Tone in Saxwe

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2 Theoretical background

A tonal language is defined by Hyman (2001b) as a language "in which an indication of pitch enters into the lexical realization of at least some morphemes" (p. 1368). As a researcher in the field of tone, one is presented with a dizzying array of potential theoretical approaches and models to make use of. This is due in part to the complexity of tone itself. Hyman (2011b) states that tone is both qualitatively and quantitatively different from segmental features, length and stress, and "extraordinarily versatile, a lot of things at once" (p. 518). In part because of this, there is a lack of consensus on many tone-related questions, such as the feature geometry of tone, the particulars of how tone interacts with prosodic structure, or whether and how tone is related to the laryngeal node.

In this chapter I make clear which theoretical models will be used to describe and analyze Saxwe tone. The ultimate justification of these choices will be found in the degree to which the models chosen are able to produce an analysis that is insightful, comprehensive, and simple (to the degree to which this is possible). This study aims to provide both data and analyses that will be easily digested and re-interpreted in an ever-changing theoretical climate.

This chapter also includes a discussion of how tone has been analyzed in other Gbe languages, as a reference point for analyzing Saxwe tone.

This chapter is organized as follows. Section 2.1 examines tonal underspecification and the possibilities for underlying contrasts when underspecification is taken into account. In section 2.2, I look at the question of whether and how tone can be organized into features. Section 2.3 addresses the phenomena of automatic and non-automatic downstep, including explanations given for these phenomena. In section 2.4, I outline the basics of lexical phonology, including the differences between lexical and postlexical processes, especially as related to tone. Section 2.5 discusses how the prosodic hierarchy can interact with tone, either by limiting the domain of a tonal process or through the introduction of boundary tones. In section 2.6, I look at tone that is related to syntax. Section 2.7 prepares the ground for the overview of Gbe tone by raising the question of consonant-tone interaction and how this interaction has been explained. Section 2.8 gives a brief survey of the study of tone in Gbe languages to date. Finally, section 2.9 summarizes the major elements of this chapter that will inform the rest of the study.

2.1 Tonal underspecification

Underspecification, the concept that features can be underspecified at the underlying level and filled in by default rules (Kiparsky, 1982), has been fruitfully applied to the study of tone. Hyman (2011a) provides an overview of the contrasts that are possible when the theory of underspecification is applied to systems of two and three heights using privative tonal units /H/ (high), /M/ (mid) and /L/ (low). These possibilities are laid out in (32), where /Ø/ stands for a TBU that is unspecified for tonal attribution or features.

(32)	**Two tone heights**	**Three tone heights**
	/H, L/	/H, M, L/
	/H, Ø/	/H, Ø, L/
	/L, Ø/	/H, M, Ø/
	/H, L, Ø/	/Ø, M, L/
		/H, M, L, Ø/

The decision regarding whether to consider that a language's tonal system includes TBUs unspecified for tone is based on several criteria discussed in Hyman (2001a) and Hyman (2011a). Surface tones may be underlyingly unspecified if they are generally inactive phonologically. This can be manifested in several ways. For example:

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.

There are also differences among tonal systems regarding the timing of the moment when a toneless TBU has default tone assigned to it. Pulleyblank (1986) gives three possibilities: default tone may be applied lexically (*i.e.* Luganda (Hyman and Katamba 1993)), postlexically (*i.e.* Tiv (Pulleyblank, 1986)), or at the level of phonetic implementation (*i.e.* Chichewa (Myers, 1996)).

In this study I show that Saxwe has a three-way tonal contrast: /H, M, L/. Both H and L are clearly phonologically active. They both spread rightward onto an adjacent M vowel (section 3.2), and are involved in H-L and L-H surface contours (sections 3.5, 3.7.5, and 3.7.8). In addition, there exist both lexical and grammatical floating Hs (sections 3.7.3, 3.7.7, and 5.4), as well as grammatical floating Ls (sections 5.2 and 5.6).

Underlying M is not phonologically active to the same degree that H and L are. In a certain sense, M could be considered inert or unstable; if there is any preceding H or L, this H or L will spread onto the M TBU (section 3.2). This might be considered good reason to posit that surface [M] is the default tonal height assigned to an underlyingly unspecified TBU were it not for the fact that M is stable as a floating tone and participates in various tonal processes, affecting the outcome of the phonological derivation. Floating M tones exist for a number of reasons. There are historic processes of vowel deletion or word formation that have resulted in floating Ms (sections 3.7.4 and 5.1). There are also synchronic processes of vowel deletion that produce floating Ms (section 4.2). In addition, the phonology of borrowed nouns involves floating Ms (section 4.5).

This floating M is the most significant reason that a /H, Ø, L/ claim is untenable for Saxwe. Chapter 6 summarizes and analyzes in detail the relationship between /H/, /M/, and /L/ and demonstrates why this is the best analysis for characterizing the contrasting levels of tone in Saxwe.

The challenge of defining a three-way contrast where the middle surface height is relatively inert compared to the other two surface heights is not unique to Saxwe. In Yoruba, underlying /rí igbá/ or [rí] + [īgbá] 'see calabash' becomes [rígbá] (Pulleyblank, 1986, p. 109). When the initial vowel [i] is deleted, there is no trace of the [M] to be found in the surface form [rígbá]. This, among other findings, is offered by Pulleyblank (1986) as evidence in favor of the theory that Yoruba has a three-way /H, Ø, L/ contrast.

However, other findings—including the observation that a floating L seems to trigger downstep on a following M tone (Ajiboye, Déchaine, Gick, & Pulleyblank, 2011), and the presence of a [M-H] surface contour (Akinlabi, 1985)—are cited in Pulleyblank (2004) as evidence that the third tone in Yoruba should be interepreted as underlying /M/ rather than /Ø/.

2.2 Tonal features and the Two-Feature model

It is widely held that privative tones such as H, M, and L are actually composed of features, although there is no final consensus about what these features are. The following is an overview of the predominant model that has been proposed to describe tonal features. Other feature models—those that attempt to include some aspect of consonant-tone interaction—are described in section 2.7.

The predominant model is that of Yip (1980, 1989) and Clements (1981), sometimes 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, shown in (33).

(33)

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

Privative tones are then 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, Michaud, & Patin, 2010; Odden, 2010). What the differing interpretations have in common is the notion of four absolute levels of pitch.

(34)

		Hyman (2011a)	Clements et. al. (2010) Odden (2010)
[+upper]	[+raised]	H	SH
	[-raised]	M_1	H
[-upper]	[+raised]	M_2	M
	[-raised]	L	L

In a three-tone system, there could theoretically be two possible ways to characterize the M tone. As seen in (34), M could be either [+upper] [-raised], or [-upper] [+raised]. This may depend on whether M is seen as having more in common with H or L (Hyman, 2010). Because these two feature combinations options exist for M, a researcher who employs underspecification in his or her analysis of a three-tone system is required to first choose which features are specified underlyingly, and then elaborate feature fill-in rules to ultimately generate the appropriate combination chosen for M, either [+upper] [-raised] or [-upper] [+raised]. Pulleyblank (1986), using the Two-Feature Model for tone, assigns the underlying features shown in (35) to Yoruba levels H, M and L. Default rules supply the features [-upper] and [+raised].

(35)

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

A claim made by this model is that it defines natural classes of tone. It has, however, proven difficult to find in the body of African tone language literature clear evidence that these natural classes do in fact exist, and because of this there are some who question the value of a universal feature model for tone (Clements et al., 2010; Hyman, 2010). For example, Clements et al. (2010) state that "the Two-

Feature Model appears to receive little if any support from African languages" and that "confirming cases are vanishingly few, and the best-known of them (Ewe) can be given alternative analyses not requiring tone features" (p. 14).

It is important to note that although the Two-Feature model gives the label 'register' to the feature [+/-upper], it does not use the term in the way that is used by those (Hyman, 1993; Inkelas, 1989; Snider, 1999) whose aim is to account for the steady lowering of the 'ceiling' of H tone seen in automatic and non-automatic downstep (see section 2.6). Yip (2002) makes this clear in her statement that "for Yip, the interpretation of L register is absolute, whereas for Hyman it is relative" (p.154). This model is therefore not intended to account in a structural way for downstep in the phonological component and would therefore rely on widely used notions of floating tone (or in this case, perhaps floating features) to account for downstep.

There remains the ongoing question of whether a universal feature model of tone is useful. Hyman (2010) emphasizes the unusual complexity of tonal behavior as compared to the behavior of segments or other suprasegmental properties such as length or stress. He argues that tone has greater diversity and autonomy than segments and that "there seems to be little advantage to treating tones other than the way that most tonologists treat them: as privative elements that are related to each other through their relative and scalar phonetic properties" (p. 74).

In a similar vein, Clements et al. (2010) conclude that "the primitive unit in tonal analysis may be the simple tone level, as is assumed in much description work" (p. 20). The authors further state however, that while they do not see the benefit of universal tone features, they acknowledge that there may be language-specific tone features.

