

PROSODIC PHONOLOGY IN BAMANA (BAMBARA):
SYLLABLE COMPLEXITY, METRICAL STRUCTURE, AND TONE

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Dedicated to my mother, Cathy, who will read every page,
and to my grandmother, Diana, who already has.

In loving memory of my grandfather, Scooge Smith, who I wish
could be here to see my 'professional student' days come to an end.
And, Dr. J. Kathryn Josserand, who pointed me in the right direction.

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Christopher R. Green

PROSODIC PHONOLOGY IN BAMANA (BAMBARA):

SYLLABLE COMPLEXITY, METRICAL STRUCTURE, AND TONE

This dissertation characterizes three components of prosodic phonology, namely syllable structure, metrical structure, and tone, in Bamana (Bambara), a Mande language of West Africa, and its related varieties. Of primary interest is the Colloquial (non-standard) variety of Bamana spoken in Bamako, Mali, by a young cohort of individuals. It is shown that Colloquial Bamana differs in significant ways from other phonologically conservative or normative varieties of the language, most noticeably in its inventory of permitted complex syllable shapes. This thesis illustrates that the synchronic emergence of complex syllables in this language variety is bounded and restricted by higher prosodic structure in the language. It is demonstrated that prosodic domains in the form of disyllabic metrical feet are present in the language and play a role in driving the outcome of two complementary and at times competing processes of segmental reduction that are active in generating the noted complex syllable types. The overall goal of this thesis is to describe and analyze the mechanisms underlying these processes and prohibitions and to explore the implications that their presence has for both descriptive and theoretical phonology, as well as for phonological change in this and other related Mande languages.

Alongside these explorations into syllable complexity and metrical structure, this dissertation sheds new light on the tonal phonology of Bamana, a subject that has been shrouded in controversy for many years. By considering the tonal results or consequences of segmental minimization in Colloquial Bamana, the thesis offers new ideas on

structures, processes, and changes underway in the language's tonology. Topics explored in detail include tonal feet, tonal compactness, and tonal word melodies.

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CHAPTER 1

INTRODUCTION AND BACKGROUND

“Dɔɔnin, dɔɔnin, kɔnɔnin bɛ ɲaga da.”

“Little by little, the bird builds its nest.” - Bamana proverb

1.1 Introduction

The study of non-standard and emergent language varieties has much to offer to the field of linguistics from both descriptive and theoretical standpoints. Such languages are often wrongfully set aside or not studied in detail, perhaps owing to a lack of reliable data from which to generate an analysis or the draw of studying a language with more readily-accessible resources and a known background. Perhaps it may be due to fear of drowning in unforeseen variation and then having to explain it. On the other hand, however, non-standard languages, particularly as they are emerging or even diverging from other language varieties, have much to contribute. On the descriptive level, such languages allow one the opportunity to capture and explore, synchronically, new linguistic characteristics alongside the potential loss of others. Furthermore, the emergence and/or loss of these components can be entertained in the diachronic sense, given that the characteristics of the normative varieties from which they are emerging or diverging may already be known and even better understood.

Theoretically, the emergence of non-standard language varieties also puts to the test the predictions of linguistic theory by bringing a new grammar into existence. Because theories and frameworks of linguistics strive to account for what is possible and

to exclude what is impossible in a grammar, the study of emerging languages is critical. Their features have the ability to challenge, support, inform, and drive the ever-changing science of linguistics. Emergent languages may also shed new light onto earlier analyses of related languages. It is with these general thoughts in mind that this thesis has been formulated.

1.2 Background on Colloquial Bamana

This thesis introduces and analyzes the morphophonological, tonological, and prosodic characteristics of a non-standard variety (perhaps best considered a koiné) of Bamana (also known as Bambara or Bamanankan), spoken by a young cohort of individuals in the city of Bamako, the capital of Mali, a land-locked nation of West Africa. This variety, described thus far in the literature as Colloquial Bamana (e.g. Green & Diakite 2008; Green, Davis, Diakite & Baertsch 2009), is an urban lect identifiable by its tendency toward segmental minimization (or reduction) primarily via two active phonological processes, namely Vowel Syncope and Velar Consonant Deletion. These processes have a net effect of satisfying an overall drive towards minimization in Colloquial Bamana by, upon their application, introducing complex syllable shapes (e.g. CCV, CVC, and derived CVV) into the syllabic inventory of the language. This development is novel given that Colloquial Bamana is understood to be emerging or diverging from the more phonologically conservative and normative Urban Standard or Classical forms of Bamana used by older generations of speakers in Bamako itself, as well as in rural areas not far from the city, including Ségou, the historic capital of the Bamana Empire (c.1640-1861). In comparison to the phonological complexities permitted in Colloquial Bamana,

Standard Urban Bamana (henceforth Standard Bamana) is phonologically conservative in terms of its restricted syllable inventory that generally permits only simple CV syllables.¹

The drive towards minimization observed in Colloquial Bamana can be described, firstly, in terms of the application of Vowel Syncope, a process exhibiting regularity and systematicity in its preference to delete vowels of varying types within the confines of the language's overall syllable and margin phonotactics. In addition to the phonotactic restrictions guiding the permissible application of Vowel Syncope, this thesis motivates a proposal of metrical or rhythmic structure in Bamana varieties, which plays an important role in constraining permissible minimizations in Colloquial Bamana. A second piece of evidence illustrating the drive towards minimization in Colloquial Bamana is Velar Consonant Deletion, a process of lenition resulting in the deletion of velar plosives found between identical vowels of any height. Similar to the application of Vowel Syncope, this thesis argues that metrical structure is active in driving the permissible application of Velar Consonant Deletion in Colloquial Bamana, and perhaps in other Bamana varieties. It is the intricacies of application of these two processes, as well as the discovered restrictions against their expected application, that provided the impetus for this thesis.

My first exposure to Colloquial Bamana was in a manuscript written by my colleague and *karamɔkɔ*, Boubacar Diakite (2006), in which he provided an optimality theoretic account of vowel syncope in his variety of Bamana that he attributed to the

¹ While the vast majority of Standard Bamana syllables are CV, certain other types are found in specific words. For example, in Arabic, French, and English borrowings, as well as in certain pronouns and particles, V-initial words are common. Furthermore, it is not unusual to find emergent nasal codas (C \check{V} N) in syllables containing nuclei with phonemic nasal vowels when they are followed by an adjacent syllable with a plosive onset. In certain words exhibiting the vestiges of an ancient noun class system, NCV syllables (where NC is a cluster) are found in word-initial position. Furthermore, a syllabic nasal is possible – most commonly the 1st person singular pronoun [ŋ]. Lastly, as a phonetic effect of fast speech, it is not uncommon for [+hi] vowels to be lost in some words, yielding a CCV syllable, e.g. [tilē] → [tlē] 'day'. The limited outcome of this effect illustrates that it is clearly separable from the process of Vowel Syncope discussed in Chapter 3.

undominated ranking of a proposed phonological constraint, MINIMIZE-SYLLABLE. He posited that the undominated status of this constraint above other constraints demanding vocalic faithfulness to the Standard form of the language (which was, and is, assumed to function as the underlying form of Colloquial Bamana) was responsible for compelling the noted syncope. Diakite also posited that the activity of competing markedness constraints on particular syllable peaks, namely *PEAK[+hi] and *PEAK[-hi], had a role to play in driving the preference for [+hi] vowel deletion when the choice for a deletion target came down to a competition between vowels of different heights. The power of the higher-ranked MINIMIZE-SYLLABLE cover constraint, however, overshadowed the subtleties of the *PEAK constraints and their relationship to other constraints active in the hierarchy.

It was later discovered that, by removing the powerful cover constraint forcing minimization, the ranking of the sequence of *PEAK constraints relative to those posited to permit or omit particular consonants from syllable margins could account optimally for the attested Colloquial Bamana data (Green et al. 2009). Discussion focusing more specifically on margin constraints themselves and the support that the synchronic development of complex onsets and singleton codas in Colloquial Bamana has for a Split Margin Approach to the syllable (Baertsch 2002) can be found in Davis & Baertsch (2008) and Baertsch & Davis (2009).

Expanded data collection has revealed words in which it is predicted that Vowel Syncope and the more widely applicable process of Velar Consonant Deletion would be able either to interact and/or to compete with one another for adjacent targets of

application.² These new data illustrate striking similarities between Vowel Syncope and Velar Consonant Deletion in terms of their expected applicability and likewise in terms of instances where they fail to apply. The applicability of these two processes alongside other features of the language has provided a basis for the proposal of higher prosodic structure in Bamana that I discuss in more depth in Chapter 6.

What originally became provocative about the interaction between Vowel Syncope and Velar Consonant Deletion and, in parallel, the possibility that metrical structure was, in some way, bounding them and driving their successful application, was the extent of their ability to interact in words of a variety of shapes, sizes, and morphological construction. A complicating issue in addressing these potential interactions is the fact that the vast majority of Bamana monomorphs are comprised of three syllables or less, and thus one can obtain only a glimpse of these processes as they interact in such short words. Longer words in the language are exceedingly common; however most are nominal or verbal compounds and other polymorphemic derivatives. One component of this thesis is devoted to addressing permissibilities and restrictions on the application and interaction of Vowel Syncope and Velar Consonant Deletion in Colloquial Bamana words with various deletion targets and morphological constituents. By addressing these questions, the characteristics of metrical structure and the role it plays in phonological processes in this and perhaps other Mande languages are elucidated.

² I describe Velar Consonant Deletion here as widely applicable given that it is sometimes active in even the more phonologically conservative varieties of Bamana, for example in Standard Bamana itself, where it appears to have an identical domain of application, as well as similar restrictions on its application, as it does in Colloquial Bamana. In Standard Bamana, however, Velar Consonant Deletion is observed only in words where the deletion target is flanked by identical [-hi] vowels. It is the younger generation of Bamana speakers in Bamako that have generalized the process, leading to its occurrence between identical vowels of any height.

Running parallel to questions concerning the segmental permissibilities and restrictions in processes contributing to Colloquial Bamana minimization, it was immediately apparent that these phenomena could not be discussed without referring to and exploring the potential interactions between segmental deletion and the complex and controversial tonal system of Bamana. A detailed discussion of the state of knowledge of Bamana tone and its quirks can be found in Chapter 2. The main aspect of tone in Colloquial Bamana explored in this thesis is one concerned with the resultant tonal consequences of either removing potential tone bearing units (e.g. vowels) from a word (e.g. via Vowel Syncope) or removing an intervocalic segment, and, in doing so, placing potential tone bearing units in derived adjacency (e.g. via Velar Consonant Deletion). The tonal consequences of minimization, specifically the tonal contours permitted to emerge upon the application of minimization processes, shed light onto how Colloquial Bamana is responding tonally to the loss of segmental material, as well as, more generally, how tonal and segmental structures in the language interact with and/or constrain one another.

This issue is of importance because, while it was discussed above that Bamana is historically conservative in terms of its maximal CV syllable structure, one can also consider it to be conservative in terms of its limited inventory of underlying tonal contours or permitted surface tonal melodies (depending on one's theoretical persuasion) as reported in the published literature (e.g. Leben 1973b; Courtenay 1974; Riailand & Badjimé 1989). The question raised, therefore, is whether the emergence of segmental complexity via the creation of marked syllable shapes will carry with it a corresponding increase in tonal complexity, or if the tonal system will maintain its conservative

characteristics and, in doing so, continue to limit its inventory of permissible tonal contours.

By addressing these questions, the detailed study of minimized words in Colloquial Bamana offers contributions on two fronts. More importantly of the two, this thesis offers the first description of the tonal system of Colloquial Bamana. Secondly, the tonal outcomes described will also have theoretical implications, either supporting or providing challenges for earlier published analyses of Bamana tone by taking their claims to task.

1.3 Bamana and the Mande continuum

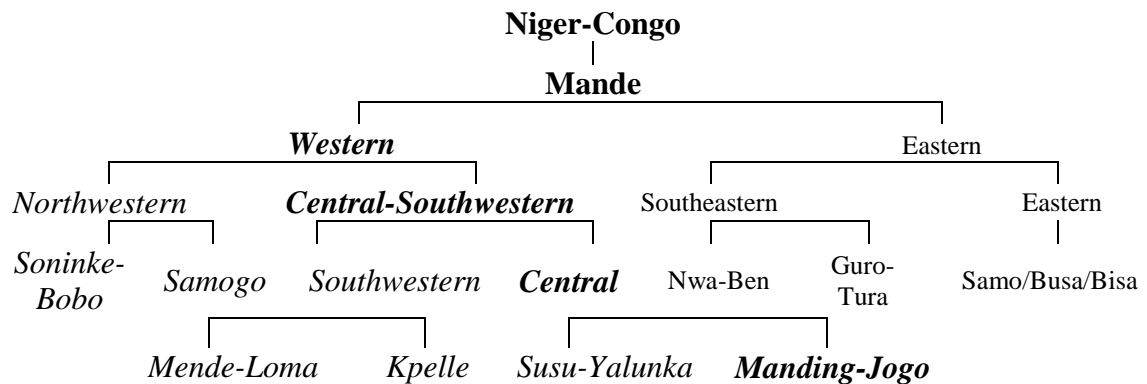
This thesis focuses on the prosodic characteristics of Colloquial Bamana, however the facts and features of the normative forms of the language provide a basis upon which to frame the non-standard variety of interest and to compare it to other languages of the Mande continuum. According to estimates in the Ethnologue (Gordon 2005), Bamana, a language of the Mande branch of the Niger-Congo family, is spoken as a first language by approximately three million people. This number includes speakers of eight major dialects, as well as those individuals speaking what have been classified as ‘local varieties’ among which one can assume Colloquial Bamana is included. This estimate does not, however, include the approximately 1.2 million speakers of three dialects of Jula (or Dyula) or over two million speakers of a number of Maninka (or Malinké) dialects; languages considered by some to differ only marginally from Bamana itself.³

The full genetic classification of Bamana follows in (1), where the Western branch of

³ Interestingly, Welmers (1949) describes Bamana (Bambara) as Maninka’s closest relative but states that “the two languages do not appear to be mutually intelligible to any great extent for the average untravelled speaker of either [language].” Courtenay (1974), however, in drawing a distinction between Guinean Maninka and Gambian Mandinka, suggests that Bambara (and Dyula) share mutual intelligibility with Maninka but less intelligibility with Mandinka.

Mande is italicized, and Bamana’s specific place within its family tree is emphasized in bold. The Eastern branch of Mande, to which Bamana does not belong, has been minimized.

(1) Bamana classification within Mande



While Bamana is spoken primarily in Mali, Jula is spoken across parts of Burkina Faso, eastern Mali, and Côte d’Ivoire. Maninka varieties are spoken in The Gambia, Senegal, Guinea, Mauritania, as well as in western Mali. As a member of the Western, or *Mande-tan*, branch of Mande, Bamana and its closest linguistic relatives differ rather significantly from the Eastern, *Mande-fou*, languages, among them Samo, Bissa, and Busa, spoken in places as distant as Nigeria, Benin, and Ghana (Delafosse 1901; Prost 1950, 1953)⁴ and Southeastern Mande languages (e.g. Gouro, Dan, Tura) that are geographically closer to them.

While Bamana differs from its relatives, both near and distant, in unique ways, recent work suggests that Mande languages other than Bamana are undergoing analogous processes of minimization leading to various types of complexity (Kuznetsova 2007;

⁴ *Tan* and *fou*, as used here, and by the cited authors, is in reference to the number shared among languages of these sub-groups for the numeral ten. In addition to works by Delafosse and Prost, other viewpoints on the classification of Mande languages can be found in Koelle (1854), Tauxier (1924), Westermann & Bryan (1952), and Long (1971).

Vydrine 2001, 2002, 2003, 2004). Specifically, Kuznetsova (2007) details a trend towards monosyllabicity in Gouro that has metrical bounds reminiscent to those driving minimization in Colloquial Bamana. Forthcoming work from Diakite (2010) has also uncovered emergent minimization in one of Bamana’s closer cousins, Kankan Maninka. What is striking, particularly in a comparison between Colloquial Bamana and Gouro minimization, is that the languages appear to be on two analogous trajectories in their drive to achieve this goal. This thesis considers Bamana’s trajectory of minimization in hopes that it may offer insight into the extent that it can be predicted given the specific characteristics and processes active in the language. This trajectory is discussed in more detail in Chapter 7.

1.4 Consonant and vowel phoneme inventories

Colloquial Bamana and Standard Bamana share an identical phonemic consonant inventory, as shown in (2). This chart includes foreign phonemes that have been nativized in the many borrowed words of the language.

(2) Bamana Consonant Inventory⁵

	Labial	Labio-Dental	Alveolar	Palato-Alveolar	Palatal	Velar	Glottal
Nasal	m		n		ɲ	ŋ	
Stop	p b		t d			k g	
Fricative		f	s z	ʃ			h
Affricate				tʃ dʒ			
Approximant	w				j		
Liquid			l, r				

⁵ Homorganic nasal + consonant clusters are rare but are also part of the consonant inventory. These segments are found word-initially as a vestige of a historical noun class marker.

The palatal glide [j] is represented in the Bamana orthography by ‘y’, while the post-alveolar affricates [tʃ] and [dʒ] are represented by ‘c’ and ‘j’, respectively. Both the palatal and velar nasal are represented in phonetic notation in the Bamana orthography.

Bamana has a seven vowel inventory with contrastive oral and nasal vowels. This symmetrical inventory contains the high vowel [i] and [u], the mid vowel tense/lax pairs [e]/[ɛ] and [o]/[ɔ], and the low vowel [a], as well as their respective nasal counterparts, i.e. [ĩ, ũ, ẽ, ɛ̃, õ, ɔ̃] and [ã].

The voiceless bilabial plosive [p] is somewhat limited in its distribution and is found only in a relatively small number of native Bamana words. It is, however, widely attested in loanwords incorporated from French. The voiceless palato-alveolar fricative [tʃ] is also limited in its distribution, as it has emerged via the avoidance of [s] + [y] and [s] + [ɔ] sequences that result from a historical process of high vowel loss, for example *siyɔ* → [tʃɔ] ‘beans’ and *sise* → [tʃɛ] ‘chicken’. This consonant is also used by some speakers before [+hi] vowels (e.g. *sinin* → [ʃinĩ] ‘tomorrow’). The voiced and voiceless velar plosives, [k] and [g], respectively, contrast only in word-initial positions. Intervocally, these sounds are, for all intents and purposes, in free variation with one another. Most words containing the voiceless glottal fricative [h] are Arabic borrowings.

1.5 Data

The Colloquial Bamana data presented in this thesis are drawn from those collected from two brothers (ages 35 and 27) who were born and raised in Bamako, Mali, but currently reside in Bloomington, Indiana, for the purpose of schooling. Data were also gathered from one male (age 21) and one female (age 23) speaker who were born and raised in Bamako, Mali, and still reside in Bamako. Bamana is the mother tongue of all four

speakers. These speakers received primary instruction in Bamana and French and secondary instruction in French. These speakers are third-language learners of English. Some of the data contained in this thesis have appeared in previously published works by the author, for example Green & Diakite (2008) and Green et al. (2009). Standard Bamana words presented for comparison are drawn from a number of sources, including Bailleul (2007), Brauner (1974), Bird, Hutchison & Kanté (1977), R. Diallo (2007), Dumestre (2003), Vydrine (1999), as well as my own collected data.

1.6 Status of Colloquial Bamana

Certain details concerning the emergence or divergence of Colloquial Bamana from a more normative variety of the language remain unclear. It is clear that this non-standard variety of the language is used to a large extent by a young cohort of mother tongue Bamana speakers in Bamako, Mali. Bamako is a multilingual and multiethnic city that sits at a linguistic border or isogloss between two different branches of the Manding languages. While Standard Urban Bamana contains many of the conservative characteristics of the Eastern Manding varieties, Colloquial Bamana has developed some characteristics that are more reminiscent of Western Manding. In certain respects, the features of Colloquial Bamana appear to be the result of a koinéization (e.g. Siegel 1985) of Eastern and Western Manding varieties. However, one could argue that Colloquial Bamana has features of a basolectal register of the Standard or normative variety of Bamana given that certain speakers have access to the conservative form of the language in formal settings. What is clear thus far is that Colloquial Bamana is spoken by mother tongue Bamana speakers in this environment who are younger than 40 years old. The

variety has been noted in educated speakers of both sexes from varying socioeconomic backgrounds.

1.7 Overall goal and purpose of the thesis

The overall goal and purpose of this thesis is to contribute to the field of African linguistics (and specifically Mande linguistics) by exploring, from both synchronic and diachronic perspectives, processes, components, and features of an emergent variety of Bamana (i.e. Colloquial Bamana) that will inform the state of knowledge about the presence of prosodic (i.e. metrical or rhythmic) structure in Mande languages at a level higher than the syllable. In addition to this descriptive contribution, this thesis aims to contribute to phonological theory by considering the implications that the development of segmental and autosegmental complexities (and their interactions) have on current and developing theories of syllable structure and prosodic phonology.

I arrive at this goal by probing questions relating to segmental processes of minimization active in Colloquial Bamana and their relationship to the tonal schema of the language. As I have introduced above, this thesis is driven by three major questions:

- 1) What are the structures, bounds, and restrictions that characterize the drive toward minimization/reduction in Colloquial Bamana?
- 2) What are the tonal consequences of minimization, and what bearing do they have on analyses of tone assignment and proposals for a tonal inventory of the language?
- 3) Is there a characteristic trajectory (trajectories) of minimization or complexification in Bamana or in Mande languages in general?

Beyond these immediate questions concerning Bamana and the Mande languages, two overarching questions are also addressed: In what ways can the development of syllabic complexity and its interaction with the tonal schemas of Bamana inform current and developing phonological theory? How are the phonological processes active in the language best captured in a theoretical framework of phonology?

1.8 Outline of the thesis

Following this introduction to Colloquial Bamana, this thesis is organized into eight chapters according to the following outline. Chapter 2 provides additional background about Bamana phonology and tonology. Chapter 3 discusses two processes of reduction in Colloquial Bamana, namely Vowel Syncope and Velar Consonant Deletion, and provides an optimality theoretic characterization of them. Chapter 4 considers the interaction of Vowel Syncope and Velar Consonant Deletion in more morphologically complex words, such as nominal and verbal compounds and other polymorphemic derivatives. Chapter 5 provides a formalization of reduction in the longer, more morphologically complex words discussed in Chapter 4 by appealing to an optimality theoretic account of minimization utilizing Harmonic Grammar. Motivation for the proposal of footing, and therefore metrical structure, in Bamana is presented in Chapter 6. Chapter 7 presents data on the tonal results of minimization and discusses the ways in which structures and processes active on both the segmental and autosegmental levels interact with one another. Chapter 8 closes with discussion of implications for descriptive and theoretical linguistics that arise from this thesis and potential directions for future research.

The core of the thesis begins in Chapter 3 with discussion of the processes of reduction contributing to the overall drive towards minimization in Colloquial Bamana, namely Vowel Syncope and Velar Consonant Deletion. In this chapter, these processes are presented in reference to words with two and three syllables, as well as in a limited number of monomorphemic words with a higher number of syllables. This chapter illustrates that one type of reduction in Colloquial Bamana is achieved via Vowel Syncope. Data show that this phonological process targets [+hi] vowels preferentially, but, in the absence of available or eligible [+hi] vowel deletion targets, the process can also syncope [-hi] vowels. In addition to words in which Vowel Syncope deletes either a [+hi] or [-hi] vowel, instances are illustrated where competition between the drive towards minimization via constraints on the number of syllable peaks permitted in a word alongside those militating against marked syllable shapes, particular consonant sequences in syllable margins, and permissible consonant-consonant syllable contact sequences, have the ability to block the application of Vowel Syncope in favor of a Colloquial Bamana output that is identical to its correspondent in Standard Bamana. The chapter then discusses the analogous process of Velar Consonant Deletion which targets intervocalic velar consonants flanked by identical vowels of any height. Similar to Vowel Syncope, the regular application and limitations on Velar Consonant Deletion are detailed. Furthermore, instances are illustrated in which variation in grammatical Colloquial Bamana outputs are attested in words of specific types when the single word contains structures targeted for deletion by both processes.

Chapter 4 characterizes the finer details of Vowel Syncope and Velar Consonant Deletion and their relationship to one another by testing their applicability and

restrictions on their interaction in longer words. Given the morphological characteristics of Bamana, the application of these processes is probed in nominal and verbal compounds and in other morphologically complex words longer than three syllables. These words afford one the opportunity to place segments targeted for deletion either within the same or different domain of application, as well as in different positions in the prosodic word (i.e. in any morphemic position: initially, medially, or finally). This chapter highlights several important observations, among them the preferential application of Velar Consonant Deletion in a subset of words where the two processes interact, the restriction of minimization via either process to a single occurrence within a prosodic domain (except in two unique instances), and the harmonic choice of a deletion target in words of different morphophonological composition.

The harmonic choice of a single deletion target within a given domain is formalized in Chapter 5 by appealing to an optimality theoretic account of segmental reduction utilizing the framework of Harmonic Grammar (e.g. Albright, Magri & Michaels in press; Farris-Trimble 2008; Smolensky & Legendre 2006, and references therein). It is shown that, within a given morphophonological level, the choice of a single instance of deletion, even in the face of multiple permissible deletion targets and a strong drive towards minimization, is most often the optimal outcome in Colloquial Bamana. This outcome illustrates that the language acts to avoid multiple violations of segmental faithfulness within this domain. It is also illustrated in this chapter that the violation of higher weight constraints on segmental markedness is a harmonically favored choice in comparison to assessing multiple violations of lower weight constraints against syllable complexity. The chapter broaches that Colloquial Bamana represents a *non-harmonically*

complete grammar whose attested outcomes are predicted neither by standard Optimality Theory nor by standard Harmonic Grammar. Thus, it is proposed that *superlinear* combinations of constraints must be used to capture certain failed minimizations observed in the language.

Drawing from the interaction of Vowel Syncope and Velar Consonant Deletion, as well as other features and processes found in Bamana, Chapter 6 proposes that metrical or rhythmic structure in the form of disyllabic feet are present in the language. Evidence in support of this proposal is drawn from instances where Vowel Syncope and Velar Consonant Deletion fail to apply as otherwise predicted. Data reveal that this failure of application is systematic and predictable based upon the position of the intended deletion target within the word. Specifically, it is illustrated that Velar Consonant Deletion fails to act on a velar consonant target located outside of a minimally disyllabic domain of application or otherwise across a domain boundary (or a morpheme boundary, for that matter). It is also shown that Vowel Syncope exhibits several interesting characteristics that can be attributed to its need to reference this same disyllabic domain for its proper application. Among these characteristics are the ability for Vowel Syncope and Velar Consonant Deletion to compete for a deletion target when both targets are located within a single domain, but the strict choice of Velar Consonant Deletion when targets are located in adjacent domains. Furthermore, it is shown that Vowel Syncope has the ability to yield variable outputs when its deletion targets are identical vowels located within the same domain. When identical targets are located in adjacent domains, variation is not permitted. Other restrictions on the ability to remove particular non-preferred vowels when the deletion of a preferred vowel is blocked are

also discussed. Overall, it is proposed that the bounds and restrictions placed on the distribution of particular complex syllables within this domain allow one to define it properly as a left-headed prosodic foot.

Chapter 7 provides a description of Colloquial Bamana tone and details the tonal results of minimization from the presumed Standard Bamana base. Because a specific unified analysis of Bamana tone has not emerged in the literature, the tonal contours that result from minimization provide an opportunity to shed new light on controversial and often conflicting ideas on this subject. More specifically, this chapter presents newly elicited data from several speakers of Colloquial Bamana that detail the types of tonal contours permitted to emerge as a result of the manifestation of two phonological processes of minimization. These data reveal that, despite the increased number of complex syllable types found in Colloquial Bamana, the tonal contours found in this language variety are simplified in comparison to those reported in the literature for other Bamana varieties. Certain well-known tonal processes such as *affaissement*, *abaissement*, and tonal compactness, however, are still found to be active in the non-standard variety. Moreover, these data confirm the hypothesis that increased syllable complexity in this language variety is not accompanied by a corresponding increase in tonal complexity.

The thesis closes in Chapter 8 with a discussion of various applied, descriptive, and theoretical applications that can be drawn from the data and analyses presented here for Colloquial Bamana. Among these points of discussion are future directions for research, including the expansion of data collection to other neighboring, or even distantly related relatives of Bamana within the Mande family. It is proposed that similar research can also be expanded outside of Mande to other West African languages for

which metrical and prosodic structure have long been ignored. The chapter touches upon some of the open-ended questions that are not possible to answer about Colloquial Bamana at the present time, for example the predicted solidification of free variants, the possibility of predictable trajectories of minimization within and across the Mande subfamily, and the eventual emergence of a stress or accent system in Bamana. The chapter also speculates upon topics such as constraint superlinearity (introduced in Chapter 5) and tonoxodus, as well as on topics that explore the interfaces between phonology, morphology, and syntax, like the link between foot, morpheme, and prosodic word headedness, and phrase level morphotonology. Also discussed are the possibilities for a resolution to the longstanding tonal controversies found in the Bamana literature, as well as for a detailed phonetic characterization of Bamana vowels and their ability to attract prominence.

CHAPTER 2

SURVEY OF BAMANA PHONOLOGY AND TONE

2.1 Introduction

The vast majority of published work on Bamana phonology has focused on its system of lexical and grammatical tone. In the works on this subject, scholars have focused largely on defining the language's tonetic and tonemic inventories, as well as the types of tonal interactions possible in the language. It has often been the case, however, that these discussions are framed against the backdrop of analogous processes underway in other closely related or better understood languages of the family (e.g. Mende and Kita-Malinké), as well as against other attested tonal inventories and/or tonal melody schemas. Attempts at a comprehensive tonological description of Bamana and its related varieties have been offered throughout the years (e.g. Creissels 1992; Diarra 1976; Dumestre 1987), however few works have considered, in detail, the segmental phonology of the language independent of the tonal phenomena at play.

The short first chapter, *Sons et tons*, of Dumestre's comprehensive (2003) *Grammaire fondamentale du bambara* stands as a testament to the minimal attention afforded to the segmental phonological characteristics of the language. Some well-understood alternations are discussed, for example that noted between [d] ~ [l] and [g] ~ [g^w] in certain dialects. Also included is commentary on varying degrees of intervocalic velar lenition, as well as on other minor phenomena, for example the distribution of nasal vowels versus nasalized vowels and palatization resulting from historic high vowel loss. Of interest for this thesis, Dumestre mentions variable vowel loss in certain conditions

but states that the process is not systematic, i.e. vowel loss is not always predictable and is not found in all words of a given shape. The instances of vowel loss that Dumestre describes involve the syncope of a high or mid vowel in the first or second syllable of a word, resulting in the creation of a CCV syllable. This limited and unsystematic emergence of syllable complexity reported for Standard Bamana may well represent a precursor to the more widespread and predictable process of Vowel Syncope described in detail in this thesis for Colloquial Bamana. I discuss these and several additional segmental characteristics of Bamana, particularly its phonological inventory and permissible syllable types in §2.2.

2.2 Segmental phonology

Bamana, and other related Mande languages, are known to have a variety of individually unique but comparatively similar consonantal, vocalic, and syllabic inventories. Courtenay (1974) and Dumestre (1984) discuss differences between Standard ‘urban’ Bamako Bamana and other nearby ‘rural’ varieties, such as the ‘classic’ variety spoken in Ségou (the historic capital of the Bamana Empire), and point out that the phonological subtleties of these varieties often necessitate remarkably different analyses. Creissels (1992) and Creissels & Grégoire (1993) point out similar differences between Standard Bamana and its cousin Malinké.

Because this thesis takes as its primary focus processes and other phenomena that reference the syllabic structure of the language, the discussion here is similarly framed to highlight the characteristics of the language’s segmental phonology in these terms. It is widely agreed upon that the standard, normative, or more historically and phonologically conservative varieties of Bamana have a maximal syllable shape of CV (consonant +

vowel). In addition to syllables of this shape, V (vowel-only) syllables are found in word-initial position in some particles and are common, also word-initially, in loanwords borrowed from languages like French and Arabic, among others. N (nasal-only) syllables are found in a similar distribution (i.e. word-initially) in interjections (e.g. *nbá* and *nsè*, the responses used in greeting exchanges by males and females, respectively) and in the first person singular pronoun. NCV syllables in which the nasal and consonant are pronounced as a unit segment or cluster are found word-initially in words exhibiting vestiges of a historical noun class system (e.g. *ngólo* ‘dew’, *nkòsɛn* ‘scorpion’, *nsiirin* ‘proverb’) and word-internally in certain compounds and phrasal constructions. CVN syllables often result from the phonetic emergence of a nasal consonant following a phonemic nasal vowel when it precedes a CV syllable with an obstruent onset. In word-final positions, however, nasal consonants are not permitted, and thus final CVN syllables are not found in Bamana. CCV syllables have also been reported to emerge in Standard Bamana, in certain instances, as a result of a phonetic effect of high vowel loss in fast speech (e.g. *i ni tilě* → *i ni tlě* ‘good morning’).

In normative varieties of Bamana, consonantal segments are contrastive in most instances, with the exception of [r] and [l] when they are found initially in certain suffixes (Houis 1970). [r], in particular, has a limited distribution and alternates with [l] or [n] (e.g. in *-ra*, the suffix marking the past tense of intransitive verbs), while [l] alternates only with [n] in these instances (e.g. in *-len*, the suffix marking the past participle). The initial consonants of such affixes are arguably underspecified to some extent, perhaps only being specified underlyingly for place of articulation, and are therefore subject to processes of manner assimilation in the relevant triggering environment. [l] (and [d], for

that matter) is otherwise contrastive in both word-initial and intervocalic positions, and [r] contrasts (notably with [l], e.g. *kóro* ‘meaning’ and *kóló* ‘shea nut’) intervocalically in native Bamana words, as well as word-initially, in a number of loanwords (e.g. *rézen* ‘grape’, borrowed from the French *raisin*).

Contrasts and consonant distribution in word-initial and intervocalic positions are similar (but not identical) in Colloquial Bamana in comparison to the Standard form of the language described above. The main surface characteristic differentiating these varieties is the complex CCV and CVC syllables permitted in the Colloquial variety. The emergence of complex syllables in a Central-Southwestern Mande language like Colloquial Bamana has not yet been explored in detail elsewhere.¹ Kuznetsova (2007) describes an analogous and seemingly similar emergence of syllabic complexity in Gouro, a Southeastern Mande language, while Vydrine (2002) mentions several other Southeastern Mande languages permitting complex syllables, e.g. Soso, Tura, and Dan. Furthermore, what is known about the more distant Eastern Mande languages (e.g. Busa, Samo, and Bissa) suggests that they too permit complex syllable shapes.

The creation of specific types of CCV and CVC syllables in Colloquial Bamana has been driven in large part by the phonotactics of syllable margins and permissibilities of syllable contact in the language. More specifically, one observes that CCV syllables can emerge in Colloquial Bamana only when the second member of the resultant branching onset is a sonorant consonant. Similarly, the only CVC syllables permitted are those with a singleton sonorant coda. The second member of a branching onset and a singleton coda, known as M_2 positions in the Split Margin Approach to the syllable

¹ Colloquial Bamana is believed to be derived from a more phonologically conservative, maximal CV syllable variety of Bamana, which is well known as a Central-Southwestern Mande language. I assume, therefore, that Colloquial Bamana is a member of the same branch of the sub-family.

(Baertsch 2002), are both limited to including only liquid and nasal consonants. Further specifics regarding the emergence of complex syllables in Colloquial Bamana are detailed in Chapter 3.

2.2.1 Vowel contrasts

Overall, the basic vocalic phonology of Bamana is regular, non-complex, and many similarities are found in a comparison of the Colloquial and Standard varieties. Bamana is known historically to have an underlying contrast in vowel length, although this contrast is found only in the initial syllable of monomorphemic words. For example, vowel length is found only in the initial syllable of monomorphemic words, such as those in (1), as well as in the first syllable of words with more than one syllable, such as those in (2).

(1)

[bá]	‘river’	[báá]	‘mother’
[fã]	‘father’	[fãá]	‘insanity’

(2)

bara	‘calabash’	baara	‘work’
fere	‘town square’	fereere	‘rag’
koro	‘small gourd’	kooro	‘to howl’
seri	‘gruel’	seere	‘witness’
surũ	‘short’	suuru	‘to pour from a height’

Note that monosyllabic words that contrast only in the length of their vowels, such as those in (1), are not always captured in the standard orthography of the language, hence the addition of phonetic brackets. Creissels (1992) and Creissels & Grégoire (1993) raise the point that contrastive vowel length may be lost in the speech of some

individuals but fully present and stable in the speech of others. Creissels further suggests that two concurrent systems are found in the language. Vydrine (1999), on the other hand, marks the long vowels of Bamana and makes use of the conventions proposed for the N'ko orthography developed by Souleymane Kanté (White-Oyler 2005). While it is not the intent to enter into a discussion of orthographical conventions here, it should be recognized, nonetheless, that some, if not the majority of Bamana speakers differentiate between short, long, and derived long vowels in their speech. It is assumed, therefore, that contrastive vowel length is a historical and perhaps conservative characteristic of the language. The conventions utilized in the N'Ko orthography to mark these characteristics are illustrated below in (3) and (4).

(3)

	Short (Brisk)		Long (Ordinary)		Derived Long	
H-tone	ba 'river'	̄	ba 'mother'	ɓ	baa 'mush'	̂
L-tone	ba 'father'	̃	ba 'goat'	ɓ̃	baka → baa 'poison'	̃̂

(4)

	Short (Brisk)		Long (Ordinary)		Derived Long	
H-tone	fa 'to fill'	̄	fa 'frying pan'	ɓ	faka → faa 'large pot'	̂
L-tone	fa 'father'	̃	fa 'craziness'	ɓ̃	faka → faa 'to kill'	̃̂

In addition to the contrast in vowel length mentioned above, Bamana also contrasts oral versus nasal vowels, as evidenced from the minimal pairs in (5). Nasal vowels have no apparent restrictions on their distribution in Bamana words (Vydrine 2004) and often result in the phonetic emergence of a nasal consonant when they precede a stop (Creissels & Grégoire 1993).

(5)

bá	‘river’	bá́	‘end’ (n.)
fě	‘with’	fě́	‘thing’
sé	‘to arrive’	sé́	‘foot’
sú	‘evening’	sú́	‘fast’ (n.)

2.2.2 Vowel hiatus and elision

One particular segmental process that has been discussed in detail in the Bamana literature (e.g. Creissels 1978, 1988, 1992) is elision resulting from vowel hiatus. It is clear that Bamana does not permit vowels in hiatus, and thus, diphthongs are not found in the language. Evidence for this is drawn from several observations. Because CV syllables are the most common syllable shape found in Bamana, and since many of the pronouns and particles of the language are V-initial, there exist notable instances in which vowels have the potential to come into contact with one another. In instances of potential hiatus, the impermissible sequence is resolved via vowel elision. This process occurs in such a way that it results in the retention of the second vowel of the sequence (M. Diallo 2003, 2004), as illustrated in the representative forms in (6), drawn from Creissels (1992).

(6)

- a. músá yé à fò [músá y’á fò] ‘Musa greeted him.’
b. kà í dá [k’i dá] ‘Lay yourself down!’

An additional piece of evidence illustrating the impermissibility of hiatus and diphthongs is drawn from the output of Velar Consonant Deletion. Velar Consonant Deletion is a phonological process that actively removes velar consonants flanked by identical vowels. The key observation here is that the process only occurs in specific

instances when it can result in the creation of a derived long vowel. If the velar consonant were flanked by vowels of different types, its removal would lead to the generation of a diphthong via derived hiatus. The impermissibility of such a sequence precludes velar deletion in these instances. This further leads to the assumption that hiatus resolution is a process that is active across word boundaries but one that fails to apply word internally.

2.2.3 Consonant homoresonance

Brief comment is warranted on the subject of consonant homoresonance, a type of consonant harmony that has been reported in other Mande languages. Languages exhibiting consonant homoresonance, particularly those in the Southern Mande branch of the sub-family (separable from the Western Branch), have been analyzed as having segmental domains called *syllabemes*, a unit described elsewhere (e.g. Kuznetsova 2007; Le Saout 1979; Vydrine 2002, 2004) as a type of featural *foot*. Within this domain, it has been shown that the characteristics and distribution of domain internal consonants, particularly liquids and nasals, are conditioned by the nature of the domain initial consonant. While this feature may be common in various Mande languages (e.g. Vydrine 2004) and in certain other languages across West Africa (e.g. Bearth 1992), Southwestern Mande languages like Bamana behave much differently in this regard in comparison to their Mande cousins. The absence of consonant homoresonance in Bamana can be illustrated in a comparison of words beginning with the same initial consonant but containing word-internal consonants believed otherwise to participate in consonant homoresonance. Illustrative examples follow in (7).²

² Dumestre (1987) presents data suggesting a degree of statistical correlation between word-initial consonant, word-internal consonant, and tone assignment in Dougoukona Bamana. His findings, however, appear to represent tendencies in the language, rather than absolutes. For further discussion the relationship between segmental structure and tonal association, see Chapter 7.

(7)

báda	‘river bank’	bára	‘work’
bála	‘xylophone’	bána	‘exterior of the village’

2.3. Lexical vs. grammatical tone

Because the literature on Bamana tone is more widespread and detailed, it has served as a starting point for formulating the questions and concerns standing at the core of this thesis. The various reports on Bamana tonal phenomena have fueled exploration into the ways in which segmental and tonal properties of this language function both independently and interactively. Key tonal concepts reported in the literature are outlined below.

2.3.1 Lexical tone

It is beyond a doubt that Bamana is a language in which tone is implicated in both lexical and grammatical specification. Bamana is replete with tonal minimal pairs (as in 8) and thus has been described classically as a lexical tone language by some scholars (e.g. Courtenay 1974; Creissels 1978, 1988). A lexical tone language is one in which the tone or tonal melody of a lexical item signals a lexical contrast.

(8)

dó	‘day’	dò	‘to enter’
bá	‘to finish’	bà	‘to refuse’
cé	‘between’	cè	‘man’
kó	‘to say’	kò	‘to wash’

Other scholars have proposed that the restricted number of tonal schema found in the language cause it to appear more like a ‘pitch accent’ or ‘tone harmony’ language

(Woo 1969). Indeed, such questions regarding the underlying tonal inventory, permissible tonal melodies, processes of tone assignment, and attested tonal interactions have stood at the center of debates on Bamana tone for decades. One longstanding issue has been the search for tonal analyses that can account for the characteristics of the language's *minor* tonal schemas. The tonal contours of these minor schemas, reported to be lexically assigned to approximately ten percent of Bamana words, often stand at theoretical and analytical odds with what has been proposed for the association of the remaining *major* tonal schemas of the language.

Courtenay (1974) was the first published work to attempt a comprehensive characterization of Bamana tone. Courtenay arrives at the general conclusion shared by others that nearly 90% of Bamana words have H or LH melodies in some instantiation, depending on their number of syllables. Courtenay takes to task the autosegmental analysis of Maninka (and some aspects of Bamana) tone offered by Leben (1973b), by suggesting that Leben arrived at his conclusions about tone in these languages based upon a limited set of data. Rather than adopting an autosegmental view of tone association in which a restricted number of tonal melodies are mapped onto words via tone assignment followed by spreading or contouring if appropriate, Courtenay argues that tones are instead assigned underlyingly to each vowel. Overall, Courtenay (1974) proposes tone patterns for Bamana words ranging from one to six syllables in length, as well as for compounds. The patterns she offers are in support of her theoretical inclination toward a process of tonal assimilation, rather than a process of dissimilation favored by others (e.g. Bird 1966; Creissels 1978; Diarra 1976). This debate is outlined further in §2.3.3. Given her inclination toward assimilation, the major contribution of

Courtenay's proposal is the reanalysis of earlier proposed final L tones as H tones, thereby avoiding the necessity to posit that a seemingly unfavorable process of dissimilation (e.g. Hyman 2007; Hyman & Schuh 1974) is active in the language.

Another comprehensive proposal of Bamana tonal schemas, although one differing somewhat from that proposed by Courtenay (1974), is laid forth in Dumestre (1987). Dumestre divides Bamana words based upon what he defines as *major* and *minor* tonal schemas. As they have been described in his work and elsewhere in the literature, the major tonal schemas comprise approximately 90% of Bamana words, while the words associated with minor tonal schemas make up the remaining percentage.³ According to Dumestre, words with one or two syllables are assigned one of two possible tonal contours, namely L or H, although L words may surface as LH in certain instances. Dumestre further illustrates that words with one or the other of these tonal schemas behave in identical ways in a variety of tonal environments, a fact that we return to below. Bird (1966, 1968) arrived at a similar conclusion, in presenting words as either H or L, attributing the derivation of additional complexities in the overall tonal contour of the word to other processes. Bird does not, however, consider the tonal contours of words longer than two syllables.⁴

For Dumestre, three syllable words following the major tonal schemas are similar but not identical to shorter words in that they can be assigned one of three possible tonal contours, namely HHH, LHH, or LLH. Words containing more than three syllables, however, are most often compounds or other polymorphemic derivatives and thus follow

³ Dwyer (1976) suggested that the minor tonal schemas are recent developments in the language that have diverged from the other two (i.e. H and L(H)) main tonal classes. This is a curious supposition given the types of words typically associated with many of them (e.g. flora, fauna, and people's names).

⁴ Bird's proposal of two lexical tone classes follows closely from that proposed by Welmers (1949) and Rowlands (1959) for Maninka varieties. I do not, however, consider these earlier works closely in comparison to others on Bamana, as the focus of this thesis is on Bamana itself.

a remarkably different process of tone assignment that has come to be known in the Bamana tonal literature as tonal compactness (*compacité tonale*) or the ‘noun-compound rule’ (e.g. Courtenay 1974; Creissels 1978; Creissels & Grégoire 1993; Dumestre 1987; Leben 1973a). Polymorphemic derivatives exhibiting tonal compactness surface with either an all H melody (if the first syllable of the first morpheme of the word is H) or with an overall LH melody (if the first syllable of the first morpheme of the word is L). Tonal compactness is introduced in more detail in §2.4.3.

The tonal analysis offered by Rialland & Badjilé (1989) is more closely aligned with Courtenay (1974) in favoring assimilation, rather than dissimilation, but offers a different interpretation of the attested tonal melodies in the language. Rialland & Badjilé concur that word-final H tones are underlyingly specified, rather than being the result of some phonological or phonetic process. They do not, however, agree with Courtenay (1974) that the underlying tonal schemas of the language actually contain these final H tones. Rather, Rialland & Badjilé argue that these H tones are separate (and seemingly abstract) phonological entities left unassociated to a vowel in the underlying representation. They posit that these H tones float at the right edge of Bamana lexemes, although importantly in a stratum closer to the lexeme itself than the floating L definite marker – an element also found, when specified, at the right edge of a lexeme (e.g. Bird 1966). These H tones then either associate or spread depending upon their particular environment, thereby resulting in the attested surface contours. The key difference, therefore, between Courtenay (1974) and Rialland & Badjilé (1989), is the argument of the former that all tones are associated to vowels underlyingly, whereas the latter authors

propose simplified schemas that invoke spreading and a *ton haut de liaison*. Their *ton haut de liaison* analysis is discussed further in §2.5.1.

Citing examples from Bailleul (1976/1977), Dumestre (1987) discusses the rarity and irregularities of the minor tonal schemas in considerable detail by juxtaposing the variable pronunciation of words identified with these contours in two Bamana dialects. Dumestre explains that the two major tonal schemas (i.e. H and LH, for him) are easily classifiable, but that the minor schemas form a group of “*tous les autres contours*”. He reports that variation in these schemas exists not only between dialects (as one might expect) but also within the productions of a single speaker. He notes, however, that even within instances of variation, the tone of the initial vowel of the word is consistent – an interesting point to reference for later discussion.

One should keep in mind that accounting for the Bamana minor tonal schema, their intrinsic variability, and the overall tonal variability reported in the literature on Bamana have been sources of contention among scholars. As Creissels (1992) points out, scholars have tended to overlook the sociolinguistic complexities that have likely contributed to the variation found in Bamana varieties. Drawing from this point, it should be made clear that many of the works on Bamana tone, in particular, have reported data collected from speakers hailing from vastly different geographic locations, although many report their findings under the pretense of a linguistically ‘standard’ form of the language.⁵ This, however, has been far less productive than characterizing the unique properties of a dialect or variety from a particular region or city with the intent of later cross-varietal comparison. This is precisely the intent of the current thesis, i.e. to describe

⁵ Creissels (1992), however, dismisses the idea that a ‘standard’ form of Bamana can be described in and of itself.

the characteristics of an emergent non-standard variety of Bamana informed by what has been proposed thus far in the literature, with a later goal of addressing the implications it has for other analyses of related varieties.

2.3.2 Grammatical tone

Bird (1966), influenced heavily by Welmers (1949) and Maninka tone, was among the first to offer a characterization of the floating L tone definite marker found at the right edge of Bamana nouns (or more appropriately noun phrases). His analysis opened the door to an array of studies aiming to detail the tonal interactions at play in this language and its constituent varieties that result from the presence of this tonal morpheme. In the years since Bird's first contribution to the subject, it is a safe to say that the presence of this morpheme has been both a unifying and divisive factor in the study of Bamana tone. Attested phenomena related to this morpheme have served as a testing ground for analyses of other processes, given that it is one of the few facts about the language that has been widely corroborated in the literature. The ways in which the floating L definite marker manifests itself and/or triggers other tonal phenomena in the language remain a subject of debate.

Bird (1966, 1968) described the abstract floating L definite marker by providing motivation for its presence in its ability to trigger downstep of adjacent (rightward) H tones. Bird described the grammatical function of the floating L in terms of 'specific' versus 'non-specific', terminology which others (e.g. Courtenay 1974; Creissels 1978, 1988; Spears 1968) have since reinterpreted as 'definite' versus 'indefinite'. (9a) illustrates a phrase in which the L-tone definite marker is absent. In this phrase, in the absence of a floating L tone, the H tone associated to the adjacent present tense/aspect

marker *bé* is unaffected. (9b), however, represents the ‘definite’ version of the phrase in which the effect of the floating L tone can be seen in its ability to trigger downstep of the H tone of the present tense/aspect marker. Details concerning Bamana tone assignment, particularly the tonal alternations seen on the final syllable of *mùso* ‘woman’ in (9a-b) are discussed further in §2.3.3.

(9)

- a. [mùsò bé yàn] ‘A woman is here.’
- b. [mùsó ^hbé yàn] ‘The woman is here.’

While the presence of a definite marker is well-attested in Bamana, given our ability to witness its presence via its triggering adjacent H tone downstep, the marking of indefiniteness (if it is marked at all) is less clear. Dumestre (1984, 1987) suggests that the manifestation of definite versus indefinite marking has different consequences, even in closely related Mande varieties, e.g. Bamako Bamana versus Ségou Bamana. Dumestre maintains that, while a floating H tone complement to the floating L definite marker may be absent from urban varieties of Bamana, some rural varieties may still have a floating H indefinite morpheme. Indeed, Bird (1968) posits a “non-specific high tone article” in the dialect of Bamana reported in his research. Few later works, however, have discussed this characteristic in any detail.

Dwyer (1976) suggests an alternative view in which the floating L tone definite marker is a vestige of a -v̄ (low tone vowel) suffix found elsewhere in Western Mande and that the indefinite is marked (once again, as elsewhere in Western Mande) by the absence of this suffix.

An intriguing observation about the floating L tone definite marker, as mentioned by Creissels (1978, 1992) and Dumestre (1987), is that it is postposed to the right edge of the entire noun phrase, rather than more locally to the right edge of the head noun of the phrase. Consider the illustrative sentences in (10) drawn from Creissels (1992).

(10)

- a. [fúláké wéré sé-rá bí] ‘Another Fulani arrived today.’
 Fulani other arrive-Pst. today
- b. [fúláké wéré ¹sé-rá bí] ‘The other Fulani arrived today.’
- c. *[fúláké ¹wéré sé-rá bí]

In (10a), there is no tonal modulation in the indefinite phrase, given that no floating L definite is specified in the sentence. We find, however, in a comparison of (10b,c) that the attested sentence in (10b) is one in which the floating L definite marker triggers downstep of the H tone of the intransitive past tense verb *sé-rá*, thereby implying that the entire noun phrase is marked for its definiteness. (10c), in which the floating L definite marker would be posited on the right edge of the noun *fúláké* and would trigger downstep of the H tone on the adjacent adjective *wéré*, is unattested as per Creissels (1992).

Given the structure of the Bamana noun phrase, i.e. a head noun followed by any number of descriptive adjectives, such morphemic postpositioning suggests either long distance movement or that the definite marker is a morphosyntactic entity (e.g. a clitic) associated with the noun phrase, rather than strictly a morphemic entity associated with a particular lexical item. The details of this phenomenon and its implications for the proper characterization of Bamana phrasal tonology have not yet been fully explored. It must be

noted however, that having the ability to remove this floating tone from a position adjacent to a lexical item to the end of the noun phrase has the potential to provide greater insight into the underlying (i.e. non-derived) tonal specification of a given noun. This is a particularly useful property that could come into play in testing analyses that rely heavily on the interaction of the floating L tone definite marker with tones associated to adjacent vowels, for example that of Rialland & Badjilé (1989), as discussed briefly in §2.5.1.

The general agreement about the characteristics of the Bamana floating L tone definite marker coupled with the general disagreement about the best way to represent the inventory of underlying tonal contours or melodies in the language, as well as their permissible surface manifestations, has provided fuel for discussion and debate over many years. Proposals aiming to provide a unified analysis of Bamana tone have resulted most identifiably from varying theoretical persuasions driving the research of Bamana scholars and other Mandeists, and also perhaps due to empirical issues, among them limited corpora, dialectal differences, and a lack of instrumental verification of results.

The most persistent debate, and one that has been discussed to some extent by Dumestre (1984) and Creissels (1992) in regards to published work available until those points in time, is between those scholars favoring assimilation versus dissimilation analyses of Bamana tone. This debate can be further dissected, if one considers separately those scholars promoting a strict dissimilation analysis alongside those favoring a tone polarization analysis (e.g. Dwyer 1976). Dumestre (1984) includes these two camps under the larger heading of ‘dissimilation’.

2.3.3 Dissimilation versus Assimilation

Section 2.3.1 introduced major and minor tonal schemas in Bamana and the fact that scholars have proposed different underlying representations of these schemas based upon the particular theoretical underpinnings they support. More specifically, the debate between assimilation and dissimilation arose as a direct result of the need to account for the presence of surface alternations between LH and LL tonal contours in the language. For dissimilationists, surface LH contours are considered to be underlyingly LL, while for assimilationists, these contours are considered to be a faithful surface mapping from their LH underlying representations with LL being the result of rightward L tone spreading in certain contexts.

Dissimilationists, among them Bird (1966, 1977), Diarra (1976), and Creissels (1978), have argued that Bamana words are underlyingly either H or L, and upon the juxtaposition of two L melody words, a process of dissimilation triggers the leftward change of L → H tone, thereby yielding a LH contour. A clear example of this proposal is found in a comparison of (11a-b).

(11)

- a. [bàlá dòn] ‘It is a xylophone.’
- b. [bàlà té] ‘It is not a xylophone.’

In a dissimilation analysis, one would propose that the word for ‘xylophone’ *bàla* is associated underlyingly to a L tone which, when unimpeded, spreads rightward to the edge of the word. We find such an instance in (11b) where the L tone noun is adjacent to the H tone negative tense/aspect marker. Because the adjacent H does not hinder the expression of the L on both vowels of the noun, no effect is seen. The view of (11a)

would be that the juxtaposition of L tones in adjacent words is disallowed, therefore triggering a dissimilation of L → H, and generating the attested LH contour on *bàlá*.

