Phonemic versus phonetic correlates of vowel length in Chuxnabán Mixe

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Research Goals

- Describe the phonetics and phonology of a previously undocumented language
- Lay the ground for future phonetic analyses of the complex vowel systems found in the Mixe language family

Answer two questions

- Is there a 3-way phonemic vowel length distinction?
- Are there any phonetic correlates of vowel length?
Introduction
  ■ Mixe Languages

Phonation Contrasts
  ■ Plain, Aspirated, Glottalized

Palatalization

Vowel Length
  ■ Study, Measurements, Results

Conclusions

Bibliography
Introduction

**Mixe Languages**
- Mixe territory: 290 communities in Oaxaca
- Each community with a different variety
- Classification of Mixe varieties still unclear due to limited sources of documentation
- Mixe–Zoque language family
- Mixe varieties differ mostly in their vowel systems (Suslak 2003)

**Chuxnabán Mixe**
- Previously undocumented, spoken by 900
- Eastern Mixe branch (Quetzaltepec Mixe)
- Midland Mixe (identified by speakers)
- Very few published grammars and dictionaries of the Mixe languages
San Juan Bosco Chuxnabán, Summer 2006
San Juan Bosco Chuxnabán, Summer 2006
Introduction

- Vowels: 7 phonemes

<table>
<thead>
<tr>
<th>i</th>
<th>ɨ</th>
<th>u</th>
</tr>
</thead>
<tbody>
<tr>
<td>e</td>
<td>o</td>
<td></td>
</tr>
<tr>
<td>æ</td>
<td>a</td>
<td></td>
</tr>
</tbody>
</table>

- Schwa (word–finally; in suffixes –s, –n; most likely allophonic of /e/ or /ɨ/)
- Central rounded vowel [ʁ]: identified only in two verbs; maybe dialect borrowing
Introduction

- 7 phonemes: /a, æ, e, i, o, u, ü/
  - i ~ ü: tsip ‘war’ tsïp ‘plant name’
  - a ~ u: kam ‘field’ kum ‘sweet fruit’
  - æ ~ u: tsák ‘dull’ tsuk ‘mouse’
  - o ~ u ~ ü: hoon ‘bird’ huun ‘hard’
    - hiïn ‘fire’
Introduction

- **Vowel length (all short and long)**
  - o ~ oo:  *mox* ‘stomach’  *moox* ‘knot’
  - a ~ aa:  *kam* ‘field’  *kaan* ‘salt’
  - e ~ ee:  *kepy* ‘tree’  *keepy* ‘bream’ (fish)

- **Phonation contrasts**
  - Modal vowels (short and long): V, VV
  - Aspirated vowels (short and long): Vh, VVh
  - Glottalized vowels (short, interrupted): Vושר, Vושר

"Vowel length (all short and long)"

- o ~ oo:  *mox* ‘stomach’  *moox* ‘knot’
- a ~ aa:  *kam* ‘field’  *kaan* ‘salt’
- e ~ ee:  *kepy* ‘tree’  *keepy* ‘bream’ (fish)
### Consonants: 15 phonemes

- $p$, $t$, $k$, $m$, $n$, $x$, $ts$, $ch$, $j$ can be palatalized
- Glottal stop only phoneme as part of the vowel system

<table>
<thead>
<tr>
<th>Category</th>
<th>Bilabial</th>
<th>Alveolar</th>
<th>Palatal</th>
<th>Velar</th>
<th>Glottal</th>
</tr>
</thead>
<tbody>
<tr>
<td>Plosives</td>
<td>$p$</td>
<td>$t$</td>
<td></td>
<td>$k$</td>
<td>(‘)</td>
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<tr>
<td>Nasals</td>
<td>$m$</td>
<td>$n$</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fricatives</td>
<td>$s$, $ʃ$</td>
<td>$ʃ$ (x)</td>
<td></td>
<td>$h$</td>
<td>(j)</td>
</tr>
<tr>
<td>Affricates</td>
<td>$ts$, $tʃ$</td>
<td>$(ch)$</td>
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<tr>
<td>Rhotic</td>
<td>$r$</td>
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<td></td>
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<tr>
<td>Lateral</td>
<td>$l$</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Glides</td>
<td>$w$</td>
<td></td>
<td></td>
<td>$y$</td>
<td></td>
</tr>
</tbody>
</table>
Phonation Contrasts

