Consonant-Tone Interaction in Saxwe

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1. Introduction

The influence of consonant type on tone patterns has been a recurring topic of interest in the literature on tonal languages. In discussions of the effects of consonants on tone, consonants have sometimes been divided into three categories – voiced obstruents, voiceless obstruents and sonorants – and generalizations have been made regarding these three categories, one of the most common being that voiced obstruents may have a lowering effect on tone (Bradshaw 1999). Studies of Kwa languages have been among those which have categorized tonal phenomena as having this three-way divide (Ansre 1961, Stahlke 1971, Bole-Richard 1983). The current study contributes to the discussion on this topic by providing a further example of a Kwa language in which tonal phenomena are related to consonant type. In Saxwe, voiced obstruents and voiceless obstruents are always opposed in the way they condition tonal phenomena, with sonorants patterning with one or the other depending on the context. The most interesting finding for Saxwe, however, is that voiced obstruents condition a lowering of low tone but not high tone. This lowering can be recursive and persists beyond the immediately following tone-bearing unit.

Saxwe is a Kwa language spoken in the southwest of Benin (Lewis 2009).[1] Saxwe has not been a frequent topic of study in the way that some of its neighboring Gbe-cluster languages such as Ewe and Fon have been. A brief sketch of the sound system of Saxwe was done by Tchitchi (1979). Following this, Tossa (1984) wrote his master's thesis on Saxwe phonology.

In this present study, I would like to examine a topic not extensively discussed by Tossa, which is consonant-tone interaction in Saxwe. In section 2, I will give background for the study of Saxwe tone by looking at the inventory of sounds and basic syllable types in Saxwe. Section 3 follows with a look at some of the simple underlying tone patterns in Saxwe and their phonetic realizations. Section 4 addresses high tone spread. Section 5 looks at the downstepping effect of voiced obstruents. Section 6 deals with low tone spread. And finally, sections 7 and 8 present the summary and some conclusions of this study. I argue that an adequate explanation of the Saxwe tone system necessitates a theoretical framework that allows for the interpretation of registers to be relative, each consecutive instance of low register downstepping pitch further. The theoretical framework must also provide a mechanism for the register-lowering effect of voiced obstruents in Saxwe.

2. Inventory of sounds and basic syllable types

Saxwe has twelve underlying vowels, seven oral (i, e, ɛ, a, u, o and ɔ) and five nasal (ĩ, ɛ̃, ã, ũ, ɔ̃) (Tossa 1984). In Tossa's analysis, he identifies twenty-four consonant phonemes. His table of consonant phonemes is reproduced below. It has been modified slightly to reflect standard IPA notation. Note that while /x/ and /xw/ do not have the same place of articulation as /ɦ/ and /ɦw/, they are nonetheless the voiceless phonological counterparts of the latter. The columns for these pairs of sounds would be better labeled by referring to them as "back" rather than "velar".

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[1] Saxwe is pronounced [saxwɛ] and has the ISO code sxw.

Table 1: Tossa's chart of Saxwe consonant phonemes

		Bila-bial	Labio dental	Dental	Alveo-lar	Retro-flex	Pala-tal	Velar	Labio-velar	Velar Fricative	Labio-velar Fricative
Obstr-uents	Voice-less		f	t	s		tʃ	k	kp	x	xw
	Voiced	b	v	d	z	ɖ	dʒ	g	gb	ɦ	ɦw
Sono-rants	Nasal	m				n	ɲ				
	Oral	w				l	j				

This table divides consonants nicely into the categories of voiceless obstruents, voiced obstruents and sonorants. It should be noted that what are marked in this table as the phonemes /m/, /n/ and /ɲ/ in this chart have been analyzed in (Ham and Beavon-Ham 2009) as being the allophones [m], [n] and [ɲ] of the phonemes /b/, /ɖ/ and /y/ respectively. This follows in the tradition of Capo (1991), Bole-Richard (1983) and Gbéto (2007), all of whom analyze nasal consonants as allophones of non-nasal consonants whose realization is conditioned by the presence of a following nasal vowel.

That having been said, my corpus of data indicates that Saxwe tonal phenomena are conditioned by the surface representations of these consonant phonemes and not by their underlying forms. Syllables beginning with surface-level [m] generally pattern with sonorants and those beginning with surface-level [b] generally pattern with voiced obstruents (although it must be said that several of the problematic words in my data set contain the sounds [m] and [b]). Interestingly, surface-level [ɖ] patterns with sonorants with regard to tonal phenomena – an observation noted by Gbéto (2007) for several other Gbe languages. The phonemes /b/ and /ɖ/ are a topic of discussion in studies of historical reconstruction of Proto-Gbe. Capo (1991) asserts that these two phonemes, both unusual in that they have no voiceless counterpart, come from the Pre-Gbe implosives /ɓ/ and /ɗ/. This may help to explain the unusual patterning of [ɖ] with sonorants with regard to tone phenomena.

Saxwe monomorphemic verbs are generally of the C(C)V syllable type. There are some bisyllabic verbs, but these can almost always be identified as being polymorphemic. Monomorphemic nouns are frequently V.C(C)V, where the initial vowel is either /o/, /a/ or /ɛ/. This initial vowel has been analyzed as a historic class marker that no longer serves a grammatical function. (For a discussion of the noun prefix in Ewe, see (Stahlke 1971).) Nouns that have more than one syllable (excluding the initial vowel) can often be identified as being either polymorphemic or borrowed words. There are occasional instances of CCCV syllable types in polymorphemic words. This study will focus exclusively on C(C)V verbs and V.C(C)V nouns. Basing the study on these syllable profiles allows one to clearly see and compare tonal phenomena.

