SYNCOPE AND THE DRIVE TOWARDS MINIMIZATION IN COLLOQUIAL BAMANA*

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Abstract: Data from two varieties of Bamana, a Mande language spoken in West Africa, illustrate that permissible syllable shapes vary between the two types. A comparison of Classic Bamana spoken in Ségou, Mali and that spoken by a younger cohort of individuals in the Malian capital, Bamako, reveals that the latter variety is synchronically developing complex CCV and CVC syllable shapes, whereas the classical variety permits only maximal CV syllables. We posit that the development of these syllable shapes represents an overall drive towards word minimization in this variety of the language. This study formalizes minimization in Colloquial Bamana in an optimality theoretic framework and illustrates the support that these developing processes in Bamana provide for the Split Margin Approach to the syllable, developed in Baertsch (2002). Preferential deletion patterns, the role of phonotactics in driving these patterns, and other processes interacting with and/or preventing syncope from occurring are also explored.

1. Introduction

The emergence of complex syllables in Colloquial Bamana has been reported in recent work in which patterns of deletion and minimization (Diakite, 2006; Green & Diakite, 2008), as well as implications for syllable theory and syllable typology have been preliminarily explored (Baertsch & Davis, 2009; Davis & Baertsch, 2008; Green, Davis, Diakite, & Baertsch, 2008, 2009). These works have posited that the phonologically more complex variety of Bamana, termed Colloquial Bamana (henceforth CB), has developed from a more phonologically conservative and historically standard variety of the language. These studies have provided data illustrating that CB is synchronically developing either syllables with complex onsets of rising sonority (CCV) in which the first consonant of the onset is typically an obstruent[1] and the second is a sonorant or syllables with singleton sonorant codas (CVC). We illustrate below that these complex syllables are being formed primarily via vocalic syncope and preferentially via syncope of [+hi] vowels. Given that the historically standard variety of the language contains maximal CV syllables, with the exception of a small number of words include syllabic nasal-initial words, vowel-initial borrowings, and emergent nasal codas arising upon the juxtaposition of phonemic nasal vowels and voiced plosives, the development of permissible CVC and CCV syllables represents a significant change to the phonology of the language. In this study, we motivate and formalize

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[1] CCV syllables with nasal + liquid clusters have been attested in some Colloquial Bamana words.

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the development of complex syllables in CB in an optimality theoretic framework and illustrate that syncope is driven largely by the interaction of a language-specific ranking of constraints on preferred syllable peaks. Additionally, we illustrate the importance of constraints on permissible syllable margins and syllable contact sequences in this process, as well as further constraints on syllable markedness and segmental faithfulness that either facilitate minimization or prevent syncope from occurring. Furthermore, we illustrate that only a single occurrence of minimization, whether via syncope or otherwise, is permitted within a word. That is, while in Colloquial Bamana, both complex CVC and CCV syllables are allowed, only one such complex syllable can occur in a word, and CCVC syllables do not occur.

2. Resolving SYNCOPE

Analyses laid forth in work by Diakite (2006) and Baertsch and Davis (2009) provide remarkable evidence supporting the derivation of CB from more phonologically conservative varieties of the language, for example Standard Bamako Bamana or Classical (Vydrine, 1999) Ségou Bamana. While these studies explore only vocalic syncope, they uncover the importance of phonotactic restrictions in the application of the process; research that has been continued in more recent work by Green et al. (2008, 2009). In these more recent works, Green et al. have provided a preliminary characterization of minimization in Bamana that we formalize here in the analysis that follows. This study teases apart the mechanism underlying the cover constraints SYNCOPE and MINIMIZE-SYLLABLE, as presented in Baertsch and Davis (2009) and Diakite (2006), respectively. We begin by assuming a constituent-based model of the Bamana syllable and later develop a characterization of Bamana with the Split-Margin Approach to the Syllable (Baertsch, 2002) in Section 3 below.

2.1 Basic syncope patterning

Data in (1) from CB illustrate the preference for syncopation of [+hi] vowels (i.e. [i] and [u] in the seven vowel system of Bamana) in the language. This preference is clearly illustrated in words containing vowels of multiple heights where [+hi] vowels are preferred for deletion when phonotactically permitted. That this preference for [+hi] vowel deletion is not just a tendency is illustrated in words in which it would appear phonotactically possible to delete either vowel (e.g. 1b, e-f). Thus, we find that a [-hi] vowel will never be chosen for deletion if an acceptable [+hi] deletion target is available.

(1) High Vowel Deletion[2]

	Standard (SB)	Colloquial (CB)		Gloss
a.	[ka.bi.la]	[ka.bla]	*kbi.la	‘tribute’
b.	[si.la.mɛ]	[sla.mɛ]	*sil.mɛ	‘Muslim’
c.	[sa.fi.nɛ]	[sa.fnɛ]	*sfa.nɛ	‘soap’

[2] Syllable boundaries are indicated by a ‘.’. While the tonology of Bamana remains a contentious subject, we have taken care to mark Standard Bamana words with attested Low tone contours with a grave accent on their first syllable. Those Standard Bamana words with attested High tone contours are left unmarked. For an overview of a number of controversies in the tonology of this language see Creissels (1992). An analysis of the tonal contour generated in Colloquial Bamana words as a result of minimization, and its implications for current understanding of the overall tonology of the language is forthcoming. Therefore, we have chosen to leave aside tonal marking on CB words.

d.	[mo.ri.ba]	[mor.ba]	*mri.ba	'man's name'
e.	[ba.ri.ka]	[bar.ka]	*bri.ka	'strength'
f.	[fa.rĩ.mã]	[far.mã]	*frĩ.mã	'hotness'
g.	[sa.nu.ma]	[san.ma]	*snu.ma	'holy'
h.	[mà.ri.fa]	[mar.fa]	*mri.fa	'gun'
i.	[de.li.ko]	[del.ko]	*dli.ko	'habit'
j.	[fa.ri.mã]	[far.mã]	*fri.mã	'brave'
k.	[dù.lo.ki]	[dlo.ki]	*dul.ki	'shirt'
l.	[ba.li.ku]	[bal.ku]	*bli.ku	'adult'

Under the view that the SB form serves as the underlying form of CB, these data reveal two important features of CB: 1) vocalic deletion is preferable to the preservation of Faithfulness, and 2) vocalic deletion of a [+hi] vowel is preferred to that of a [-hi] vowel. Considering these data therefore allows one to posit a critical ranking between a constraint militating against segmental deletion and one driving syncope, as well as a critical ranking between constraints militating against particular syllable peaks. The first of these CB features is formalized in the competition between MAX-IO and the cover constraint SYNCOPE, as in (4) below. Reversing this ranking would result in the selection of the non-syncopated output candidate; that found in the Standard variety of the language.

