Post-oralized and devoiced nasals in Panará

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University of California, Berkeley
Goal

1. To present a case of post-nasal devoicing as evidence of a phonetically unnatural sound change in Panará (Jê)

2. To discuss the implications of this sound change for the internal classification of Jê languages
Sound changes are phonetically grounded

- Understanding mechanisms of speech production and perception can help us **understand recurring sound patterns** in unrelated languages (Ohala 1993, Ohala & Ohala 1993)
  - Most likely arise from language universal factors, i.e. physiological and psychological factors common to all humans

- A series of phonetically natural sound changes may collectively result in a system that is not phonetically natural (Hayes 1999; Hyman 2001)

- **Optimality Theory**: Incorporates two main principles
  - **Markedness**: militates toward phonetic well-formedness
  - **Faithfulness**: militates for contrast preservation
  - **Sound change**: reordering of constraints results in (phonetic) well-formedness in some other aspect of the system

- **In summary**: Sound changes should be phonetically natural.
Post-nasal voicing (ND)

- The phenomenon of post-nasal voicing is of particular interest in the debate on whether sound changes should be phonetically natural or not.

- Cross-linguistic surveys claim that the most common process is for the postnasal stop to become voiced (Herbert 1986; Rosenthal 1989, Steriade 1993, and Hyman 2001)

- A number of authors have proposed a universal bias against post-nasal devoicing (*NT) (Pater 1996; Hayes 1999; Hayes & Stivers 2000)
  - Articulatorily grounded in aerodynamic principles
... but sometimes NT

- Evidence of post-nasal devoicing in a number of languages

- Mostly from Bantu languages
  - **Tswana** (Coetzee et al. 2007, Coetzee & Pretorius 2010)
    - 4/12 speakers of Tswana show clear and consistent post-nasal devoicing
    - an additional 3/12 show infrequent post-nasal devoicing
  - **Shekgalagari** (Solé et al. 2010)
    - impressionistic description

- Beguš (forthcoming) surveys eight cases of post-nasal devoicing
  - Argues that no case derives from a single atypical sound change
  - Rather, from a series of 2-3 natural and well-formed sound changes
NT in Panará

• Post-nasal devoicing is **categorical**
  - Productive for all speakers
  - Sound change is completely phonologized
  - If voicing is defined as 50% of the duration is voiced, then no stop in the corpus can be classified as voiced.

• Contributes to the body of literature providing **evidence of unnatural sound changes**

• Specifically, this sound change **does not seem to result in an improvement** of some other aspect of the grammar
  - Or to arise from a series of phonetically-grounded sound changes
Typological data on NT

- Out of a sample of 454 languages from UPSID (Maddieson & Ladefoged 1993)
  - 55 languages (12%) have prenasalized stops
  - 8 languages have devoiced and prenasalized stops (<2%)

- Why are these segments so rare?
Aerodynamics of [d]

- Alveolar closure
- Vocal folds vibrating
- Velum closed
- Lungs

- Alveolar closure
- Vocal folds closed
- Velum closed
- Lungs
Aerodynamics of [nd]

velum closed
alveolar closure
tonal folds vibrating
lungs

velum open
alveolar closure
tonal folds vibrating
lungs

velum closed
alveolar closure
tonal folds vibrating
lungs
Outline

• Part 1: Evidence of NT in Panará
  • Description of the phenomenon
  • Data collection, methodology and results

• Part 2: Evidence that NT in Panará is a sound change from ND
  • 2 proposals for the internal classification of the family
  • Data from other Jê languages
Panará

• Jê language, ~600 speakers

• Spoken in central Brazil
## Phonemes

### Consonants (12)

<table>
<thead>
<tr>
<th></th>
<th>Bilabial</th>
<th>Alveolar</th>
<th>Palatal</th>
<th>Velar</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Stop</strong></td>
<td>p</td>
<td>t</td>
<td>ʈʂ</td>
<td>k</td>
</tr>
<tr>
<td><strong>Nasal</strong></td>
<td>m</td>
<td>n</td>
<td>ɲ</td>
<td>ɳ</td>
</tr>
<tr>
<td><strong>Fricative</strong></td>
<td>s</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Approximant</strong></td>
<td>w</td>
<td>r</td>
<td>j</td>
<td></td>
</tr>
</tbody>
</table>