3. Some underlying tone patterns and their phonetic representations

3.1. Verbs

The form that Saxwe speakers give in isolation for the verb is the singular imperative. The following are the singular imperative forms for three categories of verbs: verbs whose onset contains a voiceless obstruent, verbs whose onset contains a voiced obstruent, and verbs whose onset contains either a sonorant or /ɖ/. Note that unless indicated otherwise, all low tones are pronounced with a falling pitch before a pause.

(1) Verbs in the singular imperative form

Voiceless obstruent onset

	/H/			/L/	
a.	[kpɔ̃́]	'see!'	b.	[tʃì]	'sew!'
	[tʃã́]	'choose!'		[fã̀]	'knead!'
	[kpé]	'meet!'		[tɔ̃̀]	'fry!'

Voiced obstruent onset

c.	[gbɛ̌]	‘refuse!’	d.	[gbò]	‘cut!’
	[ɦlɛ̃̌]	‘scatter!’		[gã̀]	‘shell!’
	[vũ̌]	‘rip!’		[ɦɛ̃̀]	‘hold!’

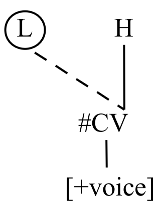
Sonorant or /ɖ/ onset

e.	[jɔ̌]	‘call!’	f.	[nũ̀]	‘drink!’
	[ɖǒ]	‘have!’		[ɖè]	‘remove!’
	[nã̌]	‘give!’		[lì]	‘crush!’

In studies of Ewe dealing with similar data, high and nonhigh have sometimes been postulated as the underlying tones (Stahlke 1971; Clements 1978). Most recently, Bradshaw (1999) has argued for the existence of underlying high, mid and low in addition to the presence of toneless syllables in Ewe. In this study, I will be taking the position that Saxwe has two underlying tonemes: high (H) and low (L). It is my view that this position allows the simplest analysis of the data.

Let us look first at underlying high-toned verbs. For verbs that have a voiceless obstruent onset, the surface realization for the singular imperative is a H tone. For all other verbs, the surface realization is a rising tone. So far this is the same pattern noted by Stahlke (1971) for Ewe, where sonorants pattern with voiced obstruents in yielding similar singular imperative forms. The singular imperative morpheme is posited for Ewe as a floating L whose docking is either blocked by a voiceless obstruent or conditioned by a voiced consonant. Bradshaw (1999) argues for the latter process in Ewe. I find Bradshaw’s arguments convincing for Ewe, and, as described below, I take the same approach for Saxwe. The structural representation for this docking is shown in (2).

(2) L docking for the singular imperative



In all low-toned verbs, as listed in (1), the singular imperative is realized as L with a falling pitch. This is regardless of the consonant quality of the verb onset. Data in this study will bear out the generalization that in Saxwe, prepausal L tones are normally realized with a falling pitch, a phenomenon that has been recognized in a number of African languages (Hyman 1993). The existence of a non-falling L tone phrase-finally is an indication of the presence of a floating H. This will be illustrated in the next section.

3.2. Nouns

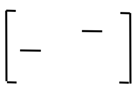
In this study, I will be discussing only two of the four underlying melody patterns that I have found for monomorphemic nouns, as limitations in length do not allow me to adequately discuss all four. The two addressed below are the most common tone patterns. They result in four separate phonetic outputs, depending on the features of the consonants involved. One of the tonal melodies that remains unconsidered (L.LH) appears to be the corollary to the Ewe nouns that are referred to by Ansre (1961) and Clements (1978) as having high tone suffixes.

The following are the most common paradigms for monomorphemic nouns of the V.C(C)V type. In (3) and in all subsequent examples, [°] denotes a non-falling utterance-final low tone.

(3) Nouns of the V.C(C)V type

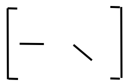
Voiceless obstruent, sonorant or /ɖ/ onset

a.



/L.H/
[òtú] 'gun'
[àɖí] 'soap'
[ònṹ] 'thing'
[òw̃ĩ́] 'bee'

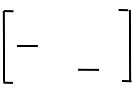
b.



/L.L/
[òkầ] 'cord'
[àɖì] 'anger'
[òɲĩ̀] 'cow'
[òwlɔ̀] 'chain'

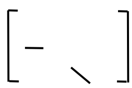
Voiced obstruent onset

c.



/L.H/
[ò↓gbò°] 'eggplant' [2]
[à↓dầ°] 'corn porridge'

d.



/L.L/
[ò↓dầ] 'snake'
[à↓dɔ̃̀] 'sickness'

In all of the nouns in (3), the initial vowel is pronounced at roughly the same pitch. In order to explain these phonetic realizations, I propose the following assertions to be true for Saxwe. For the moment, I list them briefly; they will be expanded on in the course of this study.

a. The noun prefix is underlyingly low.
b. There is low-tone spread (hereafter L spread), which is conditioned by voiced obstruents. Here, we observe that L tone spreads across a voiced obstruent onset onto the following tone-bearing unit (TBU), delinking the H tone associated with that TBU.

(4) Proposed rule (a) of L spread

L H
μ μ
V DV (Where D is a voiced obstruent.)

c. Every L tone linked to a TBU and preceded by a voiced obstruent will become a downstepped L whose pitch is lower than that of the preceding L.
d. A prepausal L is realized with a falling pitch.

