The productivity of 'unnatural' labial palatalization in Xhosa

Wm. G. Bennett, Aaron Braver
Rhodes University, Texas Tech University

Abstract

Xhosa (Bantu, South Africa) has a pattern of labial palatalization. When the passive suffix /-w-/ is added to a stem ending in a labial, the labial becomes palatal (uku-lum-a → uku-luɲ-w-a). Two main types of analysis have been proposed for this alternation: (i) the 'phonological analysis', which states that the alternation is part of speakers' synchronic phonological grammar, and (ii) the 'lexical analysis', which states that speakers learn the palatalized passive forms as part of their lexical knowledge.

To distinguish between the two hypotheses, we conducted a wug test in which speakers of Xhosa were shown nonce verbs and asked to provide their corresponding passive form. Since the phonological analysis requires there to be a synchronic phonological rule, speakers should passivize nonce forms in the conditioning environment. Under the lexical analysis, however, speakers are predicted not to palatalize nonce forms, since the real-word palatalized passives they produce are simply stored in the lexicon.

Our results show a great deal of inter-speaker variation. While some speakers produced palatalized nonce forms nearly 100% of the time, other speakers failed to produce any palatalized nonce forms at all. We argue that labial palatalization may be analyzed in different ways by different speakers.

1. Introduction

1.1. The phenomenon

This paper investigates a pattern of bilabial palatalization found in Xhosa, a Bantu language from South Africa.[*] The pattern is illustrated in schematic form in (1): a non-initial labial in a verb root changes to a palatal when followed later in the stem by [w].[1] It is observed most readily in passive verb forms, which are constructed by adding a suffix /-w-/ after the verb root, as illustrated in (2). (2b) is an active verb, built from the root /-fu^{n}d-/ 'study, read, learn' (in 2a); its passive counterpart (2c) is formed by adding the passive /-w-/ between the verb root and the 'final vowel' morpheme /-a/.

(1) *Xhosa labial palatalization*
/…B…/ + /-w/ → …J…-w
labial + labial → *palatal* + labial

[*] For helpful discussion and assistance in data collection and/or stimuli construction, we thank: Msindisi Sam, Mbuleli Mpokela, Seunghun Lee, Andrew Van der Spuy, Lionel Posthumus, Jochen Zeller, Martin Krämer, John Ohala, Matías Guzmán Naranjo, Kelly Goldstuck, Danica Kreusch, and Olona Tywabi, as well as audiences at SAMWOP-3 in Potchefstroom, and at the Palatalization Conference in Tromsø. Any errors are our own.

[1] We use the following abbreviations: B – bilabial consonants; J – palatal consonants; SM.X – subject marker for noun class X; PRES – present; FV – final vowel morpheme; PASS – passive; CAUS – causative; CLX – class-marking prefix of noun class X; LOC – locative; DIM – diminutive.

 Nordlyd 42: 33-44, special issue on Palatalization edited by Martin Krämer and Olga Urek. University of Tromsø – The Arctic University of Norway. http://septentrio.uit.no/index.php/nordlyd

(2) *Xhosa passive formation*

a. uku-fu^{n}d-a
INF-study-FV
'to study'

b. i-ja-fu^{n}d-a
SM.9-PRES-study-FV
'it is studying, it studies'

c. i-ja-fu^{n}d-w-a
SM.9-PRES-study-PASS-FV
'it is being studied'

The labial palatalization alternation is seen when passives are formed from verbs containing non-stem-initial bilabials, as illustrated in (3). The form in (3a) shows the root /-ła^{m}b-/ 'wash', which contains a non-initial labial, [^{m}b][2]. The inflected passive form in (3b) shows the root surfacing as [-ła^{n}d͡ʒ-], manifesting an /^{m}b/→[^{n}d͡ʒ]. This shift from a bilabial to a primary palatal is the process of labial palatalization we will focus on.

(3) *Palatalization of labials in passives*

a. uku-ła^{m}b-a
INF-wash-FV
'to wash'

b. i-ja- ła^{n}d͡ʒ-w-a (*ijała^{m}bwa; ^{m}b→^{n}d͡ʒ)
SM.9-PRES-wash-PASS-FV
'it is being washed'

1.2 The puzzle

The labial palatalization seen in Xhosa is atypical. Recent cross-linguistic surveys have identified two apparent universals of palatalization patterns (Bateman 2007, Kochetov 2011). First, if labials palatalize then coronals and/or dorsals do so as well: labials do not palatalize to the exclusion of other places that are more susceptible to palatalizing. Second, if back vocoids cause palatalization, then front vocoids do so as well: [w] and [u] do not trigger palatalization to the exclusion of [i] and [j]. But these two purported universals run counter to what we observe in Xhosa. The generalization in passive verbs is that only bilabials undergo palatalization; coronals do not (e.g. 2c: [ijafu^{n}dwa], *ijafu^{n}d͡ʒwa). Additionally, it is only [w] that causes this palatalization. Though there are forms where /ɓ/ palatalizes to [c'] before [w] (4a), this change is not conditioned by [i] (4b) or [j] (4c).

