Tone in Saxwe

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6 The features of H, M, and L

This chapter discusses how the atomic units H, M, and L described thus far can more profitably be understood by assigning tonal features to these units. Although it has been questioned whether there is value in a universal feature model for tone (Clements et al., 2010; Hyman, 2010), I argue in this chapter that a feature model of tone is very useful in explaining the assymetries that exist in the Saxwe tonal system. This chapter also serves as a preface to chapter 7, in which the details of the phonetic implementation of tone are examined in light of this feature model of Saxwe tone.

6.1 Background – the Two-Feature model and underspecification

The predominant feature model for tone is that of Yip (1980, 1989) and Clements (1981), often referred to as the Two-Feature Model. In this model, the TBU dominates a prosodic level that describes register, described as either [+upper] or [-upper]. Each of [+upper] and [-upper] is in turn subdivided into [+raised] and [-raised] (the latter terminology introduced by Pulleyblank (1986)). This results in four hierarchically related tone levels.

(388)

[+upper]	[+raised]
	[-raised]
[-upper]	[+raised]
	[-raised]

Tone designations such as H, M, and L are assigned positions with repect to this hierarchy. Different sets of labels have been given to these four levels: {high, mid, lower mid, and low} (Hyman, 2011a), and {super-high, high, mid, and low} (Clements et al., 2010; Odden, 2010).

(389)

		Hyman (2011a)	Clements et. al. (2010) Odden (2010)
[+upper]	[+raised]	H	super H
	[-raised]	M	H
[-upper]	[+raised]	lower M	M
	[-raised]	L	L

In a three-tone system, there could theoretically be two ways to characterize the M tone. As seen in (389), M could be either [+upper] [-raised], or [-upper] [+raised]—depending perhaps on whether M is seen as having more in common with H or L (Hyman, 2010).

Pulleyblank (1986), using the Two-Feature Model for tone, assigns the features shown in (390) to Yoruba phonetic heights H, M and L. These three phonetic heights are analyzed as being underlying H, Ø, and L. Only the features specified in the first column of (390) are pre-assigned to H and L underlyingly.[103] If no feature is assigned to a given TBU, it is toneless. Default rules supply the features [-upper] and [+raised]. To summarize, for Yoruba H, M and L phonetic heights, H and L are considered to be underspecified, and M is considered to be unspecified.

(390)

	Underlying	**After application of default rules**
H	[+upper]	[+upper, +raised]
M	Ø	[-upper, +raised]
L	[-raised]	[-upper, -raised]

The arguments for claiming that there is 'tonelessness' in Yoruba include the following (Pulleyblank, 1988, 2004).

1. A [M] vowel is easily elided in certain contexts in Yoruba and loss of the vowel does not entail phonetic perturbations to the adjacent H or L tones.
2. The tonal height [M] is associated with optionally epenthetic initial vowels on nouns (and the epenthesis of these vowels presumably does not entail phonetic perturbations to adjacent H and and L tones).
3. There are OCP effects observed with certain H and L affixes, but not with M affixes.
4. Lexical tonal contours in Yoruba do not involve M.

The decision regarding whether to consider that a language's tonal system includes TBUs unspecified for tone is a complex one. Hyman (2001a) and Hyman (2011a) provide several criteria for considering this issue. In general, surface tones may be underlyingly unspecified if they are inactive phonologically. This can be manifested in several ways. For example:

[103] In a subsequent analysis, Pulleyblank (2004) argues against the underspecification account, explaining the asymmetries in tonal behavior instead in terms of markedness and OT-framed constraints.

1. Unspecified tones should not be manipulated in phonological rules such as rules of tone spread, tone shift or tone dissimilation.
2. Morphological rules should not assign a tone which is underlyingly unspecified.
3. Surface tones which are underlyingly unspecified should not appear in tonal contours.
4. A tone which is underlyingly unspecified should not be present as a floating tone.
5. Generally, only tones that are specified underlyingly would have constraints on their position within a prosodic unit.

Given the background of the case for Yoruba, we can turn to the question of how Saxwe tone can be explained using the Two-Feature model and the theory of underspecification.

6.2 Saxwe and the Two-Feature model

There are two questions that need to be answered in a discussion of how to describe Saxwe tone in terms of features. First, there is the question of whether there is a true M in Saxwe, or whether there are instead toneless TBUs. Second, there is the question of which feature combinations might make up the three surface tonal heights H, M, and L, and how these features are specified underlyingly.

I address first the issue of whether there are toneless TBUs in Saxwe. I believe that the most simple and clearly justifiable position one can take is that there is an underlying M. The reasons for this position are given in the paragraphs below. However, I believe that it would also be possible to make a case for there being toneless TBUs in Saxwe, and I give later in this section a brief description of how the analysis of tone might look if this position were taken.

6.2.1 The case for a M analysis

The first argument in favor of a M analysis is that when there is elision of a vowel bearing M tone, any following tones behave in ways which indicate that the M tone is still present as a floating tone (section 4.2). In Yoruba, underlying /rí igbá/ or [rí] + [īgbá] 'see calabash' becomes [rígbá] (Pulleyblank, 1986, p. 109). In a similar context in Saxwe, despite the loss of a word-initial M vowel, there will still be the triggering of non-automatic downstep on a following H TBU (example (391)b) or the simplification of a following underlying LH contour in a manner that delinks the H (example (391)d)—both of which indicate that the M tone is present even though the vowel is elided.

(391)	a.	/kplā̋ ōnū́/	→	[kplā̋ ó↓nū́]	learn something
				or	(lit. learn thing)
	b.		→	[kplā̋ ↓nū́]	
	c.	/kplā̋ ōdă̋/	→	[kplā̋ ódà̋^{R}]	learn a job
				or	(lit. learn work)
	d.		→	[kplā̋ dà̋^{R}]	

By way of comparison, we see that in morphological word formation where a M vowel is elided word-internally and there is simultaneous deletion of the tone as well as the vowel, non-automatic downstep is not triggered on a following H (example (392)b) and a following underlying LH contour is not simplified in a manner that delinks the H, but rather in a manner that delinks the L (example (392)d).

