# Neutralization in Xhosa's 'unnatural' labial palatalization

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## Neutralization

- Neutralization is when a contrast is reduced
- Complete neutralization: two contrasting segments become exactly identical
- Incomplete neutralization: contrast is reduced, but a trace of the underlying contrast remains



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## Incomplete neutralization

- Classic example: German final devoicing
  - *Rad* 'wheel' vs. *Rat* 'advice' or 'council'
  - Early view: they're homophones
  - But: they are acoustically distinct
    - Duration of preceding vowel, closure duration, voicing in closure, among other differences (Port and O'Dell 1985)



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## Incomplete neutralization

American English flapping (Braver 2014)

- *(Cheese) grater* vs. *(exam) grader*
- Longer preceding vowel duration in /d/-flaps

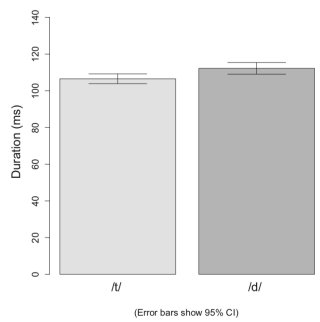


Fig. 2. Mean pre-flap vowel duration by underlying voicing status.



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## Selected other proposed incomplete neutralizations

- Final devoicing: Russian (Dmitrieva 2005), Polish (Jassem and Richter 1989), Dutch (Warner 2004), Catalan (Dinnsen and Charles-Luce 1984)
- Monomoraic vowel lengthening in Japanese (Braver 2019, Braver and Kawahara 2016)
- S-aspiration in Eastern Andalusian Spanish (Gerfen 2002, Bishop 2007)
- Intrusive stop in English (Ohala 1974, Kilpatrick et al 2007)
- Cantonese tone (Yu 2007)



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## Complete neutralization

- Most contrasts subjected to acoustic analysis appear to be *incomplete*
- Dinnsen (1985) calls complete neutralization "not well established" and "problematic"
- One counterexample: Korean manner neutralization (Kim and Jongman 1996)



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## Question:

Are some processes more likely to result in incomplete neutralization than others?

- Phonetically "natural" vs. "unnatural"?
  - Unnatural processes may be less likely to refer directly to phonetic specifications



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## Question:

Are some processes more likely to result in incomplete neutralization than others?

- Productive vs. lexical?
  - If incomplete neutralization is the result of a *process*, perhaps residue of the underlying form exists in a way that it doesn't for lexically stored exceptions



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## Question:

Are some processes more likely to result in incomplete neutralization than others?

- Based on the feature being neutralized?
  - Incomplete neutralization is frequently reported in final devoicing (German, Dutch, Polish, Russian, Catalan…)



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## In this talk, I will…

- Describe Xhosa's "unnatural" labial palatalization
- Show that some, but not all, speakers represent this pattern as a part of regular phonology
- Propose labial palatalization as a potential case of complete neutralization
- Suggest that "unnatural" processes may be no more likely to be incompletely neutralized



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# Labial palatalization in Xhosa



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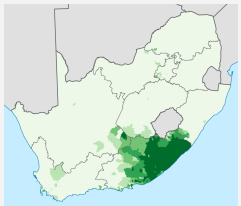
## (isi-)Xhosa

- [isí-ǁʰòsà]
- Southern Bantu (Nguni)
- South Africa: mainly in Eastern Cape, but also in most urban centers around South Africa





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## Labial palatalization

- Labials shift to their nearest palatal counterpart, with some additional disparities, e.g. aspiration (McLaren 1942, Doke 1954)

| | | | | |
|---|---|---|---|---|
| [p'] | → | [tʃ] | *p* | → *tsh* |
| [pʰ] | → | [tʃʰ] | *ph* | → *tsh* |
| [ɓ] | → | [c'] | *b* | → *ty* |
| [b] | → | [ʤ] | *bh* | → *j* |
| [m] | → | [ɲ] | *m* | → *ny* |
| [ᵐb] | → | [ⁿʤ] | *mb* | → *nj* |



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## Labial palatalization

- Triggered by [-w-] passive suffix
- Passive formation with -w- (non-labials)

| | |
|---|---|
| uku-fuⁿd-a | uku-fuⁿd-w-a |
| inf-study-fv | inf-study-pass-fv |