[2] There is some controversy in previous literature about whether nasal + consonant sequences in Xhosa and other Bantu languages should be interpreted as pre-nasal obstruents, or as N.C consonant clusters (see, e.g., Downing 2005 and sources therein). This issue is entirely tangential to the point of this paper; we transcribe NC sequences as prenasal (e.g. [^{m}b]) because the whole sequence palatalizes as a single unit.

(4) *[i] and [j] do not trigger palatalization in Xhosa passives*

a. i-ja-kx͡'oc'-is-w-a
SM.9-PRES-peep-CAUS-PASS-FV
'it is being made to peep over something'

b. i-ja-kx͡'o**ɓ-i**s-a (*ijakx͡'o**c'i**sa)
SM.9-PRES-peep-CAUS-FV
'it is being washed'

c. i-ja-**ɓuj**-a (*ija**c'uj**a)
SM.9-PRES-go.back-FV
'it is coming back'

In addition to being typologically anomalous, the Xhosa labial palatalization pattern seems phonetically unnatural. The triggering segment, [w], is a back glide with rounding; it does not involve anything like a palatal constriction. Consequently, we should expect [w] to be more likely to *reinforce* the labiality of labial consonants, rather than make them acoustically more similar to palatals (a point made previously by Ohala 1978). There is one context in Xhosa where the passive suffix /-w-/ does appear with a front vocoid: it is realized as [-iw-] with monosyllabic verb roots, to satisfy a requirement that verb stems be bisyllabic. Since this allomorph features an [i], it looks much more like something that should trigger palatalization, based on cross-linguistic norms.[3] But it systematically fails to do so, because labials in stem-initial position do not palatalize. As such, the only context where /w/ surfaces as something that *ought* to trigger palatalization, there is no palatalization to be found (5).

(5) *No palatalization with allomorph [-iw] (used with 'short' monosyllabic roots)*

a. uku-^{m}b-a
INF-dig-FV
'to dig'

b. i-ja-^{m}b-iw-a (*ija^{n}d͡ʒiwa; no palatalization)
SM.9-PRES-dig-PASS-FV
'it is being dug'

The consequence, then, is that the passive suffix /-w-/ causes palatalization when it shouldn't do so, and fails to cause palatalization when it should. The pattern is one that seems *a priori* to not make phonetic sense.

1.3 Phonological or historo-morpho-lexical?

The labial palatalization we find in Xhosa, and its cognates in other closely related languages, have been analyzed from both phonological and morphological perspectives. The former approach treats the pattern as the result of synchronic phonology: some process in the synchronic phonological grammar causes the labial ~ palatal alternation. Some such analyses treat this as a form of labial dissimilation, a view supported by the lack of [Bw] clusters in other morphological contexts (see, e.g. Doke 1954, Gorecka 1989, Beckman 1993, Selkirk 1993, Bennett 2015). Other phonological analyses take the process to be more like assimilation: palatalization is triggered by a covert /i/ or /j/, or else the result of a floating palatal feature (Stahlke 1976, Khumalo 1987, Chen & Malambe 1998, Poulos & Msimang 1998, Jokweni 1999, Vondrasek 2001, Naidoo 2002). But both general approaches share the presupposition that

[3] Indeed, some previous analyses appeal to this [iw] allomorph as a rationale for positing /iw/ as the underlying form of the passive, and attribute palatalization to that underlying /i/ (see, sources noted in §1.3). However, it should be noted that /i/ is not otherwise observed to trigger palatalization; see, e.g. (4b) [ijakx͡'oɓisa]. There is also evidence from loanwords for [i] as the default choice of epenthetic vowel; this supports an interpretation where the [-iw-] allomorph of the passive arises from epenthesis of [i] for minimality reasons. See Cook (2013) for finer discussion of this issue in closely-related Zulu.

palatalization happens as a product of the synchronic phonology; we will term this view the 'phonological hypothesis'.

The major alternative to the phonological hypothesis of labial palatalization analyzes the pattern as the result of a string of diachronic changes. The pathway involved is illustrated in (6) below, following its articulation by Ohala (1978).