(392)	a.	/kplā̋ ōnū́/	→	[kplā̋ ↓nū́]	learn something
					(lit. learn thing)
	b.	/ādí̱/ + /ōfū́/ $^{H\omega}$	→	[ādí̱-fū́]	soapsuds
					(lit. soap fur)
	c.	/kplā̋ ōdă̋/	→	[kplā̋ dà̋^{R}]	learn a job
					(lit. learn work)
	d.	/ōlṓ/ + /ōvĭ/ $^{H\omega}$	→	[ōlṓ-ví]	baby crocodile
					(lit. crocodile child)

So this is the first argument in favor of M—the fact that a M vowel may be elided either (a) in a way that indicates that the M tone is left floating, or alternatively, (b) in a way that indicates that the M is elided along with the vowel. In the former case, the floating M tone is the single mechanism responsible for two types of tonal phenomena: the triggering of non-automatic downstep and the simplification of an underlying LH contour such that the H tone (rather than the L tone) is delinked. In an analysis that employs tonelessness rather than a M tone, achieving a simple mechanism that explains all of these variations is slightly more complicated. This is explored in section 6.2.2, which addresses also the issues raised in the paragraphs which follow.

The second argument is that there are a few lexical floating M tones which are not word-initial and which are not synchronically the result of the elision of a vowel, although this may have been their origin in a diachronic process (section 3.7.4). Utterance-finally, the presence of the floating M provides the correct environment for the default L% IP boundary to associate to the right edge of the IP (example (393)a). The evidence of the presence of the floating M tone IP-medially is that following these words, H tones are downstepped (example (393)b) and underlying LH contours are simplified by delinking the H (example (393)c).

(393)	/ōklá ^{M}/	[ōklâ]	soul
			sxw-L0018-VCV nouns-soul-un.wav
	/ōklá ^{M} sɔ́/	[ōklá $^{↓}$sɔ́]	The soul left.
			sxw-L0131-clause frames-un.wav
	/ōklá ^{M} vă/	[ōklá và^{R}]	The soul came.
			sxw-L0132-clause frames-un.wav

A third argument in favor of a M analysis is that there is a floating M- tone found at the left edge of any word that has the syntactic role of being the head of a noun phrase (section 4.3) and that does not already have an initial vowel. This M-floating tone is likely a vestigial remnant of a historic noun class-marking system, present on all nouns which are realized without one of the initial vowels /a/, /ɛ/, or /o/—either (a) because they never had an initial vowel, or (b) because the initial vowel has been elided through diachronic processes, or (c) because the initial vowel is elided in synchronic processes (sections 4.4.1 and 4.4.2). Because these initial vowels are normally linked to M tone in Saxwe, it is reasonable to consider that when these initial vowels are elided in synchronic or diachronic sound changes, the tone that is left behind as a floating tone would be M rather than L.

The left floating M- tone on nouns functions in the tonal system just like any other floating M tone, and is the mechanism that triggers two things: the downstep of H tone and the simplification of underlying LH contours by delinking the H. We see it in the following example which involves a noun-noun compound.

(394)	/$^{M-}$jē ^{H}	kpɔ́	$^{M-}$**fí-zɔ̀** ^{Hω}	lē	blɛ́/
	[jē	kpɔ́	$^{↓}$**fí-zɔ̀**	lè	blɛ́/
	3PL	see	ashes-smoke	at	there
	They saw dust there. sxw-L0019-other clauses-un.wav				

The floating M- tone is also present on nominalizations of various kinds, including nouns derived from verbs, as demonstrated in (395) (section 4.4.3).

(395)	/$^{M-}$é	kpɔ́	$^{M-}$**tí-tá** ^{Hω}	lá/
	[é	kpɔ́	$^{↓}$**tí-tá**	lá]
	3SG	see	RED-draw	DEF
	He saw the [one] drawn. sxw-L0077-verb reduplication-un.wav			

This floating tone precedes words of other lexical categories that may fill the syntactic role of head of a noun phrase, as the demonstrative does in (397).

(396)	/$^{M-}$jē ^{H}	kpɔ́	ōtú	xé/
	[jē	kpɔ́	ó$^{↓}$tú	xé/
	3PL	see	gun	DEM
	They saw this gun. sxw-L0002-NP boundary tests-un.wav			

(397) /$^{M-}$ jē ^{H} kpɔ́ $^{M-}$**xé**/
[jē kpɔ́ $^{↓}$**xé**/
3PL see DEM
They saw this [one]. sxw-L0003-NP boundary tests-un.wav

A fourth argument for the M analysis is that there are first and third singular object suffixes that are affixed to verbs in Saxwe and that are represented by a M tone linked to a vowel slot on the segmental tier whose features are underspecified (section 4.6). The 1SG pronominal suffix, for example, is a M suffix specified only as being [back]. The M component of this affix is important, as its presence is the mechanism responsible for three tonal phenomena. The first of these phenomena is that IP-finally, the M tone provides the correct environment for the right $L_{\%}$ IP boundary to associate to the TBU of an underlyingly H verb, creating a surface [HL] pitch fall. This is seen in (398).

(398) /$^{M-}$ é **kó=V̄**[back]/
[é **kô:**]
3SG laugh=1SG
He laughed at me. sxw-L0044-verb plus pronoun-un.wav

When the verb is not utterance-final, as in (399), the M tone triggers either (a) non-automatic downstep on a following H, as shown in (399), or (b) the simplification of a following LH TBU such that the H is delinked.

(399) /$^{M-}$ é kó=V̄[back] fí/
[é kó: $^{↓}$fí]
3SG laugh=1SG now
He laughed at me just now. sxw-L0070-verb plus pronoun-un.wav

A fifth argument in favor of the M analysis is the existence of the grammatical floating M tone that marks imperfective aspect (section 5.1). This floating M may have originated diachronically from the elision of a segmental preverbal auxiliary identical in form to the post-argument imperfective auxiliary which accompanies it. (To my knowledge, Saxwe is unique among the Gbe varieties in having this post-argument marker.) In looking at imperfective preverbal auxiliaries in other Gbe varieties and the post-argument marker in Saxwe, it seems reasonable to assume that a cognate of these in Saxwe would have had M tone prior to the loss of segmental information.

The imperfective floating M tone is the mechanism which triggers two familiar processes: the downstep of following H tones (example (401)) and the simplification of following underlying LH contours by delinking the H (example (403)).

(400) /M- é sɔ́̃/
[é sɔ́̃]
3SG leave
He left.

(401) /M- é **M** sɔ́̃ nɔ̃̄/
[é ↓sɔ́̃ nɔ̂̃]
3SG **IPFV** leave IPFV
He is leaving.
sxw-L0109-auxiliaries-un.wav

(402) /M- é vă/
[é vá]
3SG come
He came.

(403) /M- é **M** vă nɔ̃̄/
[é và nɔ̃̄]
3SG **IPFV** leave IPFV
He is coming.
sxw-L0115-auxiliaries-un.wav

A sixth argument in favor of the M analysis is that fact that there is a floating M at the right edge of many words borrowed from English (section 4.7)—those that do not have a L tone at their right edge. Words which have stress on the final syllable in English are borrowed into Saxwe as having H tone on the final vowel, followed by a floating M tone.

