Domain-Restricted Reduction: A Proposal for Segmental Feet in Bamana

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1. Introduction and Background

Two complementary but at times competing phonological processes of segmental reduction are active in a non-standard variety of Bamana (Bambara or Bamanankan) spoken by a young cohort of individuals in Bamako, Mali. These processes, namely Vowel Syncope (VS) and Velar Consonant Deletion (VCD), act to reduce a word by a single syllable via the removal of a single vowel or consonant, respectively. Data collected and analyzed suggest that their application, and often instances of their failed application, is best captured by referring to a disyllabic domain of application resembling a prosodic foot. The current paper considers the products of VS and VCD in Colloquial Bamana (CB) and proposes that disyllabic prosodic feet referencing the segmental structure of the language are at play in driving the outcomes of these processes.

CB, as described in earlier works (e.g. Green & Diakite 2008; Green, Davis, Diakite & Baertsch 2009; Green 2010), is emerging or perhaps diverging from its normative or more phonologically conservative progenitors, e.g. Standard Urban Bamana or Classic Bamana (henceforth Standard Bamana or SB). CB differs most noticeably from its progenitors, segmentally speaking, in its inventory of permitted syllable types. While SB permits only maximal CV syllables (with few exceptions)[1], CB permits several more complex syllable types. Specifically, CB has synchronically developed CCV and CVC syllables via a process of Vowel Syncope, as well as CVV derived long vowel syllables via a process of Velar Consonant Deletion (e.g. Green & Diakite 2008). These syllable types permit only specific constituents in a given syllable margin position (i.e. the first or second position of a syllable onset or in a singleton coda), with obstruents being permitted only as a singleton onset or the first member of a branching onset. Sonorant consonants, e.g. [l], [r], and [n], can be singleton onsets, the second member of a branching onset, or a singleton word-internal coda. In word-final CVC syllables, [l] is the only consonant permitted in coda position. Phonotactic restrictions are in place that prohibit certain consonant-consonant combinations in the language (Green 2010).

As Green & Diakite (2008) first reported, VS is a phonological process of segmental reduction by which a vowel with any specification for height or backness can be deleted from any syllable in a word. That this process is non-selective in its deletion target and in the position of its deletion target within a word supports the observation that VS is not simply a manifestation of phonetic [+hi] vowel loss or unstressed vowel loss. Indeed, stress has not been definitively described as a characteristic of Bamana. There is, however, a clear preference for deletion of a [+hi] vowel via VS when it can be accommodated. As the data in (1) illustrate, VS yields CB words containing initial CCV syllables (e.g. 1e-f), word-internal CCV syllables (e.g. 1a-b, g), and CVC syllables in which consonants have the

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[1] Exceptions include words from a vestigial noun class containing an NC unit segment in word-initial position, vowel-initial borrowings, nasal codas that arise between a phonemic nasal vowel and a following plosive across a syllable boundary, and CVV syllables containing a phonemic long vowel that are restricted to word-initial position.

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ability to come into contact across a syllable boundary (e.g. 1c-d, h). These outcomes are possible via [+hi] vowel loss (e.g. 1a-f) or via [-hi] vowel loss (e.g. 1g-h). When it can be accommodated by the language's phonotactics, variation in syncopated outcomes is found when targets for VS are identical (e.g. 1i-j). The drive towards reduction via deletion is not absolute, as illustrated by words like (1k-l). In such words, a phonotactically favorable outcome of deletion cannot be achieved, and thus a deletion is not possible in these and similar words.[2]

(1) Outcome of Vowel Syncope[3]

	Standard	Colloquial		Gloss
a.	[sà.f**í**.nɛ́]	[sà.fnɛ́]	*sfa.nɛ	'soap'
b.	[ká.b**í**.lá]	[ká.blá]	*kbi.la	'tribute'
c.	[dè.l**ì**.kó]	[dèl.kó]	*dli.ko	'habit'
d.	[fá.r**í**.mã́]	[fár.mã́]	*fri.mã	'brave'
e.	[s**ì**.là.mɛ́]	[slà.mɛ́]	*sil.mɛ	'Muslim'
f.	[d**ù**.lò.kí]	[dlò.kí]	*dul.ki	'shirt'
g.	[cá.p**á**.ló]	[cá.pló]	*cpa.lo	'millet beer'
h.	[nà.m**à**.sá]	[nàm.sá]	*nma.sa	'banana'
i.	[s**ú**.r**ú**.kú]	[súr.kú]/[srú.kú]		'hyena'
j.	[b**ɔ́**.r**ɔ́**.tɔ́]	[bɔ́r.tɔ́]/[brɔ́.tɔ́]		'to tear apart'
k.	[ká.bá.nó]	[ká.bá.nó]	*ka.bno	'asylum'
l.	[fá.sá.dá]	[fá.sá.dá]	*fas.da	'to praise'