(2) MAX-IO (henceforth MAX) – segments in the input must have an output correspondent
(3) SYNCOPE - minimize the number of syllables in a word
(4) SYNCOPE >> MAX-IO – [ba.li.ku] → [bal.ku]

/baliku/ 'adult'	SYNCOPE	MAX
a. ba.li.ku	*!	
b. ☞ bal.ku		*

Having established the preference for syncope to occur, we now tease apart the role of the SYNCOPE cover constraint in terms of two constraints derived from Prince and Smolensky's (1993/2004) Margin Hierarchy that formalize the preference for syllable peaks to be of high sonority. As Tableau (7) reveals, while CB permits syllables with [+hi] and [-hi] peaks, it prefers [-hi] peaks, as evidenced by the preferred deletion of [+hi] vowels in the language. By replacing SYNCOPE with the necessary *PEAK constraints, we posit a critical ranking of these constraints above MAX. This tableau illustrates that the non-syncopated candidate containing an additional [+hi] vowel is eliminated by the higher-ranking *PEAK constraint in favor of the syncopated winner.

(5) *PEAK [+hi] – incur a violation for each high vowel syllable peak
(6) *PEAK [-hi] – incur a violation for each non-high vowel syllable peak

(7) *PEAK [+hi] >> *PEAK [-hi] >> MAX – [ba.li.ku] → [bal.ku]

/baliku/ 'adult'	*Peak[+hi]	*PEAK[-hi]	MAX
a. ba.li.ku	*!*	*	
b. ☞ bal.ku	*	*	*
c. bli.ku	*!*		*

Although [+hi] vowel syncope is preferred in CB, data reveal that [-hi] vowel deletion is permissible in instances where a [+hi] target is not available, provided that the phonotactics of the languages are not compromised. (More specific details of CB phonotactics, specifically permissible syllable margins and syllable contact sequences, are discussed below.) Data illustrating such instances of syncope support the observation that minimization is still preferred in the language. Displays (8) and (9) illustrate this point.

(8) [-hi] Vowel Deletion

a.	[ca.pa.lo][3]	[ca.plo]	'millet beer'
b.	[ka.ma.lẽ]	[ka.mlẽ]	'boyfriend'

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

/capalo/	*Peak[+hi]	*PEAK[-hi]	MAX
a. ca.pa.lo		**!*	
b. ☞ ca.plo		**	*

Along these same lines, words containing all [+hi] vowels, obeying other phonotactics, also illustrate the drive towards minimization with the non-syncopated candidate losing to the syncopated winner by accumulating multiple *PEAK[+hi] violations. The word [mi.si.ri] 'mosque', for example, surfaces in CB as [mi.sri].

Given the data and deletion patterns presented thus far, we have established the preference for various instantiations of syncope in CB but have not considered the finer details of the language's phonotactics, more specifically, the role of syllable margins in selecting patterns of deletion in words of other shapes. For example, as we discuss below, in instances where syncope would result in phonotactically impermissible sequences, minimization fails to occur. The following section introduces the Split Margin Approach to the syllable (Baertsch, 2002) and discusses its application and implications for the observed synchronic development of complex syllable shapes in CB.

[3] 'c' is utilized in the Bamana orthography to denote the voiceless affricate [ʧ]. Similarly, 'j' is utilized in the orthography to denote the voiced affricated [ʤ]. The glide [j] is denoted by 'y'.

3. The Split Margin Approach to the Syllable

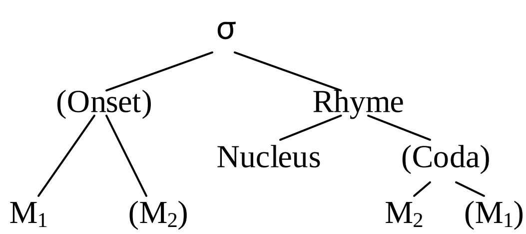
The overall phonotactics driving syncope patterning in Colloquial Bamana are best captured by adopting a Split-Margin model of the syllable (Baertsch, 2002) that formalizes the relationship between constituents in different margin positions (i.e. onset and coda consonants). This model speaks to the universal tendency for languages to contain syllables with constituents of particular sonorities by expanding upon the Margin Hierarchy proposed by Prince and Smolensky (1993/2004) that gives preference to low sonority constituents in all syllable positions. Baertsch (2002) proposed the presence of a mirror-image hierarchy within which certain syllable positions favor high sonority constituents. This effectively splits Prince and Smolensky's Margin Hierarchy into two separate Margin Hierarchies. The M_1 Hierarchy follows from the original proposal of Prince and Smolensky and therefore favors consonants of low sonority. The M_2 Hierarchy, however, favors consonants of high sonority. These Margin Hierarchies follow in (10) and (11).[4]

(10) M_1 Hierarchy:
(*M_1/ [+lo] >> *M_1/ [+hi]) >> *M_1/ r >> *M_1/ l >> *M_1/ Nas >> *M_1/ Obs

(11) M_2 Hierarchy:
*M_2/ Obs >> *M_2/ Nas >> *M_2/ l >> *M_2/ r >> (*M_2/ [+hi] >> *M_2/ [+lo])

In the Split Margin syllable shown in (12), the syllable initial consonant is the M_1 position. The M_2 position includes the second member of a branching onset (if present) and the first member of the coda.[5] Baertsch refers to these pairings as M_1 and M_2 positions, respectively. Consider the Split Margin syllable in (12).

(12) Split-Margin Syllable Model (adapted from Baertsch, 2002)



In this model, M_1 positions (drawing from Prince & Smolensky's (1993/2004) original Margin Hierarchy) are those favoring low sonority constituents, whereas M_2 positions favor high sonority constituents. A body of work, detailed elsewhere (e.g. Baertsch & Davis, 2003, 2009; Davis & Baertsch, 2005), provides support for this model of the syllable and has discussed its implications for and applications to syllable typology, L1 acquisition, phonotactics, and diachronic change. The analysis that follows describes CB

[4] The parenthesized elements in (10) and (11) are those that would be drawn into the syllable peak, and, for the most part, are not relevant to our discussion of syllable margins.
[5] The second member of a branching coda, if allowed, would be an M_1 position, but given that CB does not allow branching codas, this structure will not be discussed.

phonotactics in terms of constraints on permissible syllable margin positions and discusses how the Split Margin Approach predicts the emergent and synchronic patterns of syllable complexity observed in this language variety.

3.1 Role of M_2 constraints

Utilizing a Split Margin Approach to the syllable, we propose that language-specific rankings of constraints on margin constituents relative to those preserving faithfulness and barring against other types of markedness effectively drive the permissibility of different types of syllables in a given language. In the case of CB, we find that a constraint barring obstruents from syllable codas and from the second position in a branching onset (*M_2/Obs) is effective in selecting winning outputs with complex onsets of rising sonority. Such a constraint is undominated in the CB ranking, as no instances of obstruents in either of these positions are attested. We see, however, that a similar constraint barring sonorants from these positions (*M_2/Son) must be ranked low in the hierarchy, given the presence of complex onsets with second member sonorant consonants, as well as singleton sonorant codas in the language. Tableau (13) illustrates the ranking between these two margin constraints relative to other relevant the markedness and faithfulness constraints discussed thus far.

