3}	'*that, there*'	mː	mːãh^{2}	'*fat*'
n	nã^{3}	'*this, here*'	nː	nːãh^{3}	'*bag*'
tʃ	tʃũʔ^{3}	'*our town*'	tʃː	tʃːuh^{3}	'*egg*'
tʂ	tʂũ^{3}	'*tree*'	tʂː	tʂːũ^{2}	'*scholar*'
β	βeh^{4} ni^{4}mã^{43}	'*the heart beats*'	βː	βːeh^{35}	'*straw mat*'
j	jũ^{3}	'*palm*'	jː	jːu^{3}	'*pennyroyal*'

IT fortis-lenis contrast

- Fortis consonants *sound* longer, but it is difficult to tell because they only occur in word-initial position.
- Lenis stops, /t, k, k^w, tʃ, ʈʂ/, vary between voiced and voiceless and are sometimes produced as fricatives, [ð, ɣ, $ɣ^w$, ʃ, ʂ].
- Similar patterns are observed in Chicahuaxtla and Copala Triqui (Hollenbach, 1977).

"Fortis" and "Lenis" in phonology

- Convenient terminology used to describe differences in phonetic length and voicing among consonants, e.g. in Copala and Chicahuaxtla Triqui (Hollenbach, 1977, 1984).

> "Fortis stops and sibilants are voiceless and slightly lengthened. Fortis nasals, laterals, and semivowels are quite long." (Hollenbach, 1977:50)

- The terms do not correspond to any one phonetic characteristic, but a series of them, including "strength", as in Cajonos Zapotec (Nellis and Hollenbach, 1980), Dutch (Jansen, 2004), and German (Jessen, 1998).

"Fortis" and "Lenis" in phonetics

- Languages with a "fortis-lenis" contrast actually have a phonological *length* contrast, as in Cajonos Zapotec varieties (Jaeger, 1983; Avelino, 2001) and Swiss German (Kraehenmann, 2001).
- Languages with a "fortis-lenis" contrast actually have a laryngeal feature contrast, as in Germanic languages (Iverson and Salmons, 1995, 2003) and Korean (Cho et al., 2002).
- Some languages with a "fortis-lenis" contrast actually have a difference in constriction degree, or how strongly the consonant is articulated, as in Dargi (Maddieson, 1999).
- Where does Itunyoso Triqui fit? How do we know? What do *fortis* and *lenis* mean here?

Phonetic study on contrast: acoustics

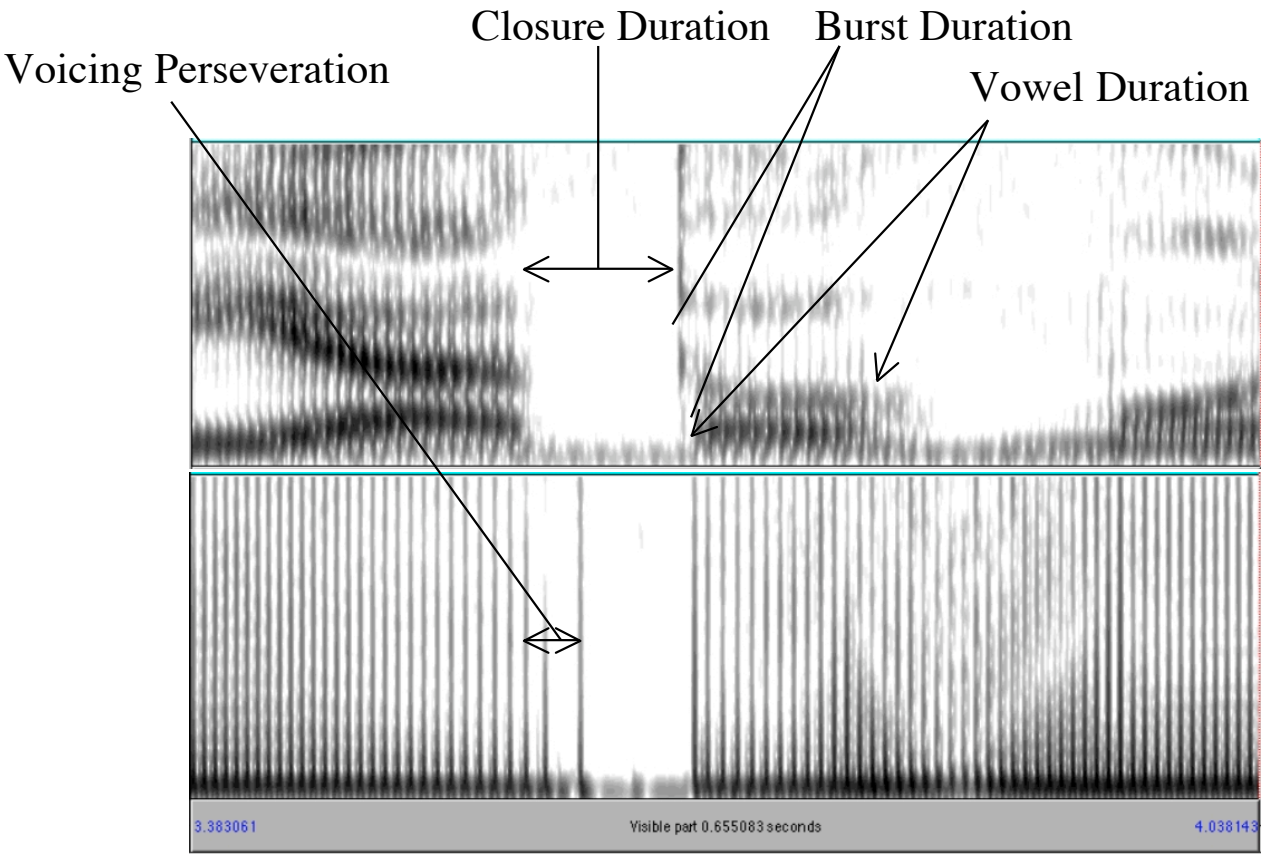
- Acoustic study performed with native speakers of Triqui (see DiCanio (2012)).
- Examination of contrast with five obstruents: /t, k, k^w, tʃ, ʦ/, and two sonorants: /n, β/.
- Forty words with lenis and fortis consonants were placed in a sentence '*I see X here.*', /ni^3ja^{32} ___ $nã^3$/.
- Each sentence was repeated six times by eight native Itunyoso Triqui speakers (4 female, 4 male), for a total of 1,920 utterances.
- Measured duration, voice onset time, and burst amplitude (intensity) of consonants.