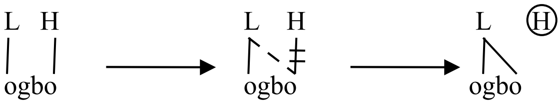
These assertions help to explain the variations seen in (3). Looking first at the words in (3a) and (3b) containing voiceless obstruents and sonorants, one does not see anything very surprising. In [*òtú*] 'gun', the second TBU is realized at a higher pitch than the first. This is what one would expect for a L-H sequence. In [*òkầ*] 'cord', the second TBU begins at the same pitch level as the first and then falls. That the two syllables begin at the same pitch is to be expected, since both are linked to the same L tone. The falling pitch of those words in (3b) is due to the fact that prepausal L tones are realized with a falling pitch.

I turn now to the words that contain voiced obstruents. In (3c) [*ò ↓gbò°*] 'eggplant', L spread causes the L tone of the prefix to be spread across the voiced obstruent, dissociating the H. Because it

[2] The tonal melody in (3c) is occasionally realized with a slight rising tone, particularly in slow speech. This variation can occur within utterances produced by an individual speaker.

follows a voiced obstruent, this L now linked to the second TBU is realized as a downstepped tone which is lower than that of the preceding L.[3] The dissociated H remains floating at the end of the word, as evidenced by the fact that there is no drifting down of pitch prepausally.

(5) Derivation of /ògbó/ 'eggplant' → [ò↓gbò°]



This proposal for the underlying tones of /*ògbó*/ finds support in two observations. One is the fact that the tonal melody in (5) is occasionally realized with a slight rising tone. This is most likely to happen in slow, deliberate speech. Second, there is also the fact that in certain compounds, the underlying H tone can surface with a rising or high surface pitch. This is true for the diminutive suffix /*-ví*/ which comes from /*òví*/ 'child'.

(6) Evidence from the diminutive suffix /–ví/

a.	/òví/ → [ò↓vì°]	'child'
b.	/òɦṹ/ → [ò↓ɦũ̀°]	'car'
	/òɦṹ + ví/ → [ò↓ɦũ̀vǐ]	'toy car'
c.	/òsɔ́/→ [òsɔ́]	'horse'
	/òsɔ́ + ví/ → [òsɔ́ví]	'foal'

Returning again to the forms in (3), in [*òdã̀*] 'snake' (3d), the two TBUs are linked to a single L tone. Once again, because in the second syllable the L is linked to a TBU that follows a voiced obstruent, this syllable becomes downstepped relative to the first syllable. The pitch of this final L is falling before a pause.

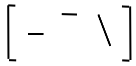
(7) Underlying form of /òdã̀/ 'snake' → [ò↓dã̀]

In order to show further evidence in support of the underlying tones that have been posited for these nouns, I turn now to what happens when these four noun tone paradigms are followed by a L tone morpheme.

[3] It is not within the scope of this paper to adequately describe the feature geometry behind the downstepping of a L tone linked to a TBU which has a voiced obstruent onset. One explanation that I intend to explore in a future work is that a voiced obstruent may generate a L tone which becomes associated to the tonal root node of the following TBU in the event that this TBU is not specified as having a H tone linked to it. This would yield the downstepped L structure as described in Hyman (1993), with one L associated to the tonal node and a second L associated to the tonal root node of the same TBU. The two TBUs in [*ò↓gbò°*] would then differ from each other structurally in that the first would have one L linked at the tonal node while the second would have both a L linked at the tonal node and a L linked at the tonal root node.

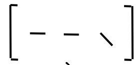
(8) V.C(C)V nouns followed by L tone verb /sè/ 'hear'

a.



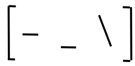
/òtú sè/ → [òtú sê]
gun hear(PERF)
'A gun heard.'

b.



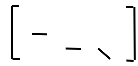
/òkã̀ sè/ → [òkã̀ sè]
cord hear(PERF)
'A cord heard.'

c.



/ògbó sè/ → [òꜜgbò sê]
eggplant hear(PERF)
'An eggplant heard.'

d.

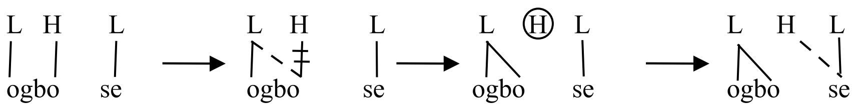


/òdã̀ sè/ → [òꜜdã̀ sè]
snake hear(PERF)
'A snake heard.'

In (8a), the third TBU [*sê*] is pronounced with a H-L fall. This is due to high spread, a phenomenon that will be discussed in section 4. The surface form [*òkã̀ sè*] of (8b) supports the assertion that the slight fall previously observed on the second TBU of the isolation form [*òkã̀*] in (3b) was a result of its being at the end of the phrase. Once it is no longer phrase-final, the falling pitch is no longer observed on [*òkã̀*]. It appears instead on the following TBU [*sè*], which is now the phrase-final L tone.

The first two syllables in (8c) and (8d) are pronounced alike. The third TBU in (8d) [*òꜜdã̀ sè*] has a L tone which starts at the same level as the immediately preceding TBU and, being prepausal, falls slightly from there. However, the third tone in example (8c) [*òꜜgbò sê*] starts high and falls low, with a steeper drop in pitch than is observed for the verb /*sè*/ in [*òꜜdã̀ sè*]. This is a true contour tone, where the dissociated H tone from the second TBU of /*ògbó*/ is linked to the following TBU, creating a H-L sequence. In (9), the structural derivation of [*òꜜgbò sê*] is shown.

(9) Derivation of /ògbó sè/ 'An eggplant heard.'