Those in the assimilationist camp, among them Courtenay (1974) and Rialland & Badjimé (1989),⁶ would view the situation in a much different light. In an assimilation analysis of the above sentence, it would be proposed that LH is a permissible underlying tonal contour in the language (as in 11a), thereby precluding the dissimilation of an impermissible LL sequence. In instances like (11b), however, it would be proposed that the resultant LL sequence on *bàlà* is due to rightward L-tone spread, with subsequent H delinking and absorption.

How is it, then, that two such distinctly different yet seemingly plausible options exist but are so strongly debated? The answer to this question lies in cross-linguistic universalities (or better yet, strong tendencies) of tonal phonology. While a dissimilation analysis may appear to be an attractive option, the assimilationist viewpoint developed in the light of discussion concerning the naturalness of particular tonal processes, as found in Hyman & Schuh (1974) and later revisited and reiterated in Hyman (2007). In these two works, processes of tonal dissimilation are described as either natural synchronic tone rules (Hyman & Schuh 1974) or morphophonemic tone rules (Hyman 2007). In both instances, the authors discuss that tone dissimilation, cross-linguistically, is not considered to be a phonetically natural diachronic process of sound change. They propose, alternatively, that the process disobeys the typical trend of tonally-induced changes by increasing, rather than decreasing, the number of ‘ups and downs’ over time (as assimilation or simplification would do). These works further suggest that true

⁶ To an extent, Leben (1973a) can be included in the assimilationist group, although this particular work only minimally references Bamana. The position adopted by Dumestre (e.g. 1984, 1987) is less clear, as he proposes three tonal classes (H/L1/L2), thereby splitting L words into separate classes of L and LH.

instances of dissimilation are morphologically-triggered or are otherwise due to the effects of a historically present H tone (cf. Hyman 1978). This provides an obvious segue to later analyses, for example Rialland & Badjímé's (1989) proposal of a *ton haut de liaison* in Bamana. As we discuss below, while their analysis may be attractive and elegantly presented, certain surface tonal contours described in their work (upon which their analysis so explicitly relies) have not been otherwise corroborated in other literature on the language.⁷

Assimilation, on both the segmental and tonal levels, cross-linguistically and historically, is considered to be a natural *diachronic* process of sound change. Such processes have the net effect of smoothing the overall tonal contour of the word as well as the phrase. This concept, appropriately dubbed the “Principle of Ups and Downs”, is explicated further in Hyman (1978). The argument for naturalness of tonal assimilation and parallel support for assimilation on the segmental level have led some scholars to shy away from dissimilation analyses.

2.3.4 Tone polarization

An alternative proposal in favor of tone polarization comes from Dwyer (1976). In order to understand the key difference between Dwyer's analysis and other dissimilation-favoring analyses, one must first consider the basic definitions of these similar but unique processes. As we saw above, in cases of true tonal dissimilation, it is posited that a tone is

⁷ Mountford (1983) contributes to the dissimilation versus assimilation debate by proposing that what has typically been considered to be L → H dissimilation (or otherwise an underlying LH melody) is actually the result of a phonetic manifestation of a general process of raising affecting both H and L tones across a morpheme boundary before an adjacent L tone. Such an analysis suggests that the L(H) contour of a word like *mùsò* is incorrect and better characterized as a L followed by a Raised L tone. The implications that this analysis has for the overall conception of the Bamana tonal inventory and tonal processes have yet to be entertained in the literature. Furthermore, it is interesting to note in comparison that while Hyman & Schuh (1974) consider low-raising to be a natural diachronic tonal process, they do not describe it as predicted to occur before L tones, but rather before non-L tones.

present, by one means or another, before dissimilation occurs. If the tone is placed in the triggering environment, *LL in the Bamana cases considered thus far, dissimilation resolves this impermissible sequence by altering one or the other tone. As in the proposed dissimilation analyses of Bamana, we find *LL → LH.

In instances of tone polarization, however, the situation is quite different. For tone polarization to occur, a potential tone bearing unit must be underspecified for (and therefore not be associated with) a tone. This potential tone bearing unit will therefore exhibit tonal alternations depending on its environment. More specifically, in the case of Bamana, the unspecified tone bearing unit would exhibit its H tone variant before an adjacent L, while its L tone variant would occur before an adjacent H or pause. This analysis, once again, appears attractive, however tone polarity has also generated some controversy among tonal phonologists. Hyman & Schuh (1974) cite tone polarization as another example of a synchronic manifestation of a historical process (much like dissimilation), such as segment or syllable loss. Others, however, have offered support for tone polarization analyses, among them Cahill (2004) and Newman (1995). In sum, dissimilation and tone polarization are clearly separable processes.

Dwyer's key evidence in favor of a tone polarization analysis is drawn from the observation that the tonal character of the final vowel of lexemes, as well as the final morphemic constituent of compounds, is independent of the tonal specification of the first vowel of the word or compound, respectively. The tone that this unit carries is dependent only on the tone associated to a following adjacent vowel. Dwyer cites this phenomenon as an argument for underspecification and therefore for tone polarization.

2.3.5 Summary

Section 2.3 has illustrated that two ‘schools’ of Bamana tonal scholarship exist, namely those supporting an analysis of dissimilation and those supporting an analysis of assimilation. Dwyer’s (1976) proposal of tone polarization can be considered a dissimilation approach (Dumestre 1984). The literature surveyed thus far that has debated even the most basic components of Bamana tone, specifically its tonemic and tonetic inventories and the processes involved in generating the latter, spans a period of several decades. While it is not to be implied that Dumestre does not have a preferred analysis of his own (certainly he must), his 2003 Bamana grammar is vague on this subject (perhaps purposefully). It is beyond a doubt, therefore, that disagreements between Bamana scholars on this subject still stand.

While this thesis does not attempt to provide a detailed tonal reassessment of Bamana, it does aim to shed new light on the subject and to supplement past analyses by considering the tonal consequences of segmental minimization in Colloquial Bamana. Because Colloquial Bamana is believed to be derived from a more conservative or standard form of the language, the ways in which minimization interacts with and/or influences tone (or vice versa) will inform the state of knowledge of tone association and tonal processes active in the language and perhaps more widely in Mande. The Colloquial Bamana data collected have been analyzed in consideration of generally accepted principles of tonal and prosodic phonology. Specifically, concepts such as *tone stability*, *tonal melodies*, and the *tone bearing unit* provide a means by which to evaluate features, processes, and other mechanisms in reference to specific components or domains of application (e.g. the mora, syllable, foot, prosodic word, and perhaps other higher levels

of prosodic structure). The appeal to prosodic structure in tonal systems has proven fruitful in the emergence of recent proposals of *tonal feet* (e.g. Bamba 1991; Bickmore 1995, 2003; Jaker 2010; Leben 1997, 2002, 2003; Pearce 2007; Yip 1996; Zec 1999), which directly juxtapose tonal components and higher prosodic structure.

2.4 Tonal features and processes

In addition to considering the proposals for the tonemic and tonetic inventories of Bamana and the mechanisms involved with their assignment, it is necessary to be familiar with other tonal features and processes in the language that have a potential to influence both the tonal and segmental outcomes of minimization that stand at the heart of this thesis. The characteristics discussed in each of the following three subsections: the tone bearing unit (§2.4.1), downstep and tone stability (§2.4.2), and tonal compactness (§2.4.3), raise questions about the potential interaction between Bamana segments and tone that can be informed by what has been uncovered via the study of minimization in Colloquial Bamana.

Indeed, other tonal processes have been described as active in Bamana varieties, among them *affaissement* and *abaissement*, both of which involve H tone lowering in particular environments. These processes are discussed further in Chapter 7. The reader is referred to the comprehensive description of these processes in Dumestre (1984) for additional details.

2.4.1 Tone bearing unit

The definition and characterization of the tone bearing unit, or TBU, is at the core of any analysis of a tonal language. TBUs vary from language to language, although they are typically the mora, the syllable, or the word/morpheme. It may come as no surprise that

among the many analyses of Bamana tone described in §2.3, scholars have proposed different TBUs for the language, among them the word (Bird 1966; Leben 1973a), the syllable (Courtenay 1974), and in reference to *compacité tonale*, the morpheme (Rialland & Badjimé 1989). Thus far, no analysis of Bamana proper has explicitly implicated the mora as the TBU, however Creissels & Grégoire (1993) posit a mora TBU for Kita-Malinké, a close relative of Bamana.

Because this remains an issue open for debate, the processes of minimization active in Colloquial Bamana can offer new insight. Considering first Vowel Syncope, this process is active in removing potential tone bearing units from a word, although it may have different tonal outcomes depending on whether the Bamana TBU is the mora or the syllable. Furthermore, Velar Consonant Deletion, in removing intervocalic velar consonants, places potential TBUs adjacent to one another in the domain of the word. The tonal consequences of minimization in Colloquial Bamana, therefore, will provide insight into several aspects of the language's tonal phonology. These issues are discussed further in Chapter 7.

2.4.2 Downstep and tone stability

Downstep, a phenomenon widely corroborated in the Bamana literature (e.g. Bird 1966; Creissels 1978, 1992; Rialland 2004), as well as in the more general tonological literature (e.g. Snider 1999), supports the fact that *tone stability*, or tone preservation, is active in the language. Section 2.3.2 introduced Bird's characterization of downstep as an argument motivating the presence of a floating L definite marker in Bamana. This work, however, does not directly discuss the status of tone stability in Bamana, given that the L tone definite marker is thought to be present in the underlying phonology of the language.

Creissels' work, on the other hand, discusses downstep in relation to tone stability by illustrating that downstepped H tones (^lH) result from certain instances of hiatus resolution. More specifically, when a H tone word-final vowel is followed by an adjacent word-initial L vowel, the two are resolved by elision. The hiatus resolution occurs in such a way that the tone of the first vowel is preserved and subsequently realized on the second vowel. The L tone dissociated from the second vowel, however, is preserved on the tonal tier as a floating L tone which then has the ability to trigger downstep of an adjacent H tone. This process is illustrated in (12). The segmental results of hiatus resolution and vowel elision are discussed in more detail in §2.2.2.

(12)

à yé à fɔ́ → à y'á^lfɔ́ 'he said it'
 3rdS Pst. 3rd say

In addition to the role of tone stability in triggering the downstep noted above, Creissels (1992) details further a number of other attested tonal resolutions of hiatus. Because tone stability is believed to be a regular feature of Bamana, it has important implications for the characteristics of the tonal contours (and segmental structure) resulting from Vowel Syncope and Velar Consonant Deletion. Among the possibilities entertained in Chapter 7 are tone reassociation with subsequent contour tone derivation and the creation of tone-bearing sonorants.

2.4.3 Tonal compactness

The phenomenon of tonal compactness or *compacité tonale* has been described in some detail in the literature (e.g. Courtenay 1974; Creissels 1978, 1988, 1992; Dumestre 1984, 1987, 2003); however the structures and mechanisms motivating its attested characteristics remain unclear. A general definition of the tonal compactness noted in

Bamana involves the neutralization of tone in non-initial word positions. The phenomenon has been observed in a number of complex word types, among them nominal and verbal compounds and certain other polymorphemic derivatives.⁸ More specifically, tonal compactness is typically witnessed in one of two instantiations, both of which refer to the tonal specification of the first syllable of a given word. One type of tonal compactness is found in words in which the first syllable of the first element of a word (i.e. the first syllable of the word) is H tone. In such instances, all elements throughout the remainder of the word remain H, regardless of their underlying tonal specification or the tonal contour of the morpheme in isolation. In instances where the first syllable of the first element of the word is L, the remaining vowels of the word will be specified L up until the last morpheme, which will surface as H, again regardless of their underlying specification. This phenomenon is illustrated in (13) with data drawn from Creissels (1992).

(13)

a. initial H tone

[básá] + [wòló] → [básáwóló] ‘lizard skin’

b. initial L tone

[jàrá] + [wòló] → [jàràwóló] ‘lion skin’

c. longer words

[jàkúmá] + [wòló] → [jàkùmàwóló] ‘cat skin’

The examples in (13) illustrate nominal compounds formed upon the juxtaposition of a word-initial noun with a particular tonal melody compounded to a LH contour word. (13a) illustrates that the H specification of the first vowel of the first word triggers the spread of a H melody across the entire word upon compounding. This involves a L → H

⁸ A detailed description of additional word types witnessing tonal compactness can be found in Dumestre (2003).

change in the contour of the second noun. (13b,c) illustrate a second scenario (in words of differing lengths)⁹ in which the L of the first syllable of the first noun, upon compounding, induces the other tones of the word from H → L. Once again, the final morpheme surfaces as H.

An outcry over tonal compactness emerged in Courtenay (1974) citing the incorrect predictions made by Leben's (1973b) autosegmental account of the phenomenon that Courtenay claimed were drawn from limited data. The analyses that both Courtenay and Leben had proposed for other aspects of Bamana tone incorrectly predict the attested contours resulting from tonal compactness, and indeed Courtenay cites tonal compactness as the motivating factor behind Woo's (1969) notion that Bamana is a tone harmony language. Dumestre (1984) describes the phenomenon as one of four *regular* tonal processes in the language. Creissels (1992) added to this discussion by considering tonal compactness comparatively in both compounds and in other polymorphemic words formed via derivation. The illustrative examples in this work, however, were limited to the affixation of the instrumental suffix *-lan*. Creissels' discussion of the topic highlighted how the morphological construction of the words prior to compounding is active in determining the application of tonal compactness.

Processes that are active in altering the overall structure of the word in Bamana (e.g. Vowel Syncope) have the ability to test the described mechanism of tone association and assignment in cases of tonal compactness. Specifically, because it has been argued that the tonal contour of words subject to tonal compactness follows from the tonal specification of the first vowel of the first syllable of the compound, one must then ask

⁹ Creissels (1992) states that tonal compactness is independent of the number of constituents comprising the compound.

what the effect of removing this vowel might have on the overall tonal structure of the word. For more on this topic, see §7.2.5.

2.4.4 Tonal feet

Reference to tonal feet as a domain of association and as a domain for the application of processes in African languages has gained prominence in recent years (e.g. Bickmore 1995, 2003; Leben 1997, 2002, 2003; Pearce 2007), and indeed some scholars have even proposed that such structure is present in Bamana itself (e.g. Bamba 1991; Leben 2002, 2003; Weidman & Rose 2006).

The earlier works by Bamba (1991) and Leben (2002, 2003) took the lead in proposing characteristics of a tonal foot in Bamana. While Bamba's (1991) description focused specifically on Bamana's cousin Maninka, the features he proposed were extrapolated and then applied to Bamana. Bamba's contribution to the discussion of tonal feet in Bamana centered upon a proposal of a binary *strong + weak* or *weak + strong* nodes that stand as the basis of surface tonal melodies. Importantly, his definition of tonal feet requires minimal reference to the segmental structure of the language in stating that the tonal feet of Maninka consist of the L-tone definite marker and the tone adjacent to it. As the examples in his thesis indicate, this implies that tonal feet themselves are not necessarily maximally disyllabic entities. Rather, Bamba proposes that more complex combinations of tones, for example the obligatory *strong + weak* sequence required on all H tones, necessitate the proposal of a higher-level of overall binary structure, constructed in a similar fashion to what one might associate with the *relative prominence projection rule* in metrical phonology (e.g. Liberman & Prince 1977; Prince 1983). Bamba extends this proposal minimally to certain phrases in Maninka, as well to Bamana's more distant

Manding cousin Jakanke (Jahanka), a language variety spoken primarily in Guinea. While it is not explicitly stated, based upon the principles of construction for these tonal feet so defined by Bamba, binary metrical units are constructed at the right-edge of a word, however each word or phrase has an overall contour such that tonal feet are not necessarily or maximally disyllabic.

Later work by Leben (2002, 2003), drawing from the Bamana tonal melodies discussed in Creissels (1978), added to this discussion by proposing further characteristics defining Bamana tonal feet, namely that they are maximally disyllabic, are constructed exhaustively, are *maximal* (i.e. they restrict the distribution of monosyllabic LH contours), and can only be associated with a H or LH melody. As opposed to Bamba (1991), Leben's position on the construction of tonal feet in Bamana makes reference to the segmental syllabic structure of the language. Leben, in his discussion of tonal feet, however, makes no substantive reference to the characteristics of segmental footing independent of the role feet appear to play in predicting the distribution of surface tonal melodies. Rather, the proposed segmental footing is assumed based upon the language's inventory of tonal melodies and tonal alternations. An implication from Leben's work that serves as an important point of comparison in this thesis is that, in order to account for the surface tonal melodies found in Bamana, feet must be permitted to be constructed from either the left edge or the right edge of a word. Thus, this directionality must be lexically specified. Chapter 6 of this thesis offers evidence problematizing this implication, as the segmental phonological processes of Vowel Syncope and Velar Consonant Deletion active in Colloquial Bamana reveal that, at least in the segmental sense, disyllabic feet are necessarily constructed from the left edge of a word. No

evidence for right edge foot construction is found in the segmental processes in this language variety; and moreover, proposing right edge footing yields incorrect predictions about the above processes of segmental minimization. See §6.3 for more detailed discussion on this point. A proposal in Chapter 7 for left-edge tonal feet constructed in parallel to left-edge segmental feet offers a unified footing analysis on both levels for this language. In sum, although Leben broaches that segmental feet exist in Bamana, the evidence upon which this observation is made draws solely from features of the tonal tier and makes incorrect predictions about other aspects of the language's phonology.

Weidman & Rose (2006) add to this discussion of tonal feet in Bamana by arguing against the edge-in tonal analysis promoted by Rialland & Badjilé (1989). While many of the components of their analysis are similar to those posited in Leben (2002, 2003), they frame their argument in terms optimality theoretic constraints on foot structure and tonal processes operating within the domain of the foot. More specifically, they offer that a degenerate foot is found in Bamana words with an odd number of syllables and that this foot is located at the left edge of the word. They also state that Bamana tonal feet are trochaic and that the heads of tonal feet cannot be adjacent to one another. Several other important properties of Bamana tonal feet are posited, among them that the head of a tonal foot is preferentially H tone and that the tonal variation witnessed in certain words (e.g. LLH vs. LHH in three syllable words) is the result of constraint re-ranking.

2.5 Competing analyses

While the tonal processes explicated in §2.4 have a specific bearing on the outcome and analysis of the interaction between segmental and tonal processes in Colloquial Bamana

that stands at the core of this thesis, there exist a number of other tonal analyses of Bamana that have been taken into consideration but that have little direct bearing on the remainder of this study. Included among these analyses are the *ton haut de liaison* analysis offered in Riailand & Badjimé (1989) and the L *ton marqué* analysis offered in Creissels (1992). These analyses provide interesting insight into further methods of accounting for the tonal characteristics of various Bamana varieties. I shall attempt to summarize each of these proposals briefly below.

2.5.1 Liaison high tone

Recall that among the assimilationist camp of Bamana tone scholars, Courtenay (1974), in particular, advocated that the tones of Bamana are assigned underlyingly to each vowel of a word and that each tonal melody ends with an associated H tone. In explaining the attested surface LL contours of Bamana words, Courtenay suggests that a diachronically natural process of assimilation via rightward L tone spreading alters the underlying LH contours of such words, thereby yielding LL melodies. The analysis offered by Riailand & Badjimé (1989), although aligning itself with many of the same principles of Bamana tone as Courtenay (1974), differs from the earlier analysis by proposing that the final H tone found in Bamana words is a floating (abstract) tonal entity found on the right edge of lexemes and certain other components. Important to their proposal is that the floating liaison H tone is found in a stratum closer to the lexeme than the floating L tone definite marker. The motivation for this proposal becomes clear below.

Riailand & Badjimé (1989), drawing upon data from Badjimé himself, argue for a floating liaison H tone by presenting data from indefinite nouns in which they claim that the rightward spread of the floating H tone generates HL contours on adjacent L words.

Therefore, in the indefinite forms of both H and L Bamana words, the liaison H tone has the ability to generate such contours. Their proposal further supports the autosegmental proposal of a strict set of tonal melodies for Bamana (e.g. Leben 1973b).

Rialland & Badjimé, in turning to H and L tone definite words in Bamana, present data suggesting that, due to the presence of the floating L tone definite marker in a more distant stratum from the lexeme, the liaison H tone is unable to spread rightward, and thus, needing to associate to some vowel, it spreads leftward to the nearest adjacent TBU, thereby leading to LH surface forms in these nouns with no subsequent HL contouring on an adjacent L word. While it is possible that dialectal differences may be at play, it is nonetheless troubling that this resultant HL contour on L words adjacent to definite nouns has not been otherwise corroborated in the literature (cf. discussion in Weidman & Rose 2006), particularly because it is upon this point that this abstract analysis so specifically relies. Furthermore, Rialland & Badjimé's (1989) analysis proposes "edge-in" tone association and spreading in order to account for the attested tonal melodies found on longer Bamana words. This analysis was later challenged by Weidman & Rose (2006) who find such an analysis at odds with the theory of Optimal Tone Mapping (Zoll 2003).

2.5.2 Marked low tone

Yet another step towards the abstract comes from Creissels (1992) and his proposal of *marked low tone* in Bamana.¹⁰ This analysis is drawn from the behavior of Bamana nouns that exhibit tonal alternations between L and LH depending on their environment. This analysis appears to draw upon aspects of other analyses, for example rightward L tone spreading (e.g. Courtenay 1974) and tonal underspecification of a final vowel (e.g. Dwyer 1976). Creissels' (1992) contribution is that, rather than the entire tonal melody

¹⁰ This proposal is echoed for Bamana's close relative Kita-Malinké in Creissels & Grégoire (1993).

being specified underlyingly (e.g. Rialland & Badjimé 1989) or tones being individually associated to vowels underlyingly (e.g. Courtenay 1974), L tones are *marked* and therefore assigned in the underlying representation of Bamana words, with H tones being filled in later by default after L tone spreading has taken place.

Creissels devises an elaborate analysis identifying the instances in which the specified L tones are permitted to spread when not impeded from doing so by *frontiers*. The abstractness of this analysis enters here in that certain contours force Creissels to propose that some words fail to have an underlying L tone directly associated with them, and further that this L tone floats on the left edge of the word. The floating L tone is then subject to rightward spread, unless once again, a frontier blocks it (e.g. a leftward floating L tone adjacent to the next lexeme). This analysis is further complicated in the more unusual, *minor* tonal schemas, which Creissels accounts for by positing floating L tones between adjacent syllables.

2.6 Summary

This chapter has provided an illustration of several characteristics of the segmental and tonal phonology of Bamana that have contributed to the conception and overall goals of this thesis. It should be clear from the presentation of literature above that Bamana is a language rich with interesting but often complex phonological phenomena as evidenced from the noted inconsistencies and discrepancies in the body of published and unpublished work discussed thus far. With these thoughts in mind, the remainder of this thesis aims to complement these earlier works by providing a detailed phonological description and analysis of an emergent non-standard variety of the language, namely Colloquial Bamana. The following chapter introduces the processes of Vowel Syncope

and Velar Consonant Deletion, both of which are active in generating complex phonological structures in the language. These structures are a key characteristic differentiating this new language variety from its more phonologically conservative progenitors.

CHAPTER 3

PROCESSES OF REDUCTION¹

(VOCALIC AND CONSONANTAL)

3.1 Introduction

Reduction, or minimization, in Colloquial Bamana proceeds via one of two analogous phonological processes, namely Vowel Syncope and Velar Consonant Deletion, that target specific vocalic and consonantal segments, respectively. Velar Consonant Deletion is a well-described process that stems from the historical lenition of intervocalic velar consonants (e.g. $k > g > \gamma > h > \emptyset$) and is found to some extent in a number of Manding languages, including more phonologically conservative varieties like the Standard Urban Bamana spoken in Bamako, Mali. Vowel Syncope, as a phonological process, is a phenomenon described in detail, thus far, only for an emergent non-standard variety of Bamana spoken by a young cohort of individuals in Bamako, and may ultimately stem from a combination of the complex sociolinguistic environment found in this urban area of multilingual contact (Creissels 1992) alongside natural phonetic and phonological processes.² As it has been described thus far in the literature (e.g. Green & Diakite 2008; Green, Davis, Diakite & Baertsch 2009), Vowel Syncope is a process exhibiting regularity in its application, acting on vowels of any type in any word position with restrictions on its application stemming mainly from its interaction or competition with other phonological processes and from the general phonotactic constraints of the language. Its widespread application supports the proposition that it is not a process

¹ Portions of this chapter appear in Green & Diakite (2008) and Green, Davis, Diakite & Baertsch (2009).

² For discussion on the complexity of urban multilingualism and homogenization in Bamako, see Canut (2009). For more on general sociolinguistic topics pertaining to Bamana, see Canut (1996).

linked to stress and should not be considered to be a simple phonetic manifestation of unstressed vowel loss, as is common in other languages. It is the case, however, that instances of phonetic vowel loss are attested in Bamana fast speech, as reported by Dumestre (1987), among others. Such instances of vowel loss are described as unpredictable, and they are clearly separable from the regular phonological process of Vowel Syncope outlined below. These observations certainly do not omit the possibility that Vowel Syncope may have its roots in phonetic processes.

The overall outcome of both Vowel Syncope and Velar Consonant Deletion is the introduction of complex syllable shapes of specific types (e.g. CCV, CVC, and derived CVV) into a language whose posited progenitor (i.e. Standard Bamako Bamana) generally permits only simple unmarked CV syllables. Alterations in the repertoire of syllable shapes permitted by the language have caused the language to tolerate the emergence of the more marked syllable shapes that result from Vowel Syncope and Velar Consonant Deletion. As discussed below, these alterations have been triggered by the demotion of key constraints on permissible syllable margins below others aiming to preserve the underlying structure of the language. It will be argued in this chapter that, via the application of these two processes, and the subsequent generation of complex syllable shapes in Colloquial Bamana, these processes contribute to an overall trend towards segmental minimization in this language variety. Furthermore, it is shown that the synchronic emergence of specific CCV and CVC syllables is predicted by a newly proposed model of syllable structure, namely the *Split Margin Approach* to the syllable, developed in Baertsch (2002).

The remainder of this chapter presents data illustrating the application of both Vowel Syncope and Velar Consonant Deletion in Colloquial Bamana and discusses the mechanisms driving these phonological processes, as well as the phonotactic restrictions that come into play that effectively hinder their application in certain instances. After presenting data detailing the application of each of the two processes, an optimality theoretic account of the processes is given.

3.2 Vowel Syncope

What is known about the emergence of syllabic complexity in Colloquial Bamana stems from earlier work by Diakite (2006) that first identified the synchronic emergence of both CCV and CVC syllables in the dialect of Bamana spoken by him and his cohorts in Bamako, Mali. Diakite's data and preliminary analysis posited that some process of vowel syncope was underway that appeared to prefer deletion of [+hi] vowels, rather than [-hi] vowels, in the creation of complex syllables in the language variety. Importantly, however, [-hi] vowels can be deleted only when a [+hi] vowel is not available.³ Work that followed (Green & Diakite 2008; Green, Davis, Diakite, and Baertsch 2009) began to probe this syncope process and offered a preliminary assessment of possibilities for its specific outcomes. The finer details of Vowel Syncope in Colloquial Bamana are illustrated below.

3.2.1 Preferential [+hi] vowel syncope

Vowel Syncope in Colloquial Bamana is a phonological process that clearly favors the deletion of [+hi] vowels to achieve minimization, yet it is not so restricted in its

³ For the purposes of this discussion, and given the seven vowel system of Bamana, I consider [+hi] vowels to be the front and back high vowels, [i] and [u], respectively. I use [-hi] to refer to any of the other five Bamana vowels, i.e. the low vowel [a] and the [±ATR] mid vowels, [e], [ɛ], [o], and [ɔ]. Nasal vowels are marked by a diacritic as conventional (i.e. [ã]), and oral vowels contain no diacritic. Some analytical shortcomings related to the binary distinction of [+hi] versus [-hi] for vowels are discussed briefly below.

application that it will overlook a [-hi] vowel deletion target when an acceptable [+hi] is not available for deletion. The preference to delete [+hi] vowels is most clearly illustrated in words containing both [+hi] and [-hi] vowels. In these words, if the phonotactics of the language do not otherwise prevent it, a [+hi] vowel will be targeted for deletion. The phonotactic restrictions that come into play in such instances require that the onset cluster of a resultant CCV complex syllable be a sequence of some consonant (i.e. a stop, a fricative, or a nasal in some instances) followed by a sonorant consonant (i.e. a nasal or a liquid). These complex onsets must rise in sonority. It is also possible for the outcome of deletion to yield a CVC complex syllable with phonotactic restrictions similar to those stated for CCV syllables. Emergent CVC syllables are permitted in instances where the resultant coda consonant is a sonorant and does not generate bad syllable contact (e.g. a rise in sonority over a syllable boundary). As we will see, slight modifications to these restrictions must be made when comparing word-internal versus word-final syllables. Syllabification in Colloquial Bamana therefore proceeds in such a way that onsets are maximized and phonotactic restrictions on sonority sequencing are respected.

Consider the data in (1) that are illustrative of the various types of CCV and CVC syllables that can result from [+hi] vowel deletion in words containing vowels of multiple heights. Data sets throughout provide a target word in Standard Bamana alongside its Colloquial Bamana counterpart. When relevant in data displays, one or more unattested forms marked by ‘*’ are provided for clarification and to illustrate impermissible or unexpected outcomes. While the tonology of Bamana will be discussed in further detail in Chapter 7, for expository purposes, Standard Bamana words with reported H and L tone contours are indicated by either an acute or grave accent on their first syllable,

respectively. It has been argued in the literature that the surface tonal melody of nearly 90% of Bamana words can be gleaned from the tone manifested on the word's first syllable (e.g. Dumestre 1987). Resultant surface tones for Colloquial Bamana are marked via the same diacritic convention, however tones are indicated on each vowel.

(1)

	<u>Standard</u>	<u>Colloquial</u>		<u>Gloss</u>
a.	[ká.bi.la]	[ká.blá]	*kbi.la	'tribute'
b.	[sà.fi.nɛ]	[sà.fné]	*sfa.nɛ	'soap'
c.	[sǎ.ku.ra]	[sǎ.krá]	*sku.ra	'New Year'
d.	[dù.lo.ki]	[dlò.kí]	*dul.ki	'shirt'
e.	[sì.la.mɛ]	[slà.mé]	*sil.mɛ	'Muslim'
f.	[mò.ri.ba]	[mòr.bá]	*mri.ba	'man's name'
g.	[bá.ri.ka]	[bár.ká]	*bri.ka	'strength'
h.	[fǎ.rĩ.mã]	[fár.mǎ́]	*frĩ.mã	'hotness'
i.	[sá.nu.ma]	[sán.má]	*snu.ma	'holy'
j.	[dè.li.ko]	[dèl.kó]	*dli.ko	'habit'

The three-syllable words in (1) illustrate the preferential deletion of [+hi] vowels in instances where the generation of word-initial coda consonants is not permissible. Words (1a-c) illustrate the creation of a CCV syllable upon deletion of the second syllable [+hi] vowel of the Standard Bamana word when it results in an onset that rises in sonority. Similarly, (1d-e) illustrate that the same outcome is possible upon deletion of the first syllable [+hi] vowel, once again, when an onset that rises in sonority can be created. (1f-j) show that a word-internal CVC syllable with a sonorant coda is formed

upon [+hi] vowel syncope when permissible syllable contact results from deletion. The outcomes in (1d-e) are key, as they illustrate the [+hi] vowel deletion preference even when a seemingly acceptable outcome with permissible syllable contact could result from the deletion of a [-hi] vowel. Put another way, a [-hi] vowel will never be chosen for deletion if an *acceptable* [+hi] deletion target is available. What constitutes an acceptable [+hi] vowel is detailed in later discussion (see §6.3.2).

That Vowel Syncope is not simply a process targeting [+hi] vowels becomes evident when considering the Colloquial Bamana outcome in words containing all [-hi] vowels. In such words, one finds that Vowel Syncope is still active in driving the deletion of a [-hi] vowel, even in the absence of a [+hi] deletion target. The same phonotactic restrictions that come into play in [+hi] vowel deletion, specifically the necessity to have resultant complex onsets with rising sonority where the second member of the onset is a sonorant or alternatively a singleton sonorant coda, are in place here. Consider the illustrative examples in (2).

(2)

	<u>Standard</u>	<u>Colloquial</u>		<u>Gloss</u>
a.	[cá.pa.lo]	[cá.pló]	*cpa.lo	‘millet beer’
b.	[ká.ma.lẽ] ⁴	[ká.mlé]	*kma.lẽ	‘boyfriend’
c.	[nà.ma.sa]	[nàm.sá]	*nma.sa	‘banana’

The data provided thus far have shown that words of a particular shape, i.e. three-syllable Standard Bamana words, reduce via Vowel Syncope to two-syllable words in

⁴ I later illustrate that [km] clusters are permissible in Colloquial Bamana, however they are restricted, as seen here, from occurring in word-initial position.

Colloquial Bamana, preferentially through the deletion of a [+hi] vowel and secondarily through the deletion of a [-hi] vowel.

3.2.2 Syncope in like-vowel words

Three-syllable Standard Bamana words once again provide insight into the application of Vowel Syncope, however in this section, we consider words that contain vowels of identical height. The data provided in this section illustrate that words containing like vowels permit two grammatical outputs upon deletion in Colloquial Bamana, provided that the overall phonotactics of the language do not disallow it. Consider the data in (3).

(3)

	<u>Standard</u>	<u>Colloquial</u>	<u>Gloss</u>
a.	[sá.ra.ma]	[sár.má]/[srá.má]	‘famous’
b.	[mè.le.kɛ]	[mèl.ké]/[mlè.ké]	‘angel’
c.	[gà.la.ma]	[gàl.má]/[glà.má]	‘spoon’
d.	[bá.ra.ka]	[bár.ká]/[brá.ká]	‘blessing’
e.	[bó.rɔ.tɔ]	[bór.tó]/[bró.tó]	‘to tear apart’
f.	[sú.ru.ku]	[súr.kú]/[srú.kú]	‘hyena’
g.	[bù.lu.ku]	[bùl.kú]/[blù.kú]	‘to plow’
h.	[wá.la.ka]	[wál.ká]/*[wlá.ká]	‘to detail’

Words (3a-g) illustrate that the deletion of one or the other of two like-vowels, whether [+hi] or [-hi], results in grammatical Colloquial Bamana words having either a CVC or CCV complex syllable. This suggests that when the competition between deleting a [+hi] in favor of retaining a [-hi] is not at play, the language is at a stage in its development where either CVC or CCV complex syllables are permitted to emerge, i.e.

both outcomes are grammatical. The role of the language’s overall phonotactics, once again, is evident in ruling out impermissible variants, e.g. in (3h), where bad sonority sequencing would result in the complex onset of the CCV deletion variant.

Yet another set of three-syllable Standard Bamana words exists that exhibit a deletion pattern similar to the words in (3), yet they have vowels of differing heights like those presented in (1). More specifically, these three-syllable words have like-height vowels in their first two syllables but have a [+hi] vowel word-finally. Words representative of this set are included in (4).

(4)

	<u>Standard</u>	<u>Colloquial</u>	<u>Gloss</u>
a.	[kè.le.ku]	[kèl.kú]/[klè.kú]	‘to stumble’
b.	[kò.lɔ.si]	[kòl.sí]/[klò.sí]	‘carefulness’
c.	[sá.ra.ti]	[sár.tí]/[srá.tí]	‘condition’
d.	[kù.lu.si]	[kùl.sí]/[klù.sí]	‘pants’
e.	[já.la.ki]	[jál.kí]/*[jlá.kí]	‘blame’

These data show that the preference in Colloquial Bamana to delete a [+hi] vowel before a [-hi] vowel is not a strict property of the word, but may be attributable to a smaller prosodic domain (e.g. a disyllabic foot) constructed at the left-edge of the word itself. (4a-c) illustrate that one of two [-hi] vowels is chosen as a deletion target, while the [+hi] vowel of the third syllable is overlooked. The motivation for the [+hi] vowel being an unacceptable deletion target may follow from two possible reasons, the first of which being that its deletion would create an impermissible obstruent coda in word-final position. A second possibility is that these [+hi] vowels fall outside of the domain of

application of Vowel Syncope, and thus they are not available targets for this process. These issues are discussed further in Chapter 6. The situation is analogous in words like (4d) containing all [+hi] vowels, where the [+hi] deletion target again is one of the first two vowels of the word. (4e) illustrates that the language’s phonotactics are still an overall driving force behind this process, given that affricates are not permitted in consonant clusters. In such instances, only a single syncope output is possible.

3.2.3 Syncope in shorter words

The data presented above for three-syllable Standard Bamana words that surface in Colloquial Bamana with two-syllables as a result of the application of Vowel Syncope allowed for a characterization of the competition between [+hi] and [-hi] vowel deletion targets in the language. Turning now to shorter words, i.e. disyllabic Standard Bamana words, we find that Vowel Syncope occurs in much the same way that it did in longer words. In shorter words, however, additional restrictions are brought to bear on minimization, for example the fact that word-final sonorant consonant codas are permissible in the language but are restricted only to [-continuant, -nasal] sounds, e.g. [l]. This restriction places new limits on the types of CVC monosyllables that can emerge from deletion in disyllabic words. Consider the data in (5).

(5)

	<u>Standard</u>	<u>Colloquial</u>		<u>Gloss</u>
a.	[sí.rã]	[srá]	*sir	‘to scar’
b.	[fi.nɛ]	[fně]	*fin	‘caste name’
c.	[bì.la]	[blă]	*bil	‘to release’
d.	[fi.la]	[flă]	*fil	‘two’

e.	[búu.ru]	[brú]	*bur	‘bread’
f.	[tè.nɛ]	[tně]	*tɛn	‘taboo’
g.	[bò.li]	[bòl]	*bli	‘to run’
h.	[sé.li]	[sél]	*sli	‘prayer’
i.	[bí.li]	[blí]/[bíl]		‘roof’
j.	[kí.li]	[klí]/[kíl]		‘egg’
k.	[fó.lɔ]	[fló]	*fɔl	‘first’
l.	[ké.lě]	[klé]	*kel	‘one’
m.	[dò.lɔ]	[dłó]	*dɔl	‘beer’

(5a-d) show that, in a competition between [+hi] and [-hi] vowel deletion in disyllabic words, [+hi] deletion yielding a permissible CCV complex syllable is favored. (5e-f) illustrate that disyllabic words with like-vowels, whether [+hi] or [-hi], emerge as CCV if they cannot otherwise create a CVC syllable with a word-final [-continuant, -nasal] sonorant consonant coda. The outcome of Vowel Syncope is quite unique in (5g-h) where one finds, for the first time, resultant word-final CVC syllables. These syllables are only permitted as a result of final [+hi] vowel deletion when the deletion yields a [-continuant, -nasal] sonorant coda. (5i-j) represent yet another situation, specifically for two-syllable CV_[+hi]LV_[+hi] words. In such words, either one of two deletion outcomes is possible. A CCV syllable can emerge via deletion of the first vowel, or otherwise, an [l]-final CVC can emerge via deletion of the second vowel. Finally, (5k-m) illustrate that disyllabic CV_[-hi]LV_[-hi] words containing identical [-hi] vowels permit only a single outcome of reduction, thereby yielding a CLV syllable to the exclusion of a final CVL.

Monosyllabic words containing both short and phonemic long vowels are found in Standard Bamana. While it may be obvious that one would not expect Vowel Syncope to act on monosyllabic CV words, it is worth mentioning that similarly, the process fails to act in any way to reduce monosyllabic CVV words containing a phonemic long vowel.⁵ Additional instances in which words fail to reduce in Colloquial Bamana are illustrated and discussed in more detail in §4.2.1.

3.2.4 Summary

Section 3.2 has presented data illustrating the outcome of Vowel Syncope in Colloquial Bamana words derived from Standard Bamana words with one, two, and three syllables. While it was discussed that monosyllabic words are not acted upon by Vowel Syncope, it was shown otherwise that two- and three-syllable words are subject to reduction via this process resulting in a number of different emergent word types containing a complex syllable. Throughout this section, it has been suggested that the process of Vowel Syncope is free to act upon target vowels, with the stipulation that it must result in words obeying the overall phonotactics of the language. In §3.3, I turn attention to the finer details of these restrictions. In this section, it is demonstrated that it is the phonotactic constraints on Colloquial Bamana syllable margins and permissibilities on syllable contact sequences that drive the specific types of syllables emergent in the language. Having provided a formalization of these constraints on margin phonotactics, the process of Vowel Syncope is presented in an optimality theoretic framework in §3.4.

⁵ Creissels (1992) has noted that some speakers have lost the phonemic contrast between short and long vowels in non-derived Bamana words, while it has been retained for others. In my own data collection, I found that speakers vary in the degree to which this distinction has been lost. Some speakers maintain a 1:2 length ratio between these vowels, while for others, this ratio has decreased to approximately 1:1.5.

3.3 Syllable margin phonotactics

The data and discussion presented thus far in this chapter have been explicit in stating that a process of Vowel Syncope is active in Colloquial Bamana, but only in instances where complex syllables of certain types can be created. It was described in general terms that Vowel Syncope has the ability to create both CCV and CVC syllables with specific properties (i.e. they are restricted by syllable margin phonotactics). Resultant CCV syllables must contain complex onsets of rising sonority where the second element of the onset is a sonorant. Similarly, resultant CVC syllables must contain a singleton sonorant coda, with the added stipulation that only [-continuant, -nasal] sonorant consonants are permitted in word-final CVC syllables. We now turn to defining the details of these phonotactics in terms of constraints on permissible syllable margins and syllable contact sequences in Bamana as informed by the Split Margin Approach to the syllable (Baertsch 2002).

3.3.1 The Split Margin syllable

The Split Margin Approach to the syllable, developed in Baertsch (2002), is a model of syllable structure that defines the elements found in syllable margins in terms of the relationship between two complementary margin hierarchies, namely the M_1 and M_2 hierarchies. Baertsch's model proposes that constraints on elements in these hierarchies (both singularly and in conjunction with one another) ranked relative to other constraints on segmental faithfulness and well-formedness (in an optimality theoretic framework) are active in predicting the permissible syllables found in a given language. The model formalizes the universal tendency for languages to contain elements of particular sonorities in a given syllable margin position. Baertsch & Davis (2009) and Davis &

Baertsch (2008) have discussed aspects of the Split Margin Approach with specific reference to Standard and Colloquial Bamana, and indeed these earlier works inform certain elements of the following discussion.

In many ways, the Split Margin Approach to the syllable (Baertsch 2002) is an extension of the Margin Hierarchy proposed by Prince and Smolensky (1993/2004). While constructed similarly, Prince & Smolensky's Margin Hierarchy, shown in (6), gives preference to low sonority components in all syllable margin positions.

(6) Margin Hierarchy (Prince & Smolensky 1993/2004)

$*M/a \gg *M/i \gg \dots \gg *M/d \gg *M/t$

Baertsch's model, however, introduces mirror-image M_1 and M_2 hierarchies, (7) and (8), respectively, that capture the tendency for low versus high sonority elements to be found in different syllable margin positions.

(7) M_1 Hierarchy⁶

$(*M_1/[-hi] \gg *M_1/[+hi]) \gg *M_1/r \gg *M_1/l \gg *M_1/Nas \gg *M_1/Obs$

(8) M_2 Hierarchy

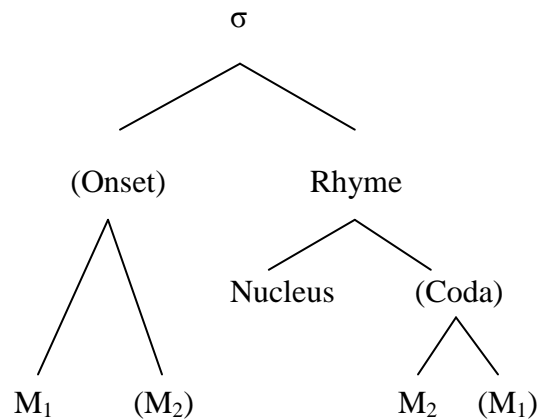
$*M_2/Obs \gg *M_2/Nas \gg *M_2/l \gg *M_2/r \gg (*M_2/[+hi] \gg *M_2/[-hi])$

The M_1 and M_2 positions that Baertsch references in her hierarchies correspond to the split margin positions in her model of the syllable. In this model, a singleton onset (or the first member of a branching onset) and the second member of a branching coda (if present) are M_1 positions that prefer to be filled with low sonority elements. The second member of a branching onset (if present) and a singleton coda, on the other hand, are M_2 positions that prefer to be filled by elements of high sonority. The Split Margin model is

⁶ The parenthesized vocalic elements in (7) and (8) would be assumed to be drawn into the nucleus or syllable peak and do not constitute a key component to this discussion. It should be noted however, that Baertsch (2002) has suggested that an M_2 vowel may be analyzed, in some instances, as a constituent of the coda.

the first of its kind to formalize the sonority relationship that exists between elements of the syllable margins flanking the nucleus.⁷ Baertsch's Split Margin syllable follows in (9).

(9) Split Margin Syllable



In the case of Colloquial Bamana, given that the language does not in any instance have complex codas, I utilize a version of this model in which the only the M₂ coda is relevant. Because the language realizes complex onsets, the split M₁ and M₂ positions will both enter into the following discussion.

It was presented above that Colloquial Bamana, in most instances, realizes syllables containing any type of consonant in its inventory in an M₁ onset position. In the parlance of the Split Margin Approach, the entire M₁ hierarchy of constraints would be ranked below other relevant constraints on faithfulness and well-formedness in order that the language is free to express this full range of M₁ onsets. This is illustrated in (10).

(10) Colloquial Bamana M₁ Hierarchy

FAITH >> *M₁ r >> *M₁/l >> *M₁/Nas >> *M₁/Obs

⁷ See Gouskova (2002, 2004) for an alternative viewpoint on this topic.

It was also presented above by drawing from Colloquial Bamana data that, in the formation of complex CCV and CVC syllables via Vowel Syncope, specific restrictions are in place on the types of consonants that can be found as the second member of the branching onset and in the singleton coda position, i.e. M₂ positions. As the Split Margin Approach predicts, given that these two positions are formally related to one another, the restrictions on these margin positions are, for all intents and purposes, identical.⁸ We know from the Colloquial Bamana data that obstruents of any type are restricted from M₂ positions but that sonorants are permitted in these positions. While we saw that the entire M₁ hierarchy was ranked below FAITH, the M₂ hierarchy is split so that the margin constraint against M₂ obstruents (i.e. *M₂/Obs) is ranked above FAITH, effectively barring such consonants from that position. The remainder of the M₂ hierarchy is ranked below FAITH, thereby permitting sonorants in M₂ positions. This ranking follows in (11).

(11) Colloquial Bamana M₂ Hierarchy

*M₂/Obs >> FAITH >> *M₂/Nas >> *M₂/l >> *M₂/r

It should be clear that by combining the effects of the hierarchies presented in (10) and (11) relative to FAITH, the general distribution of margin constituents in Colloquial Bamana is correctly predicted. As a point of comparison, and as Baertsch & Davis (2009) point out, the Standard and Colloquial varieties of Bamana differ in their M₂ Hierarchy ranking, however their M₁ Hierarchy rankings are identical. While Colloquial Bamana witnesses the demotion of all constraints against M₂ margin consonants except obstruents below FAITH, Standard Bamana is such that all constraints on M₂ margin consonants are ranked above FAITH. This ranking omits any consonant

⁸ This point, its exceptions, and its implications are discussed in more detail below.

from an M_2 position, a fact that we see borne out in the limited syllable shape inventory in the more conservative Standard variety of the language.

An important component of Baertsch's model is its ability to formalize the co-occurrence of (or restrictions on) different M_1 and M_2 constituents via the conjunction of constraints on elements in these positions within a specified local domain. The discussion that follows is specifically in reference to the conjunction of M_1 and M_2 constraints in the local domain of the syllable, unless specified otherwise. In a given conjoined margin hierarchy, for example in Colloquial Bamana, the most favorable M_1 - M_2 sequences are those containing the lowest ranked elements (and so forth) of each of the two Margin Hierarchies in (10) and (11). A partial Conjoined Margin Hierarchy for Colloquial Bamana follows in (12).

(12) Colloquial Bamana Conjoined Margin Hierarchy (partial)

$\sigma[*M_1/Obs \& *M_2/Obs \gg \sigma[*M_1/Obs \& *M_2/Nas \gg \sigma[*M_1/Obs \& *M_2/[l] \gg \sigma[*M_1/Obs \& *M_2/[r]$

This Conjoined Margin Hierarchy captures the preference in Colloquial Bamana for the co-occurrence of low sonority M_1 obstruents with high sonority M_2 sonorants in CCV onsets. Given a different local domain, e.g. the word, the conjoined margin hierarchy can capture the co-occurrence preferences for consonants in syllable contact sequences. This hierarchy also begins to elucidate the reasons that Colloquial Bamana avoids certain less preferred structures in favor of others when a choice of more than one outcome of Vowel Syncope is possible. More specifically, this hierarchy of conjoined constraints formalizes the avoidance of particular marked structures, e.g. M_1/Obs - M_2/Obs adjacent to one another within the domain of a syllable, such as in the choice in (1a) of /kábila/ \rightarrow [ká.blá], *kbi.la. The unattested winner, *kbi.la, would violate the undominated constraint $\sigma[*M_1/Obs \& *M_2/Obs$.

While the partial conjoined margin hierarchy in (12) captures certain generalizations about preferred consonant co-occurrences in Colloquial Bamana syllable margins, a more complete representation of the restrictions and permissibilities of these structures in the language is illustrated in the schematic in (13).

(13) Colloquial Bamana M₁-M₂ co-occurrence⁹

A ₁ /T ₂								
A ₁ /D ₂	I ₁ /T ₂							
A ₁ /N ₂	I ₁ /D ₂	R ₁ /T ₂						
A ₁ /L ₂	I ₁ /N ₂	R ₁ /D ₂	L ₁ /T ₂					
A ₁ /R ₂	I ₁ /L ₂	R ₁ /N ₂	L ₁ /D ₂	N ₁ /T ₂				
A ₁ /I ₂	I ₁ /R ₂	R ₁ /L ₂	L ₁ /N ₂	N ₁ /D ₂	D ₁ /T ₂			
A ₁ /A ₂	I ₁ /I ₂	R ₁ /R ₂	L ₁ /L ₂	N ₁ /N ₂	D ₁ /D ₂	T ₁ /T ₂		
*M ₁ /A	I ₁ /A ₂	R ₁ /I ₂	L ₁ /R ₂	N ₁ /L ₂	D ₁ /N ₂	T ₁ /D ₂	*M ₂ /T	
	*M ₁ /I	R ₁ /A ₂	L ₁ /I ₂	N ₁ /R ₂	D ₁ /L ₂	T ₁ /N ₂	*M ₂ /D	
		*M ₁ /R	L ₁ /A ₂	N ₁ /I ₂	D ₁ /R ₂	T ₁ /L ₂	*M ₂ /N	
		FAITH	*M ₁ /L	N ₁ /A ₂	D ₁ /I ₂	T ₁ /R ₂	*M ₂ /L	
				*M ₁ /N	D ₁ /A ₁	T ₁ /I ₂	*M ₂ /R	
					*M ₁ /D	T ₁ /A ₂	*M ₂ /I	
						*M ₁ /T	*M ₂ /A	

The schematic in (13) permits a better visualization of permissible versus impermissible M₁-M₂ co-occurrences in Colloquial Bamana. The solid line running through the schematic represents FAITH, and thus the M₁-M₂ combinations above the FAITH line are impermissible in the language, while combinations found below the line are those permitted in the language.¹⁰ This more detailed representation captures

⁹ The abbreviations used in this schematic are as follows: A - [-hi] vowels, I - [+hi] vowels, R - [r], L - [l], N - nasal consonants, D - voiced obstruents, T - voiceless obstruents. M₂ obstruents do not include affricates for independent reasons.

¹⁰ Consonant clusters containing glides are generally restricted in Colloquial Bamana. While some consonant + glide sequences are simply avoided in favor of an alternative deletion, notably [ny] sequences

additional intricacies of the permissible consonant combinations in Colloquial Bamana, specifically the impermissibility of $M_1/D-M_2/N$ (e.g. S.B. /kábano/ → C.B. [kábánó])¹¹ alongside the permissibility of $M_1/T-M_2/N$ (e.g. S.B. /sáfine/ → C.B. [sá.fné]). Furthermore, this schematic also captures the divergent distribution of consonants in Standard Bamana in comparison to Colloquial Bamana in terms of its undominated M_2 hierarchy. The distribution in Standard Bamana is indicated by the dashed line in (13).

An important intricacy of Colloquial Bamana phonology, illustrated in the schematic by the double-lined conjunctions, is that these particular sequences are found only in syllable contact sequences but do not occur in syllable onset clusters. More specifically, while N_1/N_2 and L_1/L_2 contact sequences are widely noted, for L_1/R_2 sequences, although permitted in theory, rhotics readily assimilate to liquids in a liquid environment and do not surface. This is an expected characteristic of the language following from discussion in Davis (2010). Davis, in outlining implications that follow from a split margin syllable, details that a given syllable contact sequence will violate conjoined margin constraints that have only the word as their domain, while consonant-consonant sequences in a complex onset violate conjoined margin constraints in both the domain of the word and the domain of the syllable. Thus, it is not surprising that permissible consonant-consonant sequences in a complex onset will be a subset of those permitted in a syllable contact sequence. This is precisely what is observed in Colloquial Bamana.

are realized as the palatal nasal [ɲ] which is already a sound widely found in Bamana. As discussed in §1.4, the resolution of *[sy] sequences, in some instances, yields [ʃ].

¹¹ Sequences of *dN are similarly avoided. It is possible, however, given the free variation of the voiced and voiceless velar plosives in intervocalic positions, to find [gN] sequences resulting from Vowel Syncope for some speakers.

Having presented the background and nomenclature related to the Split Margin syllable, the following section offers an optimality theoretic formalization of Vowel Syncope in Colloquial Bamana illustrating the intricate interplay between the constraints on margin phonotactics introduced above alongside conflicting constraints on vocalic faithfulness and peak well-formedness.

3.4 An optimality theoretic account of Vowel Syncope

Section 3.2 introduced the basic vowel deletion preferences associated with the phonological process of Vowel Syncope, while §3.3 discussed the syllable margin phonotactics that influence permissible reduced outputs in Colloquial Bamana. Furthermore, in §3.3.1, formal constraints on individual and conjoined margin constituents were introduced that enter into the following discussion. This section introduces additional constraints that have the ability to interact with those related to syllable margins. When taken together in an optimality theoretic framework, the ranking of these constraints is active in driving the syncopated outputs resultant in Colloquial Bamana.

3.4.1 The role of *PEAK

Earlier optimality theoretic treatments of Colloquial Bamana syncope, notably Diakite (2006) and Baertsch & Davis (2009), appeal to the cover constraints MINIMIZE-SYLLABLE and SYNCOPE, respectively, to characterize the overall process of vowel reduction in the language. While these cover constraints are sufficient to capture certain generalizations about Vowel Syncope, they fall short of tackling the precise mechanism at work driving the particular syncope patterning. It was presented in §3.1 that there exists a preference for [+hi] vowel syncope when such a target is present and available for deletion. Based

upon this observation, what one finds in Colloquial Bamana, as opposed to its more conservative progenitor (i.e. Standard Bamana), is that the language permits a violation of segmental (vocalic, in this instance) faithfulness in order to satisfy some higher-ranking constraint militating against certain syllable peaks. Furthermore, we know that, in a competition between [+hi] and [-hi] syllable peaks, the language prefers deletion of a [+hi] peak. These simple facts allow for the statement of two ranking arguments in Colloquial Bamana that utilize the constraints in (14) through (17). These ranking arguments are laid forth in (18) and (19).¹²

(14) MAX-IO (henceforth MAX) - segments in the input must have an output correspondent

(15) SYNCOPE (Baertsch & Davis 2009) - minimize the number of syllables in a word

(16) *PEAK [+hi] - incur a violation for each [+hi] syllable peak

(17) *PEAK [-hi] - incur a violation for each [-hi] syllable peak

(18) SYNCOPE >> MAX

	/kabila/ 'tribute'	SYNCOPE	MAX
a.	ka.bi.la	*!	
b. ✓	ka.bla		*

The crucial ranking of SYNCOPE >> MAX in Colloquial Bamana illustrates that the language prefers segmental deletion over some set of constraints militating against marked structures. This ranking therefore drives reduction via syncope. One can tease

¹² It is important to note here that both Standard and Colloquial Bamana are assumed to have the same segmental underlying representations, however as is discussed in later chapters of this thesis, the phonological processes of reduction active in Colloquial Bamana are such that they must reference the higher prosodic structure (i.e. foot structure) found in the Standard form of the language for their proper application. Thus, it is assumed that Standard Bamana serves as the input to Colloquial Bamana, phonologically speaking. For more on this topic, see Chapter 6.

apart the SYNCOPE cover constraint into a pair of critically-ranked markedness constraints, namely a sequence of *PEAK constraints, that militate against particular syllable peaks. These constraints are active in driving the choice of a [+hi] deletion target in words containing vowel of different heights.

