Unnatural phenomena and phonological typology

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Introduction

- Phonological typology
- Two approaches:
  - Analytic bias
  - Channel bias

(Moreton 2008)
Introduction

Phonological typology

Two approaches: (Moreton 2008)

- **Analytic bias**
- **Channel bias**

Both equally powerful in explaining typology?

UG, learning vs. transmission (Kiparsky 2006, 2008; Blevins 2004)
Introduction

- Typology feeds both approaches:
  - Constraint inventory, learning
  - Phonetic precursors and directionality that in time results in typology
- Locus of restriction: synchronic processes or sound change
- One of the most thoroughly discussed cases: **final voicing**

\[ T \rightarrow D/\_\_\# \]
Introduction

- Final voicing unattested
- UG, synchronic grammar more restricted, rules out some alternations (Kiparsky 2006)
- Several historical scenarios that could lead to final voicing
- Lezgian: no complete neutralization, alternatives possible (Yu 2004)
Introduction

- The two approaches are not mutually exclusive
- Both factors play a role in shaping phonological typology
  (cf. Moreton 2008, Hayes and White 2013)
- Goals of this talk:
  - disambiguate the two approaches
  - provide argumentation for the existence of channel bias
  - present a detailed account of how exactly channel bias shapes phonology
Introduction

- Are unnatural sound changes possible?
- Are unnatural synchronic alternations possible?
- Is unnatural gradient phonotactics possible?
- Put forth a model for explaining present and future unnatural phenomena
- Probabilistic model of typology within the “channel bias” approach
Naturalness

- **Natural**: phonetically grounded
- **Unmotivated**: lack phonetic motivations
- **Unnatural**: operating in the opposite direction from universal phonetic tendency
Naturalness

- **Natural** processes phonetically motivated, typologically common, usually attested as minor phonetic tendencies cross-linguistically

- Unmotivated: lack motivation

- Most processes in the survey (Blevins 2008) unmotivated
  
  a) \( p \rightarrow s/\_\_i \)
  
  b) \( i \rightarrow u/d\_\_ \)

- No universal phonetic tendency operating against these processes
Naturalness

- **Unnatural**: operating against universal phonetic tendency (UPT)
- **UPT**: phonetically (articulatory) motivated, typologically common, attested as phonetic tendency in languages without phonological process. Reverse processes usually not attested
- Post-nasal devoicing unnatural as final-voicing, but attested as a synchronic process
Outline

1. Introduction
2. Post-Nasal Devoicing
3. Further cases: unnatural gradience
4. Typology
5. Conclusion
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1 Introduction

2 Post-Nasal Devoicing

3 Further cases: unnatural gradience

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Post-Nasal Devoicing

- Post-nasal voicing \((T > D / N\_\_\_)\) is well attested both as a synchronic process and as a sound change.
Post-Nasal Devoicing

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Gk. /ton topo/ → [tondopo]

(Newton 1972)
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  Gk. /ton topo/ → [tondopo]

  (Newton 1972)

- Phonetically well motivated: nasal leak, “compression by the velum

- Passive voicing in post-nasal position even for languages like English

- PNV is a universal phonetic tendency

  (Hayes and Stivers 1995)
Post-Nasal Devoicing

- Clear phonetic reasons for why unnatural post-nasal devoicing is universally avoided
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\[ D > T / N \]
Post-Nasal Devoicing

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  \[ D > T / N \]

- As phonological rule attested in Tswana and Shekgalagari

  Sh.  \(/\chi_{\nu}-m-b\acute{o}n-\acute{a}/ \rightarrow [\chi_{\upsilon}\text{mp}\acute{o}n\acute{a}]\)
  
  \(/\chi_{\nu}-m-d\text{u}3-a/ \rightarrow [\chi_{\upsilon}\text{ntu3a}]\)

  (Hyman 2001, Zsiga et al. 2006, Solé et al. 2010)
Post-Nasal Devoicing

- Clear phonetic reasons for why unnatural post-nasal **devoicing** is universally avoided
  \[ D > T / N \]

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  \[ /\chi u-m-d\ddot{u}3-a/ \rightarrow [\chi u\text{ntu}3a] \]

  (Hyman 2001, Zsiga et al. 2006, Solé et al. 2010)
Post-Nasal Devoicing

- Post-nasal devoicing as sound change reported for eight languages and dialects from four language families
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- Post-nasal devoicing as sound change reported for eight languages and dialects from four language families:
  - Yaghnobi (Xromov 1972)
  - Tswana and Shekgalagari (Solé et al. 2010)
  - Sicilian and Calabrian (south Italian dial.) (Rohlfs 1949)
  - Murik, Buginese, and Land Dayak (Austronesian) (Blust 2009)
Post-Nasal Devoicing