(6) *Historical pathway of labial palatalization*
/p + jw/ → p̊j̊w → pʃw → tʃw → /tʃ/

The chain of changes begins by positing a front glide component [j] in the passive suffix, represented underlyingly as /-iw/ or /-jw/. This glide would be devoiced following voiceless consonants, thus yielding strings like [p̊j̊w]. Subsequently, the voiceless glide gets misperceived as a fricative [ʃ]. The labial component of the resulting [pʃ] sequences then gets reanalyzed as an accidental coarticulatory effect of the following labial [w]. If speakers undo this 'coarticulation', the result is a state where active verbs ending in /p/ have passive forms ending in /tʃ/ – and similar pathways are easily envisioned for other labial consonants besides /p/.

On historical accounts of labial palatalization, there is no need to posit the change as part of the synchronically-active phonology. Speakers can simply learn active forms ending with labials, and learn passive forms that have palatals; the alternation between them is merely one of allomorphy. Thus, the historical explanation of the change dovetails with a synchronic analysis that places it outside of phonology proper. We therefore term this family of analyses the 'lexical hypothesis', since palatalization is represented synchronically in the lexicon. Arguments for this type of approach, either from a historical angle, or from a morphological angle, abound (see, e.g. Louw 1975; Herbert 1977, 1990; Ohala 1978; Bateman 2010; also O'Bryan 1974, Anderson 1992, Van der Spuy 2014).

The lexical hypothesis for labial palatalization has both strengths and weaknesses. First, it seems to offer a ready explanation for the strangeness of the alternation. The phonological process posited under the phonological hypothesis is typologically and phonetically odd; by contrast, each step in the diachronic pathway is reasonable, and some of the intervening stages posited are actually attested in related languages (Kotzé & Zerbian 2008). But at the same time, the phonetic pathway less clearly makes sense for cases where palatalization happens non-locally, e.g. [-seβenza] 'work' ~ [-sec'enz-w-a] 'be worked', where intervening segments are apparently unaffected. So, there are empirical arguments to be mustered for and against both hypotheses.

1.4. Point and structure of this paper

The phonological and lexical hypotheses of labial palatalization make testably different predictions. If palatalization is part of the phonology, then speakers must have internalized some productive rule for the alternation. As such, they should apply the alternation in novel and nonce words. If palatalization is in the lexicon, however, there is no phonological process to apply. As such, speakers should ***not*** do the change in words they are unfamiliar with: palatalization should only occur in forms where speakers have already memorized passive allomorphs that have palatal consonants. Consequently, a wug test (Berko 1958) should tease them apart.

This paper presents the results of just such a wug test. Native speakers of Xhosa were shown active nonce verbs which, when made passive, contain the conditioning environment for labial palatalization. While some speakers palatalized 100% of the time in these passivized nonce forms, others failed to palatalize any nonce verbs. We argue that phonological processes such as labial palatalization may be represented differently for different members of a speech community: those who palatalized nonce forms have a phonological rule, while those who did not palatalize nonce forms have stored the palatalized passive forms of actual words in their lexicon.

The rest of the paper is organized as follows. In §2 we provide further background on the labial palatalization pattern and its treatment in previous studies. §3 describes our study and gives

methodological details. §4 presents our findings, which show that different speakers treat the pattern in apparently fundamentally different ways. In §5 we discuss the findings and present our analysis: different speakers treat palatalization differently because some have learned it as phonological, and others as morphological. §6 concludes and identifies some ramifications for future work.

2. Background and context

2.1. About the language

Xhosa, (called isiXhosa [ísíǁʰɔ̀sà] or [ì̀síǁʰɔ̀sà] in the language), is a Bantu language belonging to the Nguni sub-family of Zone S. It is prototypically spoken in the Eastern Cape of South Africa, though robust communities of speakers are also found in urban centers throughout South Africa, and also in Zimbabwe (see Kunju forthcoming). Ethnologue (Lewis et al. 2015) estimates approximately 8.2 million speakers in total, out of which approximately 5 million live in the Eastern Cape province of South Africa, where the study was carried out.

2.2. About the labial palatalization alternation

The labial palatalization alternation consists of a constellation of changes, listed in (7). The two columns on the left give the phonetic values of the segments, following Doke (1954); the two columns on the right give their usual representations in standardized Xhosa orthography.