(19) *PEAK[+hi] >> *PEAK[-hi] >> MAX

	/kalifa/ 'to entrust'	*PEAK[+hi]	*PEAK[-hi]	MAX
a.	ka.li.fa	*!	**	
b. ✓	kal.fa		**	*

The ranking of the *PEAK constraints in Colloquial Bamana follows precisely from Prince & Smolensky's (1993/2004) Peak Hierarchy in (20) that gives preference to peaks of higher sonority, i.e. [-hi] vowels. One finds, therefore, that although Colloquial Bamana is being reduced via peak (and therefore, syllable) loss, the syllables that it retains are more harmonic according to the Peak Hierarchy.

(20) Peak Hierarchy (Prince & Smolensky 1993/2004)

$P/a \gg P/i \gg \dots P/t$

The sequence of *PEAK constraints is active in reducing words containing vowels of multiple heights, as in (19), and as illustrated in (21), these constraints also apply in words with all [+hi] vowels and those with all [-hi] vowels. While the mechanism selecting a particular vowel for deletion is discussed further below, the important point here is that reduction occurs regardless of the vocalic makeup of these words via the activity of the *PEAK constraints. In both instances, these constraints are responsible for ruling out output candidates with a greater number of overall peaks.

(21) *PEAK[+hi] >> *PEAK[-hi] >> MAX

	/misiri/	*PEAK[+hi]	*PEAK[-hi]	MAX
a.	mi.si.ri	***!		
b. ✓	mi.sri	**		*
/capalo/				
c.	ca.pa.lo		***!	
d. ✓	ca.plo		**	*

3.4.2 The addition of margin constraints

Now that the role of *PEAK has been established, one can consider the role that the markedness constraints presented above in §3.4.1 on M₁ and M₂ margins have to play in eliminating other non-optimal output candidates resulting from Vowel Syncope. It has already been motivated that the Colloquial Bamana M₁ hierarchy is ranked entirely below FAITH given that any consonant is possible in syllable-initial position. Along these same lines, we have seen that the Colloquial Bamana M₂ hierarchy is split, with *M₂/Obs being the only element of the hierarchy ranked above FAITH, given the impermissibility of ever having obstruents in M₂ positions in this language. Because sonorants are readily attested in M₂ positions, we know that *M₂/Son must be ranked below FAITH. The role of these constraints in relation to *PEAK and MAX (i.e. FAITH) is illustrated in (22).

(22) *M₂/Obs >> *PEAK[+hi] >> *PEAK[-hi] >> MAX >> *M₂/Son

	/kabila/	*M ₂ /OBS	*PK[+hi]	*PK[-hi]	MAX	*M ₂ /SON
a.	ka.bi.la		*!	**		
b. ✓	ka.bla			**	*	*
c.	kab.la	*!		**	*	
d.	kbi.la	*!	*	*	*	
/silame/						
e.	si.la.me		*!	**		
f. ✓	sla.me			**	*	*
g.	sil.me		*!	*	*	*

These tableaux illustrate that, in the case of /kábila/ → [ká.blá], the undominated constraint militating against M₂ obstruents (i.e. *M₂/Obs) effectively eliminates candidates (22c-d). (22a) is eliminated by the high-ranked *PEAK[+hi] constraint. However, in words like /silamɛ/ → [sil.mé], given its low ranking, the constraint militating against M₂ sonorants (i.e. *M₂/Son) is not active in choosing the winning output (22f). Instead, the high-ranked *PEAK[+hi] constraint is active in choosing a winner that lacks a more marked [+hi] vowel syllable peak. While individual M₂ constraints are helpful in motivating the choice of these specific types of reduced output candidates, for more intricate cases, one must appeal to constraints on conjoined margins, such as those presented in (13).

One particularly striking instance in which the role of the conjoined margin hierarchies comes into play is in a comparison between a word which, upon deletion, yields a permissible M₁/voiceless obstruent-M₂/nasal complex CCV syllable and a word in which the impermissibility of conjoined M₁/voiced obstruent-M₂/nasal (when adjacent within a syllable) forces the language to opt against reduction altogether and in favor of a fully faithful mapping of the Standard to the Colloquial form of the word. The relationship between these two conjoined margins relative to FAITH is captured in the partial conjoined margin schematic in (23). Illustrative tableaux are presented in (24) utilizing the constraint abbreviations presented in (13). This is the first time, thus far, in Colloquial Bamana that a fully faithful outcome has been the optimal output candidate owing to the inability of the language to reduce in such a way that it generates permissible syllable margins.

(23) Partial Conjoined Margin Schema

N ₁ /T ₂				
N ₁ /D ₂	D ₁ /T ₂			
N ₁ /N ₂	D ₁ /D ₂	T ₁ /T ₂		
N ₁ /L ₂	D ₁ /N ₂	T ₁ /D ₂	*M ₂ /T	
N ₁ /R ₂	D ₁ /L ₂	T ₁ /N ₂	*M ₂ /D	
N ₁ /I ₂	D ₁ /R ₂	T ₁ /L ₂	*M ₂ /N	FAITH
N ₁ /A ₂	D ₁ /I ₂	T ₁ /R ₂	*M ₂ /L	
*M ₁ /N	D ₁ /A ₁	T ₁ /I ₂	*M ₂ /R	
	*M ₁ /D	T ₁ /A ₂	*M ₂ /I	
		*M ₁ /T	*M ₂ /A	

(24)

	/safine/	*M ₂ /D	σ[*M ₁ /D & *M ₂ /N	*PK [+hi]	*PK [-hi]	MAX	σ[*M ₁ /T & *M ₂ /N
a.	sa.fi.nɛ			*!	**		
b. ✓	sa.fɛ				**	*	*
c.	sfa.nɛ	*!			**	*	
d.	saf.nɛ	*!			**	*	
/kabano/							
e. ✓	ka.ba.no				***		
f.	kab.no	*!			**	*	
g.	ka.bno		*!		**	*	

Instances in which a faithful mapping of a Standard Bamana word emerges in Colloquial Bamana can be found in words similar in shape to those in (25). In many of these instances, potential output candidates can be similarly ruled out by an undominated *M₂/Obs. For other candidates, an undominated σ[*M₁/Obs&*M₂/Obs (although theoretically ranked above σ[*M₁/Obs&*M₂/Nas) would also need to be posited.

(25)

	<u>Standard</u>	<u>Colloquial</u>		<u>Gloss</u>
a.	[sà.ba]	[sà.bá]	*sba/*sab	‘three’
b.	[bà.na]	[bà.ná]	*bna/*ban	‘to become ill’
c.	[dì.bi]	[dì.bí]	*dbi/*dib	‘darkness’
d.	[kí.ti]	[kí.tí]	*kti/*kit	‘to judge’
e.	[fá.sa.da]	[fá.sá.dá]	*fsa.da/*fas.da	‘to praise’
f.	[sá.ba.ti]	[sá.bá.tí]	*sba.ti/*sab.ti	‘stable’
g.	[kì.ba.ru]	[kì.bà.rú]	*kib.ru/*ki.bru	‘news’
h.	[dú.kɛ.nɛ]	[dú.ké.né]	*du.knɛ/*dkɛ.nɛ	‘courtyard’

In addition to more general restrictions, there exist other minute details concerning the co-occurrence of particular consonants in syllable margins that are governed by positional constraints. In the case of conjoined M_1 /voiceless obstruent- M_2 /nasal complex syllables mentioned above, certain consonant combinations are restricted by their position in the word. More specifically, while combinations of [tn] and [fn] are possible both word-initially and word-internally, a [km] complex onset, for example, is restricted in its distribution. A sequence like [km] is grammatical for some speakers in word-internal position (e.g. /lókɔmã/ → [lók.má]/[lók.kmá] ‘handful’), however such sequences are banned in word-initial position (e.g. /kámalẽ/ → [ká.mlě], *kmá.lě ‘boyfriend’). Similar situations are discussed by Baertsch & Davis (2009), who suggest that segments at the same sonority level may not always patterns in precisely the same way. The behavior of [km] sequences, alongside other voiceless obstruent-nasal sequences in Colloquial Bamana, support this proposition. It is worthwhile to note that

this viewpoint differs considerably from that offered by Gouskova (2004) whose model predicts that segments at the same level of sonority should behave identically.

Along these same lines are words, such as those presented in (5), that permit reduction via [+hi] vowel loss to generate a CVC syllable with a word-final sonorant consonant. The stipulation in such words is that reduction is only permitted when the word-final sonorant coda is [-continuant, -nasal]; thus, [l] is the only word-final sonorant coda permitted in Bamana.¹³ This type of restriction is not problematic, but it requires one to posit a markedness constraint like *FINALCONTINUANT that would be undominated in Colloquial Bamana, effectively ruling out [+continuant] codas in the language word-finally. This is not an unusual restriction cross-linguistically, as a number of diverse languages fail to permit such segments in this word position, among them Korean (Kenstowicz 2005), Thai (Abramson 1962), and !Xóõ (Traill 1985).

An interesting situation arises in words like (25g-h) in which [+hi] vowel deletion is blocked by the impermissibility of M₁/obstruent-M₂/obstruent sequences. In such words, there would appear to be a seemingly acceptable [-hi] deletion alternative that could generate outcomes with permissible syllable margins. In the case of (25g), the word *kibaru* cannot delete its [+hi] vowel to yield **kbaru*, however it appears that an alternative like **kibru* should be an acceptable alternative. Similarly for (25h), the

¹³ Nasal consonants, although they are sonorants, are not found in word-final codas. These consonants, thus, appear to pattern with [+continuant] sonorants, i.e [r]. This is somewhat problematic, theoretically speaking, as nasal consonants are most often considered to be [-continuant] sounds. It may be the case, however, that this patterning can be attributed to an alternative factor. It is possible that nasal consonants are, in fact, [-continuant] but are otherwise restricted from appearing in a word-final coda position, as they would force a change in the [nasal] specification of a preceding vowel. One could argue that an undominated ID[nasal] constraint precludes this possibility and effectively prohibits nasal consonants from being found in word-final syllable codas. This is, however, also problematic given that one finds no true nasal coda emergence word-finally after phonemic nasal vowels. With these alternatives and their respective shortcomings acknowledged, I shall for the purposes of this dissertation state that nasals pattern with other [+continuant] consonants in Bamana. This particular topic clearly necessitates further research.

outcome of *dúkɛnɛ* cannot be **dkɛnɛ*, but an alternative like **dukɛnɛ* appears possible. In both instances, however, this seemingly acceptable alternative is ungrammatical in Colloquial Bamana. We observe, therefore, that if a [+hi] vowel target within the domain of application for Vowel Syncope is not eligible for deletion, reduction cannot occur by an alternative means. This unusual phenomenon is discussed in more detail in Chapter 5.

3.4.3 Addressing variation

Data presented in displays (3) and (4) illustrated that, when permitted by the margin phonotactics of the language, variation in syncopated Colloquial Bamana outputs is possible. These instances of variation can also be characterized in an optimality theoretic framework, however one must consider competing hypotheses of how to do so. One of the better established means by which scholars have proposed to address variation in output candidates is to posit that variation is due to a non-critical ranking between low-ranking constraints (e.g. Antilla & Cho 1998; Auger 2001; Davis unpublished ms; Davis & Torretta 1998; Zubritskaya 1997). This argument stems from the fact that often variation in output candidates occurs when two potential output candidates tie in their violations of high-ranking constraints in the constraint hierarchy and differ only minimally from one another in their violation of two lower ranked constraints. By proposing that these low-ranked constraints are adjacent to one another and ranked indeterminately relative to one another, scholars have proposed that this provides speakers with the opportunity to choose between one or the other output form in free variation. It may be the case that this type of variation indicates a state of change or flux in the language wherein a formerly critical ranking between two constraints has been

relaxed, or alternatively a state in which a critical ranking may ultimately develop between the two constraints.

A second analysis of variation in an optimality theoretic framework is that proposed by Coetzee (2006). In Coetzee's analysis, output forms that equally satisfy a certain set of high-ranking constraints are considered to be 'well-formed enough' in comparison to other potential output candidates and are therefore permitted to surface. Coetzee argues for this analysis by suggesting that there exists, within a particular constraint hierarchy, a cut-off point at which output candidates satisfying all constraints ranked higher than that specified point are considered to be well-formed by the grammar. Violations incurred below this cut-off point are minimal and thus generate outputs that are considered to be equally grammatical harmonic variants.

In the case of Colloquial Bamana, the variable output forms presented in (3) and (4) tie in their violations of all high ranking constraints on markedness, particularly the *PEAK constraints, as well as in their violations of FAITH (i.e. MAX). These variable outputs, e.g. /sárama/ → [srá.má]/[sár.má], differ in allowing a CCV or CVC syllable to surface upon reduction. Considering the conjoined margin constraints discussed in §3.3.1, the first of the two output variants, [srá.má], would violate, generally speaking, a conjoined constraint banning adjacent obstruent-sonorant sequences in a syllable, i.e. σ [*M₁/Obs&*M₂/Son. This potential output candidate differs only minimally from [sár.má] which realizes its M₂ sonorant in a coda and therefore in a syllable contact sequence. Taken differently, one could propose that this potential output candidate violates an analogous conjoined margin constraint that has the word as its local domain,

rather than the syllable, i.e. $\text{wd}[*M_1/\text{Obs}\&*M_2/\text{Son}]$. Note that [srá.má] would also violate this second constraint.

In the first method of variation analysis, the two proposed constraints would simply not be critically-ranked relative to one another. However, even with this stipulation, the output candidate containing the CCV syllable (i.e. [srá.má]), because it violates both conjoined constraints, would represent a less harmonic choice than an output violating only the conjoined constraint in the word domain (i.e. [sár.má]). This is a somewhat unfavorable outcome, given that these outputs are attested in free variation. A second possibility would be to posit a general cover constraint on syllable contact which would only penalize the CVC output, thereby resulting in each of the variation outputs receiving only a single violation of the equally ranked constraints. While proceeding in this manner would satisfy the first of the two variation analyses, the proposal of a cover constraint to facilitate the analysis is unsatisfactory.

Coetzee's method of analyzing variation, however, is well-suited to the Colloquial Bamana data, as well as to the constraints on conjoined margins proposed above. We have seen throughout the above section that the high-ranked individual and conjoined constraints on syllable margins, as well as the competing *PEAK constraints are active in selecting the optimal output of Vowel Syncope. Thus far, MAX has served only as an antagonist to the *PEAK markedness constraints. The first mention of constraints ranked below MAX was in reference to the variable outputs discussed above. We know from (13) that these constraints on permissible conjoined margins must be ranked below FAITH itself. Following from these observations and from Coetzee's (2006) critical cut-off

analysis of variation, one can propose a split in the Colloquial Bamana constraint hierarchy into two levels, as in (26).

(26)

Level 1: Undominated Margin and Markedness Constraints >>

*PEAK Constraints

Level 2: MAX >>_σ[*M₁/Obs&*M₂/Son, wd[*M₁/Obs&*M₂/Son >>

Low-Ranked Margin Constraints

By employing these split levels, one can analyze variable outputs in Colloquial Bamana by considering that the two possible winning candidates satisfy all the high-ranking constraints found in Level 1, rendering them well-formed and grammatical. When these candidates are passed to the Level 2 constraints for evaluation, they are evaluated only for their harmonicity or well-formedness, rather than their grammaticality, hence both output candidates emerge in variation.¹⁴ Consider the tableaux in (27) that illustrate this method of analysis for Colloquial Bamana words with attested variation in their output forms. Constraints irrelevant to the evaluation of these words have been omitted. The heavy line adjacent to MAX indicates the split between the two constraint levels. The motivation for placing this cut-off above, rather than below, MAX is further explicated in §3.5.1.

¹⁴ Coetzee suggests that the relative frequency of occurrence may be gleaned from this lower harmonic rank ordering, however, no determination in support or against this claim can be made here for Colloquial Bamana, as the frequency of occurrence of output variants has not been a focus of this study. As predicted by Coetzee's discussion, only a limited number of variable outputs are attested in the grammar of the language.

(27)

	/sarama/	*PK [+hi]	*PK [-hi]	MAX	σ [*M ₁ /Obs & *M ₂ /Son	w_d [*M ₁ /Obs & *M ₂ /Son
a.	sa.ra.ma		***!			
b. ✓	sar.ma		**	*		*
c. ✓	sra.ma		**	*	*	*
	/buluku/					
e.	bu.lu.ku	***!				
f. ✓	blu.ku	**		*	*	*
g. ✓	bul.ku	**		*		*

As the tableaux illustrate, the fully faithful (i.e. unsyncoated) output candidates lose owing to their multiple violations of a relevant *PEAK constraint. The remaining potential output candidates tie in their violations of *PEAK and are passed to the second level for evaluation where they tie once again in their violation of the antagonistic faithfulness constraint MAX. When evaluated by the relevant conjoined constraints, one finds that the attested variants are the first and second losers below the cut-off line, meaning that they are more well-formed than all other potential output candidates but equally grammatical in comparison to one another. Note that this method makes identical predictions about the variant outputs from input disyllabic words with possible [-continuant, -nasal] coda consonants that were presented in (5).¹⁵

3.4.4 Vowel Syncope summary

The analysis above formalized Vowel Syncope in an optimality theoretic framework in terms of competing constraints on segmental faithfulness alongside those on peak and

¹⁵ What is striking in (27) is that in such instances of attested variation, one of the two winning variants is harmonically-bounded, given the constraints introduced thus far. Coetzee (2006), among others (e.g. McCarthy 2007), describe this state of affairs as an impossibility. One means by which to alleviate this situation, however, would be to introduce another low-ranked constraint (e.g. NOCODA) into the Colloquial Bamana hierarchy that would have the effect of favoring candidates like (27c) and (27f) over their CVC.CV counterparts. The additional of this constraint would break the ‘harmonic bounding’ between these candidates, as traditionally defined (e.g. Samek-Lodovici & Prince 1999).

margin well-formedness. The variation noted in some Colloquial Bamana words differing only in the choice of output CCV or CVC complex syllables was motivated in this framework by proposing two constraint levels that serve to differentiate grammatical output candidates from those that are ungrammatical. Having considered in detail the data and mechanisms pertaining to Vowel Syncope in Colloquial Bamana, I now turn attention to an analogous process of consonant reduction, namely Velar Consonant Deletion.

3.5 Velar Consonant Deletion

Velar Consonant Deletion is a second process contributing to the overall drive towards minimization in Colloquial Bamana. This process, presented in detail below, has the ability to interact with Vowel Syncope and has a bearing on its application and outcome in some instances. Velar Consonant Deletion has been observed in both the Colloquial and Standard varieties of Bamana, and indeed similar processes of velar lenition are noted in other related Mande varieties, although with different specifics of application (e.g. Dumestre & Hosaka 2000; Konatè & Vydrine 1989; Vydrine 2008). In Colloquial Bamana, Velar Consonant Deletion acts upon intervocalic velar consonants stemming from Standard Bamana words of the shape $C_1V_\alpha C_2V_\alpha$, where C_2 is a velar consonant, and this consonant is flanked by identical vowels. This process is the apparent endpoint of a diachronic progression of velar consonant lenition (e.g. $k > g > \gamma > h > \emptyset$) that yields total segmental loss of the velar consonant and the subsequent derivation of a long vowel. Similar schemes of velar consonant deletion have been noted cross-linguistically, for example in Turkish (Sezer 1981), Kranichfeld German (Glover 2009), Kwasio (Duke & Martin 2009), as well as in the Mande languages cited above. Because diphthongs are

otherwise banned in Colloquial Bamana, Velar Consonant Deletion never applies between unlike vowels, as the deletion would generate an impermissible vocalic sequence (i.e. a diphthong).

Far fewer intricacies of application come into play when discussing Velar Consonant Deletion, as compared to Vowel Syncope. As the data in (28) illustrate, Velar Consonant Deletion applies regularly to velar consonants flanked by vowels of any height, as long as the vowels are identical. Furthermore, the process is similar to Vowel Syncope in that both processes achieve minimization via deletion of only a single segment upon their application. Restrictions on the application of Velar Consonant Deletion do come into play, however, in longer words, as detailed further in Chapters 5 and 6.

(28)

	<u>Standard</u>	<u>Colloquial</u>	<u>Gloss</u>
a.	[si.ki]	[si]	‘to sit’
b.	[dù.ku]	[dùú]	‘village’
c.	[mò.kɔ]	[mòó]	‘person’
d.	[tó.kɔ]	[tóó]	‘name’
e.	[có.go]	[cóó]	‘manner’
f.	[fà.ga]	[fàá]	‘to kill’
g.	[sà.ga]	[sàá]	‘sheep’

3.5.1 Competition between processes

As one might expect, instances often present themselves in which acceptable targets for both Vowel Syncope and Velar Consonant Deletion are present in the Standard Bamana

input. It is the reduced outcome of such words that provides more intimate insight into the critical relationships between constraints active in achieving the drive towards minimization in Colloquial Bamana. Put another way, we know that both Vowel Syncope and Velar Consonant Deletion are active in their own right in driving vowel or consonant reduction, respectively. However, we have not yet probed the way that the constraints driving these two processes depend on, interact with, or restrict one another. We first get to the heart of this issue by proposing a constraint (29) that is active in driving Velar Consonant Deletion (Raffelsiefen 2004).

(29)

*VKV – velar obstruent flanked by vowels are not permitted

Because it has been shown above that intervocalic velar consonant deletion is a well-attested process cross-linguistically, such a constraint is motivated. It is not, however, necessary to propose further language specific restrictions on this constraint, such as having it refer specifically to identical vowels. Instead, a second, cross-linguistically well-motivated markedness constraint (30) banning diphthongs is posited.

(30)

NODIPHTHONG – diphthongs are not allowed (Casali 1997)¹⁶

For disyllabic words, such as those in (28), it is clear that Velar Consonant Deletion is the preferred choice of minimization, given that the Colloquial Bamana outputs surface with derived long vowels, rather than with deleted vowels. In such words, the deletion of the first vowel would yield an impermissible M_1 /obstruent- M_2 /obstruent

¹⁶ It may prove to be, based upon the following discussion, that NODIPHTHONG is undominated in Colloquial Bamana and that *VKV is high-ranked but not in the same tier as the other undominated constraints in the language's constraint hierarchy. The reason for this separation would be that, while even in the Standard variety of the language, diphthongs are disallowed, intervocalic velar consonants are still found in the speech of some individuals.

sequence, while the deletion of the second vowel would yield an impermissible obstruent coda. This is illustrated in (31).¹⁷

(31) *M₂/Obs, *VKV >> *PEAK >> MAX

	/siki/	*M ₂ /Obs	*VKV	*PEAK	MAX
a.	si.ki		*!	**	
b. ✓	sii			*	*
c.	ski	*!		*	*
d.	sik	*!		*	*

The role of MAX is of considerable interest, particularly in words in which both Vowel Syncope and Velar Consonant Deletion have a potential deletion target, i.e. a vowel that can be deleted yielding permissible syllable margins and a velar consonant flanked by identical vowels. Consider the Colloquial Bamana words in (32) containing this combination of deletion targets.

(32)

	<u>Standard</u>	<u>Colloquial</u>		<u>Gloss</u>
a.	[sì.ki.lã]	[sìi.lá]/[sì.klá]	*ski.lã	‘chair’
b.	[sú.ku.na]	[súú.ná]/[sú.kná]	*sku.na	‘urine’
c.	[dù.gu.ma]	[dùù.má]/[dù.gmá]	*dgu.ma	‘on the ground’

¹⁷ I posit that in the evaluation of candidates that have undergone Velar Consonant Deletion, a derived long vowel (just as a phonemic long vowel) is a single peak and thus violates its respective *PEAK constraint only a single time. Concerning derived long vowels themselves, it is assumed that no vowel is deleted in the generation of such a vowel (only a velar consonant is deleted), and thus no violation of MAX-V is assessed as a result of Velar Consonant Deletion. While both phonemic long vowels and derived long vowels are considered to constitute a single peak and thus have identical violations of *PEAK, they differ in other ways. As discussed in Chapter 6, phonemic long vowels are associated to a single mora, given that they pattern with other light syllables, but occupy two timing slots, given that they are generally twice the length of a single vowel. These differences become important analytically in Chapter 5. For more on the characteristics of phonemic versus derived long vowels, see §6.3.1, §6.3.2, and §6.3.3. Furthermore, it will become clear in Chapter 6 pertaining to the patterning of syllables in certain metrical constructions and in Chapter 7 pertaining to the tonal melodies permitted on derived long vowel syllables that derived long vowels are tautosyllabic, i.e. the second vowel does not occupy the nucleus of an onsetless syllable.

d.	[sù.gu.ri]	[sùù.rí]/[sù.grí]	*sgu.ri	‘pre-fasting meal’
e.	[dó.kɔ.ya]	[dóó.yá]	*dɔ.kya	‘to make small’
f.	[sò.kɔ.ma]	[sòò.má]	*sɔ.kma	‘morning’
g.	[sò.kɔ.li]	[sòò.lí]	*sɔ.kli	‘to stab’

Data (32a-d) reveal that words containing potential deletion targets for both Vowel Syncope and Velar Consonant Deletion with [+hi] vowel deletion targets have the ability to delete either a velar consonant or a vowel to achieve minimization. Similar words containing [-hi] vowel deletion targets only permit intervocalic velar consonant deletion, rather than vowel deletion. Put another way, the [+hi] vowel words permit variable outputs, while the [-hi] vowel words select only a single optimal output.

A comparison between these two analogous situations reveals immediate similarities, among them the fact that the fully faithful output candidate is ruled out by the high-ranking markedness constraint, *VKV, and that remaining potential output candidates tie in their violations of their respective *PEAK constraint. Furthermore, potential candidates with phonotactically disallowed syllable margins are omitted by undominated constraints on particular syllable margin constituents. The remaining potential output candidates are left to be evaluated by the lower ranked constraints. Consider the comparison of words in tableaux (33) where attested winning candidates are indicated by a ‘✓’.¹⁸

¹⁸ In either instance, it can be argued that constraints active driving these processes participate in a conspiracy relationship to avoid VKV sequences. Whether via *VKV itself, or by a relevant *PEAK constraint, the disfavored VKV sequences are resolved via the generation of a derived long vowel or a CCV syllable, either by the deletion of a consonant or vowel, respectively. Segmental FAITH, via MAX, is ranked below the markedness constraints driving these processes.

(33)

	/sɪkɪlã/	*M ₂ /Obs	*VKV	*PEAK	MAX
a.	si.ki.lã		*!	***	
b. ✓	sii.lã			**	*
c. ✓	si.klã			**	*
d.	ski.lã	*!		**	*
	/sɔkɔli/				
e.	sɔ.kɔ.li		*!		
f. ✓	sɔɔ.li			**	*
g. ?	sɔ.kli			**	*

This comparison illustrates that the choice of output candidates evaluated by MAX cannot be resolved by appealing only to a generic, all-encompassing version of this constraint. In a choice between (33b) and (33c), one of the attested variants deletes a consonant, while the other deletes a [+hi] vowel, both of which yield grammatical outputs in Colloquial Bamana. In a comparison of (33f) and (33g), however, one observes that only (33f), the consonant deletion candidate, is the winner. A winner deleting a [-hi] vowel (33g) is ungrammatical in this instance. Such an outcome provides motivation for proposing a division of MAX into specific constraints that demand faithfulness to certain segments more so than to others. Given the attested outcomes in (33), it is clear that a constraint demanding faithfulness to underlying [-hi] vowels (i.e. MAX-V_[-hi]) would be more highly-ranked than one demanding faithfulness to underlying [+hi] vowels (i.e. MAX-V_[+hi]) or to velar consonants (i.e. MAX-K). This is drawn from the observation that [-hi] vowel deletion, e.g. (33g), is ungrammatical, while deletion of either of the other two types of segments, e.g. (33b-c), is grammatical.

Considering the outcome noted in words like (32a-d), one can entertain a variation on the ‘cut-off’ analysis offered by Coetzee (2006). It was suggested in §3.4.3

that variation in output forms could be addressed by referring to a constraint cut-off line that represents grammaticality, rather than harmonicity of an output candidate. While in (27), the variation noted was between potential output candidates violating one or the other low-ranked conjoined margin constraint found below the cut-off line, the variation in (33) is somewhat different. In such instances, the two variants differ in their violation of one or the other low-ranked MAX constraint, either MAX-V_[+hi] or MAX-K. By proposing a slight modification to the placement of the constraint level cut-off line, we arrive at the ranking in tableaux (34).

(34)

	/sikilã/	*M ₂ / Obs	*VKV	*PEAK	MAX- V _[-hi]	MAX- V _[+hi]	MAX- K
a.	si.ki.lã		*!	***			
b. ✓	sii.lã			**			*
c. ✓	si.klã			**		*	
d.	ski.lã	*!		**		*	
/sɔkɔli/							
e.	sɔ.kɔ.li		*!	***			
f. ✓	sɔɔ.li			**			*
g.	sɔ.kli			**	*!		

Tableaux (34) illustrates the placement of the cut-off line between MAX-V_[-hi] and MAX-V_[+hi], rather than between a generic MAX constraint and the sequence of *PEAK constraints. By placing the cut-off line here, one can capture both instances of variation noted in Colloquial Bamana, namely words like (32a-d) and (3a-g). In both instances, the attested variants are the first two losing candidates found below the cut-off. Importantly, splitting MAX in the manner described here motivates the fact that variation is not permitted in [-hi] vowel words like (32e-g).

It should be made clear that the modification to the placement of the constraint level cut-off line proposed above, and the subsequent split of MAX into more specific constraints militating against the deletion of particular types of segments, does nothing to alter the analysis for variation discussed above in (27). New tableaux showing the selection of variable outputs from (27) are provided here in (35) with the addition of the more specific MAX constraints and the new modification to the grammaticality cut-off line.

(35)

	/sarama/	*PK [+hi]	MAX- V _[-hi]	MAX- V _[+hi]	σ [*M ₁ /Obs & *M ₂ /Son	wd[*M ₁ /Obs & *M ₂ /Son
a.	sa.ra.ma	***!				
b. ✓	sar.ma	**	*			*
c. ✓	sra.ma	**	*		*	*
/buluku/						
d.	bu.lu.ku	***!				
e. ✓	blu.ku	**		*	*	*
f. ✓	bul.ku	**		*		*

It has been discussed thus far that the analysis of variation developed by Coetzee (2006) predicts that grammatical but harmonically variable outputs will be the first and second candidates violating constraints below the constraint cut-off line. As tableaux (35) illustrate, the modifications proposed to MAX and the constraint cut-off line do not affect the predicted harmonic variants, as the variants of the representative words tie in their violation of their respective MAX constraint. For (35b-c), both [sár.má] and [srá.má] tie in their violation of MAX-V_[-hi] above the cut-off line and are the first two losing candidates evaluated by the conjoined margin constraints found below the cut-off. In (35e-f), although the relevant MAX constraint, MAX-V_[+hi], is found below the cut-off line, both

candidates tie in their violations of this constraint, and it has no role in selecting the first or second losing candidate that will emerge as a harmonic variant. This choice is once again left to evaluation by the conjoined margin constraints, and the variants remain the first two losing candidates below the cut-off line.

The words above represent just one particular instance in which Vowel Syncope and Velar Consonant Deletion interact with and have a bearing on one another. In the following chapters, the permissible application of these processes is discussed in terms of the prosodic domain of application shared between them.

3.6 Dissimilation

An additional piece of evidence that provides striking support for the strength of the drive towards minimization in Colloquial Bamana comes from several noted instances of reduction that result from consonant dissimilation in words that would otherwise not be permitted to reduce due to their potential to produce words with impermissible syllable margins. In such instances, particularly in reference to the application of Vowel Syncope, it has been found that the language will permit minimization to occur alongside a subsequent process of consonant dissimilation that acts to satisfy the unbending margin and syllable phonotactics of the language. Consider the illustrative examples in (36).

(36)

	<u>Standard</u>	<u>Colloquial</u>		<u>Gloss</u>
a.	[á.bu.du]	[á.blú]	*ab.lu/*a.bdu	‘proper name’
b.	[mú.de]	[mlé]	*mde	‘what’
c.	[bú.du.la.yi]	[brú.lá.yí]	*bdu.la.yi/*blu.la.yi	‘proper name’

Beginning first with (36a), one finds that the word contains two [+hi] vowels, although neither of the two vowels is a permissible target for Vowel Syncope. Deletion of the final [+hi] vowel is avoided given that it would generate an impermissible word-final obstruent coda. The first of the two [+hi] vowels is also ineligible for deletion given that its removal would create an impermissible *_o[bd complex onset or alternatively an impermissible *b.d* syllable contact sequence. Furthermore, the [-hi] vowel of the word is ineligible for deletion. This is drawn from the fact that a [-hi] vowel cannot be selected for deletion if it is in the same domain with a [+hi] vowel, whether or not the [+hi] vowel is eligible for deletion or not. In this instance, the stalemate is overcome by the choice of the language to initiate a change of the obstruent [d] to the sonorant [l], which then permits [+hi] deletion via Vowel Syncope to create a permissible complex onset. The situation is quite similar in (36b) where a change from [d] → [l] once again facilitates the application of Vowel Syncope by creating an environment where a permissible _o[ml complex onset can result from [+hi] vowel deletion.

3.7 Summary

This chapter has introduced complementary and interacting methods of reduction in Colloquial Bamana that are active in driving an overall drive towards segmental minimization in the language. These processes, namely Vowel Syncope and Velar Consonant Deletion, have been shown to reduce words via preferential [+hi] deletion and the deletion of intervocalic velar consonants in words of various shapes and segmental makeup. The goal of this chapter has been to characterize these processes and to provide illustrative examples demonstrating their application in Colloquial Bamana. The processes have been formalized and their actions motivated in an optimality theoretic

framework, revealing that high ranking constraints on marked syllable peaks and dispreferred intervocalic sequences militate against these marked structures and thereby drive their deletion. It has been illustrated that these processes of reduction are bounded and restricted by requirements on permissible and impermissible syllable margins in Colloquial Bamana that differ significantly from the more conservative restrictions in place in the language's supposed progenitor, Standard Bamana. Overall, Vowel Syncope and Velar Consonant Deletion are active in introducing complex CCV and CVC syllables into the language. Based upon the unique phonotactic restrictions in place in the language, it has been shown that variation is also attested in some instances of reduction. This variation has been addressed by appealing to a split constraint hierarchy that evaluates potential outputs based first upon their grammaticality and secondarily upon their harmonicity.

CHAPTER 4

REDUCTION IN COMPOUNDS AND MORPHOLOGICALLY COMPLEX WORDS

4.1 Introduction

Chapter 3 introduced processes of vowel and consonant reduction in Colloquial Bamana that act upon words derived from Standard Bamana with three syllables or less. The data presented were drawn from a corpus of words from various lexical categories, and while most words were monomorphs, several contained more than a single morpheme. The outcomes of reduction in these words illustrated that the processes active in satisfying the overall drive towards minimization in Colloquial Bamana do not act preferentially on words of a particular lexical category, and furthermore, they have no general restrictions based upon the morphology of the language. The words presented, however, have not yet permitted a full illustration of the ways in which the processes contributing to minimization can influence and/or bound one another. These shorter words, simply by virtue of their length, did not present sufficient instances in which the processes might potentially interact. It was illustrated, however, that even within some shorter words, deletion targets that are within the same domain of application for both minimization processes can be found. Such words, as presented in §3.5.1, either permit variation in the application of one or the other process (e.g. in [+hi] vowel words) or the sole application of Velar Consonant Deletion (e.g. in [-hi] vowel words).

In the current chapter, attention is focused on the application of Vowel Syncope and Velar Consonant Deletion in nominal and verbal compounds, as well as in other

morphologically complex words containing four syllables or more in Standard Bamana.¹ Overall, compounding and derivation are extremely productive processes in Bamana. A concise description of the types of words that can result from these morphological processes, as well as the types of morphemes involved in them, can be found in Dumestre (2003).

Because these longer words have the potential to provide additional deletion targets to be acted upon by one or both of the processes, we have the opportunity to witness how these processes interact with one another when not forced to vie for a deletion target within a single domain of application. Preferential patterns of deletion in the gamut of potential environments are presented and reveal several striking characteristics of the overall minimization process in the language, some of which are shared and otherwise predicted from patterns of preferential deletion in shorter words. Still other outcomes of deletion in longer words illustrate the role that morphology has to play in reduction and showcase unexpected restrictions on the co-occurrence of one or the other process that further fuel the proposal that metrical or rhythmic structure is a key component of Bamana phonology, and perhaps the phonology of other Mande languages. The details of this proposal are defined in Chapter 6.

4.2 Preferential Velar Consonant Deletion

It is not entirely unexpected that Colloquial Bamana exhibits a preference for Velar Consonant Deletion to apply to the exclusion of Vowel Syncope in longer words when it can be accommodated. As mentioned previously, this process, when in competition with

¹ By *morphologically complex*, I am referring to words consisting of a morpheme plus some derivational affix or words that have undergone multiple rounds of derivation and/or compounding. Inflection in Bamana is quite limited. Henceforth, all mention of *morphologically complex words* should be understood in reference to this definition unless otherwise stated.

Vowel Syncope in shorter words, was the preferential choice of reduction in [-hi] vowel words but yielded variable outcomes in the reduction of [+hi] vowel words. This phenomenon was motivated in optimality theoretic terms by referencing a ranking of constraints active in the language that showcased its preference to avoid deleting [-hi] vowels when an alternative means is available to achieve minimization. The situation is similar in longer words, although these words do not exhibit the same types of strict choices for a deletion target that were found in shorter words. In each instance where a long word contains deletion targets for both Velar Consonant Deletion and Vowel Syncope, minimization is achieved via the former process. It is important to note and is discussed in more detail below that, generally, only a single instance of minimization is possible in these words. Consider the examples illustrating the preferential application of Velar Consonant Deletion in (1). Morpheme boundaries are indicated by ‘#’, and once again, one or more unattested forms is indicated by ‘*’, if relevant, for expository purposes and/or comparison. A literal translation and approximate English gloss are provided for each word. The tone of each individual component in isolation is provided for the Standard form.

(1)

	<u>Standard</u>	<u>Colloquial</u>		<u>Gloss</u>
a.	[sé.li#sà.ga]	[sé.lí.sáá]	*sel.saga/*sli.saga/	‘sacrificial sheep’
	lit. prayer + sheep		*sel.saa	
b.	[nè.rɛ#mú.gu]	[nè.rè.múú]	*nɛr.mu.gu/*nrɛ.mu.gu	‘yellow’
	lit. nɛrɛ + powder			

- c. [sú.ya#mò.kə] [sú.yá.móó] *sya.məə ‘superstitious’
lit. witchcraft + person
- d. [kú.ma#sò.kə] [kú.má.sóó] *kma.so.ko/*kum.so.ko ‘verb’
lit. speech + meat
- e. [ɲó.gɔ̃#sə̀.rə] [ɲóó.só.ró] *ɲo.gɔ̃.srə/*ɲo.gɔ̃.sər ‘to find one another’
lit. together + to find
- f. [mò.kə#tə̀.rə] [mòò.tóó.ró] *mɔ.kə.trə/*mɔ.kə.tər ‘domestic abuse’
lit. person + problem
- g. [sì.ki#yə̀.rə] [sìi.yó.ró] *si.ki.yər ‘sitting place’
lit. to sit + place

Each of the examples in (1) represents a compound composed of two disyllabic elements. In each instance, one of these elements contains a potential target for Vowel Syncope, while the other element contains a potential target for Velar Consonant Deletion (as well as targets for Vowel Syncope). The words in (1) illustrate that the latter of these two elements is always targeted for deletion, thereby yielding reduced compounds with a derived long vowel. (1a-d) reveal that intervocalic velar deletion can occur in the second element of the compound, while (1e-g) show that deletion is also possible in the first element of the compound. These examples also support the observation that no restrictions on vowels flanking a velar consonant are in place that inhibit Velar Consonant Deletion from applying.

4.2.1 Historical Velar Consonant Deletion

The examples above in (1) illustrated that a limitation is in place in Colloquial Bamana that prohibits the language from allowing more than a single instance of minimization by

the action of these processes. The strength of this imposition becomes strikingly clear in certain morphologically complex words in which one would predict that minimization could and would be achieved via Vowel Syncope owing to the apparent lack of an available deletion target for Velar Consonant Deletion, such as those in (2). It was discussed in Chapter 3, however, that Velar Consonant Deletion is a process active even in more phonologically conservative varieties of Bamana, such as Standard Bamana. Because this process is common in Standard Bamana, it has resulted in the phonologization of derived long vowels in certain words that are then available as inputs to the phonology of Colloquial Bamana. One finds in such words, however, that further minimization is blocked in Colloquial Bamana, given that reduction is restricted to a single instance in a word, as mentioned above. This failure to minimize provides insight into the nature of the underlying representation of these words in the grammar of Colloquial Bamana speakers. It appears that the non-reduced forms of these words are still present in the input or underlying representation, and thus when subjected to the phonology of Colloquial Bamana, a single reduction via Velar Consonant Deletion is the expected and attested outcome in the language, just as it was in the words in (1). Consider the illustrative examples in (2).

(2)

<u>Standard</u>	<u>Colloquial</u>	<u>Gloss</u>
a. [màa#kòrɔ]	[màà.kó.ró] *maa.krɔ	‘elder’
	/mɔkɔ+kɔ.rɔ/ → [mɔɔ.kɔ.rɔ] ² , lit. person + old	

² The Bamana word *màakɔrɔ* results from the compounding of *mɔgɔ+kɔrɔ*, lit. person + old, and is an instance in which vowels have historically undergone a shift from [ɔ] → [a] in the resultant long vowel of the first element of the compound.

- b. [táa#bó.lo] [táa.bó.ló] *taa.blo/*taa.bol ‘strategy’
 /taka+bolo/ → [taa.bo.lo], lit. to go + way

The examples in (2) illustrate that the attested pronunciation of these words in both the Standard and Colloquial varieties of Bamana are segmentally identical. Without considering the historical forms of these words, one would expect, based upon the discussion in Chapter 3, that reduction via Vowel Syncope would be permitted in these words. It is the case, however, that the underlying representations of these words each contain a segment that historically has been a target of reduction via Velar Consonant Deletion. The application of this process in the Standard form of the language and the failure of further reduction in Colloquial Bamana effectively explain the construction of these words and their place within the overall reduction schema in Bamana.

4.2.2 Reduction in words with multiple velar deletion targets

Thus far, data presented for longer words have illustrated the preferential application of Velar Consonant Deletion in words where the process does not compete with Vowel Syncope within a single domain of application, as well as instances where the historical application of Velar Consonant Deletion prohibits additional reduction via Vowel Syncope. The data presented in this section showcase words in which multiple elements of a compound contain potential targets for Velar Consonant Deletion. In isolation, both constituents of these compounds are realized with a deleted intervocalic velar. However, the data in (3) illustrate that, when the constituents are compounded, and therefore multiple targets for reduction via this process are available, once again, only a single instance of reduction is permitted.

(3)

<u>Standard</u>	<u>Colloquial</u>		<u>Gloss</u>
a. [sì.ki#nó.kǔ]	[sì.nó.kǔ]	*si.ki.nǔǔ/*sii.nǔǔ	‘neighbor’
		/siki+nókǔ/ → [sìinókǔ], lit. to sit + together	
b. [sà.ga#sò.go]	[sàà.só.gó]	*sa.ga.soo/*saa.soo	‘sheep meat’
		/saga+sogo/ → [sààsógó], lit. sheep + meat	
c. [npò.go#tí.ki]	[npòò.tí.kí]	*npo.go.tii/*npoo.tii	‘maiden’
		/npogo+tiki/ → [npòòtikí], lit. girl’s loincloth + owner	

The compounds in (3) illustrate an important aspect of Colloquial Bamana reduction, namely the preference that the language has for generating complexity, when possible, at the left edge of the word. Given what has been presented for words of other shapes and deletion targets in the language, it is clear that derived complexities are permitted in other word positions, however this is the first instance in which we have had the opportunity to witness a true preference for the position of derived complexity, all other things being equal. This is clearly a phonological trait of Colloquial Bamana, as there is no other way to predict why the language so systematically chooses to act upon the deletion target of the first element of a compound, rather than the second element.

The choice that the language makes in generating complexity at the left edge of the word might be expected in some sense given arguments offered often citing the perceptual salience of such strong word-initial, stem-initial, or utterance-initial positions. Works drawing from a number of typologically diverse languages have demonstrated that contrasts are often retained and/or enhanced, and complexities are often generated in these positions (e.g. Alber 2001; Frigeni 2009; Hyman 2008; Traill 1985; Zoll 1997,

1998). Colloquial Bamana appears to follow this cross-linguistic tendency in its preference to have syllabic complexity at the left edge when it is presented with a choice between generating complexity at either the left or right edge of the word.

4.3 [+hi] vowel deletion

It was illustrated in Chapter 3 that minimization is often achieved in Colloquial Bamana via [+hi] vowel deletion through the application of Vowel Syncope. This preference was illustrated in short words containing vowels of multiple heights. Furthermore, it was shown that Vowel Syncope has the ability to interact with and to produce variable outputs when in competition with Velar Consonant Deletion. This scenario occurs when potential deletion targets for both of these processes are found within the same domain in words containing all [+hi] vowels. This section begins to explore the application of Vowel Syncope in longer words by first witnessing the preference that the language has to delete a [+hi] vowel, if one is available and eligible for deletion, in order to achieve minimization. This preference is secondary to the removal of an intervocalic velar consonant, as was illustrated in §4.2. If a target for Velar Consonant Deletion is available, the target velar is deleted, and Vowel Syncope fails to apply. Consider the data illustrating [+hi] vowel deletion in (4).

(4)

	<u>Standard</u>	<u>Colloquial</u>		<u>Gloss</u>
a.	[kì.ba.ru#ya]	[kì.bàr.yá]	*kba.ru.ya/*ki.bru.ya	‘information’
	/kibaruru+ya/ → [kìbàr.yá], lit. news + abstract			
b.	[kò.rò#mù.so]	[kò.ròm.só]	*kròm.so/*kòr.mu.so	‘older woman’
	/kòrò+muso/ → [kòròm.só], lit. old + woman			

- c. [sù.rũ.ya#ra] [sùr.pà.rá]³ *sru.pa.ra/*su.rũ.yar ‘to have made short’
 /surũya+ra/ → [sùr.pà.rá], lit. to make short + past
- d. [sí.ni#ké.nɛ] [sín.kénɛ́] *sni.kɛ.nɛ/*sini.knɛ ‘day after tomorrow’
 /sini+kɛnɛ/ → [sín.kénɛ́], lit. tomorrow + light
- e. [sé.li#yò.rɔ] [sél.yó.ró] *sli.yɔ.rɔ ‘worship place’
 /seli+yɔrɔ/ → [sélyóró], lit. prayer + place
- f. [bè.nɛ#tù.lu] [bèn.nè.tlú] *bnɛ.tu.lu/*bnɛ.tlu ‘sesame oil’
 /bnɛ+tulu/ → [bènètú], lit. sesame + oil

The data in (4) offer unique insight into the overall process of reduction in Colloquial Bamana, and taken together, they provide the first pieces of information necessary to determine how Vowel Syncope functions in more morphologically complex words in the language. Starting first with (4a), one observes that the Standard Bamana word *kibaruya* contains two [+hi] vowel deletion targets. We know immediately from the constraints in place disallowing M₁/obstruent-M₂/obstruent complex onsets that a form like **kbaruya* is impossible in the language. The second deletion target permits a feasible outcome. While it has not been discussed in detail, the inventory of possible C_y (i.e. consonant + palatal glide) onsets is limited in Colloquial Bamana, and indeed, *_σ[ry is not permitted in the language.⁴ In order that [+hi] vowel deletion can occur in this word, and to avoid the impermissible *ry onset, the [r] is syllabified in the coda of the resultant second syllable.

³ This outcome is a clear illustration of the autosegmental nature of nasality in Bamana. The [nasal] feature is brought into the compound by the nasality of the phonemic nasal vowel in *sùrũ*. However, upon the deletion of this vowel via Vowel Syncope, its [nasal] feature is retained and reassociates to the following palatal glide, thereby yielding a palatal nasal [ɲ] in the adjacent onset.

⁴ See footnote 6 in §3.3.1 for more on this matter.

Example (4b) is similar in its construction and is included to demonstrate that the morphology of the language, at least in these instances, is not active in restricting the application of Vowel Syncope. In such an example, only a single [+hi] vowel deletion target is available. In these instances, syncope of this vowel occurs in such a way that an acceptable sonorant coda is generated in Colloquial Bamana. Importantly, in these words, potential [-hi] vowel deletion targets in the first element of the compound are passed by in favor of deleting an available [+hi] vowel.

Examples (4c-d) are similar in having two [+hi] vowel deletion targets in the first element of the compound. In both instances, the chosen deletion target is the second of the two [+hi] vowels, thereby yielding Colloquial Bamana forms of the shape CVC.CV.CV, rather than the CCV.CV.CV alternative or variant. This second CCV alternative is generally unacceptable to speakers of the language. These and other similar words lead one to the observation that Colloquial Bamana has a tendency to avoid [+hi] vowels in open complex syllables (i.e. CCV_[+hi]) when the situation can be accommodated by an equal but alternative reduction. The counterpoints to this observation presented in §3.2.2, §3.2.3, and §3.5.1 show that words in which a CCV_[+hi] is acceptable have a CV_[+hi]C or CVV_[+hi] alternative variant as well. This is the case in 3 syllable → 2 syllable words (e.g. b̀̀luku → b̀̀l.kú/bl̀̀.̀̀kú), as well as in 2 syllable → 1 syllable words (kili → kíl/klí). This may very well be a result of the observation broached in Chapter 3 that words emerging with the CVC syncope variant violate only one of the two conjoined margin constraints (i.e. the conjoined constraint with a local domain of the word), while the CCV syncope variants violate both conjoined margin constraints with the word and the syllable as their respective local domains (cf. Davis 2010). While the two variants

may be grammatical (i.e. they are variants acceptable to and used by speakers), the more harmonic CVC alternative (phonologically-speaking) emerges in instances of reduction in compounding, such as those described above. [+hi] vowels in short open syllables and CVV syllables are otherwise common in the language.

(4e) is similar to (4b) in containing only a single [+hi] vowel deletion target. This example illustrates an expected outcome of [+hi] vowel deletion and indeed an outcome still yielding a closed CVC complex syllable. Finally, (4f) illustrates a compound in which the second element contains multiple [+hi] vowel deletion targets. One finds in this instance that the chosen vowel for deletion is the first of the two targets, thereby yielding a CCV_[+hi] syllable. The CV_[+hi]C alternative is not preferred in these instances where an otherwise acceptable deletion is possible.

4.4 [-hi] vowel deletion

Having established the vowel syncope patterns in compounds containing [+hi] vowels, we now turn our attention in this section to words that contain no eligible [+hi] vowel deletion targets. The patterns of deletion via the action of Vowel Syncope are similar but not identical to those observed above in §4.3. The data in (5) showcase Colloquial Bamana compounds formed upon the deletion of a [-hi] vowel.

(5)

	<u>Standard</u>	<u>Colloquial</u>	<u>Gloss</u>
a.	[kà.la.bã.ci]	[kàl.bã.ci]/[klà.bã.ci]	‘hypocrite’
		/kalabã + nci/ → [kàlbã.ci]/[klàbã.ci], lit. mindless + instigator	

- b. [jò.rɔ#lã#ko] [jòr.nã.kò]⁵ *jrɔ.nã.ko ‘thing worried about’
 /jɔrɔlã+ko/ → jɔrlãko → [jòrnãkó], lit. worried + thing
- c. [yè.lɛ.ma#li] [yèl.mà.lí] *ylɛ.ma.li/*yel.mal ‘transformation’
 /yelɛma+li/ → [yèlmàlí], lit. to change + prog.
- d. [dà.ma#tè.mɛ][dà.mà.tmé] *dam.tɛmɛ/*dam.tmɛ ‘to exaggerate’
 /dama+tɛmɛ/ → [dàmàtmé], lit. quantity + to pass
- e. [sã#kɔ.rɔ.ta] [sã.kró.tá] *sã.kɔr.ta ‘to win’
 /sã+kɔrɔta/ → [sãkrótá], lit. sky + to raise up
- f. [nè.rɛ#kó.lo] [nèr.kó.ló] *nɛr.klo/*nrɛ.ko.lo ‘type of seed’
 /nɛrɛ+kolo/ → [nèrkóló], lit. nɛrɛ plant + seed

Beginning with (5a), although the word contains a [+hi] vowel, the position of the vowel word-finally makes it ineligible for deletion, given that its deletion would generate an impermissible obstruent coda. Deletion of either of the [-hi] vowels in the first element of the compound, however, yield acceptable syllable margins and therefore grammatical forms in Colloquial Bamana. In such [-hi] vowel words, we do not encounter a strong avoidance of CCV variants that was observed in [+hi] vowel words in §4.3. Examples (5b-c) do, however, showcase that CVC syllables resulting from the syncopation of a [-hi] vowel deletion target are the only possible outcome in instances where the phonotactics of the language do not permit a CCV variant.

The compound in (5d) offers a new glimpse into the finer intricacies of Vowel Syncope deletion preferences. While it was observed in §4.3 that Colloquial Bamana prefers to reduce words to yield complexity at the left edge of the word, we find in (5d)

⁵ Like other liquid-initial affixes, the initial [l] of the past participle *-lan* is subject to nasal harmony triggered by the [nasal] feature of the adjacent nasal vowel.

that a seemingly acceptable [-hi] deletion output, i.e. *dàmtémé*, is avoided. The language prefers, instead, to delete a mid vowel, i.e. *dàmàtmé*, in favor of retaining the low vowel [a]. This outcome points to the possibility that the dichotomy of [±hi] used to evaluate the vowel syncope patterns in the language may necessarily need to be further fleshed out to [hi], [mid], and [lo], or alternatively some combination of [±hi] and [±lo], in order to capture the deletion patterns and tendencies in more subtle instances like (5d). In the case of (5d), the language chooses to delete the less sonorous of the two available deletion targets in favor of retaining the higher sonority low vowel. Reductions in other words, for example *sámatolo* → *sámátló* ‘grandchild’ and *bálafɔla* → *báláflá* ‘xylophone player’ support this observation.