→ If PND as sound change indeed occurred, it would mean that either

(a) sound change *can* operate against the principles of phonetic naturalness or
(b) PND is phonetically well-motivated and natural process.
Explanations of Post-Nasal Devoicing

- Various attempts to explain post-nasal devoicing as a sound change
- Difficulties explaining why a sound change should operate against the strong phonetic tendency
- Limited to only one instance of PND and the data is examined in isolation
- The explanations often involve reconstructing hypothetical and unattested dialects for which there is no comparative evidence
Explanations of Post-Nasal Devoicing

- Xromov (1972) for Yaghnobi:
  1. Two unattested dialect with post-nasal voicing and without it
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**Problems:** Hypercorrection, sociolinguistic factors, hypothetical, unattested dialects
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     1. \( NT > ND \)  
     2. \( ND \rightarrow NT \)
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  1. **NT > ND**  
  2. **ND → NT**

  “In this environment [...] voice was **free to vary**” and “voiceless variant of postnasal obstruents prevailed over time”
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    1. $\text{NT} > \text{ND}$
    2. $\text{ND} \rightarrow \text{NT}$

    “In this environment [...] voice was free to vary” and “voiceless variant of postnasal obstruents prevailed over time”

- Problems: No evidence to assume post-nasal voicing for the three languages. Why would a voiceless variant prevail in an environment that strongly favors voicing?
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Explanations of Post-Nasal Devoicing

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  1. $NT > T$ or $TT$
  2. $ND$ remain unchanged
  3. Speakers analyze $ND$ as assimilated from $NT$ and ‘undo’ voicing
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  - 1. $NT > T$ or $TT$
  - 2. $ND$ remain unchanged
  - 3. Speakers analyze $ND$ as assimilated from $NT$ and ‘undo’ voicing

- **Problems**: What would prompt speakers to assume assimilation in ND? Dissimilation in phonetically strongly disfavoring direction. Not suitable for other languages.
Explanations of Post-Nasal Devoicing

- Solé et al. (2009) for Shekgalagari and Tswana
Explanations of Post-Nasal Devoicing

- Solé et al. (2009) for Shekgalagari and Tswana
  1. In Shekgalagari velum rises earlier after nasal (no passive voicing)
  2. Early velic raising causes the following stop to be longer
  3. Vocal fold vibration is difficult to sustain over time, which results in devoicing
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- Problems: If early velic rising is a present in the language, we would expect secondary ND sequences to undergo devoicing.

  Sh. /χu-m-bόn-á/ → [χ̂μp̂όná]
  Sh. /χu-mu-bόn-á/ → [χ̂umb̂όná]
  Ts. /χu-mu-bόn-á/ → [χ̂umm̂όná]

Also: dialectal data
Explanations of Post-Nasal Devoicing

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  Sh. /χu-m-bón-á/ → [χumpóná]
  Sh. /χu-mù-bóн-á/ → [χumbóná]
  Ts. /χu-mù-bóн-á/ → [χummbóná]

Also: dialectal data
Dickens (1984) and Hyman (2001) argue for a combination of sound changes.

In the absence of typological parallels, one might judge an explanation that operates with a single (albeit unnatural) sound change more parsimonious.

Essentially the correct explanation.
The Data

- The proposals above limited to particular languages: data in isolation
- The data taken together reveals an important generalization: **complementary distribution**
- Voiced stops undergo fricativization except post-nasally
Yaghnobi

- Xromov (1972, 128): $D > T / N$

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Proposal:

Stage 1  Fricativization of voiced stops except after nasals
(complementary distribution)

\[ D > \text{D} / [-\text{nas}] \]
Proposal:

**Stage 1** Fricativization of voiced stops except after nasals
*(complementary distribution)*

\[ D > \text{D} / [-\text{nas}] \]

**Stage 2** Unconditioned devoicing of voiced stops

\[ D > T \]
Yaghnobi

- Direct historical evidence for such a proposal: **Sogdian**
Yaghnobi

- Direct historical evidence for such a proposal: **Sogdian**
- **Stage 1** is directly attested:

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<th>Analysis</th>
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<td>*band</td>
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Direct historical evidence for such a proposal: **Sogdian**

**Stage 1** is directly attested:
Tswana, Shekgalagari

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Proposal in Dickens (1984) and Hyman (2001):
Tswana, Shekgalagari

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Tswana, Shekgalagari

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**Stage 1**  Fricativization of voiced stops except after nasals
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- [Gašper Beguš](mailto:begus@fas.harvard.edu)
Tswana, Shekgalagari