Electroglottography (EGG)

EGG is an articulatory method which allows us to examine vocal fold vibration, including the closing/opening phase of the vocal folds.

When the vocal folds are adducted, there is greater electrical conductance between the electrodes. When the vocal folds are abducted, there is less electrical conductance between the electrodes.

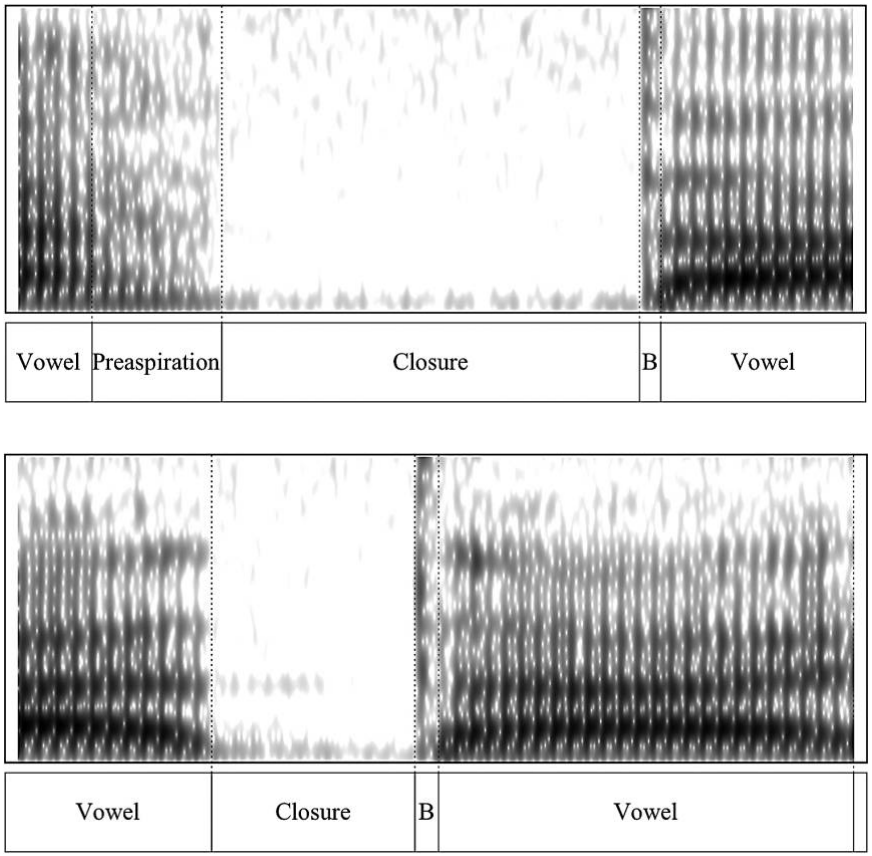
Acoustic and articulatory measures



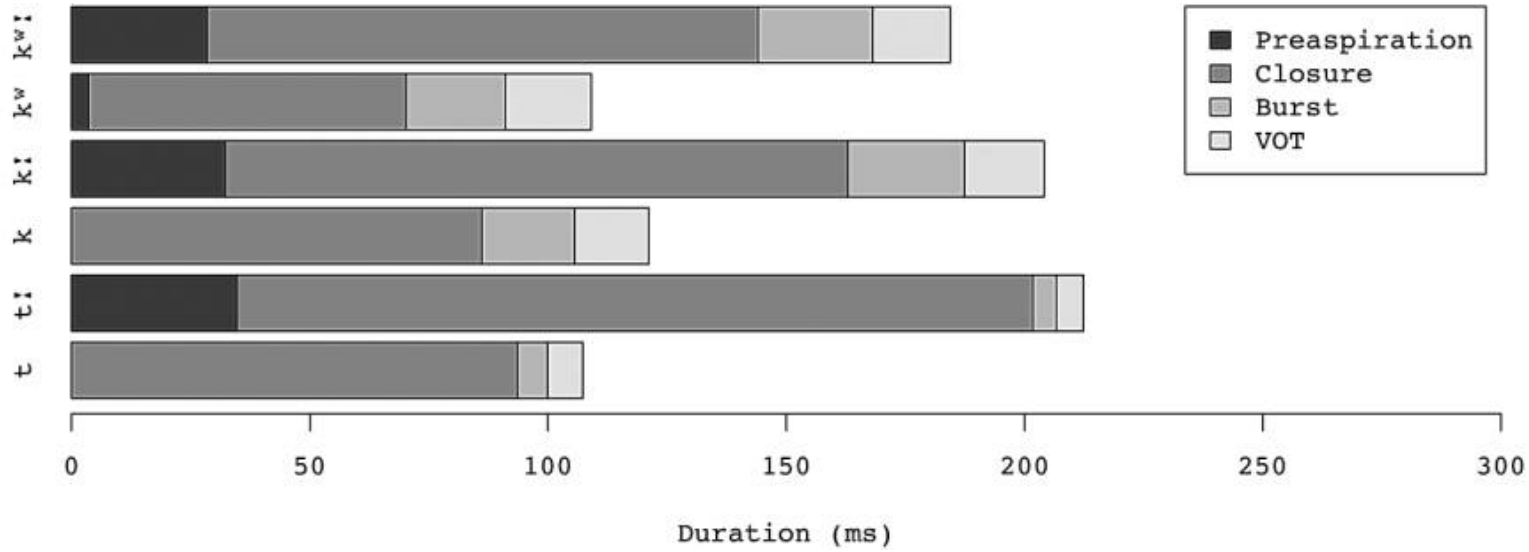
[n i j a t o h m o l i]

niya 3.32 toh 13 moli 4.43
see.1sg a.little mole
"I see a little mole."

Results: Are fortis consonants longer?