(7) *Labial palatalization mappings*

[p’]	→ [tʃ]	p	→ tsh
[pʰ]	→ [tʃʰ]	ph	→ tsh
[ɓ]	→ [c’]	b	→ ty
[bʱ]	→ [d͡ʒ]	bh	→ j
[m]	→ [ɲ]	m	→ ny
[ᵐb]	→ [ⁿd͡ʒ]	mb	→ nj

The generalization, in brief, is that labials change to their nearest palatal counterpart. Some segments exhibit additional asymmetries, which are often due to gaps in the general consonant inventory. For instance, implosive [ɓ] shifts to a palatal ejective [c’], since Xhosa has no palatal implosives. Related alternations, with some minor differences in the quality of some of the participating segments, are found in related languages, including Zulu (Doke 1954, Poulos & Msimang 1998, etc.), Ndebele (Sibanda 2004), and Siswati (Chen & Malambe 1998). Other less closely-related languages such as those of the Sotho-Tswana family (Kotzé & Zerbian 2008, Ohala 1978) and Xitsonga (Lee & Burheni 2014) also exhibit labial palatalization, though the generalizations for those cases are less similar to the pattern under study here.

In Xhosa, the labial palatalization alternation can be observed in a few different contexts. The most systematic of these is in passive verbs, which feature a suffix /-w-/ (as described above). But palatalization can also be conditioned by the locative suffix /-ini/ and the diminutive suffix /-ana/, and also occurs as a historical change (8) (examples from McLaren 1942). The generalizations for these cases are somewhat different than in passives. While many examples of palatalization in diminutives and locatives could be attributed to a covert /w/ derived by glide formation from /u/, not all palatalizing forms fit this profile. Additionally, palatalization in passives can be long-distance, and may hold even when other segments intervene between the labial and the [w]; palatalization in locatives and diminutives never crosses intervening segments. Diachronic palatalization can also happen to root-initial labials, which are never observed to palatalize synchronically.

(8) *Palatalization in contexts other than passives*

a. e-mla^{n}d͡ʒ-eni (< umla^{m}bo 'river'; *emla^{m}bweni; locative palatalization)
LOC-CL1.river-LOC
'in/at the river'

b. indac'ana (< indaɓa 'news'; *indaɓana, *indaɓwana; diminutive palatalization)
CL9.news.DIM
'small piece of news'

c. uc'ani (< Proto-Bantu *ubu-ani*; *ubwani; diachronic palatalization)
CL14.grass
'pasture grass'

2.3. Previous experimental studies

There is no previous experimental work on labial palatalization in Xhosa. The closest precedent is Herbert (1990), who reports on an informal experiment with speakers of other languages. 2 Zulu speakers were presented with 20 nonce nouns, and asked to make diminutive forms. Herbert reports that the two speakers applied palatalization in 6 and 10 forms respectively, yielding an average rate of 40%. The generalizations for palatalization are quite different in diminutives than in passives, however: diminutives show much more variation, so palatalization is not as systematic. If the general pattern is not one of systematic palatalization, it is entirely unsurprising that speakers do not apply it productively.

3. Method

In order to distinguish between the two possible analyses—the phonological hypothesis and the lexical hypothesis—we conducted a 'wug'-type (Berko 1958) experiment, in which speakers were shown the active form of a stimulus item and were asked to provide the corresponding passive form. If the phonological hypothesis is correct, speakers learn labial palatalization as a phonological rule which should apply (in the appropriate phonological conditions) to novel nonce words. If, however, labial palatalization is a morphological process we should expect that speakers apply palatalization only in words for which they already have a lexical entry. In other words, under the morphological hypothesis, labial palatalization should not apply to novel nonce words.

3.1. Stimuli

To serve as stimuli, we created 40 novel nonce verb roots, all with CVC structure (the canonical shape of verb roots in the language). Vowels were one of *a* [a] or *o* [o] (20 items each), and the final consonant was one of *mb* [^{m}b], *m* [m], *nj* [^{n}d͡ʒ], or *ny* [ɲ] (10 items each). Stimuli ending in underlying palatals were included as part of a follow-up experiment testing for phonetic differences between derived and underlying palatals. 40 real Xhosa verbs were also included as fillers, most of which contained neither labials nor palatals.[4] The stimuli (real and nonce) were put into the inflectional frame *iya-*_____*-a*, adding prefixal *i-ya-* [ija-] (SM.9-PRES) and suffixal *-a* [-a], producing a verb form that translates more or less as 'it is ____ing'. All stimuli were presented to participants in standard Xhosa orthography.

