Consonant Length in Monosyllables: Typology, Diachrony, and Phonetics

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9/29/09
Consonant length contrasts (/n/ vs. /nn/) tend to occur in polysyllabic words.

When they do occur in monosyllabic words, they usually also occur in polysyllabic words.

Could they occur only in monosyllables? How?
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Could they occur only in monosyllables? How?
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 Trique (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 surface 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/ > /ʰt/ (Helgason, 2002).
Geminates in Monosyllables

- Blevins (2004) pathways for the evolution of geminates:
  - consonant cluster assimilation
  - consonant and adjacent vowel/glide assimilation
  - vowel syncope
  - pre-stress lengthening
  - boundary lengthening
  - reinterpretation of voicing contrast
  - reanalysis of identical C+C sequences

- In Itunyoso Trique and Nhaheun, consonant length is only contrastive in monosyllabic words. Is there a systematic explanation for this?

- Are Blevins’ pathways good enough to explain this rare pattern?

- Historical reconstruction and phonetics
Genetic Relationship

- All Oto-Manguean languages spoken in Southern Mexico (Oaxaca, Veracruz, Guerrero, Chiapas, Mexico)
All Trique languages are tonal with final syllable prominence (vowel duration, more contrasts).

It is not the case that Trique has only monosyllables, most words are polysyllabic.

Itunyoso Trique - most words are disyllabic (756/1073, 70.5%). Monosyllables account for 185/1073 monomorphemic roots (17.1%) and trisyllables for 133/1073 monomorphemic roots (12.4%).

Mixtecan bisyllabic/bimoraic couplet structure (Hinton, 1991; Macaulay, 1996; Macken and Salmons, 1997).
There are 67 words with initial geminates in Itunyoso Trique (36% of all monosyllables).

- **tta³** field
- **kkāʔ³** pozole
- **kkʷeh³²** green (n.)
- **nna³** bed
- **mmã¹** there is/are
- **ββeh³⁵** straw mat
- **jju³** Mentha Polegium

- **ta³** this (disc.)
- **kāʔ¹** far
- **kʷeh²** will jump
- **na⁴** long ago
- **mã³** distal dem.
- **βeh⁴** to beat (intr.)
- **jü³** palm leaf

No contrast in consonant length word-medially or word-initially in polysyllabic words.

- **tu³ neʔ³** tail
- **na³ hto³²** banana
- ***ttu³ neʔ³**
- ***na³ tto³²**
Geminates in other Trique languages

- In Copala Trique, the consonant length contrast is absent, but, among obstruents, a cognate voicing/manner contrast is observed: [ð] vs. [t].

- In Chicahuaxtla Trique, the consonant length contrast is present among sonorants, but, among obstruents, a cognate voicing contrast is observed: [d] vs. [t].
Comparative Method


- Proto-Trique reconstruction from Itunyoso Trique database of 1638 words, dictionary of Copala Trique (Hollenbach, 2007), and dictionary of Chicahuaxtla Trique (Good, 1979).

- Comparison B: data from only Cuicatec and Proto-Trique.
Comparison A

- Out of 188 comparisons, 24 words cognate with geminates in Trique.
- 15/24 have historical disyllabic structure */(j)VCV/ in Proto-Trique, Proto-Mixtec or Cuicatec.