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**Stage 1**  Fricativization of voiced stops except after nasals  
(complementary distribution)

\[ D > D / [-nas] \]

**Stage 2**  Unconditioned devoicing of voiced stops

\[ D > T \]

**Stage 3**  Unconditioned occlusion of voiced fricatives

\[ D > D \]
Tswana, Shekgalagari

- Dialectal evidence (Solé et al. 2010)
- Tswana has systems with fricativization except after nasals and systems with unconditioned devoicing
Tswana, Shekgalagari

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- Combination of these two dialects $\rightarrow$ post-nasal devoicing

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- Crucially, fricatives got occluded back to stops
South Italian Dialects

Such combination of two sound changes is not limited to stops
South Italian Dialects

- Such combination of two sound changes is **not limited** to stops
- When other segments are targeted, we have strong evidence for a stage with **complementary distribution** as well
South Italian Dialects

- Ducibella (1934, 450):

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<tr>
<td>tintʃiri</td>
<td>tindʤere</td>
<td>‘to dye’</td>
</tr>
</tbody>
</table>
South Italian Dialects

- Ducibella (1934, 450):

<table>
<thead>
<tr>
<th>S.-Ital. dial.</th>
<th>Standard</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>anʧilu</td>
<td>anʤelo</td>
<td>‘angel’</td>
</tr>
<tr>
<td>pinʧiri</td>
<td>pinʤere</td>
<td>‘push’</td>
</tr>
<tr>
<td>chaintʧiri</td>
<td>planʤere</td>
<td>‘to cry’</td>
</tr>
<tr>
<td>fintʧiri</td>
<td>findʤere</td>
<td>‘to feign’</td>
</tr>
<tr>
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- No attempts to explain the distribution
South Italian Dialects

- Crucially: elsewhere $\delta z$ gets deoccluded to $z$
South Italian Dialects

- Crucially: elsewhere ɖʒ gets deoccluded to ʒ
- Complementary distribution: $fadʒina > faʒina$
South Italian Dialects

- Crucially: elsewhere ɖ ʒ gets deoccluded to ʒ
- Complementary distribution: faɖʒīna > faʒīna

Proposal:

**Stage 1** Deocclusion of voiced affricate except after nasals

(Complementary distribution)

DZ > D / [-nas]
South Italian Dialects

- Crucially: elsewhere ʤʒ gets deoccluded to ʒ
- Complementary distribution: *fadʒina > faʒina*

Proposal:

**Stage 1**  Deocclusion of voiced affricate except after nasals

(complementary distribution)

DZ > D / [-nas]_

**Stage 2**  Unconditioned devoicing of voiced affricates

DZ > TS
Buginese, Murik, Land Dayak

- Blust (2013):

<table>
<thead>
<tr>
<th>Proto-SS</th>
<th>Buginese</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>*bemba</td>
<td>bempa</td>
<td>‘water jar’</td>
</tr>
<tr>
<td>*lambuk</td>
<td>lampuʔ</td>
<td>‘pound rice’</td>
</tr>
<tr>
<td>*limboŋ</td>
<td>lempoŋ</td>
<td>‘deep water’</td>
</tr>
<tr>
<td>*rambu</td>
<td>rampu</td>
<td>‘fringe’</td>
</tr>
<tr>
<td>*rumbia</td>
<td>rumpia</td>
<td>‘sago palm’</td>
</tr>
<tr>
<td>*tambiŋ</td>
<td>tampiŋ</td>
<td>‘addition to a house’</td>
</tr>
<tr>
<td>*barumbun</td>
<td>warumpuuŋ</td>
<td>‘a color pattern’</td>
</tr>
<tr>
<td>*bumbun</td>
<td>wumpuŋ</td>
<td>‘heap up’</td>
</tr>
<tr>
<td>*aŋgəp</td>
<td>aŋkəʔ</td>
<td>‘price’</td>
</tr>
<tr>
<td>*anjap</td>
<td>ancəʔ</td>
<td>‘offerings to spirits’</td>
</tr>
</tbody>
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Buginese, Murik, Land Dayak

- Blust (2013):

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## Buginese, Murik, Land Dayak

