

Chapter 3

“Backwards” sibilant palatalization in a variety of Setswana

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Palatalization of coronals and stridents is well-known and widespread, and is most commonly associated with front vowels or glides as triggers. In some dialect(s) of Setswana, a much different type of palatalization occurs: alveolar stridents /s ts ts^h/ become pre-palatal [ʃ tʃ tʃ^h] before back vowels and the glide [w]. Clear empirical support for this pattern comes from productive alternations induced by the nominalizing suffix /-ɔ/, as well as alternations with an assortment of less productive morphemes, and lexical evidence. If palatalization before front vocoids is phonetically natural, then palatalization before back vocoids seems like it must be phonetically unnatural. However, this paper suggests that it is not the case: palatalization before back vowels actually makes phonetic sense, as a consequence of using lip rounding as a phonetic enhancement of the S~Š distinction.

1 Introduction

1.1 The puzzle

Palatalization of coronals and of stridents is well-known and widespread, and is most commonly associated with high front vowels/glides as triggers (Bateman 2007; 2010; Kochetov 2011; etc.). A common example is Japanese, in which the native lexical stratum exhibits allophony of [s] and [ʃ] depending on the following vowel: [s] occurs generally, but appears as [ʃ] before [i]. Similar patterns are reported in a vast number of languages; Bateman (2007) lists at least Nupe, Korean, English, Mandarin Chinese, Hausa, Mina, Romanian, Moldavian, and Yagua as having similar alternations.

This sort of [s]→[ʃ]/ ___ i alternation makes a lot of sense. It makes sense articulatorily in that [i] requires the tongue body to be elevated and close to the

palate, while [s] requires the tongue body to be much lower, such that the tip forms a constriction. Thus, it seems reasonable that [s] should be harder to produce than [ʃ] before [i], so we might expect to find the former turning into the latter in that context. This alternation also makes acoustic sense: in the sequence [si], coarticulation between the [s] and [i] should make [s] sound more like [ʃ]. This is because retraction of the tongue blade (to position the blade to produce [i]) increases the length of the cavity in front of the frication. This should shift the noise spectrum of [s] downward, towards that of [ʃ]. So, a s→ʃ alternation before a high front vocoid is phonetically natural, which seems to fit nicely with how common such processes are cross-linguistically.

Some varieties of Setswana give us a glimpse of a very different sort of pattern. In general, [s] and [ʃ] contrast (1). The examples in (2) (from Cole 1955) show underlying /s/ changing into [ʃ] before [ɔ].¹

- (1) s and ʃ are contrastive in Tswana (Cole 1955: 25)

-sɛba	-ʃɛba
‘slander’	‘look round’

- (2) s → ʃ / __ ɔ (!)

a. -hisa	sɪ-hiʃɔ
‘burn’	‘burner’
b. -ɔmisa	sɪ-wɔmiʃɔ
‘dry’	‘dryer’
c. -busa	m-muʃɔ
‘govern’	‘government’

If the s→ʃ / __ i pattern makes sense, then these examples seem downright weird. Here, we observe the same s→ʃ alternation induced by a vowel that is low and back, not high and front. This pattern is not merely s→ʃ, but rather S→Ț: it holds for all the strident affricates and fricatives alike (as §2 will demonstrate).

The weirdness of this data makes it interesting. A large body of current work appeals to phonetic naturalness as a guiding factor in phonological systems, in various forms. For instance, Hayes (1999) argues that phonological constraints are functionally motivated, and must be phonetically sensible. Steriade’s (2008) P-map proposal, similarly, posits that input-output changes are moderated by perceptual distance, such that phonetically sensible changes are preferred. And

¹While Cole describes this merely as “Setswana”, it seems to obtain only for certain Southern dialects, and not for standard Setswana. See §2.1 and §2.6 for more discussion.

the entire body of literature under the banner of “evolutionary phonology”² takes phonological patterns to be the direct result of phonetically-driven changes, coupled with morpho-phonological analogy. The pattern we observe in (2) seems phonetically as *un-natural* as can be, in that it is virtually the opposite of a pattern that is phonetically well-motivated. Instead of a high front vowel [i], we observe a relatively low back vowel [ɔ] causing palatalization.³ As §2 will show, this is not a behaviour unique to [ɔ]; other back vowels also induce the same S→Š/ __ U alternations.

