

# FORMALIZING THE PROSODIC WORD DOMAIN IN BAMBARA TONOLOGY

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The surface tonal melodies associated with *Compacité Tonale* (CT) are known in the Manding literature, however no formal mechanism linking these melodies to the phonological structure of these languages has yet been offered. It is argued in this paper that, for Bambara, the observed tonal outcomes of CT are directly linked to prosodic structure above the level of the syllable. That is, tone spreading via this process is bounded and constrained by the prosodic word (PW) domain. This paper aims to offer a principled explanation for both the regular and irregular tonal outcomes of CT in terms of the (in)ability for tone spreading to occur within the PW domain, rather than within some other morphosyntactic entity. A role for the PW domain as a domain of application for phonological processes in Bambara draws on earlier work that has characterized and offered evidence for foot structure in the language (e.g. Green 2010; Green and Diakite 2008; Leben 2002, 2003). This paper draws on Prosodic Projection Theory (e.g. Ito and Mester 2007, 2009, 2010, 2013) to illustrate that CT is triggered by rightward adjunction to the PW maximal projection, followed by tone spreading within the leftmost non-maximal PW domain immediately dominated by the maximal projection.

On trouve dans la littérature mandingue les mélodies tonales superficielles associées à la Compacité Tonale (CT). Cependant, aucun mécanisme formel qui lie ces mélodies à la structure phonologique de ces langues n'a été offert jusqu'à présent. Dans ce travail on soutient qu'en bambara, les résultats tonals observés de la CT sont liés à la structure prosodique au-dessus du niveau syllabique. En d'autres termes, le domaine du mot prosodique (PW) lie et contraint la propagation tonale par ce processus. Ce travail tente d'offrir une explication des résultats réguliers et irréguliers de la CT en termes de la (in)capacité de la propagation tonale de se produire à l'intérieur du domaine du PW, au lieu d'une autre entité morphosyntaxique. Un rôle du domaine du PW comme le domaine d'application des processus phonologiques en bambara s'appuie sur les résultats d'un travail précédent qui décrit et met en exergue la structure syllabique de la langue (e.g., Green 2010; Green and Diakite 2008; Leben 2002, 2003). Ce travail utilise la Théorie de Projection Prosodique (e.g. Ito and Mester 2007, 2009, 2010) afin d'illustrer qu'une adjonction à la droite de la projection maximale du PW déclenche la CT. Celle-ci est suivie d'une diffusion tonale à l'intérieur du domaine du PW le plus à gauche et non-maximal que la projection maximale domine directement.

## 0. INTRODUCTION

This paper focuses on constructions either exhibiting or failing to exhibit *Compacité Tonale* (CT), a tonal neutralization process in Mande languages like Bambara and its close relatives. CT is a regular and generally predictable process whose melodic outcomes have been described in some detail (e.g. Courtenay 1974; Creissels 1978, 1988a, 1992; Creissels and Grégoire 1993; Dumestre 1987). By and large, however, these contributions do not offer a formalization of the CT process. No study that I am aware of has yet attempted to provide a link between the tonal outcomes of CT and the higher prosodic structure of Bambara. This paper aims to fill that gap.

Generally speaking, CT has two characteristic surface tonal melodic outcomes, i.e. all High tones (high CT) or a sequence of Low + High tones (low CT). The process results in non-initial tones of some constructions being altered upon the application of certain types of compounding or derivation. Throughout this paper, it is assumed that Bambara's tone bearing unit (TBU) is the syllable. First, typical instances of high (H)-tone CT are observed when two elements of a construction are joined and the first element is lexically

H-tone. As a result, all other tones of the construction, regardless of their underlying specification, are neutralized to H.<sup>1</sup> This is illustrated in (1).

a. [básá] + [wòló] → [básáwóló] 'lizard skin'  
 lizard + skin

In (1), the first noun is a disyllabic H-tone lexeme with a HH melody in isolation. The second noun is a Low (L)-tone lexeme with a LH melody in isolation. The initial L-tone of [wòló] is neutralized upon compounding to H to create an all H-tone (i.e. tonally compact) word.

Typical instances of L-tone CT are observed when the first of two joined elements is a L-tone lexeme (note that L-tone nouns have a LH melody in isolation). Here, remaining tones of the first element are neutralized to L, while those of the second element receive H tone. This is illustrated in (2a) and (2b), while (2c) illustrates a LH element joined to a H element for comparison.