(13) *M_2/OBS >> *PEAK[+hi] >> *PEAK[-hi] >> MAX >> *M_2/SON

/kabila/ 'tribute'	*M_2/OBS	*PK[+hi]	*PK[-hi]	MAX	*M_2/SON
a. ka.bi.la		*!	**		
b. kab.la	*!		**	*	
c. ☞ ka.bla			**	*	*
/silamɛ/ 'Muslim'					
a. si.la.mɛ		*!	**		
b. sil.mɛ		*!	*	*	*
c. ☞ sla.mɛ			**	*	*

While this ranking of M_2 constraints applies specifically to CB, one can observe that for the standard variety of Bamana, the entire M2 hierarchy would be high-ranked given that no complex onsets or codas are permitted in the language. Conversely, a language such as Latin, where there are effectively no restrictions on coda consonants would have its entire M_2 hierarchy low-ranked. Similarly, in both the Standard and Colloquial varieties of Bamana, the M_1 hierarchy is low-ranked, given that all consonant types are possible as singleton onsets.

3.2 Conjoining margin hierarchies

We can further account for restrictions on permissible branching onsets by conjoining constraints on specific M_1 and M_2 positions adjacent in the syllable onset. The 'ideal' branching onset would be one in which the lowest ranked margin constraints from each of the M_1 and M_2 hierarchies are conjoined, as illustrated in the partial conjoined margin hierarchy in (14) that illustrates preferred M_2 constituents when the M_1 is an obstruent.

(14) Conjoined Margin Hierarchy (partial)
$_{\sigma}$[*M_1/Obs&*M_2/Obs >> $_{\sigma}$[*M_1/Obs&*M_2/Nas >> $_{\sigma}$[*M_1/Obs&*M_2/[l] >> $_{\sigma}$[*M_1/Obs&*M_2/[r]

Given the mechanics of this application of Local Constraint Conjunction as described in Baertsch and Davis (2009), the conjoined margin hierarchy captures the preference for the presence of complex onsets with low-sonority (obstruent) M_1s alongside high-sonority (sonorant) M_2s and a ban on complex onsets with constituents of identical sonority, such as the high-ranked $_{\sigma}$[*M_1/Obs&*M_2/Obs. While this ranking illustrates the general observation of $_{\sigma}$[*M_1/Obs&*M_2/Obs critically out-ranking $_{\sigma}$[*M_1/Obs&*M_2/Nas, our CB data allow us to refine this ranking further by proposing a finer distinction between constraints on voiced and voiceless M_1 obstruents. Given that SB words such as [tὲnε] 'taboo' surface as [tnε] in CB, but words such as [bana] 'to become sick' surface as in their fully faithful form, we note that complex onsets containing voiceless obstruents & nasals are permitted, whereas those containing voiced obstruents & nasals are banned.[6] Furthermore, it is important to note that any conjoined constraint, in order to be active, dominates both of its component margin constraints. Tableau (15) illustrates the interaction of these conjoined margin constraints alongside other constraints on markedness and faithfulness discussed above and reveals that the high-ranking conjoined constraint has the ability to drive the selection of a fully-faithful output candidate, as in *kabano* 'asylum', and therefore to prevent minimization.

(15) *M_2/Obs, $_{\sigma}$[*M_1/VoiObs & *M_2/Nas >> *PEAK[+hi] >> *PEAK[-hi] >> MAX >> $_{\sigma}$[*M_1/VLessObs & *M_2/Nas

/safinε/	*M_2/ OBS	$_{\sigma}$[*M_1/VoiObs & *M_2/Nas	*PK [+hi]	*PK [-hi]	MAX	$_{\sigma}$[*M_1/VLess Obs & *M_2/Nas
a. sa.fi.nε			*!	**		
b. saf.nε	*!			**	*	
c. ☞ sa.fnε				**	*	*
/kabano/						
a. ☞ ka.ba.no				***		
b. kab.no	*!			**	*	
c. ka.bno		*!		**	*	

[6] Most commonly, the second member of such an onset is the alveolar nasal, although velar obstruent & bilabial nasal complex onsets are acceptable for some speakers (e.g. lɔkɔmã → lɔɔ.mã/lɔ.kmã 'handful', takama → taa.ma/ta.kma 'journey'), however never word-initially (e.g. kamalẽ → ka.mlẽ, *kma.lẽ). Baertsch and Davis (2009) are clear that segments at the same sonority level may not pattern exactly the same way, and thus may account for the inconsistent behavior of such sequences. It is in this way that the approach taken by Baertsch and Davis differs from that taken in Gouskova (2004) in which segments at the same sonority level are expected to behave identically.

We observe further the effects of these conjoined margin constraints in CB where like-vowel words with more than two syllables display variation between outputs with complex onsets and those with singleton sonorant codas. Consider the data in (16a-l) where words containing like-vowels in which phonotactics permit the deletion of either vowel to create either of these optional complex syllable shapes.

(16) Variation in Syncope

	Standard (SB)	Colloquial (CB)	Gloss
a.	[sa.ra.ma]	[sra.ma]/[sar.ma]	'famous'
b.	[mɛ̀.lɛ.kɛ]	[mɛl.kɛ]/[mlɛ.kɛ]	'angel'
c.	[kè.le.ku]	[kel.ku]/[kle.ku]	'to stumble'
d.	[ga.la.ma]	[gal.ma]/[gla.ma]	'spoon'
e.	[ba.ra.ka]	[bar.ka]/[bra.ka]	'blessing'
f.	[kɔ.lɔ.si]	[kɔl.si]/[klɔ.si]	'carefulness'
g.	[ka.la.bã]	[kal.bã]/[kla.bã]	'a neighborhood'
h.	[bɔ.rɔ.tɔ]	[bɔr.tɔ]/[brɔ.tɔ]	'to tear apart'
i.	[sa.ra.ti]	[sra.ti]/[sra.ti]	'condition'
j.	[su.ru.ku]	[sur.ku]/[sru.ku]	'hyena'
k.	[bù.lu.ku]	[bul.ku]/[blu.ku]	'to plow'
l.	[kù.lu.si]	[kul.si]/[klu.si]	'pants'
m.	[ca.pa.lo]	[ca.plo]/*[cpa.lo]	'millet beer'
n.	[ka.ma.lẽ]	[ka.mlẽ]/*[kma.lẽ]	'boyfriend'
o.	[yo.go.ro]	[yo.gro]/*[ygo.ro]	'puppet'
p.	[jà.la.ki]	[jal.ki]/*[jla.ki]	'blame'

It has been proposed in a number of studies (e.g. Antilla & Cho, 1998; Auger, 2001; Davis, unpublished Ms; Davis & Torretta, 1998; Zubritskaya, 1997) that instances of variation in acceptable outputs, such as those described above, can be analyzed in Optimality Theory by appealing to indeterminacy between low-level adjacent constraints. Diachronically speaking, it has been proposed in several of the studies just cited that constraint rankings within a grammar may be relaxed and thus begin to allow for variation in acceptable outputs over time. These proposals would argue that indeterminacy in the grammar permits the alternative selection of either phonotactically-permissible output. CB data strongly support this proposal given that low-ranking conjoined constraints allowing permissible complex obstruent & sonorant onsets has no critical ranking relationship alongside another low-ranking markedness constraint on permissible syllable contact, *SYLLCON, which is violated when two consonants come together over a syllable boundary. Therefore, an output candidate satisfying *SYLLCON but violating $_{\sigma}$[*M_1/Obs&*M_2/Son would surface as the variant with a complex obstruent & sonorant onset, whereas one in which these relationships are reversed would surface with a singleton sonorant coda. Tableau (17) illustrates the variable selection of permissible output candidates via this mechanism. In each instance, the two competing syncopated output candidates tie in their accumulated violations of their respective *PEAK constraints and are evaluated by constraints in the lower tier. We return to this variation and its implications and support for the Split

Margin Approach to the syllable in later discussion. In tableau (17), high-ranking conjoined margin constraints that are not relevant for the data presented are omitted.