In the next sections, I provide additional support for the claims regarding underlying forms made above and explore further the specifics of how consonants interact with tone phenomena in Saxwe.

4. H spread

In addition to L spread, there is also high tone spread (hereafter H spread) in Saxwe. The following sentences in (10) and (11) exclusively contain either voiceless obstruents or sonorants. The only high tones present are supplied by the demonstrative /*xé*/ 'this'. In (10), the underlying tones of the morphemes are established. In (11), we see an example of H spread.

(10) Surface realization of underlying tones in the absence of tonal spread

a. /òkã̀ tʃì àkpò/ → [òkã̀ tʃì àkpò]
cord sew(PERF) pocket
'A cord sewed a pocket.'

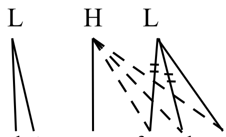
b. /òkã̀ tʃì àkpò **xé**/ → [òkã̀ tʃì àkpò xé]
cord sew(PERF) pocket DEM
'A cord sewed this pocket.'

(11) Rightward H spread across voiceless obstruents

/òkã̀ **xé** tʃì àkpò/ → [òkã̀ xé tʃí ákpô]
cord DEM sew(PERF) pocket
'This cord sewed a pocket.'

In example (11), H spread is shown to be a rightward, iterative process which continues until the end of the sentence. When H spread reaches the end of the sentence [*òkã̀ xé tʃí ákpô*], the final underlying L does not end up completely dissociated from the last TBU. Rather, H spread results here in a falling tone. This is likely due to a constraint that prohibits leaving a floating L tone unattached at the end of the sentence. In (12) we see the underlying and final representations of this sentence.

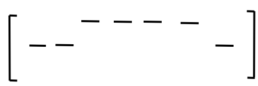
(12) H spread across a sequence of Ls



okã xe tʃi akpo
cord DEM sew(PERF) pocket

Example (13) illustrates what occurs when a second underlying high tone is place at the end of the this sequence of underlying low tones which have been affected by H spread.

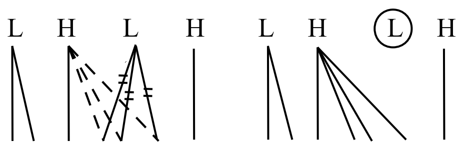
(13) Downstep due to H spread



/òkã̀ **xé** tʃì àkpò **xé**/ → [òkã̀ xé tʃí ákpó ꜜxé]
cord DEM sew(PERF) pocket DEM
'This cord sewed this pocket.'

Here in [*òkã̀ xé tʃí ákpó ꜜxé*], H spread stops when a second underlying H tone is reached. This second underlying H in the sentence becomes downstepped and is produced at the pitch level of the initial L. This is an example of downstep (also called non-automatic downstep) of a H tone in the presence of a floating L – a phenomenon that is fairly common in African languages (Hyman 1993; Yip 2002). The derivation process is depicted for [*òkã̀ xé tʃí ákpó ꜜxé*] in (14).

(14) Derivation of the process that results in downstep due to H spread



okã xe tʃi akpo xe → okã xe tʃi akpo xe
cord DEM sew(PERF) pocket DEM

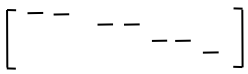
Sonorants are also permeable to H spread. Example (15b) shows an occurrence of the same process as that in (14). Here, however, the high spread occurs across sonorants rather than voiceless obstruents.

(15) Evidence of rightward H spread across sonorants

a.	/àlɔ̀ ɲã̀ àwù/ → [àlɔ̀ ɲã̀ àwù]	b.	/àlɔ̀ **xé** ɲã̀ àwù **xé**/ → [àlɔ̀ xé ɲã́ áwú ꜜxé]
	hand wash(PERF) shirt		hand DEM wash(PERF) shirt DEM
	‘A hand washed a shirt.’		‘This hand washed this shirt.’

When a H tone is downstepped due to H spread, this downstep has a global lowering effect on all subsequent tones. As evidence of the global lowering of all pitch levels following the downstepping of H tone, (16) shows what occurs when one strings together a series of alternating H and L underlying tones in a sentence that does not include any voiced obstruents.

(16) Recursive downstepping of H tone across an alternating series of /H/ and /L/ tones

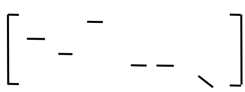


/é jì kpɔ̃́ òtĩ́ àtṹ/ → [é jí ꜜkpɔ̃́ óꜜtĩ́ áꜜtṹ]
3SG go(PERF) see tree five
‘He went to see five trees.’

In (16), each underlying H tone spreads onto the following L-toned TBU. The L tone on that TBU is dissociated; however, its continued presence as a floating L causes the following H tone to be downstepped. This process occurs across each H-L sequence, with the result being a recursive lowering of the pitch level.

I turn now to sentences that contain voiced obstruents. In (17), we see that voiced obstruents block H spread.

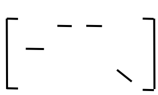
(17) Blocking of H spread across voiced obstruents



/ògã̀ **xé** gbò òdã̀/ → [òꜜgã̀ xé gbò ò ꜜdã̀]
iron DEM cut(PERF) snake
‘This iron cut a snake.’

It is useful to see what happens when a H tone is followed by two underlying L tones, the first of which does not follow a voiced obstruent and the second of which does. In (18), a single underlying H is followed by two underlying L tones.

(18) Further data regarding the blocking of H spread across a voiced obstruent



/ònṹ wà vɔ̀/ → [ònṹ wá ꜜvɔ̀]
thing do(PERF) finish
‘A thing did it already.’