Palatalization before back vocoids is not unprecedented. For instance, Bateman (2007: 68) notes palatalization before [u] in Tohono O’Odham. But, cross-linguistic surveys of palatalization (Bateman 2007; Kochetov 2011) consistently find that high front vocoids are the “best” triggers for palatalization. If palatalization is triggered by a back vocoid like [u], then front vocoids also trigger palatalization. Indeed, the generalization that Bateman reports for Tohono O’Odham is that palatalization is triggered not only by [u], but also by [i] and [e]. This dovetails with an observation (made by Bateman and Kochetov alike) that higher vocoids are better palatalization triggers. In other words, cases such as Tohono O’Odham show palatalization only before *high* back vocoids (which [ɔ] definitively isn’t), and high front vocoids also trigger the same palatalization. A further pertinent fact is that many Southern Bantu languages have palatalization triggered by [w] (Louw 1975/76; Ohala 1978; Herbert 1990; Bennett 2015; Bennett & Braver 2015, etc.). However, this phenomenon preferentially targets bilabials for palatalization, and only marginally applies to non-labials; it therefore seems dissimilatory in nature. Some previous analyses argue that it isn’t dissimilation (e.g. Kotzé & Zerbian 2008), by instead positing that the palatalization is really triggered by an /i/ or /j/ (which is typically covert). Neither of these lines of reasoning lead to a plausible analysis of the Setswana examples in (2). The /sɔ/→[ʃɔ] alternation is not obviously dissimilatory. There is also no evidence for a covert front vocoid in these examples, and indeed front vocoids in Setswana do not otherwise cause palatalization of /s/ (cf. (2a): sr-hiʃɔ, *ʃr-hiʃɔ).

The question at hand, then, is how to understand the S→Š/ __ U pattern seen in (2). Is this data reflective of a real process? If so, is it phonetic, phonological, or morphological? If it seems so squarely the opposite of a well-understood and phonetically natural pattern (S→Š/ __ i), why and how does it also exist?

²(Ohala 1981; 1990; 2004, etc.; rehashed and renamed by Blevins 2004)

³A more direct opposite of [i] would be the vowel [a], but this does not exist in Setswana.

1.2 The proposal

The main claims of this paper are three. The first is that $S \rightarrow \check{S}$ palatalization before back vowels is robust and productive in at least some variety of Setswana. The second is that the alternation seems entirely sensible when viewed from another angle: lip rounding may be a reason to prefer \check{S} over S before back vocoids. This leads to the third claim: if phonetics informs phonology, it does so in a non-deterministic way. $S \rightarrow \check{S} / __ U$ is the opposite of well-understood $S \rightarrow \check{S} / __ I$ alternations, in that it is triggered by back vowels instead of front vowels. Moreover, it seems intuitively unlikely that any language could have both $S \rightarrow \check{S} / __ I$ and $S \rightarrow \check{S} / __ U$, because the occurrence of the one undermines the evidence for the other.

If opposite phonological patterns can *both* be phonetically natural, then phonetic naturalness cannot in principle give us a complete understanding of phonology.

The paper is structured as follows. §2 presents the Setswana $S \rightarrow \check{S}$ process in further detail. §3 observes that the phenomenon does not appear to be unique to this language: parallels can be found in a few other Bantu languages, and perhaps further afield. §4 presents rounding as a potential basis for $S \rightarrow \check{S}$ being phonetically natural before back vocoids like [ɔ]. §5 concludes and observes some of the broader ramifications.

2 Data and Support

2.1 Background about the data

Setswana (a.k.a. Tswana) is a southern Bantu language (Guthrie S.50) spoken mainly in northern South Africa and Botswana. Examples marked as “own data” were collected by the author, with the help of a native-speaker consultant from Taung, North-West Province, South Africa. This speaker did not report a specific name for his idiolect, but did report being clearly aware that his accent is typical of that area, and is non-standard.⁴ Additional data comes from other sources on Setswana, chiefly Cole’s (1955) grammar (no specific dialect information is at hand for most of Cole’s data). For lack of a better name, I will refer to the dialect(s) represented in these sources of data simply as “Setswana”; but it should

⁴I thank Thabo Ditsele, Andy Chebanne, and an anonymous reviewer for confirming that Setswana dialects from further east (Gauteng) and north (Botswana) do not exhibit this $S \rightarrow \check{S}$ pattern.

be noted that standard, prescriptive, Setswana does not exhibit the patterns described here.⁵ On the basis of a dialect comparison by Malepe (1966), it seems that this is a characteristic found only in southern dialects, including those that Malepe calls Rolong, Tlhaping, and Tlharo, though further research is needed to verify how geographically widespread the phenomenon is.

The consonant inventory of Setswana is given in Table 1 (Bennett et al. 2016; see also Cole 1955; Chebanne et al. 1997, U. Arellano 2001). Consonants in parentheses are marginal. Unaspirated stops and affricates may be realized as ejectives (apparently in free variation). The affricate [qχ] is often analyzed as /q^h/ or /kx^h/, and [χ] is often characterized as /x/ (Cole 1955, etc.; see Bennett et al. 2016 for further discussion and data).