A similar outcome is found in shorter words, e.g. disyllabic SB words that emerge as monosyllabic words in CB (e.g. 2a-b). A noted difference in shorter words is that word-final CVC syllables are possible as the result of reduction when the coda consonant of these syllables is a [-nasal, -continuant] sound, i.e. [l] (e.g. 2c-e). Word-final syllables containing [r] and [n] codas are ruled out for independent reasons. Similar instances of variation noted in (1) for words with identical deletion targets are also found in these words (e.g. 2c), and reduction can be blocked due to phonotactic restrictions (e.g. 2f).

(2) Vowel Syncope in shorter words

	Standard	Colloquial		Gloss
a.	[s**í**.rã́]	[srã́]	*sir	'to scar'
b.	[t**ɛ̀**.nɛ́]	[tnɛ̌]	*tɛn	'taboo'
c.	[b**í**.l**í**]	[bíl]/[blí]		'roof'
d.	[sè.l**í**]	[sèĺ]	*sli	'prayer'
e.	[fò.l**í**]	[fòĺ]	*fli	'greeting'
f.	[kà.bá]	[kà.bá]	*kba/*kab	'corn'

[2] Deletion in such words is phonotactically unfavorably, as it would yield consonant-consonant sequences that are illicit in the language. For an inventory of permitted sequences in Bamana, see Green (2010).

[3] In data sets throughout, deletion targets are in bold type when necessary to facilitate presentation and discussion. For purposes of clarification or exposition, one or more unattested outcomes may be included and are indicated, as conventional, by a '*'. The voiceless affricate [tʃ] is represented by 'c', the voiced affricate [dʒ] is represented by 'j', and the glide [j] is represented by 'y'. Syllable boundaries are indicated by a '.'.

The details of CB phonotactics, specifically pertaining to the role played by restrictions on consonant-consonant sequences that are permitted to co-occur within a given syllable or word are discussed more extensively in Green (2010). It is argued that these restrictions are best captured by appealing to a Split Margin model of the syllable (Baertsch 2002).

While VS accomplishes reduction via the loss of a single vowel, a second process, namely Velar Consonant Deletion (VCD), is active in removing intervocalic velar consonants flanked by identical vowels of any type from a given word. This process is widespread in CB and noted to some extent in Standard Urban Bamana. It is absent, however, in more conservative Bamana varieties. VCD removes velar consonants flanked by identical [+hi] or [-hi] vowels (e.g. 3a-b) from words of different lengths (e.g. 3c-d). A ban against diphthongs in Bamana precludes the deletion of a velar consonant between non-identical vowels. Words containing deletion targets for both VCD and VS yield grammatical variation between two CB outcomes (e.g. 3e-f). This variation occurs when a deletion target is a [+hi] vowel. Otherwise, VCD is the only process that applies (e.g. 3c-d).

(3) Outcome of Velar Consonant Deletion

	Standard	Colloquial		Gloss
a.	[sì.**k**í]	[sìí]	*ski	‘to sit’
b.	[mɔ̀.**k**ɔ́]	[mɔ̀ɔ́]	*mkɔ	‘person’
c.	[dɔ́.**k**ɔ́.yá]	[dɔ́ɔ́.yá]	*dɔ.kya	‘to make small’
d.	[sɔ̀.**k**ɔ̀.má]	[sɔ̀ɔ̀.má]	*sɔ.kma	‘morning’
e.	[sú.kú.ná]	[súů.ná]/[sú.kná]		‘urine’
f.	[dù.kù.má]	[dùù.má]/[dù.kmá]		‘on the ground’

Both VS and VCD are regularly occurring processes of reduction that behave in most instances according to the standard patterns of deletion outlined in this section. There exist several notable instances, however, where these processes fail to apply as one would otherwise predict. It is to these failed and unpredicted instances that we turn next.