- Plain, aspirated, and creaky vowel nuclei
- Phonation contrasts associated with phonetic properties (Gordon/Ladefoged 2001)
  - Periodicity, intensity, spectral tilt, F0, formant frequencies, duration, airflow
  - Non-modal vowels generally correlate with increased duration
  - Breathiness/creakiness often confined to a portion of the vowel
Phonation Contrasts

- Aspiration and /h/
  - Phonemic contrast: plain vs. aspirated
  - /h/ as onset, coda, part of nucleus
  - Different realizations (onset, coda, nucleus)
  - Laryngeal timing (/h/ in final phase of vowel)

- Jalapa Mazatec (different laryngeal timing)
  - Non-modal phonation is most prominent in the first portion of the vowel
  - Contrastive tone (non-modal phonation in the first portion for tonal contrasts to be retrieved from the second portion, Silverman 1997)
Phonation Contrasts

Plain vs. Aspirated

- a/aa/(a)ah: pak ‘pigeon’ taak ‘mother’
  paajk ‘bone’
  taajk ‘police’

- ï/ïï/(ï)ïh: mïk ‘strong’ miït ‘they went’
  xïïjk ‘bean’
  miïjt ‘year’
Phonation Contrasts

- Plain VV
  - *taak* ‘mother’
Phonation Contrasts

- Aspirated (V)Vh
  - *paajk*  ‘bone’

- Decay in intensity during the second half of the vowel; post-vocalic aspiration
Phonation Contrasts

- Aspirated VVh; /h/ as onset
  - jiijp ‘nose’

- Turbulence in airflow stronger if onset
- Turbulence in airflow longer in duration if onset
Phonation Contrasts

- /h/ as coda
  - tuj ‘shoot!’

- No steady decay in intensity if not nucleus
- Coda realized as fricative separate from vowel
- Coda /h/ longer in duration than if nucleus
Phonation Contrasts

- Vowel creakiness for different reasons
  - Phonemic contrast between plain and glottalized vowels (final portion creaky)
  - Phonemic contrast between plain and interrupted vowels (middle portion creaky)
  - Phonemic contrast between glottalized and interrupted vowels (final vs. middle part creaky)
  - Vowel-initial words: /会展中心/ as initial creakiness
  - => Different laryngeal timing (glottal stop part of onset or nucleus, but not as coda)
  - Similar patterns in other Mexican languages (e.g. Copala Trique, a Mixtecan language)
Phonation Contrasts

- Plain vs. glottalized
  - a/aː:  tāp ‘you have’  kā’p ‘scorpion’
  - u/ uː:  tsuk ‘mouse’  ju’k ‘owl’
  - ţ/ ţː:  mik ‘strong’
  - mi’t ‘mother-in-law/father-in-law’
Phonation Contrasts

- Plain V
  - "täp ‘you have’"
Phonation Contrasts

- **Glottalized V**
  - *kä’p*  ‘scorpion’

- /发音 symbol/ as vowel–final creakiness
- Creakiness correlates with decay in intensity
Phonation Contrasts

- **Plain vs. Interrupted**
  
  - ii/i\i: \kiix\ 'woman' \pi'ix\ 'tail'
  
  - uu/ u\u: \puuy\ 'seat' \pu'yuy\ 'table'
  
  - ï/i\ï: \tsiip\ 'plant name' \tsi'ip\ 'plant when getting cut'
Phonation Contrasts

- Plain VV
  - *puuy* ‘seat’
Phonation Contrasts

- **Interrupted V \( \overset{\sim}{V} \)**
  - *pu’uts* ‘infection’

- Creakiness in the middle and re-articulation
- Creakiness correlates with a decay in intensity
Phonation Contrasts

■ Glottalized vs. Interrupted
  ■ u≈/u≈u: pu’ts ‘yellow’  pu’uts ‘infection’

■ Aspirated vs. Interrupted
  ■ aah/a≈a: paajk ‘bone’  a’ak ‘sweet’
Phonation Contrasts