Here, H tone spreads across a sonorant onto the L-toned TBU of the verb */wà/* ‘do’, causing it to be realized with a high pitch. The spread is then blocked by the voiced obstruent in */vɔ̀/* and the final underlying L is realized with a low pitch.

Because voiced obstruents block H spread, there is a two-way divide of observed downstepping-type phenomena. Voiceless obstruents and sonorants are permeable to H spread; this can create a situation where one observes a classical downstepped H following a floating L. This type of downstepped H, however, will never be seen following a voiced obstruent because voiced obstruents block H spread. Conversely, one will never observe in words that contain voiceless obstruents or sonorants the downstepped L that results when L is linked to a TBU following a voiced obstruent.

A few more examples will help to round out what can be said about H spread.

(19) More examples involving H spread

a. /é **kpɔ̃́** òkã̀/ → [é kpɔ̃́ ókã̂]
3SG see(PERF) cord

b. /é **gbɛ́** òkã̀/ → [é gbɛ́ ókã̂]
3SG refuse(PERF) cord

c. /é **tʃì** òkã̀/ → [é tʃí ókã̂]
3SG sew(PERF) cord

d. /é **gbò** òkã̀/ → [é gbò òkã̀]
3SG cut(PERF) cord

In (19a) and (19c), /*é kpɔ̃́ òkã̀*/ and /*é tʃì òkã̀*/ have surface realizations easily predicted after the previous discussion of H spread. Example (19b) brings something new to the picture. In the sentence [*é gbɛ́ ókã̂*], we see that the H which initiates H spread can be linked to any type of TBU, not only those with voiceless obstruent or sonorant onsets. So while H spread cannot cross a voiced obstruent, it can begin with a H linked to a TBU which follows a voiced obstruent.

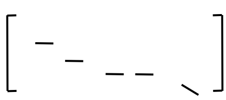
In summary, H spread is the spread of any H tone to the right in an iterative fashion until another H tone is reached or until the H spread is blocked by a voiced obstruent. A floating L delinked by the process of H spread causes a following H tone to be downstepped. Sonorants pattern with voiceless obstruents in being permeable to H spread.

5. Lowering of a L tone whose TBU follows a voiced obstruent

In section 3.2, I proposed that any L tone linked to a TBU which follows a voiced obstruent will become a downstepped low whose pitch is lower than that of the preceding L. More examples of this phenomenon are in (20).

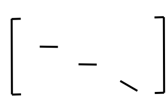
(20) Examples of downstepped Ls

a.



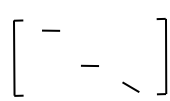
/ògã̀ gbò òdã̀/ → [òꜜgã̀ ꜜgbò òꜜdã̀]
iron cut(PERF) snake
'An iron cut a snake.'

b.



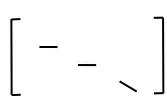
/ò **gbò** vɔ̀/ → [ò ꜜgbò ꜜvɔ̀]
2SG cut(PERF) finish
'You already cut.'

d.



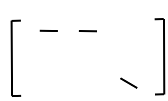
/é **gbò** vɔ̀/ → [é gbò ꜜvɔ̀]
3SG cut(PERF) finish
'He already cut.'

c.



/ò **gbɛ́** vɔ̀/ → [ò ꜜgbɛ̀ ꜜvɔ̀]
2SG refuse(PERF) finish
'You already refused.'

e.

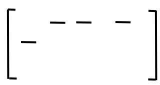


/é **gbɛ́** vɔ̀/ → [é gbɛ́ ꜜvɔ̀]
3SG refuse(PERF) finish
'He already refused.'

Example (20a) [*òꜜgà̃ ꜜgbò òꜜdà̃*] has a sequence of five L tones produced at four different levels. This downstepping pattern is also seen in (20b) [*ò ꜜgbò ꜜvɔ̀*] and (20c) [*ò ꜜgbɛ̀ ꜜvɔ̀*]. Rule (a) of L spread discussed earlier in section 3.2 accounts for the realization of the high-toned verb /*gbɛ́*/ with a surface L tone in (20c) /*ò gbɛ́ vɔ̀*/ → [*ò ꜜgbɛ̀ ꜜvɔ̀*].

Having seen the lowering of L tones following voiced obstruents, it is natural to wonder whether a H tone linked to a TBU which follows a voiced obstruent might not also be downstepped – whether voiced obstruents condition this downstepping process for all tone. However, in (20e) [*é gbɛ́ vɔ̀*], we see a surface H-H sequence where the second H tone is linked to a TBU which follows a voiced obstruent. This second H is not downstepped relative to the preceding H, leading us to conclude that the mere presence of a voiced obstruent does not affect H tone. Further evidence of this is found in (21), where the pitch in a series of H tones is not affected by the presence of voiced obstruents in the utterance.

(21) H tone not lowered as a result of the presence of a voiced obstruent

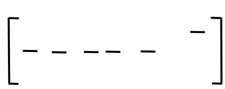


/ònṹ vá gbɛ́/ → [ònṹ vá gbɛ́]
thing come/eventually refuse(PERF)
'A thing eventually refused.'

In order to be labeled as downstep and not just a localized pitch drop, the lowering that occurs to L tones following a voiced obstruent needs to be shown to have a lowering effect on subsequent tones in an utterance. In (22a) below, the single underlying H tone follows a L-toned sequence of TBUs, none of which are preceded by voiced obstruents. In (22b), there is again a single underlying H tone. This time it follows a L-toned sequence of TBUs of which three are preceded by voiced obstruents.