<table>
<thead>
<tr>
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<th>*Proto-Mixtec</th>
<th>Cuicatec</th>
<th>Gloss</th>
</tr>
</thead>
<tbody>
<tr>
<td>nnãh³</td>
<td>nnãh³</td>
<td>nãh³</td>
<td>*/nnãh³/</td>
<td>*/jono?/</td>
<td>ja⁴na⁴</td>
<td>bag</td>
</tr>
<tr>
<td>nnãh³</td>
<td>nnãhãh³</td>
<td>nãh³</td>
<td>*/nnãh³/</td>
<td>*/ino?/</td>
<td>ju²nu²</td>
<td>cigarette</td>
</tr>
<tr>
<td>nna³</td>
<td>nna³</td>
<td>ja³na³</td>
<td>*/ja³na³/</td>
<td>*/jito/</td>
<td>ka²ma⁴</td>
<td>bed</td>
</tr>
<tr>
<td>kwc‘eh³</td>
<td>kwc‘eh³</td>
<td>kwc‘eh¹</td>
<td>*/kwc‘eh³/</td>
<td>*/lak‘a?/</td>
<td>ja³kwc‘a³</td>
<td>pus</td>
</tr>
<tr>
<td>tta³</td>
<td>ta³</td>
<td>ta³⁴</td>
<td>*/tta³/?</td>
<td>*/joso?/</td>
<td>ju²du⁴</td>
<td>field</td>
</tr>
<tr>
<td>ttúh²</td>
<td>tīh²</td>
<td>tūh²</td>
<td>*/ttūh²/</td>
<td>*/one/</td>
<td>ni³ni²</td>
<td>eight</td>
</tr>
<tr>
<td>ttjih²</td>
<td>ttjih²</td>
<td>(i)ttjih²</td>
<td>*/ttjih²/</td>
<td>*/ufe/</td>
<td>n³da⁴tf³a⁴</td>
<td>seven</td>
</tr>
<tr>
<td>ttji?²</td>
<td>ttji?²</td>
<td>(i)ttji?²</td>
<td>*/ttji?²/</td>
<td>*/ufi/</td>
<td>n³di³t³j²</td>
<td>ten</td>
</tr>
<tr>
<td>ββe³²</td>
<td>wwe³²</td>
<td>ju³ve³²</td>
<td>*/ju³ve³²/</td>
<td>*/jawi?/</td>
<td>ji⁴va⁴</td>
<td>maguey</td>
</tr>
<tr>
<td>ββih²</td>
<td>wwi³²</td>
<td>vi³h¹</td>
<td>*/wwi³²/</td>
<td>*/uwi/</td>
<td>u⁴vi⁴</td>
<td>two</td>
</tr>
<tr>
<td>ββeh³⁵</td>
<td>wwe³⁵</td>
<td>ju³ve³⁵</td>
<td>*/ju³ve³⁵/</td>
<td>*/juwi?/</td>
<td>ji³va³</td>
<td>straw mat</td>
</tr>
<tr>
<td>kkã³</td>
<td>ka³</td>
<td>kã³</td>
<td>*/kkã³/</td>
<td>*/jikk³?/</td>
<td>ju²ku⁴</td>
<td>squash</td>
</tr>
<tr>
<td>kka³</td>
<td>ka³</td>
<td>ka³</td>
<td>*/kka³/</td>
<td>*/joko³/</td>
<td>ja²mi³</td>
<td>peg, pin</td>
</tr>
<tr>
<td>kko³</td>
<td>koho³</td>
<td>koh³</td>
<td>*/kko³/</td>
<td>*/juku/</td>
<td>ja⁴ta⁴</td>
<td>herb</td>
</tr>
<tr>
<td>kki³</td>
<td>kih³</td>
<td>kih³</td>
<td>*/kki³/</td>
<td>*/juku³/</td>
<td>ji⁴ku⁴</td>
<td>hill</td>
</tr>
</tbody>
</table>
Remaining 9/24 geminates