- Vowel-initial words
  - Creakiness initially & finally: \(a't\) ‘louse’
Palatalization

- Palatalization: suprasegmental
- Carries over to adjacent vowels
  - *tsuk* ‘mouse’  
  - *tuky* [tu:kj] ‘to cut’
  - Onglide and offglide if word-medially: *kachypaaajk* [kajtọpja:hk]
  - Lowering of F1 before palatalized consonant
  - Raising of F2 before palatalized consonant
  - Characteristics of high front vowels (Fronting and Raising)
Palatalization

- **Release burst distribution**
  - Non-palatalized stops: even distribution of turbulence
    - *tsuk* ‘mouse’ (not palatalized)
Palatalization

- Release burst distribution
  - Distribution of release burst stays in higher frequencies for the palatalized stops
    - *tuky* ‘to cut’ (palatalized)
Vowel Length

- Coatlán and San José El Paraíso Mixe: phonemic 3-way vowel length distinction
  - Three lengths difficult for speakers to hear
  - Not represented in the orthography
- 3-way phonemic vowel length is rare
  - Estonian (3rd degree depends on syllable structure and word patterning; Lehiste 1970)
  - Yavapai (length not predictable from pitch or syntactic category; Thomas/Shaterian 1990)
Vowel Length

- 3-way length distinction
  - Independent of syllable pattern, vowel quality, preceding/following consonants, stress, intonation (Hoogshagen & Hoogshagen 1959)
  - No phonetic measurements so far
- Vowel length (short/long) phonemic in all varieties (+ represented in orthographies)
- Vowel duration could be influenced by:
  - Vowel position + number of syllables in a word
  - Vowel quality (low vowels longer)
  - Following consonant (lengthening with voiced codas)
  - Other factors
Vowel Length

This study

- 3 speakers (2 female, 1 male)
- Monosyllabic words with all possible nuclei and codas (mostly nouns)
- Target word recorded five times in carrier phrase (total of 195 words)
- Confounding factors (syllable structure, vowel quality, coda consonant) kept constant for comparison
### Vowel Length

- **Possible minimal triplets**
  - Triplets from **Coatlán** in **Chuxnabán Mixe**
  - Only two triplets with comparable results

<table>
<thead>
<tr>
<th>V</th>
<th>VV</th>
<th>VVV</th>
</tr>
</thead>
<tbody>
<tr>
<td>pox</td>
<td>‘guava’</td>
<td>‘spider’</td>
</tr>
<tr>
<td></td>
<td><em>poox</em></td>
<td><em>po0ox</em></td>
</tr>
<tr>
<td></td>
<td>‘knot’</td>
<td></td>
</tr>
<tr>
<td>pet</td>
<td>‘climb’</td>
<td>‘broom’</td>
</tr>
<tr>
<td></td>
<td><em>peet</em></td>
<td><em>peeet</em></td>
</tr>
<tr>
<td></td>
<td>‘Peter’</td>
<td></td>
</tr>
<tr>
<td>pox</td>
<td>‘guava’</td>
<td>‘spider’</td>
</tr>
<tr>
<td></td>
<td><em>poxm</em></td>
<td><em>mo0ox</em></td>
</tr>
<tr>
<td></td>
<td>‘knot’</td>
<td></td>
</tr>
<tr>
<td>pät</td>
<td>‘climb’</td>
<td>‘broom’</td>
</tr>
<tr>
<td></td>
<td><em>pätn</em></td>
<td><em>päät</em></td>
</tr>
<tr>
<td></td>
<td>‘Peter’</td>
<td></td>
</tr>
</tbody>
</table>
# Vowel Length

## Triplets in Chuxnabán Mixe

<table>
<thead>
<tr>
<th>V</th>
<th>VV</th>
<th>VVV</th>
</tr>
</thead>
<tbody>
<tr>
<td>pox</td>
<td>‘guava’</td>
<td>poxm</td>
</tr>
<tr>
<td>0.239 s</td>
<td>0.202 s</td>
<td>0.365 s</td>
</tr>
<tr>
<td>päť</td>
<td>‘climb’</td>
<td>pätn</td>
</tr>
<tr>
<td>0.139 s</td>
<td>0.132 s</td>
<td>0.281 s</td>
</tr>
</tbody>
</table>