Acoustic differences between obstruents /tː/ (above) from the word [tːa^{3}] 'field' and /t/ (below) from the word [ta^{3}] 'that'.


kʷː
kʷ
kː
k
tː
t
Preaspiration
Closure
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VOT
0
50
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250
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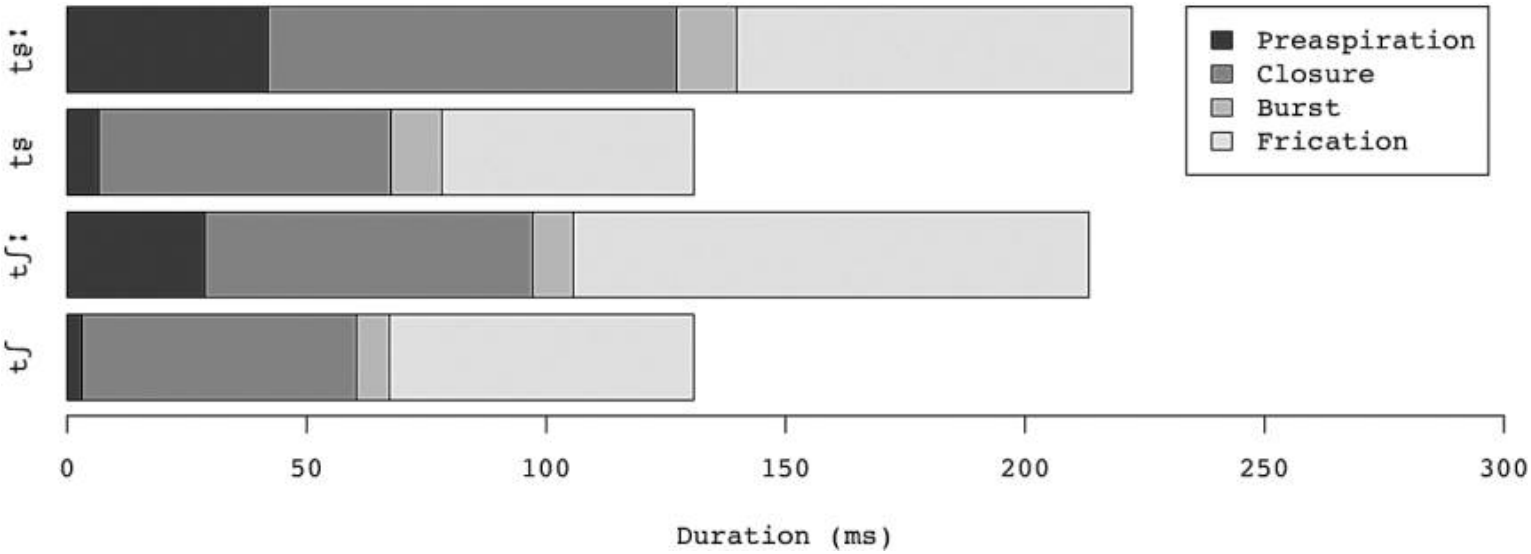
Duration (ms)


tsː
ts
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Preaspiration
Closure
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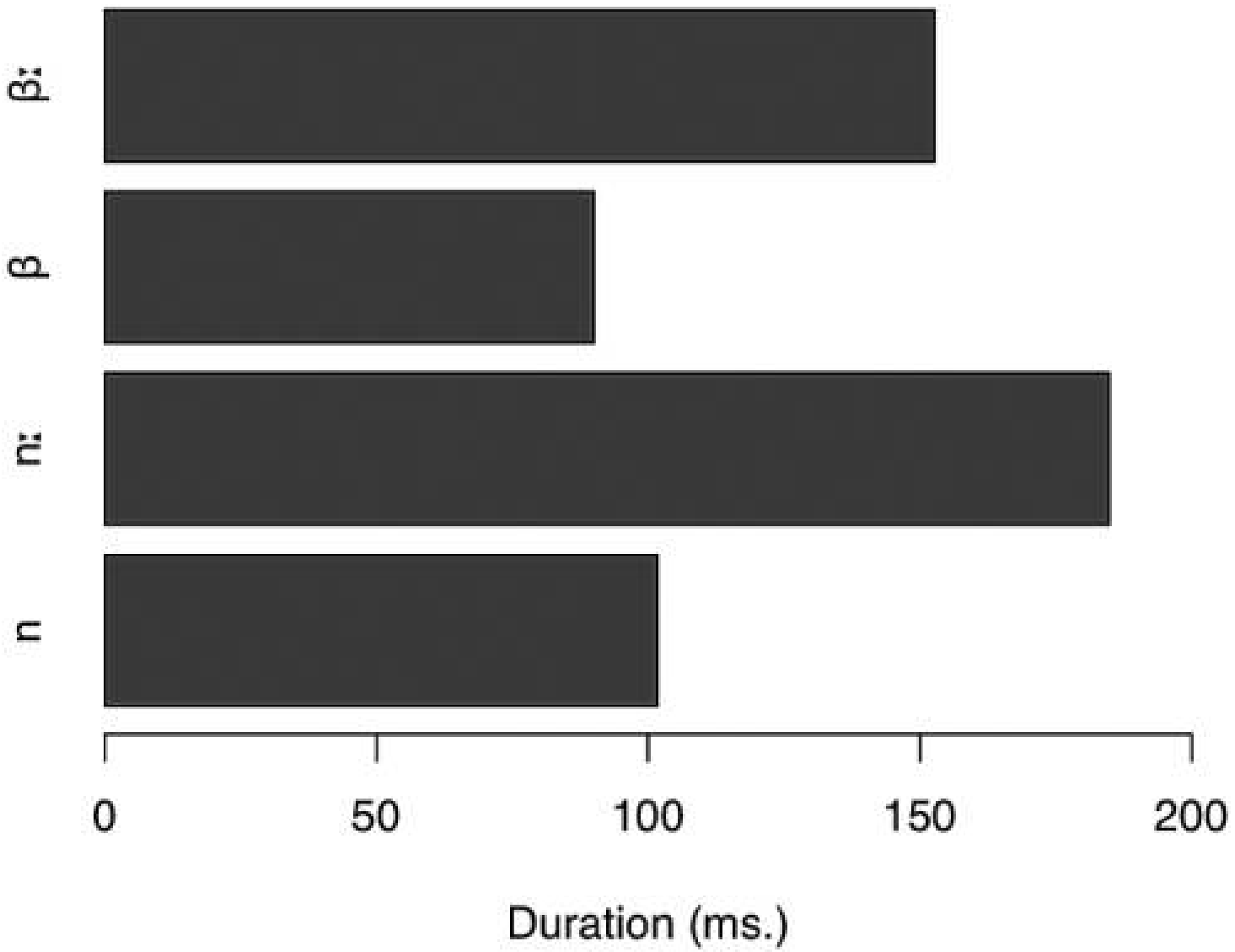
Duration (ms)


β:
β
n:
n
0
50
100
150
200
Duration (ms.)