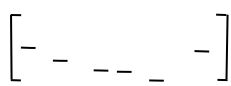
(22) Comparison of the pitch levels of the first /H/ in each of two utterances

a.



/òkà̃ tʃì àkpò kpɔ̃́/ → [òkà̃ tʃì àkpò kpɔ̃́]
cord sew(PERF) pocket see
'A cord sewed a pocket once.'

b.



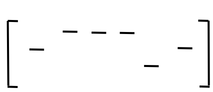
/òzò ɦù òɦà kpɔ̃́/ → [òꜜzò ꜜɦù òꜜɦà kpɔ̃́]
fire kill(PERF) pig see
'A fire killed a pig once.'

We see in (22a) a series of TBUs that remain at the same level pitch followed by a single higher pitch. In (22b), the utterance-final underlying H tone is produced at a pitch either at or just slightly below the level of that of the initial L-toned TBU. The lowering of the underlying H tone is attributed to the presence of three voiced obstruents.

The following example contains two utterances which offer a comparison of the drop between two H tones depending on the number of intervening Ls with voiced obstruent onsets. In (23a), there is a single intervening L-toned TBU with a voiced obstruent onset. In (23b), there are three intervening L-toned TBUs with voiced obstruent onsets.

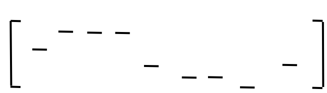
(23) Relation of pitch drop to number of intervening voiced obstruents

a.



/òtú wé òzò xɛ̃́/ → [òtú wé óꜜzò xɛ̃́]
gun AM fire this_is
'This is a gun's fire.'

b.



/òtú wé òzò ɦù òɦà kpɔ̃́/ → [òtú wé óꜜzò ꜜɦù òꜜɦà kpɔ̃́]
gun AM fire kill(PERF) pig see
'A gun's fire killed a pig once.'

Both utterances have H spread; the H linked to the associative marker /*wé*/ spreads onto the first TBU of /*òzò*/ 'fire'. Also in both utterances, the L on the second TBU of /*òzò*/ 'fire' is produced on a lower register than the initial L of the utterance. The utterance-final H of /*xɛ̃́*/ in (23a) is produced at the pitch level of the initial L of the utterance, giving a pattern of downdrift.

In (23b), the presence of three intervening voiced obstruents between the H of /*wé*/ and the utterance-final H of /*kpɔ̃́*/ results in the latter being produced at a lower pitch than the utterance-final H in (23a). In this case, the utterance-final H is produced at about the same pitch level as the L of the second TBU of /*òzò*/ 'fire'.[4]

One would like to be able to compare a H-L-H interval such as appears at the end of (23a) above with a H-L-H interval where the L is linked to a TBU which follows a voiceless obstruent. It would be very interesting to see whether downdrift would occur in the latter case. Unfortunately, H spread prevents there from being surface H-L-H intervals in these conditions; rather, H spread gives a phonetic realization of H-H-ꜜH.

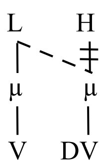
The notion of a process of downstep conditioned by consonantal features is not unprecedented. Hyman and Schuh (1974) cite observations by Welmers and Welmers (1968) that in some dialects of Igbo, it seems that H-H sequences which involve the intervocalic voiced consonant /g/ systematically become H-downstepped H sequences.

To summarize, voiced obstruents condition the downstep of a L tone. They do not, however, have a similar effect on H tones. It would be useful in a further study to explore whether there are any phonological boundaries or grammatical structures which might have some influence on this process of downstep.

6. Low spread

A rule describing L spread has already been proposed in section 3.2. This rule is reproduced here in (24) for ease of reference.

(24) Proposed rule (a) of L spread



(Where D is a voiced obstruent.)

To summarize this rule (labeled (a) here in anticipation of there being a second rule of L spread), L spread is a one-time rightward spreading of low tone across a voiced obstruent. The word /*ògbó*/ 'eggplant' in (5) first illustrated this process of L spread; the L tone on the initial vowel spreads to give [*ò*ꜜ*gbò*°].

Voiceless obstruents block L spread, as seen in the following examples.

(25) Nouns followed by H-tone verb /kpɔ̃́/ 'see'

a.	/òtú/ → [òtú] 'gun'	/òtú kpɔ̃́/ → [òtú kpɔ̃́] 'A gun saw.'
b.	/òkã̀/ → [òkã̀] 'cord'	/òkã̀ kpɔ̃́/ → [òkã̀ kpɔ̃́] 'A cord saw.'
c.	/ògbó/ → [òꜜgbò°] 'eggplant'	/ògbó kpɔ̃́/ → [òꜜgbò kpɔ̃́] 'An eggplant saw.'
d.	/òdã̀/ → [òꜜdã̀] 'snake'	/òdã̀ kpɔ̃́/ → [òꜜdã̀ kpɔ̃́] 'A snake saw.'

[4] Note, however, that the difference between the initial and final H pitches in (23b) does not seem to be three times the difference between the initial and final H pitches in (23a). It would be useful to continue researching this apparent decrease in register-lowering amplitude that one observes as the number of voiced obstruents increases. It is possible that as the speaker reaches the bottom limit of his or her pitch range, the downstepping effect of voiced obstruents is flattened.

These pitch patterns in (25) can be compared with what happens when these same nouns are followed by another H-tone verb which has a voiced obstruent onset.