- Clear distinction between short/long vowels
- ‘Medial length’ vowels with complex coda
- Negative result for 3–way vowel length
Vowel Length

- Measurements
  - Three tokens for each word
  - Mean values for comparison
  - Total of 195 different words
  - Three speakers (2 female, 1 male)
Vowel Length

Results of measurements
- Longer if ‘onsetless’ (initial glottal stop)

Same results for all vowels
- Voiced codas and palatalization no effect
Vowel Length

- Longer if coda is /x/ (also ch/chy)

Results for vowel /i/:

<table>
<thead>
<tr>
<th>CODA</th>
<th>Mean LENGTH</th>
</tr>
</thead>
<tbody>
<tr>
<td>ch</td>
<td>0.18</td>
</tr>
<tr>
<td>k</td>
<td>0.16</td>
</tr>
<tr>
<td>m</td>
<td>0.14</td>
</tr>
<tr>
<td>p</td>
<td>0.12</td>
</tr>
<tr>
<td>t</td>
<td>0.10</td>
</tr>
<tr>
<td>ts</td>
<td>0.08</td>
</tr>
<tr>
<td>x</td>
<td>0.10</td>
</tr>
</tbody>
</table>

- Same results for all nuclei
Vowel Length

- Longer if open syllable

Results for /aa/

<table>
<thead>
<tr>
<th>SYLLABLE</th>
<th>Mean LENGTH</th>
</tr>
</thead>
<tbody>
<tr>
<td>closed</td>
<td>.32</td>
</tr>
<tr>
<td>coda x</td>
<td>.34</td>
</tr>
<tr>
<td>onsetless</td>
<td>.36</td>
</tr>
<tr>
<td>open</td>
<td>.38</td>
</tr>
</tbody>
</table>
Vowel Length

- Effects of non-modal phonation on vowel duration

- Glottalized longer than modal short
## Vowel Length

**Interrupted vowels somewhat shorter than long modal vowels (except for i, ï)**

**Non-modal phonation does not always correlate with increased duration**

<table>
<thead>
<tr>
<th>Vowel</th>
<th>Long Modal</th>
<th>Interrupted</th>
</tr>
</thead>
<tbody>
<tr>
<td>aa</td>
<td>0.3</td>
<td>0.2</td>
</tr>
<tr>
<td>ää</td>
<td>0.3</td>
<td>0.2</td>
</tr>
<tr>
<td>ee</td>
<td>0.3</td>
<td>0.2</td>
</tr>
<tr>
<td>ii</td>
<td>0.3</td>
<td>0.2</td>
</tr>
<tr>
<td>oo</td>
<td>0.3</td>
<td>0.2</td>
</tr>
<tr>
<td>uu</td>
<td>0.3</td>
<td>0.2</td>
</tr>
<tr>
<td>ïï</td>
<td>0.3</td>
<td>0.2</td>
</tr>
</tbody>
</table>
Modal versus aspirated vowel nuclei

Aspirated longer than modal counterparts (short and long respectively), but short modal clearly shorter
Summary of vowel length results

- 3-way phonemic contrast not found
- Lengthening triggered by: a) lack of onset, b) lack of coda, c) coda /x/
- Lengthening not triggered by palatalization or voiced coda
- Length for different syllable nuclei
  - V  <  VV
  - V  <  V'
  - V  <  Vh
  - V'V  <  VV (!)
  - VV  <  VVh
Conclusions

- Laryngeal timing determines type of nucleus (V/VV, Ṽ, ṼV)
- Phonetic difference between aspirated vowels and onset or coda /h/
- Phonetic difference between palatalized and non-palatalized consonants
- No evidence for 3-way length contrast
- Certain syllable types and certain codas trigger vowel lengthening (onsetless, open, coda /x/)
Conclusions

What next?

- Length measurements in polysyllabic words
- Examine effects of position in word, stress, and intonation
- Test Coatlán Mixe 3-way contrast phonetically (re-elicit + measure)
- Collect data from other Mixe varieties


De Quintana, Fray Augustin. 1733 (printed 1890). *Confesionario en Lengua Mixe.* Alençon.

Bibliography


Thank you!