(2) Initial L-tone CT

a. [jàrá] + [wòló] → [jàràwóló] 'lion skin'  
 lion + skin  
 b. [jàkúamá] + [wòló] → [jàkùmàwóló] 'cat skin'  
 cat + skin  
 c. [jàkúamá] + [wárá] → [jàkùmàwárá] 'feral cat'  
 cat + wild

In (2a), both words are LH in isolation. Upon compounding, the tones of the former are L, while both tones of the latter surface H. This alteration to the surface tonal melody is witnessed in longer constructs like (2b) where the LHH melody is neutralized to all L tones. This, again, illustrates the L tone CT pattern followed by an all H tone final element. The tonal outcome in (2c), where the underlying tone of the second element is H, is identical to that observed for (2b).

These patterns are regular (in most compounds and derivatives, as shown below) and well-attested (for representative examples of CT, see Dumestre 2003). One partial explication for CT, grounded in morphosyntax, is offered by Creissels (1988a: 46-51). Creissels asserts that branching morphosyntactic structure is a means by which to identify constructions that do or do not permit CT. It is not clear from this explanation, however, how this applies to the gamut of nominal and verbal constructions. The literature does not yet contain a principled motivation defining the bounds of tonal spreading via CT or an explanation as to how and/or why the process is triggered to occur in some instances but not in others. These issues are taken up from a phonological perspective below. It is important to consider the bounds and triggers of CT from a formal perspective because

<sup>1</sup> It should be clear that CT is separable from "plateau effects" observed, for example, in Mijikenda languages (e.g. Volk 2011). In Mijikenda, a defined span of TBUs that follow the first assigned lexical H tone are realized H. While the outcome appears analogous to instances of H-tone CT, this generalization does not apply in Bambara. This is seen in (3) where a surface HLH melody is possible in some contexts.

<sup>2</sup> Throughout his paper, H-tone is indicated by an acute accent, while L-tone is indicated by a grave accent. 'y' is the glide [j], 'j' is the affricate [dʒ], and 'c' is the affricate [tʃ]. A word-final Vn sequence represents a phonemic nasal vowel. When a nasal vowel is followed by an obstruent, a phonetic nasal often emerges.

there exist instances in which CT fails to occur where one might otherwise expect it to apply. Some of these instances have been defined in terms of the type of word or phrase (e.g. comparatives, distributives) that they create (Creissels 1988a: 48-49), but this provides only a partial explanation of their exceptional behavior. To illustrate, consider (3), where CT fails to occur.

(3) Failed application of CT

- a. [dá] + [bilá] → [dábílá], \*[dábílá] ‘to stop’  
edge + to cease/put/place

In (3), a noun is joined with a verb, resulting in another verb. What is unusual here is that CT is not triggered. CT is clearly blocked, as the LH melody of [bilá] is retained when the two elements are joined. Had CT applied, an ‘all-H’ compact melody would have resulted, as in the illicit form in (3). Other constructions where nominal and verbal elements are joined do not typically or systematically block CT nor do they yield such unusual exceptions. What is more exceptional about non-compact words like [dábílá] is shown in (4). Upon another instance of word formation (here, via derivation), CT applies, even though it was previously prevented from occurring.

(4) Application of CT in successive rounds of word formation

- a. [dábílá] + [-bálí] → [dábílábálí] ‘incessant’  
to stop + without

In (4), the addition of [-bálí] results in a compact tonal melody. Here, the HLH melody of [dábílá] is neutralized to all-H, yielding the derivative [dábílábálí]. The current literature on CT does not capture why CT now applies.

It is proposed below that CT is best explained by appealing to Prosodic Projection Theory (e.g. Ito and Mester 2007, 2009, 2010, 2013) such that a tone associated with the head of the leftmost prosodic word (PW) of a construction will spread rightward within a PW domain that is immediately dominated by the PW maximal projection only when triggered to do so by rightward PW adjunction. Thus, CT is initiated by some (but not all) instances of word formation. If the appropriate structural conditions are met, a tone will spread via CT within this PW domain until the domain boundary is encountered. The tone will not spread beyond the PW domain boundary, and thus, the newly adjoined element(s) (also immediately dominated by the PW maximal projection) are assigned a default H tone.<sup>3</sup> This relationship between CT and PW adjunction also provides a principled explanation for those instances where CT fails to occur in words formed by derivation via prefixation (e.g. 3) and the subsequent ability for such constructions to become tonally compact in later rounds of word formation (e.g. 4).