In chapters 3 through 5 of this study, Saxwe tonal processes are described using the privative units H, M, and L. Then in chapter 6, I explore how the Saxwe tonal system can be profitably and insightfully described using the Two-Feature model.

I move now to two common processes that affect the surface realization of tones: automatic and non-automatic downstep.

2.3 Automatic and non-automatic downstep

Many of the descriptions of automatic and non-automatic downstep come from African languages. Before discussing and defining automatic and non-automatic downstep, I mention first some related phenomenon, the first of which is declination. Connell and Ladd (1990) define declination as "a gradual modification (over the course of a phrase or utterance) of the phonetic backdrop against which the phonologically specified F_0 targets are scaled" (p. 2). Declination is a phonetic effect that has been observed in both tonal and non-tonal languages. The gradual lowering of declination can be distinguished from final lowering, which is a more abrupt lowering at a phrase or utterance end (Connell & Ladd, 1990; Herman, 1996; Laniran, 1992).

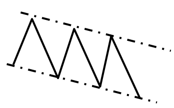
Distinct from both of these purely phonetic lowering phenomena are automatic and non-automatic downstep, terms first used by Stewart (1965). Automatic downstep is the lowering of the 'ceiling' of H tone in a phrase or utterance following a surface L. This leads to a downward stair-stepping pattern of pitch levels, or 'terracing' as it is sometimes referred to (Clements, 1979). Non-automatic downstep is described by Stewart as the lowering of H tone following an underlying L not present at the surface level. Stewart labels both of these phenomena as downstep because of the fact that both are triggered by L tone—one being at the surface level and the other being underlying. There are other labels given to these phenomena; some researchers use 'downdrift' for automatic downstep and 'downstep' for non-automatic downstep (Connell, 2011).

It is fairly common for a language to have automatic downstep but not non-automatic downstep, but it is rare for non-automatic downstep to occur in a language that does not also have automatic downstep (Connell, 2011).

The pitch level resulting from non-automatic downstep has often been compared to that of a M tone. Snider (1998) demonstrates in an instrumental study of the three-tone language Bimoba that in the context of a single instance of downstep in that language, automatic and non-automatic downstep involve the same F_0 difference. In addition, a single instance of downstep is equivalent in F_0 difference to the pitch interval of H to M.

There are other languages, however, for which the pitch difference of non-automatic downstep has been attested to be the same as that of H to L. These have been labeled as 'total downstep languages' and include Ebrie (Stewart, 1993) and Kikuyu (Clements & Ford, 1980).

There is a question whether the 'terracing' effect in downstep only affects Hs, or whether it affects Ls as well. That is, whether downstepping affects only the 'ceiling', as in (36)a, or whether it affects both the 'ceiling' and the 'basement', as in (36)b.

(36) a.  b. 

This may be a language-specific issue and may be dependent on how many iterations of downstep are considered. Instrumental studies in Bimoba (Snider, 1998) show that in that language, in the context of two instances of downstep, the F_0 decline of L exceeds the lowering that might be expected from general declination. On the other hand, a study of Yoruba (Laniran & Clements, 2003) shows that the data from lengthy sentences show no greater decline of Ls which alternate with Hs than is observed for sentences that contain all Ls.

In the vast majority of cases, L (rather than M) is named as a trigger for the downstep of H. There are indications, however, that M can also be the trigger. In Yala-Ikom (Armstrong, 1968), both a floating M and a floating L are shown to trigger downstep of H. So in [òré↓ré] 'eating' (compare to [òróōré] in Yala-Ogoja), downstep is due to a floating M following loss of a vowel. This can be compared to [èsí ɛ́↓má] 'these trees', from /èsí ɛ̀má/. In both cases—whether it is the floating M or the floating L which is the trigger—the H is downstepped by the same pitch interval.

It is not only H tones that are downstepped, although downstepping of M or L is rare. In Yala-Ikom (Armstrong, 1968) a preceding L will downstep a M. A L is downstepped in Bamileke Dschang (Hyman & Tadadjeu, 1976) and in Nawdm (Nicole, 1980). However, there are no languages documented to have downstepping of L without also having downstepping of H (Connell, 2011).

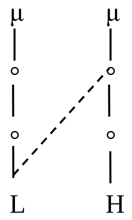
Downstep has been explained in several ways, either at the phonological level or at the level of phonetic implementation. One explanation has been that a floating L tone triggers downstep in the phonetic implementation (Pierrehumbert & Beckman, 1988; Pulleyblank, 1986). Some criticize this explanation of downstep because it has the application of phonetic implementation rules becoming phonologically significant (Snider, 1999).

Several theories of feature geometry respond to this criticism by allowing downstep to be dealt with in the phonology. One way this is done is by having a feature model that represents downstep by referring to the notion of tonal register interpreted in a relative way (*i.e.* successive occurrences of low register lower the 'ceiling' of H tone in an iterative fashion). For example in Hyman (1993), the representation of tone is as follows.

(37) TBU: μ
|
Tonal root node (TRN): °
|
Tonal node (TN): °

Downstep is represented by having L attached to the Tonal Register Node of a TBU that also has H attached to the Tonal Node (Hyman, 1993; Inkelas, 1989). The structure in (38) shows automatic downstep; in non-automatic downstep, the L would not be linked to a TBU.

(38)



There are other ways of explaining downstep. It has been shown that in some languages, non-automatic downstep may be attributed to an underlying sequence of two H tones. In KiShambaa, Odden (1982) attests that the difference between [ngó$^{\downarrow}$tó] 'sheep' and [nyóká] 'snake' is that the former has two underlying H tones while the latter has only one underlying H which is spread to the following syllable, as shown in (39).

(39)

Saxwe has both automatic and non-automatic downstep of H. Automatic downstep is triggered by a surface L. Non-automatic downstep is triggered by a floating M. Chapter 6 discusses the fact that in both cases, it is the feature [-upper] that is the trigger for the downstep. Chapter 7 examines the phonetic detail of automatic and non-automatic downstep.

2.4 Lexical phonology applied to tone

In this study, I make use of the theory of lexical phonology, a theory which is usefully applied to the study of tone because of the fact that tonal rules seem to be ordered with relation to where they fit in the interplay between phonology and morphology on the one hand, and phonology and syntax on the other.

The theory of lexical phonology (Kiparsky, 1982; Mohanan, 1986; Pulleyblank, 1986) organizes phonological processes into two sets—lexical processes and postlexical processes. Underived lexical entities are first subject to lexical rules (roughly word-level). There may be several cycles of lexical rules, following which the output from the lexical rules is subject to postlexical rules (beyond word-level), which typically apply only once.[22] Following the totality of these phonological processes, language is subject to phonetic implementation.

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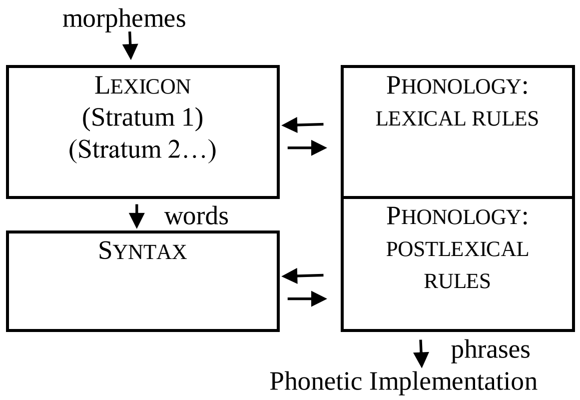
[22] Note, however, that in Ikalanga (Hyman & Mathangwane, 1998), the same postlexical tonal process may apply cumulatively by domain; a H spread process may apply multiple times if it is shown to be a common factor in multiple rules applicable to different prosodic domains.

Simply stated, what comes out of the lexical stage are words, including those that may have undergone processes such as compounding or derivation. These words enter the postlexical stage and become part of syntactic phrases. At this stage, the phonological rules that apply are postlexical rules. This is diagrammed in (40).

(40) Lexical phonology: simplified flowchart adapted from Pulleyblank (1986)



Lexical phonology is well-applied to the study of tone; Pulleyblank (1986) gives an early application of lexical phonology to the study of tone. For any given language, we can divide that language's relevant tonal processes into lexical and postlexical processes. Lexical rules may refer to word-internal structure, may not apply across words, may be cyclic, and may have lexical exceptions (Pulleyblank, 1986). Lexical tonal processes can appear to lack phonetic motivation (Snider, 1999). In some cases, it seems that lexical tonal processes may sometimes refer to the internal structure of the clitic group (taken as the phonological word in some cases) (Hyman, 1990).[23]

Postlexical rules, on the other hand, may not refer to word-internal structure, may apply across words, and cannot have lexical exceptions (Pulleyblank, 2004). Tone processes related to phrasal boundaries are necessarily postlexical. Postlexical tonal processes can refer to several prosodic units, including the phonological phrase, the intonational phrase, and the utterance. This brings up the topic of the prosodic hierarchy, which is addressed in section 2.5.