(404) a. /M- sùklú M/ [sùklû] school sxw-L0007-borrowed words-un
b. /M- sìgá M/ [sìgâ] cigarette sxw-L0014-borrowed words-un

Because the rightmost floating tone is non-high, the default right L% boundary associates to the final TBU of the word in isolation as described by the rule of L% association in (94). The combination of having both a H tone and a L% boundary associated to the same TBU creates the surface [HL] falling pitch.

In addition to being the mechanism that provides the correct environment for the association of the default right L% boundary IP-finally, the floating M tone on the right edge of borrowed words is the mechanism that triggers the downstep of a following H tone and the simplification of underlying LH contours by delinking the H.

(405) Evidence of the right floating M on borrowed nouns

/M- é kpɔ́ M- sùklú M lá/ [é kpɔ́ sùklú ↓lá] He saw the school.
sxw-L0058-borrowed words-un

In all of the arguments discussed up to this point, there are three tonal processes (IP-final association of the $L_{\%}$ boundary, non-automatic downstep of H, and the simplification of an underlying LH contour by delinking the H) that all have a single mechanism (the floating M tone) which is responsible for enabling them to occur. In some of these contexts, we see that the floating M tone could be seen as the result of the historical loss of segmental information that was once linked to M tone. A toneless analysis will likely be unable to account for all of these processes in all of these various contexts by a single mechanism. This is explored further in section 6.2.2. First, however, I present two more arguments in favor of the /H, M, L/ analysis.

A further argument in favor of the M analysis is the fact that IP-finally we find both a level [M] surface realization as well as a falling [ML] surface realization. This difference in surface realizations reflects a phonemic reality, which is the presence of a floating H. This could be a lexical floating H tone which is found on some noun tone patterns (sections 3.7.3 and 3.7.7) or the PW boundary H_{ω} tone which is found in constructions like noun-noun compounds which involve a right edge nested $]_{PW}]_{PW}$ structure (section 4.1.2).

The following examples show the difference between the IP-final [M] and [ML] surface realizations at the right edge of the IP when we have different underlying tone patterns. The noun /āmā̰ H/ 'leaf' has a lexical floating H tone at its right edge that prevents the association of the default $L_{\%}$ IP boundary, whereas the noun /ōxɛ̄/ 'bird' has no floating tone. The phonetic details of the implementation of these noun tone patterns are examined more fully in section 7.5.

(406) Utterances containing the /M.M/ and /M.M H/ noun tone patterns

a.	/M- ō xɔ̄ ōxɛ̄/	[ō xɔ̄ ōxɛ̂]	You bought a bird.	sxw-L0208-clause frames-un.wav
b.	/M- ō xɔ̄ āmā̰ H/	[ō xɔ̄ āmā̰°]	You bought leaves.	sxw-L0252-clause frames-un.wav

In the examples below, we see the difference between the IP-final [M] and [ML] surface realizations even though the same lexical form appears at the right edge of two different utterances. The lack of [ML] surface realization in (406)b is due to the presence of the boundary H_{ω} tone which prevents the association of the default $L_{\%}$ IP boundary (section 4.1.2).

(407) Compounds ending with a /M.M/ noun

a.	/ōkā̰/	cord	[ōkā̰]	cord
		sxw-L0259-VCV nouns-rope, cord-un.wav		
b.	/ālḭ̄/ + /ōkā̰/ $^{H\omega}$	waist+cord	[ālḭ̄-kā̰°]	belt
		sxw-L0063-polymorphemic nouns-un.wav		

The fact that M tone is realized IP-finally both with and without a final lowering of pitch as a reflection of phonemic contrasts shows that this lowering of pitch (the [ML] surface realization) is not simply a phonetic phenomenon. The lack of association of an IP-final $L_{\%}$ boundary is influenced by a floating H tone. If one adopts a toneless analysis, one might need to account for why H tone is found lexically floating at the end of a word that has no underlying tones associated to it. One might also need to explain why the association of a $L_{\%}$ boundary to an utterance of toneless TBUs results in a phonetic implementation where there is a [M] realization throughout the utterance up to and including the first part of the realization of the final vowel. The details of the phonetic implementation of M tone utterances are explored more fully in section 7.2.

A final argument in favor of the M analysis is that there are floating L and H tones that signal grammatical differences without the aid of segmental-level information, and these differ in behavior from the grammatical floating M tone. The floating L tones include the negation marker and the imperative (sections 3.6 and 5.2) and the floating H tone marks irrealis modality (section 5.4). Unlike the grammatical floating M tone of the imperfective, these floating L and H tones become associated to a TBU according to the rules of Grammatical tone docking (327)—docking preferentially to the right if the environment permits this, and otherwise to the left. A toneless analysis will need to account for these differences in another manner, and this is explored in section 6.2.2.

As we consider whether what is labeled as M in all of these examples could instead be an unspecified tone, we should recall from section 6.1 that according to Hyman (2001a) and Hyman (2011a), a tone which is underlyingly unspecified should not be present as a floating tone. Moreover, unspecified tones should not be manipulated in phonological rules, nor should morphological rules assign a tone which is underlyingly unspecified.

In the examples given in this section, M in Saxwe is frequently present as a floating tone. This is sometimes the result of a process of synchronic elision. Moreover, there are contrastive cases where either: (1) vowel elision processes include elision of the M tone (at a medial position in noun compounds, for example), or (2) vowel elision processes leave behind a floating M tone. The fact that this contrast can be made is a strong argument against an unspecified analysis.

There are other examples of floating M tones in this section. A floating M can result from diachronic processes of elision, such as in the case of the

imperfective which is marked in part by a floating M in the preverbal position. The floating M- tone is found to the left of a noun when there is no initial vowel. There is also a right floating M on words borrowed from English which do not have a final L.[104] So the types of floating M tones in Saxwe are varied.

We also see that the rules that govern contour simplification as well as the rule that predicts the association of the right $L_{\%}$ IP boundary to the final TBU of an utterance are all sensitive to the conditioning presence or absence of M. This is true whether this M is present as a floating tone or as a tone prelinked to a TBU. This means that M is referenced as a conditioning factor in phonological rules, although it is not itself spread or otherwise manipulated.

Morphological processes should not assign a tone which is underlyingly unspecified. The first and third singular object suffixes in Saxwe are composed of an underspecified vowel with an associated M tone. The presence of this pronominal suffix is perceptible in some cases only because of the effect of the M tone in either: (1) triggering non-automatic downstep, or (2) causing simplification of LH contours to proceed by delinking the H, or (3) permitting the association of the right $L_{\%}$ IP boundary if the suffix is utterance-final.