- Closure duration was significantly different between lenis and fortis consonants as well as VOT, but not burst duration or burst amplitude.

		Closure Duration	Burst Duration	VOT	**Total Duration**
Stops	Lenis	82.1 ms	15.6 ms	13.7 ms	**111.4 ms**
	Fortis	137.8 ms	17.8 ms	12.9 ms	**168.5 ms**
				Frication	
Affricates	Lenis	59.2 ms	8.8	58.1 ms	**126.1 ms**
	Fortis	76.9 ms	10.6 ms	95.1 ms	**182.6 ms**
Sonorants	Lenis	95.9 ms			**95.9 ms**
	Fortis	168.8 ms			**168.8 ms**

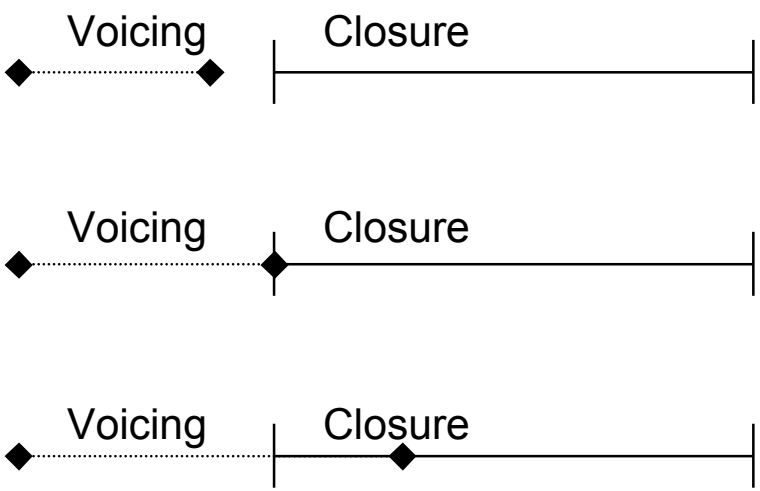
- Average duration ratio for consonantal length contrasts is between 1:1.5 - 1:3 (Ladefoged and Maddieson, 1996; Ham, 2001). The ratio here is 1:1.57.

Summary: Results

- Fortis and lenis stops mostly distinguished by duration.
- For stops and affricates, the fortis series contains preaspiration.
- Presence of preaspiration increases the duration of fortis consonants and may make the contrast easier to perceive, especially in word-initial position.
- If fortis obstruents are preaspirated, what happens to lenis obstruents?

EGG Data

Possible pre-obstruent glottal timing strategies:



P = devoicing precedes closure

S = devoicing simultaneous w/closure

V = devoicing follows closure

We can compare where consonant closure occurred with the acoustic signal to where voicing occurred with the EGG signal.

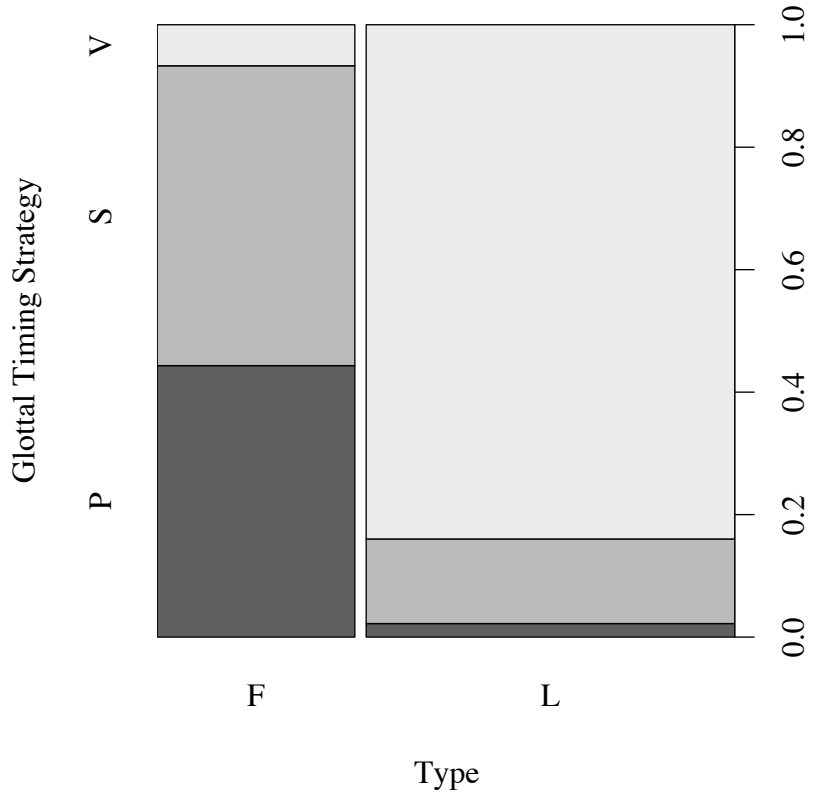
Results 2: EGG data - Obstruents

Glottal Timing Strategy by Consonant Type:

P = Devoicing Precedes Closure

S = Devoicing Simultaneous with Closure

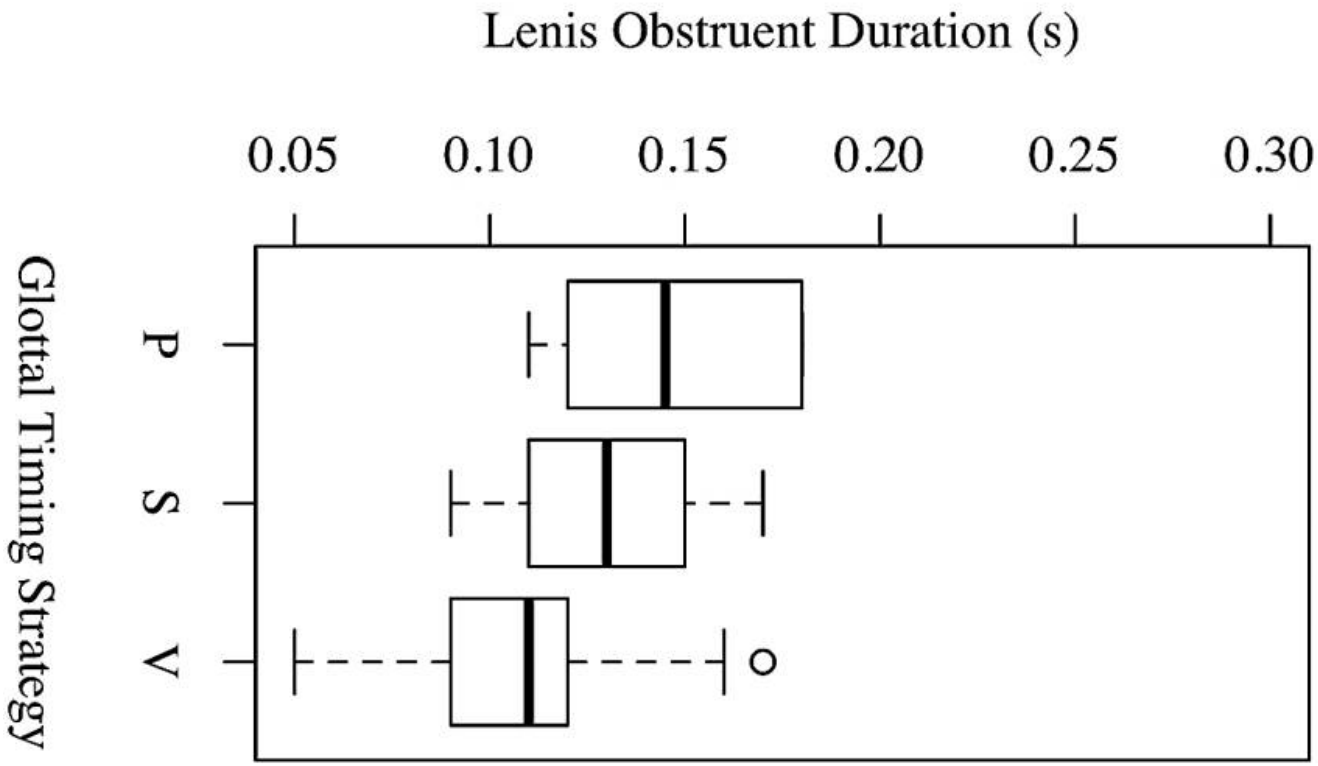
V = Devoicing Follows Closure



Results 2: EGG data - Obstruents

- 84% of lenis obstruents (304/362) realized with devoicing *after* closure, compared with 6.7% of fortis obstruents (13/194).
- Fortis obstruents realized with devoicing prior to closure (49.4%, 96/194) or devoicing simultaneous with closure (43.8%, 85/194). This is preaspiration.
- Lenis obstruents almost never realized with devoicing before closure (1.9%, 7/162).
- Voicing which occurs during the production of some lenis obstruents is variable. Only part of the consonant is usually voiced, which helps explain why these have been called "variably voiced" in the literature.

Voicing is also dependent on duration – the shorter the duration of the lenis consonant, the more likely it has voicing.



Voicing is a passive byproduct of phonetic duration.

"Fortis" and "Lenis" revisited

- Fortis and lenis consonants are mainly distinguished by duration, but not by intensity.
- Fortis obstruents contain preaspiration while lenis obstruents are variably voiced. Voicing correlates with phonetic duration.
- Voicing in lenis obstruents is passive; it occurs only in contexts where voicing may spread from a preceding sound into the consonant. This is more likely when the consonant happens to be very short (as in fast speech).
- Better labels for the fortis-lenis series in IT may be *geminate* and *singleton*, or *long* and *short* consonants.

Repercussions

Where did this odd sound contrast come from?

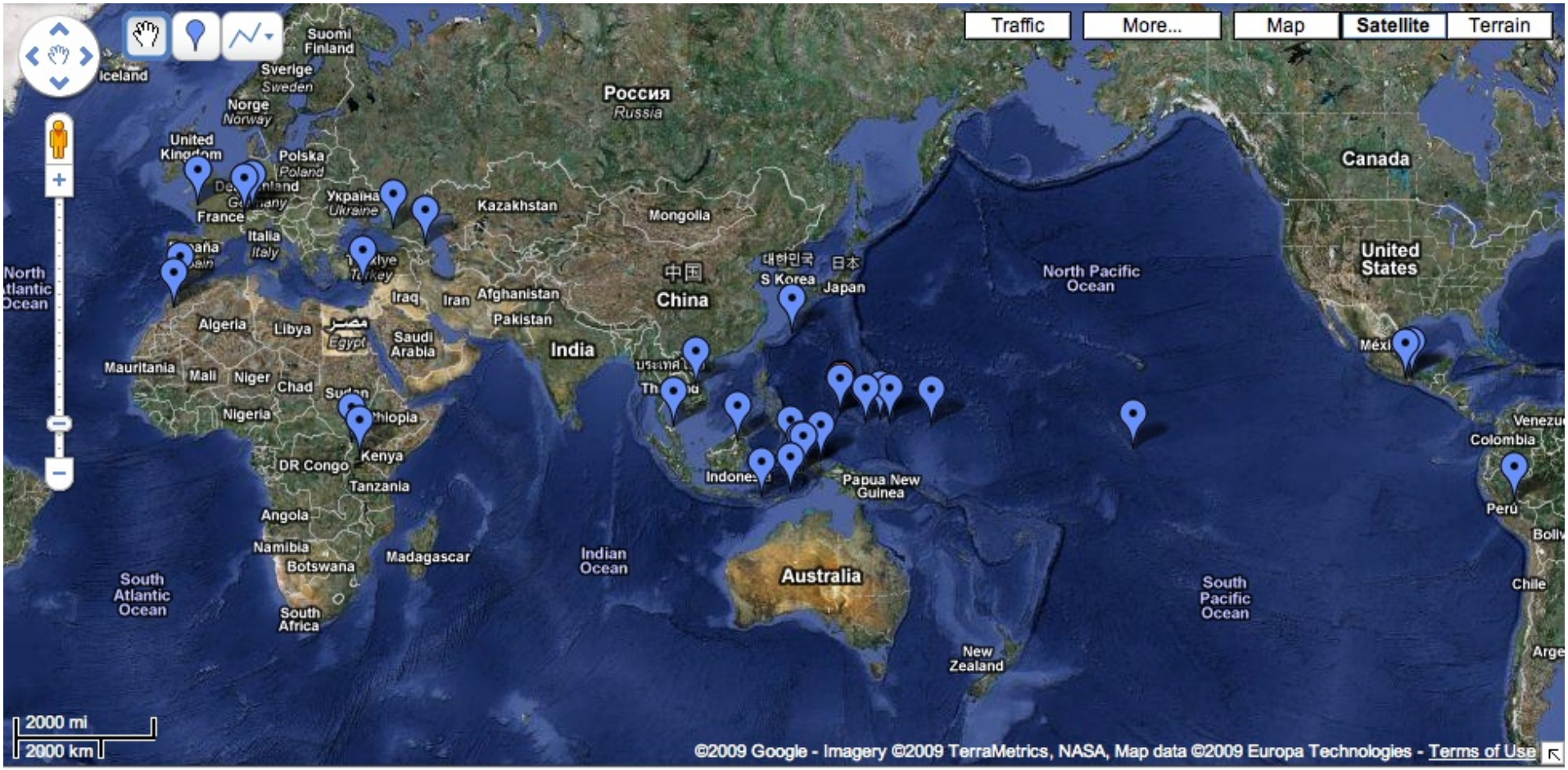
Might thinking about fortis and lenis consonants as *long* and *short* help us better determine their origin?