(26) Nouns followed by H-tone verb /gbɛ́/ ‘refuse’

a.	/òtú/ → [òtú] ‘gun’	/òtú gbɛ́/ → [òtú gbɛ́] ‘A gun refused.’
b.	/òkȁ/ → [òkȁ] ‘cord’	/òkȁ gbɛ́/ → [òkȁ ꜜgbɛ̀°] ‘A cord refused.’
c.	/ògbó/ → [òꜜgbò°] ‘eggplant’	/ògbó gbɛ́/ → [òꜜgbò gbɛ̌] ‘An eggplant refused.’
d.	/òdȁ/ → [òꜜdȁ] ‘snake’	/òdȁ gbɛ́/ → [òꜜdȁ ꜜgbɛ°] ‘A snake refused.’

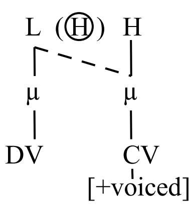
We see in (26b) that the L tone of */òkȁ/* ‘cord’ spreads to the verb */gbɛ́/* ‘refuse’, which is then realized as a downstepped L. However, the presence of the dissociated floating H tone at the end of the phrase keeps the L from having a falling pitch phrase-finally. The same thing occurs with */òdȁ/* ‘snake’ in (26d). In (26c), the L from the prefix spreads to the following TBU, giving *[òꜜgbò°]* as the surface form of */ògbó/* ‘eggplant’. Following this, however, the low continues to spread onto the next TBU without detaching the associated H from that TBU, yielding an output of *[òꜜgbò gbɛ̌]* ‘An eggplant refused’. (This same pattern was seen in (6b) *[òꜜɦȕvǐ]* ‘toy car’, although it was not addressed at the time.) These data points seem to require the formalization of a second rule of L spread. Before formalizing such a rule, however, it is helpful to see what happens when the same set of nouns is followed by a H-tone verb that begins with a sonorant.

(27) Nouns followed by H-tone verb /jɔ́/ ‘call’

a.	/òtú/ → [òtú] ‘gun’	/òtú jɔ́/ → [òtú jɔ́] ‘A gun called.’
b.	/òkȁ/ → [òkȁ] ‘cord’	/òkȁ jɔ́/ → [òkȁ jɔ́] ‘A cord called.’
c.	/ògbó/ → [òꜜgbò°] ‘eggplant’	/ògbó jɔ́/ → [òꜜgbò jɔ̌] ‘An eggplant called.’
d.	/òdȁ/ → [òꜜdȁ] ‘snake’	/òdȁ jɔ́/ → [òꜜdȁ jɔ̌] ‘A snake called.’

There is no spread of the L tone in (27b) */òkȁ/* onto the following verb */jɔ́/* ‘call’. (Recall also that in the noun tone melodies involving sonorants shown in (3a), */ònű/* ‘thing’ was realized *[ònű]* – without evidence of L spread.) However, in both (27c) and (27d) where a downstepped L precedes the verb */jɔ́/*, this latter is realized with a rising tone. These data points can be examined together with (26c) *[òꜜgbò gbɛ̌]* to create a generalized rule (b) of L spread.

(28) Proposed rule (b) of L spread



(Where D is a voiced obstruent.)

This rule states that a L tone preceded by a voiced obstruent spreads across any voiced consonant onto the following TBU without delinking the attached H tone. This happens whether or not there is an intervening floating H between the two TBUs.[5] In order to correctly predict the output *[òꜜgbò gbɛ̌]* in (26c), rule (a) of L spread must take precedence over this rule in ordering or ranking. Otherwise one would predict incorrectly that the output of */ògbó/* would be *[ògbǒ]* and the environment that might allow L to continue spreading onto the third TBU of */ògbó gbɛ́/* would no longer exist.

5 There are interesting similarities between this rule and the rule of L docking for the singular imperative formalized earlier in (2).

My data include two types of constructions involving sonorants where rule (b) of L spread above does not apply for a L-H tone sequence. One of these constructions is when these words are followed by the article /*lá*/, which roughly translated means ‘in question’.

(29) Nouns followed by H-tone article /lá/ ‘in question’

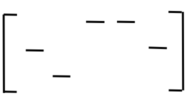
a.	/òtú/ → [òtú] ‘gun’	/òtú lá/ → [òtú lá] ‘gun in question’
b.	/òkã̀/ → [òkã̀] ‘cord’	/òkã̀ lá/ → [òkã̀ lá] ‘cord in question’
c.	/ògbó/ → [ò↓gbò°] ‘eggplant’	/ògbó lá/ → [ò↓gbò lá] ‘eggplant in question’
d.	/òdã̀/ → [ò↓dã̀] ‘snake’	/òdã̀ lá/ → [ò↓dã̀ là°] ‘snake in question’

The surface forms of (29a) /*òtú lá*/ and (29b) /*òkã̀ lá*/ are both predictable given the underlying forms. However, the surface forms seen in (29c) and (29d) are unlike those that that are seen when these same nouns are followed by the H-tone verb /*jɔ́*/ ‘call’. In the first place, there is generally no rising tone on the article /*lá*/.[6] More significantly, in the case of (29d) [*ò↓dã̀ là°*], the article /*lá*/ is realized L with a non-falling pitch at the end of the phrase.