To summarize, three kinds of tonal interactions are explained in Saxwe by positing the presence of an underlying M, whether linked or floating: (1) the triggering of the non-automatic downstep of H in situations where the M is found between Hs, (2) the simplification of any underlying LH contour which follows the M in such a way that the H tone of the LH countour is delinked, and (3) the association of the right edge $L_{\%}$ boundary in situations where M is the final tone in the IP.

These interactions can be observed in a variety of situations. They are observed most commonly when M tone is underlyingly linked to the TBU of a syllable, but they are also observed in the following cases where a floating M is needed: (1) to the left of any word functioning as a noun which does not have an initial vowel in its lexical form or its surface form, (2) to the right of nouns which have the /M.H ^{M}/ tonal pattern, (3) to the right of borrowed nouns which have surface H on the final TBU, (4) to the right of the verb when 1SG and 3SG pronominal affixes are suffixed, and (5) to the left of a verb which describes an event in the imperfective aspect. These contexts are varied and encompass a variety of lexical word categories, forms that are both monomorphemic and polymorphemic, both lexical and grammatical considerations, and differing placement of the M tone as to whether it appears to the left or to the right of a specific morpheme.

The M analysis is the most straightforward analysis of the middle tonal height in the Saxwe tone system because it permits with a single mechanism to

[104] Words borrowed from other languages were not studied, so I am unable to make any kind of statement about their tonal properties.

explain multiple tonal phenomena, and because its existence is supported by diachronic observations, contrastive comparison with tones that are clearly L, and the phonetic implementation data. However, the toneless analysis is possible given certain assumptions, and I explore those in the following section.

6.2.2 The alternative toneless analysis

The fact that L or H spreads so readily to an adjacent M in Saxwe (section 3.2) could be seen as an indicator that the TBU which has as its phonetic realization M is, to speak anthropomorphically, 'needy' in the sense that it has no features or identity of its own. Thus Saxwe could be said to have a three-way /H, Ø, L/ distinction.

Such an analysis would have to provide a new manner of accounting for the tonal observations described in section 6.2.1. Let us consider a theoretical model in which default feature assignment does not happen within the phonological component. Instead, M is the phonetic height assigned to a TBU which, at the output from the phonology, is not linked to either H or L. A TBU may be realized H or L because of underlying tonal assignment or because of Tonal spread.

In such a system, one must have a means of distinguishing between Hs which are adjacent underlyingly from the beginning of the derivation (between which there is no non-automatic downstep) and Hs which are adjacent only because of Tonal spread (between which there is non-automatic downstep). In such a system, the trigger for non-automatic downstep would not be a floating M tone. Instead, non-automatic downstep would be triggered by the presence of adjacent unmerged Hs in the output from the phonology (Odden, 1982). For this to be the case in Saxwe, an ordered rule of H fusion would be necessary, taking effect before the operation of Tonal spread.

We can show this in the derivations of /oló sɔ́/ 'a crocodile left' and /oló na sɔ́/ 'a crocodile will leave', whose underlying forms are written here in keeping with a toneless analysis. The following would be the derivations.

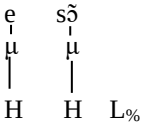
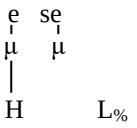
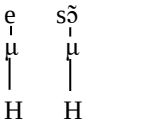
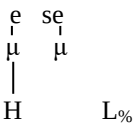
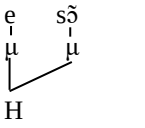
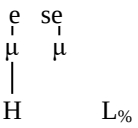
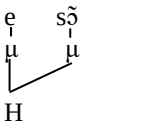
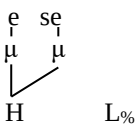
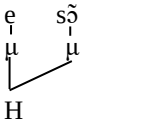
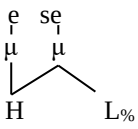
(408)

	olo sɔ̃	olo nã sɔ̃	
a.	μ μ μ | | H H	μ μ μ μ | | H H	Underlying forms
b.	μ μ μ \ | H	μ μ μ μ | | H H	H fusion
c.	μ μ μ \ | H	μ μ μ μ \ | H H	Tonal spread

The resulting surface realizations are [ōló sɔ́̄] 'a crocodile left' and [ōló nā́ ↓sɔ́̄] 'a crocodile will leave'. In this analysis, it is because of the ordering of H fusion and Tonal spread that non-automatic downstep only occurs at a boundary where there are two surface Hs which were not both H underlyingly. Non-automatic downstep of H is explained as a phonetic lowering of F_0 triggered by adjacent unmerged Hs present on the tonal tier at the output from the phonology.

One would also have to account for the difference between an utterance-final H which displays no utterance-final pitch F_0 fall, and an utterance-final H which is only H because of Tonal spread and which is realized with an utterance-final pitch fall because of interaction with the final $L_{\%}$ IP boundary. One possible way to accomplish this would be to delete the right $L_{\%}$ boundary tone when it immediately follows an underlying H. This would be ordered prior to Tonal spread. Then any $L_{\%}$ boundary still present later in the derivation would be associated prior to the output from the phonology. We can see this illustrated below with the sentences /é sɔ́̄/ 'he left' and /é se/ 'he heard'.

(409)

a.			Underlying forms
b.			$L_{\%}$ deletion
c.			Tonal fusion
d.			Tonal spread
e.			$L_{\%}$ association

The resulting surface realizations of the two underlying forms are [é sɔ́] 'he left', and [é sê] 'he heard'. Only the latter has the utterance-final surface [HL] fall because for this utterance, the $L_{\%}$ boundary is not deleted earlier in the derivation, whereas it is deleted in the case of the underlying /é sɔ́/. This analysis assumes that deletion of a boundary tone is a theoretical possibility—or that there is some alternative way to account for the association of the boundary tone being dependent on tonal specification (or its absence) prior to Tonal spread.

Given this background, we can look at how one would explain the tonal interactions that occur at places where, using the M analysis, we would posit the presence of a floating M: (1) to the left of any word functioning as a noun which does not have an initial vowel in its lexical form or its surface form, (2) to the right of nouns which have the /M.H ^{M}/ tonal pattern, (3) to the right of borrowed nouns which have surface H on the final TBU, (4) to the right of the verb when 1SG and 3SG pronominal affixes are suffixed, and (5) to the left of a verb which describes an event in the imperfective aspect.

We can re-examine the analysis of the data in (410), where underlying forms are given here in keeping with the toneless analysis. Here, a vowel segment is lost in a synchronic process of vowel elision in fast speech.