<table>
<thead>
<tr>
<th>Proto-KM</th>
<th>Murik</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>kelembit</em></td>
<td>kələmpit</td>
<td>‘shield’</td>
</tr>
<tr>
<td><em>umbuŋ</em></td>
<td>umpuŋ</td>
<td>‘ridge of a roof’</td>
</tr>
<tr>
<td><em>lindem</em></td>
<td>lintəm</td>
<td>‘dark’</td>
</tr>
<tr>
<td><em>mandaŋ</em></td>
<td>mantaŋ</td>
<td>‘to fly’</td>
</tr>
<tr>
<td><em>tundek</em></td>
<td>tuntuk</td>
<td>‘beak of a bird’</td>
</tr>
<tr>
<td><em>lindinŋ</em></td>
<td>lintinŋ</td>
<td>‘wall of a house’</td>
</tr>
<tr>
<td><em>andeŋ</em></td>
<td>antəŋ</td>
<td>‘deaf’</td>
</tr>
<tr>
<td><em>pindaŋ</em></td>
<td>pintəŋ</td>
<td>‘blossom’</td>
</tr>
<tr>
<td><em>pendan</em></td>
<td>pəntan</td>
<td>‘small fruit bat’</td>
</tr>
<tr>
<td><em>ndʒi</em></td>
<td>nʧi</td>
<td>‘one’</td>
</tr>
<tr>
<td><em>mendʒat</em></td>
<td>məntʃat</td>
<td>‘pull’</td>
</tr>
</tbody>
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Buginese, Murik, Land Dayak

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Buginese, Murik, Land Dayak

- Here too clear traces of a stage with **complementary distribution**
- Bug. *b > w and *d > r
- Mur. *d > r initially and intervocalically, but remains a stop post-nasally
Buginese, Murik, Land Dayak

- Here too clear traces of a stage with **complementary distribution**

- Bug. *b > w and *d > r

- Mur. *d > r initially and intervocalically, but remains a stop post-nasally

**Stage 1** Fricativization of voiced stops except after nasals

**(complementary distribution)**

\[
D > \bar{D} / [-\text{nas}] \]

**Stage 2** Unconditioned devoicing of voiced stops

\[
D > T
\]

**Stage 3** Velar voiced fricative undergoes occlusion, w and r stay unchanged

\[
*\gamma > g
\]
PND as a synchronic process

- Coetzee and Pretorius (2010):
  - Complete neutralization
  - Applies with the same rate to nonce-words
- Possibly also in Buginese (Sirk 1983:35-37)
**Interim Summary**

- All known cases of PND point to common patterns: a unified account of PND
Interim Summary

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- PND is a side effect of two or three phonetically well-motivated and well-attested sound changes:
  \[ D > \emptyset / [-\text{nas}] \]
  \[ D > T \]
  \[ \emptyset > D \]
- Sound change targets surface allophones
Interim Summary

- All known cases of PND point to common patterns: a unified account of PND
- PND is a side effect of two or three phonetically well-motivated and well-attested sound changes:
  
  $$D > \emptyset / [-nas]$$
  
  $$D > T$$
  
  $$\emptyset > D$$

- Sound change targets surface allophones
- Important consequences: it is no longer necessary to assume that sound change operates in phonetically unnatural direction. Likewise, we no longer need to assume PND is a phonetically natural process
Interim Summary

- Typological observation: a set of sound changes can result in phonetically unnatural synchronic process. However, of eight cases only one yielded such a synchronic process.
Typological observation: a set of sound changes can result in phonetically unnatural synchronic process. However, of eight cases only one yielded such a synchronic process.

A model for explaining similar cases of seeming unnatural sound changes in the future:

(a) a set of segments enters complementary distribution;
(b) a sound change occurs that operates on the unchanged subset of those segments;
(c) optionally, another sound change occurs that blurs the original complementary distribution.
Typology

- Universal phonetic tendency
  \[ A > B / X \]

- Unnatural process
  \[ B > A / X \]
Typology

- Universal phonetic tendency
  \[ A > B / X \]

- Unnatural process
  \[ B > A / X \]

- \[ B > C / Z \]
  \[ B > A \]
  \[ C > B \]
Typology

- **Universal phonetic tendency**
  
  \[ A > B / X \]

- **Unnatural process**

  \[ B > A / X \]

  \[ B > C / Z \]

  \[ B > A \]

  \[ C > B \]

- **B > A / X**
Typology

**BLURRING CYCLE**

B > C / Z
B > A
C > B
Typology

**BLURRING CYCLE**

- B > C / Z
- B > A
- C > B

**BLURRING CHAIN**

- B > C / X
- C > D
- D > A
Konyagi

- Recently PND identified as sound change in Konyagi
- The model exactly predicts the development
- All stops fricativize in Konyagi (dialectal data), even nasals
Konyagi

(Data from Merrill, ms.)

P | p t c k f j x b d j g w ɟ l m n ñ ŋ
Konyagi

(Data from Merrill, ms.)