Table 1: Consonant inventory of Setswana

p p ^h b	t t ^h d			k k ^h	(ʔ)
	ts ts ^h	tʃ tʃ ^h	tʃ tʃ ^h dʒ	qχ	
(f)	s		ʃ	χ	h
m	n		ɲ		
	r				
w		l	j		

The vowel inventory is given in Figure 1 (Bennett et al. 2016). The vowel system has at least four contrastive degrees of height, possibly more.⁶ To avoid a deluge of diacritics, the semi-close vowels [ɛ̝ ɔ̝] are rendered as ‘ɪ’ and ‘ʊ’ in all examples (rather than ‘e’ and ‘o’ as in the standard orthography and some previous transcriptions like those of Cole 1955; see also Le Roux & Le Roux 2008 for finer acoustic details). The tonal system of Setswana is complex and involves numerous alternations (see Chebanne et al. 1997 for an overview); as such, tones are not marked in the single-word examples given here. As far as I can tell, they do not affect the consonantal alternations of interest here.

⁵For instance, Arellano’s (2001) *Sound System of Setswana* does not mention the S→ʃ alternation as part of the phonology.

⁶This is a slight simplification. The transcriptions given here follow Cole’s (1955) orthographic ones, which do not generally reflect a vowel harmony process that produces raised counterparts of each pair of mid vowels; see Dichabe (1997) for further details on this harmony. Some sources claim that some or all of these additional degrees of height are not merely derived, but are also contrastive in that they occur in contexts not explainable by the vowel harmony (for example, see Chebanne et al. 1997; Creissels 2005, and also Khabanyane 1991 on Southern Sotho).

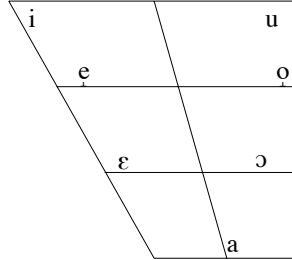


Figure 1: Vowel inventory of Setswana (Bennett et al. 2016)

2.2 On S and Š

The focus of interest for this paper is palatalization of stridents before back vowels, characterized in shorthand as $S \rightarrow \tilde{S} / \text{ } __ U$. The “S” denotes all anterior stridents, whether they appear alone or in NC sequences: {s ts ts^h ns nts nts^h}. The “Š” likewise denotes posterior stridents: {ʃ tʃ tʃ^h nʃ ntʃ ntʃ^h}. The “U” denotes back vowels and glides: {ɔ ʊ u w}. There is no evidence that the voiced posterior affricate [dʒ] participates in the pattern; this is consistent with the absence of [z ʒ] from the native consonant inventory.

2.3 Productive, synchronic S~Š alternations

The examples from §1 point to a neutralizing pattern. That is, S and Š are normally contrastive, and we find $S \rightarrow \tilde{S}$, but not the reverse $\tilde{S} \rightarrow S$. The most robust and productive source of synchronic S~Š alternations comes from nominalizations formed with the suffix /-ɔ/. Some examples are given below in Table 2. For /ts^h/ \rightarrow [tʃ^h], it’s difficult to find examples showing this alternation because /ts^h/ is relatively uncommon in stem-final position. But, it can be derived in irregular causatives; these forms do show $S \rightarrow \tilde{S} / \text{ } __ U$ in the expected fashion.

The S~Š alternations we see here are not characteristic of nominalizations in general. Agentive nominalizations are formed with a suffix /-i/, and these don’t exhibit the same alternation (cf. -t^husa ‘help’ > mɔ-t^husi ‘assistant, helper’; *mɔ-t^hufi). As such, the S~Š alternation evident in these forms must be due to the presence of the vowel [ɔ]. This is corroborated by other morphemes that also show the same related S~Š pattern.

Table 2: Productive S→Š alternations in /-ɔ/ nominalizations

/s/ → [ʃ]				
-hisa	‘burn’	sɪ-hiʃɔ	‘burner’	(own data)
-ɔmisa	‘dry sth.’	sɪ-wɔmɪʃɔ	‘dryer’	(own data)
-busa	‘govern’	m-muʃɔ	‘government’	(Cole 1955: 77)
-t ^h usa	‘assist’	t ^h uʃɔ	‘assistance’	(Cole 1955: 90)
/ts/ → [tʃ]				
-bitsa	‘call’	pitʃɔ	‘a call’	(own data)
-χɔpɔtsa	‘remind’	sɪ-χɔpɔtʃɔ	‘reminder’	(Cole 1955: 86)
-lɔɔtsa	‘whet, sharpen’	tɔɔtʃɔ	‘whetstone’	(Cole 1955: 90)
-bɔtsa	‘ask’	pɔtʃɔ	‘question’	(Cole 1955: 90)
-itsɪ	‘know’	kitʃɔ	‘knowledge’	(Cole 1955: 90)
-ikɔkɔbetsa	‘stoop (refl, caus)’	bɔ-ikɔkɔbetʃɔ	‘humility’	(Cole 1955: 205)
-ijatsa	‘despise (refl)’	ɪnatʃɔ	‘self-disparagement’	(Cole 1955)
/ts ^h / → [tʃ ^h]				
-bɔnts ^h a	‘show’	pɔntʃ ^h ɔ	‘a showing’	(own data; cf. bona ‘see’)
-t ^h alɪfa	‘become wise’	-t ^h alɪts ^h a, -t ^h alɪtʃ ^h wa	‘make wise’	(Cole 1955: 205)