2. Domain of Reduction

2.1. Failed application of Velar Consonant Deletion

It was illustrated above that VCD applies in words of varying lengths, however in (3), the velar consonant targeted for deletion were always located in the second syllable of an input word. Velar consonants in word-initial position are not eligible for deletion given that they fail to meet the key structural condition of being flanked by identical vowels for the process to apply. Furthermore, the process does not occur over word boundaries, or any other boundary (i.e. a morpheme boundary or foot boundary), for that matter. Velar consonants flanked by identical vowels also fail to be deleted when they are found in the onset of the third syllable of an input word. Consider the illustrative examples in (4) where, rather than VCD applying as expected, the language avoids removing a velar consonant from a third syllable onset. VS is the chosen alternative for reduction where possible.

(4) VCD fails to remove third syllable velar consonants

	Standard	Colloquial		Gloss
a.	[bá.rá.**k**á]	[bár.ká]/[brá.ká]	*ba.raa	‘blessing’
b.	[sú.rú.**k**ú]	[súr.kú]/[srú.kú]	*su.ruu	‘hyena’
c.	[dà.rà.**k**á]	[dàr.ká]/[drà.ká]	*da.raa	‘breakfast’
d.	[mà.nɔ́.**k**ɔ́]	[màn.kɔ́]	*ma.nɔɔ	‘catfish’

To address the systematic avoidance of VCD to apply when its velar consonant target is located in a third syllable onset but to apply regularly when the target is located in a second syllable onset, we propose that VCD applies only within a defined domain of application, i.e. a disyllabic domain. Given the particulars of the application of VCD outlined above, this domain of application appears to be built from the left-edge of a word. So constructed, when a target for VCD is located within this domain, the process applies, thereby removing the velar consonant and generating a derived CVV syllable. When a velar consonant is located outside of this domain or at the boundary of this domain, VCD fails to apply. We propose that this is due to the fact that part of the structural condition that must be met for the process to apply is that the identical vowels flanking the velar deletion target must also be located within the same domain of application. This domain and the observed application of VCD are schematized in (5), where domain boundaries are represented by '( )'.

(5) Domain-based application of Velar Consonant Deletion

a. (sɔ̀.**k**ɔ̀)má → sɔ̀ɔ̀.má vs. b. (mà.nɔ́)**k**ɔ́ → màn.kɔ́

By proposing that disyllabic domains are constructed at the left-edge of a word, the application or conversely the failed application of VCD is motivated. If one were to propose an alternative analysis in which this disyllabic domain was constructed from the right-edge of a word, the wrong predictions for the application of VCD would result. One would be hard pressed to explain why VCD would apply when a velar is at the edge of a domain or at a domain boundary but fail to apply within the domain. This alternative right-edge construction is illustrated in (6) for the sake of comparison.

(6) Right-edge domain fails to capture VCD application

a. sɔ̀(**k**ɔ̀.má) → sɔ̀ɔ̀.má *sɔ.kɔ.ma, *skɔ.ma, *sɔ.kma

b. mà(nɔ́.**k**ɔ́) → màn.kɔ́ *ma.nɔɔ

The outcome of VCD in longer words, e.g. compounds, reveals that the same domain-level permissions and restrictions remain in place and also illustrates that the construction of disyllabic domains in this language proceeds iteratively and from left to right in a word. Consider the illustrative examples in (7).

(7) Domain construction is iterative, left to right

a. (**sì.kì**)(yɔ́.rɔ́)	→	sìì.yɔ́.rɔ́	'sitting place'	Lit. to sit + place
b. (sé.lí)(**sá.ká**)	→	sé.lí.sáá	'sacrificial sheep'	Lit. to prayer + sheep
c. (nà.fò)(lò.**tí**)**kí**	→	nà.flò.tí.kí	'rich man'	Lit. wealth + owner

Example (7a) shows the expected application of VCD in a left-edge domain, yielding a CVV syllable. (7b) reveals that disyllabic domains must be constructed iteratively, given that the application of VCD here is in a second domain that is not at the left-edge of the word. (7c), like words in (4), show, once again, that VCD fails to apply when its deletion target is located outside of a disyllabic domain or at domain boundary. This also supports the observation that domains are constructed from the left edge of a word. Had the domains been constructed from the right edge, one might expect an outcome like *nà(fò.lò)(tí.kí)* → **na.fo.lo.tii*, with VCD acting upon a velar target within a right-edge domain.