### Vowels (29)

#### Short oral (9)

- i
- u
- ʊ
- ɹ
- ɑ
- ɔ

#### Short nasal (6)

- ɹɪ
- ɹu
- ɹʊ
- ɹɹ
- ɹɟ
- ɹɒ

#### Long oral (9)

- i:
- u:
- ʊ:
- ɹɹ:
- ɹɹ:
- ɹɹ:

#### Long nasal (5)

- ɹɪ:
- ɹu:
- ɹʊ:
- ɹɹ:
- ɹɹ:
The phonological process

• In Panará, nasal consonants are only fully nasalized before nasal vowels

\[/m, n, ɲ, \eta/ \rightarrow [\text{m, n, ɲ, } \eta] / \_\_ \tilde{\text{V}}\]

• NCs appear as allophones of nasal stops
  • Process of post-oralization and devoicing of nasal consonants (Lapierre et al., 2016)

\[/m, n, ɲ, \eta/ \rightarrow [\text{mp, nt, ns, } \eta k] / \_\_ \text{V}\]
Data collection

- Acoustic data was collected from 12 native speakers of Panará
  - only analyzed two so far

- 50 target words
  - mono- or disyllabic
  - target syllable types included:
    - NṼ, NCV, CV, CṼ

- Target words were presented inside a carrier phrase
  - “ĩkjẽ hẽ ka tõ syrĩ [X]”, (I say the word [X].)

- Words and carrier phrases presented on a laptop screen alongside a picture depicting the target word
  - 5 semi-randomized blocks

- Total of 250 target words produced per speaker

- Calculated percentage of voicing duration for phones in target syllables
### Results

<table>
<thead>
<tr>
<th>voicing duration</th>
<th>V</th>
<th>N</th>
<th>C</th>
<th>NC-N</th>
<th>NC-C</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>95%</td>
<td>98%</td>
<td>7%</td>
<td>91%</td>
<td>4%</td>
</tr>
</tbody>
</table>

- One-way ANOVA (DV: voicing duration, IV: phone type)
  - $F = 9055, p < .001$

- Tukey HSD post-hoc analysis
  - All pairwise comparisons are significantly different ($p < .001$),
  - except (V, N), (C, NC-C)

- Panará exhibits a clear case of categorical post-nasal devoicing
Internal classification of Jê

- At the moment, controversial
  - Especially with respect to the position of Panará within the structure

- Two recent proposals
  - Nikulin 2015
  - Lapierre et al. 2016

- I’m making a phonological argument here for the proposition by Lapierre et al. 2016
  - See Bardagil-Mas (forthcoming) for additional evidence on ergative case-marking in favour this tree
Internal classification of Jê

**Tree A**  
(Lapierre et al. 2016)

- Proto-Jê
  - Central Jê
    - Xavante
    - Xerente
  - Southern Jê
    - Kaingang
    - Xokleng
  - Savannah Jê
    - Panara
    - Timbira
  - Forest Jê
    - Kisêdje
    - Tapayuna
    - Mebêngôkre
    - Apinaye

**Tree B**  
(Nikulin 2015)

- Proto-Jê
  - Central Jê
    - Xavante
    - Xerente
  - Southern Jê
    - Kaingang
    - Xokleng
  - North-Western Jê
    - Panara
    - Mebêngôkre
    - Apinaye
  - Core Jê
    - Kisêdje
    - Tapayuna
    - Timbira
Internal classification of Jê

Tree A
(Lapierre et al. 2016)

Proto-Jê
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Tree B
(Nikulin 2015)

Proto-Jê
- Central Jê
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Data from other Jê languages

• Realization of /m/ / V__V in Jê languages

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<td>[bmb]</td>
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• Which form should be reconstructed for Proto-Jê?
  • [mb] seem to be the most suitable option
  • It occurs most frequently
Data from other Jê languages

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• Kaingang: /m/ $\Rightarrow$ [bmb] / V__V
  $\Rightarrow$ [mb] / V__V

• If a language has [bmb], then it also has [mb]. (Stanton, 2015)
  • [mb] $\gg$ [bmb]
Data from other Jê languages

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- Kaingang:  
  /m/ → [bmb] / V__V  
  → [mb] / Ą√__V