Finally, in words such as (5e-f), one witnesses the expected generation of left edge complexity upon the application of Vowel Syncope. A comparison of (5e) and (5f) illustrates, once again, that no morphological restrictions come into play blocking certain vowels from being eligible targets for Vowel Syncope. (5e) is interesting in that the CCV output *sákrótá* is attested, but that a CVC alternative, **sākɔrta*, is ungrammatical. This choice, however, should not be attributed to the avoidance of any particular type of syllable shape in these words. As we will see in Chapter 6 (specifically §6.4.2), a proposal for metrical structure is presented in which the outcome of reduction in such words is attributed to the preferential generation of complexity not only at the left-edge of the word, but specifically within a disyllabic metrical foot constructed at the left-edge of the word. The outcome of reduction for *sákrɔta* nicely illustrates the preferential generation of complexity within this domain. If one proposes that *sákrɔta* is divided into two disyllabic units, i.e. (sākɔ)(rɔta), one finds that the grammatical Colloquial Bamana

output is one in which Vowel Syncope has acted upon the first, or leftmost unit, to yield *sákrótá*. Had Vowel Syncope acted first upon the second unit, the alternative output **sākorta* would have emerged. Taken together with what has been presented in §4.2 concerning the preferential generation of left-edge complexity as an outcome of Velar Consonant Deletion, the outcome and analogous preference resulting from Vowel Syncope presented here mutually support one another.

Further support for this observation is found in the outcome in (5f) where, in a compound containing two seemingly identical mid vowel deletion targets for Vowel Syncope, the target for deletion chosen is the one found in the left-edge disyllabic domain. Notably here, for mid vowels (as with high vowel words, but not low vowel words), a CVC outcome is preferred over a CCV alternative.

4.5 Reduction in words with ineligible [+hi] vowel deletion targets

In a comparison of Vowel Syncope outcomes in shorter words alongside those resulting from this process in longer and more morphologically complex words, one observes that the key difference between these instances of reduction is in the outcome of words containing [+hi] vowels that are ineligible deletion targets. It was noted in §3.4.2 that short words containing certain [+hi] vowels that are eligible for deletion do not permit deletion via an alternative (i.e. [-hi] vowel) reduction and instead emerge in Colloquial Bamana identical to their Standard Bamana input. Recall, for example, the case of the Standard Bamana word *dúkenε* that emerges faithfully in Colloquial Bamana. Given that the [+hi] vowel was not eligible for deletion (because it would generate an impermissible complex onset), one might expect that the strong drive towards minimization in the language would force the choice of an alternative [-hi] vowel deletion target to yield

**dukne*. This form, however, is an ungrammatical outcome in Colloquial Bamana. The observation made was that, in these shorter words, if a [+hi] vowel is present in a word but is not eligible for deletion, no alternative means of reduction can be accommodated.

The outcome in longer words is somewhat different, as data collected illustrate that although a [+hi] vowel is a preferred target for deletion, when an eligible [+hi] vowel deletion target is not available, the language permits an alternative [-hi] vowel reduction, although importantly one located within a different domain than the ineligible [+hi] vowel (see 6e). Consider the following examples in (6) illustrating these points.

(6)

<u>Standard</u>	<u>Colloquial</u>		<u>Gloss</u>
a. [mé.le.ku#ya]	[mél.kú.yá]/[mlé.kú.yá]	*me.le.kya	‘literature’
	/meleku+ya/ → [mélkúyá]/[mlékúyá], lit. to master + abstract		
b. [kú.na#sí.ni]	[kú.nà.sní]	*kna.si.ni	‘day before yesterday’
	/kuna+sini/ → [kúnàsní], lit. yesterday + tomorrow		
c. [mù.so#kòrɔ#ba]	[mù.sò.krò.bá]/[mù.sò.kòr.bá]	*mso.kɔ.rɔ.ba	‘wise woman’
	/muso+kɔrɔ+ba/ → [mù.sò.krò.bá]/[mù.sò.kòr.bá], lit. woman + old + aug ⁶		
d. [sù#tá#mòbili]	[sù.tà.mó.blí]	*sta.mo.bi.li	‘hearse’
	/su+ta+mobili/ → [sùtà móblí], lit. dead + to take + car		
e. [kú.ma#gà.la.ma]	[kú.má.gál.má]/[kú.má.glá.má]		‘microphone’
		*kma.ga.la.ma/*kum.ga.la.ma	
	/kuma+galama/ → [kú.má.gál.má]/[kú.má.glá.má], lit. speech + gourd		

⁶ One speaker produced [m̀.̀sò.kò.rò.bá] consistently, instead of the alternative provided in (6c). Important to note is that this speaker chose to remove the preferred [+hi] vowel but did not remove any other vowel. Thus, the generalization that a single vowel is removed in this process is maintained, however with a slightly different outcome. This alternative was apparently not available to the other speakers.

Beginning with (6a), we note that, while the word contains a [+hi] vowel deletion target, this vowel is ineligible for deletion. Deletion of the [+hi] would either generate an impermissible obstruent coda, e.g. **me.lek.ya*, or alternatively a σ [ky sequence that is impermissible for other reasons in this language. With these prohibitions in place, the language seeks the next best option, i.e. minimization via the deletion of a [-hi] vowel. Given the resultant syllable margins of this word, either of the [-hi] vowels of the first element of the word are acceptable for deletion.

The choice of a deletion target in (6b) is somewhat different in that, rather than being compelled to delete a [-hi] vowel upon the failure to delete the first available [+hi] deletion target, the language chooses to delete an eligible [+hi] vowel in a second domain. We find here that, due to the impermissibility of a word-initial w_d [kn (a point discussed in Chapter 3), the eligible [+hi] vowel is deleted from the second element of the compound. Note that the [-hi] vowel of the first compound element was not chosen, e.g. **kun.si.ni*, thereby supporting the observation that the deletion of a [+hi] vowel is still preferred to a [-hi] vowel deletion alternative. The situation in (6d) is quite similar.

The outcome in (6c) is similar but not identical to that in (6b,d) given that the [+hi] vowel in the first element of the compound is ineligible for deletion. What is unique about (6c), however, is that although the language once again looks to a second domain for an eligible deletion target, it chooses to delete a [-hi] vowel. Because the margin phonotactics permit it, either one of the two [-hi] targets produce grammatical outcomes of minimization.

Finally in (6e), we see that the [+hi] vowel of the first syllable is ineligible for deletion due to the impermissibility of a word-initial w_d [km. With no other [+hi] vowel

available in this word as a preferential deletion target, the language seeks to reduce the word via [-hi] vowel deletion instead. Although an outcome removing the [-hi] vowel from the first element of the compound, e.g. **kum.ga.la.ma*, would appear otherwise permitted concerning margin phonotactics, this option is not chosen. The language chooses instead to delete one or the other eligible [-hi] vowel from the second element of the compound. This follows from and supports the previous observation that a [-hi] vowel will not be selected for deletion when it shares a domain with a [+hi] vowel that is ineligible for deletion, even when the phonotactics would permit such a deletion. For more on this particular topic, see Chapter 5.

These outcomes permit a parallel to be drawn between reduction in shorter versus longer words concerning ineligible [+hi] vowel deletion targets. We have seen in longer words that when the preferred domain for deletion lacks an eligible [+hi] deletion target, a word can still be reduced if it has an eligible deletion target in another domain. In shorter words, however, deletion is blocked because there is only one target domain for deletion. If deletion cannot occur within this domain, it does not have an alternative domain for deletion, and thus deletion fails to occur entirely.

4.6 Levels of morphophonological structure

The compounds and derivatives presented thus far in this chapter have been relatively uncomplicated in their construction, and most have contained no more than two elements. It has been noted in these words that only a single instance of reduction, whether via Vowel Syncope or Velar Consonant Deletion, is permitted to occur. This is precisely what has been demonstrated for smaller words, most of them monomorphs, presented in Chapter 3.

The restrictions that have been presented on reduction are complicated somewhat when considering words that have been formed by multiple rounds of compounding and/or derivation. Data collected reveal that words of a certain number and type of morphological components permit additional instances of minimization, although within the defined bounds of the language's phonology and phonotactics described thus far in this chapter, as well as in Chapter 3. Consider a typical example of nominal compounding and reduction in (7).

(7)

<u>Standard</u>	<u>Colloquial</u>		<u>Gloss</u>
a. [séli]	[sél]	*sli	'prayer'
b. [sàka]	[sàá]	*ska	'sheep'
c. [sélí#ságá]	[sélí.sáá]	*sel.saa	'sacrificial sheep'

One can observe in a comparison of (7a) and (7b) that the component nouns of the compound are free to undergo minimization, in isolation, via their respective processes of Vowel Syncope and Velar Consonant Deletion, to yield grammatical minimized Colloquial Bamana words. Upon their compounding in (7c), however, only the preferred process of Velar Consonant Deletion is permitted to apply. An alternative output in which both elements are reduced, e.g. **sel.saa*, is ungrammatical. Consider next a more complex noun in (8) generated by the compounding of a noun + postposition + verb.

(8)

<u>Standard</u>	<u>Colloquial</u>		<u>Gloss</u>
a. [fúru]	[fúru]	*fur/*fru	'marriage'
b. [nɛ]	[nɛ]		'in front of'

postposing rather than a preposing language, thus providing support for the first compounding alternative. It is unlikely that a postposition (in the wrong position) + verb would be compounded first, rather than a noun and its modifier. Importantly, the phonological restrictions concerning syllable margin phonotactics and preferential deletion targets are all still at play in determining the outcome of both instances of reduction. This illustration supports what has been observed previously for compounds containing fewer elements, such as that presented in (7), which contain only enough elements to participate in a single instance of compounding. These elements therefore permit only a single instance of deletion, i.e. {seli#saga}¹ → [sélísáá].

One can apply these principles to compounds of varying lengths. Consider, for example, {furu#nafolo}¹ → [fúrnáfóló] ‘dowry’, lit. marriage + wealth. In this instance, the deletion of a [+hi] vowel proceeds as expected to produce a resultant CVC syllable in the leftmost domain. In the second instance of {nafolo#tiki}¹ → [náflótíkí] ‘rich man’, lit. wealth + owner, Velar Consonant Deletion cannot apply for reasons related to metrical structure (see Chapter 6), and thus an alternative deletion (i.e. via Vowel Syncope) applies in the first element of the compound. Still, only a single instance of reduction is permitted. Additional examples of the unique role that the language’s morphology has to play in minimizing Colloquial Bamana compounds follow in (10).

(10)

<u>Standard</u>	<u>Colloquial</u>	<u>Gloss</u>
a. [tókɔ]	[tók]	‘name’
b. [nòna]	[nóná]	‘in place of’
c. [bilá]	[blă]	‘to put’

- d. $\{təkə\{nəna\#bila\}^1\}^2 \rightarrow \{təkə\#nənabla\}^2 \rightarrow [t́́́.nó.ná.blá]$, ‘pronoun’
- e. $[k̀̀l̀̀sɪ]$ $[k̀̀l̀̀sɪ]/[k̀̀l̀̀sɪ]$ ‘to guard’
- f. $[-li]$ $[-li]$ *progressive aspect*
- g. $[-kɛ]$ $[-kɛ]$ *masculine*
- h. $\{\{k̀̀l̀̀sɪ\#li\}^1kɛ\}^2 \rightarrow \{k̀̀l̀̀sɪli\#kɛ\}^2 \rightarrow [k̀̀l̀̀.sil.ké]^9$, ‘lookout’

The words in (10a-d) illustrate that the verbal and adverbial elements (i.e. *bila* ‘to put’ and *nəna* ‘in place of’) are compounded in the first level and a reduced via [+hi] deletion to yield *nənabla*. This output of the first level of compounding is then compounded to the noun (i.e. *təkə* ‘name’) at the second level. Upon this second instance of compounding, an additional reduction is possible, this time via Velar Consonant Deletion, yielding the doubly reduced Colloquial Bamana output *t́́́nónáblá*. For (10e-h), the verb (i.e. *k̀̀l̀̀sɪ*) and aspectual marker (i.e. *-li*) are compounded at the first level with a single deletion yielding *k̀̀l̀̀sɪli*. The adjectival suffix, *-kɛ*, is then compounded to the output of the first level, and upon this compounding a second reduction occurs yielding *k̀̀l̀̀sɪlké*. The result in (10h) is particularly striking in that it illustrates that after the level one compound has been subjected to the phonological rules of the language, the entire compound is again subjected to the same phonological rules at the next level. This is noticeable where, at the second level of compounding, the vowel selected for deletion is found in what was the output of the first level of compounding.

There remain many words containing more than one level of compounding in which a second instance of reduction is not observed due to phonotactic (or metrical) restrictions barring against it at one or the other level of compounding. Consider the case

⁹ The expected variant, *kl̀̀sɪlké*, is only marginally accepted by speakers and may stem from the general CVC preference as a result of Vowel Syncope discussed in §3.4.3 and §3.5.1.

of the Standard Bamana word *sùtà mòbìlì* ‘hearse’, containing the elements *sù* ‘corpse’ + *tá* ‘to take’ + *mòbìlì* ‘car’. This word emerges in Colloquial Bamana as *sùtà mòblí*. The word is constructed as follows: $\{\{su\#ta\}^1 mobili\}^2 \rightarrow \{suta\#mobili\} \rightarrow [sùtà mòblí]$. The phonotactics of the language do not permit minimization at the first level of compounding, given that it would generate an impermissible σ [st complex onset. Therefore, a non-reduced compound (i.e. the output of level one compounding) enters the second level of compounding. At this level, a single reduction is permitted as expected, and thus the trimorphemic word surfaces with only a single instance of reduction.

It is also possible that morphologically complex words can surface in Colloquial Bamana with no instances of reduction at all owing to impermissible phonotactics or metrical restrictions at one or more levels of compounding. Consider, for example, the Standard Bamana word *kálálíyóró* ‘tailor’s shop’, containing the elements *kála* ‘to sew’ + *li* ‘progressive aspect’ + *yóró* ‘place’. This word emerges in Colloquial Bamana faithfully as *kálálíyóró*. The word is constructed as follows: $\{\{kala\#li\}^1 yóró\}^2 \rightarrow \{kalali\#yóró\} \rightarrow [kálálíyóró]$. Once again, for semantic reasons, *kála* is not permitted to reduce. Additional restrictions on word-final codas disallow an output like **kalal*. The output of level one compounding is therefore not reduced. At the second level of compounding, neither a syllable-initial σ [ly sequence nor an *l.y* syllable contact sequence with rising sonority are permitted, and thus minimization does not occur at this level.

One can compare this to a similar Standard Bamana word *kálilísó* that emerges in Colloquial Bamana as *kálálsó*. In this instance, the word is constructed $\{\{kala\#li\}^1 so\}^2 \rightarrow \{kalali\#so\} \rightarrow [kálál.só]$. Although level one compounding proceeds in the same manner (i.e. it emerges non-reduced), the restrictions on syllable contact found in the

previous example are not present here at the second level of compounding. Thus, [+hi] vowel deletion is permitted to apply, thereby yielding a singly reduced output in Colloquial Bamana.

4.7 Residual issues

It can be expected in any language that certain residual issues and/or inconsistencies may be found in reference to a particular process or phenomenon that do not follow precisely with the predictions and analysis of the vast majority of other words in the language. The outcomes of vowel and consonant reduction in Colloquial Bamana are no different in this regard. The sub-sections below offer brief comment on several issues that arise, including the inability to reduce certain words for reasons of semantic avoidance and homophony, restrictions on reduction in compounds due to word minimality conditions, non-recursive application of phonological processes within a single domain, and a limited number of unpredicted instances of multiple deletions within a single domain.

4.7.1 Homophony and semantic avoidance

It was illustrated above that some Standard Bamana words do not permit deletion as expected in Colloquial Bamana owing to a combination of homophony and semantic avoidance. This was demonstrated in (8) for the Bamana word *fúru* ‘marriage’, where speakers prefer to avoid reducing this word to **fru* as one might otherwise expect. **fur* is also not an acceptable outcome of reduction due to the impermissibility of [+continuant] word-final sonorant coda consonants. This avoidance of *fúru* → *frú* ‘marriage’ stems from the fact that *frú* is the outcome of reduction for the homophone *fúru* ‘to spit’. Speakers, however, permit this reduction in longer words, as in (8). Similarly, the word *bólō* ‘hand/branch’ is never reduced in Colloquial Bamana, given that its predicted

reduced form **bl̃* is the minimized outcome of the homophone *bòl̃* → *bl̃* ‘vestibule’. The inability of *ból̃* ‘hand/branch’ to reduce yields instances in which compounds which would otherwise appear to be subject to minimization are left unreduced. For example, the Standard Bamana word *bólówóló* ‘blackmail’ emerges faithfully in Colloquial Bamana. This avoidance is unpredictable as there are many instances in which homophones are both permitted to reduce, e.g. *bílá* → *blǎ* ‘to release’ and *bílá* → *blǎ* ‘to provoke’.

4.7.2 Minimality conditions

While one can view the processes affecting minimization in Colloquial Bamana compounds in terms of morphophonological levels, the language has conditions or thresholds of minimal structure in place that must be satisfied in order for one or more instances of reduction to occur. It has already been presented that monosyllabic Standard Bamana words are not subject to reduction in Colloquial Bamana. The minimality condition in place disallows words not meeting a minimal structural condition of bisyllabicity from reducing. Standard Bamana words containing two, three, and four syllables permit a single instance of reduction, and therefore emerge in Colloquial Bamana with one less syllable than their Standard input form. These reductions occur within the bounds and restrictions on phonotactics and metrical structure mentioned thus far.

A second threshold is found in complex words that are formed by more than one level of compounding. It has been shown that words satisfying this multi-level requirement typically permit additional instances of reduction, however in order for this second reduction to occur, the word must again meet a minimality condition for

reduction. The condition for allowing a second reduction in Colloquial Bamana (all else being equal) is an input form with five syllables. This condition is illustrated in a comparison of the Bamana words *tákamala* ‘traveler’ and *fúruɲebila* ‘marriage griot’. Consider their respective constructions in (11).

(11)

a. $\{\{taka\#ma\}^1la\}^2 \rightarrow \{taama\#la\} \rightarrow [táámálá]$ ‘traveler’

b. $\{\{furu\#ɲɛ\}^1bila\}^2 \rightarrow \{furuɲɛ\#bila\} \rightarrow [fúruɲéblá]$ ‘marriage griot’

The examples of compounding in (11) illustrate Standard Bamana words with four and five syllables and their outcomes in Colloquial Bamana. In (11a), the input form contains three morphemes spread across four syllables, and the output in Colloquial Bamana has three syllables. We find here that although it would appear that the output *táamala* in (11a) may be able to reduce a second time yielding **taamla*, this second reduction is ungrammatical. The input form in (11b), however, contains three morphemes spread across five syllables. In this compound, a second instance of reduction is permitted and readily occurs. These restrictions on minimization point to the intimate interplay of the morphology and phonology of the language and highlight the bearing that one has upon the other. More specifically, the morphological condition for a second reduction is that the compound must be composed of more than two morphemes, while the phonological condition for a second reduction is that the compound must contain more than four syllables in its underlying form.

4.7.3 Non-recursive application

Brief mention is warranted in reference to additional evidence for the interplay of morphology and phonology in the reduction of morphologically complex words in

Colloquial Bamana. One finds that in words meeting the syllabic requirement for a second deletion but failing to meet the morphological requirement, reduction cannot occur recursively within a single level of compound formation. Such an instance would represent an analog to a word like that presented in (11a) where the morphological requirement for a second reduction was met, but the phonological requirement for a second reduction failed to be satisfied. We have witnessed that words like (11a) that fall into the latter category fail to minimize a second time. Example (12) below, represents the former category, and once again illustrates that both conditions for a second reduction must be met in order for it to occur.

(12)

{nãfolo#tiki}¹ → [nãflótíkí], *[nãflotii], ‘rich man’

Example (12) shows that only a single instance of reduction is possible in this bimorphemic compound. While it has been otherwise shown that intervocalic velar deletion via Velar Consonant Deletion is a preferred process in Colloquial Bamana, for reasons of metrical structure, this process fails to apply in *nãfolotiki*. Instead, Vowel Syncope acts upon the first element of the compound to yield *nãflotiki* in Colloquial Bamana. Even though the result of this first round of minimization creates what would otherwise be an acceptable target for Velar Consonant Deletion, (e.g. **nãflotii*), a second round of minimization fails to occur. This failure of application, even in the presence of a preferred deletion target, reinforces the observation that only a single instance of reduction is permitted upon the compounding of only two elements.

4.7.4 Unpredicted deletions

A limited number of noted instances have been discovered in which multiple deletions are unexpectedly permitted to occur within a single morphological level. In such instances, the outcome is severely restricted in its syllabic structure and the types of reductions from which it can result. Words falling into this category are of two shapes: 1) those created by the loss of two [+hi] vowels or one [+hi] and one [-hi] vowel to create a CCV.CCV word, 2) those created by the loss of two [+hi] vowels to create a CVC.CCV word. Importantly, however, the M₂ position (i.e. the second member of the branching onset or singleton coda) in each syllable must contain a different sonorant consonant. Consider the representative examples in (13).

(13)

	<u>Standard</u>	<u>Colloquial</u>	<u>Gloss</u>
a.	[bì.lá.kò.ró]	[blà.kró]	‘uncircumcised boy’
b.	[bì.là.sí.rá]	[blà.srá]	‘paved road’
c.	[jí.rí.bú.lú]	[jír.blú]	‘leaf’

The examples in (13) illustrate that such instances of unexpected multiple reductions are possible in both compounds and monomorphs. One can judge from the tonal pattern of the words in (13) that (13a) is a monomorph and that (13b) is a nominal compound. This is apparent given that (13b) exhibits the tonal compactness pattern found in L-initial Bamana compounds. It may be the case that the limited ability of Colloquial Bamana to permit multiple instances of minimization such as these indicates that the language is at a state of flux in its development where only certain less-marked types of multiple complexity are permitted. Indeed, out of all the potential outcomes of multiple

deletion within a single level of compounding, these specific $CC_{\alpha}V.CC_{\beta}V$ and $CVC_{\alpha}.CC_{\beta}V$ words are permitted to the exclusion of all other possibilities, among them other $*CVC.CCV$ words, as well as $*CVV.CCV$, $*CVV.CVC$, $*CCV.CVV$, $*CVC.CVV$, $*CCV.CVC$, $*CVV.CVV$, $*CCVC.CV$, $*CVCC.CV$, and even $*CC_{\alpha}V.CC_{\alpha}V$. These restrictions are discussed in more detail in §5.8.

4.8 Summary - A scheme for minimization in compounds

Taken together, the phonological and morphological properties of Bamana discussed in this and the preceding chapter allow one to construct a scheme by which minimization occurs in nominal and verbal compounds, as well as in other morphologically complex words in the language. What is immediately clear is that the phonology of the language is active, first and foremost, in compelling the overall drive towards minimization in the language via the application of two analogous and at times competing processes, namely Vowel Syncope and Velar Consonant Deletion. The additional role of metrical or rhythmic structure in bounding and restricting elements of the language's phonological processes is presented in Chapter 6. Furthermore, we have seen in §4.5, that the morphology of the language is active in defining the morphophonological levels within which the discussed phonological processes in the language can act. It has been illustrated that a single instance of reduction, either via Vowel Syncope or Velar Consonant Deletion, is permitted to apply within a given morphophonological level. For words that witness multiple instances of compounding and/or derivation, and therefore contain more than one morphophonological level, additional instances of reduction are permitted, although always respecting the overall phonological characteristics and phonotactics of the language.

A typical Bamana monomorph, necessarily occupying only a single morphophonological level, generally permits only a single instance of reduction via Vowel Syncope or Velar Consonant Deletion, provided that it meets the minimal condition for reduction of bisyllabicity. Two element compounds and other bimorphemic words also occupy a single morphological level and similarly permit only a single instance of reduction. Within this level, all words are subject to the restrictions in place in the language on margin and syllable phonotactics, as well as on metrical structure. More morphologically complex words and compounds in Bamana enter into higher morphophonological levels of compounding within which the phonological processes of reduction in the language are once again permitted to apply a single time.

With this scheme of reduction in place, and the morphology and segmental phonological processes active in Colloquial Bamana analyzed, I turn next to a formalization of reduction in an optimality theoretic framework utilizing Harmonic Grammar (e.g. Albright, Magri & Michaels in press; Farris-Trimble 2008; Smolensky & Legendre 2006) in Chapter 5, followed by a proposal for prosodic structure above the level of the syllable in Bamana in Chapter 6. Data presented illustrate that restrictions bounding the application of Vowel Syncope and Velar Consonant Deletion are due to the language's construction of disyllabic prosodic feet that serve as a domain of application for these processes. It will be shown that these two processes fail to occur across a foot boundary and that the processes of reduction in the language operate in such a way that they preferentially generate syllabic complexity in the leftmost foot. Additional features and processes active in Bamana in support of prosodic footing are also discussed.

CHAPTER 5

AVOIDING MULTIPLE COMPLEXITIES

5.1 Introduction

The preceding two chapters described the emergence of syllabic complexity via the application of two phonological processes, namely Vowel Syncope and Velar Consonant Deletion, in monomorphs, nominal and verbal compounds, as well as in other morphologically complex words in Colloquial Bamana. While both chapters illustrated the strength of the overall drive towards minimization in this language resulting from these processes, Chapter 4 began to explore the intricate interplay between the morphology and phonology of the language, components of the grammar that have been shown to place mutual restrictions on the language's ability to accommodate multiple instances of segmental minimization, and thereby, to inhibit the introduction of multiple syllabic complexities into a word.

It has been shown that the avoidance of multiple instances of syllabic complexity is not an explicit property of the Colloquial Bamana word, but rather, it is a property of a given level of the language's morphology. It has been illustrated, with limited exceptions (see §4.7), that a well-formed morphophonological level in Colloquial Bamana contains a maximum of two lexical elements (or alternatively a combination of lexical and grammatical elements) within which a single instance of segmental reduction is permitted to occur. This observation was supported with evidence from Colloquial Bamana monomorphs containing just a single element, as well as nominal and verbal compounds containing two elements, where a single instance of minimization is permitted within the

bounds of the language's prosodic phonology and phonotactics. Furthermore, it was shown that some words are formed by more than a single round of compounding or derivation, and therefore these words are comprised of elements found within more than one morphophonological level. Importantly, the output of the first level of compounding serves as one of the two input elements to the second level. Upon the compounding or derivation of two elements in the second level, an additional instance of reduction is then permitted to occur if possible. Additional details concerning the minimal phonological and morphological conditions necessary for segmental reduction are described in §4.7.2.

Drawing upon what has been presented thus far concerning segmental minimization in Colloquial Bamana and its application and restrictions in compounds and morphologically complex words in the language, the current chapter proposes a formalization of the described phenomena in an optimality theoretic framework. Importantly, this chapter illustrates that the avoidance of multiple complexities in this language is due to harmonically weighted (§5.2) and superlinear (§5.9) relationships that exist between certain types of constraints in the language. In its simplest instantiation, this harmonic relationship is witnessed in the interaction between those constraints militating against marked syllable peaks (i.e. those driving minimization) and those demanding segmental faithfulness to the input.

What is key in this chapter is the observation that a *strict domination* evaluation in standard Optimality Theory has the effect of overpredicting segmental deletion and therefore the creation of syllable complexity. Because the *PEAK and *VKV constraints compelling segmental deletion are ranked higher than antagonistic faithfulness constraints (i.e. MAX) that resist minimization, a standard optimality theoretic evaluation

of potential output candidates would predict that a winner with the least syllable peaks (or a combination of fewer peaks and fewer intervocalic velar consonants) will be optimal in all instances. This can be shown clearly in (1), where the attested winner (1a) is ruled out owing to its retention of a three syllable peaks. The predicted but unattested winner (1c) containing only two syllable peaks is instead selected as the winner.

(1)

/nɛrɛkolo/	*PK[-hi]	MAX[-hi]	σ [*M ₁ &*M ₂ /L]	w_d [*M ₁ &*M ₂ /L]	*M ₂ /L
a. ✓ nɛr.ko.lo	***!	*		*	*
b. nɛ.rɛ.ko.lo	***!*				
c. ☹ nɛ.klo	**	**	**	**	**

It is clear that a framework in which candidates are evaluated via *strict domination* cannot account for Colloquial Bamana. It is shown in this chapter that the unique interplay between constraints in Colloquial Bamana is better characterized in an instantiation of Optimality Theory (Prince & Smolensky 1993/2004) known as Harmonic Grammar (e.g. Smolensky & Legendre 2006). Because Harmonic Grammar permits constraints to be assigned *weights*, rather than a hierarchical ranking that obeys the principle of *strict domination*, this framework has the ability to capture effects of cumulativeness, e.g. cumulative markedness. This is drawn from the observation in Colloquial Bamana that the violation of a high-weighted constraint on segmental markedness is harmonically favored in comparison to the accrual of multiple violations of low-weighted constraints against syllable complexity (i.e. relevant margin constraints and conjoined margin constraints). Taken another way, in this language, having a higher number of syllable peaks is a more harmonic choice than generating multiple complex

syllables. However, as we will see, this harmonicity only holds to a point, as minimization is still the overall preference in the language.

This chapter also introduces that additional types of cumulativity are at play in the avoidance of multiple instances of syllabic complexity. It was shown in Chapter 4 that two idiosyncratic properties of Colloquial Bamana are the preference to delete intervocalic velar consonants via Velar Consonant Deletion to the exclusion of other types of deletion, as well as the inability of the language to delete a [-hi] vowel via Vowel Syncope when a [+hi] vowel is present within the same domain. Taken another way, these analogous phenomena illustrate that the presence of certain structures in Colloquial Bamana, and their ability or inability to be deleted, either facilitate or preclude other processes from contributing to minimization.

5.2 Cumulativity and Harmonic Grammar

A key component of Harmonic Grammar (e.g. Smolensky & Legendre 2006), and one of its most striking attributes in comparison to standard Optimality Theory (Prince & Smolensky 1993/2004), is its ability to account for the unique effects of cumulativity found in the languages of the world. Such cumulativity effects have been attested for markedness constraints, faithfulness constraints, and combinations of markedness and faithfulness constraints. Standard optimality theoretic approaches, as we have seen in Chapter 3, employ a principle known as *strict domination* in their evaluation of constraints. In a framework utilizing strict domination, constraints on markedness and faithfulness are ranked hierarchically relative to one another according to the ways in which they interact, i.e. either critically or non-critically, to yield an optimal output candidate for the grammar. The idea of strict domination is such that a single violation of

a high-ranked constraint is more costly, phonologically speaking, than multiple violations of any single constraint ranked below it, or alternatively any combination of constraint violations assessed below it. Evaluation proceeding in this manner is unable to capture phenomena that have come to be known as *gang effects* or *cumulative constraint interactions*, i.e. instances in which the cumulative violation of lower ranking constraints has the ability to overshadow the violation of a higher ranked constraint, thereby rendering optimal an output candidate violating the higher ranked constraint.

Rather than employing a strict ranking of constraints, as in standard Optimality Theory, Harmonic Grammar proposes that constraints are weighted. Drawing from the conventions developed in more recent works employing Harmonic Grammar analyses (e.g. Albright, Magri & Michaels in press; Farris-Trimble 2008; Legendre, Sorace & Smolensky 2006; Pater 2009), constraint weights are assigned positive numbers that may be whole integers or decimals. When constraints are evaluated for a given output candidate, the candidates accumulate violations that are indicated by a whole negative number. The number of violations and the constraint weights are factored to yield a total harmony score. The candidate emerging with the lowest absolute value for its harmony score is deemed the optimal, or most harmonic, output among the potential candidates. Because constraints are evaluated in this way, potential output candidates accruing multiple violations of low-ranked constraints have the potential to ‘out score’ other candidates that might violate a higher weighted constraint, but in a less costly way. Thus, effects of cumulativity can be witnessed. Importantly, constraint weights are language specific, just as constraint rankings are in standard Optimality Theory. Furthermore, as Farris-Trimble (2008) discusses, the constraint weights themselves are arbitrary, and it is

the relationship (or ratio) between them that is crucial in predicting the most harmonic outcome for some input. Consider the comparison between methods of constraint evaluation in Standard Optimality and Harmonic Grammar illustrated in (2) and (3), respectively.

(2) CONSTRAINT 1 >> CONSTRAINT 2 >> CONSTRAINT 3

/input/	CONSTRAINT 1	CONSTRAINT 2	CONSTRAINT 3
Candidate A	*!		
✓ Candidate B		*	*

(3) $W_{\text{CONSTRAINT 2}} + W_{\text{CONSTRAINT 3}} \gg W_{\text{CONSTRAINT 1}}$

(adapted from Farris-Trimble 2008)

/input/	C ₁ w = 3	C ₂ w = 2	C ₃ w = 2	H
✓ Candidate A	-1			-3
Candidate B		-1	-1	-4

Tableau (2) illustrates a typical strict domination analysis of potential output candidates. In this standard optimality theoretic analysis, Candidate A loses to Candidate B owing to its single violation of the high-ranking CONSTRAINT 1, even though Candidate B has accrued multiple violations of other lower ranked constraints. Because CONSTRAINT 2 and CONSTRAINT 3 are lower ranked than CONSTRAINT 1, it is impossible, with the constraints ranked as they are, for Candidate A to emerge as the winner.

Tableau (3) illustrates an analogous situation that yields a far different outcome when constraints are assigned weights rather than being ranked in a strict hierarchical fashion. One finds that although CONSTRAINT 1 has a higher weight than either of the other two constraints involved, Candidate B, by its multiple violations of the two lower

weighted constraints, accrues a higher violation score than Candidate A. Candidate A emerges as the winner given its lower violation score, and thus reveals that cumulativity, rather than strict domination, is at work in selecting the most harmonic or optimal output.

These and other types of cumulativity effects in phonology have been discussed in a variety of contexts, among them developing languages (Albright, Magri & Michaels in press; Goldrick & Daland 2009; Khanjian, Sudo & Thomas 2010; Levelt, Schiller & Levelt 2000; Tessier 2009) and fully-developed languages (e.g. Coetzee & Pater 2008; Green & Farris-Trimble 2010; Kirchner 1992), loanword phonology (e.g. Kawahara 2006; Pater 2009; Pater, Bhatt & Potts 2007), and in terms of limits on complexity within a given prosodic domain (e.g. Albright 2008, 2009). Farris-Trimble (2008) utilizes Harmonic Grammar to provide a detailed typological illustration of attested and predicted cumulativity effects, specifically cumulative faithfulness, in both developing and fully-developed languages.

As this chapter demonstrates, effects of cumulativity come into play in Colloquial Bamana – particularly effects of cumulative markedness. More specifically, the markedness constraints that most obviously come into conflict with one another are the high weighted *PEAK constraints (that effectively act to drive minimization via Vowel Syncope) and the set of low weighted individual and conjoined margin constraints that, in sum, militate against marked syllable structures. The relationship between these constraints is discussed in detail in §5.4.

Another important relationship is that which exists between the markedness constraints active in the language that compel minimization (once again, the *PEAK constraints) relative to those demanding faithfulness to the Standard Bamana input (i.e.

MAX constraints). The antagonistic relationship between these constraints is crucial in Colloquial Bamana, as the ratio between these sets of constraints is key to the appropriate ratio of constraint weightings for this language. This relationship is considered in §5.3.

5.3 Antagonistic weighting

While constraints in a Harmonic Grammar analysis are weighted rather than ranked, the weights that they are assigned, in essence, reflect a hierarchy of sorts. For example, constraints that would be undominated in a Standard Optimality Theory analysis are those that carry the highest weight in a Harmonic Grammar analysis. Likewise, constraints that would be low-ranked in a standard analysis are assigned lower weight in a Harmonic Grammar analysis. Therefore, the weights assigned to constraints in Harmonic Grammar allow one to formalize the degree or ratio of preference or dispreference for a particular structure or outcome. This property of Harmonic Grammar comes to the fore in Colloquial Bamana in a comparison between the *PEAK constraints and the vocalic MAX constraints that influence the phonological processes underway in the language.

While it has been otherwise illustrated by the Colloquial Bamana data presented in Chapters 3 and 4 that minimization in the language is preferred to the maintenance of the fully faithful and non-reduced Standard Bamana form of a word, we have, thus far, been unable to formalize the *degree* of antagonism between these competing sets constraints. Furthermore, the standard optimality theoretic analysis offered in Chapter 3 was not able to capture some of the more intricate details of the choice that the language makes to delete a [+hi] versus a [-hi] peak, or alternatively, the choice to retain one or the other of these peak vowels. It may come as little surprise that the relationship between the

weightings of *PEAK and MAX is the most crucial ratio to consider in the determination of a harmonically reduced output in Colloquial Bamana. It is this weight relationship that allows the language to express its drive towards minimization via the higher weight of *PEAK, coupled with a lesser violation of relevant faithfulness constraints (i.e. MAX). The ratio between these constraints insures that a fully faithful candidate (i.e. one maintaining more peaks) is less harmonic than one in which FAITH has been violated.¹ Consider the tableau in (4) where the relevant margin constraints (i.e. both individual *M₂ constraints and conjoined *M₁&*M₂ constraints) are collapsed into one cover constraint (i.e. *MARGIN) for the sake of brevity.

(4)

/kabila/	*PK[+hi] w = 5	*PK[-hi] w = 4.25	MAX[+hi] w = 2	*MARGIN w = 1.5	H
a. ✓ ka.bla		-2	-1	-1	-12
b. ka.bi.la	-1	-2			-13.5

This Harmonic Grammar tableau illustrates that *káblá* is the winning output with a total violation score of 12, compared to the fully faithful candidate *kábilá*, with a total violation score of 13.5. This tableau allows us to observe the fact that, *ceteris paribus*, had the ratio of weights between the constraint compelling [+hi] peak deletion (i.e. *PEAK[+hi]) and the antagonistic constraint favoring its retention (i.e. MAX[+hi]) been altered more than minimally, a ungrammatical outcome would have emerged.² More specifically, if the *PEAK[+hi] constraint was weighted more closely to its [-hi]

¹ While this is the prevailing generalization for vowel minimization in Colloquial Bamana, it is illustrated below in §5.9.2 that this is not always the case. Colloquial Bamana data have shown that, in a limited set of instances, an output that is fully faithful to the Standard Bamana input is more harmonic than one that has undergone some type of reduction.

² While only the antagonism between *PEAK[+hi] and MAX[+hi] is spelled out in detail here, it should be clear that a similar antagonism exists between *PEAK[-hi] and its counterpart MAX[-hi], as well as between *VKV and its counterpart MAX-K.

counterpart (e.g. $w = 4.5$), and MAX[+hi] was weighted closer to the antagonistic *PEAK constraints (e.g. $w = 3.5$), the fully faithful candidate, with a violation score of 13, would have emerged as the winner, rather than *káblá*, with a total violation score of 13.5. This hypothetical alternative is provided for comparison in (5).

(5)

/kabila/	*PK[+hi] w = 4.5	*PK[-hi] w = 4.25	MAX[+hi] w = 3.5	*MARGIN w = 1.5	H
a. ✓ ka.bla		-2	-1	-1	-13.5
b. ⊖ ka.bi.la	-1	-2			-13

This illustration of just a single input word and its harmonic output is an obvious oversimplification of the complexities that come into play in determining the appropriate ratio between these sets of constraints given the many types of words and deletion patterns found in the language. The relevant observation, however, is that an appropriate ratio between the weights of these antagonistic markedness and faithfulness constraints must be determined in order to compel the observed phonological processes underway in the language. The finer details of a Colloquial Bamana Harmonic Grammar analysis are explicated in the sections that follow.

5.3.1 Weight assignment

Computational programs designed to assist in the proper determination of constraint rankings (*OTSoft*, Hayes, Tesar & Zuraw 2003) and more recently constraint weightings (*OT-Help*, Becker, Pater & Potts 2007) are currently available and have been used in this chapter as a supplementary means to verify the constraint weights utilized in this chapter and to strengthen motivations for the proposal of superlinear constraint conjunction, as discussed in §5.9.

Following the protocol suggested for OTSoft (Hayes, Tesar & Zuraw 2003), constraints motivated in Chapter 3 for Bamana (with the initial exception of conjoined margin constraints), along with the winning and potential output candidates for Colloquial Bamana words presented therein, were submitted to the program for computation utilizing a constraint demotion algorithm. It was necessary to utilize the *a priori ranking* function to prevent atheoretical rankings of singleton margin constraints interspersed between other constraints in the hierarchy. It was confirmed via this program that singleton margins constraints alone are not capable of producing the attested Colloquial Bamana grammar, and thus relevant conjoined margin constraints were introduced to the ranking. Upon the addition of these conjoined constraints, the program generated a constraint ranking identical to that proposed in Chapter 3. Importantly, variation between output candidates was not able to be addressed in OTSoft, as the programs algorithm necessitates the assignment of only a single winning candidate for its computations. In such instances, one of the two possible grammatical candidates was chosen and introduced to the program.

Potential candidates suspected to disobey strict domination were introduced to OTSoft, and as predicted, the constraint hierarchy was not able to predict the attested winner. Files were transferred to OT-Help (Becker, Pater & Potts 2007), a similar computational program with the capability to assess violations in a Harmonic Grammar framework. While this particular program has some limitations, specifically its inability to introduce adjustments similar to those mentioned above concerning the theoretically fixed ranking of certain margin constraints, it still has the ability to evaluate and assess the feasibility of a given grammar. The candidates predicted to behave in a harmonic

manner were submitted to OT-Help, and an appropriate weighting was computed. Importantly, when candidates predicted to require a superlinear ranking of constraints were submitted for computation, an appropriate constraint weighting was not possible. At this cue, a superlinearly conjoined constraint (§5.9) was added to the constraint inventory, after which an appropriate weighting was computed. This was repeated with identical results for the second and third proposed superlinear combination of constraints. This outcome confirms and supports the proposed addition of superlinearly conjoined constraints into the Colloquial Bamana constraint inventory in order to generate a *harmonically complete* grammar. These issues are discussed further in §5.9.

5.4 Conflicting markedness constraints – Peaks versus syllable margins

The Colloquial Bamana data presented in Chapter 4 highlight the fact that only a single instance of segmental reduction is permitted (in most instances) within a given morphophonological level, whether that level contains a single monomorph or a more morphologically complex word with two constituents, e.g. a nominal or verbal compound. This restriction is most apparent in compounds composed of constituents that are otherwise permitted to reduce when in isolation. An illustrative example is the Standard Bamana word *nèremugu* ‘yellow’, composed of the nouns *nèrɛ* ‘a type of tree’ and *múgu* ‘powder’. The component nouns, in isolation in Colloquial Bamana, are *nrɛ* and *múú*, respectively. However, upon their compounding in the colloquial variety of the language, only a single instance of reduction is permitted, and thus the compound *nèrèmúú* emerges as the grammatical output for the word ‘yellow’. Another closely related word *nèrekolo* ‘seed of the nèrɛ plant’ emerges in Colloquial Bamana, again with a single reduction, i.e. *nèrkóló*, as opposed to the doubly reduced **nerklo* or **nrɛklo*.

The observation that Colloquial Bamana avoids generating multiple reductions, and subsequently avoids generating multiple instances of syllabic complexity within a single morphophonological level, can be formalized by considering the competition between two conflicting sets of markedness constraints active in the phonological grammar of the language. On the one hand, we know that the pair of *PEAK constraints introduced in §3.4.1 are highly-weighted markedness constraints in Colloquial Bamana that militate against particular syllable peaks. Their high weight compared to that of their antagonistic faithfulness constraints compels vowel deletion. Subsequently, these constraints are active in generating the CCV and CVC complex syllables that result from Vowel Syncope.

This pair of *PEAK constraints is in direct opposition to a second set of markedness constraints, namely the individual and conjoined margin constraints introduced in §3.3. These constraints, in their various instantiations, militate against the presence of certain types of segments (e.g. obstruents, sonorants, nasals, etc.) in particular syllable margin positions (i.e. M_1 or M_2 positions), or alternatively against the co-occurrence of particular segments within a local domain (e.g. the syllable or the word). It was shown in §3.4.3 that the conjoined margin constraints, as they are defined, penalize M_1 and M_2 consonants in syllable contact sequences, as well as those in syllable onset clusters when their local domain is the word. When the local domain of the conjoined margin constraints is the syllable, only syllable onset clusters are penalized. We find, therefore, that while the *PEAK constraints are active in generating complex syllables, the M_2 and conjoined M_1 & M_2 constraints are active in preventing them.

The issue that arises in the competition between these opposing sets of constraints is the low weight of the individual and conjoined margin constraints compared to that of their *PEAK counterparts. By considering the competition between these constraints in a Harmonic Grammar framework, the limits on reduction in Colloquial Bamana become clear. Consider the result of minimization in (6). Constraints relating to [+hi] vowels do not have a role in evaluation for this input and have been removed for the sake of brevity.

(6)

/nɛɛkolo/	*PK[-hi] w = 4.25	MAX[-hi] w = 2.5	σ [*M ₁ & *M ₂ /L] w = .6	w_d [*M ₁ & *M ₂ /L] w = .6	*M ₂ /L w = .2	H
a. ✓ nɛɛ.ko.lo	-3	-1		-1	-1	-16.05
b. nɛ.ɛ.ko.lo	-4					-17
c. nɛ.klo	-2	-2	-2	-2	-2	-16.3

The Harmonic Grammar tableau in (6) illustrates that the most harmonic output of reduction for the Standard Bamana word *nèrekolo* is the candidate (6a), *nèrkóló*, with a single instance of reduction. This output candidate accumulates the lowest total violation score among those candidates considered. Furthermore, this outcome is telling on several levels in that it demonstrates both the antagonistic relationship between *PEAK and MAX and the ability of the low weight single and conjoined margin constraints to act in such a way that their cumulative violation overshadows the effects of a higher weight markedness constraint (i.e. *PEAK). The first of these points becomes clear by comparing the winning output (6a) with the fully faithful candidate (6b). Candidate (6b), with its additional violation of *PEAK[-hi] is less harmonic than the singly reduced winner with its combined violations of MAX[-hi] and other relevant margin constraints. As the Harmonic Grammar tableau reveals, the doubly reduced output candidate **nreklo*, in

(6c), also loses to the singly reduced alternative. Although the doubly reduced candidate incurs fewer violations of the high-weighted *PEAK constraint, the formation of complex syllables that the accompanying vowel deletion brings with it cause the candidate to accrue multiple violations of the lower-weighted individual and conjoined margin constraints. The cumulative effects of these low weighted markedness violations effectively outweigh the effect of the *PEAK constraint. A potential output candidate, **nerklo*, that would be reduced by the loss of two [-hi] vowels is not shown here, however it is illustrated below in §5.9 that this candidate is also a less harmonic choice than the winner (6a).

The correct outcome would not be predicted if one were to invoke a standard optimality theoretic analysis utilizing strict domination and constraint rankings, rather than constraint weighting. The Harmonic Grammar tableau in (6) is reconstructed in (7) using Standard Optimality Theory and the constraint rankings motivated in Chapter 3. The marker “⊖” indicates an unintended winner.

(7)

/nɛɾkolo/	*PK[-hi]	MAX[-hi]	σ[*M ₁ & *M ₂ /L]	w _d [*M ₁ & *M ₂ /L]	*M ₂ /L
a. ✓ nɛɾ.ko.lo	***!	*		*	*
b. nɛ.ɾɛ.ko.lo	***!*				
c. ⊖ nɾɛ.klo	**	**	**	**	**

The predicted winner in a standard optimality theoretic evaluation is the doubly reduced candidate (7c). This is an incorrect prediction, as it has already been illustrated that the attested Colloquial Bamana output is the singly reduced candidate (7a). In this strict domination style of analysis, the high ranked *PEAK constraint is fatally violated by

both (7a) and (7b) due to the fact that they have a higher number of syllable peaks than (7c). The doubly reduced candidate, by virtue of having the fewest syllable peaks, is incorrectly predicted to be the winning output candidate. It is clear that constraint weighting must be invoked to capture the observation that the violation of a higher ranked markedness constraint is tolerated in order to overcome the cumulative effect of multiple violations of the lower ranked margin constraints.

5.5 Reduction in compounds

The discussion in §5.4 highlights the fact that a standard optimality theoretic analysis utilizing strict domination of constraints cannot adequately predict all the attested optimal or most harmonic outcomes of reduction in Colloquial Bamana. It has been demonstrated that, depending upon the phonological shape of the constituents of a compound, one might predict that multiple instances of reduction, whether via Vowel Syncope or Velar Consonant Deletion, would be permitted to occur. We have seen, however, that the effects of cumulative markedness, as formalized in a Harmonic Grammar analysis, restrict multiple instances of deletion, thereby limiting minimization to a single instance in a given two constituent word.

Cumulativity effects, and the subsequent necessity for a harmonic evaluation, are not witnessed in every word. It is often the case that other high ranked (or high weighted) constraints rule out other unfavorable output candidates, effectively overshadowing any subtleties of cumulativity. Regardless of the need to illustrate cumulativity or not, a weighted constraint analysis is sufficient to evaluate these other morphologically complex words. Consider the representative illustration of a harmonic versus standard analysis in tableaux (8) and (9), respectively.

(8)

/kunasini/	* _σ [kn w = 5.5	*PK[+hi] w = 5	*PK[-hi] w = 4.25	MAX[+hi] w = 2	* _σ [*M ₁ /T& *M ₂ /N w = .6	w _d [*M ₁ /T& *M ₂ /N w = .6	*M ₂ /N w = .2	H
a. ku.na.si.ni		-3	-1					-19.25
b. kna.si.ni	-1	-2	-1	-1	-1	-1	-1	-23.45
c. kna.sni	-1	-1	-1	-2	-2	-2	-2	-22.15
d. ✓ku.na.sni		-2	-1	-1	-1	-1	-1	-17.95

(9)

/kunasini/	* _σ [kn	*PK[+hi]	*PK[-hi]	MAX[+hi]	* _σ [*M ₁ /T& *M ₂ /N	w _d [*M ₁ /T& *M ₂ /N	*M ₂ /N
a. ku.na.si.ni		***!	*				
b. kna.si.ni	*!	**	*	*	*	*	*
c. kna.sni	*!	*	*	**	**	**	**
d. ✓ku.na.sni		**	*	*	*	*	*

Comparing the predicted optimal outputs in both (8) and (9) reveals that both methods of analysis yield the same winning candidate, i.e. (8d) and (9d), respectively. It was discussed in previous chapters that Colloquial Bamana systematically excludes word-initial *_σ[kn sequences. Thus, an undominated (or high-weighted) language-specific constraint militating against such sequences is at play and active in the language. This constraint is responsible for rendering ungrammatical any possible output candidate in which the first [+hi] vowel of the word is deleted, e.g. (8b,c) or (9b,c). Evaluation of the remaining candidates is passed to the *PEAK constraint, which acts in both instances to select a winning candidate containing fewer peaks. A similar outcome emerges in the evaluation of other words in the language as well. Because a weighted Harmonic

Grammar analysis is most effective in accurately predicting the attested winner in both types of words, it is clear that it is a preferred method of evaluation for Colloquial Bamana minimization.

5.6 Reduction in monomorphs

Section 5.5 demonstrated that Harmonic Grammar is better suited than standard Optimality Theory in predicting attested Colloquial Bamana outputs for two-element compounds and other morphologically complex words comprised of a single morphophonological level. The current section showcases that this framework can also correctly predict reduced monomorphs in the language. The tableaux that follow in (10) through (12) showcase this observation in Colloquial Bamana monomorphs of several representative types.

(10)

/seli/	*PK[+hi] w = 5	*PK[-hi] w = 4.25	MAX[-hi] w = 2.5	MAX[+hi] w = 2	σ [*M ₁ /T& *M ₂ /L w = .6	w_d [*M ₁ /T& *M ₂ /L w = .6	*M ₂ /L w = .2	H
a. se.li	-1	-1						-9.25
b. sli	-1		-1		-1	-1	-1	-8.9
c. ✓ sel		-1		-1		-1	-1	-7.05

Tableau (10) illustrates that the attested output candidate *sél* (10c) is predicted by the harmonic analysis. This output, minimized via Vowel Syncope, has the lowest total violation score of the potential outputs considered. Both the fully faithful candidate **seli* (10a) and a candidate in which a [-hi] vowel has been deleted **sli* (10b) (rather than the preferred [+hi] vowel) are correctly predicted to be less harmonic options for reduction.

(11)

/faka/	*VKV w = 8	*M ₂ /T w = 5.5	*PK[-hi] w = 4.25	MAX[-hi] w = 2.5	MAX-K w = 1.5	H
a. fa.ka	-1		-2			-16.5
b. fka		-1	-1	-1		-12.25
c. ✓ faa			-1		-1	-5.75

Tableau (11) shows that the winning candidate *fàá* (11c), that has been reduced via Velar Consonant Deletion, is the correctly predicted output candidate. Once again, the fully faithful candidate **faka* (11a) fails to be the most harmonic choice for an output in Colloquial Bamana. A candidate like **fka* (11b) is an obvious losing choice given its violation of the high weighted **M₂/T* constraint.

(12)

/kabila/	*M ₂ /D w = 5.5	*PK[+hi] w = 5	*PK[-hi] w = 4.25	MAX[-hi] w = 2.5	MAX[+hi] w = 2	_σ *M ₁ & *M ₂ w = .6	_{wd} *M ₁ & *M ₂ w = .6	*M ₂ /L w = .2	H
a. ka.bi.la		-1	-2						-13.5
b. ✓ ka.bla			-2		-1	-1	-1	-1	-11.9
c. kbi.la	-1	-1	-1	-1					-17.25

One can observe that the preference for [+hi] deletion via Vowel Syncope introduced in Chapter 3 is still captured in a Harmonic Grammar analysis. The high weight of a **PEAK[+hi]* violation is responsible for ruling out the fully faithful, non-reduced output candidate, **kabila*, shown in (12a). The correctly predicted winner, *káblá* (12b) violates several lower weighted constraints, however their cumulative violation is not enough (in this instance) to make this candidate less harmonic than the other alternatives. (12c), shown for the sake of comparison, demonstrates that constraints on

permissible syllable margin constituents are still active in this framework in ruling out unacceptable consonant-consonant sequences.³

5.7 Multiple reductions

Section 4.7.4 brought to light the issue of grammatical but unpredicted deletions within a single morphophonological level. It was shown that, in a limited number of instances related to vowel deletion targets, multiple deletions are permitted to occur within a single level as long as both deletions can create acceptable syllable types with non-identical M₂ consonants. This is an apparent reflex of M₂ dissimilation wherein identical M₂ consonants are not permitted adjacent to one another in a word. A representative example of such an instance of double reduction is the incorporation of the Standard Bamana word *bilakoro* ‘young boy’ into Colloquial Bamana as *blàkró*. One can see that in this word, both σ [bl and σ [kr complex onsets are permitted upon vowel deletion, and that the M₂ consonants in the resultant clusters are non-identical. While this may appear to be an unexpected wrinkle in the emergent phonology of Colloquial Bamana, it is demonstrated below that the double reduction witnessed in this limited set of words is a predicted outcome in an analysis of Colloquial Bamana minimization that utilizes weighted constraints. Consider the harmonic analysis of *bilakoro* → *blàkró* in (13).

³ For the sake of completeness, one can entertain a potential output candidate, e.g. *kabil*, which we will see in Chapter 6 is not permitted for reasons of metrical structure (i.e. the avoidance of iambic structure). A high ranked or high weight constraint, *IAMB, militating against such sequences would rule out this output candidate.