Of the 40 nonce verb roots, 10 ended in *m* and 10 ended in *mb*. When the passive suffix *-w-* is added to these verbs, the final consonants are put into the conditioning environment for labial

[4] Real-word filler items were chosen on the basis of having certain obstruents of interest for other unrelated studies. Two filler items contained [p^{h}], and one [b], and one had non-root-final [ɓ]; two other fillers had final [ɲ]. Apart from these six items, other filler items had final and medial consonants that neither undergo nor result from the palatalization pattern under study. Some did have [c'] in root-initial position, but root-initial consonants are unaffected by palatalization, as noted above. A total of 12 filler items had either an initial [c'], or some other palatal consonant that is unaffected by palatalization [j ɟ c^{h} ^{ɲ}c']. One stimulus item, *kwanya* [-k'waɲa], had a [w] in the root. Impressionistically, we noted that this form seemed to be more difficult for speakers. A number of speakers produced the passive as [-k'aɲwa], exhibiting apparent labial dissimilation; this was coded as a reading error, but we mention it here for interest.

palatalization (by virtue of the suffixal [w]). We will refer to these items as 'derived palatalization targets'. The 20 remaining nonce verb roots all ended in palatals: 10 ended in *ny* [ɲ] and 10 ended in *nj* [ⁿd͡ʒ]. These items will therefore be referred to as 'underlying palatals', and were included to ensure that speakers treat underlying palatals faithfully.

3.2. Procedure

Participants were shown the real and nonce verbs, in random order, on a laptop screen. On each trial, participants saw a verb with the [i-ja-] prefixes and the *–a* final vowel suffix, followed by an arrow, and then by a blank surrounded by *iya-* and *-wa* as in (9). The presence of the -w- in the form on the right cued speakers to produce passive forms with this /-w-/ suffix, and the *iya-* prefixal material serves to hold tense and subject agreement constant. The active and passive forms were also labeled based on the Xhosa language terms for 'active voice' (*isixando sokwenza*) and 'passive voice' (*isixando sokwenziwa* – a phrase which itself features a passive verb stem *-enziwa*).

(9) *Example of stimulus presentation*

active		passive
ukwenza		ukwenziwa
iyafamba	→	iya_____wa

Before beginning, speakers were shown 3 examples with real verbs and their passive counterparts, illustrating roots with and without palatalization alternations, followed by practice with 9 real word items.

On trials with a root-final bilabial (i.e. a potential palatalization target), speakers were required to decide whether or not to apply labial palatalization. Recall that under the phonological hypothesis speakers are predicted to apply labial palatalization in the appropriate phonological context (even in nonce words), whereas under the lexical hypothesis speakers are predicted to apply labial palatalization only to words they have already learned and stored in their lexicon.

3.3. Participants and recording

The participants were 10 native speakers of Xhosa, ranging in age from 20–42 years old (mean age = 26). 9 of the participants were from the Eastern Cape province of South Africa, and one was from Gauteng Province (but had family in the Eastern Cape). All participants lived in Grahamstown, Eastern Cape, at the time of the experiment, and all identified Xhosa as the language they spoke the most at home. 8 of the participants included Grahamstown in their response to the question 'Where did you grow up?'. Speakers also participated in two unrelated experiments in the same session (order of tasks was counterbalanced across subjects).

Recordings were made in the sound laboratory in the Rhodes University department of English Language and Linguistics, a quiet room with heavy shutters for sound attenuation. Recordings were made with a Handy Zoom H4n, with a Nady HM-10 head-mounted microphone[5], and saved as 44.1 kHz wav files at 16 bits.

3.4. Analysis

Speakers' responses were reviewed by the authors and coded to indicate whether labial palatalization had been applied to the derived palatalization targets (and to verify whether underlying palatals were produced faithfully). We also recorded whether speakers accurately applied the -w- passive suffix, and whether they applied any other morphology in addition to the passive suffix. Forms with reading errors,

[5] The head-mounted microphone did not fit well on many participants' heads, and so the headset was placed around their neck instead. From this position, the boom on the headset allowed the microphone to be angled upwards and positioned within 1–2 inches of participants' mouths in all cases.

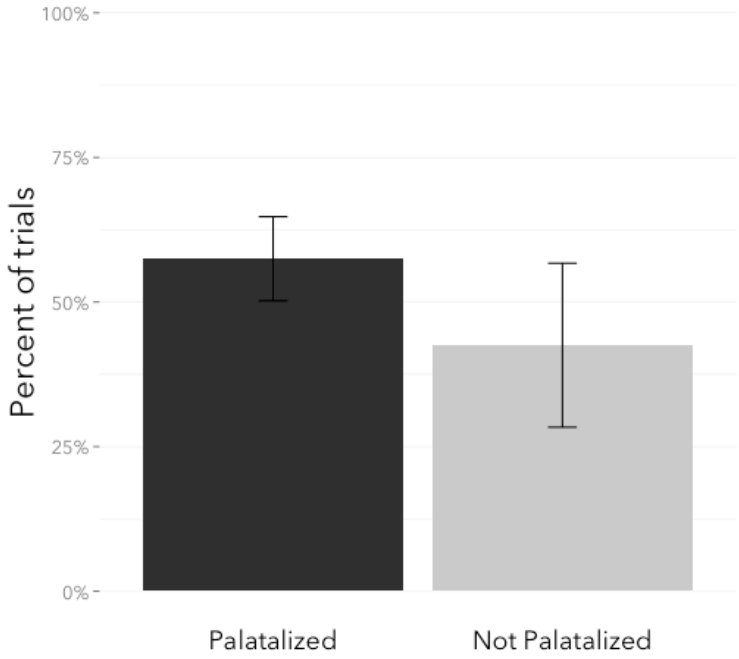
and those in which the *-w-* suffix was not applied, were excluded from our analysis (88 trials total). To test whether participants applied labial palatalization at greater than chance levels, a one-tailed binomial test was applied.