<sup>3</sup> That H tone is the default in Bambara is drawn from the outcomes of CT discussed in this paper and from the tonal outcomes of trisyllabic words whose third syllable is invariably H tone. Earlier work discusses that Bambara words are lexically H or LH and that these melodies occupy a disyllabic tonal foot. It has been proposed that *affaissement* (settling) occurs, causing L tone to spread within a tonal foot, i.e. (LH)(H) → (LL)(H). No independent evidence is found in support of a LH tonal melody being assigned such that the H tone spreads rightward, only to be followed by L tone spreading bounded by a prosodic domain. Thus, it has been argued that a lexical tonal melody is associated with a tonal foot, and the remaining TBU is assigned a default H tone. Support for default H in Manding languages is found in Creissels and Grégoire (1993).

When word formation occurs via prefixation, the structural conditions necessary to initiate CT are not met. Because CT is triggered only by rightward adjunction to the PW maximal projection, the tone of the newly left-adjoined element cannot spread within its PW domain. Thus, such words surface with a faithful, non-compact tonal melody. However, once the construction in (3) is created, rightward PW adjunction via another round of word formation provides the appropriate trigger for CT to occur. The tone of the formerly prefixed PW (now the leftmost PW head) can now spread within the PW domain immediate dominated by the PW maximal projection and does so until it encounters the boundary of this domain, yielding a compact tonal melody. These outcomes illustrate that the PW domain in Bambara provides a domain of application within which CT occurs and defines the bounds of tone spreading via this process. The remainder of this paper explores and discusses these concepts and formalizes the role of the PW domain in more detail.

### 1. BAMBARA PROSODIC STRUCTURE

Prosodic structure, as described in Selkirk (1984) and Nespor and Vogel (1986), is viewed as a hierarchy within which smaller units (e.g. syllables) comprise successively larger units (e.g. feet), and so forth. Discussion of prosodic structure in Bambara has been limited in the literature until recently. Work by Bamba (1991), Leben (2002; 2003), Weidman and Rose (2006), and Green (2010), however, began to explore motivations for prosodic structure above the level of the syllable in Bambara phonology. Although avoiding the discussion of stress, which does not appear to have consistent phonetic correlates in Bambara, these works provide some evidence that foot structure is present in Bambara, acting as a domain of application for phonological processes occurring in the language. Green et al. (2012) have also reported syncope patterns in the language that create phonological prominences. These patterns are driven by an avoidance of iambic sequences and the creation of words with a strong left edge (i.e. complex syllables are preferred in word-initial position). The data presented by these authors illustrate that the characteristics of Bambara foot structure help to dictate the types of syncope that can(not) occur. These generalizations rely on the presence of foot structure and the headedness of the foot domain. With these arguments implicating a role for the foot domain in mind, a natural extension is to explore a role for the next higher domain in the prosodic hierarchy, namely the PW domain, in Bambara phonology. By motivating a role for this domain and defining its characteristics, one may come to a better understanding of the role of prosodic structure in Manding languages and in Mande typology. In order to approach this goal, §2 briefly outlines the types of constructions created by compounding and derivation in Bambara and the tonal melodies that emerge from them via CT.

### 2. WORD FORMATION

Bambara forms new words via derivation and compounding. These processes are robust, and many Bambara words over three syllables in length are formed via one of these processes. Even many disyllabic and trisyllabic words are formed in this way. Inflection, however, is limited in the language. Compounding and derivation are implemented in Bambara in many ways, and nominal and verbal constructions are divisible into two groups, identified by their (in)ability to permit CT. Dumestre (2003)

describes these as being either tonally compact or non-tonally compact, respectively, with tonal compactness being more common.

Creissels' (1988a) description of tonally compact constructions states that CT operates on juxtaposed nominal lexemes in a determinative relationship where the determinant precedes its complement, as well as in certain other word formation processes. He points out that in constructions with multiple levels of word formation, the surface tonal outcome of the construction depends upon the rank of the constituents within the word's morphosyntactic tree. The current paper aims to complement Creissels' work by linking his observations about the language's morphosyntax to a phonological mechanism for tonal spreading defined and bounded by the PW domain.