Historical-Typological Perspective

Consonantal length contrasts tend to occur word-medially in languages of the world (Dmitrieva, 2009; Ladefoged and Maddieson, 1996; Maddieson, 1985; Muller, 2001; Thurgood, 1993). Word-initial geminates are rare.

- Of 30 known languages with word-initial geminates, 24/30 (80%) also have a length contrast word-medially (Muller, 2001).
- 6/30 languages have word-initial geminates but not word-medial geminates: Pattani Malay, Sa'ban, Leti, Nhaheun, Yapese, and Itunyoso Triqui (DiCanio, 2008).
- A large percentage of the languages with word-initial geminates are Austronesian (13/30, 43%).

Languages with word-initial geminates (Google, 2009)



- In 28 of these 30 languages, geminates occur only in polysyllabic words.

- Why should we expect geminates more often word-medially in polysyllabic words?
  1. Vowel shortening before a geminate cues consonant length (Maddieson, 1985; Ham, 2001; Idemaru and Holt, 2007; Port and Dalby, 1982). This cue is unavailable when geminates are word-initial.

  2. Use of non-durational cues in languages with this contrast (e.g. Pattani Malay (Abramson, 1986, 1991, 2003)) leads listeners to perceive the contrast as non-durational.

  3. In Icelandic, */tt/ > /^{h}t/ (Helgason, 2002).

- But IT geminates occur in monosyllabic words. This is rare. Where did they come from?

Comparative method

The comparative method involves the comparison of apparent cognates across dialects or languages with the goal of reconstructing an ancestral state (mother language) from which the forms of words in the daughter languages emerged. (Data below from Hockett (1958:488))

Gothic	Old Icelandic	Old English	Old Saxon	Old High German
faðar	faðir	fæder	fader	fater

- We know that, between vowels, /t/ > /ð/ or /d/ in historical sound change. The reverse is rare.
- So, we might reconstruct an ancestral *Proto-Germanic* word */fater/ for '*father*.'

Comparative data

- In Copala Triqui, the fortis-lenis contrast is absent, but, among obstruents, a cognate voicing/manner contrast is observed: [ð] vs. [t].
- In Chicahuaxtla Triqui, the fortis-lenis contrast occurs among sonorants, but, among obstruents, a voicing contrast is observed: [d] vs. [t].
- Comparative data in Triqui dialects and from Proto-Mixtecan reconstructions (Josserand, 1983) can help us piece together where this length contrast came from.

Triqui-internal reconstructions

For 16/67 Triqui words, we do not have to delve very far in the past; the Copala Triqui word contains an additional syllable /(j)V/-.

Itunyoso	Chicahuaxtla	Copala	*Proto-Triqui	Gloss
ββe^{32}	wwe^{32}	ju^{3}ve^{32}	*/ju^{3}we^{32}/	*maguey*
ββeh^{35}	wwe^{5}	ju^{3}ve^{5}	*/ju^{3}weh^{5}/	*straw mat*
ββe^{3}	wwe^{3}	ju^{3}va^{31}	*/ju^{3}wa^{31}/	*brave*
ββeh^{3}	wwehe^{3}	ju^{3}veh^{3}	*/ju^{3}weh^{3}/	*boundary stone*
βĩ^{3}	wwĩ^{3}	a^{3}vi^{32}	*/a^{3}wĩ^{32}/	*to be*
nnah^{2}	na^{2}nah^{2}	na^{2}nah^{2}	*/na^{2}nah^{2}/	*slowly*
nniʔ^{2}	a^{2}nɨʔ^{1}	ja^{3}niʔ^{1}	*/ja^{3}nɨʔ^{1}/	*ugly, gross*
mmiʔ^{3}	mmiʔi^{3}	ju^{3}miʔ^{3}	*/ju^{3}miʔ^{3}/	*soap*
mmi^{31}	mmi^{31}	ju^{3}mi^{1}	*/ju^{3}mi^{1}/	*bridge*
mmi^{32}	mmi^{32}	ju^{3}me^{3}	*/ju^{3}mi^{3}/	*sweet potato*
ttah^{35}	ta^{5}	(u)taʔ^{3}	*/u^{3}ta^{5}/	*to be above*
ttuh^{35}	tu^{5}	i^{3}tu^{5}	*/i^{3}tuh^{5}/	*knot, goiter*
ttu^{32}	si^{5} tu^{2}	i^{3}tu^{32}	*/i^{3}tu^{32}/	*thief*
ttʃih^{2}	tʃih^{2}	(i)tʃih^{2}	*/itʃih^{2}/	*seven*
ttʃiʔ^{2}	tʃiʔ^{2}	(i)tʃiʔ^{2}	*/itʃiʔ^{2}/	*ten*
ttʂoh^{3}	tʂoho^{3}	ni^{3}tʂoh^{3}	*/ni^{3}tʂoh^{3}/	*female's belt*

Comparisons with Proto-Mixtec

In 9/67 cases, the Triqui forms do not suggest a language-internal change, but one which occurred longer in the past when Triqui split from Proto-Mixtecan.