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

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<th>Gloss</th>
</tr>
</thead>
<tbody>
<tr>
<td>nne³²</td>
<td>nne³²</td>
<td>na³</td>
<td>*/nne³²/</td>
<td>*/ndute/</td>
<td>nu⁴ni⁴</td>
<td>water</td>
</tr>
<tr>
<td>tto³²</td>
<td>to³²</td>
<td>to³²</td>
<td>*/tto³²/</td>
<td>*/towī/</td>
<td>du⁴du⁴</td>
<td>feather</td>
</tr>
<tr>
<td>kkāh³</td>
<td>kāh³</td>
<td>kʷāh³</td>
<td>*/ukāh³/</td>
<td>*/ndifēʔ/</td>
<td>ndā³ku³</td>
<td>sandal</td>
</tr>
<tr>
<td>jjoʔ³</td>
<td>joʔo³</td>
<td>joʔ²</td>
<td>*/jjooʔ/</td>
<td>*/kʷija/</td>
<td>ndu²ju⁴</td>
<td>year</td>
</tr>
<tr>
<td>llih³</td>
<td>llih⁴</td>
<td>(ku¹ni¹)</td>
<td>*/lliǔh³/</td>
<td>*/luʔu/</td>
<td>lʔi</td>
<td>small</td>
</tr>
</tbody>
</table>

- 4 obscure cases, possibly from sound changes related to Proto-Mixtecan */ndʒ*/ or Proto-Trique lexical innovations.

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</tr>
</thead>
<tbody>
<tr>
<td>nne³¹</td>
<td>nne³¹</td>
<td>ne³¹</td>
<td>*/nne³¹/</td>
<td>*/koyō/</td>
<td>ju²ta⁴</td>
<td>meat</td>
</tr>
<tr>
<td>ttū³</td>
<td>tū³</td>
<td>ttō³</td>
<td>*/ttō³/</td>
<td>*/nijiʔ/</td>
<td>jū³</td>
<td>blood</td>
</tr>
<tr>
<td>jja³</td>
<td>jja³</td>
<td>na³ja¹</td>
<td>*/jja³/</td>
<td>*/ndifē/</td>
<td>ndu³du³</td>
<td>truth</td>
</tr>
<tr>
<td>jjeh³</td>
<td>jjeh³</td>
<td>jaih³</td>
<td>*/jjaih³/</td>
<td>*/juuʔ/</td>
<td>tu²⁴</td>
<td>stone</td>
</tr>
</tbody>
</table>
Summary: Comparison A

- 20/24 (80%) words with geminates the result of sound changes: */C_iVC_jV/ > */C_iC_jV/ > C_iC_iV, or */C_iVC_jV/ > C_jC_jV.

- Two of Blevins’ predicted pathways to geminate evolution: consonant and adjacent vowel/glide assimilation, and vowel syncope. Blevins’ explanations work.

- Comparison B: 44 additional geminates, with no Proto-Mixtec reconstruction as a comparison.
**Comparison B**

- 22/44 of remaining geminates in Itunyoso Trique have a clear historical origin.
- Proto-Trique disyllable > Itunyoso geminate onset (12 forms):