The output from the phonology is subject to rules of phonetic implementation, which are generally understood to produce effects of a gradient or scalar nature which do not either mask or represent underlying phonemic contrasts.

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[23] There are occasional mismatches between syntactic words and phonological words. The combination of noun followed by associative marker has been analyzed as the phonological word in Dschang (Hyman, 1985).

2.5 The prosodic hierarchy and tone

Related to the issue of postlexical rules is the notion of the prosodic hierarchy (Nespor & Vogel, 1986; Selkirk, 1984). The prosodic hierarchy is composed of several hierarchically-arranged levels. From top down, these are:

1) the Utterance (U)
2) the Intonational Phrase (IP)
3) the Phonological Phrase (PhP)
4) the Clitic Group (CG)
5) the Phonological Word (PW).

Selkirk (1984) proposes that these levels of prosodic hierarchy cannot appear recursively in a nested fashion. That is, a PhP must only contain PWs or CGs, but cannot contain PhPs. This is known as the Strict Layer Hypothesis (Selkirk, 1984).

There are several hypotheses as to how the prosodic structure is constructed in relation to the syntactic structure, with particular consideration often given to how the PhP is constructed. One possibility is that edges of PhPs are established with reference to the right or left edge of either the head or the maximal projection of the syntactic phrase, using X-bar terminology ((Selkirk, 1986), building on Chen (1987)).

For example, in the Anlo dialect of Ewe, PhPs are constructed by creating a new boundary at the left edge of every maximal projection of the syntactic phrase (Clements, 1978; Selkirk, 1986). Within these PhPs, a rule is applied which raises a mid tone located between two high tones to extra-high.

Branchingness of the syntactic phrase is also considered to be a factor in the construction of PhPs in some languages. One example of this is Kinyambo, which constructs phonological phrases with reference to the right edges of maximal projections—but only those maximal projections that branch (Bickmore, 1990). Within the delimitations of phonological structures that meet this description, a rule of H deletion is consistently applied.

Selkirk and Lee (2015) includes a number of modifications on the Nespor and Vogel (1986) and Selkirk (1986) notions of the prosodic hierarchy. For one thing, the U and CG levels are not considered necessary. Moreover, the authors recognize recursivity to be a possibility—a possibility not recognized in the Strict Layer Hypothesis.

In a more recent hypothesis about the way in which prosodic structure is constructed, Selkirk (2011) proposes Match theory. In this optimality-theoretic approach, there is a Match constraint which constructs PWs, PhPs, and IPs by matching the boundaries of these prosodic structures to the boundaries of syntactic words, phrases and clauses. This Match constraint can be ranked lower than other prosodic structure markedness constraints (such as a Headedness constraint, a Layeredness constraint, a Non-recursivity constraint, and an Exhaustivity constraint) when this becomes necessary in describing a specific language.

Just as the syntactic phrase can be non-isomorphic with the PhP, so too the grammatical word can be non-isomorphic with the PW. Hyman (2008) notes that the grammatical word can be larger than the PW (in which case the PW is foot-like), and it can also be smaller than the PW (in which case the PW can behave like a CG).

For example, Myers (1995) describes the PW in Shona as being a structure which includes what he terms a "full word" (a word of any category excluding function words) together with a string of procliticized function words. Thus in Shona, PW boundaries are created at the right edge of "full words". These PWs are the domain in which operate a rule of stress, a rule of epenthesis, and Meeussen's Rule.

Some examples given by Myers are shown in (41) and (42). The brackets and subscript labeling of PWs are my addition.

(41)	[babá]$_{PW}$	[vá-babá]$_{PW}$	[vángu]$_{PW}$
	father	of-father	my
	father of my father (Myers 1995:85)		

(42)	[ívo]$_{PW}$	[ndí-babá]$_{PW}$	[vángu]$_{PW}$
	he	COP-father	my
	he is my father (Myers 1995:85)		

Note in these examples that a single PW encompasses both a function word and the following noun even though the noun (the NP complement of the preposition, for example) may belong to a different branch of the syntactic tree than the function word (the head of the prepositional phrase, for example).

Based on Hyman's (2008) discussion of the Shona data, the following are two possible structures that could be considered to represent the sequences [vá-babá] 'of father' or [ndí-babá] 'COP-father'.

(43) Possible structures for [ndí-babá], based on Hyman (2008) and Myers (1995)

In structure (a), we see recursivity of the PW prosodic level, while structure (b) employs the term CG for what Myers labels as the PW. In both cases there is a recognition that the morphemes involved carry word status at some level in the lexical phonology, but are also integrated into a larger prosodic unit during the lexical stage of the phonology. The tone rules that operate within the PW or CG are lexical processes, although they may operate within the final stratum of lexical processes.

This recursivity in the prosodic structure at the level of the PW is an important element of Saxwe phonology and can account for certain observed tonal phenomena that cannot be dealt with by referencing prosodic structure at the higher level of the PhP. I show in section 4.1 that in Saxwe, two types of structures display this type of recursivity: compounds and nouns derived through reduplication.

So far the noted interaction between prosody and tone has been related to the fact that the operation of certain tone rules—such as a rule of tone deletion or tone raising—can be restricted to being applicable only within boundaries of particular prosodic constituents. However, another form of interaction is that boundary tones can be assigned or attributed to a location where there is a specific prosodic boundary. Such boundary tones are not uncommon in African languages.

In Kinande, a Bantu language, Hyman (1990) describes three different boundary tones: a $H_{\%}$ boundary tone that appears on the right edge of the PhP, a $L_{\%}$ IP boundary tone that appears on the right edge of a completed assertion or a citation form, and a $H_{\%}$ IP boundary tone that appears on the right edge of a question or a form given with list intonation.[24] In the appropriate context, the $H_{\%}$ phrasal boundary tone may appear on the surface together with a $L_{\%}$ or $H_{\%}$ intonational boundary tone.

Assertions and questions are common sources for right edge intonational effects, with higher pitch levels often being associated with questions and lower pitch levels with assertions. This has been observed for Hausa (Inkelas & Leben, 1990; Leben, Inkelas, & Cobler, 1989) and Chichewa (Myers, 1996), as well as Kinande (Hyman, 1990).

Snider (1999) predicts that "phonological phrases in many if not all Niger-Congo languages have Lo boundary tones assigned to their left and right edges" (p. 46). Snider finds partial support for this in the downglide of L tones utterance-finally.

Saxwe is among the Niger-Congo languages that has a $L_{\%}$ boundary tone. In Saxwe, a $L_{\%}$ boundary tone exists to right edge of the IP. However, there are circumstances that may prevent this $L_{\%}$ IP boundary from being realized at the surface level. This is discussed in section 3.5.

The relationship between tone and intonation is a complicated one, and Yip (2002) remarks that "the line between final tonal particles and what we usually call intonation is extremely fuzzy" (p. 114). For some languages, it seems more

[24] Hyman uses the symbol % for PhP boundary tones and // for intonational phrase boundary tones. I have used the symbol % for both in keeping with current notational trends.

appropriate to address pitch-related boundary effects in the phonetic implementation rather than in the phonology (Myers, 1996; Pierrehumbert & Beckman, 1988). The literature on intonation includes much discussion on how to represent intonation in tonal languages (Cruttenden, 1986; Hirst & de Cristo, 1998; Ladd, 1996; Pierrehumbert, 1980).

2.6 Syntactically-informed tone

Turning to the issue of tone and syntax, we see that there can be a relationship between tone and syntax that is not necessarily or entirely mediated by prosody. Tone can be the sole manifestation of a syntactic marker, in which case it is commonly referred to as grammatical tone. It is also possible that a tonal phenomenon may reference a particular morphosyntactic structure rather than relying solely on references to prosodic structure (Odden, 1990).

For example, Yoruba (Pulleyblank, 1986) has a H boundary tone on the right edge of a subject NP under certain TAM conditions. Thus underlying /bàtà/ 'the shoe' and /já/ 'be cut' are realized as [bàtǎ já] 'the shoe got cut'.

Yip (2002) includes a good overview of the ways that tone interacts with morphology and syntax. Particular tonal rules may apply to particular morphological constructions (such as reduplication). Examples of various morphological and syntactic meanings carried by tone include: the associative construction, focus constructions, complement structures, case, definiteness, referentiality, and all types of tense, aspect, and modality. For example, in the Kwa language Gun, a sentence-final low tone marks a yes-no question (Aboh, 2010a).

In many cases like the Gun low tone of negation, a tone may carry a certain kind of syntactic meaning and be a morpheme in its own right even though it has no associated segmental information; this is what I refer to in this study as grammatical tone. I distinguish this from structurally-driven tone which I consider to be tone conditioned by prosodic structure (referencing any of the levels in the prosodic hierarchy).

The fact that syntax has a bearing on tone (whether directly or indirectly through prosodic mediation) has consequences for the person studying tonal languages. According to Snider (2014), when justifying an analysis of underlying contrasts of tonal patterns, the researcher must strictly control for morphosyntactic factors (in addition to many other factors). This excludes, for example, including both verbs and nouns in a single paradigm that is intended to demonstrate underlying contrast of tonal patterns. Boundary tone interference, prosodic mediation of tonal processes, or other morphosyntactically-driven tone phenomena may mean that such a contrast is not truly a contrast in analogous environments. Bearing this in mind, underlying contrasts in this study will be illustrated in paradigms that strictly control for morphosyntactic factors.