2.4 S→Š in other morphological contexts

The S~Š alternation can also be observed in certain pronominal concords; examples are given in Table 3 below (from Cole 1955). The first set of forms are pronouns, demonstratives, and quantifiers with class 8/10⁷ concord. In pronominal stems that have front vocoids like [ɛ], class 8/10 forms always have [ts]. However, class 8/10 forms have [tʃ] when the following vowel is [ɔ], manifesting the S→Š/ — U pattern. The second set of forms show class 7 behaving the same way: we find [s] in class 7 forms generally, but [ʃ] before [ɔ]. (These pronominal stems are few in number, and phonotactically non-diverse; in reading Cole’s (1955) grammar, I was unable to find any that have other vocoids.

We can also observe S→Š/ — U in certain verbal suffixes. One is the reversive verb extension, variously /-ɔl-/ or /-ɔlɔl-/ (3) (Cole 1955:212ff). The form in (3a) looks on the surface like an applicative structure /-ts^h-ɛl-a/, based on a root /-ts^h-/ (which is not attested by itself). Related stems that have the reversive extension instead of the applicative one have [tʃ^h] instead of [ts^h] (3b,3c).

⁷Classes 8 and 10 are homophonous, so I will not distinguish them here.

Table 3: S~Š alternations in pronominal stems

Class 8/10: ts before ε		tʃ before ɔ	
tse	‘this’	tʃone	‘they’
tseʊ	‘that’	tʃosi	‘only they’
tseɲʊ	‘that one’	tʃɔɔpɛdi	‘both’
tsele	‘that one yonder’	tʃɔtʰɛ	‘all’
muxatse	‘his/her spouse’	muxatʃɔ	‘your spouse’
Class 7: s before ε		ʃ before ɔ	
sɛ	‘this’	ʃone	‘it’
sɛʊ	‘that’	ʃosi	‘only it’
sɛɲʊ	‘that one’	ʃɔtʰɛ	‘all’
sele	‘that one yonder’		

(3) Reversive verb extension

- a. -ts^hɛla ‘pour’
- b. -tʃ^hʊla ‘serve, dish out food’
- c. -tʃ^hʊkʊla ‘spill’

The passive suffix also shows evidence for the same S→Š/ __ U alternation, albeit in a less simple way. This is illustrated in (4) and (5), based on data and observations from Cole (1955: 193–195). The basic form of the passive is /-w-/ (4a). However, Cole reports that the same extension is normally realized instead as /-iw-/ after roots ending with {s ts ts^h} (4b); roots ending with /ts/ additionally change the /ts/ into [d] (4c). This is not direct evidence for the S→Š/ __ U alternation, but the allomorphy is clearly phonotactically-based, and systematically fails to produce surface SU sequences.

(4) Passive suffix allomorphy (Cole 1955:193ff)

- a. -bɔn-a > -bɔn-w-a
‘see’
- b. -bɛs-a > -bɛs-iw-a
‘roast’
- c. -bits-a > -bid-iw-a
‘call’

Furthermore, Cole (1955) does note that some Eastern dialects of Setswana use /-w-/ instead of /-iw-/ in these instances. In those forms, we *do* find the S→Š/___U alternation, occurring just as expected (5). Thus, the passive suffix allomorphy avoids creating SU sequences; where it does create them, we find S→Š as usual.

(5) Setswana: Eastern dialects (Cole 1955)

- a. -bəs-iw-a ~ -bɛf-w-a
‘be roasted’
- b. -bid-iw-a ~ -bitf-w-a
‘be called’

Palatalization can also be observed with the diminutive suffix /-ana/, which causes a host of changes to preceding consonants (for further details and discussion, see Cole 1955; Louw 1975/76; Herbert 1990; Bateman 2007; Kotzé & Zerbian 2008). The generalization of note here is that some of these changes can derive stridents from other, non-strident, consonants. These derived consonants follow the same S→Š alternation we see elsewhere. This is illustrated in (6): /d/ changes to [ts] generally (6a), but to [tʃ] when it precedes a back vocoid (6b).

(6) S→Š in diminutives (Cole 1955)

- a. pɔdi → puts-ana
‘goat’
- b. lɪ-χɔdu → lɪχɔtʃw-ana
‘thief’

2.5 Further lexical evidence

We can also observe the S→Š/___U pattern in the lexicon. One source of evidence is from lexical doublets. These substantiate the same observation made about the diminutives above: when something changes a consonant into S, it also changes into Š before U. Cole (1955: 83ff) notes that certain nouns of class 5/6 have doublets, one with [ts] or [s], the other with {b l d r h χ}. Table 4 gives some examples of this variant S (mainly drawn from Cole 1955:83ff); for example, the first one [lɪ-tsatsi] ‘sun, day’ has [ts], while the usual plural form Cole reports is [ma-latsi], with [l] instead.