Itunyoso	Chicahuaxtla	Copala	*Proto-Triqui	*Proto-Mixtec	Gloss
nnãh^{3}	nnãh^{3}	nãh^{3}	*/nnãh^{3}/	*/jonoʔ/	*bag*
nnãh^{32}	nnãhãh^{3}	nãh^{32}	*/nnãh^{32}/	*/inoʔ/	*cigarette*
kkʷeh^{3}	kʷeh^{3}	kʷeh^{1}	*/kkʷeh^{3}/	*/lakʷaʔ/	*pus*
tta^{3}	ta^{3}	ta^{32}	*/tta^{32}/	*/joðoʔ/	*field*
ββih^{2}	wwih^{2}	vih^{1}	*/wwih^{2}/	*/uwi/	*two*
kkã^{3}	kã^{3}	kã^{32}	*/kkã^{32}/	*/jɨkɨ̃ʔ/	*squash*
kka^{32}	ka^{32}	ka^{32}	*/kka^{32}/	*/jokoʔ/	*peg, pin*
kkoh^{3}	koho^{3}	koh^{3}	*/kkoh^{3}/	*/juku/	*herb*
kkih^{3}	kɨhɨ^{3}	kih^{3}	*/kkɨh^{3}/	*/jukuʔ/	*hill*

Note that the Proto-Mixtec reconstructions *also* contain an additional syllable /(j)V/-.

Comparisons with Cuicatec

Modern Cuicatec suggests an earlier stage there was a disyllabic cognate which underwent syncope/assimilation.

Itunyoso	Chicahuaxtla	Copala	*Proto-Triqui	Cuicatec	Gloss
nna^{31}	nna^{31}	na^{31}	*/nna^{31}/	ju^{2ⁿ}du^{4}	*farm field*
nneh^{3}	nnehe^{3}	neh^{3}	*/nneh^{3}/	jʔa^{4ⁿ}dʔi^{4}	*dream*
nnu^{32}	nu^{32}	nu^{32}	*/nnu^{32}/	ve^{3}nu^{3}	*Dysphania ambrosioides*'
ββeh^{3}	gʷeʔ^{2} (POT.du)	gʷeh^{4}	*/ββeh^{3}/	ka^{2}va^{4}	*to jump*
ttʂũ^{2}	tʂũʔ^{2} (du.)	tʂũ^{1}	*/ttʂũ^{2}/	de^{4}nu^{1}	*wise man*
ttʃuh^{3}	tʂuh^{3}	tʂuh^{3}	*/ttʂuh^{3}/	du^{3}ti^{1} ti^{4}	*egg*
kkãh^{3}	kãh^{3}	kãh^{3}	*/kkãh^{3}/	ⁿdɔ^{3}ku^{3}	*sandal*

- Similar to the previous comparisons, the loss of a penultimate syllable, often of the shape */(j)V-/ caused the genesis of word-initial geminates in final, now monosyllabic, roots.

Some odd cases

5 clear cases where pre-final CV > C and underwent complete assimilation.

Itunyoso	Chicahuaxtla	Copala	*Proto-Triqui	*Proto-Mixtec	Cuicatec	Gloss
nne^{32}	nne^{32}	na^{3}	*/nne^{32}/	*/^{n}dute/	nu^{4}ni^{4}	*water*
tto^{32}	to^{32}	to^{32}	*/tto^{32}/	*/towĩ/	du^{4}du^{4}	*feather*
kkãh^{3}	kãh^{3}	k^{w}ãh^{3}	*/ukãh^{3}/	*/^{n}diʃẽʔ/	^{n}dã^{3}ku^{3}	*sandal*
jjoʔ^{3}	joʔo^{3}	joʔ^{2}	*/jjoʔ^{3}/	*/k^{w}ija/	^{n}du^{2}ju^{4}	*year*
llih^{3}	lih^{4}	(ku^{1}ni^{1})	*/llih^{3}/	*/luʔu/	lʔĩ	*small*

4 obscure cases, possibly from sound changes related to Proto-Mixtecan */^{n}d^{j}/ or Proto-Triqui lexical innovations.

Itunyoso	Chicahuaxtla	Copala	*Proto-Triqui	*Proto-Mixtec	Cuicatec	Gloss
nne^{31}	nne^{31}	ne^{31}	*/nne^{31}/	*/koyõ/	ju^{2}ta^{4}	*meat*
ttũ^{3}	tũ^{3}	ttõ^{3}	*/ttõ^{3}/	*/nɨjɨʔ/	jũ^{3}	*blood*
jja^{3}	jja^{3}	na^{3}na^{1} ja^{1}	*/jja^{3}/	*/^{n}diʃe/	^{n}du^{3}du^{3}	*truth*
jjeh^{3}	jɛh^{3}	jaih^{3}	*/jjaih^{3}/	*/juuʔ/	tu^{24}	*stone*

Discussion

- The origin of geminates is consonant and adjacent vowel/glide assimilation, and vowel syncope, two of the pathways for geminate evolution in the literature (Blevins, 2004).
- Why might this have occurred? Non-final syllables are unstressed.
- The loss of vowels in unstressed syllables and accompanying assimilation is a common source of sound change that may govern the specific processes above. Prosody is at the heart of the evolution of geminates in Triqui.

$$*C_iV'C_kV > *C_iC_kV > C_kC_kV$$

- 41/67 (61%) geminates in Triqui are accounted for.
- Vowel syncope and assimilation of consonant & adjacent vowel/glide readily account for the origin of most of the geminates in monosyllables in Itunyoso Triqui.
- The data is messy, partly due to historical innovation in Mixtecan where /j/-initial words mutated to /nd/ (van Doesburg et al, submitted).
- What might the repercussions of this analysis be?

Morpho-phonological behavior of geminates

- Consider the morphology of IT words and gemination
- IT geminates degeminate when prefixed. They are produced as regular consonants in these cases.

Word	Gloss	Inflected word	Gloss
tːuh^{35}	'*knot*'	si^{3}-tuh^{35}=reʔ^{1}	'*your knot*'
kːaʔ^{3}	'*candle*'	si^{3}-kaʔ^{3}=reʔ^{1}	'*your candle*'
nːe^{3}=reʔ^{1}	'*you are sitting*'	ka^{3}ne^{3}=reʔ^{1}	'*you were sitting*'
mːã^{4}	'*there is*'	ki^{3}mã^{4}	'*there was*'

Possessive prefixes

Possession is typically marked on alienable, inanimate nouns with prefixation. However, there is an alternation too.