- Passive with labial palatalization (ᵐb → ⁿʤ)

| | |
|---|---|
| uku-ɬaᵐb-a | uku-ɬaⁿʤ-w-a |
| inf-wash-fv | inf-wash-pass-fv |



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## Labial palatalization

- Passive with labial palatalization (m → ɲ)

| | |
|---|---|
| uku-lum-a | uku-luɲ-w-a |
| inf-bite-fv | inf-bite-pass-fv |

- Passive with labial palatalization (ɓ → c')

| | |
|---|---|
| uku-k͡xʼoɓ-a | uku-k͡xʼoc'-w-a |
| inf-peep-fv | inf-peep-pass-fv |



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## "Natural" palatalization: typological tendencies

- Triggered by high front vocoids
- Applies to coronals (and/or dorsals) but not labials



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## "Unnatural" palatalization in Xhosa

- Triggered by [-w-], but not by high front vocoids ([i])

  uku-kʘ'oɓ-is-a (*uku-kʘ'oc'-is-a)

  inf-peep-caus-fv

- Applies to labials, but not to coronals

  uku-boɲ-w-a (*uku-boɲ-w-a)

  inf-see-caus-fv



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## Representation of unnatural patterns

Two possible views:

- Unnatural patterns can be learned as a regular, *productive* part of phonology (e.g. Reiss 2017).
- Phonological patterns are restricted by phonetic naturalness (e.g. Ohala 1990, Steriade 1997, 2008). Apparently unnatural patterns may be lexically stored and *less productive*.



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## Is labial palatalization productive in Xhosa?



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## Assessing productivity

- A wug test (Berko 1958) can detect productivity since nonce words cannot have lexically stored passive/palatalized forms
- Predictions of hypotheses:
  - Productive phonology: speakers will palatalize both real and nonce words productively
  - Lexical: speakers will palatalize real words, but not productively with nonce words



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## Stimuli

- 40 nonce verb roots with CVC structure
- Final C:
  - Half: palatalization targets (*mb* [ᵐb] or *m* [m])
  - Half: underlying palatals (*nj* [nʤ]or *ny* [ɲ])
- 40 filler real verb roots



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## Method

- Each root was shown in the frame *iya-____-a* (sm.9 pres) in Xhosa orthography
- Participants read this form, then were asked to fill in the frame *iya-_____-w-a* (sm.9 pass) aloud

| active | passive |
|---|---|
| ukwenza | ukwenziwa |
| iyafamba → | iya____wa |

- 24 participants



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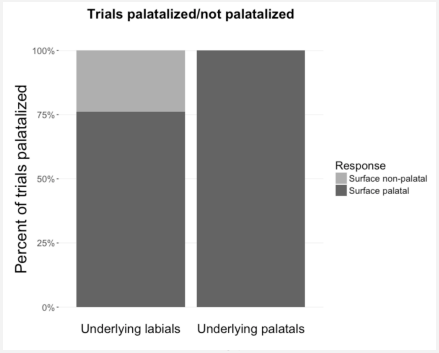
## Pooled results



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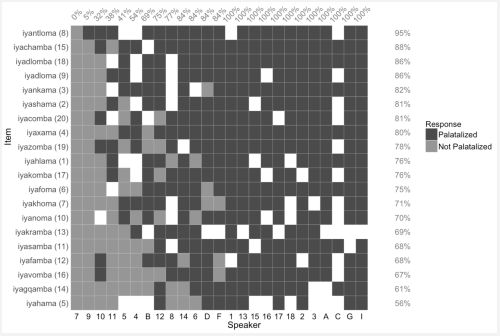
## Results by speaker and item



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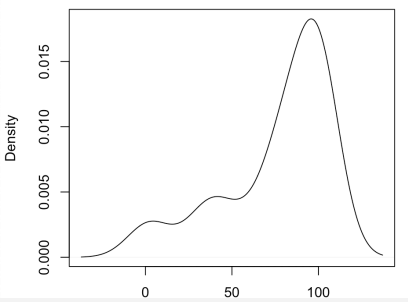
## Distribution of speaker palatalization rates



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## Derived vs. underlying palatals



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## Derived vs. underlying palatals

- Is the labial palatalization process completely or incompletely neutralizing?