Table 4: Lexical doublets with S

-latsi	lr-tsatsi (cf. pl. ma-latsi)	‘sun, day’	(l ~ ts)
-dibɔχɔ	lr-tsibɔχɔ	‘ford’	(d ~ ts)
-bele	lr-tsele	‘breast’	(b ~ ts)
-rapɔ	lr-sapɔ	‘bone’	(r ~ s)
-rama	lr-sama	‘cheek’	

Table 5: Lexical doublets have Š instead of S before U

-bɔχɔ	lr-tfɔχɔ (cf. pl. ma-bɔχɔ)	‘arm’	(b ~ tf before U)
-bɔlr	lr-tfwɪlr	‘fist’	
-rɔp ^h i	lr-fɔp ^h i	‘blister’	(r ~ f before U)
-rɔpe	lr-fɔpe	‘ruin’	
-rɔɔ	lr-tf ^h ɔɔ	‘paw’	
-χɔdi	lr-fɔdi	‘starling’	(χ ~ f before U)
-hulɔ	lr-fulɔ	‘foam, froth’	(h ~ f before U)
-hudu	lr-fudu	‘hole for stamping corn’	

When a back vowel follows the initial consonant of the root, we do not find doublets with S; instead, they have Š. This is illustrated in Table 5 (examples again from Cole 1955).⁸

Additional support for S→Š/ __ U comes from the distribution of stridents in the lexicon. The occurrence of SU, i.e. {s ts ts^h} before a back vocoid, seems to be vanishingly rare. Some examples of SU forms are attested in Cole’s grammar, but many are presented as variant forms that may also be realized with Š. A few words systematically must have SU (not ŠU), but are clearly loanwords. These are illustrated in Table 6 below. It is worth noting, however, that there are also loanwords where source S *does* neutralize to Š before U. Such forms cannot be attributed by some general characteristic of the treatment of loanwords, because loans with [s] before non-back vocoids normally retain it faithfully as [s] (as in ‘stool’ in Table 6).

⁸Cole (1955: 83) notes some exceptional forms that deviate from this generalization in minor ways. For example, [lr-saχɔ] ‘buttock’ is listed with variant forms [lr-ts^haχɔ ~ lr-faχɔ]. No [f] is expected here, since the following vowel is [a]. But, interestingly, the plural is only given with [s], as [ma-saχɔ].

Table 6: Sporadic S→Š/ __ U in loanwords

Exceptional SU sequences in loanwords		
lɪ-tsula ~ lɪ-sʊlə ~ lɪ-zʊlə	‘Zulu person’	< Zulu
pɔsɔ dʒɛsu zuu	‘post office’ ‘Jesus’ ‘zoo’	< Afrikaans
Loanwords with non-exceptional S→Š/ __ U		
lɪ-ʃɔlə ʃukiri sɪ-tulɔ	‘soldier’ ‘sugar’ ‘stool’	s→ʃ neutralization normally s→s

In the native lexicon, Š may occur before any of the vowels: {f tʃ tʃʰ} are not as restricted as {s ts tsʰ}. Some examples of Š before non-back vowels are given in Table 7 below (from Cole 1955).

The preponderance of examples in Table 7 show Š before [a], rather than the other non-back (i.e. front) vowels. This is not an accident of presentation, but reflects the trend in the data that Cole (1955) provides. Š seems more common before [a] than before front vowels. ŠI sequences (where ‘I’ stands for front vowels) also seem less common than SI sequences, but they are not nearly as rare as ŠU. These observations, consolidated in Table 8, are based on my own impressions of data collected first-hand, as well as examination of Cole’s (1955) data. Cole’s (1955: 35) description of the relationship between S and Š agrees with my impressions.

The generalization that SU sequences are almost completely absent from the lexicon suggests that the S→Š/ __ U generalization is not merely part of the morpho-phonology of the language, but also holds over the lexicon as a phonotactic generalization. The observation that Š is more common before back vowels than front vowels is not obviously expected. It is conceivable that Š is over-represented before back vowels because the S→Š/ __ U neutralization derives Š in this context, but more extensive quantitative study is needed to be sure.

Table 7: Š may occur before non-back vowels (Cole 1955)

Ši	ma-fi	‘milk’
Šɪ	di-faɪ	‘coward’
	mʊ-fi	‘meerkat’
	-fiɪna	‘(to) bare teeth’
	ntʃɪ	‘ostrich’
	bʊ-ratʃɪ	‘brush’
Šɛ	-fɛba	‘(to) look round’
	fɛɛŋ	‘shilling’
Ša	-fa	‘disperse’ (of mist)
	-fa	‘(to) burn (unacc.)’
	-fa(j)a	‘give child a name’
	-fa	‘new’
	mʊ-fa	‘young person’
	-faqχala	‘become angry’
	ntʃa	‘dog’
	-tʃa	‘dry up (unacc.)’
	sɪ-tʃaɪba	‘nation, tribe’

Table 8: Impressionistic trends in the distribution of S and Š before front, central, and back vowels