(17) Indeterminacy yields variation in output candidates

*M_2/OBS >> *PEAK[+hi] >> *PEAK[-hi] >> *SYLL-CON, $_{\sigma}$[*M_1/Obs & *M_2/Son >> *M_2/Son

/sarama/ 'famous'	*M_2/OBS	*PK [+hi]	*PK [-hi]	*SYLLCON	$_{\sigma}$[*M_1/Obs & *M_2/Son	*M_2/Son
a. sa.ra.ma			***!			
b. ☞ sar.ma			**	*		*
c. ☞ sra.ma			**		*	*
/buluku/ 'to plow'						
a. bu.lu.ku		***!				
b. ☞ bul.ku		**		*		*
c. ☞ blu.ku		**			*	*

Thus far, we have presented data in CB derived from three-syllable SB words that has allowed us to illustrate general syncope preferences and patterning, as well as the importance of margin phonotactics on selecting either a single permissible output candidate or variation in acceptable output in limited instances. Next, we present CB data derived from two-syllable words in SB. Our analysis illustrates that syncope still actively applies in these words but can be blocked when not permitted by higher-ranking constraints on both syllable and word-level phonotactics.

3.3 Syncope in shorter words

By turning our attention next to shorter words derived from SB, we are able to view the syncope mechanism active in CB in environments that are more restricted than in words with a greater number of syllables. These words allow us to observe the ways in which the language satisfies its overall drive towards minimization while still obeying the important phonotactic constraints governing the application of the syncope mechanism. Of importance in the presentation of these shorter words are restrictions that become apparent on codas in word-final syllables. In our presentation of longer words above, we observed in each instance that the optimal output of syncope is always a word containing either a complex onset or singleton coda in an internal word position. While we have expounded upon the preference in CB to syncopate [+hi] vowels, we have also illustrated that a [-hi] vowel will never be deleted when a [+hi] vowel that is eligible for deletion is otherwise present in a word. Thus, words such as (1k-l) and (16c, g, j, and q) that contain [+hi] vowels in final position in SB never syncopate this final [+hi] vowel, due to the impermissible M_2 obstruent that would be created. While this avoidance of an obstruent M_2 is expected, we must then consider the permissibility of deriving M_2 coda sonorants as a result of an analogous [+hi] vowel deletion. The possibility of such a scenario is illustrative of more detailed features of

CB grammar in several ways. First, the presence or absence of sonorant codas in these shorter words will permit comment on any overarching preference for a particular complex syllable structure in the language (i.e. CVC vs. CCV). Second, the presence of sonorant codas in these words would provide additional support to the theoretical implication of the Split Margin Approach that, due to the proposed relationship between M_2s in codas and those found as permissible second members of a branching onset, the same types of M_2s should be possible in either syllable position. Details regarding these points are most readily illustrated in a consideration of shorter CB words, such as those in (18).

(18) Two-Syllable Standard Bamana Words

	Standard (SB)	Colloquial (CB)		Gloss
a.	[bu.ru]	[bru]	*bur	'bread'
b.	[si.rã]	[srã]	*sir	'to scar'
c.	[fi.nɛ]	[fnɛ]	*fin	'caste name'
d.	[fi.nĩ]	[fnĩ]	*fin	'caste name'
e.	[tɛ̀.nɛ]	[tnɛ]	*tɛn	'taboo'
f.	[bò.li]	[bol]	*bli	'to run'
g.	[se.li]	[sel]	*sli	'prayer'
h.	[fò.li]	[fol]	*fli	'greeting'
i.	[sò.li]	[sol]	*sli	'to wake early'
j.	[bi.li]	[bli]/[bil]		'roof'
k.	[ki.li]	[kli]/[kil]		'egg'
l.	[fi.li]	[fli]/[fil]		'to err'

Upon first glance, data from (18a-e) behave in precisely the manner that one would expect given the preceding discussion. We observe in (18a-d) syncope via deletion of a [+hi] to yield a complex syllable containing an onset with a complex onset with an obstruent M_1 and a sonorant M_2. We also see that syncope of a [-hi] vowel is possible when a permissible complex onset can be created. Based upon earlier observations, as presented in Section 2.2, the fact that the emergent syllable shape is CCV, rather than permissible variation between CCV and CVC, is less expected in these words. According to principles laid forth in the Split Margin Approach (Baertsch, 2002) and the permissibility of sonorant M_2s in longer CB words, as motivated earlier, one would expect this possibility. Note, however, in (18f-i), as opposed to (18a-e), that in derivations from SB words of the shape $CV_{[-hi]}[l]V_{[+hi]}$ (where C is an obstruent), the preferred CB output is a CVC syllable with a sonorant [l] coda. A CCV syllable is not an acceptable output in these instances. This observation, thus, permits us to address the first of our two questions above regarding an overall syllable structure preference in CB. The presence of monosyllabic CVC output (18f-i), when an acceptable CCV alternative appears possible (18a-e) suggests that CCV is not necessarily an overall preferred maximal syllable shape in the language. This, thereby, rules out the necessity to propose a general markedness constraint banning codas in the language. Finally, in SB words of the shape $CV_{[+hi]}[l]V_{[+hi]}$ (where C is an obstruent), such as (18j-l), we find attested variation between the two possible syncope outcomes. In these instances, upon syncopation of the first [+hi] vowel, a complex CCV syllable is formed. Conversely, we find that word-final [l] codas are also acceptable, as they were in (18f-i).

These data with permissible word-final [l] codas reveals an intricate component of CB phonology. Notice, for example, in (18a-b), the target sonorant consonant is [r], but that in (18f-i, and j-l), the target sonorant is [l]. As in other languages, [r] and [l] in CB have opposite specifications for the feature [continuant], with these two sounds being plus and minus [continuant], respectively. Given the distribution of these types of segments in emergent CVC and CCV syllables in CB, as well as their distribution in other languages (e.g. Korean (Kenstowicz, 2005), Thai (Abramson, 1962), and !Xóõ (Traill, 1985)), we posit a constraint on markedness, *FINALCONTINUANT, that militates against [+continuant] consonants from word-final codas. We propose that this constraint is undominated in CB. Thus, we find that the [-continuant] liquid [l] is chosen as a singleton sonorant coda when possible in CB words, whereas the [+continuant] [r] is banned from this position and, instead, emerges as the second member of a branching onset in a CCV syllable.