(13)

/bilakoro/	*PK[+hi] w = 5	*PK[-hi] w = 4.25	MAX[-hi] w = 2.5	MAX[+hi] w = 2	σ [*M ₁ /T& *M ₂ /L w = .6	w_d [*M ₁ /T& *M ₂ /L w = .6	*M ₂ /L w = .2	H
a. bi.la.ko.ro	-1	-3						-17.75
b. bla.ko.ro		-3		-1	-1	-1	-1	-16.15
c. bi.la.kro	-1	-2	-1		-1	-1	-1	-17.4
d. ✓ bla.kro		-2	-1	-1	-2	-2	-2	-15.8

The fully faithful candidate (13a) is the least harmonic output owing to its several violations of the higher weighted *PEAK markedness constraints. A second potential output candidate (13c) that deletes a [-hi] rather than a [+hi] vowel to create a CCV complex syllable is also a non-harmonic choice for a reduced output. Among other things, this candidate's retention of its [+hi] vowel is a dispreferred and unacceptable option in the language. The remaining competition is between the two most harmonic candidates, i.e. (13b) and (13d). One might otherwise predict that the singly reduced output (13b) would be chosen as the winning output given its satisfaction of the high weighted *PEAK[+hi] constraint and its subsequent generation of permissible syllable margins. We find, however, that Harmonic Grammar correctly predicts the doubly reduced output candidate *blàkró* (13d) to be the winning candidate. Because of the unique composition of this particular word (containing a single [+hi] and a single [-hi] deletion target), it is able to satisfy the necessary higher weighted constraints while not accruing a detrimental sum of violations from the lower weighted constraints active in the phonological grammar. The grammar allows the deletion of a non-harmonic [+hi] vowel, as well as an additional instance of [-hi] vowel reduction owing to the fact that the set of margin violations incurred by the doubly minimized candidate is overshadowed, in this

instance, by the retention of an additional syllable peak in (13b). While this outcome may appear unusual in the light of other words in the language, it is nonetheless an accurate outcome predicted by the grammar.

The type of reduction illustrated in (13) showcased a word in which a [+hi] and [-hi] vowel were both permitted to be deleted owing to the language’s ability to permit deletions generating two permissible complex syllables that avoid the cumulative effects of margin constraint violations. The importance of the shape of each individual word as it is evaluated by the constraints active in the grammar becomes strikingly clear when comparing words of shapes that are minimally different from that presented in (13). Tableau (14) shows that double deletion is also permitted in words, e.g. *bilasira* ‘to travel a short distance with someone’, containing multiple [+hi] vowel deletion targets.

(14)

/bilasira/	*PK[+hi] w = 5	*PK[-hi] w = 4.25	MAX[+hi] w = 2	σ [*M ₁ /D& *M ₂ /L] w = .6	ω d[*M ₁ /D& *M ₂ /L] w = .5	*M ₂ /L w = .2	H
a. bi.la.si.ra	-2	-2					-18.5
b. bla.si.ra	-1	-2	-1	-1	-1	-1	-16.8
c. bi.la.sra	-1	-2	-1	-1	-1	-1	-16.8
d. ✓ bla.sra		-2	-2	-2	-2	-2	-15.1

It is clear that the fully faithful candidate **bilasira* (14a) is the least harmonic output candidate for this input, owing to the high violation score that it accumulates via its four syllable peaks. It is not surprising that there exists no apparent harmonic preference between candidates (14b) and (14c), as both potential candidates contain an identical syllabic repertoire. The only difference between the two candidates is the choice to delete a [+hi] vowel in a given element of the compound. The preference for syllabic

complexity to be at the left edge of the word, as discussed in Chapter 4, cannot be captured by the constraints presented thus far.

This preference could, however, be captured by referring to a particular type of alignment constraint, namely COINCIDE, that has been proposed by Alber (2001) to be active in driving the phonological preference for certain types of syllabic and prosodic complexity in the first position of a given domain (e.g. a word, stem, or morpheme). An appropriate COINCIDE constraint for Colloquial Bamana is one which penalizes elements that are not in the first syllable of the prosodic word. This COINCIDE- σ_1 constraint would, *ceteris parabis*, select a CCV.CV.CV candidate, as opposed to a CV.CV.CCV alternative, in reductions such as those presented in §4.2.2 for Velar Consonant Deletion and in §4.4 for Vowel Syncope. Importantly, this constraint would not come into play in instances of CVC versus CCV variation that have been witnessed in Colloquial Bamana words, for example those offered in §4.5.

Returning to tableau (14), one observes that a doubly reduced candidate in which both of the offending [+hi] peaks have been removed is the most harmonic output. In this instance, the ability of the language to remove an additional [+hi] peak, and therefore to satisfy the corresponding highly weighted constraint against these peaks (i.e. *PEAK[+hi]), is not overshadowed by effects of cumulative markedness violations like those introduced in §5.4. Even though the deletion of a second [+hi] peak subsequently generates another complex syllable, and along with it, causes the candidate to incur additional violations of lower weighted margin constraints, the trade off is not enough to prevent the second peak deletion.

It was illustrated in (6) that only a single reduction is possible in words containing all [-hi] vowels. (13) and (14), however, showed that a second instance of deletion is permitted in words containing permissible [-hi] and [+hi] deletion targets, as well as in those words containing two permissible [+hi] deletion targets. It is in this comparison that the effects of cumulative markedness manifested in the ratio between constraints on different types of markedness in Colloquial Bamana are revealed. These outcomes show that the potential cumulative effect of multiple [-hi] vowel deletions is enough to prevent a second deletion, while those in the latter two instances described just above are not enough to prevent it. This observed disparity is an obvious effect of the overwhelming preference to satisfy the high weighted *PEAK[+hi] constraint. Additional characteristics of Colloquial Bamana minimization introduced in §5.8-§5.10 expand upon the permissibilities and restrictions on multiple instances of reduction discussed above.

5.8 Restrictions on word shape

What is known about the constraints active in either driving or preventing minimization to occur in Colloquial Bamana, taken alongside what has been presented thus far in this chapter about the limited number of word types that permit multiple reductions within a single morphophonological level, help the noted restrictions on resultant word-level syllable structure introduced in §4.7.4 to become more clear. The Colloquial Bamana data have shown that multiple deletions within a single morphophonological level are permitted in instances where a CCV.CCV word can result from specific vocalic reductions (i.e. either two [+hi] vowels are deleted, or one [+hi] vowel and one [-hi] vowel are deleted). An additional stipulation is that the M_2 consonants of the two CCV syllables must not be identical, thereby yielding only $CC_\alpha V.CC_\beta V$ words. Similarly,

words of the shape CVC.CCV are possible but in an even more restricted distribution. These words are only found in instances where two [+hi] vowels have been lost. Furthermore, the M₂ consonants of the resultant word must not be identical, with the most widely accepted combination being CV[r].C[l]V. This restriction or requirement is likely a reflex of dissimilation.

Minimized words of the shapes *CVV.CVC and *CCV.CVC are non-harmonic choices given the presence of high-weighted constraints in the language militating against word-final closed syllables, as well as for reasons of metrical structure and contextual weight that are discussed in Chapter 6. *CCV.CVV and *CVC.CVV words are similarly deemed non-harmonic for reasons related to metrical structure, namely the avoidance of iambic feet in the language. It is posited in Chapter 6 that derived long vowels are heavy, and thus they are not permitted to surface in instances where they would generate impermissible iambs, rather than trochees. The weight of long vowels also comes into play in ruling out *CVV.CVV syllables resulting from two instances of Velar Consonant Deletion, as such instances would potentially result in a clash of prominences (nb §4.2).

Words of the shape *CVCC.CV and *CCVC.CV are not found due to the systematic avoidance of complex codas or more than one M₂ consonant within a single syllable. These restrictions appear analogous to trends noted in the acquisition of complex syllable types in certain languages (e.g. Dutch), where it has been posited that language learners follow one of two paths (e.g. Levelt et al. 2000). In both potential pathways, it has been illustrated that CCV syllables are acquired before CCVC syllables. In one pathway, CVCC syllables are acquired even later than CCVC, while in the other, CVCC emerges even before CCV. Importantly, in both pathways, CVC is predicted to

emerge before CCV. If one were to draw a parallel between the emergence of complex syllable shapes in Colloquial Bamana and these findings in language acquisition, one would posit that Colloquial Bamana is following the former trajectory of syllabic complexity development, as one finds CCV syllables widely represented in the language, while CVCC syllables are unattested. These predictions are borne out in the single reduction found in *kàrɔmuso* → *kàrɔm.só* ‘old woman’, rather than a double deletion yielding **krɔm.so* or **kɔrm.so*.

Minimized words of the shape *CVV.CVV, as well as *CVV.CCV, are also avoided for harmonic reasons. It has been discussed elsewhere in this thesis that Colloquial Bamana is unique in avoiding multiple instances of deletion when the preferable process of Velar Consonant Deletion has applied. This was illustrated in §4.2 in a number of instances. More specifically, it was shown that 1) Velar Consonant Deletion is a preferred means of minimization compared to Vowel Syncope, 2) additional instances of minimization are blocked in words that have historically undergone Velar Consonant Deletion, and 3) only one instance of Velar Consonant Deletion is permitted in words containing two potential velar consonant targets. Section 5.9 presents an argument in favor of attributing these facts and certain other idiosyncratic properties of the language’s scheme of minimization to the superlinear conjunction of certain constraints (Legendre, Sorace & Smolensky 2006).

5.9 Superlinear ordering

A methodological counterpoint to Harmonic Grammar is the mechanism utilized in one instantiation of Standard Optimality Theory known as Local Constraint Conjunction (e.g. Smolensky 1995). This mechanism, as its name implies, allows for the conjoining of two

constraints (or alternatively a single constraint with itself) within a defined domain of application such that the violation of both of the constraints within that defined domain yields a more costly violation than either of the individual constraints evaluated independent of one another. While Local Constraint Conjunction is typically employed in a standard optimality theoretic framework, its outcomes yield similar results as Harmonic Grammar in terms of assessing certain effects of cumulativity. It is the case, however, that one cannot achieve the subtle effects of cumulativity possible in a Harmonic Grammar analysis when employing typical Local Constraint Conjunction. This is due to the fact that strict domination still applies in standard evaluation. Therefore, a locally conjoined constraint is often undominated in the constraint hierarchy, and thus its effects are not easily overshadowed by any combination of effects stemming from other constraints. A number of arguments have been made both for and against Local Constraint Conjunction, with its opponents citing few rules in place limiting the types and domains in which constraints can be conjoined, and thus the mechanism's ability to generate or predict impossible or otherwise unattested grammars (e.g. McCarthy 1999, 2003; Lubowicz 2003, 2005; Pater, Bhatt & Potts 2007).

Abricht, Magri, and Michaels (in press) present a somewhat different mechanism to address effects of cumulativity in a Harmonic Grammar framework in the form of the Split-Additive Model. In essence, this particular model of evaluation splits the two major constraint categories (i.e. markedness and faithfulness) into separate categories whose violations and weights are summed separately. In abbreviated terms, upon the individual summation of violations in these categories, a candidate accruing a higher violation score for one or the other category is deemed the loser. Thus, a candidate is penalized for

accruing too many markedness violations or conversely too many faithfulness violations. The optimal or most harmonic output will be one in which markedness and faithfulness violations are distributed evenly within the candidate.

Legendre, Sorace & Smolensky (2006), on the other hand, have discussed the possibility of grammars and therefore languages, in which some instantiation of local conjunction is still necessary to arrive at an attested grammar. The authors argue that local conjunction is a mechanism that can be utilized to illustrate a *superlinear ordering* relationship between certain constraints in a phonological grammar. In other words, they describe a relationship between two constraints such that the combined violation of the two constraints is effectively greater than the sum of their individual violations. Thus, the situation that they describe is one by which neither a standard *strict domination* analysis nor a numerically *weighted* harmonic analysis can accurately predict the language's grammar. Moreover, in such a situation, both *ranking* and *summation* would arrive at the same incorrect predictions about a grammar.

While Legendre, Sorace & Smolensky (2006) discuss superlinearity in more mathematically abstract theoretical terms, the outcome that they predict is one that I will argue is supported by the phonological grammar of Colloquial Bamana. More specifically, it is illustrated below that instances exist in Colloquial Bamana wherein both a strict domination standard optimality theoretic analysis and a weighted harmonic analysis arrive at identical but incorrect predictions for certain outcomes of minimization in the language. These analyses show that both frameworks incorrectly predict that permissible instances of double deletions should occur and that the rankings and weights, as they stand, result in a static relational paradox for words of three specific types.

It is interesting to note that a similar possibility has been recently discussed by Khanjian, Suto & Thomas (2010) in which the authors (invoking a reflex of the Split-Additive Model) propose and discuss the idea of constraint weight *exacerbation*. Again, in abbreviated terms, the authors discuss that there exist instances in which certain combinations of constraints are worse than combinations of others. As a result of these more costly or problematic combinations, the violation score obtained by the combination of the constraints is multiplied by a mathematically determined percentage, thereby yielding a determined degree of exacerbation. This exacerbation score is then added to the simple sum of the combined violation score, thereby effectively rendering the combined violation of the two constraints more costly, harmonically speaking, than their simple sum. This method of evaluation is noticeably similar to the idea of constraint superlinearity discussed above.

5.9.1 Velar Consonant Deletion & Vowel Syncope

Let us first explore inputs from Standard Bamana that contain potential targets for both Velar Consonant Deletion and Vowel Syncope. We know from §4.2 that in instances of competition between these two processes, a single reduction is permitted and that that reduction is always the result of Velar Consonant Deletion. Consider the Harmonic Grammar tableau in (15) that uses the same constraint weightings presented throughout this chapter.⁴

⁴ As it was discussed in §3.5.1, it is assumed in the evaluation of candidates that have undergone Velar Consonant Deletion that a derived long vowel is a single peak and thus violates its respective *PEAK constraint only a single time. Along these same lines, it is assumed that no vowel is deleted in the generation of a derived long vowel, and thus no violation of MAX is assessed in these instances. A phonemic long vowel also contains a single peak and violates its respective *PEAK constraint only once. It will be illustrated in Chapter 6 that phonemic long vowels pattern with other light syllables (i.e. CV) and consist of a single vowel associated with two timing slots. Thus, the removal of a phonemic long vowel accrues only a single MAX violation. Further discussion on this topic is found in §6.3.3.

(15)

/mɔkɔtɔɔrɔ/	*VKV w = 8	*PK [-hi] w = 4.25	MAX [-hi] w = 2.5	MAX- K w = 1.5	σ [*M ₁ /T &*M ₂ /R w = .6	w_d [*M ₁ /T &*M ₂ /R w = .6	*M ₂ /R w = .2	H
a. ✓ mɔɔ.tɔɔ.rɔ		-3		-1				-14.25
b. mɔ.kɔ.tɔɔ.rɔ	-1	-4						-25
c. ☹ mɔɔ.trɔ		-2	-1	-1	-1	-1	-1	-13.9
d. mɔ.kɔ.trɔ	-1	-3	-1		-1	-1	-1	-24.65

Beginning with (15a), one observes that the attested Colloquial Bamana output *mɔɔtɔɔrɔ* is not predicted to be the most harmonic output candidate by this grammar. Although this candidate is one that has successfully avoided violating the highest weight constraint against intervocalic velar consonants, i.e. *VKV, it is still deemed to be a less harmonic option than the double deletion candidate **mɔɔtrɔ* (15c). Even though (15c) accumulates a number of additional violations of low weight margin constraints and MAX constraints, the cumulative violation of these constraints is not enough to overcome the additional violation of *PEAK that (15a) incurs. We find, however, that the grammar has been successful in predicting that both the fully faithful candidate (15b) and the potential output candidate undergoing Vowel Syncope instead of Velar Consonant Deletion (15d) are non-harmonic. Thus far, this is the first instance in which we have found that a harmonic analysis has been unable to predict the correct winner. This is the same outcome that emerges in a standard optimality theoretic analysis, as in (16).

(16)

/mɔkɔtɔɔrɔ/	*VKV	*PK [-hi]	MAX [-hi]	MAX-K	σ [*M ₁ /T &*M ₂ /R	wd[*M ₁ /T &*M ₂ /R	*M ₂ /R
a. ✓ mɔɔ.tɔɔ.rɔ		***!		*			
b. mɔ.kɔ.tɔɔ.rɔ	*!	****					
c. ⊕ mɔɔ.trɔ		**	*	*	*	*	*
d. mɔ.kɔ.trɔ	*!	***	*		*	*	*

Just as was observed in (15), the predicted winner in a standard optimality theoretic framework is the doubly reduced candidate (16c), rather than the attested grammatical singly reduced output (16a). Furthermore, one observes that it is the fatal violation of the *PEAK[-hi] constraint that causes the attested winner to lose to the doubly reduced candidate. Thus, we find that neither method of analysis can accurately predict the attested Colloquial Bamana output. We must ask ourselves why it is that even the harmonic analysis, which has thus far correctly predicted all other instances of single and double deletion, fails to yield the correct result for minimizations like *mɔkɔtɔɔrɔ* → *mɔɔtɔɔrɔ*. In order to address this issue, let us consider the two most harmonic output candidates from the harmonic tableaux in (14) and (15) alongside one another. This combination tableau is given in (17).

(17)

		*PK [+hi]	*PK [-hi]	MAX [-hi]	MAX [+hi]	MAX K	σ [*M ₁ /T &*M ₂ /L]	w_d [*M ₁ /T &*M ₂ /L]	*M ₂ /L	H
	/bilakoro/	5	4.25	2.5	2	1.5	.6	.6	.2	
a.	bla.ko.ro		-3		-1		-1	-1	-1	-16.15
b. ✓	bla.kro		-2	-1	-1		-2	-2	-2	-15.8
	/məkətəɾə/									
c. ✓	məɾ.təɾə		-3			-1				-14.25
d. ☹	məɾ.trə		-2	-1		-1	-1	-1	-1	-13.9

What is striking in a comparison between the most harmonic candidates in the two tableaux in (17) is the difference in their respective total violation scores. We find that for the *bilakoro* output candidates, the winner beats the second most harmonic candidate by a violation score difference of .35. Comparison to the *məkətəɾə* output candidates, however, the attested output candidate is beaten by the incorrectly predicted winner by the same violation score difference of .35. The tableaux in (18) illustrate the key comparison between these two sets of potential outputs.

(18)

		*PK [+hi]	*PK [-hi]	MAX [-hi]	MAX [+hi]	MAX K	σ [*M ₁ /T &*M ₂ /L]	w_d [*M ₁ /T &*M ₂ /L]	*M ₂ /L	H
	/bilakoro/	5	4.25	2.5	2	1.5	.6	.6	.2	
a.	bla.ko.ro		-3		-1		-1	-1	-1	-16.15
b. ✓	bla.kro		-2	-1	-1		-2	-2	-2	-15.8
	/məkətəɾə/	to win, sum must be < *PEAK[+hi]								
c. ✓	məɾ.təɾ		-3			-1				-14.25
d. ☹	məɾ.tə		-2	-1		-1	-1	-1	-1	-13.9
		to lose, sum must be > *PEAK[-hi]								

The conclusion to be drawn from the information in these tableaux is that the winning candidate in (18b) and the predicted winner in (18d) differ from their alternatives by violations of the same constraints to the same degree. However, as we have seen, in order for (18b) to remain the predicted winner, the sum of these constraint violations must sum to a total that is less than the amount accrued for a violation of *PEAK[-hi]. The situation for (18c) and (18d) is the exact opposite in that the summed violations of these same constraints would have to equal a total that is more than the amount accrued for a violation of *PEAK[-hi] in order for the attested winner to be predicted. Thus, there is no way, with the constraints considered thus far, for both attested outputs to be predicted as correct by the grammar. It is here that the proposal of superlinear ordering enters into the harmonic analysis. It is clear from tableaux (18) that a simple summation of constraints cannot capture the effects of constraint cumulativeness that have been illustrated so straightforwardly for other word types. In Legendre et al.'s

(2006) terms, neither the standard nor the harmonic system that have been considered are *harmonically complete*, and thus, in order to achieve this harmonic completeness, a superlinear constraint conjunction must be introduced into the Harmonic Grammar analysis. As discussed in §5.3.1, the necessity of introducing superlinearly combined constraints has also been supported computationally.

The combined violation of two superlinearly combined constraints yields a result that is less harmonic than the simple summation of their parts. That is, a superlinear constraint combination introduces an additional weighted violation when a candidate violates both of its constituent constraints. Therefore, such a candidate accrues violations equaling the sum of the violations of the constituent constraints plus a small additional violation due to their combination.

In the case of $m\dot{\alpha}k\alpha t\alpha r\alpha \rightarrow m\dot{\alpha}\dot{\alpha}t\acute{\alpha}r\acute{\alpha}$, $*m\alpha t r\alpha$, one observes that the impermissible doubly reduced outcome is a candidate that violates the two faithfulness constraints MAX[-hi] and MAX-K. The attested winner, $m\dot{\alpha}\dot{\alpha}t\acute{\alpha}r\acute{\alpha}$, on the other hand, avoids a violation of MAX[-hi] by violating a single faithfulness constraint (i.e. MAX-K) and a markedness constraint (i.e. *PEAK[-hi]). We find, therefore, that while a violation of MAX-K and a high weight markedness constraint is possible, the violation of this constraint with a second faithfulness violation is impermissible in Colloquial Bamana. The weight of the superlinear combined constraint need not be high (i.e. overly powerful). The weight, however, must be sufficiently high enough to overcome the predicted ungrammatical mapping. Given the .35 violation score difference between the predicted grammatical and ungrammatical mappings presented in (18), I propose that the superlinear combined constraint MAX[-hi] & MAX-K be assigned a weight of .4. Importantly, this weight could

be any value greater than .35, however .4 has been chosen for the sake of simplicity. The tableaux in (19) incorporate this new constraint.

(19)

/bilakoro/	MAX[-hi]& MAX-K .4	*PK [-hi] 4.25	MAX [-hi] 2.5	MAX [+hi] 2	MAX K 1.5	σ [*M ₁ /T &*M ₂ /L .6	ω d[*M ₁ /T &*M ₂ /L .6	*M ₂ /L .2	H
a. bla.ko.ro		-3		-1		-1	-1	-1	-16.15
b. ✓ bla.kro		-2	-1	-1		-2	-2	-2	-15.8
/mɔkɔtɔɔrɔ/									
c. ✓ mɔɔ.tɔɔ.rɔ		-3			-1				-14.25
d. mɔɔ.trɔ	-1	-2	-1		-1	-1	-1	-1	-14.3

Tableaux (19) shows that the addition of the superlinear combined constraint MAX[-hi] & MAX-K with its minimal violation score of .4 introduces an additional degree of harmonic completeness to the harmonic analysis of Colloquial Bamana minimization. This constraint is effective in causing the unattested double deletion candidate in (19d) to accumulate a higher total violation score than the attested grammatical output in (19c). Importantly, the addition of this constraint has had no effect on the ratios and relationships between the other constraints active in this language, as is clear from the outcome of (19a) and (19b).

5.9.2 Conflicts in Vowel Syncope

Another instance can be found in which one must appeal to superlinear ordering in order to capture the choice that Colloquial Bamana makes to block less harmonic instances of minimization in favor of retaining marked structures. Such a situation exists in Colloquial Bamana words where the seemingly acceptable deletion of a [-hi] vowel is blocked when

a [+hi] vowel target that, for one reason or another is ineligible for deletion, is found within the same domain as the [-hi] vowel. Such words were introduced in §3.4.2. Consider the harmonic tableau in (20) that yields a remarkably similar outcome to that discussed in §5.9.1.

(20)

/dukɛnɛ/	*M ₂ /T 5.5	*PK [+hi] 5	*PK [-hi] 4.25	MAX [-hi] 2.5	MAX [+hi] 2	_σ *M ₁ /T &*M ₂ /N .6	_{wd} *M ₁ /T &*M ₂ /N .6	*M ₂ /N .2	H
a. ⊗ du.knɛ		-1	-1	-1		-1	-1	-1	-13.15
b. dkɛ.nɛ	-1		-2		-1				-16
c. ✓ du.kɛnɛ		-1	-2						-13.5

One observes in tableau (20) that a harmonic summation of relevant constraints once again predicts an unattested winner. This unattested candidate **du.knɛ* (20a) is predicted due to its low total violation score stemming from having fewer violations of *PEAK. The attested winner is the fully faithful candidate, *dúkɛné* (20c), that has not been reduced. (20b) is a non-harmonic alternative illustrating the impossibility of deleting the preferable [+hi] vowel target in the word. Such a deletion would generate an impermissible *_σ[dk complex onset. What is striking in (20) is that the violation score difference that stands between the attested and unattested winners is once again, .35. That this same ratio emerges in this instance offers assurance that the language's phonology is behaving in a systematic way for situations in which surface violations of MAX[-hi] are avoided in favor of violating a higher-weight markedness constraint. This is precisely the situation that was observed in §5.9.1.

In the faithful mapping of *dúkɛɛ* → *dúkɛ́ɛ́* from Standard to Colloquial Bamana, the attested winning candidate avoids a violation of MAX[-hi] in favor of violating both *PEAK[+hi] and *PEAK[-hi]. What is clear in this situation is that the combined violation of these two markedness constraints is less costly than the combined violation of *PEAK[+hi] and MAX[-hi] accrued by the incorrectly predicted winner **du.kɛɛ*. Taken another way, the superlinear combination of *PEAK[+hi] & MAX[-hi] is such that this combined violation is more costly than a simple summation of the two individual constraints. Once again, I propose that this superlinear combination of constraints has a violation weight of .4. This constraint has been added to tableau (21) and effectively yields a correctly predicted and unreduced winner. Thus, we now arrive at the prevailing observation in Colloquial Bamana that a [-hi] vowel cannot be deleted when a [+hi] vowel is also present within the same domain.

(21)

	MAX[-hi]& *PK[+hi] .4	*M ₂ /T 5.5	*PK [+hi] 5	*PK [-hi] 4.25	MAX [-hi] 2.5	MAX [+hi] 2	o[*M ₁ /T &*M ₂ /N .6	wd[*M ₁ /T &*M ₂ /N .6	*M ₂ /N .2	H
a. du.kɛɛ	-1		-1	-1	-1		-1	-1	-1	-13.55
b. dɛɛ.nɛ		-1		-2		-1				-16
c. ✓ du.kɛɛ			-1	-2						-13.5

Yet another conflict that can be found in reference to Vowel Syncope is in words containing two seemingly acceptable [-hi] vowel deletion targets in adjacent domains. We saw above in (6) for *nèrekolo* that the most harmonic and indeed the attested output candidate in Colloquial Bamana for this word is *nèrkóló*. The fully faithful candidate *nerekolo* and a doubly reduced candidate containing two CCV complex syllables *nreklo*

were shown to be non-harmonic options in a Harmonic Grammar framework. An additional output candidate that was not entertained at that time, i.e. *nerklo*, also has a double deletion but resulted in a combination of a CVC plus a CCV syllable. Since we have learned that, generally speaking, a CVC syllable is more harmonic than a CCV syllable, it is not surprising that the CVC.CCV candidate accumulates a less costly harmony score than the CCV.CCV alternative. Taken alongside other candidates, and even the attested winner, the double deletion CVC.CCV candidate emerges as the predicted winner by the weighted constraints. As another illustration of the systematicity of the Colloquial Bamana grammar, the difference between harmony scores for the attested winner and the predicted winner in this instance is again .35. This outcome is illustrated in (22).

(22)

/nɛrɛkolo/	*PK[-hi] w = 4.25	MAX[-hi] w = 2.5	σ [*M ₁ & *M ₂ /L w = .6	w_d [*M ₁ & *M ₂ /L w = .6	*M ₂ /L w = .2	H
a. ✓ nɛr.ko.lo	-3	-1		-1	-1	-16.05
b. nɛ.rɛ.ko.lo	-4					-17
c. nrɛ.klo	-2	-2	-2	-2	-2	-16.3
d. ☹ nɛr.klo	-2	-2	-1	-2	-2	-15.7

It is necessary, given this unpredicted outcome, to uncover the generalization about these words in order to determine why the grammar is once again not behaving harmonically. This generalization becomes clear when comparing the attested winner and the wrongly predicted winner side by side in light of other reduced outcomes in Colloquial Bamana. As in the two instances of superlinearity noted above, this particular outcome arises out of the necessity for the language to compensate for certain violations

which, in combination, are more costly than the sum of their individual parts. Also similar to the above examples of superlinearity, the issue that surfaces here involves the violation of the MAX[-hi] constraint. In the previous examples, it has been observed that MAX[-hi] cannot be violated in conjunction with certain other constraints that stand as the driving force of the overall drive towards minimization in Colloquial Bamana, i.e. MAX-K and *PEAK[+hi] (i.e. MAX-K regulates Velar Consonant Deletion, while *PEAK[+hi] drives Vowel Syncope). In the current example, it is the violation of MAX[-hi] in conjunction with itself that is not permitted in Colloquial Bamana minimization. In order to avoid this double violation of the strongest of the language's faithfulness constraint, the language chooses instead to block additional reduction and retain peak markedness by allowing an additional violation of *PEAK[-hi]. As in the previous examples, I shall propose a low weight (again $w = .4$) superlinear combined constraint, namely MAX[-hi] & MAX[-hi], that introduces additional harmonicity into the system and effectively selects against the unattested doubly reduced outcome. The introduction of this constraint and its outcome are illustrated in (23).

(23)

/nɛɾɛkolo/	MAX[-hi]& MAX[-hi] .4	*PK[-hi] 4.25	MAX[-hi] 2.5	σ [*M ₁ & *M ₂ /L .6	w_d [*M ₁ & *M ₂ /L .6	*M ₂ /L .2	H
a. ✓ nɛɾ.ko.lo		-3	-1		-1	-1	-16.05
b. nɛ.rɛ.ko.lo		-4					-17
c. nɛɾ.klo	-1	-2	-2	-2	-2	-2	-16.7
d. nɛɾ.klo	-1	-2	-2	-1	-2	-2	-16.1

5.9.3 Impermissible combinations

The proposal for superlinear ordering presented in the subsections above, as well as more general observations concerning the outcomes of minimization in all Colloquial Bamana words yield several conclusions about what constitutes a well-formed reduced output in this language. We have observed in this chapter, as well as in Chapters 3 and 4, that reduced Colloquial Bamana outputs of many shapes are possible in the language, but that in all instances, the constraints in the language are active in determining what types and combinations of markedness and faithfulness violations are permitted to co-occur in grammatical outputs. We have seen that certain constraint violations are permitted to co-occur to yield reduced words, however it is clear that others act cumulatively to rule out other ungrammatical reductions. We have seen this come to the fore, on the one hand, in the cumulative combination of low weight markedness constraints on permissible syllable margins that have the effect of limiting the types of doubly reduced Colloquial Bamana words that can be accommodated by the language's phonological grammar. On the other hand, we have seen that the superlinear combination of constraints also has the ability to prevent the overgeneration of double deletions in other instances. While the former case is a relatively straightforward illustration of the effects of cumulative markedness, the latter instances of superlinear ordering require further explanation.

We have seen that the only double deletions within a single morphophonological level permitted in Colloquial Bamana minimization are those that generate a restricted inventory of CCV.CCV words and an even more restricted inventory of CVC.CCV words. For every CCV complex syllable that is generated, in addition to violating its relevant MAX constraint, it also necessarily yields violations of the conjoined margin

constraints $\sigma[M_1 \& M_2]$ and $w_d[M_1 \& M_2]$, as well as a relevant individual $*M_2$ margin constraint. Importantly, however, in instances where a CVC syllable is generated, the $\sigma[M_1 \& M_2]$ constraint would not be violated. For the generation of a CCV syllable in instances where a [-hi] vowel has been deleted, the combined violation score of the relevant MAX constraint (i.e. MAX[-hi]) and its accompanying margin constraints is 3.9.

We have observed in Colloquial Bamana that the only instance in which a CCV complex syllable can be formed upon the deletion of [-hi] vowel is when another [-hi] vowel is found in the same domain, e.g. *tènɛ* → *tně* ‘taboo’. In such instances, a MAX[-hi] violation and a $*PEAK[-hi]$ violation are permitted to co-occur in a winning candidate. The combined violation score of MAX[-hi] and its accompanying margin constraints, along with PEAK[-hi] is 8.1. This tells us that a hypothetical violation of 8.1 due to these violations is permissible in the language.

It was shown in (22) that a MAX[-hi] violation (along with its margin violations) cannot co-occur with a $*PEAK[+hi]$ violation in a winning candidate, as this would yield a word in which a [-hi] vowel deletion target has been deleted instead of a [+hi] vowel within the same domain. The hypothetical total violation score of this combination would be 8.9. We know, however, that in order to avoid this impermissible combination, Colloquial Bamana chooses instead to violate both $*PEAK[-hi]$ and $*PEAK[+hi]$, as was the case in the fully faithful emergence of *dúkéné* in (21). The combined violation score for these constraints is 9.25 – once again, a difference of .35 emerges upon the comparison of permissible and impermissible outcomes. It is here that the weight of superlinear constraint combination comes into play. It is clear that combining MAX[-hi] and its margin violations with $*PEAK[+hi]$ is ungrammatical, and thus their combined

violation must be worse than the sum of their individual violations, hence the proposal of a $w > .35$ violation score for the superlinearly combined constraints. The outcome is analogous in situations where the combined violation of MAX[-hi] and MAX-K must outweigh MAX-K and *PEAK[-hi], as in (19), as well as where the combined violation of MAX[-hi] with itself must outweigh MAX[-hi] and *PEAK[-hi], as in (23).

The value .35 represents a critical ratio between constraints against peak markedness and those striving to maintain segmental faithfulness. This value shows the violation weight difference between the preferable retention of a [-hi] peak ($w = 4.25$) alongside the sum of violations that would accrue via the unfavorable deletion of such a peak and the margin violations that accompany it, once again the total is 3.9, a difference of .35. Colloquial Bamana therefore represents an emergent language variety that maintains strict checks and balances on the types and amount of complexity that it permits. On the one hand, by the action of cumulative violations of low-weight markedness constraints, the language permits reduction and the introduction of syllable complexity via Vowel Syncope but limits the types of reductions that can occur to achieve it. On the other hand, the effects of superlinear constraint conjunction do not permit the introduction of margin markedness when an acceptable resolution to peak markedness cannot be satisfied. It is for this reason that we witness that a harmonically improving velar deletion is the preferred resolution in a choice of between this outcome versus a [-hi] vowel deletion that would introduce additional markedness violations. Similarly, we find that the language will not permit the introduction of margin markedness into a word when a non-harmonic [+high] peak must remain for phonotactic reasons. Furthermore, the language will not permit additional markedness to be

introduced into the system when it necessitates the loss of multiple preferred [-hi] syllable peaks.

5.10 Variable outputs

In concluding this chapter, I turn attention to the issue of variation in potential output candidates and how an evaluation utilizing a harmonic weighting of constraints in Colloquial Bamana can capture this outcome. Consider the variable outputs in tableau (24).

(24)

/kolokowo/	MAX[-hi] ² w = .4	*PK[-hi] w = 4.25	MAX[-hi] w = 2.5	_{ol} [*M ₁ /T& *M ₂ /son w = .6	_{wd} [*M ₁ /T& *M ₂ /son w = .6	*M ₂ /son w = .2	H
a. ko.lo.ko.wo		-4					-17
b. (✓) klo.ko.wo		-3	-1	-1	-1	-1	-16.65
c. ✓ kol.ko.wo		-3	-1		-1	-1	-16.05
d. klo.kwo	-1	-2	-2	-2	-2	-2	-16.7

In (24), we find that variable outputs are possible in instances where the input word contains all [-hi] vowels. More specifically, in such words, a doubly reduced output is never the most harmonic choice, and thus an output that has been minimized by two instances of [-hi] vowel deletion (i.e. two violations of MAX[-hi]) cannot emerge in Colloquial Bamana. It comes as no surprise that the fully faithful candidate **kolokowo* in (24a) is not the most harmonic choice in this language with an overall drive towards segmental minimization. Furthermore, we observe that the doubly reduced candidate **klokwo* (24d) is also a non-harmonic choice in the language. Motivation for this avoidance was discussed in §5.9.2.

While (24c) is clearly the most harmonic output, the collected Colloquial Bamana data reveal that both (24b) and (24c) are grammatical in the language. As we have seen previously in §3.2.2 and §3.4.3, harmonic variation between grammatical outputs is not an unusual property of the language. It was posited in §3.4.3, following the analysis of output variation in Optimality Theory presented in Coetzee (2006), that a grammaticality cut-off line exists in Colloquial Bamana. This cut-off line assesses grammaticality such that potential output candidates ruled out by constraints above the cut-off are ungrammatical and never emerge in the language. Potential output candidates surviving past this line are deemed grammatical and are passed down to be evaluated for their harmonicity by constraints below the cut-off line. This analysis allows us to formalize the variation attested in certain types of words in the language. Although the grammaticality cut-off line discussed in Chapter 3 was explained in terms of a standard optimality theoretic analysis, we observe, at least for Colloquial Bamana, that this cut-off line can also be applied in an analogous manner in a harmonic analysis. In the case of (24b) and (24c), the important observation for the current section is that these grammatical variants have the two lowest total violation scores and only witness a single instance of segmental reduction.

As the tableaux below illustrate, both a standard Optimality Theory analysis utilizing a grammaticality cut-off (i.e. 25), and Harmonic Grammar analysis utilizing the same cut-off line (i.e. 26) yield the same correctly-predicted results, with only slight modifications to the evaluation parameters. More specifically, in a standard optimality theoretic analysis, potential output candidates that were not eliminated by some fatal violation of a constraint above the grammaticality cut-off line were passed to constraints

below the line for evaluation. The modification to this, in a harmonic analysis, is that only those two potential output candidates that are deemed most harmonic above the cut-off line are permitted to pass below it for further evaluation of their harmonicity by the lower weighted constraints. Consider first a standard analysis of the Standard Bamana input *kólokowso* in (25).

(25)

/kolokowo/	MAX[-hi] ²	*PK[-hi]	MAX[-hi]	$\sigma_l^*M_1/T \& *M_2/son$	$w_d^*M_1/T \& *M_2/son$	*M ₂ /son
a. ko.lo.ko.wo		****!				
b. (✓) klo.ko.wo		***	*	*	*	*
c. ✓ kol.ko.wo		***	*		*	*
d. klo.kwo	*!	**	**	**	**	**

In this standard analysis, candidates (25a) and (25d) incur fatal violations of constraints above the grammaticality cut-off line, and thus they are deemed ungrammatical. The remaining candidates, (25b) and (25c) tie in their violations of all constraints above the grammaticality cut-off line and represent the first and second losers below the line. Both candidates are grammatical but vary in their harmonicity. Next, consider a harmonic analysis of the same input in (26). This particular tableau differs from that presented in (24) in that the proposed grammaticality cut-off line has been incorporated into the newly modified tableau.

(26)

/kolokowo/	MAX [-hi] ² w = .4	*PK[-hi] w = 4.25	MAX[-hi] w = 2.5	σ_l [*M ₁ /T& *M ₂ /son w = .6	w_d [*M ₁ /T& *M ₂ /son w = .6	*M ₂ /son w = .2	H
a. ko.lo.ko.wo		-4					-17
b. (✓) klo.ko.wo		-3	-1	-1	-1	-1	-16.65
c. ✓ kol.ko.wo		-3	-1		-1	-1	-16.05
d. klo.kwo	-1	-2	-2	-2	-2	-2	-16.7

The Harmonic Grammar tableau in (26) correctly shows that the two least harmonic potential output candidates are once again the fully faithful candidate (26a) and the doubly reduced candidate (26d). The total violation scores that these two candidates accumulate above the grammaticality cut-off line are higher than those accumulated by both (26b) and (26c). The latter two candidates emerge as grammatical harmonic variants in the language and illustrate that the idea of a grammaticality cut-off may be applicable in a Harmonic Grammar analysis of Colloquial Bamana.

5.11 Summary

This chapter has provided a harmonic formalization of minimization in Colloquial Bamana that has offered motivation for instances in which the language either permits or prohibits instances of multiple reductions within a single morphophonological level. Although instances of double reduction are few in this language within such a domain, the harmonic analysis provided has shown that they are predicted by the language's phonological grammar. Furthermore, it has been shown that effects of cumulative markedness are at play in prohibiting other instances in which a standard optimality theoretic analysis would predict that multiple instances of reduction are possible. This chapter has also suggested that superlinear constraint combinations must be invoked to

address instances in which multiple reductions are incorrectly predicted by both standard and harmonic methods of analysis.

Having explored and formalized the introduction of syllabic complexity in Colloquial Bamana via Vowel Syncope and Velar Consonant Deletion, and considering the interacting roles that the language's phonology and morphology have to play in bounding particular types of deletion, the following chapter proposes that the patterns and restrictions on minimization in this language are further influenced by metrical or rhythmic structure. It is illustrated that higher prosodic structure, in the form of disyllabic feet constructed at the left edge of the word, is responsible for restricting the application of the language's phonological processes and that certain reduced outcomes are prohibited in order to avoid the introduction of unfavorable prosodic prominences into the language.

CHAPTER 6

A PROPOSAL FOR FOOTING

6.1 Introduction

Chapters 3 through 5 of this thesis characterized the emergence of syllable complexity in Colloquial Bamana in both descriptive and formal terms and explored both phonological and morphological features of the language that act to influence the types and number of complex syllables that are permitted in the language. We have seen that one of the main phonological factors driving the emergence of particular complex syllable shapes is the language's phonotactics, particularly the phonotactic restrictions that the language places on permissible consonant-consonant sequences in both complex onsets and syllable contact sequences. These phonotactic restrictions were introduced in the form of optimality theoretic markedness constraints on syllable margin constituents. It was next discussed that the phonology and morphology of the language place mutual but unique restrictions on the type, length, and componential structure of words that can undergo minimization, as well as on the number of instances of minimization that can be accommodated in any one word, whether that word is a monomorph, a nominal or verbal compound, or some other morphologically complex construction. In addition to the more global phonological and morphological restrictions discussed in Chapter 4, the formalization of restrictions on multiple instances of syllabic complexity in Chapter 5 posited that the prohibitions against specific types and instances of minimization stem from both harmonic and superlinear relationships, as well as the competition between

constraints on syllable well-formedness and segmental faithfulness active in the language.

While the previous three chapters have focused strictly on the emergence of syllabic complexity in terms of phenomena defined on the segmental level, there remain notable instances in which the selection and/or avoidance of certain minimized outcomes cannot be predicted solely by referencing the properties of the language's segmental morphophonology. It was broached in earlier chapters that the outlying or unpredicted choices made in Colloquial Bamana are best addressed by attributing them to bounds or restrictions put in place by the higher prosodic structure of the language. Reference has been made to foot structure for certain tonal features of the language (e.g. Bamba 1991; Leben 2002, 2003; Weidman & Rose 2006), although as this chapter details, the characteristics of these proposed tonal feet stand in opposition, in some instances, with those bounding segmental processes. This comparison is discussed critically in Chapter 7. The possibility that some type of higher prosodic structure can be found elsewhere in Mande languages and has a role in certain processes has been posited in works by Vydrine (2002, 2004) and Kuznetsova (2007), specifically in reference to Southeastern Mande languages, e.g. Gouro, Soso, and Dan. While these works are provocative, they do not provide a fully detailed characterization of prosodic structure in these languages.

The current chapter aims to provide the first detailed description of higher prosodic structure in a Central-Southwestern Mande language that draws specific evidence for such foot structure from segmental phonology. This structure will be defined in terms of the bounds it places on the application of phonological processes in Colloquial Bamana, as well as in reference to word and syllable types found in both

phonologically conservative Bamana varieties and those permitting segmental minimization. It will be shown that prosodic structure above the level of the syllable is present in Bamana and that this structure is manifested in disyllabic prosodic feet constructed from the left-edge of a word. The sections below detail the characteristics of this structure, among them how it is defined, its role as a domain of application for processes of minimization, structures bounded or influenced by its presence, and its role in limiting the types of words that have been permitted to emerge as Colloquial Bamana developed from its more phonologically conservative predecessor.¹

6.2 Identifying a domain of application

Section 3.5 introduced the process of Velar Consonant Deletion in Colloquial Bamana and outlined its role in removing velar consonants flanked by identical vowels of any type. It was shown later in Chapter 3 that Velar Consonant Deletion competes with Vowel Syncope in instances when both processes have potential deletion targets in what is posited to be the same domain. Discussion in §4.2 illustrated that Velar Consonant Deletion is the preferred means of reduction in Colloquial Bamana given that words permitting only a single instance of deletion and having targets for both Velar Consonant Deletion and Vowel Syncope in different domains choose for the first of the two processes to apply. Additional characteristics of Velar Consonant Deletion have also been discussed throughout the previous chapters, among them that only a single application of the process is permitted in a given word and that words containing more than one intervocalic velar deletion target only permit the process to apply in the leftmost domain

¹ An interesting counterpoint to the discussion in this chapter can be found in Orié's (1997) work that details a proposal for metrical foot structure in select Benue-Congo languages. The work draws evidence from phenomena similar to those explored in this thesis in Colloquial Bamana, e.g. restricted deletion and intervocalic consonant lenition.

of the word. While these last two characteristics concern instances in which Velar Consonant Deletion fails to apply, the restrictions that they describe can be attributed to the language's morphophonology. In addition to these restrictions, there are other instances in which Velar Consonant Deletion fails to apply but that cannot be linked to the language's morphology or segmental phonology. As this section introduces, additional instances in which the application of Velar Consonant Deletion is prohibited are due to the inability of this process to apply across prosodic and/or morphological boundaries. Consider the Colloquial Bamana disyllabic monomorphs in (1) where Velar Consonant Deletion is permitted to apply.

(1)

	<u>Standard</u>	<u>Colloquial</u>	<u>Gloss</u>
a.	[sì.ki]	[sìí]	'to sit'
b.	[dù.ku]	[dùú]	'village'
c.	[mò.kɔ]	[mòó]	'person'
d.	[tó.kɔ]	[tóó]	'name'
e.	[cò.go]	[còó]	'manner'
f.	[fâ.ga]	[fâá]	'to kill'
g.	[sà.ga]	[sàá]	'sheep'

One observes in these monomorphs that Velar Consonant Deletion readily applies in such words when an acceptable velar deletion target is found between two identical vowels of any type. This process is also permitted to apply in longer input words, such as those in (2).

(2)

	<u>Standard</u>	<u>Colloquial</u>		<u>Gloss</u>
a.	[sì.ki.lã]	[sì.lá̃]/[sì.klá̃]	*ski.lã	‘chair’
b.	[sú.ku.na]	[súú.ná]/[sú.kná]	*sku.na	‘urine’
c.	[dù.gu.ma]	[dùù.má]/[dù.gmá]	*dgu.ma	‘on the ground’
d.	[sù.gu.ri]	[sùù.rí]/[sù.grí]	*sgu.ri	‘pre-fasting meal’
e.	[dó.kɔ.ya]	[dóó.yá]	*dɔ.kya	‘to make small’
f.	[sò.kɔ.ma]	[sòò.má]	*sɔ.kma	‘morning’

Once again, one finds that Velar Consonant Deletion applies and removes a velar deletion target located between identical vowels. The important observation here is that the process applies and deletes a velar target that is the onset of the second syllable of these trisyllabic CV.CV.CV inputs, thereby generating a Colloquial Bamana word of the shape CVV.CV containing a derived long vowel.² Consider next the Colloquial Bamana outcome for words in (3) that contain a velar consonant flanked by identical vowels where the velar consonant is the onset of the third syllable of the input word, rather than the second.

(3)

	<u>Standard</u>	<u>Colloquial</u>		<u>Gloss</u>
a.	[bá.ra.ka]	[bár.ká]/[brá/ká]	*ba.raa	‘blessing’
b.	[mè.lɛ.kɛ]	[mèl.ké]/[mlè.ké]	*mɛ.lɛɛ	‘angel’
c.	[sú.ru.ku]	[súr.kú]/[srú.kú]	*su.ruu	‘hyena’

² For further discussion of the outcome in words like (2a-d) in which Velar Consonant Deletion and Vowel Syncope compete in [+hi] vowel words, see §3.5.1.

- d. [bù.lu.ku] [bùl.kú]/[blù.kú] *bu.luu ‘to plow’
 e. [dà.ra.ka] [dàr.ká]/[drà.ká] *da.raa ‘breakfast’
 f. [mà.nɔ.kɔ] [màn.kó] *ma.nɔɔ ‘catfish’

We find from the data in (3) that the reduced words emergent in Colloquial Bamana opt to permit Vowel Syncope to the exclusion of Velar Consonant Deletion when an intervocalic velar consonant is in the onset of the third syllable of the input word. Rather than forming a derived long vowel, as in (2), the result is variation between CCV.CV and CVC.CV (when permitted by the language’s phonotactics), regardless of whether or not the word contains [-hi] or [+hi] vowels. A comparison between the outcomes in (2) and (3), taken alongside what is already known about the preferential application of Velar Consonant Deletion in Colloquial Bamana, leads one to posit that some additional restriction or structure must be in place in the language prohibiting the predicted deletion from occurring. From what has been observed here and is explored further in sections below, I posit that one of two complementary restrictions is at play in this language that yield the same outcome for Velar Consonant Deletion. Consider the modified representation in (4) of two illustrative words drawn from the data sets in (2) and (3). Potential velar deletion targets are shown in bold type.

(4)

- a. (sɔ.**kɔ**)(ma) → (sɔɔ.ma) ‘morning’
 b. (bu.lu)(**ku**) → (blu.ku)/(bul.ku), *bu.luu ‘to plow’

Added to the typical representation of words utilized throughout this thesis, those shown in (4) include boundaries (marked by parentheses) of a disyllabic domain constructed from the left edge of Bamana words. As the words (4) illustrate, target velars

are permitted to delete via Velar Consonant Deletion in words like (4a) where both vowels of the triggering environment for deletion are located within the disyllabic left-edge domain. Words like (4b), however, in which the vowels of the triggering environment are located across a domain boundary, fail to witness deletion. I shall demonstrate below that this observation holds for all similarly constructed Bamana words. As the discussion in this chapter reveals, this prosodic domain is a characteristic of all Bamana words and plays a key role in determining the permitted versus prohibited application of certain phonological processes in the language, e.g. Velar Consonant Deletion. Additional characteristics of this domain are discussed throughout this chapter.

That this domain is present in Bamana words and places restrictions on particular phonological processes in the language allows one to make several observations pertaining specifically to Velar Consonant Deletion. As the words in (4) suggest, Velar Consonant Deletion is a process that fails to apply when its triggering environment is outside of a defined prosodic domain of application. A complementary observation is that Velar Consonant Deletion fails to apply when its application would generate a CV.CVV sequence. It is discussed, in §6.3.1, that derived long vowels, such as those created by Velar Consonant Deletion, can be considered *heavy* in terms of their phonological weight (e.g. Clements & Keyser 1983; Hyman 1985). CV syllables, on the other hand, are considered *light*. Therefore, the disyllabic CV.CVV sequence avoided by the language is a sequence of *light* + *heavy*, or what is known in the metrical and prosodic phonology literature as an *iamb* (e.g. Goldsmith 1990; Halle & Vergnaud 1987; Hayes 1995). We observe then that Colloquial Bamana does not permit Velar Consonant Deletion to apply in instances where its application would generate an iambic sequence. That Velar

Consonant Deletion is permitted in instances where it yields a CVV.CV sequence, i.e. *heavy + light*, reveals an obvious preference for *trochees* in the language.³ It is this behavior in Colloquial Bamana, functioning in such a way that it references the preference for trochaic sequences and the parallel avoidance of iambic sequences in the language, that provides motivation for defining the noted disyllabic domain as a type of *prosodic foot*. A detailed characterization of the features of this foot is found in §6.3.

An additional characteristic of Velar Consonant Deletion can be observed in the representative words in (5). These words reveal that Velar Consonant Deletion is a process that is sensitive to both prosodic and morphological boundaries, such that it fails to apply across these boundaries. In the remainder of this chapter, foot boundaries are indicated by parentheses, morpheme boundaries are indicated by ‘#’, and morphophonological levels (where appropriate) are indicated by curly brackets.

(5)

	<u>Standard</u>	<u>Colloquial</u>		<u>Gloss</u>
a.	{(bo.lo)#(ko)}	ból.kó/bló.kó	*bo.loo	‘to circumcise’
b.	{(kũ#ti)(ki)}	kũ.tí.kí	*kũ.tii	‘director’
c.	{(ko.lo)#(ko.wo)}	kól.kó.wó/kló.kó.wó	*ko.loo.wo	‘window’
d.	{(ma#ka)(ri)}	mà.krí	*maa.ri	‘mercy’

Words like (5a) and (5b) are compounds but behave similarly to those words shown in (3) where Velar Consonant Deletion fails to apply when the velar target is in the onset of the third syllable of the word. (5c) shows that the failed application of Velar Consonant Deletion observed in short words also obtains in longer words containing

³ Importantly, trochees in Colloquial Bamana must be considered syllabic, rather than moraic, as discussed further in §6.3.5.

more than one disyllabic domain. (5d) shows that Velar Consonant Deletion is also sensitive to morpheme boundaries, as it fails to apply foot-internally when a morpheme boundary is located inside this domain.

6.3 Defining the foot and its properties

The preceding section presented data in support of the presence of a prosodic foot in Bamana, specifically in regards to the application (or failed application) of Velar Consonant Deletion. The remainder of this chapter discusses how the observations and generalizations presented about the foot in §6.2 apply to all words in the language. In order to discuss the foot and how its presence can be attributed to other structures and processes in Bamana, I first define its properties.

It has already been posited, based upon the outcome of Velar Consonant Deletion, that the foot in Bamana is a maximally disyllabic prosodic domain constructed at the left edge of a given word. Evidence supporting this observation is drawn from the representative words provided in (4) and repeated here in (6).

(6)

- a. (sɔ.kɔ)(ma) → (sɔɔ.ma) ‘morning’
b. (bu.lu)(ku) → (blu.ku)/(bul.ku), *bu.luu ‘to plow’

These words show that when an intervocalic velar consonant targeted for deletion is flanked by vowels within a foot, Velar Consonant Deletion is permitted to apply. However, when the conditioning vocalic environment is split by a domain boundary, the process fails to apply. Had one proposed alternatively that disyllabic feet are constructed from the right edge of the Bamana word, as in the hypothetical instances in (7), one

would be hard pressed to capture any generalization about the application of Velar Consonant Deletion.

(7)

a. (sɔ)(kɔ.ma) → *(sɔ.kma) ‘morning’

b. (bu)(lu.ku) → *(bu.luu) ‘to plow’

Proposing that footing occurs as in (7) yields incorrect Colloquial Bamana words given what we already know about the relationship and application preferences between Vowel Syncope and Velar Consonant Deletion in this language. The hypothetical case of (7a) would yield a Colloquial Bamana word that has undergone Vowel Syncope instead of Velar Consonant Deletion. This would result given the sensitivity that we have learned that this process has for boundaries, specifically that it fails to apply across them. (7b), on the other hand, incorrectly predicts that Velar Consonant Deletion would target a third syllable velar onset and thereby generate an impermissible iamb. Note that proposing that feet are constructed beginning at the right edge of a word generates two incorrect predictions, while proposing that feet are constructed beginning at the left edge of a word yields the attested Colloquial Bamana forms.

One finds evidence for another property of Bamana footing by considering the assignment of feet in words longer than three syllables that would accommodate a second complete disyllabic foot. Consider the illustrative examples in (8).

(8)

a. (se.li)(sa.ga) → (se.li)(saa) ‘sacrificial sheep’

b. (si.ki)(yɔ.rɔ) → (sii.yɔ)(rɔ) ‘sitting place’

The outcome of longer words like (8a) and (8b) suggests that footing proceeds iteratively from the left edge to the right edge of a word in this language. Had the footing mechanism stopped assigning feet after the construction of a single disyllabic domain, no domain of application would have been created within which Velar Consonant Deletion could properly act in (8a). These words illustrate that the process of footing continues from left to right in this language to create maximally disyllabic feet.

Following from observations made about the language's tonal phonology and the presence of tonal foot structure in Chapter 7, I posit that footing in this language is exhaustive and creates degenerate monosyllabic feet, such that segmental and tonal feet are constructed in parallel. A degenerate foot cannot attract prominence. Derived long vowel syllables, however, attract prominence, and thus they are considered to be parsed into a well-formed unary foot when in a third syllable position, as in (8a). As discussed further below, the necessity that a derived long vowel syllable be prominent disallows sequences of adjacent derived long vowel syllables given that such an outcome would yield a clash of prominences. Furthermore, it was introduced in §6.2 that Bamana is a language that disallows iambic feet and alternatively favors trochaic sequences. Evidence for this observation was drawn from the failure of reductions that yield *(CV.CVV) sequences but permit a (CVV.CV) alternative.