- If a language has [bmb], then it also has [mb] (Stanton, 2015)
  - [mb] >> [bmb]
Data from other Jê languages

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- It is uncontroversial that Tapayuna is most closely related to Kîsêdjê
- In the 1960s, the Tapayuna were massacred by rubber barons. (Camargo 2010)
  - Only 31 speakers survived.
  - They were incorporated into Mebêngôkre & Kîsêdjê speaking villages.
  - Language is critically endangered.
• **Realization of /m/ / V__V in Jê languages**

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• Tapayuna [m] is due to recent heavy contact with Mebêngôkre.
  • Not an independent innovation.
  • Nearly all speakers are bilingual in Mebêngôkre.
  • Many young speakers are L1 MBG and L2 TPY
Data from other Jê languages

- Realization of /m/ / V__V in Jê languages

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- Panará and Timbira
  - oral release is devoiced
Data from other Jê languages

• Realization of /m/ / V__V in Jê languages

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• Which form should be reconstructed for Proto-Jê?
  • [mb]
  • post-oralization occurs in 7/10 languages
  • oralization occurs in 9/10 languages
Internal classification of Jê

Tree A
(Lapierre et al. 2016)
Internal classification of Jê

Tree A
(Lapierre et al. 2016)

4 innovations

Proto-Jê

Northern Jê

Forest Jê

Savannah Jê

Panara

Timbira

Kîsêdjê

Tapayuna

Mebêngôkre

Apinaye

Xavante

Xerente

Southern Jê

Kaingang

Xokleng

27
Internal classification of Jê

Tree B
(Nikulin 2015)

Proto-Jê

Amazonian Jê

North-Western Jê

Core Jê

Central Jê

Southern Jê

Xavante

Xerente

Kaingang

Tapayuna

Kĩsē djẽ

Apinaye

Mebêngokre

Panara

Timbira

[mb] [b]

[bmb]
Internal classification of Jê

Tree B
(Nikulin 2015)

- **5 innovations**
- **2 x [mb] → [mp]**

- **Proto-Jê**
  - [mb] Southern Jê
  - [mb] Central Jê
  - [mb] Amazonian Jê

- **North-Western Jê**
  - [mb]

- **Core Jê**
  - [mb]

- **Panara**
  - [mp]

- **Mebêngôkre**
  - [m]
  - [mb]

- **Apinaye**
  - [mb]

- **Kisêdjê**
  - [mb]

- **Tapayuna**
  - [mb ~ m]

- **Timbira**
  - [mp]

- **Xavante**
  - [b]

- **Xerente**
  - [b]

- **Kaingang**
  - [bmb]

- **Xokleng**
  - [mb]
Internal classification of Jê

Tree B
(Nikulin 2015)

- Amazonian Jê
  - Central Jê
    - South Jê
      - Proto-Jê
        - North-Western Jê
          - Core Jê
            - Panara
            - Mebêngôkre
            - Apinaye
            - Kĩsêdjê
            - Tapayuna
            - Timbira
            - Xavante
            - Xerente
            - Kaingang
            - Xokleng
Internal classification of Jê

Tree B
(Nikulin 2015)

6 innovations
2 x [mb] → [mp] → [mb]

Proto-Jê

Amazonian Jê

North-Western Jê

Central Jê

Mebêngôkre

Core Jê

Tapayuna

Tapayuna

Timbira

Core Jê

Panara

Kisêdjê

Tapayuna

Xavante

Xerente

Kaingang

Xokleng
Interim summary

• I’ve shown evidence in favour of tree A over Tree B
  • Tree A requires only 4 innovations (1x mb > mp)
  • Tree B is less parsimonious
    • 5 innovations: 2x mb > mp
    • 6 innovations: 2x mp > mp > mb (back-mutation)

• Even if the internal classification of Tree A is incorrect, ND → NT still occurred (at least!) once.
Conclusion

• The change of ND $\rightarrow$ NT in Panará seems to be an instance of a phonological change for the worse
  • No synchronic evidence of an improvement in some other area of the grammar resulting from this diachronic change
  • Unlike other documented cases of post-nasal devoicing

• Although we should avoid positing unnatural sound changes when possible, changes for the worse do occur in natural language
  • as evidenced by Panará ND $\rightarrow$ NT
  • no clear evidence that this occurred as a series of phonetically natural sound changes
References