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<th>Cuicatec</th>
<th>Gloss</th>
</tr>
</thead>
<tbody>
<tr>
<td>nnah²</td>
<td>na²nah²</td>
<td>na²nah²</td>
<td>*/na²nah²/</td>
<td>ji²nu⁴</td>
<td>slowly</td>
</tr>
<tr>
<td>nniʔ²</td>
<td>a²niʔ¹</td>
<td>ja³ni¹</td>
<td>*/ja³niʔ¹/</td>
<td>ku³vi²</td>
<td>ugly, gross</td>
</tr>
<tr>
<td>mmiʔ³</td>
<td>mmiʔ³</td>
<td>ju³mi³</td>
<td>*/ju³mi³/</td>
<td>na²ma²</td>
<td>soap</td>
</tr>
<tr>
<td>mmi³¹</td>
<td>mmi³¹</td>
<td>ju³mi¹</td>
<td>*/ju³mi¹/</td>
<td>jje²ko²</td>
<td>bridge</td>
</tr>
<tr>
<td>mmi³²</td>
<td>mmi³²</td>
<td>ju³me³</td>
<td>*/ju³me³/</td>
<td>mʔi²⁴</td>
<td>sweet potato</td>
</tr>
<tr>
<td>ββe³</td>
<td>wwe³</td>
<td>ju³va³¹</td>
<td>*/ju³va³¹/</td>
<td>tā⁴</td>
<td>brave</td>
</tr>
<tr>
<td>ββeh³</td>
<td>wwehe³</td>
<td>ju³veh³</td>
<td>*/ju³veh³/</td>
<td>n²⁴de²de⁴</td>
<td>boundary stone</td>
</tr>
<tr>
<td>β³</td>
<td>wwi³</td>
<td>a³vi³²</td>
<td>*/a³vi³²/</td>
<td>ku³vi²</td>
<td>to be</td>
</tr>
<tr>
<td>ttah⁵</td>
<td>ta⁵</td>
<td>(u)ta³</td>
<td>*/u⁵ta³/</td>
<td>mnā³</td>
<td>to be above</td>
</tr>
<tr>
<td>ttuh⁵</td>
<td>tu⁵</td>
<td>i³tu⁵</td>
<td>*/i⁵tu⁵/</td>
<td>ja⁴tu⁴</td>
<td>knot, goiter</td>
</tr>
<tr>
<td>ttu²⁵</td>
<td>si⁵ tu²</td>
<td>i³tu³²</td>
<td>*/i³tu³²/</td>
<td>du³ku³</td>
<td>thief</td>
</tr>
<tr>
<td>ttsoh³</td>
<td>tsoho³</td>
<td>ni³tsoh³</td>
<td>*/ni³tsoh³/</td>
<td>NA</td>
<td>female’s belt</td>
</tr>
</tbody>
</table>
Modern Cuicatec suggests an earlier stage there was a disyllabic cognate which underwent syncope/assimilation (10 forms):

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<th>Gloss</th>
</tr>
</thead>
<tbody>
<tr>
<td>nna³¹</td>
<td>nna³¹</td>
<td>na³¹</td>
<td>*/nna³¹/</td>
<td>ju²ndu⁴</td>
<td>farm field</td>
</tr>
<tr>
<td>nneh³</td>
<td>nnehe³</td>
<td>neh³</td>
<td>*/nneh³/</td>
<td>jʔa⁴ndʔi⁴</td>
<td>dream</td>
</tr>
<tr>
<td>nnih³</td>
<td>nnih³</td>
<td>nuh³</td>
<td>*/nnih³/</td>
<td>ji⁴ma⁴</td>
<td>leather</td>
</tr>
<tr>
<td>nnu³²</td>
<td>nu³²</td>
<td>nu³²</td>
<td>*/nnu³²/</td>
<td>ve²nu³</td>
<td>Dysphania ambrosioides</td>
</tr>
<tr>
<td>mma⁴</td>
<td>moʔ⁴ (du.)</td>
<td>bah⁴</td>
<td>*/mba⁴/</td>
<td>ku³mba²⁴</td>
<td>compadre</td>
</tr>
<tr>
<td>ββeh³</td>
<td>gʷeʔ² (POT.du)</td>
<td>gʷeh⁴</td>
<td>*/ββeh³/</td>
<td>ka²va⁴</td>
<td>to jump</td>
</tr>
<tr>
<td>ttśʔ³</td>
<td>tśʔ³</td>
<td>tśʔ³</td>
<td>*/ttśʔ³/</td>
<td>ju³ni³</td>
<td>grass</td>
</tr>
<tr>
<td>ttśu²</td>
<td>tśu² (du.)</td>
<td>tśu¹</td>
<td>*/ttśu²/</td>
<td>de⁴nu¹</td>
<td>wise man</td>
</tr>
<tr>
<td>ttśuh³</td>
<td>tśuh³</td>
<td>tśuh³</td>
<td>*/ttśuh³/</td>
<td>du³ti¹ ti⁴</td>
<td>egg</td>
</tr>
<tr>
<td>kkãh³</td>
<td>kãh³</td>
<td>kãh³</td>
<td>*/kkãh³/</td>
<td>ndo³ku³</td>
<td>sandal</td>
</tr>
</tbody>
</table>

Similar to Comparison set A, loss of a penultimate syllable, often of the shape */(j)V/ (13/22 cases), caused the genesis of word-initial geminates in final, now monosyllabic, roots.
Analysis: Historical Reconstruction

- 42/68 (62%) geminates in Trique have clear origin.