(410)	a.	/kplɑ́ onú/	→	[kplɑ́ ó↓nú]	learn something
				or	(lit. learn thing)
	b.		→	[kplɑ́ ↓nú]	
	c.	/kplɑ́ odǎ/	→	[kplɑ́ ódà^{R}]	learn a job
				or	(lit. learn work)
	d.		→	[kplɑ́ dà^{R}]	

In (410)a, if Tonal fusion is ordered before Tonal spread, this results in having adjacent unmerged Hs in the output from the phonology. This triggers downstep in the phonetic implementation. In (410)c, Contour simplification would be formulated as two ordered rules stating that an underlying LH contour is simplified by deleting the L whenever the contour immediately follows a H TBU; following this, the contour is simplified by delinking the H.

One would still need to account for: (1) the fact that there is downstep in (410)b despite the elision of the toneless vowel [o], and (2) the fact that the LH contour in (410)d is simplified by delinking the H despite the elision of the toneless vowel [o]. To account for these, one might have to either: (1) order Tonal fusion before the process of vowel elision, or (2) employ the notion of a floating toneless TBU. This toneless TBU would be a residual autosegmental anchor for tone left behind after elision of the segmental vowel. Its presence would prevent the fusion of Hs in (410)b and would condition the delinking of H in (410)d. This would be a fairly abstract notion.

Another possible mechanism to account for the observations in (410)b and (410)d would be to posit a phonological boundary inserted to the left of the noun—somewhat like the M- floating tone but not tonal in nature, simply a hindrance to tonal interactions. This phonological boundary would both prevent the fusion of tones and also condition the simplification of a following underlying LH contour such that the H was delinked, regardless of the tonal specification of what preceded the boundary. The prevention of tonal fusion at this type of boundary seems phonologically justifiable, while the simplification of an underlying LH contour in this particular way at this boundary seems less phonologically justifiable.

The notion of such a barrier would help to explain why complex nouns and other words which function as a noun interact with previous tones in manners similar to what we see in (410)b and (410)d even when they do not have an initial vowel.

However, there is still the problem of explaining the failure for the Hs to merge in sentences such as (411), where there is downstep of H to the right of the 3SG suffix; or in (412), where there is downstep of the H tone of the verb in the imperfective aspect; or in (413), where there is downstep of H to the right of the noun /oklá ^{Ø}/ 'soul'.

(411) /M- é kó=V[back] fí/
[é kó: ↓fí]
3SG laugh=1SG now
He laughed at me just now. sxw-L0070-verb plus pronoun-un.wav

(412) /M- é Ø sɔ́ nɔ̃/
[é ↓sɔ́ nɔ̂]
3SG IPFV leave IPFV
He is leaving. sxw-L0109-auxiliaries-un.wav

(413) /oklá Ø sɔ́/ [ōklá ↓sɔ́] A soul left. sxw-L0131-clause frames-un.wav

To explain these cases, one would have to invoke such possibilities as: (1) further phonological boundaries (some of which would seem arbitrary), or (2) a large number of floating toneless TBUs inserted because of lexical or morphosyntactic reasons, or (3) floating L tones which do not associate to a TBU in these contexts, but which do associate to TBUs in other contexts—since the floating Ls of negation and the imperative do associate to TBUs.[105]

There could be a categorical decision made that for every floating M tone that I invoke in this study, a floating L tone would be used instead. This would prevent having to posit the existence of floating M tone, which is typologically rare. There would be several disadvantages to this solution. First, one would have to disregard the diachronic evidence that certain of these floating tones have developed from the loss of syllables which, from comparison with their cognates in other Gbe varieties, would have had M rather than L tone associated to the TBU of the syllable.

Second, one would have multiple paths by which identical tonal phenomena were conditioned. Where segmental information was present, and the tone was neither H nor L, it would be the non-specification of tone on the TBU that would indirectly (in some cases by preventing Tonal fusion) condition effects such as the downstep of H, the association of the L% IP boundary tone, and the simplification of an underlying LH contour such that H is delinked. However, where

[105] It is true that the floating Ls of the imperative and the negation marker occur on the edges of the IP and this might help in making a distinction between floating grammatical Ls which do associate to TBUs and those which do not. However, there are indications that this reflects instead a tendency for the language to avoid having grammatical Ls lexically floating within the IP. There is a preverbal auxiliary marking prohibition which occurs IP-internally and this auxiliary /kâ/ has a HL contour in its lexical underlying form – surfacing always as [HL]. This is an extremely rare tonal assignment on a single TBU (the only other case I am aware of is another preverbal auxiliary /bô/ which marks deontic modality) and may reflect a historic incorporation of the L of negation into an auxiliary form which was formerly H.

segmental-level information was not present and the same tonal phenomena were observed, it might then be a floating L tone which would condition these phenomena. And furthermore, if the notion of phrasal boundaries were also invoked (such as at the left edge of the noun phrase), then this would be a third path that would lead to these same tonal phenomena.

Any combination of these mechanisms introduces complexities into the analysis of the Saxwe tone system and weakens the motivation for the phonological phenomena that are observed. These complexities make the toneless analysis a less desirable alternative to the M analysis. The simplification of the inventory of Saxwe tones by the removal of M does not sufficiently counterbalance the theoretical complexity that would be introduced. It is my conclusion, therefore, that the M analysis is preferable to the toneless analysis.

6.2.3 The features of H, M, and L

Although the M tonal height is not an unspecified TBU, there are clearly asymmetries in the Saxwe tonal system. I believe these asymmetries are best explained when we consider the three atomic tones {H, M, L} in light of the Two-Feature model of tone. In my analysis, all three tones are underspecified underlyingly, but none is absolutely underspecified; all three tones have some underlying featural specification. The following are the surface and underlyingly features of tones in Saxwe.[106]

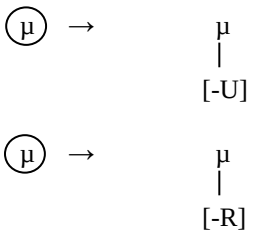
(414)

	Surface	**Underlying**
H	[+upper, -raised]	[+upper]
M	[-upper, +raised]	[+raised]
L	[-upper, -raised]	[-raised]

The following feature fill-in rules apply before the application of tonal rules within the phonology. Here and in all other tonal rules in this chapter, [U] refers to the feature [upper] and [R] refers to the feature [raised].

[106] The description of surface features here is the same as the description in Pulleyblank (1986) of the tone features of Yoruba after default fill-in rules apply.

(415) Feature fill-in rules



These feature fill-in rules state that a TBU unspecified for the feature [upper] will receive a default specification of [-upper]. A TBU unspecified for the feature [raised] will receive a default specification of [-raised].

Inherent in the Two-Feature model of tone is the notion that these features define natural classes of tone (Pulleyblank, 1986; Yip, 2002). In Saxwe, there is much support within the data for the understanding that M and L form a natural class (the class of [-upper] tones) distinct from H ([+upper]).