Important to the discussion of foot structure in the remainder of this chapter (just as was the case for syllable structure) is that Colloquial Bamana and Standard Bamana are assumed to have the same segmental underlying representations for a given word. The general assumption in the generative phonological literature is that parsing of segments into syllables and the assignment of footing are not properties of the underlying

representation. Rather, this is accomplished derivationally by the phonology of the language and emerges on the surface (e.g. Kiparsky 1982). In the optimality theoretic literature, the question as to whether or not prosodic structure can be (or must be) posited in the underlying representation remains a matter of debate. It follows most closely from discussion of the grammar component GEN (Prince & Smolensky 1993/2004), that syllable and foot structure need not be specified in the underlying representation of a word, as GEN will generate possible output candidates (and impossible ones, theoretically) with various manifestations of these structures, which will then be subject to evaluation by the language's constraint hierarchy. The outcome of this evaluation thereby yields the optimal or grammatical output(s) for a given underlying representation. I posit precisely this method of analysis for Bamana. In an optimality theoretic account of metrical structure, although not formalized here, the relevant high-ranking footing constraints would include *IAMB (a constraint militating against iambic structures, discussed briefly in Chapter 5), COINCIDE (a constraint aimed at maximizing strong positions of a word, discussed in the current chapter, cf. Alber 2001), and a constraint such as EDGEMOST (Prince & Smolensky 1993/2004) that disallows unparsed feet. While both Standard and Colloquial Bamana words have the same segmental underlying representation and are footed on the surface in a similar fashion as a result of the above constraints, the phonology of Colloquial Bamana is such that the processes of segmental reduction active in the language must reference the foot structure (or as we shall see in Chapter 7, the tonal structure) of the Standard input for their proper application. Thus, it is posited that Standard Bamana serves as the input to Colloquial Bamana.

To be clear, both Standard and Colloquial Bamana are subject to the same constraints on their footing, hence their identical surface footing patterns, generally speaking (i.e. maximally disyllabic, trochaic feet). In terms of their segmental structure, I posit that both varieties have, in principle, identical underlying structure, however the difference between them is that the direct input to Colloquial Bamana (i.e. Standard Bamana) has already been parsed into feet, and hence the phonological processes underway in Colloquial Bamana are able to reference this structure for their proper application. This is not unusual in the light of arguments laid forth by McCarthy (2008) concerning forced seriality, ‘free’ prosodification, and Harmonic Serialism, an instantiation of Optimality Theory that incorporates serial derivations in achieving well-formedness. An alternative possibility, although one argued against in McCarthy (2008) would be a Stratal Optimality Theory style approach (Bermúdez-Otero 2007, in preparation). In such an analysis, one might propose that the underlying representation is unparsed for footing and undergoes evaluation for metrical well-formedness on a metrical tier. Importantly, these metrical constraints would be identical to those necessary to parse the Standard variety of the language. The output of this metrical level would then serve as the input to a second tier in which candidates would be evaluated as discussed in Chapters 3 and 5. These propositions necessitate additional research.

6.3.1 Quantity sensitivity

I have shown, thus far, that Colloquial Bamana is a language that prefers trochaic sequences and excludes iambic sequences. While a detailed characterization of the phonetic correlates of prominence is not an immediate goal of this thesis, there are several observations about potential correlates that can be made. Specifically, one can

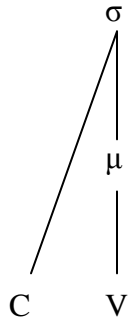
consider the roles that length and phonological weight play in defining prominence. It was discussed above that, upon the application of Velar Consonant Deletion, derived long vowels are permitted only in instances where they are the head of a trochaic foot (i.e. (CVV.CV)). Such vowels are disallowed in a context where they would form an impermissible iambic sequence, e.g. (CV.CVV). Derived long vowels are also possible in monosyllables (i.e. CVV). The comparison between the permissibility of (CVV.CV) versus (CV.CVV) sequences, and thus the preference for trochees to the exclusion of iambs, is telling in that this characteristic of Colloquial Bamana reveals that derived long vowels are treated in phonologically different ways by the language. More specifically, their restricted distribution suggests that they attract prominence to themselves. If one considers that a vowel is associated to a single mora (e.g. Hyman 1985), one can argue that, as a result of Velar Consonant Deletion, the resultant derived long vowel is bimoraic, with one mora having been contributed from each of the two vowels flanking the velar deletion target. The bimoraicity of the resultant long vowel renders the CVV syllable *heavy* and thus *prominent* in comparison to a short CV syllable containing just a single mora. That these vowels attract prominence regardless of their distribution leads to the observation that Bamana is a quantity sensitive language. As Goldsmith (1990) discusses, in quantity sensitive languages, heavy syllables demand to be stressed (i.e. they are prominent) and must appear only in strong positions (i.e. as the head of a foot). We have seen that this requirement holds true in Colloquial Bamana, as derived CVV syllables are restricted in their distribution to the head of a trochaic foot or as the sole syllable of a heavy unary foot.

6.3.2 Contextual weight

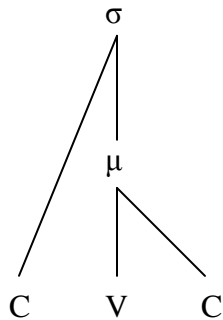
The distribution of closed (i.e. CVC) syllables reveals another intricacy of Colloquial Bamana phonology. CVC syllables are permitted to emerge upon [-hi] or [+hi] vowel loss via Vowel Syncope, e.g. *sárama* → *sár.má/sŕá.má* ‘famous’ and *fà.rĩ.mã* → *fàr.mǎ́* ‘hotness’. They are also found word-finally as a result of [+hi] vowel loss when the final consonant is [-continuant, -nasal], i.e. [l]. It is the case, however, that word-final CVC syllables are restricted in their distribution in a similar way as derived long vowels. While these syllables are permitted to emerge in monosyllables derived from Vowel Syncope, e.g. *séli* → *sél* ‘prayer’, they are avoided in disyllabic words, e.g. *sòsoli* → *sò.slí*, **sò.sól* ‘argument’. Importantly, CVC syllables are readily attested in instances where they emerge as the second syllable of a reduced word, e.g. *kàròmuso* → *kà.ròm.só*. This distribution suggests, therefore, that rather than closed syllables behaving no differently from their light or non-prominent CV counterparts or having the characteristics of *Weight by Position* (e.g. Hayes 1989), wherein the final consonant of a CVC syllable is assigned a mora (thereby rendering the syllable heavy), CVC syllables in Colloquial Bamana are contextually weighted (e.g. Morén 2000; Rosenthal & van der Hulst 1999). More specifically, the contextual weight of Colloquial Bamana CVC syllables is such that when these syllables are found word-internally, they pattern with other light syllables, but when they occur word-finally, they are heavy, and like their heavy derived CVV counterparts, they attract prominence. The structural representation of Colloquial Bamana CV, word-internal CVC, and word-final CVC syllables follows in (9).

(9)

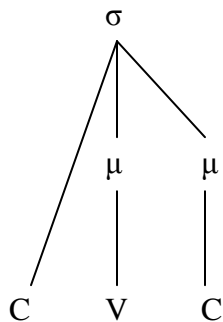
(a) Light CV



(b) Word-internal CVC



(c) Word-final CVC



(9a) represents a simple light monomoraic CV syllable that can be found in any word position. (9b) represents a word-internal CVC syllable that is also light and monomoraic. In such a syllable, following from the notion of a syllable rhyme, the vowel and coda consonant are assumed to share a single mora. (9c), however, represents a

word-final contextually-heavy (and therefore bimoraic) CVC syllable in which both the vowel and coda consonant of the syllable are associated with their own mora.

Contextual weight has obvious implications in Colloquial Bamana. We find that in the case of words like *séli* → *sél*, a contextually heavy CVC monosyllable is permitted to be the head of a unary foot, just as was observed for derived CVV syllables resulting from Velar Consonant Deletion, e.g. *màkɔ* → *màó* ‘person’. In instances like *sàsɔli* → *sàs.lí*, **sɔ.sɔl*, however, a word-final heavy CVC syllable is avoided given that it would generate an impermissible iambic sequence. The counterpart to this is found in *kàrɔmuso* → *kà.ròm.só*, where the word-internal CVC is permitted to emerge and thus cannot be considered heavy.

The specific requirements for what constitutes a permissible word-final CVC syllable are such that these syllables are avoided in many words due in large part to the interaction between the language’s phonology and morphology. As Chapter 4 discussed, multiple deletions are permitted (with few notable exceptions) in Colloquial Bamana words in instances where they are derived from a minimum four-syllable, and minimum three-constituent input where the phonotactics of the language lend themselves to the conditions for a second deletion. The representative words in (10) illustrate these points and provide additional instances in which word-final CVC syllables cannot be accommodated.

(10)

a. $\{\{yɛlɛ\#ma\}^1li\}^2 \rightarrow \{yɛlma\#li\}^2 \rightarrow yèlmàlí, *yɛl.mal$ ‘transformation’

lit. to turn + causative + progressive

- b. {sutura#li}¹ → sùtràlí, *su.tu.ral ‘burial’
lit. to hide + progressive
- c. {tɛ.kɛ#ka.li}¹ → téékálí, *tɛ.kɛ.kal ‘to swear an oath’
lit. palm + to swear
- d. {tɛ.kɛ#ka.li}¹ya² → {tɛkɛli#ya}² → téé.kál.yá ‘the swearing of an oath’
lit. palm + to swear + abstract
- e. {sa.ka#ki.li}¹la² → {saakili#la}² → sàà.kil.lá ‘near the sheep’s testicle’
lit. sheep + testicle + PP
- f. {kũ.ko#fa.li}¹ → kù.kó.fál ‘wild donkey’
lit. forest + donkey

Words like (10a) are morphologically complex enough (i.e. having more than two constituents) to permit multiple deletions. The problem with such words, however, stems from their construction. If the words were evaluated by the language’s phonology on one level, one might witness the following hypothetical outcome in (11).

(11)

{(yɛlɛ)#(ma#li)}¹ → *yɛlɛmal

If the morphology of the language permitted three constituents to be evaluated by the phonology within a single level, we might chance to find that the [+hi] vowel of the word would be targeted for deletion, thereby yielding a word-final CVC. However, (10a) shows the proper construction of this word such that the first two constituents *yɛlɛ + ma* are compounded first yielding the intermediate ‘*yɛlma*’. This compounding now places the [+hi] syllable in the third syllable of the word, thereby rendering it incapable of

deleting. Situations such as these provide motivation for the observation that, like Velar Consonant Deletion, Vowel Syncope only applies within a well-formed foot.

Words like (10b) and (10c) illustrate that when words are not morphologically complex enough to realize a second deletion, other factors come into play such as a preference for generating left-edge complexity via vowel syncope and the preference for Velar Consonant Deletion to apply before Vowel Syncope, that conspire to avoid the generation of final CVC syllables that might otherwise be predicted to occur. The word-final CVC complex syllables avoided by the phonology of the language are similarly blocked by the morphology of the language, as their emergence becomes possible in instances where an additional morpheme permits a second deletion, but this necessarily removes them from word-final position, as in (10d) and (10e).

Words like (10f) represent cases where deletion is prevented by phonotactics in the first foot but also where an eligible word-final [+hi] vowel is a viable deletion target. The inability of a deletion to occur in the first foot leaves that foot intact in Colloquial Bamana. Subsequently, the [+hi] vowel of the second foot is permitted to delete, thereby generating a word-final CVL syllable that is contextually heavy and can surface as a unary foot. Thus, (CV.CV)(CVL) words with a heavy third syllable are permitted in CB, a situation analogous to what is found in instances of right-foot Velar Consonant Deletion that generate (CV.CV)(CVV) words.

The Colloquial Bamana outcome in instances like *sə̀sə̀li* → *sə̀.sli*, **sə̀.səl* also demonstrates a subtle point concerning the overall Vowel Syncope process, specifically in regards to the definition of what makes an acceptable vowel deletion target. We have observed that it is an overall preference in Colloquial Bamana to delete a [+hi] vowel via

Vowel Syncope when it can be accommodated by the language's phonotactics, however we find that in *səsɔli*-type words, a [-hi] vowel is chosen as the deletion target. This illustrates, therefore, that the word-final [+hi] vowel of this word is not an acceptable deletion target, although this is potentially for one or more reasons. We have observed via independent evidence that word-final contextually-heavy CVC syllables are avoided in the reduced Colloquial Bamana forms of longer words given their potential to generate an impermissible iambic sequence, e.g. *yèlɛmali* → *yèlmàlí*, **yɛlɛ.mal*. In such instances, the [+hi] deletion target is clearly within a disyllabic foot. In shorter *səsɔli*-type words, it is not possible to predict whether the necessity for Vowel Syncope to act only upon vowel targets within a well-formed foot that precludes word-final [+hi] vowel deletion, or if it is the avoidance of iambic structure that is first at issue. In either scenario, however, the offending iambic sequence is avoided. In sum, it is clear that the [+hi] vowel of such words is an unacceptable target for deletion via Vowel Syncope. One can consider, however, that given the ability of word-final CVV and CVC syllables to attract prominence, they are best analyzed as well-formed unary bimoraic feet. Thus, a well-formed foot in Bamana can be either monosyllabic or disyllabic, but it must be bimoraic.

6.3.3 Derived versus non-derived long vowels

Instances can be found that support the observation that derived and phonemic long vowels in Bamana have notably different properties and participate in different ways in the language's phonological processes. While it has been motivated that *derived* long vowels resulting from Velar Consonant Deletion are bimoraic, heavy, and have a limited distribution owing to their ability to attract prominence, the properties of *phonemic* long vowels are somewhat different. Even without the telling details that would result from a

full phonetic characterization of these two sets of vowels, certain observations about their properties can be made. From a more impressionistic point of view, and in full acknowledgement that orthography is not a tool of phonological analysis, it was presented in §2.2.1 that the N’Ko orthography developed by Souleymane Kanté and discussed in White Oyler (2005) and Vydrine (1999) was created in such a way that it captures a three-way distinction between vowels – short (brisk), long (ordinary), derived long. It is unclear however, what this distinction truly captures. In terms of their distribution in Standard Bamana itself, phonemic long vowels are limited in their distribution to the first syllable of a word in monomorphs, as in those offered in (12). They are only found in other word positions in instances of compounding.

(12)

bara	‘calabash’	baara	‘work’
ferε	‘town square’	feεε	‘rag’
koro	‘small gourd’	kooro	‘to howl’
seri	‘gruel’	seere	‘witness’
surũ	‘short’	suuru	‘to pour from a height’

This distribution suggests that phonemic long vowels may be prominent in some way in terms of their length, but in comparison to their derived long vowel counterparts, the two types of vowels differ in their weight. Consider the illustrative compound in (13).

(13)

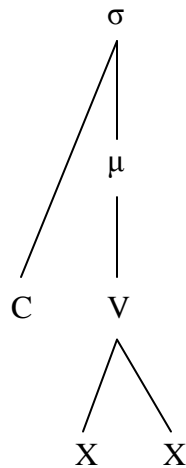
(mɔgɔ)#(tɔɔrɔ) → (mɔɔ.tɔɔ)(rɔ) ‘domestic abuse’

lit. person + problem

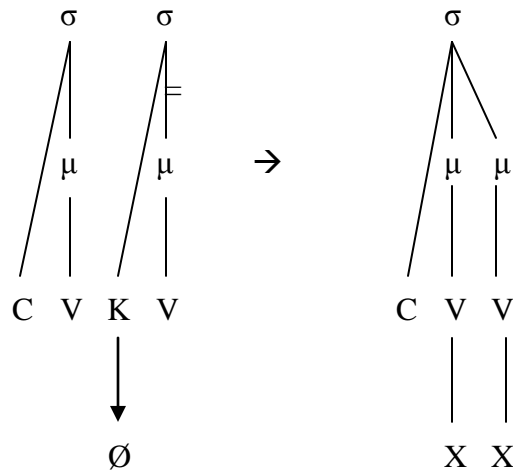
The nominal compound in (13) behaves just as we have come to expect in terms of its minimization in Colloquial Bamana. One finds that this two constituent compound permits a single instance of reduction, and the chosen reduction is that accomplished by Velar Consonant Deletion, rather than by Vowel Syncope. Drawing from the discussion of derived long vowel quantity sensitivity and prominence attraction in §6.3.1, one observes that the derived long vowel in (13) is permitted where expected in the first syllable of a foot. The phonemic long vowel, however, is permitted in the right edge position of a foot, i.e. a position where derived long vowels are banned. The noted distribution of these two vowel types leads to the observation that phonemic long vowels are phonologically light (i.e. monomoraic), while derived long vowels are phonologically heavy (i.e. bimoraic). Consider the representations of these two vowel types in (14).

(14)

(a) Phonemic CVV



(b) Derived CVV



(14a) represents a syllable containing a phonemic long vowel. As the distribution of these syllables suggests, they pattern and behave like other light syllables. The peak of these syllables, however, is twice the length of the peak of a typical CV syllable, suggesting that this vowel is associated with two timing slots (indicated by ‘X’). Phonemic long vowels, however, pattern with other light monomoraic syllables regarding their distribution and inability to attract prominence. I posit, therefore, that they are associated only with a single mora. The representation in (14b) illustrates the creation of a derived long vowel, as observed in the process of Velar Consonant Deletion. In these instances, each vowel remains associated with its own mora upon the loss of the target velar consonant and subsequent resyllabification. The resultant syllables are bimoraic and heavy, and furthermore, they maintain their length by virtue of being associated with two timing slots – one contributed from each vowel.

To be clear, it is the case in Bamana that moraicity and duration do not correlate with one another in all instances. Moras, here, correlate with phonological weight such that CV, CV: (i.e. phonemic long vowel), and word-internal CVC syllables pattern

together as light syllables and are monomoraic. CVV (i.e. derived long vowel) and word-final CVC syllables, on the other hand, pattern together as heavy syllables and are bimoraic. What is somewhat unusual here is that CV: and CVV syllables are both phonetically long. Because of this, I posit a richer structure in which the vowel of a CV: syllable is associated with a single mora but retains its association to two timing slots. Derived long vowels, on the other hand, are uncontroversially associated with two timing slots. As discussed in this thesis and elsewhere in the literature (e.g. Creissels 1992), some (but not all) speakers have lost their length contrast between short and phonemic long vowels. However, because this contrast is retained by some speakers, this peculiar pattern of syllable weight must be addressed. As shown in (14), this distribution and patterning necessitates reference to different tiers; a moraic tier for the representation of weight and a timing tier for the representation of duration.

While this configuration may not ultimately be stable, given other well-known and cross-linguistically widespread representations of moraicity and timing (e.g. X theory (Levin 1985), CV theory (Clements & Keyser 1983), Moraic theory (e.g. Hayes 1989), and Weight Unit theory (e.g. Hyman 1985)), it captures the properties of Colloquial Bamana long vowels synchronically. The behavior of long vowels in this language, however, is not entirely unique. A remarkably similar process has been reported to be underway in Seoul Korean (e.g. Kim 2008; Park 1994) in which the phonemic contrast in vowel length is being lost in this urban variety in younger speakers, but is often retained in word-initial positions, such that the underlying status of lexically specified moras and the presence of a phonetic distinction between these vowels on the surface has been called into question. Motivations for this process in Seoul Korean include the lengthening

of short vowels in prominent positions that has obscured the underlying contrast, and it has been suggested that the instability and inconsistency of contrast maintenance in younger speakers may be the result of hypercorrection. Historical changes in vowel quantity and subsequent issues of reanalysis can also be found in Seiler (2004, 2005) for a number of German and Bavarian dialects. In sum, Seiler discusses that surface quantity distinctions can be lost when length specification has been removed from the underlying representation of lexemes. These observations taken together alongside the noted behavior of phonemic long vowel syllables in Colloquial Bamana echo certain similarities. Historically speaking, short versus phonemic long vowels in Bamana contrast only in word-initial (prominent) positions, and synchronically this contrast is maintained only by some speakers. Given their distribution, I posit that, historically, phonemic long vowels were bimoraic and singleton vowels were monomoraic, as otherwise predicted by moraic theory. By some process, this contrast in underlying weight was lost such that the underlying specification for moraicity of these vowels has been neutralized or obscured. Whether via historical analogy, hypercorrection, or some other means, phonetic length has been maintained to some degree for these vowels, although, as reported, it is slowly being lost in younger speakers. It follows, therefore, that the language is reflecting the phonological loss of a mora via the patterning of phonemic long vowel syllables with other light syllables. Their length, however, appears to be a residual or vestigial phonetic effect. This phenomenon surely calls for further research.⁴

⁴ The literature on the representation of moraicity and its relationship to phonological processes and phonetic realization is quite rich. In addition to the theoretical works cited above, I refer the reader to several influential and provocative works that tackle these issues from several different perspectives,

Another important point here is that a phonemic long vowel syllable cannot be prominent in the same way that the derived long vowel syllable is, as no apparent prominence clash results between them in (13) that either prevents *mɔ̃kɔ* from reducing or alternatively forces a second reduction such as *tɔ̃rɔ* → **trɔ*. One might argue, on the other hand, that perhaps *mɔ̃kɔ* is located in its own foot in the reduced form, however such an outcome would still not explain the lack of a prominence clash between the two syllables. Thus, I posit that while both phonemic and derived long vowels attract prominence, they do so in different ways. Phonemic long vowels appear prominent due to their length, while derived long vowels are prominent due to a combination of their weight and length. For the purposes of footing and head assignment within the foot, the more prominent of two elements is preferred in the head position of the foot. As we find below in §6.4, this generalization about preferred prominence also applies in words containing no phonologically heavy syllables.

6.3.4 Avoiding prominence clashes

An important counterpart to those types of words discussed in §6.3.3 in which adjacent derived and phonemic long vowels are permitted in Colloquial Bamana can be found in words containing more than one eligible velar deletion target. As discussed in the previous section, because phonemic long vowels are not phonologically heavy, they do not create a clash of prominence when adjacent to a heavy derived long vowel. There are notable instances in Bamana, for example in nominal compounds, where both compound elements contain targets for Velar Consonant Deletion. Because we know that derived long vowels attract prominence in this language, if Velar Consonant Deletion were

among them Tranel (1991), Broselow, Chen & Huffman (1997), Gordon (2002), Downing (2005), Topintzi (2010), and Davis (in press, to appear).

permitted to apply and therefore to remove both target velar consonants, it would subsequently generate prominences on the two adjacent derived long vowel syllables. This situation however is avoided in Colloquial Bamana. Consider the illustrative examples in (15).

(15)

<u>Standard</u>	<u>Colloquial</u>	<u>Gloss</u>
a. [sì.ki#nó.kõ]	[sìi.nó.kṍ] *si.ki.nõõ/*sii.nõõ	‘neighbor’
	/siki+nókõ/ → [sìi.nókṍ], lit. to sit + together	
b. [sà.ga#sò.go]	[sàà.só.gó] *sa.ga.soo/*saa.soo	‘sheep meat’
	/saga+sogo/ → [sààsógó], lit. sheep + meat	
c. [npò.go#tí.ki]	[npòò.tí.kí] *npo.go.tii/*npoo.tii	‘maiden’
	/npogo+tiki/ → [npòòtíkí], lit. girl’s loincloth + master	

The reduced nominal compounds in (15) illustrate that, in each instance, only a single velar deletion is permitted, and thus only a single derived long vowel is permitted in the word. As expected, due to the preference in this language to avoid iambic sequences in favor of trochees, the resultant words are always of the shape (CVV.CV)(CV), as opposed to *(CV.CV)(CVV). The doubly reduced alternative *(CVV.CVV) is not permitted, thereby avoiding a clash of adjacent prominences, better known as stress clash (e.g. Goldsmith 1990; Liberman & Prince 1977; Prince 1983). The trochaic outcome of these reductions also references the overall preference in this language for the generation of left-edge complexity whenever possible.

6.3.5 Summary of characteristics

In sum, the characteristics of a foot in Bamana and the process of footing in the language are defined as follows:

- 1) Feet are maximally disyllabic, however derived CVV syllables and word-final CVC syllables are heavy and are parsed into a unary foot.
- 2) Feet are assigned exhaustively from left to right, and well-formed feet are minimally bimoraic. Monomoraic feet are degenerate and do not attract prominence.
- 3) Feet are left-headed (i.e. trochaic).
- 4) Heavy syllables obligatorily attract prominence, and thus the language is quantity sensitive.
- 5) Syllabic complexity tends toward the left-edge of the word, and thus this is suggestive that Colloquial Bamana prosodic word is also left-headed.

This is discussed further in §6.4.3 and in Chapter 7.

6.4 Foot-based evaluation of phonological processes

Phonological evaluations couched in different theoretical frameworks carry with them specific underpinnings about the ways in which rules or processes apply to a given representation. Much of the evaluation discussed in Chapters 3 and 5 of this thesis has been framed in some version of an optimality theoretic framework, either Standard Optimality Theory (Prince & Smolensky 1993/2004) or Harmonic Grammar (Smolensky & Legendre 2006). In these two particular frameworks, any appeal to seriality is removed from consideration, as evaluation is done in parallel between the input and output of a given grammar. This method of evaluation contrasts with rule-based derivational

approaches such as that utilized in a generative phonological framework (Chomsky & Halle 1968) and those introduced in more recent instantiations of Optimality Theory, namely Optimality Theory with Candidate Chains (McCarthy 2007) and Harmonic Serialism (McCarthy 2008). Modifications to these frameworks have also been incorporated to address issues that are not well-handled by standard generative analyses. Among these modifications are Lexical Phonology (e.g. Kiparsky 1982) which permits evaluation in derived versus non-derived environments, as well as the cyclic application of certain processes. Another more recent development is Stratal Optimality Theory (e.g. Bermudez-Otero 2007, in preparation) which allows for the proposal of different strata or tiers of evaluation based upon a given language's phonological and morphological properties.

In the sections that follow, I describe the application of phonological processes in Colloquial Bamana in relation to the prosodic foot. While it may be possible to capture certain characteristics of these processes in a derivational framework by referring to a serial application of processes in a foot-by-foot manner in conjunction with an ordered application of preferred processes before others, it has been shown in the earlier chapters of this thesis that the harmonic nature and intricacies of these processes can be formalized more succinctly in optimality theoretic terms. Evaluation in an optimality theoretic framework has permitted the motivation of the preferential application of [+hi] vowel versus [-hi] vowel syncope and the preferential application of Velar Consonant Deletion to Vowel Syncope, among other details, by referring to the harmonic and superlinear relationships between key constraints active in the language. It has also been suggested that the left-edge preference for complexity that becomes apparent in certain instances,

(discussed in more detail in §6.4.3) can also be captured in such a framework by referring to a type of COINCIDE constraint (Alber 2001) that compels the maximization of strong word positions, such as the first syllable. In the current section, I discuss the influences and/or restrictions offered by the higher prosodic structure of Bamana as it interacts with constraints driving phonological processes in the language, their preferential targets, and the language's morphology, thereby ultimately influencing the outcome of minimization in the language.

6.4.1 Velar Consonant Deletion

It was discussed in §6.2 that Velar Consonant Deletion is a phonological process sensitive to the presence of prosodic boundaries. This process is only permitted to apply foot-internally when a velar deletion target is flanked by identical vowels within the same prosodic domain. When a velar deletion target is flanked by identical vowels but these vowels are separated by a foot boundary or a morpheme boundary, Velar Consonant Deletion fails to apply. These three situations are illustrated in (16) through (18), respectively.

(16) Velar deletion within a foot

(sɔ.kɔ)(ma) → (sɔɔ.ma) 'morning'

(17) Velar deletion fails across a foot boundary

(mɛ.lɛ)(kɛ) → (mɛl.kɛ)/(mlɛ.kɛ) 'angel'

(18) Velar deletion fails across a morpheme boundary

{la{ka.li#ta}¹}² → {(la#kal)ta}² → (la.kal)(ta) 'news'

It has also been illustrated that when Velar Consonant Deletion and Vowel Syncope have targets within the same domain of application (i.e. the same foot) in a [+hi]

vowel word, one or the other of the two processes is permitted to occur, thereby yielding output variants. This is illustrated in (19).

(19) Velar deletion competes with vowel syncope within a foot

(si.ki)(lã) → (sii.lã)/(si.klã) 'chair'

When these two processes have deletion targets located in adjacent domains, the preferred process of Velar Consonant Deletion applies to the exclusion of Vowel Syncope. This is illustrated in (20).

(20) Velar deletion is preferred to vowel syncope

(se.li)(sa.ga) → (se.li)(saa) 'sacrificial sheep'

Furthermore, due to iterative footing, similar restrictions are in place on the application of Velar Consonant Deletion in longer words. This is illustrated in (21). Important to this particular datum is the principle outlined in Chapter 4 that only a single deletion is permitted in most two-constituent compounds found within a single morphophonological level such that, if Velar Consonant Deletion is not a permissible *first* deletion, it will not be permitted even when another deletion places a velar deletion target in what would otherwise appear to be an appropriate environment for application of the process.

(21) Velar deletion fails across boundaries in longer words

(na.fo)(lo.ti)(ki) → (na.flo)(ti.ki), *naflotii 'rich man'

In words meeting both the morphological and phonological minimality conditions for multiple deletions, it is the case that Velar Consonant Deletion is permitted to apply in the second round of deletion, as illustrated in (22).

(22) Velar deletion can apply *second* in more complex words

$\{t\acute{o}k\acute{o}\{n\acute{o}n\#b\acute{i}l\acute{a}\}^1\}^2 \rightarrow \{t\acute{o}k\acute{o}\#n\acute{o}n\acute{a}b\acute{l}\acute{a}\}^2 \rightarrow (t\acute{o}o.n\acute{o})(n\acute{a}.b\acute{l}\acute{a})$ ‘pronoun’

The representative data and their reduced Colloquial Bamana outcomes presented above illustrate that Velar Consonant Deletion is a process whose application is both dependent upon and bounded by the foot structure of the language. More importantly, these outcomes necessarily show that the input language itself (i.e. Standard Bamana) contains higher prosodic structure, although it may not have been apparent in an overwhelming number of instances (for some possible exceptions, see §6.5) until the more recent emergence of Colloquial Bamana wherein processes are now found to be dependent on it for their proper application.

6.4.2 Vowel Syncope

The application and restrictions on Vowel Syncope within a foot are more subtle than those described above for Velar Consonant Deletion. Nonetheless, compelling evidence can be found that the former process operates within certain bounds defined by this structure. We have observed that Velar Consonant Deletion is only permitted to apply when its environment for application (i.e. the identical vowels flanking the velar target) is properly located within a single foot. This is more difficult to capture in relation to Vowel Syncope, as this process results from the drive in the language to remove syllable peaks. The bounds placed on the process, i.e. margin and syllable phonotactics, are of a somewhat different nature than those bounding Velar Consonant Deletion. Despite these differences, reduced Colloquial Bamana outputs provide compelling evidence implicating foot structure in the proper application of Vowel Syncope. We have already seen the importance of foot structure in the competition between Vowel Syncope and Velar

Consonant Deletion when both processes target segments within the same domain. This competition was illustrated in (19) where the two processes result in variable outputs. Along these same lines, it was shown that within a single domain, when it is permitted by the phonotactics of the language, variation is also possible between output candidates when vowel deletion targets are identical. This is illustrated in (23).

(23) Variable vowel syncope within a domain when phonotactically permitted

(sa.ra)(ti) → (sar.ti)/(sra.ti) ‘condition’

Also important in this regard is the inability of Vowel Syncope to delete a seemingly permissible [-hi] vowel when a [+hi] vowel is found within the same domain. The language chooses instead in favor of retaining a fully faithful mapping in Colloquial Bamana from the Standard Bamana input. Representative examples are in (24).

(24) [+hi] vowel deletion is an absolute preference within a foot

- a. (du.kɛ)(nɛ) → (du.kɛ)(nɛ) *du.knɛ ‘courtyard’
 b. (ki.ba)(ru) → (ki.ba)(ru) *ki.bru ‘news’
 c. (fu.ga)(ri) → (fu.ga)(ri) *fu.gri ‘worthless person’

It is also known that Vowel Syncope is limited in its application owing to a combination of restrictions put in place by foot structure and the language’s morphology. These mutual restrictions are responsible for yielding certain regularly occurring vowel deletion patterns, such as those shown in (25).

(25)

- a. {(dɔ̃#ki)li}¹da}² → (dɔ̃.kli)(da), *dɔ̃.kil.da ‘to sing’
 b. {(ku.ma)#{(yɛ.lɛ)#ma}¹}² → (ku.ma)(yɛl.ma), *(ku.ma)(yɛ.ma)
 ‘to change one’s words’

c. $\{(s\tilde{a}\#k\text{ɔ})(r\text{ɔ}.ta)\}^1 \rightarrow (s\tilde{a}\#kr\text{ɔ})(ta)$, * $s\tilde{a}.k\text{ɔ}r.ta$ ‘to win’

d. $\{(mu.so)\#\{(k\text{ɔ}.r\text{ɔ})\#ba\}^1\}^2 \rightarrow (mu.so)(kr\text{ɔ}.ba)/(mu.so)(k\text{ɔ}r.ba)$
‘wise woman’

The words in (25) illustrate several important points about the application of Vowel Syncope. First in (25a) and (25b), the morphology of the language is such that the first level of compounding yields a reduction from CV.CV.CV \rightarrow CV.CCV. This then enters the next level of evaluation, and although no second reduction is possible, the CCV complex syllable that resulted from the first level of compounding is protected from any alteration. Thus, its CVC alternative is not attested for this word, even though reduction in analogous monomorphs, e.g. *kùlusi* \rightarrow *kùl.sí/klù.sí* ‘pants’, would otherwise yield variation.

Words like (25c) yield an interesting counterpoint to words behaving like that presented in (23). We find that in (25c), even though the morphology is less complex than in (25a,b), still only a single reduced output (i.e. CV.CCV.CV) is attested to the exclusion of *CV.CVC.CV. As with *kùlusi* \rightarrow *kùl.sí/klù.sí*, the second morpheme of (25c), *kóɾɔta* ‘to lift up’, in isolation, yields variable outcomes in Colloquial Bamana, i.e. *kórtá/kró.tá*. This illustrates that the variation characteristically found in words like (23) is permitted only when both potential Vowel Syncope targets are within the same domain of application. When the syncope targets are in adjacent domains, only a single output candidate is found, i.e. the candidate realizing Vowel Syncope in the first foot. This is yet another instance of Colloquial Bamana favoring complexity at the left-edge of a word. This observation about permissible variation is further borne out in words like (25d)

where, within the first level of compounding, variable deletions are possible within the first foot. In the result of the second level of compounding, this variability remains.

A final piece of evidence implicating the foot in the application of Vowel Syncope concerns instances of double deletion wherein only one reduction (when permitted) is allowed within a single domain. In other words, as broached in Chapter 4, a minimal phonological condition for double deletion is the presence of two well-formed disyllabic feet, with one deletion being permitted in each foot. For more on the minimality conditions for double deletion, see §4.7.2.

6.4.3 Left-edge complexity

Thus far, several characteristics of Colloquial Bamana have been presented that provide compelling evidence that the language favors the generation of complexity at the left-edge of a word as a result of minimization. First and foremost of these characteristics is the overall footing schema of the language which has been argued to consist of maximally disyllabic feet constructed iteratively and exhaustively from the left-edge of the word. As shown in the sections above, it is within these feet that reduction and therefore the generation of syllabic complexity occurs. For shorter Bamana words, such as those presented in Chapter 3, this generates particular results depending upon the specific shape and length of a word. While monosyllabic words are not reduced, and disyllabic words are reduced by a single segment (and therefore by a syllable), reduction in three syllable words allows one to witness the generation of left-edge complexity. Indeed, as input words increase in length, and thus the language has more freedom to showcase its preferred patterns of deletion, the tendency towards left-edge complexity becomes clear.

Another tendency towards left edge complexity in Colloquial Bamana is its avoidance of iambic structure. The language instead favors the generation of structures that attract prominence in the stronger left edge position of a foot. A similar situation arises, as was illustrated in §6.3.4, for words containing multiple potential deletion targets. We saw that in words containing two potential targets for Velar Consonant Deletion where importantly, only a single instance of deletion is permitted, the language always chooses in favor of deleting the target located in the first foot of the word, thereby generating a left edge heavy syllable, e.g. (CV.KV)(CV.KV) → (CVV.CV)(KV). The alternative deletion is not a permitted reduction in this situation, e.g. (CV.KV)(CV.KV) → *(CV.KV)(CVV). Even though both options would successfully avoid generating impermissible iambic sequences, the clear preference is for left edge prominence.

A similar outcome is found for words that undergo Vowel Syncope instead of Velar Consonant Deletion. We saw in Chapter 5 that words containing two disyllabic feet in which each foot has a potential deletion target for Vowel Syncope, various possibilities arise in terms of reduced outputs. It was illustrated that such words containing either two [+hi] vowel deletion targets or alternatively one [+hi] vowel and one [-hi] vowel deletion target permit multiple instances of deletion as long as the deletions both yield phonotactically permissible CCV syllables with non-identical M₂ consonants or, in even more limited instances, a CVC.CCV word via the deletion of two [+hi] vowels. It was also shown that the outcome of words differing from these only by virtue of the fact that both vowel deletion targets are [-hi] is quite different. In the latter case, only a single instance of deletion is permitted, and that deletion is always one that generates complexity in the first foot and therefore closer to the left edge of the word. Thus, all

things being equal in this situation, complexity is favored at the left edge. This choice is illustrated in (26).

(26)

$(nɛ.rɛ)(ko.lo) \rightarrow (nɛr.ko)(lo)$, * $nɛ.rɛ.klo$ ‘ $nɛrɛ$ seed’

It is important to note that the avoidance of the alternative first foot deletion candidate **nɛrɛkolo* is attributed to its violation of a second constraint militating against certain adjacent margin consonants in the syllable. Additional factors related to this observation are discussed in §3.2.2, §3.2.3, §3.5.1, and §4.3.

A final characteristic of Colloquial Bamana that stands in favor of left edge complexity concerns the outcome of certain instances of multiple deletions. It was presented in Chapter 4 that multiple deletions, and therefore the generation of multiple syllabic complexities, are permitted in words that meet specific phonological and morphological conditions. It was shown that in words meeting these conditions, the input to the second morphophonological level of compounding is subject to the same phonological rules that applied in the first level. Therefore, one observes that the same processes applying to generate preferable left edge complexity in less complex words apply again, and in some instances, they have the ability to generate additional complexity at the left edge. This situation is illustrated in (27).

(27)

$\{\{kɔlɔsi\#li\}^1kɛ\}^2 \rightarrow \{kɔlsili\#kɛ\} \rightarrow [kɔl.sil.kɛ]$, ‘lookout’

One observes in (27) that the expected reduction of $(kɔlɔ)(si\#li) \rightarrow (kɔlsi)(li)$ via the application of Vowel Syncope in the first foot of the word generates a single complex syllable in the resultant left edge domain. Then, upon the second level of compounding,

(kɔlsi)(li.kɛ), being subject to the same phonological preferences for a reduction, minimizes to *(kɔlsil)(kɛ)*, thereby introducing another instance of complexity into the resultant left edge domain.

The choice that the language makes to generate complexity at the left edge of the word is also predicted in relation to arguments offered citing the perceptual salience of strong word-initial, stem-initial, or utterance-initial positions. Works drawing from a number of typologically diverse languages have demonstrated that contrasts are often retained and/or enhanced, and complexities are often generated in these positions (e.g. Alber 2001; Frigeni 2009; Hyman 2008; Traill 1985; Zoll 1997, 1998). Colloquial Bamana is a language that follows this cross-linguistic tendency in its preference to have left edge syllabic complexity when it has a choice between generating complexity at either the left or right edge of the word. That consonantal strength is favored in initial position and is a historical and areal feature of Bamana and its closest relatives has been discussed in earlier typological work by Dwyer (1987/1988).

It is clear that the preferred generation of complexity within a foot is indicative of the left-headedness of the foot domain. The fact that Colloquial Bamana favors the generation of complexity at the left edge of a prosodic word, however, is only suggestive of the left-headedness of this higher domain. This diagnostic is not absolute, and thus further investigation is needed in order to uncover additional phonetic or phonological segmental correlates that may ultimately be indicative of this particular characteristic of the Bamana prosodic word. For additional discussion on the subject of prosodic word headedness, see §7.6. While it may be true that complexity is favored at the left edge of a word, complex syllables are not necessarily disallowed in other word positions. Rather,

such syllables are readily allowed when no permissible mechanism for driving leftmost complexity can be accommodated. Thus, it is not yet clear what, if any, prominence is associated with the generation of CCV or word-internal CVC syllables, and furthermore, cross-linguistic evidence suggests that prominence diagnostics are not uniform across the world's languages.⁵ While I have shown that length is not necessarily a correlate of prominence in Colloquial Bamana (see §6.3.3), it has been noted that one correlate of prominence is phonological weight. Future experimental studies may ultimately uncover more information about prominence in Bamana leading to a better characterization of this phenomenon in relation to the development of stress and/or accent in the language.⁶

6.4.4 Syllabic versus moraic trochees

A specification that must be addressed is the characterization of the Bamana foot as a syllabic trochee versus a moraic trochee. The distinction between these two types of trochees is helpful to explain the proper application of both noted processes of minimization active in Colloquial Bamana. These two types of trochees differ in how the structures comprising the foot are counted in the footing process. For example, in an instance like (sɔ.kɔ)(ma) → sɔ̀̀.má 'morning', the question is whether the resultant Colloquial Bamana word is footed as (sɔ̀̀.ma), i.e. syllabically, or alternatively as (sɔ̀̀)(ma), i.e. moraicly. The distinction between these two instances would be that in the first case, i.e. (sɔ̀̀.ma), the foot would be constructed by counting syllables, thereby yielding a disyllabic trochee. For the second possibility, i.e. (sɔ̀̀)(ma), a derived long vowel heavy syllable (a bimoraic syllable) would be footed on its own, as the foot would

⁵ For differing viewpoints on this issue, consider Halle & Vergnaud (1980) and Davis (1988). cf. Dinnsen & Farris-Trimble (2008) for a discussion of prominence in developing languages.

⁶ I echo the observation in Weidman & Rose (2006) that no exploration into stress and/or prominence has previously been reported in the Bamana literature. It is interesting to note, however, that Ngom (2000) asserts the presence of predictable initial stress in two varieties of Bamana's close relative Maninkakan in Senegal and Guinea-Bissau, although with minimal data and no discussion of phonetic correlates.

be constructed by counting moras (one contributed by each vowel of the derived long vowel), thereby yielding a moraic trochee. Evidence can be drawn from two specific types of words that have undergone minimization in Colloquial Bamana to support the proper definition of the Bamana foot as a syllabic trochee, rather than a moraic trochee.

A first piece of evidence favoring a syllabic trochee is in the systematic avoidance of CV.CVV and CV.CVC sequences in Colloquial Bamana. We saw in both Chapter 3 and in the current chapter that Colloquial Bamana is active in preventing deletion, whether by Vowel Syncope or Velar Consonant Deletion, when the result would yield such light + heavy sequences of syllables. If one were to assume that Bamana feet are moraic trochees, rather than syllabic trochees, one would be hard pressed to explain this outcome given the compelling evidence presented, thus far, in support of left-to-right footing in Bamana. If trochees were moraic in this language, one might expect words of the above shapes to be found. However, one would have to propose that CVV and word-final CVC syllables, as heavy bimoraic syllables, would surface as unary feet, as we have seen in other word-final instances where these syllable types are the third syllable of a Colloquial Bamana word (i.e. CV.CV.CVV and CV.CV.CVC words) or a monosyllabic word (i.e. CVV and CVC words). This would have the unfortunate result of leaving a monomoraic CV syllable footed at the left edge of a word in a language otherwise illustrating a clear preference for left-edge complexity (see §6.4.3). Proposing that Bamana feet are syllabic trochees, however, captures the observed impermissibility of CV.CVV and CV.CVC words, as well as the generalization of avoiding iambic sequences altogether without resorting to the generation of otherwise unpredicted structures or forcing an argument contrary to other noted phenomena in the language.

Another form of support for syllabic trochees can be found in certain words that have undergone multiple levels of compounding/derivation, and thus are eligible to have multiple instances of deletion. Consider the illustrative data in (28).

(28)

- a. $\{\text{t}\epsilon.\text{k}\epsilon\#\text{ka.li}\}^1\text{ya}\}^2 \rightarrow \{\text{t}\epsilon\text{kali}\#\text{ya}\}^2 \rightarrow \text{t}\acute{\epsilon}\acute{\epsilon}.\text{k}\acute{\alpha}l.\text{y}\acute{\alpha}$ ‘the swearing of an oath’
 b. $\{\text{sa.k}\acute{\alpha}\#\text{ki.li}\}^1\text{la}\}^2 \rightarrow \{\text{saakili}\#\text{la}\}^2 \rightarrow \text{s}\grave{\text{a}}\grave{\text{a}}.\text{kil.l}\acute{\text{a}}$ ‘near the sheep’s testicle’

In both (28a) and (28b), one observes words in which the constituents to be compounded within the first morphological level contain non-competing deletion targets. That is to say, one constituent contains a deletion target for Velar Consonant Deletion, while the other constituent contains a deletion target for Vowel Syncope such that the chosen deletion in both instances is that which satisfies the more preferred process of Velar Consonant Deletion. Both of these words are then eligible to undergo a second round of deletion in a second level of compounding, and in both instances, a second complex syllable is generated to yield words of the shape CVV.CVC.CV.

Recall from (23) and (25) that when a word contains two eligible Vowel Syncope targets within a single domain, barring any phonotactic restrictions, variation is possible. When the vowel deletion targets are in different domains, however, only a single variant is possible. Turning now to (28b), we can once again put this characteristic of Vowel Syncope to the test as a second diagnostic for syllabic versus moraic footing. If one assumes syllabic trochaic footing, $\{(\text{sa.k}\acute{\alpha})\#\text{(ki.li)}\}^1$ yields $(\text{saa.ki})(\text{li})$ as the output of the first level of compounding. The input to the second level of compounding, $\{(\text{saaki})(\text{li}\#\text{la})\}^2$, then yields $(\text{saa.kil})(\text{la})$, as expected. What is important to note here is that the alternative variant **saaklila* is not attested. This is an expected outcome given

that the two identical vowel deletion targets are not located within the same domain in the second level of compounding. Proposing moraic trochaic footing, on the other hand, would yield (saa)(ki.li) as the result of the first level of compounding, and thereafter, the input to the second level of compounding would be {(saa)(ki.li)#la}². With identical vowel deletion targets in the same domain, one would therefore expect that both *sààklilá* and *sààkillá* to be possible outcomes. The impermissibility of the former and the permissibility of the latter lend support in favor of a syllabic trochaic foot analysis that yields the attested outcome and away from a moraic trochaic foot analysis that yields an unpredicted outcome. For the sake of comparison, this variation is not at issue in (28a) where vowel deletion targets are non-identical. Only a single variant is predicted.

6.5 Other phenomena implicating foot structure

The sections above have illustrated the role that higher prosodic structure plays both in defining the domain of application for the phonological processes active in achieving the overall drive towards minimization in Colloquial Bamana and in placing restrictions on the type and number of minimizations that can occur within a given domain. Detailed evidence from Colloquial Bamana has illustrated that higher prosodic structure can be implicated in these specific processes; however there are at least two additional phenomena observed in Bamana that also appear to support the proposal of foot structure in the language. While I will not explore these two phenomena in detail in this thesis, I present some key generalizations about them and provide illustrative of examples of how they appear to be related to the higher prosodic structure of the language.

6.5.1 Ludlings

Language games and secret languages, better known in the linguistics literature as *ludlings*, are a crosslinguistic phenomenon (e.g. Botne & Davis 2000, and references therein), with one of the best known among them being Pig Latin. As Botne & Davis (2000) discuss, ludlings are of two main types, namely those involving the transposition of elements within a word and those involving some type of reduplication. It has been observed that ludlings of both types are used by Bamana speaking children. Importantly for this thesis, the Bamana reduplication ludling appears to reference disyllabic prosodic domains in its construction. The second Bamana ludling is somewhat different in its construction and is formed by a mirror image transposition of syllable elements. This second ludling will not be discussed further.

The Bamana reduplication ludling is observed in both words and sentences. The reduplication pattern found in this game is one which each individual syllable is selected for reduplication; however syllables containing different types of consonants are reduplicated in a slightly different way. More specifically, syllables containing sonorant consonant onsets are reduplicated in their entirety with no modifications or additions. Syllables containing obstruent onsets, however, are reduplicated in such a way that a nasal consonant is inserted in the coda of the reduplicant. This particular feature of the reduplicant suggests that the reduplicant is prefixed, rather than suffixed, to its base. Representative examples of this ludling follow in (29).

(29)

a. Reduplication ludling in the word

dà.rà.ká 'breakfast' → (dan.da)(ra.ra)(kaŋ.ka)

b. Reduplication ludling in the sentence

né bé táká ‘I am going.’ → (ne.ne)(bembɛ)(tan.ta)(kaŋ.ka)

At both the word level (29a) and the sentence level (29b), the Bamana reduplication ludling is constructed in such a way that each syllable is reduplicated to create disyllabic sequences that are similar in their appearance to the prosodic feet discussed throughout this chapter.

6.5.2 Loanword incorporation

A second noted area in which foot structure appears to have a role in Bamana is in the incorporation of French loanwords into the normative varieties of the language. Drawing from loanword data in R. Diallo (2007) and from my own collected data, a consistent pattern of their adaptation into Bamana can be observed. What is striking about this loanword incorporation is the manner in which Standard Bamana speakers resolve the many consonant clusters and word-final consonants found in French as the words are borrowed into their maximal CV language. While it is not surprising that Bamana speakers insert epenthetic vowels to break up these clusters or to generate permissible word-final sequences, the particular patterns of vowel insertion found for words of different shapes appear to be influenced by the higher prosodic structure of the language. More specifically, I propose that French loanwords are incorporated into Bamana in such a way that an empty slot is inserted between consonants of a given cluster, as well as after certain word-final consonants, to create a maximal CV grid. These words are then parsed into maximally disyllabic feet similar to that described in sections above. It is the manner in which the empty vocalic slots are filled that is of greatest interest. Consider first the words in (30).

(30)

	a. <i>drapeau</i> 'flag'	b. <i>démocratie</i> 'democracy'	c. <i>fromage</i> 'cheese'	d. <i>informatique</i> 'computing'
i. French input	[dʁa.po]	[de.mo.kʁa.si]	[fʁɑ.maʒ]	[ɛ̃.fɔʁ.ma.tik]
ii. Grid formation	d_.ra.po	dɛ.mo.k_.ra.si	f_ro.ma.z_	ɛn.fo.r_.ma.ti.k_
iii. Footing	(d_.ra)(po)	(dɛ.mo)(k_.ra)(si)	(f_.ro)(ma.z_)	(ɛn.fo)(r_.ma)(ti.k_)
iv. Epenthesis	(da.ra)(po)	(dɛ.mo)(ka.ra)(si)	(fo.ro)(ma.zi)	(ɛn.fo)(ri.ma)(ti.ki)
v. Bamana output	[darapo]	[dɛmokra:si]	[foromazi]	[ɛnforimatiki]

The incorporation of words in (30a-c) occurs in a unified fashion. From the French input (i), sounds are approximated to the most similar Bamana segment, and consonant clusters are split by an empty slot inserted between them. The input vowel is syllabified with the consonant that was the second member of the input cluster (ii). Footing then proceeds non-exhaustively to create disyllabic units (iii). Epenthesis (iv) is the key step where one can observe that, in a foot containing a C_LV sequences (where C is some consonant, and L is a sonorant but not a glide), the empty vowel slot is filled harmonically via spreading within a foot. This is seen in the first foot of (30a) and (30c), as well as in the second foot of (30b). Importantly in the second foot of (30c), one observes that spreading cannot occur within a foot across a non-sonorant consonant, and thus this slot is filled with a default vowel (usually a [+hi] vowel). Careful observation of (30d) reveals an important difference between the incorporation of this word and (30a-c). Because of the way that footing proceeds in Bamana, an input CVL_ sequence in this word is divided between the first and second foot in Bamana. One observes that, due to the presence of this foot boundary, the expected harmonic spread is not possible, and the empty vocalic slot is filled, once again, by a default vowel. The fact that this sequence is

a resolution of syllable contact sequences, rather than a complex onset, is of no matter, as it has been observed that spreading occurs as expected within a foot in the incorporation of a French word like *fourchette* ‘fork’, i.e. [fuʁʃɛt] → fu.r_.sɛ.t_ → (fu.r_)(sɛ.t_) → (fu.ru)(sɛ.ti) → [furuseti].

Instances in which harmonic spreading within a foot containing consonant-sonorant sequences fails to be observed for words in which both vowels of a foot are supplied by the input, i.e. where no cluster resolution is necessary. Furthermore, for cluster resolutions that involve sequences of consonants where the second consonant is not a sonorant, a default vowel is once again the epenthetic vowel. Representative instances of these situations are in (31a) and (31b), respectively.

(31)

	a. <i>carotte</i> ‘carrot’	b. <i>basket</i> ‘basketball’
i. French input	[ka.ʁɔt]	[ba.skɛt]
ii. Grid formation	ka.ro.t_	ba.s_.kɛ.t_
iii. Footing	(ka.ro)(t_)	(ba.s_)(kɛ.t_)
iv. Epenthesis	(ka.ro)(ti)	(ba.si)(kɛ.ti)
v. Bamana output	[karoti]	[basikɛti]

While this analysis of French to Bamana loanword incorporation does not pretend to be exhaustive, it captures the attested adaptations from a sample of over 100 loanwords and reveals compelling evidence that foot structure can be implicated to explain noted patterns of vowel epenthesis in consonant cluster resolution.

An additional phenomenon that has been proposed to be related to foot or metrical structure in Bamana is found in the analysis of attested surface tonal melodies in the language. The assignment of these melodies has been attributed by some scholars (e.g.

Bamba 1991; Leben 2002, 2003; Weidman & Rose 2006) to the presence of tonal feet in Bamana. The issue of tonal feet is discussed in more detail in Chapter 7, where similarities and differences in the characteristics of the tonal feet proposed in the works cited above and those defined in this thesis for segmental prosodic feet are contrasted.

6.6 Summary

This chapter has explored phenomena in both Standard and Colloquial Bamana that provide compelling evidence for the proposal that prosodic structure above the level of the syllable is present in this language in the form of maximally disyllabic prosodic feet. It was illustrated that processes of minimization active in Colloquial Bamana are influenced and, in some instances, restricted or prohibited by the language's foot structure, as it defines their permissible domain of application. It was further shown that this structure limits the types of syllables permitted within it, as the language actively avoids the generation of iambic sequences. Additional evidence for this structure in the processes involved in one of two types of ludlings utilized by Bamana-speaking children, as well as patterns of loanword incorporation into Bamana support this proposal. Having presented two key components of Colloquial Bamana prosodic phonology, namely its syllable and foot structure, the next chapter of this thesis explores the relationship between these components and the tonal system of the language by considering the tonal results of minimization.