Considering VCD separately, it is clear that one cannot predict the instances in which this process applies or fails to apply without referencing an iteratively constructed disyllabic domain. The representative examples presented in this section have demonstrated that VCD applies only in those instances where its target and the vowels flanking it are located within this disyllabic domain. It fails to apply elsewhere. Furthermore, the process fails in instances in which a velar target is located across a morpheme boundary (#), e.g. *(lá#ká)(lí#tá)* → *lá.kál.tá*, **laa.li.ta* 'news'. VCD is clearly a boundary sensitive process. Given that VCD must reference a disyllabic domain for its proper application, we now consider the role that this domain plays in the outcome of VS.

2.2. Competition between Velar Consonant Deletion and Vowel Syncope

To explore the role that higher prosodic structure in the form of a disyllabic domain plays in the application of VS, we turn first to words in which VCD and VS compete with one another for deletion targets within a word. The idea of competition between processes of reduction is key given the fact that, generally speaking, within a word, only a single reduction is permitted, either by VCD or by VS. Consider the outcomes of reduction in (8).

(8) Velar Consonant Deletion vs. Vowel Syncope

a. (sé.lí)(sá.ká)	→	sé.lí.sáá (VCD only), *sel.sa.ka, *sel.saa	‘sacrificial sheep’
b. (sú.kú)nɛ́	→	súú.nɛ́ (VCD) / sú.knɛ́ (VS)	‘urine’

Example (8a) illustrates a word in which deletion targets for VCD and VS are located in adjacent disyllabic domains in the SB input. In this and similar instances, the outcome of reduction is always such that VCD applies to the exclusion of VS. This reveals that, in general, VCD is a preferred method of reduction in this language. That is, in the drive towards reduction or minimization in CB, VCD is a more favorable choice to satisfy this drive, all things being equal, compared to VS. Words like (8b) reveal a much different outcome when deletion targets for VCD and VS are located within the same domain in the SB input. In such instances, the two processes of reduction are in clear competition with one another to achieve their respective reductions. In these instances, barring any restrictions in place from the language's phonotactics, variation between the application of VCD and VS is observed. Either deletion of a velar consonant to yield a CVV syllable or deletion of a vowel to yield a CCV syllable is grammatical in CB. Importantly, VS cannot occur in such a way that the velar consonant becomes the second member of a branching onset, given the ban the language has on obstruents in this position. Overall, variation between VCD and VS is noted only in instances like (8b), thereby illustrating that VS must reference a disyllabic domain for its application. Additional dependencies on this domain relating to VS are explored below.

2.3. Domain-internal Vowel Syncope Variation

Recall from (1i-j) and (4a-c) that when permitted by the phonotactics of the language, variation is observed in the outcome of VS, thus yielding CB words containing either a CCV or CVC complex syllable. As these examples illustrate, variation is possible only in instances where the vowels targeted for deletion by VS are identical. Vowels sharing only the same specification for height or for backness do not witness variation. An additional restriction on this type of variation via VS is revealed by the domain structure of the SB input words. Consider the examples in (9).

(9) Vowel Syncope Variation

a. (**bɔ̀.rɔ̀**)tɔ́	→	brɔ̀.tɔ́ (1st vowel) / bɔ̀r.tɔ́ (2nd vowel)	‘to tear apart’
b. (mù.sò)(**kɔ̀.rɔ̀**)bá	→	mù.sò.krɔ̀.bá/mù.sò.kɔ̀r.bá	‘wise woman’
c. (dɔ̃̀.**kì**)(**lì**.dá)	→	(dɔ̃̀.klì)dá, *dɔ̃.kil.da	‘to dance’