Preceding a discussion of how M and L form a natural class, it is useful to consider the evolution of the Saxwe tone system. Those who have written about Saxwe history (Kpinso, 2006; Metinhoue, 2006; Pazzi, 1979) claim that there was a historical migration of the Saxwe ancestors from a Yoruboid-speaking area to a Gbe-speaking area (section 1.1). Bearing this in mind, it is likely that the Saxwe system evolved through contact between a three-way {H, Ø, L} system like that of Yoruba (Akinlabi, 1985; Pulleyblank, 1986) where consonant-tone interaction was absent, and a two-way {H, Ø} system like that of Ewe (Ansre, 1961; Clements, 1978; Stahlke, 1971) in which depressor consonants were responsible for a third, surface L tonal height. The discussion of how a two-tone system like Ewe would have been restructured into a phonemic three-tone system is covered in section 3.9. There we see that the historical development of the Saxwe tone system helps to explain why L tone in Saxwe most commonly follows a depressor consonant, why there are relatively few underlying H tones following a depressor consonant, and why there are never underlying M tones following a depressor consonant—the latter fact an indication that there is a neutralization of the contrast between M and L in the environment following a depressor consonant. (In these summary statements, depressor consonants are defined as the set of voiced obstruents excluding /b/ and /ɖ/.)

Looking at this development in terms of features, we can imagine that the Gbe influence on the current Saxwe tone system represented a simple [+upper] *vs.* [-upper] distinction, with phonetic M and L being surface realizations of the [-upper] trait. The Yoruboid influence was responsible for L having the status of a tone in its own right in the current three-tone system. Thus the feature [+/-raised] became necessary to subdivide the [-upper] register.

In short, H has likely been a contrastive tone longer than L has and is, in the current tone system, the unique tone within the [+upper] register and thus specified underlyingly only as [+upper]. This distinctiveness of H helps to explain some of the asymmetries that group the two [-upper] tones together in ways that oppose them to the single [+upper] tone. These include asymmetries within the phonology, asymmetries in distribution, asymmetries in the phonetic realization of the output from the phonology, asymmetries in the distribution of boundary tones, and asymmetries in sensitivity to OCP violations. In the following paragraphs, I consider each of these kinds of asymmetries.

First, there are phonological rules which make reference to a H *vs.* non-high distinction ([+upper] *vs.* [-upper]), while there are no rules which make reference to a L *vs.* non-low distinction. For example, the rules of Contour simplification and the rule of $L_{\%}$ association both make H *vs.* non-high distinctions. These phonological rules are reformulated in light of a Two-Feature model of tone in section 6.2.5.

Second, there are asymmetries in the distribution of the three tones. For example, the initial vowel of monomorphemic nouns is either L or M, both [-upper], but not H (section 3.7). As another example of distributional asymmetries, we see that words that are borrowed from English are phonologized as having H on the stressed syllable in the language of origin, but either L or M on the other syllables—both of which are [-upper] (section 4.5). What influences the assignment of L (the most frequent assignment) or M in a given case is not clear and may be related to the date or path of borrowing, but we see for example that for the principal language consultant for this study, 'teacher' is phonologized as /ʧĭtʃã/ (realized [ʧĭtʃâ]), and 'tailor' is phonologized as /télà/ (realized [télà]).[107] In all these cases, we see that in certain positions, the distribution of sounds is limited to the two [-upper] tones.

One asymmetry observed in the phonetic implementation is that if there is unequal distribution of the three tones {H, M, L} within the F_0 range of a speaker, it is the two [-upper] tones which are closer in F_0 to each other. For the speakers tested in chapter 7, the difference in F_0 between [+raised] and [-raised] within the [-upper] register is either smaller than or equal to the difference in F_0 between [+upper] and [-upper]. The difference in F_0 between [+raised] and [-raised] is never greater than the difference in F_0 between [+upper] and [-upper].

In addition, we see in chapter 7 that in the phonetic implementation, downstep—whether automatic or non-automatic—is only triggered when there is alternation between the values [+upper] and [-upper]. Stated in terms of atomic tones, downstep is only triggered by having a floating M or surface L between Hs; it is not triggered by having a floating M between Ls.

[107] There is, however, interspeaker variation on this matter; some Saxwe speakers have 'teacher' phonologized as /ʧĭtʃà/ (realized [ʧĭtʃà]).

Looking at boundary tones, we see that IP boundary tones are $H_{\%}$ or $L_{\%}$ (sections 3.5, and 5.8), which differ in their values for [upper]; we do not see two [-upper] alternatives.

A final asymmetry is in the OCP sensitivity to potential violations. There is a sensitivity to OCP violations regarding H (or [+upper]) tone—a sensitivity that does not exist in the same way for the [-upper] tones. Floating Hs and the H_{ω} phonological phrase boundary are sensitive to OCP violations; the constraint against having two unassociated Hs on the tonal prevents the delinking of H that would otherwise occur as described by rule B of Contour simplification (see sections 4.4.2, 4.4.3, and 5.2). In contrast with this, there is no constraint preventing the presence of two unassociated [-upper] tones on the tonal tier.

All of these asymmetries show that the [+/-upper] distinction is the primary featural distinction in Saxwe tone processes, and that M and L tone are often treated similarly in phonological processes in contrast with the way H is treated. These asymmetries also help us to draw some conclusions about the relative markedness of the features of Saxwe; this is the topic of the next section.

6.2.4 Markedness and tonal features

Jiang-King (1996) proposes a tonal hierarchy whereby {[+upper] > [-raised]}, or (in her terms) [+upper] is more sonorous than [-raised]. Pulleyblank (2004) applies this to the three-tone system of Yoruba and disusses the hierarchy in terms of markedness, drawing the conclusion that H, which is [+upper, +raised], is the most marked tone; L, being [-upper, -raised] is the next in the hierarchy of markedness; and M, which has neither of the values [+upper] nor [-raised] is the least marked tone. The term 'markedness' used by Pulleyblank refers to the notion that a phonological change in the language will favor the output of the more marked element in a ranking of constraints, thus a "markedness as faithfulness" understanding, in the language of Optimality Theory (Pulleyblank, 2004).