P | p t c k f f j x b d j g w y l m n ñ η
P | f r j x f f j x w y w r j y l ŋ n ų ų ų
Konyagi

(Data from Merrill, ms.)

| P | p t c k f j x b d ğ g w ɣ l m n ŋ ɲ |
| P | ř ž Ĺ ĵ x w ɣ w r j ɣ l ſ n ỹ ţ ţ |
| B | ű s Ĺ ĵ x w ɣ w r j ɣ l ſ n ỹ ţ ţ |
### Konyagi

(Data from Merrill, ms.)

|   | P | t | c | k | f | ʃ | x | b | d | ʒ | g | w | ɣ | l | m | n | ŋ | ɲ |
| P | f | ŋ | ʃ | x | f | ʃ | x | w | ɣ | w | r | ɬ | ɣ | l | ŋ | ŋ | ŋ | ŋ |
| B | f | s | ʃ | x | f | ʃ | x | w | ɣ | w | r | ɬ | ɣ | l | ŋ | ŋ | ŋ | ŋ |
| K | f | r | s | x | f | s | x | w | l | j | w | l | ŋ | ŋ | l | ŋ | ŋ | / |
Konyagi

(Data from Merrill, ms.)

\[\begin{array}{|c|ccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccc
## Konyagi

(Data from Merrill, ms.)

<table>
<thead>
<tr>
<th></th>
<th>p t c k f j x b d j g w y l m n ŋ ŋ</th>
</tr>
</thead>
<tbody>
<tr>
<td>P</td>
<td>f r j x f j x w y w r j y l ŕ n ſ ſ</td>
</tr>
<tr>
<td>B</td>
<td>f s j x f j x w y w r j y l ŕ n ſ ſ</td>
</tr>
<tr>
<td>K</td>
<td>f r s x f s x w l j / w / l ŕ n ſ ſ</td>
</tr>
<tr>
<td>P</td>
<td>p t c k f j x b d j g w y l m n ŋ ŋ</td>
</tr>
<tr>
<td>P</td>
<td>p t c k p c k b d j g b g l m n ŋ ŋ</td>
</tr>
</tbody>
</table>
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(Data from Merrill, ms.)

<table>
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<th>P</th>
<th>p t c k f j x b d j g w y l m n ŋ ŋ</th>
</tr>
</thead>
<tbody>
<tr>
<td>P</td>
<td>f r j x f j x w y w r j y l ŋ n ŋ y ŋ y</td>
</tr>
<tr>
<td>B</td>
<td>f s j x f j x w y w r j y l ŋ n ŋ y y</td>
</tr>
<tr>
<td>K</td>
<td>f r s x f s x w l j / w / l ŋ n ŋ y /</td>
</tr>
</tbody>
</table>

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Gašper Beguš
Harvard University — begus@fas.harvard.edu
Unnatural phenomena and phonological typology
Konyagi

(Data from Merrill, ms.)

| P | p t c k f ğ x b d ğ g w 晔 l m n ñ ˛ ˛ |
| P | f ę ğ x f ğ ċ x w 晔 w r į 晔 l ˇ n ˇ į ˇ į |
| B | f s ğ x f ğ ċ x w 晔 w r į 晔 l ˇ n ˇ į ˇ į |
| K | f r s x f s x w l j / w / l ˇ n ˇ į / |

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(Data from Merrill, ms.)

| P | p t c k f ā x b d ķ g w ỹ l m n ň ŋ |
| P | p t c k p ā c k b d ķ g b g l m n ň ŋ |
| B | p t c k p ā c k b d ķ g b g l m n ň ŋ |
| K | p t c k p ā c k p t c k p k l m n ň ŋ |
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B $>$ C / Z
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- D > A
Tarma

- Tarma Quechua, a dialect of Quechua spoken in Tarma, Junín, Peru (Adelaar 1977, Nazarov 2008)
- Stop voicing
- Proto-Quechua, Pre-Tarma only voiceless stops
Introduction

Post-Nasal Devoicing

Further cases: unnatural gradience

Typology

Conclusion

Tarma

Tarma Quechua, a dialect of Quechua spoken in Tarma, Junín, Peru

(Adelaar 1977, Nazarov 2008)

Stop voicing

Proto-Quechua, Pre-Tarma only voiceless stops

Voicing occurs: intervocalically, post-consonantally, but not post-nasally

Bilabial, velar series undergo voicing, dental remain voiceless
Data

- From Adelaar 1977 and Nazarov 2008
  
  \[ p, k > b, g / C \square; C \neq N \]
  
  \[ p, k > b, g / V \square V \]