1. Inanimate nouns, like /na^{3}sĩ^3/ '*tomato*' are preceded by a prefix /si^3/, e.g. si^3-na^{3}sĩ^4=re?^{1} '*your tomato*'.

2. Inanimate nouns which begin with /j/ undergo a mutation to /t/, e.g. jũ^3 '*palm*' > tũ^4=re?^{1} '*your palm.*'

Table: /j/ > /t/ alternation with alienably-Possessed inanimate nouns

Unpossessed Noun	Gloss	Possessed Noun	Gloss
ju^{3}ʔβeh^{3}	'*thread*'	tu^{3}ʔβeh^{1}=reʔ^{1}	'*your thread*'
jə̃^{32}	'*salt*'	tə̃h^{3}	'*my salt*'
ja^{2}ʔnə̃^{3}	'*mask*'	ta^{2}ʔnə̃h^{5}	'*my mask*'
jo^{3}ʔoh^{5}	'*land*'	to^{3}ʔoh^{4}=sih^{3}	'*his land*'
ja^{3}ʔah^{3}	'*chile pepper*'	ta^{3}ʔah^{3}=sih^{3}	'*his chile pepper*'
jːu^{3}	'*pennyroyal*'	ttuh^{45}	'*my pennyroyal*'
jːah^{3}	'*flower*	tta^{32}	'*my flower*'

Irregular prefixation

Many words with geminates in IT contain an irregular prefix /tu-/ or /ta-/.

Noun	Gloss	Possessed Form	Gloss
βːe^{32}	'*maguey cactus*'	tu^{4}-βeh^{4}	'*my maguey cactus*'
βːeh^{35}	'*straw mat*'	tu^{3}-βe^{43}	'*my straw mat*'
mːi^{31}	'*bridge*'	tu^{3}-mih^{2}	'*my bridge*'
mːi^{32}	'*sweet potato*'	tu^{3}-mih^{2}	'*my sweet potato*'
mːiʔ^{3}	'*soap*'	tu^{3}-mih^{3}	'*my soap*'
nːeʔ^{3}	'*straw rope*'	tu^{4}-neh^{4}	'*my straw rope*'
nːe^{32}	'*water*'	ta^{3}-neh^{3}	'*my water*'
nːih^{3}	'*leather*'	ta^{3}-nih^{3}-sih^{3}	'*his leather*'

Each of these prefixes begins with /t/.

The origin of irregularity

- Recall that the reconstructed form for /mːi^{32}/ '*sweet potato*' was */ju^{3}mi^{3}/ and /βːeh^{35}/ '*straw mat*' was */ju^{3}weh^{5}/.
- If we were to apply the /j/ > /t/ alternation to the historical forms of these words, it would produce /tu^{3}-mi^{32}/ and /tu^{3}-weh^{35}/. This is what we find!
- The origin of the irregular prefixes in Itunyoso (and Chicahuaxtla) Triqui is the regular /j > t/ alternation on roots which possessed a historical */j/ onset.
- Our reconstruction of geminates in IT is not only supported by the comparative data, but helps explain morphological exceptions in the grammar.

General discussion

- Triqui fortis and lenis consonants occur only in word-initial position in monosyllabic words.
- The contrast is distinguished mainly by duration, suggesting that the contrast is one of phonological length.
- Fortis obstruents are marked with preaspiration, but lenis ones permit passive voicing.
- Preaspiration is found medially in IT voiceless obstruents as well as a redundant phonetic feature. It may have spread to geminates with sound change and enhance the distinction synchronically.

Ongoing changes

Gemination is an ongoing process in IT. Certain words still vary among speakers, e.g. /na^{2}nah^{2}/ $\sim$ /nːah^{2}/ '*slowly*'.

This process is related to a more general pattern where non-final (unstressed) syllables are lost in Triqui dialects. This process is much further advanced in Copala Triqui than in the other dialects, e.g. /tʃa^{3}ta^{32}/ '*eagle*' in IT is /ʃta^{32}/ in Copala Triqui.

Currently it is unclear if the distinction is being lost. More work is needed.

Historical findings

- There is a clear relationship between a long consonant in synchronic forms in Triqui and the reconstructed form possessing an unstressed penultimate syllable.
- A historical process of compensatory lengthening occurred with syllable loss for many words.
- Though the pattern is typologically odd, it has a clear explanation.
- The hypothesized reconstructions help explain exceptions within Triqui morphology.

Structural-historical explanation for typological oddity

- Geminates are rare in word-initial position and in monosyllables.
- While unstressed syllable deletion is not uncommon, a confluence of structural factors in Triqui has led to the current state of affairs:
  - Most roots in Mixtecan languages are disyllabic (Pike, 1948; Hinton, 1991; Macken and Salmons, 1997; McKendry, 2013).

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- This runs counter to the view that rare sound patterns do not stem from regular phonetically-motivated sound changes (Blevins, 2004).
- Are there other languages with such factors too? Has it happened elsewhere?

Yes!

- The same pattern is found in Nhaheun, an Austro-Asiatic (Mon-Khmer) language spoken in Laos (Pająk, 2009; Sidwell, 2003).
- The language has word-final stress and sesquisyllabic word structure, where non-final syllables are very short.
- Origin of geminates here is the result of the similar set of sound changes described for Triqui, with the same structural conditions present in the parent language.

Conclusions

1. Quantitative phonetic methods helps us determine the details of a difficult-to-hear contrast, which turns out to be important for its phonological representation and the historical reconstruction.

2. Consonant length contrasts are very rare in monosyllables, but structural factors (disyllabic word structure, iambic stress) and phonetically common pathways (adjacent vowel assimilation) explain where it came from.

3. The reconstruction here helps account for exceptions in the morphological system of Triqui languages.

Future directions

- Documentation work on Itunyoso Triqui.
- Phonetic research on the tone-prosody interface.
- Historical-comparative work on the verbal system in Triqui languages.
- Ultrasound work on Triqui consonant production.

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ku^{3}ru^{4}a^{43}=re?^{1}
thank=2S
Thank you!

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WHERE DISCOVERIES BEGIN

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