The {H > L > M}—or {[+U] > [-R] > [+R]}—tonal hierarchy holds true as well when discussing tonal markedness in Saxwe. However, it must be clarified how markedness is understood here. There is debate about whether markedness is universally predictive or whether it is language-specific, as well as whether it is part of innate phonology or not (Blevins, 2004; de Lacy, 2006; Hume, 2003). Moreover, there is relatively little discussion in the literature which focuses on tonal markedness. This topic could be addressed in much greater length. For the purposes of this study, I confine myself to giving here a brief summary of the understanding of markedness that is assumed for Saxwe. In Saxwe, markedness cannot be tied structurally to having more extensive underlying feature specification, since all three tones are to an equal extent unspecified. Instead, tonal markedness is language-specific and develops through phonetically-driven sound changes over time and in the course of language contact. Increased markedness is related to perception; there is a higher perceptibility of the more marked tone in the phonetic output. One

contributing factor to greater perception is that the more marked tone is more likely to be favored in the output of phonological rules. Another contributing factor is that the more marked tone is more likely to be preserved in the more infrequent or restrictive prosodic structures.

Some of the data supporting the {[+U] > [-R] > [+R]} hierarchy of markedness are discussed in section 6.2.3 and are repeated here. For example, we see that H is the most marked tone from the fact that there is sensitivity to OCP violations regarding adjacent floating and boundary [+upper] tones—a sensitivity that does not exist for the [-upper] tones. To illustrate this, we see that in compounding processes, the delinking of H from an underlying LH contour will be prevented when there is a H_{ω} boundary present at the right edge of the compound (section 4.1.2).

In addition, the phonologically weak initial vowel of monomorphemic nouns—a vowel which is easily elided in fast speech and which in lexical compounding processes is obligatorily elided word-medially—contains the less marked [-upper] tones, but not the more marked [+upper] tone (sections 3.7, 4.2, and 4.4).

Furthermore, in rules A and B of Contour simplification, a delinked [+upper] tone remains floating on the autosegmental tier while the linked [-upper] tone is deleted (sections 3.6.4 and 3.7.5). Later in the derivation, this floating [+upper] tone blocks Tonal spread and therefore its presence does have a perceptible effect in the phonetic output.

More evidence comes from the asymmetry in the types of tones that are found as floating tones in the inventory of monomorphemic noun tone patterns. The inventory includes /M.M ^{H}/ and /M.L ^{H}/ as minority tone patterns. There are no floating Ls in monomorphemic noun tone patterns, and while the tone pattern /M.H ^{M}/ exists, there are only two examples of words of this pattern in my corpus.

We also see in the phonetic implementation that downstep (whether automatic or non-automatic) is a relevant aspect of the realization of H tone, but not of L tone (section 7.3). This means that in the phonetic implementation, the perceptibility of the [+upper] tone is heightened relative to the [-upper] tones.

Again having to do with the phonetic implementation, when there is unequal distribution of the three tones {H, M, L} within the F_0 range of a speaker, it is the two [-upper] tones which are closer in F_0 to each other. For the speakers tested in chapter 7, the difference in F_0 between [+raised] and [-raised] within the [-upper] register is either smaller than or equal to the difference in F_0 between [+upper] and [-upper]. Here again, assuming that markedness is related to increased perceptibility, we see that [+upper] is the most marked tone.

So far we have seen support for [+upper] being the most marked tone in the language. However, there are also reasons to argue that the second half of the {[+U] > [-R] > [+R]} hierarchy holds true. For example, in nouns and verbs,

underlying contours composed of two tones linked to a single TBU in Saxwe contain a [+upper] and [-raised] tone, but not a [+raised] tone (sections 3.7.5 and 5.5). Here is a case where [+upper] and [-raised] values are favored to the exclusion of [+raised] in a restrictive prosodic structure.

In addition, there are rules which prioritize the realization of [+upper] and [-raised] over the realization of [+raised], such as the rule of Tonal spread (72) which spreads H and L tone onto a M TBU, and the rule of Grammatical tone docking (327) which links a floating grammatical H or L rightward to an available M TBU (linking leftward elsewhere). In both of these rules, the output of [+upper] and [-raised] features are favored over the [+raised] feature.

Given this understanding of Saxwe tone in terms of features and the relative markedness of these features, I proceed in section 6.2.5 to a reformulation of Saxwe tone rules.

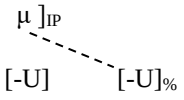
6.2.5 Reformulation of tone rules in terms of features

In this section, the six postlexical phonological tone rules described in the previous chapters of this study are reformulated in light of the Two-Feature model of tone. Here, these tones rules are given in the order they occur in the phonology.

Note that because there are rules which reference [-upper], this feature—which is not specified underlyingly for any tone—must be filled in by default fill-in rules before derivational rules apply. At the same time, [+upper] tones also get the default feature assignment [-raised]. This is shown in section 6.2.3.

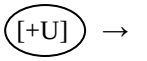
The first rule is that of right edge $L_{\%}$ association. A feature model of tone nicely captures the generalization that the right edge $L_{\%}$ boundary (discussed in section 6.2.6 and symbolized here as the $[-U]_{\%}$ boundary) links to the final TBU of an IP when a tone of the class of [-upper] tones—either associated to a TBU or floating—is found on the right edge of the IP.

(416) $L_{\%}$ (or $[-U]_{\%}$) association



The next rule is a mechanism to explain the fact that the /M.L ^{H}/ and /M.M ^{H}/ noun tone patterns differ from the /M.L/ and /M.M/ noun tone patterns only in that the floating H prevents $L_{\%}$ association at the right edge of the IP. There is no other role played by these floating Hs later in the phonology and, in fact, it is important that they *not* be present later in the phonology.

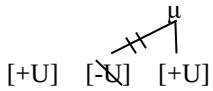
(417) Nominal floating H (or [+U]) deletion



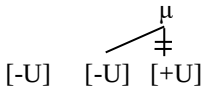
One might argue that this rule does not support the notion that [+upper] is the most marked value for tone. However, the motivation for this rule appears to be the preservation of the contrastive identity of the underlying /M.LH/ pattern, a pattern which is more common and less subject to interspeaker variability than the /M.L ^{H}/ pattern (section 7.5). Speaking in anthropomorphic terms, the field of floating H tones on nouns is being cleared so that the floating H tone resulting from the simplification of the /M.LH/ pattern can serve as a recovery mechanism for identifying this latter tone pattern. The [+upper] tone of the underlying /M.LH/ pattern is preserved throughout the phonology at the expense of that of the underlying /M.L ^{H}/ pattern.

The next rule, perhaps not coincidentally, describes the simplification of an underlying LH TBU in a /M.LH/ noun or a /LH/ verb. Here again, the [+/-upper] feature distinction helps to elegantly capture what is happening.