- Examples:

<table>
<thead>
<tr>
<th>#</th>
<th>*pirwa</th>
<th>pirwa</th>
</tr>
</thead>
<tbody>
<tr>
<td>N</td>
<td>*wampu-</td>
<td>wampu</td>
</tr>
<tr>
<td>V</td>
<td>*kupa-</td>
<td>kuba</td>
</tr>
<tr>
<td>Y,R,S,T</td>
<td>*kipu-</td>
<td>kipu</td>
</tr>
<tr>
<td></td>
<td>*takpa-</td>
<td>takba</td>
</tr>
</tbody>
</table>

- In some words: lexical variation, not productive
Data

- From Adelaar 1977 and Nazarov 2008
  
  \[ p, k > b, g / C \_\_; C \neq N \]
  
  \[ p, k > b, g / V \_V \]

- Examples:

  - \#\_\_  |  *pirwa    | pirwa
  - N\_\_   |  *wampu-  | wampu
  - V\_V    |  *kupa-   | kuba
  - *kipu-   |  kipu
  - *takpa-  |  takba

- In some words: lexical variation, not productive
Data

- Distribution of voicing
- Native vocabulary analyzed by Nazarov (2008)
Data

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- Native vocabulary analyzed by Nazarov (2008)
Data

- Post-nasally voiced stops universally preferred  
  (Hayes and Stivers 2000)
- After voiceless stops voiced stops universally dispreferred  
  (voice disagree)
- Intervocalically, voiced stops universally preferred
Data

- Post-nasally voiced stops universally preferred
  (Hayes and Stivers 2000)
- After voiceless stops voiced stops universally dispreferred
  (voice disagree)
- Intervocally, voiced stops universally preferred
- Gradience goes in the **opposite direction!**
Data

- More voicing after T than after Y, R  
  \[\text{(Nazarov 2008)}\]

\[
\begin{array}{c|cc}
 & Y,R & T \\
\hline
\text{Voiced} & 66 & 66 \\
\text{Voiceless} & 14 & 6 \\
\end{array}
\]

- However, this is not significant \(p < 0.10\)
Data

- Post-consonantally voicing after (Nazarov 2008): t, ãf, ãf, k, s, ñ, x, l, ãp, r, j, w

<table>
<thead>
<tr>
<th>Pre-Tarma</th>
<th>Tarma</th>
<th>Pre-Tarma</th>
<th>Tarma</th>
</tr>
</thead>
<tbody>
<tr>
<td>atʃka</td>
<td>atʃga</td>
<td>maţʃka</td>
<td>maţʃga</td>
</tr>
<tr>
<td>atʃpa</td>
<td>atʃba</td>
<td>arku</td>
<td>argu</td>
</tr>
<tr>
<td>arku</td>
<td>argu</td>
<td>kuţʃka</td>
<td>kuţʃga</td>
</tr>
<tr>
<td>awkis</td>
<td>awgis</td>
<td>luʃpi</td>
<td>luʃbi</td>
</tr>
<tr>
<td>aypa</td>
<td>ayba</td>
<td>pilpa</td>
<td>pilba</td>
</tr>
<tr>
<td>ãfaspu</td>
<td>ãfasbu</td>
<td>luxpi</td>
<td>luxbi</td>
</tr>
<tr>
<td>ãfilpi</td>
<td>ãfilbi</td>
<td>mutki</td>
<td>mutgi</td>
</tr>
<tr>
<td>takpa</td>
<td>takba</td>
<td>tikpa</td>
<td>tikba</td>
</tr>
<tr>
<td>lutpi</td>
<td>lutbi</td>
<td>tikpi</td>
<td>tikbi</td>
</tr>
</tbody>
</table>
Another locus of unnaturalness: \( kb, \, tb, \, tg \)

Intervocalic stop-stop cluster: \( VC_1C_2V \) when \( C_2 = [b] \) or \( [g] \)

<table>
<thead>
<tr>
<th>TT</th>
<th>TD</th>
<th>DT</th>
<th>DD</th>
</tr>
</thead>
<tbody>
<tr>
<td>6</td>
<td>66</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

Clusters that agree in voice preferred
Pre-voicing preferred
Tarma Quechua gradience in the **opposite direction**
Data
Data

![Bar chart showing data for different categories with p < 0.00001](image)

- **N_**
- **V_V**
- **Y,R,S,T_**

$\text{p < 0.00001}$
[aku]

![Waveform and spectrogram of the word "aku"]

- **Introduction**
- **Post-Nasal Devoicing**
- **Further cases: unnatural gradience**
- **Typology**
- **Conclusion**