The patterning of nasals in relation to the other Bamana sonorants requires further consideration and discussion. Recall from (18c-e), that CV[n]V words pattern with CV[r]V words, rather than CV[l]V words in their ability to realize a word-final sonorant coda upon final vowel deletion. It has been noted, however, in earlier preliminary work (Green, 2007) that nasal consonants often emerge in coda positions in Bamana following phonemic nasalized vowels. This study explored this phenomenon in various word conditions, and found that nasal codas emerged in this manner both when one might expect (i.e. before voiced stops or often before other obstruents) and word-finally. One can posit, therefore that Colloquial Bamana has an additional high-ranking constraint on markedness, *VN#, that permits nasal codas only when the preceding vowel is nasalized.

3.4 Blocking Syncope

While the preceding sections have illustrated the importance of constraints on margin phonotactics in choosing a permissible syncope target, we can now turn to a consideration of instances where syncope is blocked from occurring when favorable phonotactic sequences cannot by generated upon its application. The following SB words of varying lengths offer support to the presentation of permissible M_2 consonants, as well as permissible conjoined M_1 & M_2 sequences in complex onsets. The CB data that follow in (19) facilitate further discussion on these and several other important features of the language's phonology.

(19) Syncope Blocked in CB

	Standard	Colloquial		Gloss
a.	[sà.ba]	[sa.ba]	*sba	'three'
b.	[ka.ba.no]	[ka.ba.no]	*ka.bno/*kba.no	'asylum'
c.	[ba.na]	[ba.na]	*bna	'to get sick'
d.	[fa.sa.da]	[fa.sa.da]	*fsa.da/*fas.da	'to praise'
e.	[dì.bi]	[di.bi]	*dbi	'darkness'
f.	[sa.ba.ti]	[sa.ba.ti]	*sba.ti/*sab.ti	'stable'
g.	[ki.ti]	[ki.ti]	*kti	'trial'
h.	[kì.ba.ru]	[ki.ba.ru]	*kib.ru/*ki.bru	'news'
i.	[du.kɛ.nɛ]	[du.kɛ.nɛ]	*du.knɛ/*dkɛ.nɛ	'courtyard'

j.	[dù.su.ka.si]	[du.su.ka.si]	*dus.ka.si	'heartbreak'
k.	[mu.sa.ka]	[mu.sa.ka]	*mu.ska	'expense'

The first observation we make is that syncope is always blocked in instances where the application of syncope would place an obstruent into an M_2 position; either as the second member of a branching onset or a singleton coda. As was presented in the conjoined margin hierarchy in (14), an M_1/Obs & M_2/Obs complex onset is the most marked, and the relevant conjoined constraint militating against this combination $_\sigma$[*M_1/Obs & *M_2/Obs in Bamana is undominated. Similarly, we motivated in (15) the high ranking of *M_2/Obs in CB relative to the *PEAK complex. This ranking effectively bars obstruents from emerging as singleton codas in the language. Examples such as (19a-b, d-e), among others, are representative of these rankings. Because such constraints are ranked higher than those driving the syncope machinery of the language, potential syncopated output candidates are ruled out in favor of the fully faithful SB form that would violate the lower ranking *PEAK constraint(s).

Words like (19c) highlight further the subtlety of the conjoined margin hierarchy illustrated above. The impermissibility of conjoined M_1/VoiObs & M_2/Nas adjacent in a syllable, along with the observed inability for [+continuant] segments to occupy word-final codas drives the selection, once again, of the fully-faithful candidate in such words. Words such as (19h-k) provide further evidence of the ability for syncope to be blocked when it is not compatible with other components of the language's phonology. The section that follows discusses several further subtleties that compete with the overall drive toward minimization in CB and are relevant for several of the words explored above (e.g. 19h-i).

4. Rhythmic structure

This study of syncope and syllable structure in Bamana suggests preliminary evidence for the proposal of rhythmic or metrical structure in the language. Such a finding is novel, indeed, as it has not been previously reported or even proposed that Bamana has this type of structure as part of its phonology at the segmental level. Recently, others have suggested that similar structures may exist in certain South-Eastern Mande languages (e.g. Kuznetsova, 2007; Vydrine, 2003). Leben (2003) and Weidman & Rose (2006) have analogously proposed tonal feet to account for the surface tonal patterns found in the language. The relationship between these earlier analyses and the current proposal of metrical structure is explored further before. While it is not the intent of this paper to detail this potential rhythmic structure, we will provide evidence implicating it in driving its specific types of SYNCOPE in CB and in the deletion of velar consonants between identical vowels in both SB and CB.

4.1 Velar consonant deletion

The noted deletion of velar consonants between identical vowels in CB (and often even in SB) is a process that is not uncommon typologically. In Bamana words of the shape $C_1V_1C_2V_1$, where C_2 is a velar consonant, we observe the results of a diachronic progression of velar consonant lenition (i.e. k → g → h → Ø) that has yielded 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), and in other Mande languages (e.g. Lélé

(Vydrine, 2008)). Given that both varieties of Bamana have an overall ban on diphthongs (and therefore an undominated NODIPH constraint (Casali, 1997)), we can explain the restrictions on this process to a domain of application between identical vowels. Data in (20 a-g) illustrate further that deletion can occur between identical oral vowels of any type. Minimization as the result of vocalic syncope in such words is never be permitted, given that such a process would create either an impermissible obstruent & obstruent complex onset (upon deletion of the first of the two vowels) or an impermissible obstruent coda (upon deletion of the second of the two vowels). Instances of words containing velar consonants between identical nasal vowels have not been found.

(20) Velar Consonant Deletion

	Standard	Colloquial	Gloss
a.	[si.gi]	[sii]	‘to sit’
b.	[mɔ.kɔ]	[mɔɔ]	‘person’
c.	[tɔ.gɔ]	[tɔɔ]	‘name’
d.	[sa.ga]	[saa]	‘sheep’
e.	[du.ku]	[duu]	‘village’
f.	[co.go]	[coo]	‘manner’
g.	[fa.ga]	[faa]	‘to kill’

Given the cross-linguistic application of this process, we follow Raffelsiefen (2004), in proposing a modified constraint (21) against intervocalic velar consonants. In optimality theoretic terms, we illustrate that this constraint is high-ranked in CB, the rationale for this being that CB prefers deletion of a targeted velar consonant (when possible) to the syncopation of [-hi] vowels. This ranking is illustrated in (22), and the accompanying tableau showcases that the winning candidate, even with two violations of the relevant *PEAK constraint, wins to the fully faithful candidate. Even with identical violations of *PEAK, the fully faithful candidate loses due to its additional violation of the higher-ranked markedness constraint (i.e. *VkV) militating against intervocalic velar consonants. We explore later that the relationship between *VkV and *PEAK[+hi] is somewhat different.

(21) *VkV – velar obstruents flanked by vowels are not permitted

(22) *VkV, *M_2/Obs >> *PEAK[-hi] >> MAX - /saga/ → [saa][7]

/saga/ ‘sheep’	*VkV	*M_2/Obs	*PEAK[-hi]	MAX
a. sa.ga	*!		**	
b. sga		*!	*	*
c. sag		*!	*	*
d. ☞ saa			*	*

[7] We assume here that, upon velar consonant deletion, resyllabification occurs in which the vowel of the second syllable is adopted into the nucleus of the first syllable, thereby generating a CVV syllable with a single long vowel.