2.7 Consonant-tone interaction

Beginning with some of the earliest studies of Ewe, Gbe languages have been cited in the literature as having consonantal interaction with tone. In this study of Saxwe tone, we see that most of the consonant-tone correlations observed are based on a historic phonological relationship between consonants and tones. Synchronically, however, L has become independent of consonant quality at the phonological level. The lowered tone height that developed because of the lowering effect of depressor consonants is now fully phonologized as phonemic L tone. As evidence of this phonologization, we now see that L may occur in a variety of environments—not simply in a context where it follows a depressor consonant. Just as L is no longer phonologically tied to the presence of a depressor, depressors are no longer categorically followed by L. These facts are discussed in chapter 3.

Because of the historic links between consonant and tone in Saxwe, it is useful to summarize some of the relationships that have been described between consonant quality and tone.

It has long been recognized that depressor consonants—most frequently voiced obstruents—can have a lowering effect on tone. An example of the lowering effect of depressor consonants can be seen in Suma (Adamawa) verbs in the present tense where verbs have either a H or LH pattern depending on whether they begin with a depressor or a non-depressor (Bradshaw, 1995). Bradshaw's paradigm is given in (44).

(44)

Initial depressor		**Initial non-depressor**	
bǒm	'be blind'	ɓúk	'applaud'
dǐk	'be sonorous'	ɗǎŋ	'mount'
gǎy	'reprimand'	éé	'leave behind'
gbǎk	'borrow'	fɔ́ɗǐ	'stir briskly'
vǎy	'bet'	kírí	'look for'
zàfí	'sneeze'	nɔ́y	'boil'
bùsí	'be bland'	rɛ́m	'be able to'
dìkílí	'tickle'	yárí	'unravel'
gɔ̀ɓí	'twist'	ndáŋgí	'boom'
zìkíɗǐ	'delay'	níkírí	'exaggerate'

The categories of sound that are treated as depressors can vary among languages. For example, Zina Kotoko, a Chadic language, includes glottal stops in the group of what can act as depressors, lowering H to M (Odden, 2007). In addition, the environment that conditions a M to L lowering rule includes voiced obstruents, glottal stops and implosives. Tsua, a Khoisan language, includes among its depressors voiced obstruents, aspirated obstruents, and the glottal fricative /h/ (Mathes, 2015). Tang (2008) and Bradshaw (1999) both include surveys of consonant-tone interaction which show that, in addition to voiced obstruents, the voiceless glottal fricative is one of the most frequent additions to the list of depressor consonants, with sonorants and implosives also occasionally having an affinity for lower tone.

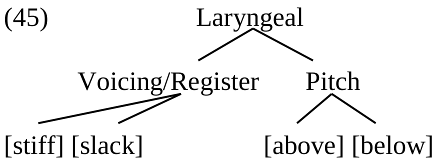
A purely phonetic correlation between voiced obstruents and lowering of pitch, as well as between voiceless obstruents and raising of pitch exists even in languages where there is no phonological relationship between consonants and tone. In one study, Hombert (1977) shows that in Yoruba, a 3-tone language where tone is not affected by consonant quality at the phonological level, there is a lowering effect for voiceless obstruents and a raising effect for voiced obstruents. This effect in Yoruba wears off, however, by the end of the realization of the vowel—somewhere between 40 and 60 msec into the vowel in most cases.

Halle and Stevens (1971) relate the lowering and raising effects of voiced and voiceless obstruents to slack and stiff vocal cords, respectively. The lowering and raising of the larynx in voiced and voiceless obstruent production may also play a role in lowering and raising phonetic pitch (Ewan, 1976).

In order to capture the relationship between consonant type and tone, Halle and Stevens (1971) propose the features [+/- slack, +/- stiff], creating a three-way tonal contrast such that [+slack, -stiff] identifies voiced obstruents with low tone and [-slack , +stiff] identifies voiceless obstruents with high tone.

Duanmu (1990) incorporates the features [stiff] and [slack] into a featural representation where a Voicing/Register node projects from the Laryngeal node. (He borrows Yip's (1989) notion of register, identifying register with voicing). It is below this Voicing/Register node that we find the features [stiff] and [slack]. In this model, the features [above] and [below] replace the traditional use of H and L.

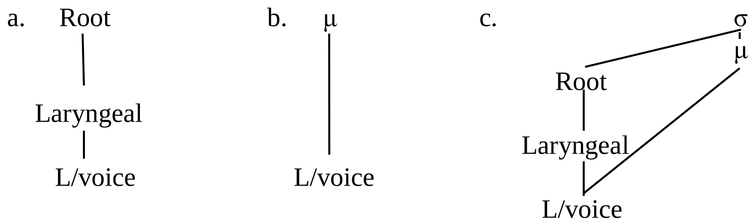
(45)



The problem with the complete identification of [slack] with low tone or lower register is that it is a model that can't be universalized. There are languages for which consonant-tone interaction is not a reality—many of which have more than two tone levels. Moreover, there are languages like Siswati in which voiced consonants play a role in one process in the phonology—creating rising tones—while appearing irrelevant in another process—shifting H to the antepenult (Odden, 2010).

Bradshaw (1999) addresses this difficulty in her Multiplanar account, where a single feature [L/voice] can be associated either to the Laryngeal node as in (46)a, or to the mora, as in (46)b, or to both.

(46)



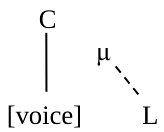
This means that L can be both segmental and autosegmental; it is crossplanar in nature. Interestingly, in Bradshaw's proposal, L is the only tone that has this crossplanar nature. This lopsidedness could be considered a weakness of Bradshaw's proposal, which would suffer if it were shown conclusively that H tone and voiceless obstruents have a parallel consonant-tone interaction.

Note that Bradshaw's model also allows bidirectional spreading of [L/voice]. A consonant may acquire voicing from the following L, just as a mora may acquire L from the preceding consonant.

One wonders about the universality of the Multiplanar mode considering the many languages where voicing of consonants and tone are completely independent of each other. The strong claims made by the Multiplanar model have yet to be shown to be widely valid.

As an alternative to trying to explain consonant-tone interactions through feature hierarchy interrelatedness, one can maintain the suprasegmental nature of L and have the feature [voice] or [+slack] trigger the insertion of L on a following mora by means of a phonological rule. The latter approach is proposed for Suma (Bradshaw, 1995) and Ikalanga (Hyman & Mathangwane, 1998) and is shown in (47) as a rule of L tone insertion.

(47)



Pearce (2009) describes a possible life cycle for consonant-tone interaction over time. First, a language may begin with an underlying voicing contrast but no related underlying tonal contrast. Then there is a development of pitch cues to enhance the voicing contrast. In the next stage of the cycle, both voicing contrast and tonal contrast exist in a redundantly contrastive situation. This may lead to two possible outcomes. Either voicing can lose its contrastiveness and exist only as byproduct of tone—a situation which Pearce argues is presently true for the Chadic language Kera—or voicing and tone develop independently of each other.

In Saxwe, one can find evidence that underlying voicing and tone are currently phonologically independent despite the fact that they may once have been in a redundantly contrastive situation. Section 3.9 discusses how the rule of L tone insertion shown in (47) represents a process that was relevant at one stage in the historical development of Saxwe and could still be considered to be categorically applicable if one looked only at the data from verbs. However, this rule is no longer tenable as a synchronic rule in Saxwe phonology.

2.8 Tonal analysis of Gbe languages

The Gbe languages share many lexical forms, and many of these are likely to have similar underlying tones. Moreover, there is an overlap of tonal processes in the various Gbe languages. For this reason, any student of tone in a Gbe language is well-served by studying previous analyses of tone in Gbe languages. The following is an overview of these tone studies.

2.8.1 Ewe

The most well-researched tone system among Gbe languages is that of Ewe. Studies of Ewe cover several different dialectical variants. Westermann (1930) (cited in Stahlke (1971)), is the first description of the fact that Ewe has three phonetic tone heights—H, M and L—as well as rising and falling pitch. Westermann describes an allophonic relationship between L and M when comparing nouns in isolation with those same nouns in complex forms. He interprets L as underlying in these alternations.

In the first in-depth analysis of Ewe tone, Ansre (1961) describes the Peki dialect and demonstrates that Ewe has consonant-tone interaction. Ansre also describes Ewe as having three phonetic tone heights: H, M and L. He sees the basic underlying tonal contrast as being H *vs.* non-H, and argues for M and L being complementary allotones of non-H, although he does not choose either M or L as being underlying. The realization of M *vs.* L is based on several factors, including (1) the consonant quality preceding the TBU, (2) whether the syllable is in isolation, in a complex form, or in final position, and (3) the following tone.