4. Results

4.1. Overall results

Speakers were, on average, more likely than not to apply labial palatalization in derived palatalization targets ($\chi^2(1)= 3.592$, $p < 0.05$). As shown in the graph in (10), across all speakers, 57% of trials with derived palatalization targets were, in fact, palatalized by speakers.[6]

(10) *Percent of trials palatalized, across all speakers*

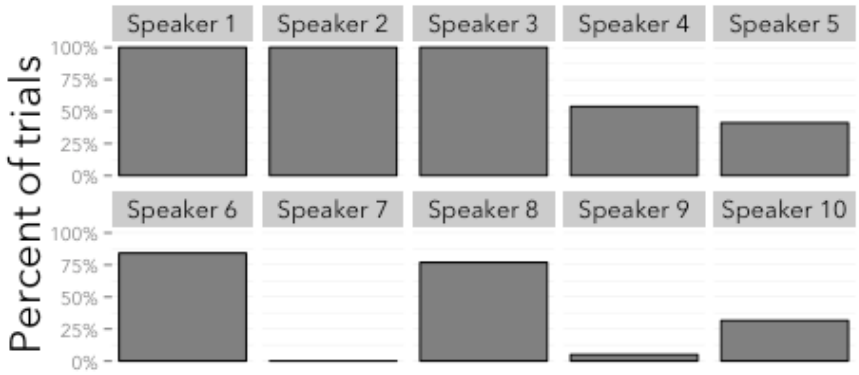


4.2. Inter-speaker variation

While the overall results suggest that, on average, speakers palatalize derived palatalization targets at a rate of 57%, individual speakers' rates of palatalization varied widely: as can be seen in (11), Speaker 7 palatalized 0% of the time, whereas Speakers 1, 2, and 3 palatalized 100% of the time. The remaining speakers fall somewhere between this range. Some of these are quite close to the extremes, however: for instance, speaker 9 palatalized in just 1 trial, and was otherwise a systematic non-palatalizer like speaker 7.

[6] We do not discuss here the difference between roots with the vowel [a] vs. the vowel [o]. It is conceivable that the presence of an additional labial (i.e., an [o]) might inhibit palatalization. This question is left for future work.

(11) *Percent of trials palatalized, by speaker*



4.3. Long-distance palatalization

While speakers were instructed to produce passive forms of nonce verbs using the *-w-* suffix, some added other affixes in addition to the passive. For example, when presented with the form in (12a), speakers should have produced the form in (12b)—however some speakers produced forms like (12c), which contains both the passive suffix *-w-* as well as the causative suffix *-is-*:

(12) *Addition of causative morpheme* -is-
a. i-ya-hlanj-a
b. i-ya-hlanj-w-a
c. i-ya-hlanj-**is**-w-a

In cases like those in (12c), the root-final consonant is separated from the palatalization-inducing [w] in the *-w-* suffix. In order to examine whether the labial palatalization process can be triggered by a non-local [w], we examined the productions of Speaker 4, who added both *-is-* and *-w-* in 12 trials with labials (which could undergo palatalization to derive palatals). Across all tokens, Speaker 4 palatalized 53.85% of the time; among just the 12 long-distance tokens, this speaker palatalized 6 tokens (50%). This suggests that labials are, for at least some speakers, able to trigger palatalization across several intervening segments, at the same frequency as palatalization overall.

5. Discussion and interpretation

Which hypothesis—phonological or lexical—is correct? The answer appears to be 'both'. The phonological hypothesis holds that palatalization is learned as part of active synchronic phonology; as such, it predicts that speakers will palatalize productively in all appropriate nonce words. Speakers 1, 2, and 3 bear this out, with 100% palatalization rates over all trials. Speakers 6 and 8 are also quite close to this benchmark, with palatalization rates above 70%. The lexical hypothesis holds that speakers learn palatalized passive forms rather than generating them from the grammar; as such, it predicts that speakers will not apply palatalization in nonce words. This too is borne out: speaker 7 palatalized in 0% of trials, and speakers 9 and 10 are also fairly close, with palatalization rates below 30%. Thus, both predictions are borne out in our data – albeit by different speakers.