CHAPTER 7

TONAL CONSEQUENCES OF MINIMIZATION

7.1 Introduction

Chapters 3 through 6 of this thesis have discussed two main components of the prosodic phonology of Bamana, namely syllable complexity and metrical structure. The final prosodic component of tone, and specifically the tonal results or consequences of the minimization processes discussed in these earlier chapters, are explored in the current chapter. Thus far, we have seen that both Vowel Syncope and Velar Consonant Deletion are segmental phonological processes in Colloquial Bamana for which there are no apparent bounds in place stemming from the tonal melody of a given word. This has been demonstrated throughout earlier chapters via data illustrating the input tone (either H or L) on the first syllable of a Standard Bamana word, as well as the complete surface tonal melody found on the Colloquial Bamana output. The tone associated with the first syllable of a Standard Bamana word was provided alone given that the general tonal scheme or melody can be determined for approximately 90% of all Bamana words simply by knowing the nature (i.e. H or L) of this first syllable (e.g. Dumestre 1987). The melodies found on this higher percentage of words in the language have been defined as *major* tonal schema. The melodies found associated with the remaining 10% of words are defined as *minor* tonal schema, and it is these schema that have spawned a great deal of disagreement and controversy in the Bamana tonal literature. As demonstrated below, even among major tonal schema words, some intricacies of their surface tonal patterns are not quite as predictable as these percentages lead one to believe. More specifically, it

appears that while the tonal melody assigned to a word has little bearing on the application of a relevant phonological process, the same cannot be said for the relationship between segmental structure and the tonal melodies found on a given word. Several instances are discussed in this chapter where certain tonal melodies are absent on words of specific types. Nonetheless, as stated, the application of Vowel Syncope and Velar Consonant Deletion is entirely independent of tone, however the nature of these processes (i.e. the types of segments and environments that they act upon) has an important bearing on how the language's tonal melodies are expressed in the Colloquial variety of the language.

In this chapter, data from both Standard Bamana and Colloquial Bamana are presented illustrating the tonal outcome of minimization for words of various shapes, sizes, morphological makeup, and tonal melodies. It is demonstrated that the surface tonal melodies found in Colloquial Bamana are both reduced in number and simplified in type in comparison to those reported in earlier work on Standard Bamana. The issue of defining the language's *tone bearing unit* and its relationship to the *tonal word melody*, as well as a consideration of Colloquial Bamana's status as a lexical tone language will be discussed. Furthermore, the chapter reports on important issues such as the presence of tone bearing sonorants as a result of minimization in certain word positions and the maintenance of seemingly unusual tonal patterns that result only from derivation via prefixation. The concepts of *tonal feet*, *affaissement*, *abaissement*, and *tonal compactness* that were introduced in Chapter 2 are revisited and discussed with new insight offered from the results of minimization in Colloquial Bamana. Finally, a preliminary trajectory

of minimization from both segmental and tonal perspectives is considered for the language.

7.2 Surface tonal melodies

The surface tonal melodies found on Standard versus Colloquial Bamana words differ quite significantly when considering the outcomes observed in the Colloquial Bamana data collected for this thesis. This becomes clear when Colloquial Bamana tonal contours are viewed alongside those tonal contours reported in the earlier Bamana tonal literature (e.g. Creissels 1992; Dumestre 1987; Rialland & Badjimé 1989), which presumably capture the tonal characteristics of one or more older and more historically conservative varieties of the language. Laying aside the finer details of arguments for and against L tone assimilation versus dissimilation, these earlier works (and others) discuss the general differences between underlyingly H and L melody words in Bamana. Put simply, the debate about the tonal specification of these words concerns whether words are H versus L (with LH generated via dissimilation or polarization) or whether they are properly H versus LH (with LL generated via assimilation). This analytical issue and others regarding Bamana tone were outlined in Chapter 2 of this thesis.

In the current chapter, I adopt a somewhat modified assimilationist viewpoint reminiscent of Courtenay (1974), Rialland & Badjimé (1989), and Dumestre (1987), in which Bamana words associated with LH tonal melodies and surface as LL as a result of assimilation via rightward L tone spreading in certain environments – a process known in the Bamana tone literature as *affaissement*, i.e. ‘settling’. The assimilationist viewpoint is couched in more widely accepted principles of tonal phonology (e.g. Hyman 2007; Hyman & Schuh 1974) in comparison to dissimilation analyses (e.g. Bird 1966; Creissels

1978; Diarra 1976) or tone polarization analyses (e.g. Dwyer 1976) that have similarly been proposed for Bamana. This assimilationist viewpoint is complemented by ideas laid forth in Leben (2002, 2003) and Weidman & Rose (2006) concerning *tonal feet*, as well as by what has been reported in this thesis about the presence of segmental feet in the language.

For the sake of clarity and to assist the reader, I briefly describe here the set of assumptions that I make regarding the inventory of tonal melodies found specifically in Colloquial Bamana, as well as their patterns of association. Motivations for these assumptions will become clear as the discussion in this chapter progresses. While I shall not argue for the status of major versus minor tonal schema in Standard Bamana (and other normative varieties), I refer the reader to Chapter 2 of this dissertation for additional discussion on this topic and references to other relevant literature. For Colloquial Bamana, I posit that, with few exceptions, lexemes are underlyingly assigned one of two lexical tonal melodies, namely H or LH. Following from discussion in Leben (2001, 2003) and what I have uncovered in Colloquial Bamana, these tonal melodies are a property of the tonal foot. The constituent tones of each melody are assigned left-to-right within a tonal foot following the conventions discussed in this chapter. Tonal association does not spread autosegmentally beyond a foot boundary. This is a necessary proposition given the dynamics of *affaissement* discussed below. For a few exceptional cases, I posit that certain particles (e.g. the third person singular pronoun *à* and the copula *dòn*) are pre-linked to their tone, thus accounting for their immunity to certain tonal processes. With these basic assumptions in place, I begin by considering a comparison of H and LH tonal melodies on words in Standard versus Colloquial Bamana.

7.2.1 Standard Bamana monomorphs

As stated above, the Bamana tonal literature reports that approximately 90% of words in the language are associated with one of two major tonal melodies, i.e. H vs. L(H), generally speaking. Consider first the surface tonal melodies for major schema words in Standard Bamana monomorphs containing one to three syllables in (1).¹ For the moment, I put aside those words containing phonemic or derived long vowels in their first syllable.

(1) Standard Bamana major scheme words

<u>H</u>			<u>L(H)</u>		
ćv	dá	‘mouth’	cǔ	fǎ	‘father’
ćvćv	dílá	‘to put’	c̀vc̀v	mùsó	‘woman’
ćvćvćv	bárámá	‘to praise’	c̀vc̀vc̀v	nàfóló	‘wealth’
			c̀vc̀vc̀v	màrifá	‘gun’

It is clear that two simple yet distinct tonal contours are possible for these words. Words either surface with a H melody or with some instantiation of a LH melody. Importantly, words that have a H tonal melody, i.e. their first syllable has a H tone, carry H tone through the word, regardless of their length. Words that have a LH tonal contour, i.e. their first syllable has a L tone, can have slightly different outcomes. Monosyllabic LH contour words permit both tones to surface on a single light monomoraic CV syllable. Disyllabic LH contour words witness one tone associating to each of the word’s two

¹ Throughout this chapter, I utilize both nouns and verbs in data sets that I posit are both properly specified as H or LH underlyingly. It is convention in some of the Bamana tonal literature to list L nouns as LH and L verbs as all L. This practice appears to have arisen due to the tonal alternations reportedly triggered by the presence or absence of the floating L tone definite marker in noun phrases. Following from an assimilationist perspective, I find no independent evidence to suggest that the tonal melody assigned to L verbs is any different from that assigned to L nouns. Both L nouns and L verbs, at least among Colloquial Bamana speakers, are subject to the same processes of *affaissement*, *abaissement*, and *tonal compactness*, and they behave similarly in similar tonal environments. There is no compelling reason to assume that L tone entities in these two lexical classes are assigned different tonal melodies.

vowels. Trisyllabic LH words surface with either LLH or LHH contours. LHH contours are far less common than LLH contours and appear to be generally restricted to words of certain shapes, as discussed further in §7.2.3. The particular surface tonal behavior of these trisyllabic LH words is a major contributing factor behind Leben's (2002, 2003) proposal for disyllabic tonal feet in Bamana – a point that we shall return to in §7.5. An important observation to make is that, for all words, a H tone is always associated to the final syllable of the word, at least prior to the application of any postlexical tonological rules (e.g. *affaissement* or *abaissement*) that have the effect of altering surface tonal contours.

One also finds Standard Bamana words that contain either a phonemic long vowel or a derived long vowel (via a more conservative process of Velar Consonant Deletion than observed in Colloquial Bamana) in their first syllable, or indeed in their only syllable in the case of monosyllabic words. Words containing phonemic long vowels are less common in Bamana, and, as implied by their name, derived long vowels are the result of a phonological process. It was shown in Chapter 6 that phonemic and derived long vowels contain notably different properties, particularly in terms of their moraic structure. It was illustrated that while both phonemic long vowels and derived long vowels are of roughly equivalent lengths by virtue of both occupying two timing slots, phonemic long vowels are associated with only a single mora, and thus the syllables to which they belong pattern with other light syllables in the language, i.e. they do not create prominence clashes. Derived long vowels, however, retain moras from each of their original vowels, and thus they are bimoraic. The syllables to which they belong are heavy. The details of this distribution and the properties of these vowels are discussed

further in §6.3.3. Consider the tonal contours on representative phonemic and derived long vowel words in Standard Bamana in (2) and (3), respectively. Once again, H and LH patterns are found. Because phonemic long vowels are not generally written in the Bamana orthography, I use a ‘long’ diacritic (:) to indicate length on these vowels.

(2) Phonemic long vowel words

c̣ṿ:	bá:	‘mother’	c̣ṿ:	fã:	‘insanity’
c̣ṿ:c̣ṿ	gá:ri	‘thread’	c̣ṿ:c̣ṿ	fã:mũ	‘to understand’

(3) Derived long vowel words

c̣ṿṿ	táá	‘to go’	c̣ṿṿ	fãá	‘to kill’
c̣ṿṿ:c̣ṿ	dóó.kun	‘week’	c̣ṿṿ:c̣ṿ	sòò.má	‘morning’

It is observed from the tonal contours on the words in both (2) and (3) that these words follow precisely from the same two types of major tonal schema seen on the short vowel words in (1). We observe, once again, that H scheme words surface with an ‘all H’ tonal melody, while LH scheme words surface with a LH melody on all word types, regardless of their length. Derived long vowel words of the shape c̣ṿṿc̣ṿ (i.e. LHH) are not observed in the language.

A significant number of minor tonal schema have also been reported in the literature and are summarized in Dumestre (2003) for speakers of Ségou Bamana. These schema deviate remarkably from the H versus LH melodies found in displays (1) through (3), with LH contours, for example, being reported on single syllables in any word position. It is unclear to what extent these minor melodies can be found in the speech of individuals from different Bamana-speaking towns and villages, however it has been stated that such melodies tend to vary even within productions by the same speaker.

Furthermore, many of these minor schema are often associated with words referring to particular species of flora and fauna, and thus such words may not be present in the lexicon of all speakers. If nothing else, one can surmise from Dumestre’s observations that these minor tonal schema are somewhat unstable even in normative Bamana varieties. Note, however, that there exist several well-known and widely-used Bamana words (e.g. *mángòró* ‘mango’ HLH, *tásàlén* ‘teapot’ HLH, *dórǒmé* ‘five francs’ HLHH) that are reported to have minor tonal melodies. These and similar words afford one the opportunity to assess the presence and stability of these melodies in Colloquial Bamana.

7.2.2 Colloquial Bamana monomorphs

Monosyllabic Colloquial Bamana words permit the same basic tonal melodies found in the Standard variety of the language, i.e. H and LH, regardless of whether the word is a faithful mapping from the Standard variety or if the word has emerged via Vowel Syncope or Velar Consonant Deletion. Monosyllabic words of the shapes CCV, CVC, and CVV (containing a derived long vowel) result from these processes, with the phonotactic limitations and restrictions discussed in Chapter 3 taken into consideration. The tonal contours of representative Colloquial Bamana monosyllabic words in isolation are provided in (4).

(4) Tonal contours on Colloquial Bamana monosyllabic words

- | | | | | |
|----|------|-----|--------------|----------------|
| a. | ć | dá | ‘mouth’ | |
| b. | cǔ | gǒ | ‘girlfriend’ | |
| c. | ć: | bá: | ‘mother’ | |
| d. | cǔ: | bǎ: | ‘dad’ | |
| e. | ćv́ | súú | ‘market’ | from SB [súkú] |

f.	c̀v̀	m̀ò	‘person’	from SB [m̀òk̀ó]
g.	cc̀v̀	fr̀á	‘to tear’	from SB [f̀ár̀á]
h.	cc̀v̌	dľ	‘beer’	from SB [d̀òl̀ó]
i.	cc̀v̌	fľ	‘peer’	from SB [f̀iľ]
j.	c̀v̀c̀	s̀él	‘prayer’	from SB [s̀él̀í]
k.	c̀v̀c̀	f̀ál	‘donkey’	from SB [f̀ál̀í]

The data in (4) illustrate that the inventory of monosyllabic word shapes in Colloquial Bamana is more numerous than that found for the Standard form of the language seen in (1) through (3) above. This stems from the fact that the minimization processes in the language, and Vowel Syncope in particular, have created several new syllable types that are not found in normative Bamana varieties. Examples (4a-d) illustrate basic monosyllabic words found in identical forms in both Standard and Colloquial Bamana. Examples (4e-f) show monosyllabic words containing derived long vowel syllables that have resulted from Velar Consonant Deletion. The difference in Colloquial Bamana, however, is that this process is free to apply between identical vowels of any height. Examples (4g-k) showcase CCV and CVC monosyllables that have resulted from the application of Vowel Syncope. (4g-i), in particular, illustrate the Colloquial Bamana outcome when Vowel Syncope removes the first vowel of an input disyllabic word. In the case of H contour words, the resultant contour is also H on the Colloquial Bamana monosyllable. For LH contour disyllabic words, i.e. c̀v̀c̀, upon the application of Vowel Syncope, the resultant monosyllabic word emerges with a LH contour, i.e. cc̀v̌. Thus, the entire LH melody is stable and reassociates to the resultant syllable, even though the syllable is monomoraic. Regarding CVC monosyllables, there

are additional restrictions in place on their distribution, as discussed in Chapter 6. As (4j-k) show, the only CVC monosyllabic words possible in Colloquial Bamana are those that result from the loss of a [+hi] vowel in word-final position when a [-continuant, -nasal] sonorant coda can be created. Other sonorants are permitted in the coda of CVC syllables in word-internal positions, as illustrated further below. Important here is the fact that word-final sonorant codas are contextually heavy and therefore bimoraic. By virtue of being moraic, these sonorants permit tonal association, as is clear in words like (4k) containing LH contours, where a H tone is found on the word-final sonorant. In these monosyllabic words, one does not observe an increase in tonal complexity corresponding to an increase in syllabic complexity. Rather, the same tonal melodies are simply mapped onto a fewer number of syllables.

It is helpful to mention at this juncture that sequences of a L tone followed by two successive H tones in both Standard and Colloquial Bamana are susceptible to the well-known tonal process of *affaissement* or ‘settling’ that acts to generate LLH sequences from LHH sequences when the syllables associated with one or more of these tones are separated by a boundary. As Leben (2002, 2003) suggests, and the Colloquial Bamana data presented in this chapter support, *affaissement* readily occurs across a tonal foot boundary within a single morpheme. One can consider *affaissement* to be a natural diachronic tonological process of assimilation accomplished via rightward bounded L tone spreading (Hyman 2007; Hyman & Schuh 1974). Important here is the fact that LH contour words are subject to *affaissement* in instances where they are followed by a H tone word such that they surface as L. This phenomenon is illustrated in (5).²

² It will become clear in this chapter (similar to what was argued in Chapter 6 for foot structure), that the Standard Bamana input to Colloquial Bamana is specified for tone. This proposition is most apparent in

(5) *Affaissement* generates surface “all L” words

- | | | | |
|----------------------------|---|-------------------------|----------------------|
| a. /cě dǒ/ | → | [cě dǒ] | ‘It is the man’ |
| b. /cě té/ | → | [cè té] | ‘It is not a man’ |
| c. /màrfǎ dǒn/ | → | [màrfǎ dǒ] | ‘It is the gun’ |
| d. /màrfǎ té/ | → | [màrfǎ té] | ‘It is not a gun’ |
| e. /nàmàsá flǎ bé n bǒlól/ | → | [nàmàsá flǎ bé n bǒlól] | ‘I have two bananas’ |

A comparison of (5a-b) and (5c-d) shows parallel examples for words of different lengths containing LH contours before an adjacent L or H word. In the instances where a LH contour word is followed by an adjacent L word (e.g. 5a and 5c), no conditioning environment exists to trigger *affaissement*, and thus the input words retain a LH contour in their surface phonetic forms. The outcome is quite different for these same words when they are followed by an adjacent H word. As (5b) and (5d) illustrate, the process of *affaissement* applies to input sequences of LHH across a morpheme boundary, thereby yielding a resultant LLH sequence. The application of *affaissement* is shown in a longer phrase in (5e).

Turning next to disyllabic Colloquial Bamana words that stem from input trisyllabic Standard Bamana words, we find once again that a number of new word shapes are possible that contain a complex syllable. Recall that within a single level of the language’s morphophonology, with few exceptions, only a single instance of minimization via Vowel Syncope or Velar Consonant Deletion is permitted. Consider the following disyllabic word shapes and their accompanying tonal contours in (6) that are found in Colloquial Bamana.

the noted restrictions on tonal contours associated to certain segmental strings, as discussed in the current section and in §7.2.3.

(6) Tonal contours on disyllabic Colloquial Bamana words

- | | | | | |
|----|-----------|---------|------------|------------------|
| a. | ćv.ćv | ká.bá | ‘hammer’ | |
| b. | c̀v.c̀v | gà.fé | ‘book’ | |
| c. | ćv:ćv | bá:sí | ‘couscous’ | |
| d. | c̀v:c̀v | kò:rí | ‘cotton’ | |
| e. | ćv́v.ćv | lóó.má | ‘handful’ | from SB [lókómá] |
| f. | c̀v̀v.c̀v | jàà.mí | ‘mixture’ | from SB [jàgámí] |
| g. | cćv.ćv | srá.ká | ‘alm’ | from SB [sáráká] |
| h. | cc̀v.c̀v | dl̀ò.kí | ‘shirt’ | from SB [dùlòkí] |
| i. | ćvc.ćv | bál.má | ‘kin’ | from SB [bálímá] |
| j. | c̀vc.c̀v | màr.fá | ‘gun’ | from SB [màrifá] |
| k. | ćv.cćv | há.klí | ‘thought’ | from SB [hákílí] |
| l. | c̀v.cc̀v | sà.fné | ‘soap’ | from SB [sàfiné] |
| m. | c̀v.cc̀v | mì.srí | ‘mosque’ | from SB [mìsírí] |

Beginning with words like (6a-d), one observes that identical contours are found on such disyllabic words in both Standard and Colloquial Bamana. Furthermore, as a result of Velar Consonant Deletion between identical vowels of any type in words like (6e-f), derived long vowel syllables containing H and LH melodies are found in Colloquial Bamana. There is an unexpected absence of Standard Bamana words containing LHH tonal contours associated to segmental strings of $CV_\alpha KV_\alpha CV$ (granted that LHH is a less common tonal melody), where K is a velar consonant, in monomorphemic words. The absence of such a tonal melody foregoes the potential creation of a $c̀v_\alpha v_\alpha.c̀v$ melody upon the application of Velar Consonant Deletion. Recall,

however, that $c\grave{v}_\alpha\acute{v}_\alpha$ syllables resulting from Velar Consonant Deletion are readily found in monosyllabic words. Examples like (6g-h) illustrate that $ccv.cv$ words associated with H or LH contours are created in Colloquial Bamana via the application of Vowel Syncope on the first vowel of a three syllable input. While both representative contour possibilities are attested, i.e. $cc\acute{v}.c\acute{v}$ and $cc\grave{v}.c\acute{v}$, it is observed that the LH contour in these words arises only from LLH sequences. As with the velar deletion outputs above, one is hard-pressed to find an input Standard Bamana LHH word of a segmental shape necessary to generate a $ccv.cv$ sequence in Colloquial Bamana. The outcome is quite similar in $cvc.cv$ words like (6i-j). These words result from Vowel Syncope when it acts upon the second syllable vowel of a Standard Bamana word. As in other instances, one finds that both H and LH contours are attested, however, like $ccv.cv$ words, there is a restriction on the tonal melodies of the words that associate with these contours. For $c\acute{v}c.c\acute{v}$ outputs, the only possible input, as expected, is a H contour word, i.e. $c\acute{v}.c\acute{v}.c\acute{v}$. For $c\grave{v}c.c\acute{v}$ outputs, once again, one observes that the Bamana tonal system is restricted in such a way that words with a LHH contour, i.e. $c\grave{v}.c\acute{v}.c\acute{v}$, are not those that reduce to yield $ccv.cv$. LHH contour words, however, generate $c\grave{v}.cc\acute{v}$ words, as otherwise expected. Importantly, both [+continuant] and [-continuant] sonorant consonants can occupy word-internal coda positions in Colloquial Bamana, but their constituent syllables are light and monomoraic, and hence their sonorant codas do not permit tonal association. Unlike the previous examples that illustrate specific restrictions on tonal association conventions in Bamana, examples like (6k-m) show that words with input tonal melodies HHH, LLH, and LHH all have the ability to yield $cv.ccv$ words in Colloquial Bamana. In the case of HHH contour words, the result once again is an all H contour. The result for

both LLH and LHH input words is $c\grave{v}.cc\acute{v}$. No second syllable LH contour is found on the outputs from LLH input words, i.e. $*c\grave{v}.cc\check{v}$, and likewise, no first syllable LH contour is found on the outputs from input LHH words, i.e. $*c\check{v}.cc\acute{v}$. Further discussion on the three segmental-tonal anomalies noted in this section follows in §7.2.3. Similar to the discussion provided above for monosyllabic words, the process of *affaissement* readily yields disyllabic words that surface with a LL tonal contour, given the proper conditions.

7.2.3 LHH melodies

It was identified above that there exist three specific shapes of trisyllabic words that cannot associate with a LHH tonal contour. Thus, it follows that Colloquial Bamana outputs are only possible when stemming from a reduced subset of input LHH contour words. It was found that a very limited number of monomorphemic words containing the input segmental strings $CV_{\alpha}KV_{\alpha}CV$ (where K is some velar consonant) and $CVRVCV$ (where R is some sonorant consonant) permit association of LHH tonal melodies. These are almost exclusively French and Arabic borrowings. Other words permitting this particular melody contain some *strong* consonant in the onset of the second syllable, for example the Standard Bamana words *bànfúlá* ‘man’s hat’, *bùtúrú* ‘large basket’, and *tàsáí* ‘to be nauseous’. Words containing a LHH melody can also be found where the second syllable onset contains a *strong* voiced obstruent, such as *bàdígí* ‘hair pin’, *sàbárá* ‘sandal’, *jògírí* ‘to kneel’, and *kàbúsí* ‘airgun’.³ The observation that Bamana contains strong versus weak consonants and indeed restrictions on the association of certain tonal melodies to words of specific shapes was discussed in considerable detail by Dumestre

³ This particular observation is important in Bamana, as it illustrates that the generation of LLH contours is not due to a depressor consonant effect. While voiced obstruents are among the best known depressor consonants, it has been shown here that H tones are still possible on voiced obstruent initial syllables. Thus, surface distribution of tones noted below is clearly an effect of higher prosodic structure, and specifically the phonological weakness of particular word positions. For more on various types of depressor effects, see Bradshaw (1999), Odden (2007), Lee (2008), and references therein.

(1987). Dumestre similarly identified that a LHH melody, in particular, is not arbitrarily assigned to trisyllabic Bamana words in a way reminiscent of the unpredictable assignment of other H versus LH melodies. He described the remarkable tendency for the LHH melody to be avoided on trisyllabic words containing a *weak* consonant (e.g. a sonorant) in the onset of their second syllable.

It has been presented in this thesis, that the second syllable is a non-head and therefore phonologically weak position of a segmental foot. In trisyllabic words, this position is flanked by two strong phonological positions, namely the heads of adjacent feet. It stands to reason that the combination of phonetic weakness of these consonants (as suggested by Dumestre) and the phonological weakness of the position of these consonants in a segmental foot (as presented in this thesis) results in exceptional tonal association to syllables in this position. By virtue of the weakness of this position, I posit that these words are LHH underlyingly (due to the association of a LH melody to the tonal foot) but that the weakly associated second syllable tone is subject to *affaissement*, e.g. (LH)(H) → (LL)(H), across a tonal foot boundary. Thus, the weak syllable/consonant combination is assigned its surface tone by way of assimilation through rightward L tone spreading, and thus the melody on such trisyllabic words surfaces as LLH. Given these restrictions, *cc̀̀.ć́* or *c̀̀c.ć́* words are derived from *c̀̀r̀̀ć́* and never from **c̀̀r̀̀ć́*. For more on the role of tonal feet in tone association, see §7.5.

Another noted segmental-tonal restriction is the avoidance of LHH Standard Bamana words of the shape *c̀̀_αk̀̀_αć́*, where a velar consonant is flanked by identical vowels and therefore is a target for Velar Consonant Deletion. While Dumestre (1987) discusses to some degree the unusually *weak* behavior of velar consonants in some word

positions, he does not attribute this phenomenon to any particular phonological characteristic of the language. In most instances, velar consonants should otherwise be considered *strong* and should pattern with other *strong* obstruents. This, however, appears to be a specific instance in which velar consonants are weak, and thus such words exhibit the same types of tonal contour association avoidance witnessed above for sonorant consonants in weak phonological positions. Thus, Colloquial Bamana words of the shape $c\grave{v}\grave{v}.c\acute{v}$ are always the result of the application of Velar Consonant Deletion upon $c\grave{v}_\alpha k\grave{v}_\alpha c\acute{v}$ words.

It has been shown in previous chapters that Velar Consonant Deletion is a process that applies only to foot internal velar consonants. Instances can be found, however, where a velar consonant appears to be flanked by identical LH vowels, i.e. $c\grave{v}_\alpha k\acute{v}_\alpha$, but these instances are often the result of prefixation of certain morphemes, for example the *ma-* causative or other L tone derivational morphemes whose affixation places velar consonants into a second syllable position. In these and similar instances, Velar Consonant Deletion fails to apply, as the process cannot occur over a morpheme boundary.

It follows from these observations that one should be able to find $c\grave{v}.cc\acute{v}$ words in Colloquial Bamana that result from Vowel Syncope acting upon the second syllable vowel of an input word where the onset of the third syllable is a sonorant consonant. The overall phonotactics of the language, of course, must be taken into consideration. Input strings of CVCVRV, where R is some sonorant, can be associated to either a LHH or a LLH melody. In such words, the strong consonant in the onset of the second syllable is not subject to *affaïssement* across the tonal foot boundary and thus retains its association

to a H tone in LHH words. It is observed, therefore, that *c̀v̀.cćv* words result from input sequences of both *c̀v̀.̀c̀v̀.́c̀v̀* and *c̀v̀.́c̀v̀.́c̀v̀*.

The behavior of strong versus weak consonants in weak phonological positions provides additional support for the characteristics of both segmental and tonal feet in Bamana. The systematic avoidance of specific tonal melodies in similarly constructed words provides an effective explanation for the noted lacunae.

7.2.4 Minor tonal melodies

It has been reported in the literature that a number of minor tonal melodies are found in certain dialects or varieties of Bamana. The presence of these minor melodies has spawned a great deal of controversy over the most appropriate analysis by which to capture the gamut of tonal contours attested in the more conservative varieties of the language. Components of several of these analyses were outlined in Chapter 2 of this thesis. While the vast number of Bamana words associated with minor tonal schema are those referring to flora, fauna, reduplicated words, and certain polymorphemic derivatives, there exist other well-known words in the language that are reported to possess such contours. In order to address the presence or absence of minor tonal contours in the synchronic state of Colloquial Bamana, a number of these attested well-known words were elicited from speakers. In each instance, no evidence could be found indicating that a minor tonal contour has been retained for these words. Furthermore, the tonal contour found in the Colloquial Bamana words corresponded to that which would result from the first tone of the input word. For example, a HLH input word like *tásàlén* ‘teapot’ surfaced in Colloquial Bamana with an all H melody, thereby neutralizing the minor tonal contour. Similarly, a HLH input word like *mángòró* ‘mango’ surfaced in

Colloquial Bamana with a H melody, i.e. *mángró*, once again neutralizing the attested minor tonal contour of the input. An even more complex HLHH minor scheme found on a word like *dórǒmé* ‘five francs’ similarly yields a H melody. These possible outcomes follow from all input minor scheme words elicited and therefore suggest that the minor tonal melodies reported for Standard Bamana words have been neutralized and perhaps lost altogether for these younger Colloquial Bamana speakers. The exception to this is words created via prefixing derivation, as discussed further below.

An interesting comparison can be made to the discussion in Dumestre (1987) in which the author, in explaining the behavior of minor tonal schema words, points out that even among the tonal variants found in the contours of these words, the tone of the first syllable remains consistent. Thus, one can draw a parallel between the noted retention of first syllable tone in Standard Bamana variants and the outcome in Colloquial Bamana of speakers generalizing or neutralizing the tonal melody for minor tonal schema words to the tone of the first syllable. As introduced in Chapter 2 and discussed further below in §7.2.5, the well-known process of *compacité tonale* or tonal compactness is yet another instance in which the tone associated to the first syllable of a word plays an important role in determining the melodic outcome of that word. It has already been demonstrated throughout this thesis that the first syllable position in Bamana is a phonologically strong position that occupies the head of a segmental foot, and arguably the head of the prosodic word. Drawing from these tonal observations, one can argue that this position is also strong tonally and may very well indicate the importance of foot headedness in tone assignment and that tonal feet in this language are best defined as left headed and constructed from the left edge of a word, i.e. in parallel to segmental feet.

Although the vast majority of Colloquial Bamana words surface with either a H melody or some instantiation of a LH melody, specific instances can be found in which certain other tonal melodies can be witnessed. These other melodies, however, result from defined phonological processes and instances of derivation via prefixation. It has already been discussed that, in certain environments, input LH contour words can surface in both Standard and Colloquial Bamana with a LL melody owing to the process of *affaissement*. That these melodies can still be found in the appropriate conditioning environment in the Colloquial variety of the language provides strong evidence that this process of tonal assimilation remains active in the phonology of younger speakers. Similarly, often in utterance-final position, H tones are often subject to a process of *abaissement* that renders them L.

Derivation via prefixation generates instances of unusual tonal contours that deviate from typical H and LH melodies. Certain particles and morphemes in Bamana appear to be pre-associated to a generally inalterable tonal melody. The copula marker *dòn* and the negative aspect marker *té*, for example, are pre-associated to L and H tones, respectively. Similarly, the two prefixing causative markers *lá-* and *mǎ-* are also pre-associated to their respective tone. Upon derivation via these particular markers, it is common to find surface melodies such as HLH (e.g. *lácèná* ‘to beautify’) and LH LH (e.g. *mǎsòró* ‘to obtain’). Furthermore, the *mǎ-* causative prefix is subject to *affaissement* when it is followed by a H tone word, thereby yielding a derived LHH melody (e.g. *màsúamá* ‘to calm’). In each instance, the derivational prefix retains its tone, and the word’s tonal association conventions proceed as usual. These words, however, are not subject to tonal compactness. A similar outcome is observed for certain other nouns that act as verbal

prefixes in some instances of derivation. Two notable and representative examples are the prefixes *dá* ‘mouth’ and *nǝ* ‘trace (n.)’. When prefixed derivationally, e.g. *dáminé* ‘to begin’ (lit. ‘to seize the mouth’) and *nǝbilá* ‘to abandon’ (lit. ‘to leave the trace’), these abstract or phrasal concepts do not behave tonally like other words. While such words are not tonally compact, they are subject to *affaissement* in a manner similar to the causative suffixes above.

7.2.5 Tonal compactness

The presentation of data and discussion in §7.2 has, for the most part, focused on monomorphemic Bamana words. It has been shown that despite the historical presence of a number of minor tonal schema in the language, the Colloquial variety of Bamana has generalized or neutralized nearly all of its surface tonal melodies either to H or some instantiation of LH. Variations on these melodies are due to the application of phonological processes, e.g. *affaissement*, or to derivation via prefixation. Turning next to polymorphemic words in the language, it is clear from the collected Colloquial Bamana data that a common process of *compacité tonale* or tonal compactness described at length in the literature (e.g. Courtenay 1974; Creissels 1978, 1988, 1992; Dumestre 1984, 1987, 2003) still applies in this non-standard Bamana variety. Tonal compactness is a morphotonological phenomenon witnessed in a large variety of Bamana words that have undergone compounding and/or derivation via one or more rounds of suffixation. As Dumestre (2003) summarizes, and as has been shown briefly for causatives above, not all polymorphemic words are subject to tonal compactness. This process has been explained most simply as one by which non-initial tones are neutralized in a given polymorphemic word such that their resultant tonal melody matches the schema of the tone associated to

the first syllable of first morpheme of the word. Representative examples of tonal compactness in Colloquial Bamana are provided in (7). Thus, if the first syllable of the first morpheme of a polymorphemic word carries H tone, the entire word carries H tone throughout, thereby resembling a typical H melody word, as in (7a). If the first syllable of the first morpheme of a polymorphemic word carries L tone; however, each vowel will be assigned a L tone up until the final morpheme, whose vowels will be assigned H tone. This is shown in (7b). This, therefore, resembles a typical LH melody word. Tonal compactness occurs in this manner regardless of the underlying tonal specification of the other constituent morphemes of the word. Importantly, as illustrated in (7c), the tonal conventions observed elsewhere in the language regarding tone stability hold in instances of tonal compactness such that the removal of the first syllable peak (whose tone drives the resultant tonal scheme of a compound) do not result in the complete tonal reversal of the entire compound, i.e. /sìná + mùsò/ → [snàmúsó], *[snámúsó].

(7) Tonal compactness in Colloquial Bamana

a. /fúrá+fè:rè+yóró/ → [fráféryóró]

lit. medicine + to sell + place, ‘pharmacy’

b. /lě̀búru+kùmú+ní/ → [lě̀brùkùnnín]

lit. citrus + acid + small, ‘lemon’

c. /sìná + mùsò/ → [snàmúsó]

lit. rival + woman, ‘co-wife’

What is important to the discussion in this chapter is that, once again, Bamana has facilitated the widespread neutralization of possible tonal contours to just two, as noted for other tonal processes in the language. Similar to what has occurred in the

neutralization of input minor tonal schema words, speakers of Colloquial Bamana, in nearly all instances, need only acquire the input tonal specification of the first syllable of a word, i.e. H or L. The tonal specification on the remaining vowels of the word follows from this specification. This is complicated slightly in the case of trisyllabic inputs which have the possibility of a LLH or a LHH tonal melody. We have seen however, that this choice is not entirely arbitrary. For this subset of words, the choice of the correct tonal melody is determined largely by the input tonal specification of the first syllable in combination with the nature of the onset consonant of the second syllable. Tones pre-associated to certain particles and morphemes, such as those discussed in §7.2.4, must be learned by speakers. The situation for tonally compact words is similar in that the speaker need only know the tonal specification of the first word. The remainder of the word's tonal melody is predictable from that information alone.

7.3 Tonal melodies and the tone bearing unit

By viewing the tonal outcome on Colloquial Bamana words, type by type, one comes to a better understanding of the language's tonal association conventions; however the ambiguous nature of the language's tone bearing unit remains in question. The observed tonal melodies of these words provide information on the relationship between the underlying lexical tonal melody of a word and its surface manifestation, as well as on the questionable identity of the tone bearing unit – syllable versus mora. It is clear that the concept of a *tonal word melody* is one that must be invoked in explaining the surface tonal contours observed in Bamana. We have seen throughout the current chapter that Colloquial Bamana is a language variety that contains lexemes underlyingly specified for one of two tonal melodies (i.e. H or LH), generally speaking. The more analytically

informative of these two tonal melodies is LH, given that it has the potential to provide one the opportunity to view the association and mapping of two successive unique tones to words of different shapes.

It has been observed that a LH melody is found on both monosyllabic and disyllabic Colloquial Bamana words associated in a manner that appears to follow typical autosegmental tone association conventions (e.g. Goldsmith 1976). In the case of monosyllabic words, the constituent tones of the LH melody are manifested either via their association entirely on a single light monomoraic syllable or with the tones dispersed, one to each mora, across a bimoraic syllable. For languages utilizing lexical tone melodies, this is not an uncommon state of affairs (e.g. Gussenhoven 2004). This does not, however, provide definitive evidence in favor of one tone bearing unit or the other. In disyllabic words, each of the two tones is associated to its own syllable, even when the first syllable of the word is bimoraic. This results, however, from the nature of the input to Colloquial Bamana from Standard Bamana, as discussed further below.

A LH melody surfaces as either LLH or LHH, with the former being more common in trisyllabic words as a result of *affaissement*. For most compounds and other polymorphemic constructions, the process of tonal compactness appears to neutralize non-initial tones such that a simple H or LH melody once again surfaces. In any case, it is clear that if a word is associated with a LH melody, both elements of the melody are expressed at least prior to the application of postlexical tonal processes, i.e. *affaissement* and *abaissement*.

While the inventory of tonal word melodies in Bamana is limited, addressing the question of the tone bearing unit of the language is complicated by the types of syllables

and words upon which these melodies can be found. In Bamana, one finds LH contours associated with a single syllable and often with a single mora. This characteristic is instructive in verifying that the H tone of the tonal melody is indeed part of the underlying structure of the melody and not simply supplied by default. An issue that one encounters in the case of Bamana tone is the fact that, often, while a LH tonal word melody is located on a single syllable, that syllable may be bimoraic, such that the two tones of the melody are distributed across the two constituent moras of the syllable. This is precisely what one observes for LH melody Colloquial Bamana monosyllables created via Velar Consonant Deletion or via Vowel Syncope when a [-continuant, -nasal] sonorant coda can be created via [+hi] vowel loss in word-final position. Such behavior might, for some languages, imply that the mora is the language's tone bearing unit. However, if one considers that the language's tone bearing unit is in fact the syllable, the results could be argued to be identical and therefore ambiguous for these words.

Identification of Bamana tone bearing unit is perhaps better discussed in the light of the tonal contour of disyllabic words. Recall from display (6) that, although disyllabic words still associate with only H and LH contours, one can view tonal association in instances where a bimoraic syllable is the first syllable of a word. Such words should be instructive in demonstrating the nature of the language's tone bearing unit, namely mora versus syllable. The complicating factor here lies in the restrictions that the language has independently developed in its tonal association conventions. These can be defined by two specific characteristics. First, the language lacks native $c\grave{v}k\acute{v}c\acute{v}$ words that could potentially surface as $c\grave{v}c\acute{v}$ as a result of Velar Consonant Deletion. Were such words found in the Bamana lexicon, they would provide definitive evidence either for or against

a mora versus syllable tone bearing unit analysis. Secondly, the word-internal sonorant codas created in Colloquial Bamana via Vowel Syncope are not moraic. Here again, the language has independently eliminated a potential tone bearing unit diagnostic. If word-internal sonorant coda consonants were moraic, one would have the potential to witness their ability to carry contrastive tone in LH words, once again swaying the tone bearing unit diagnostic in favor of one unit or the other. This diagnostic, however, is precluded in Colloquial Bamana. Finally, we have observed that phonemic long vowels are monomoraic and that their syllables pattern with other light syllables in the language, hence precluding any assistance they might offer in this type of diagnostic. However, if one were to consider that, historically, phonemic long vowels were in fact bimoraic and, in their synchronic state, still witness no tonal contouring, this would provide some evidence (but again, not definitive evidence) in favor of a syllable tone bearing unit.

Despite these analytical roadblocks, it is instructive to consider the disyllabic outcome in Colloquial Bamana more carefully. The issue at hand is one of input. In terms of segmental structure, we know that both Standard and Colloquial Bamana share the same underlying structure, and it is the unique ranking of the languages' constraints on markedness and faithfulness that drive the noted differences between the two varieties. Furthermore, we know that an input such as *c̀v̀k̀v̀c̀v̀*, upon losing its velar consonant, retains both of its vowels, along with their respective moras, given that the resultant syllable is heavy and patterns with other heavy syllables. Thus, one observes that the input moraic structure present in the underlying representation is preserved in the Colloquial Bamana input. Also, as was shown in Chapter 6, foot structure must be available in the input to Colloquial Bamana for the proper application of its phonology.

Tone, and tonal melodies in particular, behave analogously. One can posit that, like the underlying segmental structure of Standard Bamana, the input to Colloquial Bamana includes an associated lexically-specified tonal word melody. Given this position, upon the application of segmental phonological processes in Colloquial Bamana, the tonal melody remains associated as per the language's tonal phonology and its conventions. The tonal outcomes and restrictions on resultant surface tonal melodies in Colloquial Bamana reveal the necessity of positing that this structure is present in the input. Again, this does little to provide definitive evidence for one tone bearing unit versus another.

Some additional observations can be made regarding the emergence of *c̀v.cćv* from input both *c̀vc̀vćv* and *c̀vćvćv* words upon the loss of a second syllable vowel via Vowel Syncope. Here, one has the ability to see that the minimized outcomes of both these types of words fail to yield contour tones. Based upon the tonal association conventions for trisyllabic words discussed in §7.5, this outcome is entirely predictable. In the former case, the deleted vowel would have been associated to its L tone via spreading, and thus upon its loss, no motivation would be found for generation of a contour on the resulting word-final syllable. In the latter instances, the H tone associated to the deleted second syllable vowel would simply be absorbed by the adjacent H tone and would not be expected to generate a contour on the resultant word-initial syllable. Evidence drawn from the outcome of hiatus resolution via elision, as well as the presence of floating L tones and their ability to induce H tone downstepping supports the fact that H tones are subject to absorption and are not stable in comparison to L tones in the language.

Synchronically, Bamana appears to provide no definitive diagnostic by which to state the true nature of its tone bearing unit. However, drawing upon the observation stated above that phonemic long vowels currently (and historically) have not been reported to carry contour tones supports the statement of a syllable tone bearing unit. The observation of contouring on monomoraic monosyllabic words does not challenge this proposition. What is most clear is that the schema for tonal association in the language is best described in reference to tonal feet which act as a *melody bearing unit*. Any deviations from the input tonal melody assigned to this tonal foot are the result of regular tonological processes and necessitate little if any reference to a distinct *tone bearing unit*. The dispersal of the melody's tones to multiple *potential* tone bearing units, be they moras or syllables, similarly provides no substantive evidence for an analysis proposing one tone bearing unit or the other. In the light of these observed outcomes and the information presented throughout this chapter, I shall posit (with caution) that the Bamana tone bearing unit is the syllable.

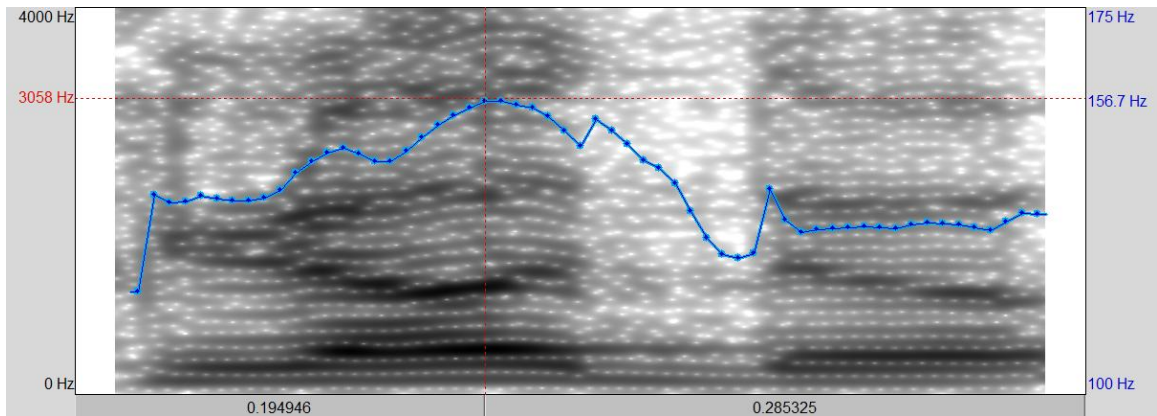
7.4 Tone bearing sonorants

The question that arises upon the formation of certain complex syllable types, particularly CCV syllables, is whether or not such structures can be considered true syllables, rather than remaining a sequence of two syllables. Some scholars (e.g. Lowenstamm 1996, 2003; Nikièma 2003, and references therein) have argued that CRV syllables (where R is some sonorant) that emerge from CV.RV words via vocalic syncope are properly analyzed as two separate syllables. Arguments for this proposal have arisen in large part from the fact that, in some languages, the sonorant consonant in these syllables emerges with the ability to bear tone. Thus, it would be argued that these syllables are properly

characterized as CR.V where the sonorant consonant occupies the nucleus of the first syllable and the following vowel occupies the nucleus of a second onsetless syllable. This analysis relates to the fact that onsets are not typically moraic and thus cannot bear tone (e.g. Hayes 1989; cf. Topintzi 2010 for an alternative viewpoint on onset moraicity). If the resultant sonorant consonant can bear a tone, it must be moraic and not part of the syllable onset. Contrary to such an outcome in some languages, the sonorant consonants of CRV syllables in Colloquial Bamana resulting from Vowel Syncope are not tone bearing. This is not to say that these consonants do not have a fundamental frequency, as all voiced sounds tend to have. One observes, however, that upon the syncope of the first syllable vowel of a L melody word, the resultant LH tonal contour is found solely on the remaining vowel of the CRV syllable. Support is found for this observation in a Standard Bamana word like *dəló* ‘beer’ that surfaces in Colloquial Bamana as *dlɔ̃*. If the sonorant consonant of this word was tone bearing, one would expect to find a L tone associated with it, followed by a H tone vowel. This is clearly not the case, as shown in display (8), where the vowel surfaces with a strong LH contour. Importantly, one cannot argue that the sonorant consonant here is tone bearing and that the L tone has spread rightward to the following vowel to create its representative contour. No independent motivation for L spread can be found in such instances. As illustrated elsewhere in this chapter, rightward L tone spreading is only witnessed in instances of *affaissement* in which sequences of LHH across a boundary emerge as LLH.

(8) CLV sonorant consonants do not bear tone

d l ɔ̃ d ɔ̃ 'It is the beer.'

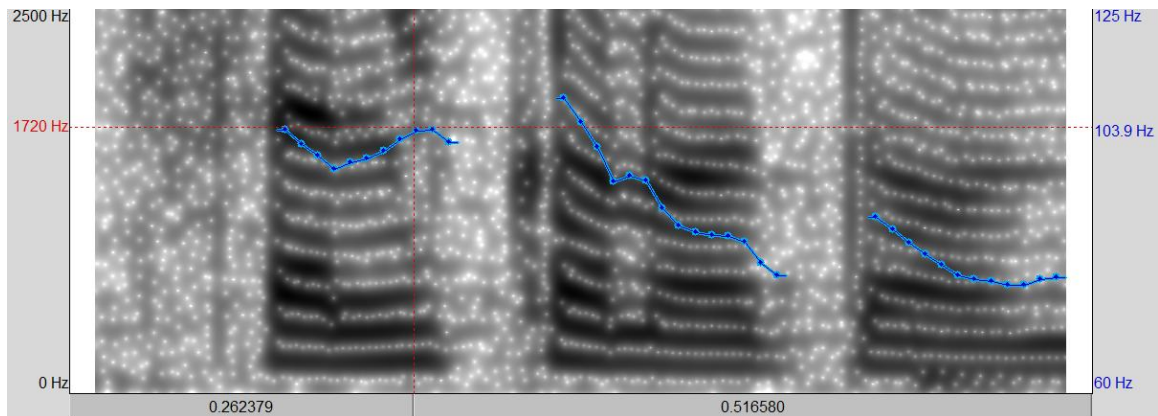


Standard Bamana: [dɔ̃lɔ̃]

This outcome is remarkably different for CVL syllables, but only in instances where these syllables are in word-final position. It was discussed in Chapter 6 that word-final CVC consonants are permitted in Colloquial Bamana only when the final consonant is the [-continuant, -nasal] sonorant [l]. Furthermore, in word-final position, CVC syllables are contextually heavy (e.g. Rosenthal & van der Hulst 1999; Morén 2000), meaning therefore that they obtain an additional mora. In such instances, the final [l] is associated with this additional mora and can manifest contrastive tone. This is precisely the outcome we find in L contour words like *fàlí* ‘donkey’ that have undergone Vowel Syncope to yield *fál*. In these instances, upon the loss of a H tone [+ hi] vowel, the moraic word-final sonorant consonant carries the H tone given up by the vowel. This outcome is illustrated in (9).

(9) Contextually heavy CVL syllables have tone bearing sonorants

f à í k ò n ò n t ò̃ ‘nine donkeys’



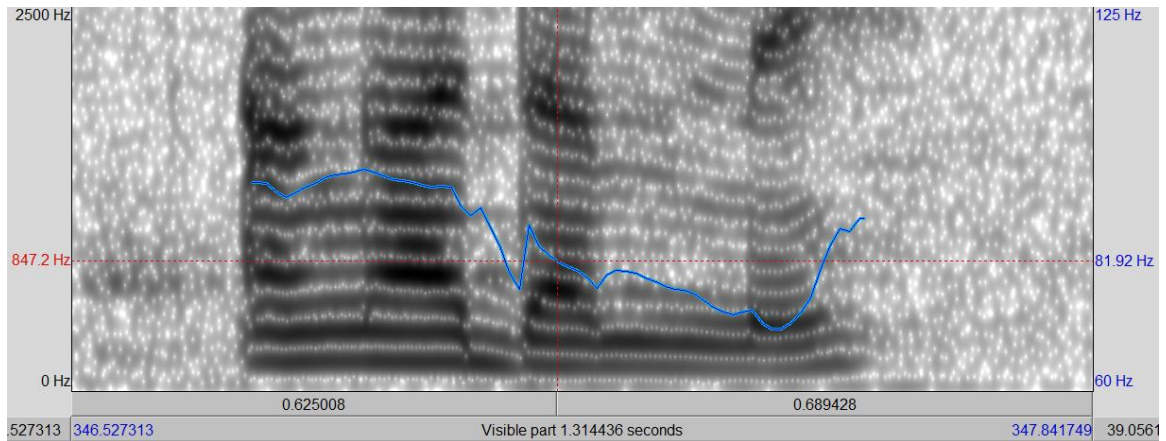
Standard Bamana: [fàlí kònòntò̃]

It is observed that unlike certain word-final sonorant codas, word-internal sonorant codas do not bear tone in Colloquial Bamana. Once again, this is not to say that these consonants do not have a fundamental frequency, however tone does not behave in a contrastive fashion on them. This characteristic of word-internal coda consonants is clear in (10) where, in the outcome of *dámìné* → *dám.ně* ‘to begin’, the resultant bilabial nasal coda is not associated with the vacated L tone.⁴ Instead, this stable L tone associates with the adjacent vowel to generate a LH contour tone on the final syllable of the word.

⁴ The word *dámìné* ‘to begin’ gets its somewhat unusual surface tonal pattern by virtue of the fact that it is a polymorphemic word formed via prefixal derivation. Such words are discussed in more detail in §7.6.

(10) Word-internal sonorant codas do not bear tone

á ñ g á d á m n ě 'let's begin'



Standard Bamana: [áñ gá dáminé]

With this information about tone bearing sonorants in place, it is safe to assert that the generation of CRV syllable via Vowel Syncope in Colloquial Bamana results in the creation of *true* CCV syllables such that the sonorant consonant of the complex onset cannot carry a tone. Furthermore, these data support the observation that word-final sonorant codas are moraic and are located in contextually heavy syllables given their ability to bear tone. We have also observed that word-internal sonorant codas are not moraic, as they are located in light patterning syllables and do not bear tone.

7.5 Tone association and tonal feet

Drawing upon proposals for tonal feet in Bamana (e.g. Leben 2002, 2003; Weidman & Rose 2006), I discuss here a role for tonal feet in the tone association of Bamana words. The characteristics of tonal feet discussed in this chapter, however, differ in several ways from earlier proposals of this prosodic structure. Most striking among these differences is the proposal herein that tonal feet are domains constructed in parallel to the segmental prosodic feet discussed at length in Chapter 6. I also outline the close relationship found

between segmental prosodic feet and the types of tonal contours permitted to associate with them in tonal feet on a parallel tier. The role that tonal feet play is most apparent in longer words in the language, however I discuss tone association in monosyllabic and disyllabic words first.

It has been presented throughout this chapter that Colloquial Bamana words surface with one of two major tonal word melodies, namely H and LH. Variations on these melodies, and specifically the noted surface changes of a LH melody to LL, have been demonstrated to result from two regular tonal processes of lowering, including rightward spreading across a boundary. It has also been broached above that the maintenance of LHH melodies in certain words is the result of the exceptional behavior of syllables with strong onset consonants in weak phonological positions. Generally speaking, every Bamana monomorphemic lexeme is underlyingly assigned a lexical tonal melody, either H or LH. When a LH tonal melody is assigned to monosyllabic words, two unique tones must be expressed on a single tone bearing unit, i.e. a single syllable. Following Leben (2002, 2003), I posit that a tonal foot in Bamana contains either a H or a LH melody, that tonal feet are maximally disyllabic, and that tonal feet are parsed exhaustively.⁵ My analysis differs noticeably from Leben's in that the proposal herein states that tonal feet are constructed in parallel to segmental feet, i.e. from the left-edge of a word, rather than from either the right-edge or left-edge. I further propose that every lexeme is composed of at least one foot such that a H or LH contour can exist on an otherwise degenerate monosyllabic lexeme. Degenerate feet resulting from exhaustive parsing are found only in odd-number syllable positions and are only assigned a H tone.

⁵ While Leben discusses Bamana tonal feet in detail, his analysis draws almost entirely upon the surface tonal melodies of trisyllabic words reported in Creissels (1978).

Monosyllabic Bamana words contain a single tonal foot with either a H or LH melody. While the tone bearing unit of the language is presumed to be the syllable, if more than a single mora is available, the tones of a LH melody will disperse across them. The tone association for representative monosyllabic words is illustrated in (11).

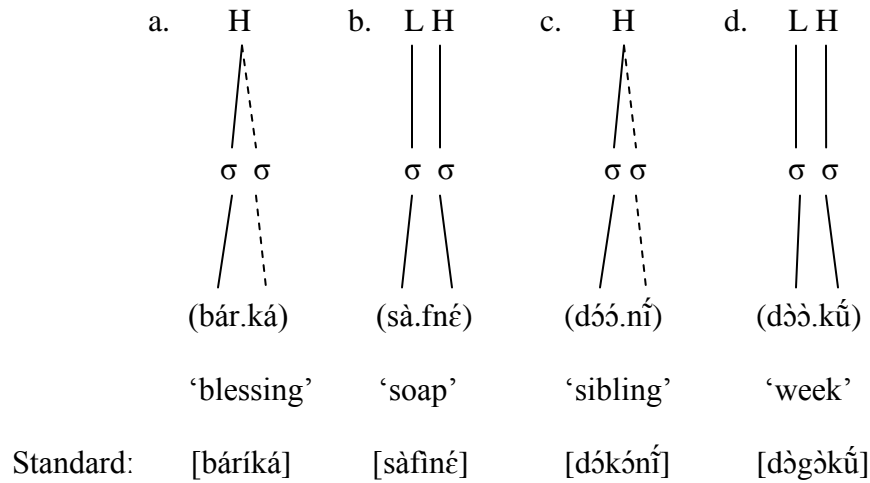
(11) Tonal association in Colloquial Bamana monosyllabic words

a.	H	b.	LH	c.	H	d.	LH
	σ		σ		σ		σ
					∧		∧
	μ		μ		μ μ		μ μ
	(srá)		(dlǒ)		(táá)		(fàá)
	‘road’		‘beer’		‘to go’		‘to kill’
Standard:	[sírá]		[dòlò]		[táká]		[fàká]

Examples (11a-b) illustrate tonal association for monosyllabic monomoraic syllables such as *ćv*, *cǔ*, *ćv:*, *cǔ:*, *cćv*, *ccǔ*, *ćvc*, and *cǔc* (*cǔc*). Examples (11c-d) illustrate the tonal association for monosyllabic bimoraic syllables such as those created via Velar Consonant Deletion, i.e. *ćv* and *cǔv*, and those permitting a word-final [-continuant, -nasal] sonorant coda consonant via Vowel Syncope, i.e. *ćv* and *cǔv*.