- Vowel syncope and assimilation of consonant & adjacent vowel/glide readily account for the origin of most of the geminates in monosyllables in Itunyoso Trique.

- Rare contrast, but with a clear explanation.
Analysis: *Historical Reconstruction*

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Topics

1. Consonant length contrasts (/n/ vs. /nn/) tend to occur in polysyllabic words.

2. When they do occur in monosyllabic words, they usually also occur in polysyllabic words.

3. Could they occur only in monosyllables? How?
Diachronic (in)stability (Blevins, 2004)

Three diachronic pathways for initial geminates:

1. Maintenance: a length contrast remains due to its high functional load, e.g. paradigmatic reinforcement or lexical competition (Blevins and Wedel, 2009). E.g. Leti, Nukuoro.

2. Maintenance/Mutation: a length contrast remains but additional, non-durational cues reinforce perception. The contrast may mutate along laryngeal dimensions (voicing, glottal spreading, glottal constriction). E.g. Proto-Icelandic, Pattani Malay, Taba.

3. Degemination: the length contrast is neutralized. E.g. Swiss German (some contexts).
The phonetics of geminates in Itunyoso Trique

- Examination of geminate-singleton contrast among 5 obstruents: /t/, /k/, /kw/, /tʃ/, /tʃ/; and 2 sonorants: /β/, /j/.

- Acoustic and Electroglottographic (EGG) data.
  - Acoustic measures for obstruents: closure duration, burst duration, VOT, adjusted burst amplitude, and preaspiration duration; for sonorants: closure duration.
  - EGG measures: VST (voice offset time) in /V #C/ vs. /V #CC/ transition.

- 8 Native Itunyoso Trique speakers (4 female, 4 male).
- 40 monosyllabic words (20 singleton onsets, 20 geminate onsets).
- In carrier sentences, e.g. ‘I see X here.’, /ni⁴ja⁴³ ___ nã³/.
Acoustic Measures
Electroglottographic (EGG) Measures

- EGG involves the use of electrical current to determine the contact area of the vocal folds.
- The presence of EGG maxima and minima indicates that there is glottal vibration.
Results 1: Acoustic data - Obstruents

Consonant Length in Monosyllables
Results, cont.

- Closure duration was significantly different between singletons and geminates, \((F[1,7] = 25.13, p< 0.01)\) as was VOT \((F[1, 7] = 8.56, p < 0.05)\), but not burst duration or burst amplitude.

<table>
<thead>
<tr>
<th>Consonant</th>
<th>Closure Duration</th>
<th>Burst Duration</th>
<th>VOT</th>
<th>Total Duration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stops</td>
<td>Singleton</td>
<td>82.1 ms.</td>
<td>15.6 ms.</td>
<td>111.4 ms.</td>
</tr>
<tr>
<td></td>
<td>Geminate</td>
<td>137.8 ms.</td>
<td>17.8 ms.</td>
<td>168.5 ms.</td>
</tr>
<tr>
<td>Affricates</td>
<td>Singleton</td>
<td>59.2 ms.</td>
<td>8.8</td>
<td>126.1 ms.</td>
</tr>
<tr>
<td></td>
<td>Geminate</td>
<td>76.9 ms.</td>
<td>10.6 ms.</td>
<td>182.6 ms.</td>
</tr>
</tbody>
</table>

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

- With preaspiration: 1:1.70 for stops, 1:1.61 for affricates.
Results 1: Acoustic data - Sonorants

- Average duration of singleton = 95.9 ms., geminate = 168.8 ms.
- Ratio = 1:1.76 ($F[1,7] = 55.9$, $p< 0.001$).
Summary: Results

- Initial consonant length contrast distinguished by duration.