For isolation forms of nouns, Ansre gives data to show that monomorphemic (V).C(C)V-shaped nouns in isolation have three surface tonal patterns following voiceless obstruents and sonorants (non-depressors) and two surface tonal patterns following voiced obstruents (depressors). The following are data from Ansre (1961) pp. 24, 26, 27, 60, 62, and 63.[25] Note that Ansre himself

[25] Ansre indicates contour tones by placing the second tone over a full stop character, such as in [kē.́] 'root'. He gives no indication of vowel length being phonemic. According to his explanation of vowel length, vowels that are semi-long are always contour tones and those that are long are found in words that have ideophonic qualities. In Stahlke's (1971) copies of Ansre's data, he writes contour tones over two vowels, as in [kēé] 'root'. Although long

does not speak of 'tonal patterns'. Instead, he analyzes some nouns as having a high tone suffix.

(48)

	Voiceless obstruent or sonorant onset			
	CV-shaped noun		VCV-shaped noun	
[H]	[tú]	gun	[àkpé]	thanks
	[ké]	sand	[àfí]	ashes
	[ló]	crocodile	[ānyí][26]	bee
	[nú]	thing	[ālá]	raffia
[L]	[klò]	knee	[àfì]	mouse
	[tò]	buffalo		
	[mò]	face	[àwù]	clothes
	[nyà]	word	[àmì]	oil
[MH]	[pɛ̄ɛ́]	chisel	[àkpāá]	fish
	[tōó]	mortar	[àtɔ̄ɔ́]	nest
	[nūú]	mouth	[āmāá]	greens
	[yāá]	air		
	Voiced obstruent onset			
	CV-shaped noun		VCV-shaped noun	
[L]	[bè]	thatch	[àdzò]	riddle
	[dà]	snake	[àzì]	egg
[LH]	[gbɔ̀ɔ́]	goat	[àvùú]	dog
	[dèé]	palm nut	[àzìí]	peanuts
	[gòó]	gourd		

In this summary table, the tone of the 'prefix' [a-] is not included in the labeling of tonal patterns. The tone of the prefix [a-] is non-H and is discussed at length in this section. For the moment, I note that although the term 'prefix' is used by both Ansre and Stahlke (1971) to describe the initial vowel of these nouns, it is not clearly shown to what degree this vowel would function synchronically in Ewe as a true inflectional prefix despite its presumed historic role as a noun class prefix.

According to Ansre, surface L which is seen following non-depressors in isolation forms such as [mò] 'face' and [àwù] 'clothes' is exceptional and occurs only because these words are in their isolation form. His observation is that in non-isolation environments following non-depressors, the non-H tone is realized as a

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vowels do not appear to be phonemically contrastive in Peki, Stahlke (p. 205) argues that they are in Kpando, giving the following forms as evidence of words that have contrastive length while being linked to a single tone: [āyíí] 'skin', [fyáá] 'axe', [fúú] 'fur', [táá] 'pond, [nɛ́ɛ́] 'palm nut', [kéé] 'sand'. In accordance with the tradition for work in Ewe, I mark contour tones on two vowels.

[26] For the data sets in this section, I employ the original conventions of the authors by writing **ny** for [ɲ] and **y** for [j], and not marking nasality on vowels that follow a nasal consonant.

"characteristic mid allotone" (p. 28). He gives the following data which are put in a frame which includes the definite article [lá] to show that the non-H tone following a non-depressor is realized in non-isolation environments as M.

(49)

	CV-shaped noun		VCV-shaped noun	
	[tē lá]	the yam	[àsī lá]	the market
	[lā̃ lá]	the animal	[āwū lá]	the dress
	[mō lá]	the face	[āŋē lá]	the rubber

There is evidence from Ansre's data to indicate that the single [LH] rising contour seen after depressors in (48) may in fact be a neutralization of two different underlying tonal patterns (Stahlke, 1971). Consider the following data from Ansre (p. 60) where the possessive forms [nyèé] 'my' and [éɸé] 'his' precede nouns that have depressor consonants. Note that all of the nouns in (50) have the same [LH] surface pattern in isolation.

(50) **Isolation form**

nyèé + gbɔ̃̀ɔ̃́	my + goat	→	[nyè gbɔ̃́]	[L] [H]
éɸé + dèé	his + palmnut	→	[éɸé dé]	[H] [H] [H]
nyèé + gòó	my + gourd	→	[nyèé gòó]	[LH] [LH]
éɸé + dòó	his + hole	→	[éɸé dòó]	[H] [H] [LH]

Stahlke (1971) re-examines Ewe using Ansre's data in light of the derivational rules of Smith (1968) and compares these with his own data from the Kpando dialect. Stahlke and Smith both take /M/ to be the underlying non-H tone, thus assuming that nouns have either underlying /H/ or /M/ and that surface L is derived from /M/ by a series of rules that will be examined shortly.

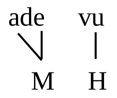
Stahlke draws several important conclusions about underlying tones in Ewe nouns. First, he argues that forms like [gbɔ̃̀ɔ̃́] 'goat' and [gòó] 'gourd' in (50) have different underlying tones—/H/ for the former and /MH/ for the latter. These forms have the same rising contour in isolation, but are realized in different ways when they appear as the final element in a complex noun (where noun-initials vowels are deleted word-medially). We can see this difference in the following data from Stahlke (1971, pp. 175, 207).

(51) **Isolation form**

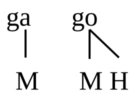
/gā/ + /gōó/	[gà] 'metal' + [gòó] 'gourd'	→	[gàgòó] 'oil drum'
/ādē/ + /āvú/	[àdè] 'hunt' + [àvùú] 'dog'	→	[àdèvú] 'hunting dog'

The following would be the underlying forms for the compounds in (51).

(52) a.



b.



In order to explain surface rising contours in the isolation form of a noun that has underlying H, such as in [àvùú] 'dog', Stahlke introduces two rules. First, there is a rule of M prefix lowering. This rule lowers M prefixes to L preceding any obstruent—voiced or voiceless. (This accounts for the initial L on forms such as [àkpé] 'thanks' and [àdzò] 'riddle', but not on [ānyí] 'bee'.)[27]

Following application of the rule of M prefix lowering, there is a rule of L tone insertion. This rule inserts L (and a vowel to function as the TBU for this L) in the environment that includes both of the following: (1) a preceding sequence of L plus a depressor consonant, and (2) a following H.[28]

Stahlke sees this same rule of L tone insertion applying in cases of the imperative, where the underlying H verb /vá/ becomes [vàá] (p. 212). He asserts that there is a separate L tone grammatical prefix that is inserted for the imperative. It is this L tone that creates the conditioning environment for the rule of L tone insertion to apply.

This brings us to the form for 'goat', [gbɔ̃̀ɔ̃́] in Ewe. There is evidence (such as in the paradigm in (50)) that this is underlyingly /gbɔ̃́/. One might wonder where would be the L tone that would trigger L tone insertion following the depressor in this case. Stahlke argues that a L is present here as well, but as a floating noun prefix. According to Stahlke, *all* nouns in Ewe have a prefix. Where there is no segmental element to that prefix, the prefix is simply a floating M (which is lowered to L preceding an obstruent). He provides evidence for this proposal from several angles.

First, he gives the following examples where a H verb followed by a H noun is realized with a falling [HL] contour. The following is taken from Stahlke (1971, p. 167) and is representative of both the Peki and the Kpando dialects.

(53) **Underlying form**

kpɔ́ + `tó	see + ear	→	[kpɔ́ɔ̀ tó]
kpɔ́ + àtí	see + tree	→	[kpɔ́ àtí]

As we can see in (53), the same verb does not have a HL contour when followed by a noun that has a [a-] prefix. Stahlke argues that when the noun prefix

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[27] In light of this rule, sonorants should be seen as having a phonological categorization distinct from the category of obstruents—both voiced and voiceless.

[28] Note that this rule of L tone insertion does not apply in the case of the compound [àdèvú] 'hunting dog'.

does not have a segmental dimension, the floating M prefix (lowered by the rule of M prefix lowering) becomes associated to the vowel of the verb.

The presence of the floating noun prefix is also indicated by the tonal difference in reduplicated forms of the verb which have either nominal or adjectival roles. These are illustrated below from Ansre (1961, p. 39) and Stahlke claims they are the same in the Kpando dialect.

(54)	**Underlying form**		**Nominal derivation**		**Adjectival derivation**	
	/bú/	to lose	[bùbú]	loss	[búbú]	lost
	/bū/	to respect	[bùbù]	respect	[būbūú]	respected
	/vó/	to rot	[vòvó]	rottenness	[vóvó]	rotten
	/vō/	to be free	[vòvò]	freedom	[vōvōó]	free
	/tú/	to shut	[tùtú]	shutting	[tútú]	closed
	/tū/	to grind	[tùtù]	grinding	[tūtūú]	ground

Stahlke (1971) describes this paradigm by saying that the reduplication prefix does not have any pre-assigned tone. In cases where the reduplicated form serves as a noun, the floating tone that is the noun prefix in these examples becomes linked to the vowel of the reduplication prefix. Otherwise, the tone of the prefix is presumably obtained through copying or spread from the verb root, although this is not explicitly stated by Stahlke.[29]

Note also in (54) that the adjectival forms derived from verbs in Ewe have what is labeled in the Ewe literature as a 'high suffix'. This high suffix causes a final M to be realized as a MH contour.