The reasons for this apparent anomaly are not fully clear yet. One hypothesis is that the article /*la*/ is underlyingly toneless and receives H tone by default except in the case of /*òdã̀*/ where the presence of a downstepped L not followed by a floating H tone causes /*la*/ to be realized with a L tone. This hypothesis fails to account for the lack of falling pitch on the phrase-final TBU in [*ò↓dã̀ là°*]. A second hypothesis also assumes that the article /*la*/ is underlyingly toneless. In this hypothesis, the combination of noun+/*la*/ forms a single phonological word that has a floating H tone at its right boundary.[7] This floating H tone becomes associated to the /*la*/ morpheme in all cases except that of [*ò↓dã̀*], where spread of the downstepped L tone causes the /*la*/ morpheme to be realized with a low tone. The continuing presence of the floating H tone at the right boundary of this phonological word would explain the lack of falling pitch phrase-finally on [*ò↓dã̀ là°*].[8]

There is a second type of construction involving sonorants where rule (b) of L spread does not apply for a L-H tone sequence. In (30) below, the morpheme /*wé*/ is an associative marker.

(30) Example of L spread failing to occur



/òdã̀ wé ònṹ/ → [ò↓dã̀ wé ó↓nṹ]   snake AM thing ‘snake’s thing’

In (30), the L tone of /*òdã̀*/ ‘snake’ does not spread onto the TBU of the associative marker. It is possible that the associative marker /*wé*/ introduces a grammatical boundary across which L spread is unable to operate. The collection of more data will help clarify the question of how L spread is limited by phonological or grammatical boundaries.

Voiced obstruents clearly play a significant role in both types of processes of L spread depicted in the rules shown in (24) and (28). In rule (a) in (24), L tone spreads across a voiced obstruent to the following TBU. In rule (b) in (28), a L tone will spread (although without dissociation of H tone) across a voiced consonant only if that L tone follows a voiced obstruent.

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[6] The final high tone of [*ò↓gbò lá*] is occasionally produced with a rising tone rather than a level high. This variation can occur in utterances produced by a single speaker.

[7] There is evidence that a floating H exists on the right boundary of other polymorphemic phonological words that fill the slot of a noun phrase. For example, the gerund, which involves verb reduplication, always ends on a non-falling pitch phrase-finally even when the verb being reduplicated is L.

[8] This hypothesis finds some support in the observation that newly-literate speakers of the language sometimes write the noun+/*la*/ combination as one word.

7. Summary

In this study, I have made the claim that Saxwe has two underlying tonemes: high (H) and low (L). I looked first at how these tones are realized in the singular imperative form of the verb. The singular imperative morpheme is a floating L. For underlying L-tone verbs, the surface realization is always a L tone with a falling pitch. This falling pitch is consistently observed for prepausal L tones. For underlying H tone verbs, the surface realization depends on whether docking of the floating L is allowed or disallowed. A H-tone verb with either a voiced obstruent or a sonorant in its onset allows for docking of the L, resulting in a surface rising tone. Voiceless obstruents, however, block the docking of the floating L, and verbs containing these sounds are realized H. With reference to docking, therefore, sonorants pattern with voiced obstruents in being permeable to the docking of a floating L, while voiceless obstruents block this docking.

Next, I looked at two underlying tone melodies for V.C(C)V nouns - /L.H/ and /L.L/. The underlying tone of the initial prefix vowel was posited to be /L/. These two underlying tone melodies yielded four surface melodies.

In order to explain these and other patterns, I described the phenomenon of downstepped Ls, as well as the processes of H and L spread. It was shown that voiced obstruents condition the downstep of L tone. A L linked to a TBU which follows a voiced obstruent is realized at a pitch level lower than that of the preceding L. With regard to this process, sonorants pattern with voiceless obstruents in that they do not have this effect on L tones.

H spread was described as the iterative rightward spread of any H tone until another H tone is reached. H spread is blocked by voiced obstruents. Sonorants pattern with voiceless obstruents in being permeable to H spread.

In looking at L spread, I found two types of one-time rightward spread of L tone: 1) spread of a L tone across a voiced obstruent, and 2) partial spread (without delinking of the H tone) of a downstepped L tone to the following TBU when the intervocalic consonant is voiced. Here, sonorants are permeable to only the second type of L spread. The limiting of L spread by phonological or grammatical boundaries needs to be explored more.

The table in (31) summarizes the consonant-tone interactions that have been explored in this study.

(31)

	Voiced obstruents	**Sonorants**	**Voiceless obstruents**
Allow docking of floating L	Yes	Yes	No
Condition downstepping of Ls	Yes	No	No
Permeable to non-downstepped L spread	Yes	No	No
Permeable to partial spread of a downstepped L	Yes	Yes	No
Permeable to H spread	No	Yes	Yes

8. Conclusions

Consonant-tone interaction plays a significant role in the phonology of Saxwe. In every process examined in this study where consonants affect tone, voiced obstruents play a role which is opposite that of voiceless obstruents. Sonorants, however, pattern sometimes with voiced obstruents and sometimes with voiceless obstruents.

The outstanding characteristic of voiced obstruents seems to be the fact that they condition the downstep of a L tone. The fact that they are not permeable to H spread may be related to this characteristic, rather than to their quality of being voiced (since sonorants, also voiced, *are* permeable to H spread).

Sonorants alternate in their alignment with regard to tone phenomena. On the one hand, they allow docking of floating Ls and are permeable to the partial spread of downstepped L tones to create a surface rising tone. On the other hand, they fail to be permeable to the spread of non-downstepped L tones and are instead permeable to the spread of H tone. The reasons for this patterning and the questions it might provoke regarding the underspecification of certain features would be an interesting topic for further study.

More broadly, one could investigate what kind of theoretical approach for representing tone might be used in trying to account for the Saxwe data, focusing specifically on the feature geometry that best explains the observed patterns. The Saxwe data require an approach that can account for the fact that a sequence of multiple syllables containing voiced obstruents can condition a string of downstepped low tones, each lower than the previous; this implies an interpretation of tonal register that is defined relatively.

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