	Front {i ɪ ɛ}	Central {a}	Back {u ʊ ɔ}
S {s ts tsʰ}	common	uncommon	very rare
Š {ʃ tʃ tʃʰ}	uncommon	common	common

2.6 Historical and comparative support

Finally, there is also historical and comparative evidence that corroborates the S→Š/ __ U pattern. According to Malepe’s (1966: 67ff) dialect survey and comparative analysis, the Rolong, Tlhaping, and Tlharo dialects underwent a historical change *S > Š/ __ {u ʊ ɔ}. Evidence for this change comes from dialect variation of exactly the sort expected based on the lexical variation seen so far. For example, Malepe identifies ‘hearth’ as [lɪ-ɪʝ] in the Rolong dialect, but [lɪ-iso] in Kwena and other dialects. There is no S~Š dialect variation before front vowels.⁹

The point: circumstantial evidence confirms that the S~Š alternations seen above are a change *from* S, *to* Š – a change conditioned by *back* vocoids. It is not the case that there is back-and-forth allophony with no contrast. Nor is it the case that the alternating stridents were historically *Š, with de-palatalization or fronting induced by front vowels.

3 Parallels elsewhere?

Setswana is not alone in having a “backwards” distribution of Š and S before vowels. A similar pattern is reported much further north, for Haya and Nkore-Kiga, Bantu languages spoken in Tanzania and Uganda. In both cases, the reported pattern is that [s z] occur before /i/, while [ʃ ʒ] occur before /e a o u/ (Byarushengo 1975; Hyman 2003b; see also Hansson 2001; 2010). This is more narrowly the opposite of patterns like the Japanese one, with a split between the high front vowel [i] versus all the other vowels.

In the Haya and Nkore-Kiga cases the origin of the “backwards” pattern seems to be morphological. Hyman’s (2003b) analysis of the S~Š alternations in Haya is that Proto-Bantu *c spirantized to [s] before the short causative *-i-, and the causative *-i- was absorbed in the process, yielding a string of changes *c-i- > sj > [s].¹⁰ This resulted in synchronic s~ʃ alternations between related verb stems, e.g. [-fáaf-a] ‘hurt (intransitive)’ vs. [-fáas-a] ‘hurt (transitive)’ (Hyman 2003b: 85). The stem-final [s] in the latter form is due to the historical presence of *-i-, while the unaffixed form retains [ʃ]. Such alternations were then generalized by analogy, in effect treating all s-final stems as “pseudo-causatives”.

⁹Malepe (1966) characterizes Rolong, Tlharo and Tlhaping as Southern dialects. He identifies the hometown of the primary consultant, Taung, as a Tlhaping area. Another consultant I worked with came from Kuruman, which Malepe notes as a Tlharo area.

¹⁰See also Bennett & Pulleyblank (2018) for an argument that morphology is a major factor in the synchronic distribution of [s] and [ʃ] in Nkore-Kiga.

The Setswana pattern is clearly not morphological in this way, however: it seems entirely phonotactic in nature. The S~Š alternation can be seen in a wide range of morphemes, and even root-internally. This includes many situations where any kind of spirantizing influence of a historical superhigh vowel is implausible, e.g. in demonstratives, possessives, and /-ɔ/ nominalizations. In short, the Setswana pattern is clearly not due to front vocoids; not historically, and not synchronically.

Examples of other languages more in line with Setswana, with *phonotactic* s~ʃ patterns induced by back vocoids, are less abundant. However, there is a possible example in Tigrinya¹¹: numerals exhibit s~ʃ alternation, with ʃ appearing only before back, round, vowels. Thus, we find [s] in [səbʃa] ‘seventy’, but [ʃ] in [ʃobatte] ‘seven’ (Banksira 2000:231ff).

4 A roundabout explanation

4.1 Rounding as an enhancement for S~Š distinction

Why should back vowels have an affinity for [-anterior] stridents? One possible reason is rounding. Back vowels normally involve lip rounding, both in Setswana and cross-linguistically.

In at least some languages with s S≠Š contrast, lip rounding serves as a redundant phonetic enhancement of that contrast (Stevens et al. 1986; Keyser & Stevens 2006). English is such a language: [ʃ] is normally articulated with some degree of lip rounding. This rounding makes good phonetic sense: it shifts the noise spectrum of [ʃ] downward, further away from that of [s].¹² With this in mind, an interaction between posterior sibilants and round vowels seems much less outlandish.

4.2 Conjecture: A historical pathway

If posterior sibilants have an affinity for rounding, then perhaps the situation we find in Setswana is a phonologization of that interaction. How would this work? One possibility is a historical pathway as follows.

¹¹I thank Sharon Rose for pointing this example out to me.

¹²Keyser & Stevens (2006: 49) demonstrate this interaction for English, but the phonetic effect of rounding seems to be far more general. See Ní Chiosáin & Padgett (2001: 7) on Turkish, and McCollum (2015: 342-343) on Kazakh, for instance.