Words like (9a) and (9b) illustrate the expected outcome of VS when targets for deletion are identical and no phonotactic restrictions are at issue. In these instances, either a CCV or CVC complex syllable emerges from VS. By considering the disyllabic domain structure of these words, constructed in the same manner as discussed above for VCD, a different picture emerges. As the reduced CB outcomes of these words show, VS applies within a disyllabic domain and removes either the first or second of two identical vowels within the domain to yield a CCV or CVC syllable, respectively. The key comparison to make is to words like (9c). (9c) is of a similar shape to (9a) and (9b) and contains two potential vowel deletion targets for VS, as indicated. In comparable instances, e.g. *kèlèkú* → *klè.kú/kèl.kú* ‘to stumble’, the deletion of one or the other vowel via VS to yield a $_{\sigma}$[kl complex onset or an KVL syllable is observed. In (9c), however, only a single reduction is possible via VS, yielding a CCV syllable. This reveals another reference that VS makes to disyllabic domain structure, i.e. that variation in the outcome of VS is only possible when the identical vowel deletion targets of this process are located within the same disyllabic domain. This is shown in (9a) and (9b). When the deletion targets for VS are located in adjacent domains, only a single outcome is possible, and variation is not possible. This is precisely what is found in (9c). Here again, we find that the outcome of this process cannot be predicted without reference to a disyllabic domain of application.

2.4. Preventing Dispreferred Deletions

Another reference that CB makes to the proposed disyllabic domain is found in the unexpected avoidance of deletions that would otherwise appear to be phonotactically favorable but that are precluded by the language's inability to delete a more preferred target. It is in these instances that the strength of the language's preference for particular deletions comes to the fore. We have seen, thus far, that in a competition between VCD and VS, when the deletion targets for these processes are located in separate domains, VCD is a preferred process of reduction in the language (as in (8)). We have also illustrated with specific reference to VS (e.g. 1c-f) that even when it appears phonotactically possible to remove a [-hi] vowel deletion target, if a [+hi] vowel deletion target is also eligible for deletion, the [-hi] vowel will never be removed. A [-hi] vowel will only be selected for deletion via VS if no [+hi] vowel is present (e.g. 1g-h). The strength of this preference for vowel deletion becomes remarkably clear in instances of failed VS like those in (10).

(10) Vowel Syncope Fails to Apply

	Standard	Colloquial		Gloss
a.	(dú.kɛ́)nɛ́	dú.kɛ́.nɛ́	*du.knɛ	'courtyard'
b.	(kì.bà)rú	kì.bà.rú	*ki.bru	'news'
c.	(fù.gà)rí	fù.gà.rí	*fu.gri	'worthless person'

The examples in (10) reveal an unexpected outcome, namely that VS fails to apply. It is clear in each word that the removal of a [+hi] vowel deletion target via VS is prohibited given that such a deletion would generate a complex onset containing an impermissible obstruent-obstruent sequence, e.g. *$_{\sigma}$[dk (10a), *$_{\sigma}$[kb (10b), and *$_{\sigma}$[fg (10c). Such sequences are not permitted by the language's phonotactics. A seemingly acceptable alternative for CB, in order to satisfy the language's drive towards reduction, would be to remove a [-hi] vowel, thereby yielding complex onsets that are witnessed elsewhere to be phonotactically permitted in the language, e.g. $_{\sigma}$[kn (10a), $_{\sigma}$ [br (10b), and $_{\sigma}$[gr (10c). As the CB outcomes in (10) show, however, the language chooses against this alternative and instead maintains a faithful mapping from the Standard variety to the Colloquial variety. Considering this outcome alongside what we have observed thus far about the construction of disyllabic domains in Bamana, an interesting picture emerges.

The failure of VS to apply in words like those in (10) stems from the fact that a [-hi] vowel deletion target cannot be removed when it occupies a disyllabic domain with a [+hi] VS target that cannot be deleted. Thus, rather than removing a less favorable target (i.e. the [-hi] vowel), VS fails altogether. From a simple comparison of the CB outcomes in (10) to the reduction that occurs, for example, in *(sá.bá)lí* → *sá.blí* 'calm', we see that a [-hi] vowel is readily removed in similar instances where there are no complicating issues created by the presence of domain-internal [+hi] vowels. The precise mechanism of this restriction is left to future research.