---

Unnatural phenomena and phonological typology

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[agu]

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<thead>
<tr>
<th>a</th>
<th>g</th>
<th>u</th>
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93.32 | 93.57
Gašper Beguš
Harvard University — begus@fas.harvard.edu
Unnatural phenomena and phonological typology
Introduction | Post-Nasal Devoicing | Further cases: unnatural gradience | Typology | Conclusion

[ebi]

<table>
<thead>
<tr>
<th>e</th>
<th>b</th>
<th>i</th>
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closure
Introduction

Post-Nasal Devoicing

Further cases: unnatural gradience

Typology

Conclusion

[m*p*a]

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<tr>
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<td>a</td>
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<tr>
<td>closure</td>
<td>VOT</td>
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387.6  | 387.7  | 387.9
[arba]
[utbi]
[utbi]
Further cases: unnatural gradience
[okba]
asga
Explanation

**BLURRING CHAIN**

<table>
<thead>
<tr>
<th>B &gt; C / X</th>
<th>T &gt; S / Y,R,S,T__, V__V</th>
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<tbody>
<tr>
<td>C &gt; D</td>
<td>S &gt; Z</td>
</tr>
<tr>
<td>D &gt; A</td>
<td>Z &gt; D</td>
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</tbody>
</table>
Phonetics

- Stops surface as fricatives sometimes
Introduction

Post-Nasal Devoicing

Further cases: unnatural gradience

Typology

Conclusion

[rga]
[usbi]
[agii]
Phonetics

- This indicates that there was a stage in the development with *voiced fricatives*
- Occlusion to stops not operated categorically
Berawan dialects (Blust 2005)

- Berawan stops

\[
\begin{array}{c|c|c}
\text{D} & \text{T} & \text{V} \\
\hline
*b & b & k \\
*d & d & r \\
*g & g & k \\
\end{array}
\]
Berawan dialects (Blust 2005)

- Berawan stops

\[
\begin{array}{c|c|c}
\text{D} > \text{T} & \text{V___V} \\
\hline
\text{*b} & \text{b} & \text{k} \\
\text{*d} & \text{d} & \text{r} \\
\text{*g} & \text{g} & \text{k} \\
\end{array}
\]
Berawan dialects (Blust 2005)

- Berawan stops

\[ D > T / V____V \]

\[
\begin{array}{ccc}
\# & V & V \\
*b & b & k \\
*d & d & r \\
*g & g & k \\
\end{array}
\]
Berawan

Batu Belah

Labial | Alveolar | Velar

variable
Voiced | Voiceless

0% | 25% | 50% | 75% | 100%

# | V-V | # | V-V | # | V-V

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Unnatural phenomena and phonological typology
Berawan

Long Teru

<table>
<thead>
<tr>
<th></th>
<th>Labial</th>
<th>Alveolar</th>
<th>Velar</th>
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<tr>
<td>#_V-V</td>
<td><img src="Berawan_Labial" alt="Bar Chart" /></td>
<td><img src="Berawan_Alveolar" alt="Bar Chart" /></td>
<td><img src="Berawan_Velar" alt="Bar Chart" /></td>
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<tr>
<td>100%</td>
<td><img src="Berawan_Labial_Voiced" alt="Color Bars" /></td>
<td><img src="Berawan_Alveolar_Voiced" alt="Color Bars" /></td>
<td><img src="Berawan_Velar_Voiced" alt="Color Bars" /></td>
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<tr>
<td>75%</td>
<td><img src="Berawan_Labial_Voiceless" alt="Color Bars" /></td>
<td><img src="Berawan_Alveolar_Voiceless" alt="Color Bars" /></td>
<td><img src="Berawan_Velar_Voiceless" alt="Color Bars" /></td>
</tr>
<tr>
<td>50%</td>
<td><img src="Berawan_Labial_Voiced" alt="Color Bars" /></td>
<td><img src="Berawan_Alveolar_Voiced" alt="Color Bars" /></td>
<td><img src="Berawan_Velar_Voiced" alt="Color Bars" /></td>
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<tr>
<td>25%</td>
<td><img src="Berawan_Labial_Voiceless" alt="Color Bars" /></td>
<td><img src="Berawan_Alveolar_Voiceless" alt="Color Bars" /></td>
<td><img src="Berawan_Velar_Voiceless" alt="Color Bars" /></td>
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<tr>
<td>0%</td>
<td><img src="Berawan_Labial_Voiced" alt="Color Bars" /></td>
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<td><img src="Berawan_Velar_Voiced" alt="Color Bars" /></td>
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variable