1. Proto-Bantu did not have a $S \neq \check{S}$ contrast (Meinhof 1932; Hyman 2003a, etc.), but Setswana currently does. At some point, that contrast must have arisen in some intermediate ancestor of present-day Setswana; call it “Pre-Tswana”.¹³
2. Lip rounding serves to enhance the $S \neq \check{S}$ contrast. Pre-Tswana would have used this enhancement, in much the same fashion as English and other languages.
3. In a SU sequence, normal C-V co-articulation would cause S to be produced with some degree of rounding.
4. Adding lip rounding to S shifts the spectral distribution down, making it closer to that of \check{S} .
5. This means that SU sounds more like $\check{S}U$. Speakers of Pre-Tswana would be more likely to misperceive S as \check{S} when it comes before U than before other vowels.
6. The result:
 - a) $*SU > \check{S}U$: $*S$ and $*\check{S}$ merge to \check{S} before round (=back) vocoids.
 - b) $*SA > SA$: $*S$ remains S before non-round (=non-back) vocoids.
 - c) $*\check{S}A > \check{S}A$: $*\check{S}$ also remains \check{S} before non-round (=non-back) vocoids.The $S \neq \check{S}$ contrast is retained, except before back vocoids.

This pathway is conjecture, with certain facts still to be confirmed. The use of rounding as an enhancement gesture on \check{S} remains to be quantified. The degree of rounding on back vowels, likewise, remains to be documented. However, it is worth noting that at least one much earlier description corroborates the presence of lip rounding on \check{S} before back vowels.

One of the earliest published descriptions of the phonetics and phonology of Setswana comes from Daniel Jones and Sol Plaatje (Jones & Plaatje 1916, *et seq.*). Jones & Plaatje (1916: xx.32) make a fine-phonetic distinction between two kinds of posterior sibilants, [ʃ] and [ʃ̹], the latter being essentially a rounded [ʃ]. In their transcriptions, [ʃ̹] corresponds to modern <šw>, and to <š> before any back (round) vowel. Thus, [tʃɔtʰɛ] ‘cl.10-all’ is transcribed by Jones & Plaatje (1916: 3)

¹³Based on Malepe’s (1966) list of historical changes, it seems that [s] comes primarily from Proto-Bantu velars (particularly *k), while [ʃ] is more often from historical *t and *p (especially *pw). This may be the reason why [ʃ] is more common with back vowels than front vowels.

as [cʰōtʰhě], with rounded [ʰ] rather than plain [f]. This degree of rounding on /f/ is not distinct from sequences regarded in later work as Š-w clusters (e.g. Cole 1955; Chebanne et al. 1997, and in standard orthography). Thus, modern standard rendering <bêšwana> (= [betʰwana]; archaic variant of *baTswana*) is transcribed by Jones & Plaatje as [becʰana]. This implies that /f/ has considerable rounding before back vowels, in at least the Setswana dialect spoken by Plaatje. Jones & Plaatje do not indicate rounding on any other coronal consonants before back vocoids (e.g. [kxatwani]).

Although the presence of rounding on stridents before back vowels still needs to be documented instrumentally, the fact that Jones & Plaatje detected rounding in this position is highly suggestive. The point: while the historical pathway sketched out above is conjectural, the available evidence suggests that it's very much on the right track.

4.3 From diachronic change to synchronic phonology

Modern Setswana (or at least the variety considered here) has productive S→Š alternations, not merely a skew in its lexical items. This means that at some point, the interaction between stridents and back vowels must have changed from diachronic drift to part of the learned, synchronic, phonology.

Co-articulatory rounding blurring the phonetic distinction between [s] and [ʃ] seems insufficient to explain the synchronic situation. There is a contrast between Š and S. All Setswana speakers I have consulted seem to be entirely capable of distinguishing these consonants acoustically and articulatorily, and also capable of producing both anterior and posterior sibilants before all vowels. The S~Š pattern also seems to be a point of non-trivial salience from a sociolinguistic standpoint: compare modern spellings *Setswana* and *Tswana* with more archaic spellings *Sechuana* and *Chuana* (used by Jones & Plaatje (1916), for instance, and the apparent standard at that time). This entails the possibility that speakers could produce both ŠU and SU, and moreover have some awareness of the possibility of varying between them. So, it is plainly not the case that /s/ and /ʃ/ simply sound alike before back vocoids.

In the synchronic phonology, it seems like the S→Š pattern is a qualitative alternation, not merely the result of gradient gestural overlap or co-articulatory rounding of S. The phonetic pathway sketched out above is a plausible origin story for the pattern. But at some point, it must have been integrated into the phonology of Setswana, with a concomitant shift in representation.