In sum, we have illustrated that both processes of reduction necessarily reference a disyllabic domain for their proper application. Furthermore, we have shown that instances in which one or the other process fails to apply as otherwise predicted can be explained by appealing to this domain. We argue that these results provide evidence for prosodic structure above the level of the syllable in this language manifested as disyllabic segmental feet. Additional properties of these segmental feet and the implications that their presence has for the state of knowledge of Mande linguistics, and for Bamana in particular, are discussed below.

3. Discussion and Implications

3.1. Prosodic Feet in Mande

The presence of prosodic structure above the level of the syllable that is active in the segmental phonology of Bamana is a novel proposal and one that has not been explored in detail elsewhere in the literature. Foot-like structure has, however, been proposed in earlier work on Bamana tonology (e.g. Leben 2002, 2003; Weidman & Rose 2006) to account for certain surface tonal melodies in the language. These earlier studies and their discussions of tonal feet in Bamana differ in from what we propose in the current study for the language's segmental phonology. Leben (2002, 2003), in particular, does not report independent evidence for feet on the segmental tier in Bamana. His proposal maps tonal feet onto the maximal CV segmental tier of SB, based upon surface tonal melodies. Moreover, Leben implies that tonal footing can proceed exhaustively from either left-to-right or right-to-left in Bamana and does so exhaustively. Leben motivates this latter characteristic by referencing the restricted distribution of surface LH (rising) tonal melodies to certain word positions in the language (i.e. on either the first or last syllable of a word, but never word-internally). While it is entirely possible that segmental and tonal footing may proceed in different ways on the two tiers, it is clear from the data presented in this study that right-to-left segmental footing would make incorrect predictions about the outcomes of reduction in CB via both VS and VCD. Weidman and Rose (2006) add to this discussion by proposing a somewhat different analysis of tonal feet, namely that tonal feet are constructed at the right-edge of a word, that footing proceeds from right-to-left, and that footing is exhaustive. The authors frame their argument in terms of constraints on foot structure and tonal processes operating within the domain of the foot in optimality theoretic terms. 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 further 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 a 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. Once again, while different analyses may be possible for footing on adjacent tiers, the properties of segmental footing in Bamana presented here cannot be reconciled with these earlier proposals for tonal feet. A possible resolution to this matter is beyond the scope of the current paper, but see Green (2010) for more on this subject.

Foot structure has also been proposed to address various phenomena in a few other Mande languages, specifically those within the Eastern Mande branch of the sub-family, for example Tura, Soso, Dan (Vydrine 2002), and Gouro (Le Saout 1979; Vydrine 2003; Kuznetsova 2007). Languages within this branch of Mande are distant cousins, both genetically and geographically speaking, to languages of the Manding branch of the sub-family within which Bamana and its closest relatives are located. Le Saout (1979) discusses segmental foot structure in Gouro in reference a phenomenon he termed *consonant homoresonance*, i.e. the nature of certain foot-internal consonants is governed by the nature of the first consonant of the foot. Consonant homoresonance is not a phenomenon observed in Bamana. Kuznetsova (2007) also discusses segmental foot structure in Gouro, specifically in reference to an observed drive towards minimization that appears analogous to that noted for Bamana in the current study. Tonal feet are also discussed in these works. It is yet unclear as to what extent foot structure on either the segmental or tonal tier (or both) can be implicated in the features and processes underway in other Mande languages, and moreover what group-internal changes might be occurring in tandem or independently in different languages of this sub-group. The possibility that one or more predictable trajectories of minimization may be underway in Mande that make reference to higher prosodic structure in languages of this family is also a promising path for future research.

3.2. Characteristics of Bamana Segmental Feet

Thus far, we have introduced the application and outcome of two processes of segmental reduction in CB and have detailed the ways in which they must reference a disyllabic domain for their proper application. We propose that this domain is best characterized as a prosodic segmental foot given its noted properties. First, we have seen from the application of VCD and VS that a segmental foot in Bamana is maximally disyllabic, although we leave open the possibility that certain syllable types (e.g. a derived CVV syllable containing two moras) may comprise a unary foot. Second, we have provided representative data from longer Bamana words that illustrate that foot domains are constructed iteratively and importantly from left-to-right in a word. This left-to-right iterative construction provides a domain of application within which these processes, and VCD in particular, can apply. An alternative right-to-left process of footing produces incorrect generalizations about potential outcomes of reduction via VCD. Furthermore concerning VS, we have illustrated several instances in which the outcomes of this process (i.e. competition with VCD for a deletion target, resultant variation, and blocking) are restricted by the bounds of the domain. The outcomes of VS also support proposal of left-to-right iterative disyllabic footing. With no evidence to the contrary, we also assume that the exhaustive footing found for the tonal tier (Leben 2002, 2003; Weidman & Rose 2006) will apply to the segmental tier.