- Voiced
- Voiceless

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Unnatural phenomena and phonological typology
Berawan

Long Jegan

- Labial: 100% Voiced, 0% Voiceless
- Alveolar: 75% Voiced, 25% Voiceless
- Velar: 100% Voiced, 0% Voiceless

variable:
- Voiced
- Voiceless

Unnatural phenomena and phonological typology
Berawan

Long Terawan

<table>
<thead>
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<td>#_</td>
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<td>50%</td>
<td>100%</td>
</tr>
<tr>
<td>V-V</td>
<td>50%</td>
<td>100%</td>
<td>100%</td>
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variable

Voiced
Voiceless
Berawan dialects (Blust 2005)

- Blurring chain

<table>
<thead>
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<th>Blurring Chain</th>
<th>Berawan</th>
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<tr>
<td>B &gt; C / X</td>
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<td>D &gt; A</td>
<td>S &gt; T</td>
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</tbody>
</table>
**Typology**

- A combination of sound changes appears unconstrained
- A single sound change is constrained, combination unconstrained
- How to derive typology?
Minimal number of sound changes

- Note that unnatural processes always require three operating sound changes
- \(B > A \text{ / } X\)
Minimal number of sound changes

- Note that unnatural processes always require three operating sound changes
  - $B > A / X$
  - $B > C / X$
  - $C > A$

At least three sound changes

While it is theoretically possible $B > C$ and $C > A$, the last sound change would necessarily involve two features to change, which in fact means two sound changes as $C$ differs from $B$ in one feature, which cannot be the feature producing unnaturalness, and $A$ differs from $B$ in one feature, which has to be the feature producing unnaturalness in a given context.

Crucial assumption: sound change is a change in one feature in a given environment.
Minimal number of sound changes

- Note that unnatural processes always require three operating sound changes
- B > A / X
- B > C / X
  - C > A
- At least three sound changes
- While it is theoretically possible B > C and C > A, the last sound change would necessary involve two features to change, which in fact means two sound changes as C differs from B in one feature, which cannot be the feature producing unnaturalness, and A differs from B in one feature, which has to be the feature producing unnaturalness in a given context
- Crucial assumption: sound change is a change in one feature in a given environment
Typology

- Rare phenomena produced by rare sound changes
  (Blevins 2008)
- Morphological phenomena rare because of complex history
  (Harris 2003, 2008)

\[ P(A \cap B) = P(A)P(B) \leq P(A) \]
Typology

- Rare phenomena produced by rare sound changes  
  (Blevins 2008)
- Morphological phenomena rare because of complex history  
  (Harris 2003, 2008)

\[
P(A \cap B) = P(A)P(B) \leq P(A)
\]

\[
P(A \cap B \cap C) = .1 \times .1 \times .1 = .001
\]
Typology

- **Natural**
- **Unmotivated**: Two sound changes, less frequent (telescoping, Wang 1968)
- **Unnatural**: At least three sound changes, least frequent

- Low probability not the only reason
- As soon as an \( B \rightarrow A \) \( \rightarrow X \) arises, the inverse universal phonetic tendency \( A > B \) \( \rightarrow X \) will begin operating against it
- Confirmed by Tswana
Model

- The model can be quantified
- Poisson stochastic process

\[ P(T_1) = \int_0^t f_1 t_1 dt_1 \ast \int_{t_1}^t f_2 t_2 dt_2 \ast \int_{t_2}^t f_3 t_3 dt_3 \]

\[ f_i = \lambda_i e^{-\lambda_i t} \]
Typology

- Easier to implement model

\[ P(T_1) = \frac{P(A_1)P(A_2) \times \ldots \times P(A_n)}{n!} \]

\[ P(Alt) = P(T_1 \cup T_2 \cup T_3 \cup \ldots \cup T_n) \]

\[ Pl(Alt) = - \log(P(Alt)) \]
Typology

- Where to go from here?
Typology

- Where to go from here?
- More precise calculations of sound change probabilities/rates
- Channel and analytical bias not mutually exclusive:
- Grounds for experimental data
Conclusion

- Gradient phonotactics can be unnatural
- A model of development for unnatural processes:
  - Unnatural alternations
  - Unnatural phonotactics (gradience)
- A model for explaining typology within the channel bias
- Grounds for experimental research
References

Beguš, Gašper. 2015a. Post-nasal devoicing as a sound change. Presentation at the 89th Annual LSA Meeting, Portland, OR.
———. 2015b. Intervocalic Devoicing in Kiput and Berawan Dialects. Presentation at the 22nd AFLA, McGill University.
References


References


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References


Thank you!