5 Summary and conclusions

5.1 Summary

The primary aim of this paper has been to demonstrate the existence of a “backwards” pattern of sibilant palatalization in some variety of Setswana. As we have seen, there are speakers who robustly produce $S \rightarrow \check{S}$ alternations conditioned by a following back, round, vocoid. These alternations apply systematically to the class of anterior stridents [s ts ts^h], and yield their posterior counterparts [ʃ tʃ tʃ^h]. They occur productively across various different categories of morphemes, including verbs, nouns, quantifiers, and demonstratives; the pattern also appears to hold over the lexicon in a near-complete way (with the exception of some recent loanwords). Though the pattern is not part of standard Setswana, evidence that it is real and robust comes not only from speakers I consulted, but also from the consultants who provided the data for Cole’s (1955) grammar, and from Sol Plaatje’s own intuitions (Jones & Plaatje 1916).

The secondary aim of the paper has been to argue that the $S \rightarrow \check{S} / __ U$ pattern is not as phonetically unnatural as it might at first seem. The use of rounding as an enhancement of the $S \neq \check{S}$ contrast offers a very reasonable mechanism for stridents to shift away from S, and to \check{S} , in the context of a back, round, vocoid. The synchronic $S \rightarrow \check{S} / __ U$ alternations can be regarded as a sort of phonologization of co-articulatory rounding of stridents before back vowels. Though not immediately intuitive, the pattern is not wholly unnatural.

5.2 Broader conclusions

The existence of $S \rightarrow \check{S} / __ U$ in Setswana has broader ramifications for the relationship between phonetics and phonology.

If the claim that $S \rightarrow \check{S} / __ U$ is a natural development as suggested in §4, then we must conclude that two very different kinds of $S \rightarrow \check{S}$ alternations are *both* natural: $S \rightarrow \check{S} / __ I$, and $S \rightarrow \check{S} / __ U$. The naturalness of these patterns comes from different sources: one is an interaction based on the tongue blade, the other based on the effects of lip position. But both are phonetically natural – despite seeming like near opposites.

The naturalness of $S \rightarrow \check{S} / __ U$ leads to a much broader conclusion: to the extent that phonetics guides phonology, it does so non-deterministically. The idea that phonological systems and mechanisms are somehow derived from phonetics is very much in vogue in some recent work (Ohala 1981; 1990; 2004; Hayes 1999; Steriade 2008; Kawahara 2008, to name just a few). But in this case, “Does it make

phonetic sense?” is not the right question to ask. $S \rightarrow \check{S} / _ I$ and $S \rightarrow \check{S} / _ U$ are *both* phonetically natural, albeit in different ways.

Though $S \rightarrow \check{S} / _ I$ and $S \rightarrow \check{S} / _ U$ are both phonetically natural, they seem intuitively incompatible with one another, in that the occurrence of the one deprives us of most of the data that makes the other apparent. The $S \rightarrow \check{S} / _ U$ pattern in Setswana is evident largely *because* $\{s \text{ } ts \text{ } ts^h\}$ do occur before front vowels, without palatalizing; without this data, the $S \rightarrow \check{S} / _ U$ palatalization would not be apparent as such.¹⁴ It therefore seems unlikely that a stable phonological system could have both $S \rightarrow \check{S} / _ I$ and $S \rightarrow \check{S} / _ U$ simultaneously. If two mutually-incompatible phonological patterns can both be phonetically natural, then phonetic naturalness is in principle not enough to give us a complete understanding of sound patterns – the choice between these two kinds of palatalization cannot be made on the basis of naturalness.

Explaining this issue away as something that doesn’t bear on the phonetics-phonology relationship seems very unsatisfying. The Setswana pattern seems entirely phonotactic in character. It is *not* linked to any particular morpheme(s), nor to one lexical stratum, etc. Despite seeming phonetically odd, it clearly does not have the hallmarks of a “crazy rule”; instead, it has the hallmarks of being part of normal phonology.

Interestingly, Malepe (1966) also reports that the Kgatla dialect of Setswana has $S \rightarrow \check{S} / _ i$, the much more familiar sort of pattern found in Japanese and many other languages. This implies that both $S \rightarrow \check{S} / _ I$ and $S \rightarrow \check{S} / _ U$ can both arise from the same phonetic and phonological substrate.

Why $S \rightarrow \check{S} / _ i$ is so common cross-linguistically, and why $S \rightarrow \check{S} / _ u$ is not more abundant, is a lingering question for future work to sort out. But as a preliminary, it seems unlikely that the choice between them can be attributed to micro-level phonetic differences. That is, it’s unlikely that the appearance of $S \rightarrow \check{S} / _ U$ in Setswana is somehow tied to the fine phonetic quality of S , \check{S} , or U in the language, because Pre-Tswana also developed the $S \rightarrow \check{S} / _ i$ pattern, albeit in a different dialect.

¹⁴If Setswana also had $S \rightarrow \check{S} / _ I$, then the surface generalization would be $S \rightarrow \check{S} / _ \{i \text{ } e \text{ } \text{ } u\}$, i.e. before all vowels except $[a]$. With so many fewer opportunities to observe non-palatalized sibilants, and with palatalization happening everywhere else, it would be easy for learners to re-analyze the pattern as one of de-palatalization: $\check{S} \rightarrow S / _ a$.

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