(418) Contour simplification A



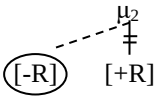
Contour simplification B



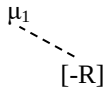
This might be seen as a kind of assimilation; a TBU that has both [+upper] and [-upper] values associated with it assimilates to the preceding TBU by delinking the value (of the two) which is not identical to that which precedes. Where we see the difference in the two rules of Contour simplification is in the fact that when [-upper] is delinked, it is immediately deleted, whereas when [+upper] is delinked, it remains present as a floating element on the autosegmental tier.

The next two-part tonal process shows evidence of the tonal hierarchy within the phonological rules. Here, in the rules of Grammatical tone docking, the more marked [-raised] values (one of which is [+upper] and one of which is [-upper]) will first dock rightward and delink the less marked [+raised] value. Otherwise, if this does not happen (because the condition is not favorable), docking will occur leftward. There are two points to note here. First, a [+raised] value is dispreferred in the output when opposed to a [-raised] value. Second, there is no mechanism for a floating [+raised] tone to dock to a TBU; if present in the input to the phonology as a floating tone, it will remain as a floating tone.

(419) Grammatical tone docking A - ordered first

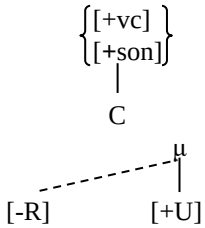


Grammatical tone docking B



The rule of Partial L spread is reformulated in (420) using feature notation. We see in chapter 7 that peak delay (or F_0 target achievement delay—a term I use to cover both delay in attaining a H target as well delay in attaining a L target) is fairly common in Saxwe. The rule of Partial L spread is a phonologization of this tendency. When an underlyingly voiced consonant (a voiced obstruent) or a sonorant appears between a [-raised] tone and a [+upper] tone, there is a spread of the [-raised] tone onto the following TBU.[108]

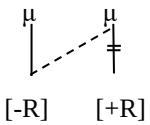
(420) Partial L (or [-R]) spread



The [+sonorant] feature is specifically noted in this rule because we do not know the ordering of this rule relative to the default voicing of sonorants.

The final rule which is reformulated in terms of tonal features is the rule of Tonal spread. This rule is iterative. In this rule, the more marked [-raised] tones spread onto a TBU which is [+raised], delinking this latter tone.

(421) Tonal spread (iterative)



[108] Note that although it is not specified in this rule that the [-raised] tone is [-upper], it is not important to the formulation of this rule; in the event that the [-raised] tone is [+upper], we would have adjacent H tones and the issue of spread would be moot.

Note that as with the rules of Grammatical tone docking, we see in this rule of Tonal spread that a [+raised] value, if present to the right of either of the other two more marked tones, is dispreferred in favor of a [-raised] value. The practical result of this rule of Tonal spread is that there are far fewer surface realizations of the unmarked underlying [+raised] tone than there are of the other two more marked tones. Thus the most unmarked tone in Saxwe is not the most common tone at the surface level.

Now that the derivational rules of Saxwe have been reformulated in terms of tonal features, I turn finally to a discussion of boundary tones and floating tones when examined in terms of features rather than atomic units.

6.2.6 Boundary tones, floating tones, and features

If we consider the distribution of boundary tones, we see that there is a [+upper] PW boundary tone (H_{ω}) and there is a [+upper] and a [-raised] IP boundary tone ($H_{\%}$ and $L_{\%}$). These are described in sections 4.1, 4.3, 3.5, and 5.8.

Neither the H_{ω} PW boundary nor the $H_{\%}$ IP boundary (both [+upper]) ever associate to a TBU. Rather, they are mechanisms by which downglide and downward pitch fall are arrested or avoided in environments where they would otherwise be observed. This is different from the $L_{\%}$ IP boundary ([-raised]) which does associate to a TBU and has a direct effect on pitch levels by lowering the level of pitch F_0 toward the end of the duration of the TBU.

If we compare this with floating tones, we see some similarities and some differences. Lexical floating Hs ([+upper]) resemble [+upper] boundary tones in that they do not associate with TBUs but have an indirect effect on pitch levels by their role in the absence of pitch lowering (sections 3.7.3 and 3.7.7). Contrary to this, the grammatical floating H of irrealis modality ([+upper]) will associate to a TBU and thereby plays a direct effect on pitch levels by raising the level of pitch F_0 (sections 5.4 and 5.5).

The left M- floating tone on nouns, lexical floating Ms and the floating M of imperfective aspect (all of which are [+raised]) all have an indirect role in pitch levels by conditioning Contour simplification to effect a particular result and triggering non-automatic downstep in the phonetic implementation. In addition, these floating tones have an indirect effect on pitch levels by conditioning the association of the [-raised] boundary when in an IP-final position (sections 3.7.4 and 5.1).

Grammatical floating Ls marking imperative modality and negation, as well as the intonational $L_{\%}$ of yes-no questions (all [-raised]) have a direct lowering effect on pitch F_0 levels, similar to the direct lowering effect of the [-raised] default $L_{\%}$ boundary when it associates to a TBU (sections 3.6, 5.2, and 5.6).

A generalization that can be made, then, is that [+raised] floating tones do not associate to TBUs and therefore have an indirect effect on phonetic implementation. Conversely, [-raised] boundary tones and floating tones can associate to TBUs. Because of this, they play a direct role in lowering the level of pitch F_0 in the phonetic implementation.

6.3 Summary: an accounting of H, M and L using features

In this chapter, I address first the question of whether there is a true M in Saxwe, or whether there are instead toneless TBUs. I argue that the most felicitous position one can take is that that there is an underlying M. This is based on an examination of the many varied contexts where M appears in the language, and the possibilities of how an alternative analysis might present itself.

The next issue addressed is whether the Two-Feature model of tone can be fruitfully applied to the Saxwe tone system. I conclude that the Two-Feature model of tone effectively explains many of the asymmetries that exist when one compares the atomic tones H, M and L. Most importantly, the Two-Feature model of tone predicts that the primary distinction made is the [+/-upper] distinction. The [-upper] tones (M and L) often function as a natural class in opposition to H. In addition, we see that the [-raised] tones (H and L) also sometimes function as a natural class. The Two-Feature model correctly predicts that H and M will not function as a natural class with regard to tonal phenomena.

After describing the underlying features of Saxwe {H, M, L} in light of an underspecification model, these features are discussed in terms of their position in a tonal hierarchy of markedness. I note that the hierarchy {[+U] > [-R] > [+R]} (Jiang-King, 1996) is one that holds true for Saxwe. Following this is a reformulation of the phonological rules from previous chapters using feature notation. Finally, I note some generalizations that can be made about boundary tones and floating tones when these are described in terms of tonal features.

Having looked at the theoretical underpinnings of the Saxwe tone system, it becomes useful to examine things from the final end of the workings of the system. Chapter 7 studies the phonetic implementation of tone in light of the theory discussed here.