What our results suggest is that palatalization is genuinely phonological for some speakers, and genuinely not for others. Since our nonce items were unfamiliar to speakers, they could not have lexically stored palatalized forms for them. This means those speakers who systematically *do* palatalize must be synchronically producing palatalized forms – i.e. generating them using some kind of rule. The speakers who systematically don't palatalize do not appear to have such a rule. Interestingly, the non-palatalizing speakers all *did* apply palatalization in at least some of the real-word practice and filler items. This means the labial-palatal alternation is not just completely unfamiliar to them. Rather, it seems more

likely that these non-palatalizers apply the alternation only in words that they already know. This is consistent with palatalized forms being lexically stored.[7]

An anonymous reviewer suggests that the presence of speakers who palatalize some, but not all of the time, might indicate an alternative explanation: perhaps some speakers have a grammar which optionally produces palatalization in some forms, and has stored palatalized allomorphs for some forms as well. Due to space reasons, discussion of this alternative will be left for future work.

The variation in palatalization rates does not appear to connect to any of the socio-linguistic variables we included in our demographic data. In particular, it does not appear to be the case that palatalization is being lost by younger speakers. Speaker 7, who did not palatalize labials in any nonce words, was the oldest participant in the sample. The next oldest participant was speaker 4, who palatalized approximately 50% of trials, followed by speaker 3, who palatalized 100% of the time. Additionally, speakers 6 and 9 are the same age, both near the lower end of the range in the sample, and they have nearly opposite palatalization rates: speaker 6 is close to 100%, speaker 9 close to 0%. Additionally, we don't see the variation as a plausible regional difference: 8 of our 10 speakers grew up (at least in part) in Grahamstown (the location of our study), so the likelihood of dialect differences between them is quite low. We also do not see this variation as a result of influence from other languages. Nearly all of our speakers identified English as another language they speak; other common second languages were Afrikaans (n=2), Zulu (n=2), and Sotho/Tswana (n=2). Since Zulu, Sotho, and Tswana are all known to have labial palatalization as well, it seems unlikely that exposure to these would somehow cause speakers to be less likely to palatalize when speaking Xhosa.

6. Conclusion

In this paper, we have reported on a wug test experiment on Xhosa labial palatalization. Our experimental findings show that the palatalization pattern is robustly productive for some speakers, and not productive for some other speakers. This points to palatalization being phonological for some speakers, and lexically stored for other speakers. We note that this situation—a pattern being analyzed as phonological by some speakers, and lexical by others—is not restricted to the case presented here. For example, Kramer (2009) presents a case of "crypto-variation" in Italian velar palatalization, with similar inter-speaker variation.

Our findings suggest that different speakers – potentially even members of the same speech community – can learn or analyze the same linguistic pattern in fundamentally different ways. This has significant methodological ramifications for other experiments. If we pool tokens across participants, the average palatalization rate for the group is approximately 60%. However, the finer analysis shows that half of the sample are almost completely consistent – either full palatalizers, or non-palatalizers. This pooled value is thus a poor approximation of what individuals are really doing, and of the state of palatalization in the speech community.

An anonymous reviewer points out that the unexpected nature of the results suggests that either (a) the lexical/phonological distinction isn't psychologically real, or (b) the wug test is not the proper tool for distinguishing between lexical and phonological phenomena. Due to space reasons, we leave these questions for future research.

Xhosa labial palatalization is undeniably peculiar from a typological and phonetic standpoint. On the one hand, it flouts purported universals of palatalization: only labials palatalize (which are typologically the least likely segments to palatalize), and palatalization is conditioned only by other labials (which are the least likely triggers of palatalization). It is also to some extent phonetically unmotivated: while the pathway envisioned by Ohala (1978) and others is very plausible when decomposed into individual steps, the full alternation does not appear to be the result of phonologization of coarticulation without such decomposition. In other words: the alternation does not make phonetic

[7] Due to space reasons, we do not discuss a by-item analysis here. One possible explanation for the mixed results is that some items may be palatalized across the board, while others are rarely palatalized.

sense as a single step. Nevertheless, our findings show that Xhosa labial palatalization is completely productive, at least for some speakers. This means that its typological 'strangeness' cannot be attributed to it being somehow not part of normal phonology. Our results show that even a phonetically unnatural pattern can be learned as real phonology.

References

Anderson, Stephen R. 1992. *A-Morphous Morphology*. Cambridge University Press, Cambridge.

Bateman, Nicoleta. 2007. A crosslinguistic investigation of palatalization. PhD dissertation, University of California, San Diego.

Bateman, Nicoleta. 2010. The change from labial to palatal as glide hardening. *Linguistic Typology* 14:167–211.