While it is beyond the scope of the current study's goal to explore further the role of segmental foot structure in the application or failed application in other instances of VCD and VS, there exist other characteristics of Bamana phonology that may assist in defining this prosodic domain in more detail. A subtle point to recall is that, although we have been considering the processes of reduction in CB, the segmental foot structure that VCD and VS have referenced is necessarily a feature of the Standard variety of the language. This characteristic of SB, however, is largely obscured by the seemingly simple segmental phonology of the more conservative language variety. Nonetheless, there exist characteristics of SB that provide additional clues about the nature of segmental feet in Bamana, as a whole.

One interesting characteristic of Bamana is its distribution of phonemic long vowels. SB exhibits a vowel length contrast in all vowel types, however this contrast manifests itself only in the vowels of the first syllable of a word. Long vowels observed in other positions in SB result from word formation. The skewed distribution of this syllable type within Bamana words suggests that perhaps it carries with it some manifestation of prominence that can be accommodated only in certain word and/or foot positions. Because this prominence is located at the left edge of a word, and necessarily in the left edge position of a foot, it suggests that Bamana favors trochaic (i.e. prominent + non-prominent) structure. Furthermore, if one considers the outcome of VCD, one could propose that the language's avoidance of a third syllable velar consonant deletion is due to the avoidance of generating a long vowel (and similarly prominent) syllable when an iambic (i.e. non-prominent + prominent) sequence would be the result. This would provide further support that Bamana feet are indeed trochees and that segmental feet are present historically in the language.

Support for disyllabic segmental feet in Bamana can be drawn from at least two additional features of the language. The first of these is the presence of a reduplication ludling (language game) utilized by Bamana-speaking children. Used in both individuals words and complete sentences, 'secret words' are constructed in this game in such a way that each syllable of a given word is reduplicated and prefixed to its base (with modification in some instances) to construct disyllabic units.

Still other evidence for effects of segmental footing can be drawn from the incorporation of French loanwords into Bamana. A preliminary survey of approximately 150 French loanwords to Standard Bamana gathered from Diallo (2007) and the first author's field notes reveal that the distribution of epenthetic vowels to break up impermissible French clusters is predicted by a scheme for footing similar to that presented above. More specifically, an empty vocalic slot located within a foot with another vowel and separated by a liquid consonant will be filled via a copy of the specified vowel (e.g. /fʁɔ.maʒ/ → (f_.ro)(maz_) → [f**o**r**o**mazi], *fromage* 'cheese'). If the empty vocalic slot is located outside the foot or is separated by a foot boundary from the specified vowel, a default [+hi] vowel will fill the slot (e.g. /ɛ̃.fɔʁ.ma.tik/ → (ɛn.fo)(r_.ma)(ti.k_) → [enf**o**r**i**matiki], *informatique* 'computing'). These and other phenomena in Bamana varieties merit additional research.

4. Conclusion

What we have done in this paper is to characterize the application or failed application of two phonological processes of reduction, namely Velar Consonant Deletion and Vowel Syncope, that are active in Colloquial Bamana. These processes, via their respective methods of segmental deletion, satisfy an overall drive towards minimization in CB by reducing input words from a phonologically-conservative variety of the language by a single syllable via the removal of a single segment. We have shown that, while the application of both VCD and VS are regular in most instances, there exist defined instances in which failed application, variable application, or seemingly unusual outcomes of these processes can be predicted only in reference to a disyllabic domain that is best defined as a segmental prosodic foot. Our analysis of VCD and VS has permitted us to provide a number of characteristic details of Bamana segmental feet. Finally, we have discussed several implications for the role of prosodic feet in both segmental and tonal phonology in Bamana and in Mande and possibilities to explore in future research on languages across the Mande sub-family.

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