- For stops: closure duration and preaspiration distinguish the length contrast.

- For affricates, closure duration, frication duration, and preaspiration distinguish the length contrast.

- Presence of preaspiration increases the duration of geminates and may make the contrast easier to perceive. A mutation of a length contrast along a laryngeal dimension (glottal spreading).
**EGG Data**

Possible pre-obstruent glottal timing strategies:

- **P** = devoicing precedes closure
- **S** = devoicing simultaneous w/closure
- **V** = devoicing follows closure

- Geminate obstruents devoice before closure (preaspiration). What do singletons do?
Results 2: EGG data - Obstruents

- Singletons undergo **passive voicing** (V) during closure.
Results 2: EGG data - Obstruents

- 84% of singleton obstruents (304/362) realized with devoicing after closure, compared with 6.7% of geminates obstruents (13/194) ($G^2[1] = 162.0, p < 0.001$).

- Geminate obstruents realized with devoicing prior to closure (49.4%, 96/194) or devoicing simultaneous with closure (43.8%, 85/194).

- Singletons almost never realized with devoicing before closure (1.9%, 7/162).
Evolutionary hypothesis

- Copala Trique: /t/ vs. /ð/, no sonorant length contrast
- Chicahuaxtla Trique: /t/ vs. /d/, /nn/ vs. /n/; only length contrast among sonorants.
- Itunyoso Trique: /t/ vs. /tt/, /nn/ vs. /n/; length contrast for obstruents and sonorants.
Evolutionary hypothesis

- Presence of partial voicing in singleton obstruents and preaspiration in geminates.

- (Possible) Evolution: singleton vs. geminate contrast > singleton (partial voicing) vs. geminate (devoiced) contrast > voicing contrast

- Presence of laryngeal cue to obstruent length contrast in monosyllables led to mutation.
Main Points

- Evolution of rare contrast explainable diachronically through (pre-tonic) vowel syncope and consonant assimilation when the parent language has both word-final stress and bisyllabic word structure. Incidentally – same pattern in Nhaheun (Pajak, 2009; Sidwell, 2003).

- Contrast realized primarily by duration, but with added cue of preaspiration for geminate obstruents and partial voicing for singleton obstruents.

- Historically, this added laryngeal cue may have been reanalyzed as the primary cue to the contrast in other Trique dialects, resulting in a reinterpretation of initial length contrast as initial voicing contrast.
What factors would lead us to expect neutralization in the Trique length contrast?

- Rare contrasts are maintained in language when they have a high functional load (Blevins and Wedel, 2009).
- No functional load in Trique.

As evidenced by dialectal differences, the word-initial length contrast is *diachronically unstable* in Trique.
Thank you!
Rarity of contrast is diachronically explained via two structural conditions in Proto-Trique:

1. Phonological constraint on word size (bimoraic/disyllabic).
2. Final syllable prominence.
Preaspiration

- Preaspiration occurs more often before geminates (235/347, 68%) than before singletons (91/699, 13%).

- Preaspiration duration for geminate obstruents is 37.2 ms., but 21.0 ms. for singletons (affricate pre-frication).

- Common presence of preaspiration increases the duration of geminate obstruents. 114.1 vs. 193.7 ms. for stops; 128.8 vs. 207.8 ms. for affricates.

- Including preaspiration, durational ratios between singletons are geminates are larger for obstruents. 1:1.70 for stops, 1:1.61 for affricates.
Nhaheun?

- Word-initial consonant length contrast found in one other language: Nhaheun (Austro-Asiatic: Bahnaric).

- Word-final stress (iambic).

- Sesquisyllabic word structure.

- Origin of geminates here is the result of the similar set of sound changes described for Trique, with the same structural conditions present in the parent language (Pająk, 2009; Sidwell, 2003).

- Consonant length contrasts are very rare in monosyllables, but have a clear historical origin.