We return then to the question of the rising tone on [gbɔ̄̀ɔ̄́] 'goat', derived from underlying /gbɔ̄́/. The premise is that all nouns have a floating M prefix. The rule of M prefix lowering causes this prefix to be lowered to L. At this point, the conditions are met for Stahlke's rule of L tone insertion, yielding the surface form [gbɔ̄̀ɔ̄́].

Now we can re-examine the tonal patterns of nouns in Ewe (Peki dialect) from (48) in light of Stahlke's ideas regarding underlying forms.

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[29] Note that the adjectival forms all end in H or rising tones. Ansre and Stahlke mention the existence of what they label as a 'H tone participial suffix'.

(55) **Voiceless obstruent or sonorant onset**

	CV-shaped noun		VCV-shaped noun	
/(M.)H/	[tú]	gun	[àkpé]	thanks
	[ló]	crocodile	[ānyí]	bee
/(M.)M/	[klò]	knee	[àfì]	mouse
	[mò]	face	[àwù]	clothes
/(M.)MH/	[pɛ̄ɛ́]	chisel	[àkpāá]	fish
	[yāá]	air	[āmāá]	greens

Voiced obstruent onset

	CV-shaped noun		VCV-shaped noun	
/(M.)H/	[gbɔ̀ɔ́]	goat	[àvùú]	dog
/(M.)M/	[bè]	thatch	[àdzò]	riddle
/(M.)MH/	[gòó]	gourd	[àdèé]	saliva

Here we see that there are only three underlying tonal patterns. There remains the question of how to explain many of the instances of L. Given the assumption that all L phonetic tones are derived from /M/, Smith (1968) endeavors to create rules that account for every instance of L. These rules are simplified in some cases by Stahlke (1971). First, there is the previously discussed rule of M prefix lowering which lowers the M prefix before an obstruent, accounting for the initial L on the forms [àkpé] 'thanks' and [àdzò] 'riddle', in contrast with the initial M on [ānyí] 'bee'.

There is also a rule that /M/ in nouns becomes L following a depressor.[30] This rule applies only to nouns, not to verbs or forms from other grammatical categories. This accounts for L following the depressors in [bè] 'thatch' and [gòó] 'gourd'. This also accounts for the forms in (56)a and (56)b from Stahlke (1971, p. 140).

(56)	a.	/¯dā lá/	[dà lá]	the snake
	b.	/¯hā lá/	[hà lá]	the pig
	c.	/¯kpō lá/	[kpō lá]	the stick
	d.	/¯nyī lá/	[nyī lá]	the cow

The fact that this lowering rule applies only to nouns is evident from examples such as [wó dā nyī lá] 'they threw the cow', derived from /wó dā ¯nyī lá/ (Stahlke, 1971, p. 141). In this utterance, the verb /dā/ 'throw' does not have its M lowered even though this M follows a depressor.

In the Peki dialect of Ewe (Ansre, 1961; N. Smith, 1968), there is also a rule that /M/ becomes L in final position. This explains surface forms such as [mò]

[30] This is the second rule that refers specifically to the category of depressors. The other is the rule of L tone insertion which inserts L before H; here, /M/ becomes L.

'face', as well as the final L in an utterance such as [wó wù nyì] 'they killed a cow', derived from /wó wū ¯nyī/ (Stahlke, 1971, p. 141). Stahlke claims that this rule does not apply to final noun stems in the Kpando dialect.[31]

Finally, there is a bidirectional rule of L spread that iteratively spreads L to an adjacent M TBU. This accounts for forms such as /¯dā wū ālɛ̃́/ 'a snake killed a sheep', which is realized as [dà wù àlɛ̃́] following the depressor-motivated lowering of /¯dā/ 'snake' to [dà] (Stahlke, 1971, p. 215).

Given these rules, one can understand the paradigms in (57), taken from Stahlke (p. 141).

(57)	**underlying**	**prefix lowering**	**depressor effect**	**L spread**
a.	/wó wū ¯dzātá lá/ 'they killed the lion'	wó wū ˋdzātá lá	wó wū ˋdzàtá lá	[wó wù dzàtá lá]
b.	/wó wū ¯sɔ́ lá/ 'they killed the horse'	wó wū ˋsɔ́ lá	wó wū ˋsɔ́ lá	[wó wù sɔ́ lá]
c.	/wó wū ¯nyī lá/ 'they killed the cow'	wó wū ¯nyī lá	wó wū ¯nyī lá	[wó wū nyī lá]
d.	/wó dā ¯zē lá/ 'they threw the pot'	wó dā ˋzē lá	wó dā ˋzè lá	[wó dà zè lá]
e.	/wó dā ¯sɔ́ lá/ 'they threw the horse'	wó dā ˋsɔ́ lá	wó dā ˋsɔ́ lá	[wó dà sɔ́ lá]
f.	/wó dā ¯nyī lá/ 'they threw the cow'	wó dā ¯nyī lá	wó dā ¯nyī lá	[wó dā nyī lá]

In the Kpando dialect, L spread is affected by the presence of a voiceless obstruent—specifically one found in a noun. This is shown in data from Stahlke (pp. 147, 163, 178, 179).[32]

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[31] The example of [wó wù nyì], comes from a data set that appears in Stahlke (1971, p. 141). Although this utterance is not explicitly stated as representing the Peki dialect, given his claim that nouns do not undergo final lowering in Kpando, it is presumed that these data are from the Peki dialect.

[32] I skip the depressor effect rule in these derivations for reasons of fitting the derivations on one line and because the final realization is the same whether it is listed or not.

(58)	underlying	prefix lowering	L spread
a.	/mē fī ¯kpō lá/ 'I stole the stick'	mē fī `kpō lá	[mè fì kpō lá]
b.	/mē bū ¯fyā lá/ 'I repected the chief'	mē bū `fyā lá	[mè bù fyā lá]
c.	/āmē fī āzī lá/ 'a person stole the egg'	āmē fī àzī lá	[àmè fì àzì lá]
d.	/āfī fī āzī lá/ 'a mouse stole the egg'	àfī fī àzī lá	[àfī fì àzì lá]
e.	/āmē wū āfī lá/ 'a person killed the mouse'	āmē wū àfī lá	[àmè wù àfī lá]

The last tonal process to highlight, one that is only valid in the Kpando dialect, is a process of H spread that exists at the boundary between verb and noun. This rule spreads final H from a verb to the prefix vowel of the noun. Some examples of this are /kpɔ́ āyíí/ 'see beans', which is realized as [kpɔ́ áyíí], and /kpɔ́ ādɔ̄/ 'see squirrel', which is realized as [kpɔ́ ádɔ̀]. Interestingly, this H spread does not happen before a voiceless obstruent, so /kpɔ́ àtí/ 'see tree' is realized as [kpɔ́ àtí] (Stahlke, 1971, p. 167).

Before moving to a discussion of an alternate analysis of Ewe, it is worth mentioning that although Stahlke maintains that Ewe has an underlying /H, M/ contrast, there is a role for grammatical L in his analysis—marking the imperative and marking yes-no questions utterance-finally—that is not well-accounted for in his analysis.

There are (at least) two ways to approach the Ewe data. One can explain these data by positing a small number of underlying tonal patterns and proposing multiple phonological rules that account for the variety in surface forms. This is the strategy employed by Stahlke and Smith. One can also propose a greater number of underlying patterns, thereby requiring fewer derivational rules. Bradshaw (1999) opts for the latter strategy, proposing the following as the underlying forms of Ewe nouns (p. 127). Note that this analysis assumes the existence of a four-way underlying tonal contrast: /H, M, L, Ø/.

(59)		**CV-shaped noun**	**VCV-shaped noun**
		Voiceless obstruent onset	
	high	` CV́	` VCV́
	non-high	` CV̄	` VCV̄
	contour	` CV̄V́	` VCV̄V́
		Sonorant onset	
	high	CV́	VCV́
	non-high	CV	VCV
	contour	CVV́	VCVV́
		Voiced obstruent onset	
	non-high	` CV	` VCV
	contour	` CVV́	` VCVV́

According to Bradshaw's analysis, all that is required in addition to these underlying forms is a bidirectional iterative rule of L spread and a default fill-in of M following the rule of L spread. In exchange for Stahlke's three underlying tonal patterns, Bradshaw has sixteen distinct underlying tonal patterns. In exchange for the increased complexity involved in having sixteen underlying patterns, Bradshaw avoids the necessity of having rules that refer specifically to morphological structures such as the noun prefix (as in the M prefix lowering rule) or syntactic structures such as the noun (as in the depressor-motivated lowering rule). This analysis also prevents having a rule that seems to imply that sonorants may belong to a natural class distinct from voiced and voiceless obstruents (as in the M prefix lowering rule).