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## Speakers

| Speaker | % nonce words palatalized | Proposed representation |
|---|---|---|
| 1 | 100 | Phonological |
| 2 | 100 | Phonological |
| 3 | 100 | Phonological |
| 4 | 54 | Lexical |
| 5 | 41 | Lexical |
| 6 | 84 | Lexical |



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## Acoustic measurements

- 6 time points

ija-ɬa$^{m}$b-w-a

"V1" "V2"

- V1: midpoint, 10ms before offset, offset
- V2: onset, 10ms after onset, midpoint

- Key acoustic cue: F2 as a cue to palatal-ness



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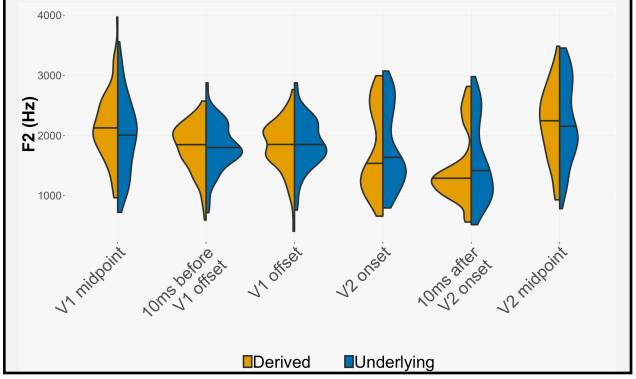
## Results (pooled)

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## Results (pooled)

| Time point | Derived F2 mean | Underlying F2 mean | Coefficient of derived/underlying | t | p |
|---|---|---|---|---|---|
| V1 midpoint | 2140.03 | 1993.39 | -148.81 | -1.07 | *ns* |
| V1 offset - 10 | 1804.64 | 1810.38 | 2.28 | 0.04 | *ns* |
| V1 offset | 1820.11 | 1861.66 | 19.86 | 0.36 | *ns* |
| V2 onset | 1727.35 | 1780.28 | 11.28 | 0.15 | *ns* |
| V2 onset + 10 | 1550.21 | 1447.45 | 127.32 | 1.34 | *ns* |
| V2 midpoint | 2192.39 | 2227.48 | -37.631 | -0.44 | *ns* |

- Separate linear mixed models for each time point
  - Fixed factors: derived/underlying, consonant, vowel
  - Random intercepts for speaker and item



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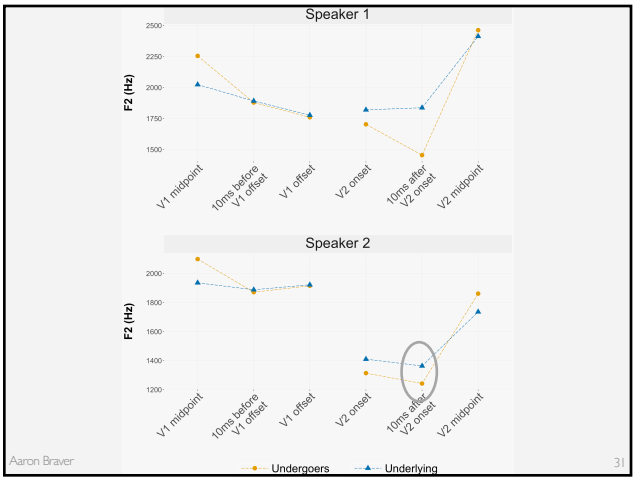