Beckman, Jill N. 1993. Feature organization and the strong domain hypothesis in Zulu [labial] phonology. *UMass Occasional Papers* 16:1–26. University of Massachusetts-Amherst: GLSA.

Bennett, Wm. G. 2015. *The Phonology of Consonants: Harmony, Dissimilation, and Correspondence*. Cambridge: CUP.

Berko, Jean. 1958. The Child's Learning of English Morphology. *Word* 14:150–177.

Chen, Su-I and Gloria Malambe. 1998. Palatalisation in Siswati: An Optimality Theoretic approach. In Maddieson, I. and Hinnebusch, T. J., editors, *Language history and linguistic description in Africa*, pages 137–146. Trenton, NJ: Africa World Press.

Cook, Toni. 2013. Morphological and Phonological Structure in Zulu Reduplication. PhD thesis, University of Pennsylvania.

Doke, Clement M. 1954. *The Southern Bantu Languages*. Oxford University Press, London.

Downing, Laura. 2005. On the ambiguous segmental status in homorganic NC sequences. In Marc van Oostendorp and Jeroen van de Wijer, editors, *The Internal Organization of Phonological Segments*. Berlin, New York: Mouton de Gruyter.

Gorecka, Alicja. 1989. The phonology of articulation. PhD thesis, MIT.

Herbert, Robert K. 1977. Morphophonological palatalisation in southern Bantu: A reply to segmental fusion. *Studies in African Linguistics* 82:41–63.

Herbert, Robert K. 1990. Labial palatalization in Sotho and Nguni languages: internal and external evidence. *South African Journal of African Languages* 10:74–80.

Jokweni, Mbulelo. 1999. Deviating from identity: syntagmatic constraints in Xhosa nasal assimilation and palatalisation. *South African Journal of African Languages* 193:149–154.

Khumalo, James Steven Mzilikazi. 1987. An autosegmental account of Zulu phonology. PhD thesis, University of Witwatersrand.

Kochetov, Alexei. 2011. Palatalisation. In Colin Ewen, Elizabeth Hume, Marc van Oostendorp, and Keren Rice, editors, *Companion to Phonology*, pages 1666–1690. Oxford: Wiley Blackwell.

Kotzé, Albert E. and Sabine Zerbian. 2008. On the trigger of palatalization in the Sotho languages. *Journal of African Languages and Linguistics* 29 1:1-28.

Krämer, Martin. 2009. Crypto-variation in Italian velar palatalisation. In Pascual J. Masullo, Erin O'Rourke, and Chia-Hui Huang (eds.) *Romance Linguistics: Structures, Interfaces, and Microparametric Variation*. Amsterdam: John Benjamins. 193-208.

Kunju, Hleze. In preparation. IsiXhosa as a minority language in Zimbabwe. PhD thesis, Rhodes University.

Lee, Seunghun J. and Clementinah Burheni. 2014. Repair strategies in labial dissimilation: Diminutive formations in Xitsonga. *Stellenbosch Papers in Linguistics Plus* 44:89-103.

Lewis, M. Paul, Gary F. Simons, and Charles D. Fennig (eds.). 2015. *Ethnologue: Languages of the World, Eighteenth edition*. Dallas, Texas: SIL International. Online version: http://www.ethnologue.com.

Louw, J. A. 1975/76. Palatalisation of bilabials in the passive, diminutive and locative in Xhosa and Tsonga. *Afrika und Übersee* 614:241-278.

McLaren, J. 1942. *A Xhosa Grammar*. London: Longman, Green, and Co., 3rd edition.

Naidoo, Shamila. 2002. The palatalisation process in isiZulu revisited. *South African Journal of African Languages* 1:59-69.

O'Bryan, Margie. 1974. The role of analogy in non-derived formations in Zulu. *Studies in the Linguistic Sciences* 41:144-178.

Ohala, John J. 1978. Southern Bantu vs. the world: The case of palatalization of labials. *Berkeley Linguistics Society* 4:370-386.

Poulos, G. and C.T. Msimang. 1998. *A Linguistic Analysis of Zulu*. Cape Town: Via Afrika.

Selkirk, Elizabeth. 1993. [labial] relations. Ms. University of Massachusetts, Amherst.

Sibanda, Galen. 2004. Verbal Phonology and Morphology of Ndebele. PhD thesis, University of California Berkeley.

Stahlke, Herbert F. W. 1976. Segment sequences and segmental fusion. *Studies in African Linguistics* 7:41–63.

Van der Spuy, Andrew. 2014. Bilabial Palatalisation in Zulu: A morphologically conditioned phenomenon. *Stellenbosch Papers in Linguistics Plus* 44:71-87.