Another result of Bradshaw's analysis is that it avoids attributing to voiceless obstruents any role in blocking L spread. Rather, it is the presence of /M/ which prevents L from spreading in the underlying forms of nouns that have voiceless obstruents.

Note that among nouns that have voiced obstruents, there is no 'high' category of tonal patterns as there is for nouns that have either voiceless obstruent or sonorant onsets. This means that there is no way to explain why some nouns that have [LH] contours in their isolation forms are realized H when in compound or possessive constructions, and others are realized [LH] in these same constructions. The relevant data are repeated here.

(60) **Isolation form** (Ansre 1961, 60)

nyèé + gbɔ̃̀ɔ̃́	my + goat	→	[nyè **gbɔ̃́**]
éɸé + dèé	his + palmnut	→	[éɸé **dé**]
nyèé + gòó	my + gourd	→	[nyèé **gòó**]
éɸé + dòó	his + hole	→	[éɸé **dòó**]

(61) **Isolation form** (Stahlke 1971, 175, 207)
[gà] 'metal' + [gòó] 'gourd' → [gà**gòó**] 'oil drum'
[àdè] 'hunt' + [àvúú] 'dog' → [àdè**vú**] 'hunting dog'

This may be a weakness in Bradshaw's analysis. One also wonders whether, in multiplying numbers of underlying tones and underlying tonal patterns, the explanatory power gained makes up for this increased complexity.

Clements (1972, 1978) also addresses Ewe, but deals with the Anlo dialect. Clements, like Smith and Stahlke, posits Ewe as having a two-way underlying tonal contrast: /H, M/. However, from these underlying tones, the Anlo dialect has four surface levels—including raised H (hereafter ↑H), H, M and L. Clements (1978) describes a rule raising /M/ to ↑H in certain syntactic domains. A frequently cited example of this is /ātyí mɛ̄gbé/ 'behind a tree', which is realized as [àtyı̋ mɛ̋gbé].

Clements demonstrates that this type of raising occurs within the domain of of prosodic consituents that are mapped from syntactic structures that contain no left branches. Selkirk (1986) restates this using X-bar theory by saying that phonological phrases are mapped in Ewe by creating a phrasal boundary at the left edge of every syntactic maximal projection.

Besides its relevance to theories of phonology-syntax interactions, Clements' work is also theoretically interesting as it has been used to support the idea of mid tone being in a natural class with raised high. This idea is an assertion made by the Two-Feature Model of tone (see section 2.2). Clements himself, however, does not consider the Anlo data to be adequately convincing evidence for this assertion (Clements et al., 2010).

Before closing this section on Ewe tone, I note one other interesting tonal phenomenon found in Ameka (1999), which is that complex nominal constructions sometimes have a H tone suffixed to the end of the construction. An example Ameka (p. 75) gives is found in (62).

(62)	[é-nyé	ŋútsu	gbɔ́	ŋútsǔ]
	3SG-be	man	vicinity	man-high.tone.suffix

He is an effeminate/emasculated man. (lit. He is a man near man.)

Here, the H suffix is responsible for the final [LH] rise on [ŋútsǔ] 'man'. Additionally, Ameka states that the H suffix has a function, particularly in the northern dialects of Ewe, in marking syntactic nominal compounds (p. 96).

Other Gbe languages have been the topic of tone studies as well, and I briefly turn to some of the observations made in those studies before summarizing some of the phenomena common to all of these languages.

2.8.2 Gen

Although Bole-Richard's (1983) study of Gen is not primarily a tone study, he does include tone in his study. He analyzes Gen as having an underlying /H, L/ system. The following is an overview of the underlying forms and the surface realizations of these forms in monomorphemic nouns in Gen according to Bole-Richard (1983, pp. 107, 109). Note that C(C)V-shaped nouns do not exist in Gen.

(63)			
		Voiceless obstruent or sonorant onset	
	/L.H/	[ètɔ́]	father
		[àlɔ́]	cheek
	/L.L/	[ètɔ̀]	stream
		[àlɔ̀]	hand
		Voiced obstruent onset	
	/L.H/	[ègǎ]	chief
	/L.L/	[ègà]	metal

In Gen, all of the initial vowels on nouns are realized L. Another observation to be made is that in monomorphemic nouns, an underlying /H/ following a voiced obstruent is realized as a [LH] contour.

Bole-Richard also mentions six exceptional forms that have a rising contour following a voiceless obstruent or sonorant. These are [ètǎ] 'head', [àtǎ] 'chief', [ètǒ] 'mortar', [ènǔ] 'mouth', [àyǐ] 'beans', and [àyǎ] 'wind'.

Bole-Richard documents an interesting pattern that has to do with the phonemes /b/ and /d̪/ and what he analyzes as their allophones [m] and [n]. Following [b] and [d̪], a surface [LH] contour is the realization of underlying /H/. Following [m] and [n], surface [H] is generally the realization (except in the exceptional case of [ènǔ] 'mouth'). He gives the following as examples of this pattern (p. 110).[33]

(64)	**[b] and [d̪]**		**[m] and [n]**	
	[àbǎ]	mat	[èmá]	fermented flour
	[àbɔ̌]	arm	[èmɔ́]	path
	[èbǔ]	other	[èmú]	mosquito
	[èd̪ǐ]	sweepings	[èní]	namesake
	[àd̪ɔ̌]	rejoinder	[ànɔ́]	breast
	[àd̪ǔ]	tooth	[ènú]	thing

Thus in Gen, the tonal process that takes as its input an underlying /H/ in a noun and yields [LH] following a depressor is consistently distinguishing between

[33] The transcriptions given by Bole-Richard do not mark nasalization on vowels that follow nasal consonants; nasalization is nonetheless assumed by Bole-Richard to be present (p. 48).

these allophones based on a surface-level distinction between [b] and [m] in the one case, and [ɖ] and [n] in the other. Stated otherwise, in Gen, surface [b] and [ɖ] pattern with depressors in their tonal patterns, but [m] and [n] do not, regardless of the underlying phonemic status of these latter sounds.

Bole-Richard discusses noun compounds at length. In noun compounds, the initial vowel of any noun is deleted word-medially along with its tone. He notes that in noun compounds, there is always a raising of pitch at the right edge of the compound (p. 253).

(65)

	Isolation form	**At right edge of compound**
all consonants	CV̀	CV̌
depressors	CV̌	CV́
non-depressors	CV́	CV́

In addition, if the surface tone of any initial noun in a noun-noun compound is H (in the case of non-depressors) or LH (in the case of depressors), the tone of the final noun will be H regardless of its tone in isolation. This indicates that there is H spread within noun compounds in Gen.

2.8.3 Fon

In Fon as in Ewe, monomorphemic nouns can have a C(C)V or V.C(C)V shape. The following captures the tonal paradigms in Fon as seen in data taken from Brousseau (1993, pp. 8, 12, 13) and Lefebvre and Brousseau (2002, pp. 20, 26, 48).

(66)

	CV-shaped noun		**VCV-shaped noun**	
	Voiceless obstruent onset			
/(L.)H/	[xú]	bone	[àsɔ̃́]	crab
/(L.)L/	[xɔ̀]	building	[àsì]	wife
	Voiced obstruent or sonorant onset			
/(L.)H/	[vǐ]	child	[àvũ̌]	dog
	[lǒ]	crocodile	[àlǐ]	liver
/(L.)L/	[dã̀]	snake	[àzɔ̃̀]	disease
	sonorant data unavailable		[àwù]	clothes

Lefebvre and Brousseau (2002) describe Fon as having a two-way underlying /H, L/ tonal contrast. Disregarding the initial vowel (which is always L), nouns are either /H/ or /L/. Sonorants pattern with voiced obstruents in having a [LH] rise rather than a [H] surface realization on the C(C)V syllable of the noun.

Brousseau (1993) rejects the notion of there being a tonal 'prefix' or initial floating tone on nouns that have no initial vowel.[34] Instead, she explains this rising tone by positing that voiced obstruents and sonorants are themselves tone-bearing units (TBUs) and are associated to L tone. Thus in [vǐ] 'child', a L linked to the voiced obstruent spreads rightward to the following vowel which is already associated to H.

In certain contexts, the L linked to a voiced obstruent is prevented from linking to the following vowel and one gets a surface H rather than a rising LH following this obstruent. This happens in verbal reduplication. For example, the verb /gbá/ 'build' can be reduplicated to yield the adjectival form [gbìgbá] 'built'. Here, Brousseau argues that the L linked to the voiced obstruent spreads leftward to the prefix and therefore cannot also spread rightward.

The L linked to the voiced obstruent is also prevented from linking to the following vowel when the obstruent is preceded by a H. So, for example, the verb /gbá/ 'build' is realized [gbá] following a H tone in [é gbá xwé] 'he built a house' (Lefebvre & Brousseau, 2002, p. 24).