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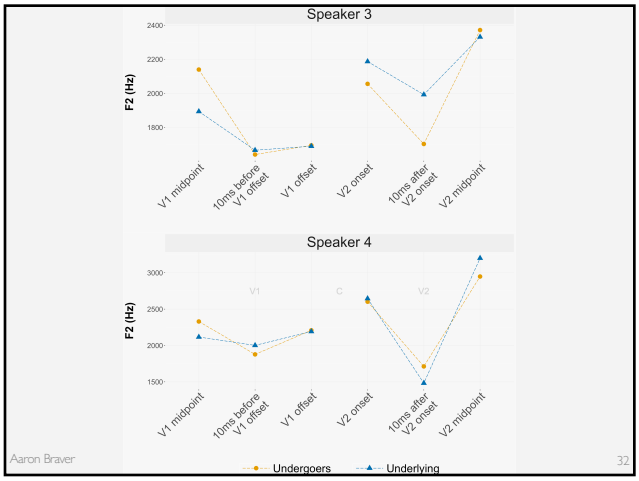
Speaker 3
Speaker 4
F2 (Hz)
V1 midpoint
10ms before V1 offset
V1 offset
V2 onset
10ms after V2 onset
V2 midpoint
Undergoers
Underlying
Aaron Braver
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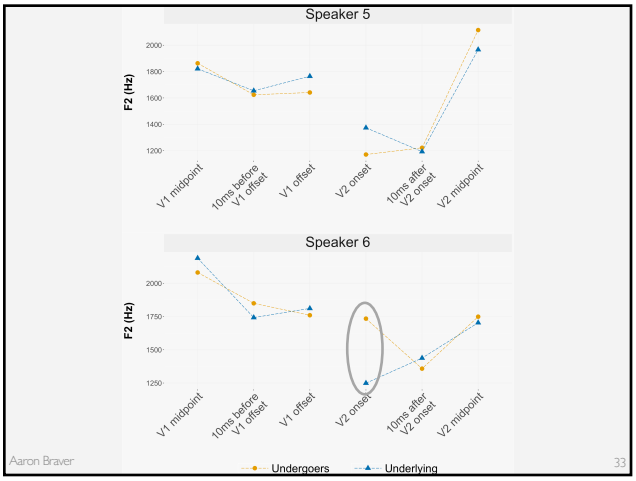
Speaker 5
Speaker 6
F2 (Hz)
V1 midpoint
10ms before V1 offset
V1 offset
V2 onset
10ms after V2 onset
V2 midpoint
Undergoers
Underlying
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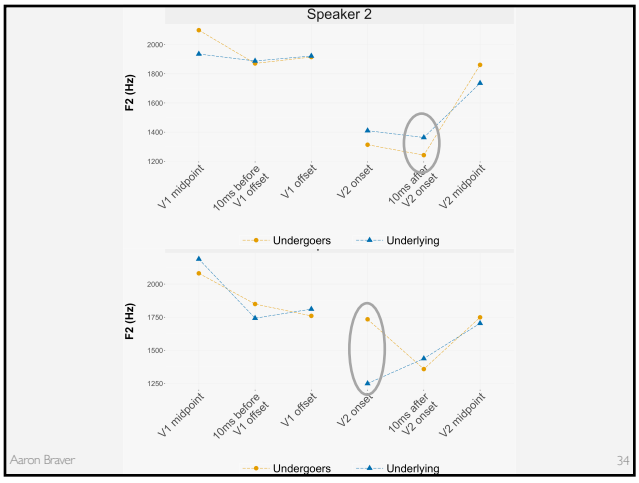
Speaker 2
F2 (Hz)
V1 midpoint
10ms before V1 offset
V1 offset
V2 onset
10ms after V2 onset
V2 midpoint
Undergoers
Underlying
Aaron Braver
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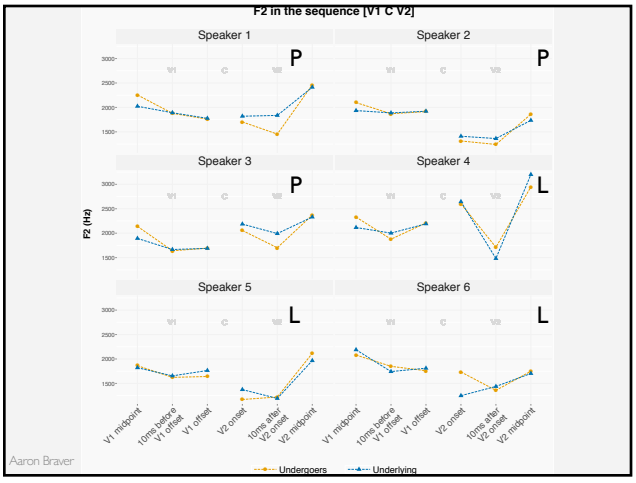
F2 in the sequence [V1 C V2]
Speaker 1
Speaker 2
Speaker 3
Speaker 4
Speaker 5
Speaker 6
P
P
P
L
L
L
F2 (Hz)
Undergoers
Underlying
Aaron Braver

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## Discussion

- No apparent difference in F2 in derived vs. underlying palatals in pooled or individual results
- Appears to be a completely neutralized contrast
- Speakers' complete vs. incomplete neutralization is not conditioned by degree of palatalization productivity



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## Discussion

- Despite ling 101 canon, complete neutralization is rarely found acoustically
- "Unnatural" patterns can, apparently, be completely neutralized
- Loci of neutralization may play a role in complete/incomplete
  - Voicing contrasts tend to incomplete
  - Korean manner neutralization is complete (Kim and Jongman 1996)



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## Thank you

Thanks to Will Bennett, Brian Smith, and the audience of AMP 2018 for helpful discussion of this project.



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