While the data presented in (20) illustrate a seemingly transparent application of intervocalic velar consonant deletion (VCD), a further look into more complex Bamana words reveals that restrictions are in place that block the application of VCD. The data in (23) are representative of words in which VCD is blocked in one of two ways.

(23) Blocking Velar Consonant Deletion[8]

	Standard	Colloquial		Gloss
a.	[ɲa.ma.ka#la]	[ɲa.ma.ka.la]	*ɲa.maa.la	'caste'
b.	[ba.ra.ka]	[bar.ka]/[bra.ka]	*ba.raa	'blessing'
c.	[ko.lo#ko.wo]	[klo.ko.wo]/ [kol.ko.wo]	*ko.loo.wo	'window'
d.	[la#ka.li#ta]	[la.kal.ta]	*laa.li.ta	'news'
e.	[bo.lo#ko]	[blo.ko]/[bol.ko]	*bo.loo	'to circumcise'
f.	[mɛ.lɛ.kɛ]	[mlɛ.kɛ]/[mɛl.kɛ]	*mɛ.lɛɛ	'angel'
g.	[su.ru.ku]	[sru.ku]/[sur.ku]	*su.ruu	'hyena'
h.	[bu.lu.ku]	[blu.ku]/[bul.ku]	*bu.luu	'to plow'

Following Green and Diakite (2008), we note that in (23a-b, f-h), VCD fails when the velar consonant targeted for deletion is located underlyingly at what will become the onset of the third syllable of the word. Similarly, in (23c,e), VCD fails when the targeted velar consonant is the onset of the third syllable, but also at a word-internal morpheme boundary. (23d) illustrates VCD blocking in an even-numbered syllable that is also at a word-internal morpheme boundary. We can question, therefore, why this process fails to apply systematically in such specific environments.

As Green and Diakite (2008) broached, the failed application of VCD in words such as those described above, as well as further evidence that we present below in Section 3.2, leads us to propose that Bamana contains metrical or rhythmic structure. In terms of VCD, the words presented in (20) and (23) suggest that VCD is a phonological process that can occur only within units that we can describe as binary 'foot'-like trochees (Green & Diakite, 2008). If we assign binary feet in a left-to-right direction in Bamana, we find that, in each instance (at least in monomorphemic words), VCD occurs within a foot. As we have illustrated, VCD fails when the velar consonant is in the onset of the third syllable of the word and, thus, at a foot boundary. VCD, therefore, cannot occur over this boundary. One can argue that the application of phonological processes within a given domain offers promising preliminary evidence for the presence of such a domain. In the case of Bamana, this analysis provides support for the proposal of at least one higher level of prosodic structure above the syllable in this language. Interestingly, others have implicated 'foot'-like units to be responsible for the phenomenon of *compacité tonale*, or tonal compactness, in Bamana compound nouns (e.g. Courtenay, 1974; Creissels, 1992; Dezeeuw, 1979; Rialland & Badjimé, 1989).

While the matter will not be discussed here, regarding Bamana morphology, the application of VCD and other phonological processes in relation to morphemic boundaries may provide intriguing evidence for the proposal of more complex morphology in the language than has been previously discussed.

[8] Morpheme boundaries are indicated by a '#'.

4.2 SYNCOPE and rhythmic structure

Additional support for the proposal of rhythmic structure in Bamana is also found by considering the finer details of the application of SYNCOPE in the colloquial variety of the language. In our introduction of basic syncope patterning via the action of the *PEAK complex in Section 1.1, we proposed that these constraints drive the preferential syncopation of [+hi] vowels, although instances are found where [-hi] vowels can be deleted if [+hi] vowels are not otherwise available for deletion. The determination of whether or not [+hi] vowels are available for syncopation stems from higher-ranking constraints on permissible syllable margins and other phonotactics that were introduced in Section 2. The ranking of margin constraints relative to the *PEAK complex has allowed us, thus far, to motivate the selection of optimal output candidates in CB, as well as to explain the failed application of syncope in particular instances. The proposed constraints, in their current instantiations, however, fail to predict a small number of attested but seemingly opaque outputs. The presence of such opacity has, in turn, further drawn our attention to the importance of rhythmic structure in the language. These instances of opacity and their relationship to rhythmic structure are outlined below.

Consider first a Bamana word such as [sabali] 'to calm' that emerges in CB as [sa.bli]. In words such as this, it is expected that a syncopated form such as *[sba.li] would not emerge given the high-ranking constraint on conjoined obstruent & obstruent onsets. The attested form with its obstruent & sonorant onset in its second syllable appears a feasible alternative. We must ask, however, why it is that *[sa.bal] is unacceptable, given that we have observed elsewhere that [-continuant] sonorant codas (i.e. [l]) are otherwise permitted in the language. The *PEAK complex, in other instances, has driven [+hi] vowel syncope, and thus the emergence of a winning output containing a [+hi] vowel, rather than one contain two [-hi] vowels, given the principle of *strict domination* (Prince & Smolensky, 1993/2004), is opaque. Tableau (24) illustrates this opacity.

(24) *PEAK Opacity

/sabali/ 'to calm'	$_\sigma$[*M$_1$/Obs &*M$_2$/Obs	*PEAK [+hi]	*PEAK [-hi]	MAX	$_\sigma$[*M$_1$/Obs &*M$_2$/[l]	*M$_2$/[l]
a. sa.ba.li		*!	**			
b. ☜ sa.bal			**	*		*
c. sba.li	*!	*	*	*		
d. ☞ sa.bli		*!	*	*	*	*

We note similar opacity in Bamana words, such as [kamalẽ], that contain all [-hi] vowels. As was illustrated in (8b), the attested CB form of this word is [ka.mlẽ]. We can question the choice of the second vowel as the target for syncope, rather than the final vowel, for example, that would, once again, generate a seemingly acceptable [l]-final word. Just as in (24), the constraints, as they are currently ranked, predict *[ka.mal] to be the transparent output, rather than the attested output [ka.mlẽ].

It is clear in both instances that the vowel targeted for syncope is found within the first two syllables of the word, whereas the expected target for syncope, as selected by the language's constraints, falls outside of this two syllable unit and is opaquely avoided. As one might expect, Bamana words permitting us to illustrate this unique property of the language are relatively rare given the necessity to have precisely the right segments in relevant combinations and environments to showcase their interaction with one another, as well as with the proposed metrical structure of the language. Nonetheless, a sufficient number of words exist that allow us to view this process and propose an analysis for its application relative to other words in the language. The data collected, once again, suggest that rhythmic structure is at play in these seemingly opaque cases of syncope. We propose, therefore, that in these and all other instances, syncope in CB is permitted to apply only within the two-syllable foot-like metrical unit that has been described to be the domain for the other phonological processes described in this study.

Theoretically speaking, we can also propose that, if SYNCOPE only applies within a 'foot', then 'footing' in this language is not exhaustive, given that final vowels, for example, do not appear to be in a foot, and are therefore not available for deletion. In the two-syllable words that we have seen, given permissible phonotactics, final vowel deletion is permissible, because in these instances, the vowel is found in the 'foot'. One can propose, therefore, that we find no minimization in the many monosyllabic words of Bamana given that a 'foot' in the language can only be well-formed if it contains its full two syllables. Finally, in words derived from those in SB with four syllables, we find that only one instance of minimization is permitted and that this minimization occurs preferably in the leftmost foot.[9] Implications pertaining to this matter are discussed further in Section 4.