Tonal association proceeds for disyllabic words much as it does for monosyllabic words, with the exception that the tones of a LH tonal melody are able to associate one per tone bearing unit. Disyllabic words contain a well-formed tonal foot such that no degenerate foot is parsed. The examples in (12) are representative of the tonal association of all disyllabic Colloquial Bamana words.

(12) Tonal association in Colloquial Bamana disyllabic words



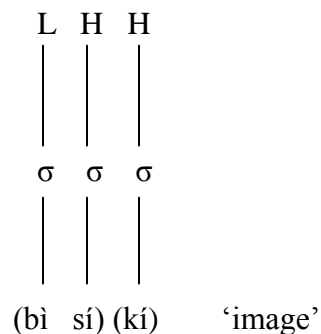
The tonal association for words in (12) follows for all disyllabic Colloquial Bamana words. Examples (12a-b), in particular, show an instance where disyllabic *cvc.cv* and *cv.ccv* words have resulted from Vowel Syncope, respectively. It should be clear, however, that the same tonal association applies to *cv.cv* and *ccv.cv* words as well. Examples (12c-d) show the result of words minimized via Velar Consonant Deletion. In instances like (12b) and (12d), each tone of the LH tonal melody is associated to one tone bearing unit, i.e. one syllable. In the case of H tonal melody words like (12a) and (12c), the H tone is associated to the tone bearing unit of the head of the tonal foot and then spreads rightward to fill the unassociated position within the foot, resulting in a HH surface tonal melody on these and similar words.

Trisyllabic words faithfully mapped from certain trisyllabic inputs are found in Colloquial Bamana in instances where they cannot undergo Vowel Syncope or Velar Consonant Deletion. As in Standard Bamana, both LLH and LHH tonal contours derived from a LH tonal word melody are found. It was broached above that the assignment of LLH versus LHH tonal contours to Bamana trisyllabic words is not entirely arbitrary and

that the distribution of LHH contours stems from the fact that only syllables containing certain consonants are able to maintain their association with a H tone. The tonal melody on such words effectively fails to be subject to the process of *affaissement*.

Starting first with trisyllabic words containing second syllable *strong* consonants, one finds that these words permit a surface LHH melody. Because tonal feet are built in parallel to segmental feet (i.e. they are maximally disyllabic and are constructed from the left edge of a word), a LH tonal foot is one containing a *strong* consonant in a phonologically *weak* position. The third syllable is the head of a degenerate segmental foot, as well as a degenerate tonal foot, and contains a default H tone. Although the adjacent associated H tones are located in two separate tonal feet, *affaissement* is blocked in these instances. By virtue of the strength of such consonants, the process of *affaissement* fails to lower the H tone associated to this syllable to L across the tonal foot boundary, thereby resulting in the retention of the LHH melody. One could argue that the strong second syllable consonant blocks rightward spreading, thereby effectively precluding the application of the assimilation process. Tonal association thus occurs in a very straight forward manner for LHH words. This outcome is illustrated in (13).

(13) Tonal association in LHH words

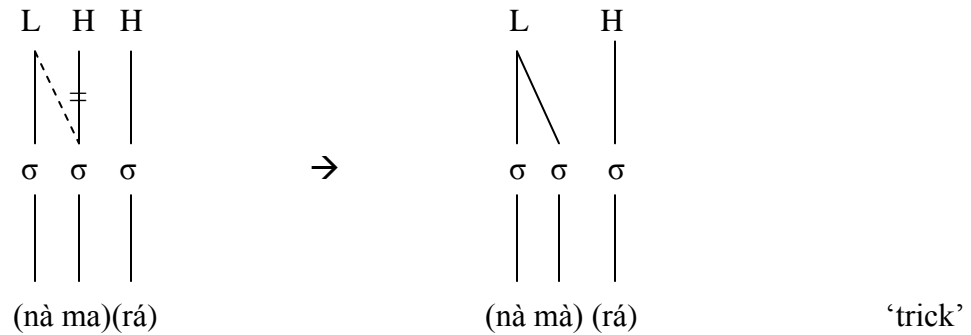


Leben analyzes LHH contour words differently by positing a right-edge tonal foot structure for these words, i.e. (L)(HH), such that a L foot before a HH foot does not provide the proper cross-boundary environment needed for *affaissement* to apply. Positing this alternative tonal footing, however, necessitates the lexical specification of footing direction for all lexemes. By positing, instead, that the retention of LHH melodies is exceptional and due to the segmental structure of a given word allows the segmental and tonal footing of Colloquial Bamana words to be constructed in parallel and avoids the need for lexemes to be underlyingly specified for directionality of footing. Furthermore, LHH melodies are found in only a small number of Bamana words, thereby providing support for the observation that their behavior is, in fact, exceptional. Thus, such words are underlyingly assigned a LH melody that associates with and is retained by the tonal foot.

LLH words, on the other hand, are those whose second syllable is *weak*, both phonetically and phonologically speaking. These words are similar to those discussed just above in that they are underlyingly assigned a LH tonal melody. They differ in the fact that the weak second syllable consonant cannot block rightward L tone spreading. Given the presence of an adjacent H tone degenerate tonal foot, the proper conditioning environment is present for *affaissement* to apply across a tonal foot boundary. The result is a LLH sequence on the surface. A schematic of tonal association for surface LLH words is illustrated in (14).⁶

⁶ It is important to point out that exceptions are found to both the generalizations noted for LHH and LLH trisyllabic words in Bamana. These exceptions, however, are found almost exclusively in loanwords borrowed from Arabic, and that such exceptions exist for both generalizations among these words does not appear to be accidental. Thus, I posit that additional constraints related to the tonal incorporation of these particular borrowings are at issue in the language. French borrowings, however, do not witness such inconsistencies. The peculiarities in Arabic borrowings may ultimately stem from the unique properties of

(14) Tonal association in LLH words



The association of tones in these Colloquial Bamana monosyllabic, disyllabic, and trisyllabic words illustrates a subtle yet important tonal-segmental relationship that references the higher prosodic structure of the language. Past analyses aiming to capture the mapping of tonal melodies in most Bamana words have been complicated in their attempts to address the distribution of tone on minor tonal schema words, as well as in predicting the distribution of LHH versus LLH surface tonal melodies. By far the most noteworthy of these analyses are those offered by Leben (2002, 2003) and Weidman & Rose (2006) that invoke tonal feet to address the tonal association conventions in the language. The reduced tonal system of Colloquial Bamana, specifically in regards to its omission of most minor tonal schemas, permits a similar yet modified analysis invoking tonal feet reminiscent of those presented in these earlier cited works. The simplified nature of the Colloquial Bamana tonal system precludes the need for some of the more complex components of these earlier analyses. The analysis presented in this chapter has aimed to characterize the synchronic state of the language's tonology and has provided a method by which to address the parallel relationship and interplay between the language's segmental and tonal phonology. The tonal results of minimization discovered

the loaning language's prosodic phonology (e.g. stress/syllable weight), among other factors. These issues will be taken up in future research.

in this language variety reveal that it is no longer necessary to assume a lexically specified direction of tonal footing. Rather, evidence has been presented that disyllabic segmental and tonal feet are constructed in parallel such that the structures bounding and restricting segmental minimization are analogous to those driving the surface realization of the language's tonal melodies. In summary of this section, I have proposed that tonal feet in this language variety are maximally disyllabic, are constructed from the left edge of a word exhaustively, and act as a domain for tone association and spreading. The language's underlying H or LH tonal melodies associate with this domain but may be subject to additional tonal processes (e.g. *affaissement* in trisyllabic words). Furthermore, I have proposed that tonal feet are left-headed, once again in parallel with segmental feet, such that the association of a tone with the head of a tonal foot and the strength of a consonant in weak phonological positions largely interact to determine the tonal contour for the entire word.

7.5.1 Thoughts on accent

Although the above tonal analysis has been successful in capturing the surface tonal contours of Colloquial Bamana that result from the association conventions of its reduced inventory of tonal word melodies in comparison to that reported for normative varieties of the language, it is tempting to consider the language's tonal system in light of ongoing discussion about the typological possibility of a *pitch accent* or *tonal accent* prosodic system (e.g. Hyman 2009). Such a prosodic system is one in which tone continues to play an important lexical role in the language, but where the distribution of tone is limited and generally contrasts only in certain predictable places in a word. Languages reported to utilize pitch accent are reduced tonal systems that Hyman suggests borrow components

from lexical tone languages and stress languages such that they have severely restricted tonal inventories and display one or more of four particular properties, namely obligatoriness, culminativity, metricality, and privativity.

We have seen in Colloquial Bamana that the language's two tones, L and H, are indeed restricted in their distribution. Regardless of a word's lexically-specified tonal melody, a H tone is the only tone possible in word-final position, and furthermore, a L tone can only be directly associated to non-word-final positions. In terms of obligatoriness, L tone cannot be said to be obligatory in the language, as many words surface with an all H tonal melody. H tone, however, could be said to be lexically specified once for each word. The distribution of tones in Colloquial Bamana is also culminative such that, marginal exceptions aside, only a single H (or L) tone is present in a given word. We have also seen that the distribution of tones is metrical in nature, particularly regarding the distribution of L tones and the unique properties of LLH versus LHH tonal association. The question that arises with Colloquial Bamana tone is privativity. One would be hard pressed to propose a L/Ø (or H/ Ø) tonal distribution, rather than the L/H system discussed throughout this chapter.

For the sake of comparison, let us begin by entertaining a L/Ø system. While this may be a tempting possibility given that a L must be expressed in many words, it is not obligatory. One also encounters an analytical issue in the presence of a LH contour on certain monomoraic monosyllabic words. One must question why a H needs to be expressed in these instances as well, short of positing some convention for the pre-association of a H tone in final position. Such an analysis is less problematic in other instances. One could propose that a L is associated to some non-final tone bearing unit

and can only spread in certain directions. In the absence of a L tone, a \emptyset would be filled with a default H tone to generate an all H melody. A H/ \emptyset analysis is a more promising analytical alternative, given that a H tone is both obligatory and culminative. One could argue that a H can associate with any tone bearing unit such that in trisyllabic words for example, in final position one finds LLH, in second position one finds LHH, and in initial position, one finds HHH. One encounters a similar analytical issue in LH monosyllabic words, however. It is unclear why a L would be expressed in these instances. In summary, although Colloquial Bamana has several characteristics that might lead one to suggest the eventual emergence of an accent-like prosodic system for the language, it is clear that the language (in its current state) is best analyzed as a reduced lexical tone language that utilizes word melodies and tonal feet in its conventions of tonal association.

7.6 Tonal compactness reconsidered

Recall from the discussion in §7.2.5 that tonal compactness, or *compacité tonale*, is a process described in the literature as one that neutralizes non-initial tones of words such that nominal and verbal compounds and certain polymorphemic derivatives surface with either H or LH contour, the choice of which depends on the tonal melody assigned to the first morpheme of the word and moreover the tone associated to the first tone bearing unit of the word. While this generalization correctly and adequately captures the widely attested surface contours found on words exhibiting tonal compactness, the process says little about how and/or why this process occurs as it does. In this section, tonal compactness as a process is reconsidered in the light of what has been learned about the

higher prosodic structure of Bamana, namely the importance of tonal feet in the tonal association conventions in the language.

Recall from Chapter 6 and from the current chapter evidence offered in support of the presence of left-headed prosodic feet both on the segmental and tonal tiers in Bamana. Also recall, from Chapter 4, discussion of the general schema of compounding and derivation in the language, specifically that it occurs in discrete morphophonological levels within which the phonological rules of the language reapply. As shown in this section, similar principles can be invoked to explain the process of tonal compactness.

Tonal compactness as a process must refer to the morphological structure of Bamana. This observation is drawn from the fact that the outcome of the process is sensitive to the location of the first syllable of a word-final morpheme. This is most apparent in the assignment of a LH contour via tonal compactness where the L tone of a word-initial morpheme is spread across a given word until it reaches the word-final morpheme. The word-final morpheme is then assigned H tone. The process occurs in much the same fashion for H tone word-initial morphemes, however the outcome is not striking given that a H is seemingly assigned once again to the word-final morpheme, thereby resulting in a generally flat H tonal contour for the entire word. Because tonal compactness for LH words is easier to observe, it is used to demonstrate tonal compactness in this section.

Consider a simple bimorphemic compound in which both elements contain two syllables and are lexically specified for a LH word melody. Such a compound would be parsed into two disyllabic prosodic feet, i.e. (LH)(LH), where each foot projects a head. The tonally compact outcome of such a word would be (LL)(HH). Upon the

compounding of two elements, I posit that the first syllable of the leftmost morpheme becomes the head of the resultant prosodic word. Not only is this position one of prominence, segmentally speaking, but also on the tonal level, the tone associated with this projection determines the tonal melody of the entire construction. Display (15) illustrates the creation of such a bimorphemic compound. In the displays that follow, I mark a head projection above a syllable or tone by ‘*’.

(15)

Prosodic Word	(*)	(*)	(*)	()
Morpheme	()	()	()	()
Foot	*	*	*	*
(LH) + (LH) → (LL)(HH)				
fàlí + kòró → fàlikóró ‘old donkey’				

In the next level of compounding or suffixing derivation, the output (LL)(HH) word in (15) would serve as one element of the input to this next level. If this word were to be joined by another element, the result would once again be a single prosodic word containing three elements whose tonal melody is driven by that associated with the head of the prosodic word. This is illustrated in (16).

(16)

Prosodic Word	(*)	(*)	(*)	()	()	()
Morpheme	()	()	()	()	()	()
Foot	*	*	*	*	*	*
(LL)(HH) + (LH) → (LL)(LL)(HH)						
fàlikóró + tígí → fàlikòròtígí ‘old donkey owner’						

The outcomes in (15) and (16) allow one to observe a mechanism and process for the assignment of tone via tonal compactness that occurs with respect to the higher prosodic structure of the language. Consider first the mechanism in (15). The head of the leftmost prosodic word, which will also become the head of the prosodic word of the resultant compound, is associated with a L tone. Upon compounding, the tone of the prosodic word head spreads rightward within the bounds of prosodic word domain until it encounters the domain boundary. The tone of the prosodic word domain, however, is not permitted to cross the domain boundary. H tone is then assigned by default to the leftmost tone bearing unit of the adjacent morpheme and spreads rightward where possible. Upon compounding, an adjacent projection on the prosodic word level is removed. An identical outcome is found in (16) and similarly for other similar instances compounding. In (16), the output of (15) serves as one element of the input and contains a single projection on the prosodic word level associated with a L tone. When the following element is added, the L tone once again spreads rightward within the prosodic word domain until it encounters the boundary of the domain. The adjacent tone bearing unit is then assigned a default H tone, which spreads within its domain, and the prosodic word head projection is removed. This mechanism applies in an identical fashion for prosodic words whose head is associated with an input H tone, and the mechanism applies recursively throughout levels of compounding and suffixing derivation.

In instances of suffixal derivation, no independent evidence exists that suffixes and other particles are footed in the input. Rather, these elements are footed upon compounding/derivation. Suffixes do, however, have a morphological domain, and their

participation in the assignment of tone via tonal compactness proceeds in an identical fashion as in nominal and verbal compounds. Consider a representative example in (17).

(17)

Prosodic Word	(*)	(*)	
Morpheme	()()	()	()()
Foot	* *	* *	
	(LL)(H) + (L) → (LL)(LH)		
	silámé + yà → silàmèyá ‘Islam’		

The example in (17) represents a trisyllabic input noun containing a LLH melody. The L tone derivational suffix added to this noun is not footed and does not project a prosodic word head. Upon derivation, the L tone head of the prosodic word spreads across its domain until it encounters a boundary. A H tone is then assigned to the first tone bearing unit of the adjacent morpheme. The result is a single prosodic word containing two morphemes and is footed (LL)(LH).

This process, so proposed, is also effective in providing an explanation for the failure of tonal compactness to apply in instances of derivation via prefixation, and therefore the maintenance of apparent *minor* tonal schema on such words. In these words, the head of the compound is in a word-internal position and maintains its tonal specification, while the derivational prefix retains its input tone as well. A notable example of this is the word *dábilá* ‘to stop’ with a non-tonally compact HLH contour that arises from the prefixation of *dá-* to the verb *bilá*. In these and similar instances of prefixation, the head projection on the prosodic word tier for *bilá* linked to a L tone has no impetus to spread rightward, as there exists no adjacent morpheme to trigger

spreading. I propose that words like *dá* (and similar derivational prefixes) are not footed and thus do not project a prosodic word head. This explains their inability to participate in, or more appropriately trigger, tonal compactness. The stalemate results in both elements of the derivative retaining their specified tonal contours. This outcome is illustrated in (18). The resultant word, however, is footed and re-parsed as a single prosodic word, as supported below.

(18)

Prosodic Word	(*)	(*)	
Morpheme	()	()	()()
Foot	*	*	*
	$H + (LH) \rightarrow (HL)(H)$		
	$dá + bilá \rightarrow dábílá$		
			‘to stop’

That these prefixed derivatives are re-parsed into a single left-headed prosodic word is clear in instances where one or more additional rounds of derivation occurs. In these instances, as illustrated in (19), the word is tonally compact and its surface melody follows from the input specification of the associated tone of the new head of the prosodic word.

(19)

Prosodic Word	(*)	(*)	(*)	
Morpheme	()()	()	()()	()
Foot	*	*	*	* * *
	$(HL)(H) + (HH) \rightarrow (HH)(HH)(H)$			
	$dábílá + bálí \rightarrow dábílábálí$			
				‘incessant’

Metrical structure in the form of tonal feet are once again helpful in predicting the outcome of tonal association in even these seemingly unusual and unpredictable instances in which tonal compactness fails to apply where otherwise expected. To my knowledge, this is the first time that such a mechanism for tone assignment via tonal compactness has been proposed that has invoked higher prosodic structure in this way.

7.7 Trajectory of minimization

One of the questions that arose in the formulation of this thesis was the possibility that the trajectory of minimization that Bamana is following may also be at play within other Manding languages, or perhaps within the Mande languages as a sub-family. Given the assumed common ancestor among languages of this family, it is not far-fetched to envision such an outcome. This question first came to mind when considering the dual methods of minimization discussed in this thesis for Colloquial Bamana alongside reports of similar processes reported and described to some degree in language's closely related to Bamana, among them Kankan Maninka (Diakite 2010), Beledugu Bambara (Konatè & Vydrine 1989) and Kagoro (Vydrine 2001). This curiosity was further fueled by reports of analogous processes of minimization, although with somewhat different properties and outcomes, in other more distantly related Mande languages, most prominently among them Toura (Bearth 1971) and Gouro (Kuznetsova 2007; Le Saout 1979; Vydrine 2003). With the exception of Diakite (2010) and Kuznetsova (2007), the information contained in other works pertaining to this subject is far less detailed, as these studies understandably did not take processes of minimization as their focus.

From Colloquial Bamana, we have learned that the drive towards minimization is achieved via the interaction and competition between two processes of segmental

reduction. While minimization is clearly active and preferential in the language variety, it can be blocked in some words by phonotactics or metrical structure. Furthermore, given the nature of Colloquial Bamana as either a koiné or alternatively a basolectal register of Standard Bamana, it is present to varying degrees among speakers of the language in different situations. We have learned that although Colloquial Bamana is being minimized segmentally, it is, by and large, remaining faithful to its limited inventory of underlying lexically specified tonal word melodies such that segmental minimization does not generate new or unusual tonal contours on resultant tone bearing units. It has been shown, however, that Colloquial Bamana speakers have effectively reduced the language's inventory of tonal schema, a fact clearly shown by the failure of minor tonal melodies to be found on expected words in this non-standard variety. Thus, segmental minimization and therefore the emergence of syllabic complexity in Colloquial Bamana does not carry along with it a corresponding increase in tonal complexity. The processes of minimization in this language variety, taken as a whole, clearly support the proposition that they are phonological, rather than phonetic in nature. The application of these processes is predictable only with reference to the phonological structures, phonotactics, and morphophonological boundaries of the language. The ability of these processes, and Vowel Syncope in particular, to remove a vowel of any type from any word position while obeying the language's phonotactics, lends strong support to the assertion that the processes of minimization in the language are phonological in nature. It is likely, however, that these processes had their start in phonetic processes, as velar consonant lenition and instances of [+hi] vowel deletion are present to some degree even in Standard Bamana.

Kuznetsova's (2007) work on prosodic structure in Gouro provides an excellent survey of past literature on the language while adding her own data to the mix. It is clear in her explanation and juxtaposition of relevant data (hers and others) from the language that dialectal differences are likely at play. Drawing mainly from her data, she shows that processes of minimization are present in the language, several of which are highly reminiscent of those occurring in Colloquial Bamana. Kuznetsova, however, attributes the minimization found in Gouro to phonetics rather than phonology for two apparent reasons. Firstly, she explains that the tonal contours that result from minimization are not able to surface on resultant syllables in all logically possible combinatory ways. Furthermore, it appears in her data that some speakers produce CLV sequences with a tone-bearing second consonant, thereby suggesting that such sequences are in fact comprised of two syllables. There may be independent reasons for the inability of these tone contours to interact in certain ways; however this is not explored. Furthermore, minimization in the language is discussed only for words of shorter lengths such that it is difficult to presuppose what, if any, outcomes of minimization in the language would be for longer derivatives or compounds, assuming that they exist in the language. It would nonetheless be an interesting study to explore a potential interaction between different types of minimization in other Gouro dialects, similar to that reported by Le Saout (1979), where consonant deletion and vowel deletion have the potential ability to interact with one another, as in Colloquial Bamana. In sum, although certain processes like elision and hiatus have the ability to generate more complex tonal contours in Gouro, it appears that the language has a limit on the number of contours and/or restrictions on the interaction of segmental minimization and tone in the language. It is also quite possible

that these seemingly phonetic implementations of minimization may ultimately become phonological as they appear to have done in the creation of Colloquial Bamana.

At this point, much more research is called for in a larger number of Mande languages in order to further explore the typology of ways that minimization processes (if present) function on both the segmental and tonal tiers. The possibility of one or more trajectories of minimization is not yet clear. This thesis, and indeed Kuznetsova's characterization of Gouro and Diakite's forthcoming characterization of Kankan Maninka are important pieces of this puzzle.

7.8 Summary

This chapter has explored the tonal results and consequences of minimization in Colloquial Bamana that result from the application of both Vowel Syncope and Velar Consonant Deletion. It has been shown that the tonal system of Colloquial Bamana is reduced in notable ways compared to that reported for Standard Bamana and that, rather than generating more complex tonal contours as a result of minimization, the language variety maintains its conservative inventory of H versus LH tonal word melodies. Restrictions that the segmental structure of the language places on tone assignment in three specific word types were also explored. It was also shown that the processes of *affaissement*, *abaissement*, and *compacité tonale* remain active in the tonology of Colloquial Bamana. Furthermore, it was illustrated that the tonal association conventions of the language are best captured by making reference to higher prosodic structure in the form of tonal feet. The tonal feet proposed in this chapter are reminiscent of, but different from, those presented in earlier works, such that they parallel the segmental feet of the language and need not be lexically specified. The final chapter of this thesis provides a

summary of the components covered, discusses implications for descriptive and theoretical linguistics that come from this research, and outlines possibilities for future research.

CHAPTER 8

IMPLICATIONS, FUTURE DIRECTIONS, AND CONCLUDING THOUGHTS

“Kodɔnbaga bɛ kodɔnbali hakili waga.”

“Education opens the door to the unknown.” - Bamana proverb

It is perhaps the hope of many researchers that their work spawns just as many, if not more, questions than it answers. For me, personally, I feel that this study of the intricacies of two phonological processes in Colloquial Bamana opens the door to several promising and unique lines of research to pursue in the future that have implications for both theoretical and descriptive linguistics. While this thesis has offered a description and analysis of the morphophonology and tonology of a previously uncharacterized language variety, it has broached a number of new questions for which answers are still outstanding. The true question is where to start first and what to put aside for later.

Although an exploration into the sociolinguistic particulars of Colloquial Bamana is needed, as its usage pervades the overall linguistic environment in Bamako and surely affects and influences the speech of generations of younger children, I defer to the sociolinguists and linguistic anthropologists to tackle a more detailed and thorough characterization of the “whos” and “whys” of the language and the sociocultural or even sociopolitical reasons that it has developed or diverged from its normative predecessors. One will likely find, as is the case in many large, multiethnic and multilingual urban cities, that such an environment is a melting pot and indeed a breeding ground for new language varieties like Colloquial Bamana to emerge. What has been uncovered thus far

is that this language variety is one spoken by both males and females within a specific age range (youth until approximately 40 years) who have grown up as mother-tongue speakers of Bamana in Bamako, Mali. It has been beyond the scope of this thesis to probe more deeply into the percentages of usage, education, relative socioeconomic status, or other such factors that are ultimately important to take into consideration when characterizing a language variety.

I find that several of the more intriguing questions that remain unanswered about Colloquial Bamana, and even other varieties of the language, are those that cannot be answered immediately, as time must take its course to determine the ways that the language will resolve variation (if at all) or if and when the language may ultimately lose its system of contrastive tone and develop into a stress/accent language as its tonal system continues to reduce. It may prove that Bamana will continue to lose its contrastive vowel length such that it will ultimately be lost for all speakers, as has already been reported for some individuals in earlier work (e.g. Creissels 1992) as well as for some speakers interviewed for this thesis.

The resolution of variation, particularly in regards to the preference for a CVC versus CCV outcome as a result of Vowel Syncope for certain types of words will prove to be telling for syllabic theory. As it has been discussed in previous work (Green et al. 2009), both Kaye & Lowenstamm's (1981) constituent-based theory of the syllable and Baertsch's (2002) Split-Margin Approach to the syllable predict that languages with a maximal syllable shape of CCV should not be possible. While the presence of certain languages falling into this category have been described, they have been disputed in the literature and remain controversial. Mainly on theoretical grounds, it is predicted for

Colloquial Bamana, that the resolution of the CVC versus CCV outcome of words containing identical vowel targets within a domain may ultimately end in favor of the CVC alternative. Reasons for the superior choice of CVC as a syllable type, as compared to CCV, were outlined in Chapter 3. An outcome of the attested variation between CCV versus CVV syllables in the competition between Vowel Syncope and Velar Consonant Deletion for targets within a single domain is more difficult to predict. While Velar Consonant Deletion is clearly a preferred process overall (given its chosen application when its target and a target for Vowel Syncope are in adjacent domains), it is unclear if its precedence will hold in the long term, as well as why or why not.

Beside these immediate unknowns, there remain promising directions for future research that can be explored in the interim, several of which imply that a broader focus is necessary to bring certain issues into perspective. Starting from the lowest descriptive level, one can consider the phonetic correlates of the phenomena that have been characterized (from a phonological perspective) in this thesis for Colloquial Bamana. One immediate question to explore concerns the experimental determination of what it truly means to be a short versus long versus derived long vowel in Bamana, and moreover what it means for a vowel or a syllable to be *prominent* in the language. This is especially imperative to begin exploring now given the fact that the phonemic contrast in vowel length found historically in this language is being lost, as mentioned above. It was proposed in Chapter 6 of this thesis that the difference between phonemic long vowels and derived long vowels in terms of their ability to attract prominence is a matter of phonological weight (i.e. their moraic structure). However, a correlate of both types of these vowels that apparently does not contribute to their prominence attracting ability is

length. There is perhaps much more to say about this if one considers the restrictions that even the normative varieties of Bamana place on the distribution of phonemic long vowels to the left-edge of a word, i.e. an apparent prominence-attracting position. We have seen that Bamana permits adjacent derived long and phonemic long vowels in a word where a seemingly non-prominent phonemic long vowel can occupy the right-edge position of a foot. However, if it is the case that a phonemic long vowel is prominent in some way due its restriction to a left-edge position in monomorphs, how is it that these two vowel types do not conflict with one another? The answer may lie in a more detailed study of the phonetic correlates of these and other vowels, as well as other structures (i.e. consonant clusters) in the language. While singleton vowels in a CV syllable do not appear to attract prominence, it is possible that they may have some other phonetic correlate that differs when they are found in prominent positions, i.e. the left-edge of a foot. Details such as these then have a role to play in assessing the eventual emergence of a stress or accent system for Bamana, as well as support for prosodic word headedness and a more detailed definition of the prosodic word domain in the language.

Moving upwards to phonology, and theoretical phonology in particular, one finds that explorations into additive or harmonic frameworks of analysis are steadily expanding in both the published and unpublished phonology literature. Colloquial Bamana offers an interesting starting point for studying certain types of phonological systems (i.e. non-harmonically complete systems) that have only scarcely begun to be explored. Such systems, at first, were only speculated to exist in the theoretical phonology literature (e.g. Legendre, Solace & Smolensky 2006); however, as we saw in Chapter 5, Colloquial Bamana, in its current state, exhibits a synchronic manifestation of such a system. A

question that has been broached and begs to be answered concerns what types or families of constraints are (or should/should not be) able to interact in a superlinear relationship (Albright, personal communication). This question necessarily awaits future and more widespread research.

Continuing on to morphology, the outcome of minimization that was observed in Bamana nominal and verbal compounds, as well as in other polymorphemic derivatives, in Chapter 4 calls out for one to revisit this component of the language's grammar. Bamana is often considered to be isolating in its morphology drawing in large part from the fact that the language has very few instances of inflection. The morphosyntax of derivation in the language, however, is extremely rich and complex. While many details of Bamana morphosyntax have been captured (e.g. Dumestre 2003), what has been uncovered in Chapter 4 concerning how the processes of minimization appear to apply at different morphophonological levels and re-occur as more levels are added, necessitates a new look at the language's morphology and a systematic reanalysis of its morphosyntax.

Although this thesis has said little about syntactic processes, we can draw from what we have begun to learn and reassess about Bamana tone to consider an important intersection between the language's phonology (or more appropriately tonology) and syntax. Tonoexodus (Lea 1973) is a term coined to describe the gradual loss of tonal contrast, and it contrasts with the better known concept of tonogenesis (e.g. Matisoff 1973). While one might characterize the neutralization of tonal contrast discussed in Chapter 7 as a type of tonoxodus, there exists yet another manifestation of this process related specifically to morphosyntax for some Colloquial Bamana speakers. More specifically, some speakers of this language have begun to lose their ability to mark

definiteness versus indefiniteness in nouns tonally. Indeed, this distinction is marked in most varieties of Bamana by the presence of a floating L tone postposed to the end of a noun phrase. For more on this tonal morpheme, see Chapter 2. Speakers who have begun to lose this morpheme have taken to postposing the demonstrative marker *nin* to the end of the noun phrase in its place. Because the tonal definite marker has a role to play in the tonal phonology of the language, e.g. inducing downstep of adjacent H tone syllables, the loss of this marker is introducing changes to the language's phrasal syntax, phonology, morphology, and tonology. This is yet another trend to watch as Colloquial Bamana becomes more widely used.

Above all, the motivation for this thesis stemmed from conflicting accounts and analyses of the language's tonology. Even the most basic tonological facts, such as the tone bearing unit and the underlying and surface tonal melodies found in the language, have not been widely agreed upon in the literature. Published accounts of Bamana tone, thus, have been conflicting and inconclusive for decades. Analytical and phonological trends that have come and gone have had much influence over the state of knowledge on this subject. Increasingly abstract analyses have been proposed throughout the years to account for the tonal features of the language, yet these analyses have done little to answer any questions about its tonal characteristics. They have, however, provided many different ways to look at the same types of words from perhaps markedly different varieties of the same language, with the unfortunate consequence and outcome of placing research on the language in a holding pattern with little forward motion being accomplished. This is a fact that became remarkably clear to me upon visiting with several professors of linguistics at the University of Bamako when conducting fieldwork

in Bamako in Summer 2010. Upon explaining my project to them and what I hoped to accomplish while in Bamako, they warned me about the dangers of Bamana tone and that no one seemed to be able to capture it. They further explained that the subject had been left to rest for some time and that even they themselves have had difficulties explaining what is known about it to their students. It is my hope that the knowledge gained by studying the tonal consequences of minimization in Colloquial Bamana reported in this thesis has and will continue to shed some much needed light on the subject of Bamana tonology and thus curb this trend. A reanalysis of Bamana tone is long overdue.

This study of Colloquial Bamana is complemented in several ways by work being done on Southeast Mande languages, as well as on Bamana's close cousin Kankan-Maninka. In the descriptive contributions that have been made to the study of Mande linguistics, it is clear that certain minimization processes, for example Velar Consonant Deletion, exist in a continuum of increasing velar lenition across the Manding languages, and perhaps across the entire Mande sub-family. Within Manding itself, it is clear that the most conservative varieties of Bamana, for example those spoken in areas northeast of Bamako (e.g. Ségou Bamana), tend to retain their intervocalic velar consonants and that these consonants are most often the voiceless velar plosive [k]. As one moves westward, one finds that the process of lenition driving this velar deletion becomes stronger, as languages closely related to Bamana, e.g. Kagoro (Vydrine 2001), that are spoken in areas nearer to Bamako, exhibit voicing and/or fricativization of intervocalic velar consonants. Standard Urban Bamana itself is somewhat different in exhibiting the loss of velar consonants between identical [-hi] vowels, but retaining them between [+hi] vowels. In terms of Velar Consonant Deletion, Colloquial Bamana bears a closer

resemblance to its cousins to the west, for example Kankan-Maninka (Diakite 2010), that also exhibit extensive velar consonant deletion between vowels of all types. Similarly, in regards to Vowel Syncope, it is clear that Bamana's cousins, e.g. Kagoro (Vydrine 2001) and Beledugu Bamana (Konatè & Vydrine 1989), exhibit a degree of vowel reduction in non-final vowels, with some of the same syllabic results as in Colloquial Bamana. Diakite (2010) reports vowel syncope in Kankan-Maninka that is even more progressive than that observed in this thesis for Colloquial Bamana. These trends can likely be found to some degree in other Bamana dialects, as well as in other related Mande languages. The question that arises is whether or not the types of velar deletion and vowel deletion noted in these other languages follow (or will follow) the same systematic path of minimization as Colloquial Bamana has and whether or not the processes are bounded in similar ways by higher prosodic structure. At the present time, there exists an active line of research on Southeast Mande languages probing the presence of higher prosodic structure in specific languages (e.g. Kuznetsova 2007; Vydrine 2003) and its relationship to certain reductions noted in those languages. To my knowledge, an in depth study of higher prosodic structure across the Mande sub-family has not been undertaken, and indeed certain branches of this family (e.g. Eastern Mande) remain underdocumented. Furthermore, rather than conglomerating groups of languages or language varieties and overlooking the subtleties of non-standard varieties, it is important from both descriptive and theoretical perspectives that the properties of these *small* languages be re-examined to see what they can offer to the field of African Linguistics. A cross-linguistic and typological study of higher prosodic structure, and the processes and features that are

affected, governed, or restricted by it, is now necessary and warranted given the evidence offered for its presence in at least two branches of this sub-family.

Foundations for exploring the presence of one or more predictable trajectories of segmental and tonal minimization within certain Mande branches and perhaps across the entire Mande sub-family have been discussed. The work presented in this thesis and that currently underway focusing on processes of minimization in other Mande varieties are promising steps to learning more about the typology of prosodic systems found in these languages. A great deal of research on this topic remains to be done.

Explorations into the role and characteristics of higher prosodic structure have the potential to span outside of the Mande sub-family to other groups of languages across West and Central Africa. The Bantu languages, indeed, have a complementary and expansive body of literature on the subject. The importance of higher prosodic structure has become apparent in the work of several linguists whose work has focused on languages from various areas of West Africa, for example Purvis's (2009) work on meter in Akan praise poetry and Anderson's continuing work (2009, forthcoming) on Akan rhythm and its interaction with tone. Akinlabi and Urua (2003) have written on foot structure in Ibibio. Such studies represent a revitalized effort to capture prosodic phenomena in West African languages that fall outside or are at least concurrent with the purview of tone. Studies of tonal phenomena in these languages have enjoyed many decades of detailed study. Their metrical and rhythmic properties and the characterization of processes related to them, however, have been largely overlooked, even though their detailed study has the potential to shed light on the development of new prosodic systems (e.g. stress or accent systems) from the tonal systems present in these languages presently

and historically. This is yet another line of research in African Linguistics that begs to be revisited, rekindled, and expanded in order to determine the typology of prosodic systems that can/cannot co-occur and the processes and characteristics that have the ability to influence one another in these languages. The studies cited above, and surely others, are positive steps in the right direction.

At the beginning of this thesis, I stated that it was driven by two specific goals, namely to provide both a descriptive and theoretical contribution to the areas of African Linguistics and Phonology by capturing and reporting on the prosodic phonology of Colloquial Bamana, a non-standard language variety, perhaps in a state of flux, spoken by a young cohort of individuals who have been born and raised in the linguistic melting pot of Bamako, Mali. In order to achieve this goal, I began with three general questions in mind concerning the processes of minimization active in the language, the tonal outcome of these structures, and the place of these processes observed in Colloquial Bamana within the larger Mande family. In addition to gathering more insight into these issues, several interesting and complementary characteristics of the language emerged that have been reported in this thesis.

First, the details of two phonological processes of minimization or reduction, namely Vowel Syncope and Velar Consonant Deletion, were illustrated and analyzed. These processes were reported for words of a wide range of shapes, sizes, and phonological makeup. It was determined that these two processes can occur independent of one another but can also interact with or even compete with one another for deletion targets within a specific prosodic domain, depending on whether that domain is a prosodic foot or a word. It was also shown that the outcome of these processes is driven

and at times restricted by the strict syllable and margin phonotactics of the language, as well as by minimality conditions in place in the language's phonology and morphology. These processes were also shown to be bounded by higher prosodic structure in the language in the form of disyllabic trochaic feet. These prosodic feet serve as a domain of application for these processes and are active in driving their proper application, as well as instances in which the processes fail to occur as otherwise expected. To my knowledge, this is the first detailed characterization of such structure, specifically in reference to segmental structure, for a Central-Southwestern Mande language.

From a theoretical standpoint, this thesis has also reported on the support that the phonological processes of minimization in Colloquial Bamana have for syllabic theory, particularly the language's synchronic development of CCV and CVC complex syllable shapes. Such a parallel development lends support to Baertsch's (2002) Split Margin Approach to the syllable. Furthermore, it has been shown that permissibilities and restrictions on multiple reductions in Colloquial Bamana have the ability to inform emerging work on harmonic and additive models of phonological analysis, as well as the study of non-harmonically complete phonological grammars. It has become clear that this language is one in which a standard strict domination optimality theoretic analysis is not capable of capturing the intricacies of the competing minimization processes and that some manifestation of a harmonic grammar framework is necessary to formalize the phonological phenomena observed in the language.

In order to capture the full potential of interaction between Vowel Syncope and Velar Consonant Deletion, it was necessary to probe the permissibilities and restrictions of minimization in words made up of a diverse variety of morphological constituents. It

was illustrated that the language's phonology and morphology are intimately connected with one another in determining the outcome of minimization. This reaffirms the fact that Bamana morphology is indeed rich in complexities that must be revisited and explored further in the future.

In terms of tone, this thesis has provided a descriptive characterization and preliminary analysis of the tonal system of Colloquial Bamana. With the controversial nature of Bamana tone in mind, the intent of this contribution was to shed new light on some of the most basic tonal features of the language that have long been debated in the literature. By observing the tonal results of minimization, it was determined that the tonal system of Colloquial Bamana is indeed reduced or simplified in comparison to that which has been previously reported for other normative varieties of the language. It has been further demonstrated that Colloquial Bamana has only two surface tonal melodies and that these melodies stem from underlying tonal features that are now captured only in words of particular sizes and shapes. New ideas on the well-known process of tonal compactness have also been discussed.

Finally, this thesis has reported on a trajectory of minimization for Colloquial Bamana, and perhaps for other closely related Manding languages. It has been shown that, via the processes of minimization occurring in Colloquial Bamana, the language is being reduced by segments and therefore syllables, and furthermore that the tonal results of minimization are simplifying in a similar fashion. One instance in which this is noted is in the disappearance of the *minor* tonal schema reported in the literature for other Bamana varieties. Speakers of Colloquial Bamana neutralize these minor contours by adopting the characteristic contour of the first syllable of a given word. Another instance

in which this is seen is in the disappearance of the opposition between LLH and LHH contours on trisyllabic words. When these words emerge in Colloquial Bamana, both have simple LH melodies. These characteristics of Colloquial Bamana exist alongside the well-known neutralization process of *compacité tonale*, which remains active in this non-standard variety. Colloquial Bamana is therefore following a trajectory of minimization in which an emergent increase in syllabic complexity does not carry with it a corresponding increase in tonal complexity. Thus, tonal contrasts are being neutralized along with their role in conveying lexical meaning.

While it is perhaps too preliminary to report on the typological relationship between Colloquial Bamana's trajectory of minimization and that reported for other Mande languages like Gouro, it is clear that the two systems are quite different. Following from recent works on such Southeastern Mande languages, these languages are on a trend towards monosyllabicity. However, alongside this trend, these languages are in large part maintaining their tonal contrastiveness. Thus, in Southeastern Mande languages, their particular trajectory of minimization appears to be one in which tone continues to play an important role in the lexicon. It is unclear at this point to what extent other languages of these groups follow (or will follow) these trends or how these trends relate to other languages of the Mande family, e.g. Northwestern Mande and Eastern Mande, if at all. The outcome(s) of these trajectories of minimization can only be observed in due time.

This dissertation has presented a number of novel facts and characteristics about Colloquial Bamana, and moreover, it offers the first in-depth look at the phonological characteristics of this non-standard language variety. Through this detailed exploration

into Colloquial Bamana, several matters pertaining more directly to the normative varieties of Bamana that are better known in the literature have also come to light. In the list that follows, I highlight and summarize several key descriptive and theoretical contributions of this thesis.

Descriptive Contributions

1) Segmental minimization via vowel syncope, as first reported in Diakite (2006) and explored preliminarily in Baertsch & Davis (2009), Davis & Baertsch (2008), and Green & Diakite (2008), interacts with, and at times competes with, a second segmental minimization process of intervocalic velar consonant deletion.

2) Vowel Syncope and Velar Consonant Deletion are regularly occurring phonological processes whose application can only be predicted in reference to the presence of metrical structure in the form of maximally disyllabic prosodic feet. Substantive support for such structure on the segmental level has never before been offered for languages in this group and has only been gleaned from earlier proposals of tonal feet (e.g. Leben 2002, 2003; Weidman & Rose 2006). Furthermore, the application of Velar Consonant Deletion and Vowel Syncope in Colloquial Bamana necessarily implies the presence of segmental foot structure in Standard Bamana. Preliminary support can be found for this observation in ludlings and French loanword incorporation.

3) Distinct preferences exist in Colloquial Bamana segmental minimization, among them:

i) Velar Consonant Deletion is a preferred process of minimization in Colloquial Bamana. ii) Vowel Syncope does not occur to the exclusion of, or in conjunction with, Velar Consonant Deletion. iii) A [-hi] vowel cannot delete when it shares a domain with a [+hi] vowel that is ineligible for deletion. iv) Both Velar Consonant

Deletion and Vowel Syncope favor the creation of syllable complexity at the left-edge of a word when it can be accommodated.

5) Generally speaking, within a single level of the language's morphophonology, only a single instance of segmental minimization is permitted to occur. In certain exceptional cases involving [+hi] vowels, multiple deletions are possible, taking into consideration overall restrictions on the language's syllable and margin phonotactics and the overall *harmonicity* of the resultant word.

6) The tonal system of Colloquial Bamana is reduced in comparison to other varieties reported in the literature. In nearly all instances, lexically-specified minor tonal schemas have been lost. In partial support of Leben (2002, 2003), the distribution of tones in Colloquial Bamana is best captured in reference to tonal feet. The retention of LHH versus LLH melodies is motivated in reference to these tonal feet. The processes of *affaissement* and *compacité tonale* remain active in the language. *Compacité tonale* provides evidence for the importance of the prosodic word domain in this language.

Theoretical Contributions

1) Expanding upon data first reported in Diakite (2006) and explored preliminarily in Baertsch & Davis (2009), Davis & Baertsch (2008), and Green & Diakite (2008), SYNCOPE in Colloquial Bamana is a process best captured in a competition between *PEAK constraints, alongside higher-ranked markedness and lower-ranked faithfulness constraints.

2) Following from Baertsch & Davis (2009), the synchronic emergence of CVC and CCV complex syllable shapes in Colloquial Bamana is in support of a Split Margin Approach to syllable structure (Baertsch 2002).

3) The processes of minimization in Colloquial Bamana cannot be captured in a *strict domination* standard optimality theoretic framework. Furthermore, a standard harmonic grammar framework also fails to account for some phenomena, thereby revealing that Colloquial Bamana is an example of a *non-harmonically complete* grammar. MAX[-hi] is largely unable to interact with other constraints, and thus the superlinear conjunction of constraints must be invoked to achieve harmonicity in this language.

4) Tonal and segmental feet in Colloquial Bamana are constructed in parallel, i.e. they are maximally disyllabic, exhaustive, and constructed left-to-right from the left edge of the word. This runs counter to earlier proposals for tonal footing in Standard Bamana by Leben (2002, 2003) that necessitate the lexical specification of footing direction and Weidman & Rose (2006) who propose right-to-left footing.

5) Minimization in Colloquial Bamana appears analogous to that observed in closely related (e.g. Kankan Maninka (Diakite 2010)) and more distantly related (e.g. Gouro (Kuznetsova 2007) Mande languages. One or more predictable trajectories of minimization related to higher prosodic structure may be at play in these languages.

In summary, this thesis has provided much new data, has shed new light on old ideas, and has opened up the door for several new lines of research to explore in the future. Overall, the thesis has shown that non-standard language varieties have much to offer on many levels for both descriptive and theoretical linguistics and that they must be captured and characterized whenever possible before they disappear or morph into something else.

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Prosodic Phonology, Syllable Structure and Contact, Phonological Acquisition and Disorders, Nasal/Consonant Interactions, Moraic Theory, African Linguistics, Field Linguistics, Endangered Languages

EDUCATION

2003 B.S., Biochemistry, Florida State University, Tallahassee, FL
2003 B.M., Music Performance, Florida State University, Tallahassee, FL
2008 M.A., Linguistics, Indiana University - Bloomington
2010 Visiting Scholar, University of Bamako, Faculté des Langues, Arts et Sciences Humaines, Bamako, Mali
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CURRENT POSITION

2011 - Assistant Research Scientist, Center for Advanced Study of Language - Less Commonly Taught Languages and Cultures, University of Maryland

PROFESSIONAL EXPERIENCE

2007-2010 Research Assistant, Learnability Project, Lab of Dr. Daniel Dinnsen and Dr. Judith Gierut, Indiana University Linguistics and Speech & Hearing Sciences
2008 Primary Instructor, Indiana University, Department of Linguistics
2008-2010 Research Assistant, Indiana University, Program in African Studies
2009-2010 Research Assistant, Indiana University, Department of Applied Health Sciences
2009-2010 Editorial Assistant, *Language*, Book Reviews
2009-2010 Editorial Assistant, *Issues in Political Discourse Analysis*
2010 Associate Instructor, Indiana University, Department of Linguistics

FELLOWSHIPS AND GRANTS

2006 – 2007 Foreign Language and Area Studies (FLAS) Academic Year Fellow, Indiana University, Program in African Studies, *Elementary Bamana* - (tuition waiver plus \$15,000 stipend)
2007 – 2008 FLAS Academic Year Fellow, Indiana University, Program in African Studies *Intermediate Bamana* - (tuition waiver plus \$15,000 stipend)
2008 FLAS Summer Term Fellow *Elementary Kiswahili* - (tuition waiver plus \$2,500 stipend)
2008 – 2009 FLAS Academic Year Fellow, Indiana University, Program in African Studies *Advanced Bamana* - (tuition waiver plus \$15,000 stipend)
2009 - 2010 NIH Pre-Doctoral Fellow (tuition waiver plus \$22,900 stipend)

- Training Grant in Speech, Hearing, and Sensory Communication (DC-000012),
Indiana University
- 2010 National Science Foundation Dissertation Grant #1023781, Co-PIs Samuel
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HONORS AND AWARDS

- 1999 Douglas J. Sydney Scholar
- 2000 Eta Sigma Phi (Eta Chapter) National Classics Honor Society
- 2000 James Jacob Jones Presidential Scholar
- 2000 National Society of Collegiate Scholars
- 2000 – 2003 Florida State University, School of Music Scholar
- 2003 Phi Eta Sigma National Honor Society
- 2008 Indiana University Department of Linguistics Graduate Student Travel Award
39th Annual Conference on African Linguistics, Athens, GA
- 2009 Fred W. Householder Outstanding Graduate Student Paper Award
“Nasal Deletion in Class 9/10 and its Effect on Augment Use (in Luwanga)”
Indiana University, Linguistics Department
- 2009 Carleton T. Hodge Prize in African Studies
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- 2009 Indiana University College of Arts & Science Travel Award
6th World Congress on African Linguistics, Cologne, Germany
- 2009 Herman B Wells Graduate Fellowship (departmental nominee)
- 2010 Indiana University Dissertation Year Fellowship (departmental nominee)

JOURNAL ARTICLES (PEER-REVIEWED)

- 2008 Christopher R. Green. “Discursive Strategies in Political Speech: The Words of
Dr. Bingu wa Mutharika,” *Issues in Political Discourse Analysis* 2(1), 59-74.
- 2008 Christopher R. Green and Boubacar Diakite. “Emergent Syllable Complexity in
Colloquial Bamana,” *Journal of West African Languages* 35(1-2), 45-56.
- 2009 Christopher R. Green. “Prosody and Intonation in Non-Bantu Niger-Congo
Languages: An Annotated Bibliography,” *Electronic Journal of Africana
Bibliography* 11, 1-45.
- in press, 2011 Daniel A. Dinnsen, Judith A. Gierut, Michele L. Morrisette, Christopher R.
Green, and Ashley W. Farris-Trimble. “On the interaction of Deaffrication and
Consonant Harmony,” *Journal of Child Language*.
- in press, 2011 Daniel A. Dinnsen, Christopher R. Green, Judith A. Gierut, and Michele L.
Morrisette. “On the anatomy of a chain shift,” *Journal of Linguistics*.
- in press, 2011 Daniel A. Dinnsen, Christopher R. Green, Michele L. Morrisette, & Judith A.
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Linguistics & Phonetics*.
- under review Christopher R. Green, Stuart Davis, Boubacar Diakite, and Karen Baertsch. “On
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- under review Christopher R. Green and Ashley W. Farris-Trimble. “Voice contrast and
cumulative faithfulness in Luwanga nouns”.
- under review Michael C. Dow and Christopher R. Green. “The morphophonology of animate
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- under review Daniel A. Dinnsen and Christopher R. Green. “The coronal fricative conspiracy
in acquisition”.

EDITED VOLUMES

- 2009 Jonathan C. Anderson, Christopher R. Green, and Samuel G. Obeng (eds.). *IULC Working Papers in Linguistics, Volume 8: African linguistics across the discipline*. Bloomington, IN: IULC Publications.
- in preparation Christopher R. Green and Jonathan C. Anderson (eds.). *Compounding in West African languages*.

PAPERS IN EDITED VOLUMES (PEER-REVIEWED)

- 2009 Christopher R. Green, Stuart Davis, Boubacar Diakite, and Karen Baertsch. "Syncope and the drive towards minimization in Colloquial Bamana," In Anderson, J.C., Green, C. R., & Obeng, S.G. (eds.), *IULC Working Papers in Linguistics, Volume 8: African Linguistics across the discipline*, 109-131. Bloomington, IN: IULC Publications.
- under review Christopher R. Green. "Paradigm uniformity in Luwanga derived nouns," Paper submitted to the *Proceedings of the 6th World Congress on African Linguistics*.
- under review Christopher R. Green, Stuart Davis, Boubacar Diakite, and Karen Baertsch. "Domain-restricted reduction: A proposal for segmental feet in Bamana," Paper submitted to the *Proceedings of the 41st Annual Conference on African Linguistics*.

BOOK REVIEWS/BOOK NOTICES

- 2008 Samuel G. Obeng and Christopher R. Green. Review of *The Handbook of Discourse Analysis*. D. Schiffrin, D. Tannen, and H. E. Hamilton, eds. *World Englishes* 27(1), 144-147.
- 2009 Christopher R. Green. Review of *Radicalism and Cultural Dislocation in Ethiopia, 1960-1974*. by Messay Kabebe. *Africa Today* 56(1), 113-114.
- 2010 Christopher R. Green. Review of *The Paradox of Third-Wave Democratization in Africa: The Gambia Under AFPRC-APRC Rule, 1994-2008*. by Adoulaye Saine. *Africa Today* 56(2), 106-108.
- 2010 Christopher R. Green. Review of *Natural Phonetics and Tonetics*. by Luciano Canepari. *eLanguage*, March 27.
- in press Christopher R. Green. Review of *Strength Relations in Phonology*. Ed. by Kuniya Nasukawa and Phillip Backley. *eLanguage*.
- in press Christopher R. Green. Review of *The Languages of Urban Africa*. Ed. by Fiona McLaughlin. *eLanguage*.
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CONFERENCE PRESENTATIONS

- 2008 Christopher R. Green. "Nasal Deletion in Class 9/10 and its Effect on Augment Use," Paper presented at the 39th Annual Conference on African Linguistics, Athens, GA. April 20.
- 2008 Christopher R. Green, Stuart Davis, Boubacar Diakite, and Karen Baertsch. "Syncope in Bamana," Paper presented at the 14th Annual Mid-Continental Workshop on Phonology, Minneapolis, MN. October 17-19.
- 2009 Christopher R. Green, Stuart Davis, Boubacar Diakite, and Karen Baertsch. "Syncope in Bamana: In Support of a Split-Margin Approach to the Syllable," Paper presented at the 40th Annual Conference on African Linguistics, Champaign, IL. April 9-11.

- 2009 Christopher R. Green. "Paradigm Uniformity in Luwanga Derived Nouns," Paper presented at the 6th World Congress on African Linguistics, Cologne, Germany. August 17-21.
- 2009 Daniel A. Dinnsen, Judith A. Gierut, Michele L. Morrisette, Christopher R. Green, and Ashley W. Farris-Trimble. "Chickens kick 'n chew, but tigers do too: The interacting error patterns problem," Paper presented at the 15th Mid-Continental Workshop on Phonology, Bloomington, IN. October 9-11.
- 2010 Christopher R. Green, Stuart Davis, Boubacar Diakite, and Karen Baertsch. "Margins and metrical structure: Constraining minimization in Colloquial Bamana," Paper presented at the 41st Annual Conference on African Linguistics, Toronto, Ontario, Canada. May 6-8, 2010.
- 2010 Christopher R. Green and Stuart Davis. "Avoiding multiple complexities in the prosodic word: Minimization in Colloquial Bamana," Paper presented at the 18th Manchester Phonology Meeting, Manchester, UK. May 20-22, 2010.
- 2010 Michael C. Dow and Christopher R. Green. "On the seemingly opaque morphophonology of Najamba (Dogon). Paper presented at the 16th Mid-Continental Workshop on Phonology. Evanston, IL.
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OTHER MANUSCRIPTS

- 2008 Christopher R. Green. "Characterizing Pre-Nasalized Stops in Luwanga," Indiana University.
- 2008 Christopher R. Green. "Pronominal Distance in United Nations General Assembly Debates: A Critical Pragmalinguistic Study". *First qualifying paper, Indiana University.*
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TEACHING

- 2008 Primary Instructor, Indiana University
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SERVICE AND SYNERGISTIC ACTIVITIES

- Co-founder, Indiana University African Languages Club (2006)
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