In Fon, there is a process of H spread in certain domains. These are described in (67), where the domains in which spread occurs are marked with brackets. The data here come from Lefebvre and Brousseau (2002, pp. 22, 23)

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[34] This notion is rejected principally because Brousseau also observes a rising tone on the isolation forms of verbs that have voiced obstruent or sonorant onsets. She states that there cannot be a floating tone preceding both verbs and nouns.

(67)	**underlying**[35]		**surface form**	**domain of spread**
a.	/é sà àsɔ́n wè/ '(s)he sold two crabs'	→	[é sâ] [àsɔ́n wê]	Subj NP+Verb; Obj NP
b.	/é kò xɔ̀ àsɔ́n/ '(s)he bought some crab'	→	[é kó ꜜxɔ̂] [àsɔ́n]	Subj NP+Aux+Verb; Obj NP
c.	/àsá-mɛ̀/ 'groin' (lit. thigh-inside)	→	[àsá-mɛ̂]	N-Prep Compound
d.	/hwèví-sà-tɔ́/ 'fishmonger' (lit. fish-sell-AGENT)	→	[hwèví-sá-ꜜtɔ́]	N-Verb-Suffix Derivation
e.	/à só tè/ 'you mashed yams'	→	[à só tê]	Subj NP+Verb+Obj NP (monosyllabic)
f.	/é nɔ̀ sà tè/ '(s)he usually sells yams'	→	[é nɔ́ sá tê]	Subj NP+Aux+Verb+Obj NP (monosyllabic)

According to Lefebvre and Brousseau, H spread occurs iteratively in Fon (1) in any derived word, whether affixed or compounded; (2) within the object NP; (3) within a domain which includes the subject NP, any verbal auxiliaries, and the verb head of the VP; and (4) within a domain which includes the former *plus* a monosyllabic object NP. Spread continues until the end of the domain. If the last TBU in the domain is underlyingly L, a surface HL contour is created on this TBU. If a second H appears within the domain, this H is realized as a downstepped H.[36]

2.8.4 Maxi

The Gbe variety called Maxi has also been the topic of a tone study. Gbéto (1997) proposes that in Maxi, voiced obstruents and sonorants are TBUs and carry L tone. This L tone spreads to the following H vowel to produce a surface LH rise in isolation forms of nouns and verbs. This is the same proposal as that made for Fon by Brousseau (1993).

An interesting twist, however, is that following this spread of tone, there is devoicing of voiced obstruents. This can be seen in /à ̀zé/ 'sorcery', which is realized [àsě] and in / ̀gbɛ́/ 'refuse', which is pronounced [kpɛ̌] (p. 125, 127). (The floating L

[35] I have copied the data as presented by Lefebvre and Brousseau. Nasalization of vowels is not marked when the vowel follows a nasal consonant. Otherwise, nasalization is marked by adding an orthographic **n** following the vowel.

[36] It is unclear why there is a downstepped HL contour on the verb in (67)b since there is no underlying H tone on the verb /xɔ̀/ 'buy'.

marked in these underlying forms is the L originating from the voiced obstruent.) Interestingly, though, this process of devoicing never applies to the sounds [b] or [ɖ]. For example, / ̀blú/ 'trouble, be troubled' is realized [blǔ] (p. 111).

This devoicing process can yield surface contrasts like the following given in Gbéto (p. 122).

(68)	**underlying**		**surface form**
a.	/xwà/ 'weed'	→	[xwà]
b.	/xwá/ 'empty (v.)'	→	[xwá]
c.	/ ̀ɦwá/ 'eat avidly'	→	[xwǎ]

This concludes the overview of tone analyses for some of the Gbe languages. I turn now to a summary of the common trends found in these tonal data in light of the theoretical framework discussed earlier in this chapter.

2.9 Summary

Saxwe displays many tonal phenomena that have interested researchers of African tone over the years. The various topics discussed in this chapter—including automatic and non-automatic downstep, tone effects related to prosodic structure, and syntactically conditioned tone—are all addressed in the course of this study of Saxwe tone. While the bulk of this study employs privative H, M and L to describe and discuss the data, in chapter 6, I look at how tone features might be employed to describe the Saxwe tonal system.

This study of Saxwe tone comes in the wake of many previous studies on tone of languages in the Gbe continuum. While there are many common trends to be found in the Gbe tone data, these may be dealt with in a variety of ways by the researchers who describe them. Some of this has to do with the relative complexity of the system being described. I highlight some of these common trends in the following paragraphs.

First, we see that in none of the Gbe languages surveyed here do we find surface [H] following a voiced obstruent in the isolation form of a monomorphemic noun. Instead, we always find a [LH] rise in this context.

In some cases, researchers have decided that this [LH] rise is derived from underlying /H/ through a tonal rule. In Ewe, Stahlke (1971) has a rule of L tone insertion (also inserting a V slot to bear the L) that inserts L before H in the appropriate environment. In Gen, Bole-Richard (1983) has a rule of allotonic variation that changes /H/ to [LH] in the same environment.

In the case of Fon, Brousseau (1993) claims that the [LH] rise is derived from underlying /H/ not only following voiced obstruents, but also following sonorants. In order to deal with this, she hypothesizes that voiced obstruents and sonorants have the status of being TBUs. As such, they bear L tone. She then has a rule that spreads this L to the following H vowel, thus producing the [LH] rise. Gbéto (1997) takes the same position for describing the [LH] rise in Maxi.

Bradshaw (1999) takes yet another approach to explaining the [LH] rise in Ewe. She posits an underlying sequence of two vowels in these forms—one toneless and one /H/. Using her Multiplanar model (discussed in section 2.7), she explains that the low pitch of the [LH] sequence is due to the multiple association of L both to the laryngeal node of the voiced obstruent as well as to the TBU of the adjacent toneless vowel.

The questions that are being answered in all of these cases are similar. Is L in this context underlying or phonologically derived? How directly is its presence understood to be triggered by the voiced obstruent—indirectly through a rule that refers to the voiced obstruent or more directly through lines of association that run directly from the voiced obstruent to L? These are questions that must be answered in the analysis of Saxwe tone as well.

Another trend in the Gbe data (noted in two of the four languages surveyed) is that there are certain constructions that seem to have H tone suffixes. In Ewe, these include derivations involving verbal reduplication as well as complex nominal constructions (Ameka 1999, Ansre 1961). In Gen, there are H tone suffixes on noun-noun compounds (Bole-Richard 1983). The question that can be raised here is whether this H tone is truly a suffix, or whether it marks a syntactic or prosodic boundary (discussed in section 2.5). If it marks a boundary, what exactly is the nature of that boundary? These questions will also be addressed in the analysis of Saxwe, although in Saxwe the tonal cognate of this H suffix is shown to operate much like a floating H in that it cannot link to a TBU.

A third common trend in the Gbe languages is a process of H spread. It is interesting that the process of H spread in Fon (Lefebvre & Brousseau, 2002) operates within a domain that includes the subject and the verb but not the object—unless this object is comprised solely of a monosyllabic noun (*i.e.* one that does not have an initial vowel), in which case H will spread to the monosyllabic object noun. In the Kpando dialect of Ewe, H is spread *only* from the verb to the initial vowel of the noun object (Stahlke, 1971, p. 167). In contrasting the two languages, we see very different, almost opposing, situations with regard to how the initial vowel participates in helping to delineate domains of H spread. We also see that H spread occurs within all derived words in Fon (Lefebvre & Brousseau, 2002). In Gen, H spread occurs in noun-noun compounds (Bole-Richard, 1983).[37] Here, there are similarities in processes of H spread.

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[37] H spread may occur in other types of derived words in Gen as well; Bole-Richard does not

These observations attest to the fact that H spread is a relevant process in several of the Gbe languages. However, its domains of operation can be defined in very different ways. In the analysis of Saxwe, it is shown that the domain of H spread in Saxwe is more broadly encompassing than in any of the Gbe languages surveyed in this section.

Turning to questions of underlying tonal contrasts, we see that the most common analysis for these Gbe langauges is one that proposes a two-way underlying contrast—either /H, M/ (Ewe) or /H, L/ (Gen, Fon). Bradshaw's (1999) analysis of Ewe as having a four-way /H, M, L, Ø/ underlying tonal contrast is unique in this regard. In the more common two-way contrast proposed for Ewe, we see that in some dialects, this contrast is realized as three tonal heights. In the Anlo dialect, however, it is realized as four tonal heights (Clements 1978).

This study demonstrates that Saxwe has three tonal heights and a three-way underlying contrast—/H, M, L/. This makes it atypical among the Gbe varieties. Rather, in this respect, Saxwe has more in common with Yoruba. As noted in section 1.1, this is not altogether surprising given the Saxwe peoples' putative history of being the product of a Yoruboid group that migrated into the Gbe-speaking territory. However, unlike the /H, Ø, L/ analysis of the Yoruba underlying contrasts, Saxwe is best analyzed as having a /H, M, L/ contrast. Reasons for this are discussed in chapter 3.

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provide data to ascertain this.