An additional feature of CB that may be attributable to the presence of rhythmic units in the language concerns the resolution of impermissible obstruent & obstruent onset sequences that result from the drive towards minimization in the language. Certain words, for example the proper name [abudu] (in SB) emerges as [a.blu] in CB. In this word, an available [+hi] vowel is syncopated within a left-edge 'foot'. This syncopation left unrepaired, however, would yield an impermissible $_{\sigma}$[bd onset. CB repairs the impermissible sequence by changing the manner of articulation of the second consonant from obstruent to liquid, thereby generating an acceptable $_{\sigma}$[bl (i.e. obstruent & liquid) onset cluster. Another name [budulayi], however, behaves in a slightly different manner. CB still satisfies the drive towards minimization as expected, resulting in the syncopated output [bru.la.yi]. However, in this instance, the choice of a substitute for the repair of an impermissible $_{\sigma}$[bd onset is $_{\sigma}$[br (i.e. obstruent & rhotic), rather than $_{\sigma}$[bl (i.e. obstruent & liquid), as noted just above in the previous example. We propose that the motivation for this substitution is, once again, related to metrical structure in the language.

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[9] Of further interest here is the foot-based analysis proposed by Weidman & Rose (2006). In their analysis of Bamana tone, they implicate metrical feet to account for the various tonal patterns found in the language. Without going into the full details of their analysis, they claim that tonal feet are assigned in an exhaustive right-to-left manner, thereby leaving monosyllabic words and the first syllable of trisyllabic (and assumedly other words with an odd-number of syllables) as degenerate feet. Importantly, these degenerate feet are found at the left-edge of the word. As we have seen in our analysis of the outcome of syncope and velar deletion thus far, at least on the segmental level, footing in Bamana appears to be assigned non-exhaustively from left-to-right. Taken together, these two analyses imply that metrical footing is at play in this language but yields different structures on the segmental and tonal tiers. While this speaks to the autosegmental independence of these tiers, it is yet unclear what implications this has for the overall phonology of the language. It is our hope that these concerns will be fleshed out as our tonal analysis of Colloquial Bamana continues.

Because upon the application of SYNCOPE, footing occurs once again, the first two syllables of [bru.la.yi] are footed together. It appears that within this unit, Colloquial Bamana may have a constraint barring against the presence identical consonants flanking a vowel in adjacent syllables and thus, within a foot. CB addresses this co-occurrence restriction by driving the choice of the dissimilated $_\sigma$[br complex onset (as opposed to $_\sigma$[bl), given the presence of an [l] in the adjacent syllable. Because words in which such sequences would be derived are quite rare in Bamana, further comment on this detail of CB phonology must await future research.

By placing limits on the domain of application of these processes, and also considering the important role played by margin constraints, syllable contact, and other phonotactics, the processes contributing to an overall drive for minimization, as well as their interactions with one another, become clear in Colloquial Bamana. We find that the interactions between consonants predicted by the Split Margin Approach taken alongside the proposed metrical structure of the language offer a concise description of this emerging process of syllable complexification.

5. Discussion and Implications

The data presented in this study have detailed that processes are underway in Colloquial Bamana that interact to achieve an overall drive towards minimization in the language. The data have also illustrated that the attested phonologically complex outputs witnessed in this language that have been derived from the more conservative Standard variety of the language provide compelling support for the principles laid forth in the Split-Margin Approach to the Syllable (Baertsch, 2002). We have seen that the inventory of M_1 and M_2 syllable margins in CB and their permissible conjunction in complex onsets that have resulted from SYNCOPE and other relevant processes has been accurately predicted by Baertsch's model. We have also witnessed the ways in which other constraints on markedness and faithfulness in the language have been freely permitted to interact with these single and conjoined margin constraints as is predicted in an optimality theoretic framework. While the implications and machinery of the Split Margin Approach have been described in detail elsewhere (e.g. Baertsch & Davis, 2003, 2009; Davis & Baertsch, 2005), we can consider both how the predictions of this model are borne out in Colloquial Bamana and the additional intricacies that we have discovered in the emergent phonology of the language.

While we have discussed in detail the predictions of the Split Margin Approach regarding the permissible conjunction of margin constraints in the formation of complex onsets, we have yet to consider that this approach also makes predictions about syllable contact. We have already seen that this model correctly predicts the attested complex CCV and CVC syllable structures that result from SYNCOPE given the stipulations about the sonority of the involved consonants described in detail above. Because the second member of a branching onset and the consonant of a singleton coda are both M_2 positions in a Split Margin syllable, we note one inherent prediction of the model, namely that for any permissible sequence of consonants in a complex onset, i.e. M_1 & M_2, one should also find a syllable contact sequence, i.e. between a M_2 singleton coda and a following M_1 onset containing the same elements. As Baertsch & Davis (2003, 2009) have stated, this property of the Split Margin syllable captures the universal dispreference for rising sonority over a syllable boundary, given that M_2 consonants are preferentially higher-sonority elements, and

M_1 consonants are preferentially lower-sonority elements. As expected, this prediction is borne out in Colloquial Bamana, wherein sonorant consonants are possible in M2 positions, both as the second member of a branching onset and as a singleton coda. This is seen most obviously in the variable CB output forms illustrated above in (16). Note, however, that higher-ranked constraints on markedness may supercede these constraints, for example in the case of impermissible [+continuant] consonants word-finally.

On the subject of variation, we can discuss further some potential implications for the presence of such acceptable outputs. As was mentioned above, many scholars have attributed the variation that they have found in attested outputs in a variety of the world's languages to the presence of an indeterminate ranking between low-level constraints and/or the gradual diachronic loss in stringency between two previously ranked constraints. This brings us to consider what the situation may be in Colloquial Bamana. On the one hand, it is possible that the constraints that we have proposed are now indeterminately ranked. Ranked in this manner, they thus permit variation in output and may perhaps remain so ranked and continue to permit variation in the language as it develops. On the other hand, however, it may be the case that one or the other constraint will ultimately win out in comparison to the other. In such an instance, a critical ranking relationship would be born between them resulting in the demotion of one constraint below one other, and, subsequently, the presence of a single attested output syllable shape (either CCV or CVC) for these types of words. The end result of this competition, should it emerge, should have an interesting impact on the overall phonology of CB and will allow one to test the implicational strength of the Split Margin Approach and other models of syllable structure. This is due chiefly to the fact that, typologically, languages with a maximal syllable shape of CCV are predicted not to occur (Kaye & Lowenstamm, 1981). Such CCV languages are predicted to permit CVC syllable as well, although data from a number of other West African languages have recently been gathered that challenge this prediction (e.g. Fongbe, Eβe, and Lelemi). The theoretical complications posed by such languages become clear from the body of work that has emerged in which scholars have attempted to minimize all syllable structure to a maximal CV (see Lowenstamm (1996, 2003), Nikiema (2003), and references therein).

An additional area that must be explored further is the machinery motivating the choice in Colloquial Bamana to avoid multiple deletions in nominal compounds and polymorphemic words. As Green & Diakite (2008) introduced, in words where it appears that multiple deletions would be possible (for example, in nominal compounds where each component would be permitted to undergo minimization on its own), only a single deletion is permitted. Representative words are included in (25) below. In some instances, the resultant deletion occurs, as predicted, owing to the proposed ranking of constraints. For example, in certain compounded or polymorphemic words, we find that Velar Consonant Deletion occurs but Syncope does not, given that the *VKV constraint driving velar deletion is ranked critically above the appropriate *PEAK constraint which drives syncope (see 25a-b).

(25)

	Standard	Colloquial		Gloss
a.	[se.li#sa.ga]	[se.li.saa]	*sli.saa/*sel.saa	'sacrificial sheep'
a´	[se.li]	[sel]		'prayer'
a´´	[sa.ga]	[saa]		'sheep'
b.	[nɛ.rɛ#mu.gu]	[nɛ.rɛ.muu]	*nɛr.muu/ *nɛ.rɛm.gu	'yellow'
b´	[nɛ.rɛ]	[nrɛ]		'type of tree'
b´´	[mu.gu]	[muu]		'powder'

What is more provocative are words in which the ranking of constraints alone cannot precisely predict the target for deletion. In these instances, the attested outputs do not confound the ranking of constraints, but rather the constraints appear to allow for multiple optimal outputs when only one form is possible. A Standard Bamana word such as [kolo#kowo] 'window' that emerges in Colloquial Bamana as [klo.ko.wo]/[kol.ko.wo], but never *[ko.lo.kwo] (or *[klo.kwo], for that matter) may shed some light onto the overall preference in the language to have complexity closest to the left-edge of a word. It would otherwise appear that *[ko.lo.kwo] is an equally acceptable output in CB, however the apparent preference for left-edge complexity drives minimization in favor of other outputs. It may be the case that Colloquial Bamana is undergoing a phonological change analogous to that described by Frigeni (2009) for Campidanian Sardinian from Latin where, upon the emergence of restrictions on syllable complexity, the complex syllable develops at the left-edge of the word, even at the expense of long-distance consonant movement. We must then ask what implications this may have for the variable outputs of syncope that we have noted above. As we have just seen, the preference for left-edge complexity clearly applies at the level of the word, however it is not yet clearly defined at the level of the morpheme or syllable, given that variation is found between acceptable CCV and CVC syllables in the language. Further research is therefore warranted to explore this variation, its trajectory, and perhaps its eventual resolution.

As a final point of discussion, we find an interesting complement to our earlier observation about restrictions on the deletion of [-hi] vowels when a [+hi] present in a word in an example like those in (26) below.

(26)

Standard	Colloquial		Gloss
[fà.ri]	[fa.ri]	*fri/*far	'body'
[ki.ba.ru]	[ki.ba.ru]	*ki.bru/*ki.bar	'news'

In a Standard Bamana word like [fà.ri] 'body', we are able to witness the interaction of constraints of different types in the language that ultimately yield the fully faithful form of the word in CB. Because we know that [+hi] vowels are preferred for deletion, but that [+continuant] sounds are disallowed in final position, it is not surprising that an output like *[far] is not found in CB. Given the drive towards minimization and the acceptability elsewhere of onset sequences like [fr], it is perhaps surprising that *[fri] is an unattested output. The choice of the fully faithful candidate in this instance is unexpected but provides further support for the observation that SYNCOPE must act preferentially on a [+hi] vowel, if one is available, or not at all.

An additional seemingly opaque process occurring in Colloquial Bamana can be noted in a comparison of words like those in (27) where Syncope and Velar Deletion are in competition with one another, but only one or the other is permitted to apply. Words like (27a-d) illustrate instances in longer words where a velar consonant susceptible to deletion is flanked by identical [+hi] vowels. In such words, one finds one of two possibilities: 1) either velar deletion applies, or 2) syncopation of the second [+hi] vowel occurs when it would yield a phonotactically-permissible sequence. As noted above, syncopation of the first vowel of these words would yield impermissible obstruent & obstruent complex onsets, and is therefore not allowed.

(27)

	Standard	Colloquial		Gloss
a.	[si.ki.lã]	[sii.lã]/[si.klã]	*ski.lã	'chair'
b.	[su.ku.na]	[suu.na]/[su.kna]	*sku.na	'urine'
c.	[du.gu.ma]	[duu.ma]/[du.gma]	*dgu.ma	'on the ground'
d.	[su.gu.ri]	[suu.ri]/[su.gri]	*sgu.ri	'pre-fasting meal'
e.	[dɔ.gɔ.ya]	[dɔɔ.ya]	*dɔ.gya	'to make small'
f.	[sɔ.gɔ.ma]	[sɔɔ.ma]	*sɔ.gma	'morning'

Variation between these potential outputs appears plausible if one considers Syncope and Velar Deletion to be in direct competition with one another. As we saw in (25), however, Velar Deletion is the preferred choice over Syncope, at least in nominal compounds. It is yet unclear what implications this variation may have for the higher level morpho-phonology of the language. Opacity arises in words like (27e-f) in which the velar consonant targeted for deletion is flanked by identical [-hi] vowels. Drawing from what we noted above for (27a-d), one might expect that variation (when phonotactically permitted) would also be observed in these words. As the data indicate, only one output is permitted: that resulting from Velar Consonant Deletion.[10] Much like we observed above in (26) for the drive towards syncopation of [-hi] vs. [+hi] vowels, we note here that, although Syncope would appear to be a viable choice for minimization in these words, syncopation of a [-hi] vowel is not permitted to occur if a velar consonant available for deletion is otherwise available. Thus, we find that the accepted output in CB for such words is that in which the velar consonant has been deleted, rather than one resulting from syncopation of a [-hi] vowel.

While it is of interest to note that such instances of opacity exist in the emerging phonology of Colloquial Bamana, one is unable to capture such opacity within standard Optimality Theory (Prince & Smolensky, 1993/2004). It is unclear as of yet as to whether an instantiation of this framework that does not utilize strict domination of constraints, e.g. Harmonic Grammar (Smolensky & Legendre, 2006), may better capture these intricacies of the language. We necessarily leave such issues regarding opacity for future exploration.

[10] It has been observed that the Syncope variant for these words may be marginally acceptable to some speakers, however the output resulting from Velar Consonant Deletion is clearly preferred.

6. Conclusion

In this study, we have presented a theoretically-driven analysis of processes in Colloquial Bamana that collectively apply and interact with one another in the overall drive towards minimization in the language. We have shown that, by assuming a Split Margin Approach to syllable structure, the attested outputs resulting from vocalic syncope and other phonological processes in Colloquial Bamana can be motivated by considering the ranking of constraints on syllable margins and their preferable conjunction alongside other constraints on syllable and word markedness, as well as those preserving faithfulness to the more phonologically-conservative standard form of the language. Furthermore, we have provided preliminary evidence for the proposal of metrical structure in this language by illustrating that, in instances where the transparent application of processes fails to occur in the language, it is consistently due to restrictions on a domain of application that resembles a bi-syllabic foot.

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