## 2.1 TONALLY COMPACT CONSTRUCTIONS

Many tonally compact constructions are formed via compounding. Data in (5) show that all logically possible input tonal combinations are found for three common types of compounds. In each, the lexical tonal melody of the first element predicts the resultant compact melody, namely HH (for H+H and H+L compounds) or LH (for L+L and L+H compounds). This suggests, therefore, that the leftmost input element acts as the prosodic head of the resultant PW. Given the variety of possible compounds, it should be clear that the morphological or syntactic head of a construction is not always its prosodic head. Earlier work on prosodic phonology (e.g. Hayes 1989; Nespor and Vogel 1986) argues that the hierarchical structure of these components of the grammar is not necessarily isomorphic. The outcome of CT is indicative of the fact that the tone associated with the head of the leftmost input PW spreads (when triggered to do so) within its PW domain upon the addition of a rightward adjacent element. These details follow for N+N compounds like (5a-d). For N+V compounds like (5e-h), only when this combination yields a noun is the outcome compact. When a N+V combine to yield another verb, the construction is not tonally compact. This situation is discussed further below. In more complex constructions, the domain of tone spreading is not limited to a single morpheme.

### (5) Compound formation

	Isolated	Conjoined		Gloss
a.	<b>sélí + sàgá</b>	<b>[sélíságá]</b>	prayer + sheep	'sacrificial sheep'
b.	<b>sírá + múgú</b>	<b>[sírámúgú]</b>	tobacco + powder	'snuff'
c.	<b>tùbàbù + kán</b>	<b>[tùbàbùkán]</b>	foreigner + speech	'French'
d.	<b>wòró + dùgú</b>	<b>[wòròdùgú]</b>	kola + village	'south'
e.	<b>kábúró + dòn</b>	<b>[kábúródòn]</b>	grave + to enter	'cemetery'
f.	<b>báará + jínín</b>	<b>[báarájínín]</b>	work + to ask for	'laborer'
g.	<b>sàn + pérén</b>	<b>[sànpérén]</b>	sky + to yell	'thunder'
h.	<b>yèré + mìné</b>	<b>[yèrèminé]</b>	oneself + to seize	'self-control'
i.	<b>bírí + finí</b>	<b>[bírífíní]</b>	to cover + cloth	'blanket'
j.	<b>táá + bóló</b>	<b>[táábóló]</b>	to go + hand	'strategy'
k.	<b>kàlán + dén</b>	<b>[kàlàndén]</b>	to learn + child	'student'

- l. **kàlán + sàrá** [kàlànsàrá] to learn + payment 'scholarship'

Other tonally compact nominal sequences are created upon the addition of a noun to its qualifying adjective (6a-d), a noun to its modifying ordinal number (6e-h), and in other attributive adjectives derived from their predicative bases (6i-l). In Bambara, an adjective follows the noun that it qualifies.

(6) Tonal Compactness in Noun + Qualifier

Isolated	Conjoined	Gloss
a. <b>fágá + kúrá</b>	[fágákúrá]	'new cooking pot'
b. <b>nónó + kùmún</b>	[nónókùmún]	'sour milk'
c. <b>cě + bèlèbélé</b>	[cèbélébélé]	'large man'
d. <b>kìbàrú + júgú</b>	[kìbàrùjúgú]	'bad news'
e. <b>jégé + tánnán</b>	[jégétánnán]	'tenth fish'
f. <b>fúró + filàrán</b>	[fúrófílàrán]	'second marriage'
g. <b>kòńó + mùgànnán</b>	[kòńòmùgánnán]	'twentieth bird'
h. <b>kèlé + dúúrúnán</b>	[kèlèdúúrúnán]	'fifth war'
i. <b>bá + júgúmán</b>	[bájúgúmán]	'bad mother'
j. <b>téρί + kègùnmán</b>	[térikégúnmán]	'clever friend'
k. <b>sǒ + fínmán</b>	[sòfínmán]	'black horse'
l. <b>mùsó + fàrínmán</b>	[mùsòfàrínmán]	'brave woman'

The latter two types of constructions warrant additional comment. For noun + ordinal number constructions, the ordinal number itself is formed by adding the suffix **nan** to the numeral base. A noun and its qualifying cardinal number, however, do not permit CT, e.g. /**mùsó + kòńòntón**/ → [mùsó kòńòntón] 'nine women', \*[mùsò kòńòntón]. In (6i-l), an attributive adjective is formed from its predicative base via the addition of the suffix **man** before it can act as a noun complement. If this were not the case, one would expect a different tonal outcome. In typical tonally compact constructions, a default H tone is manifested only on the final morpheme, but this is not the case in the L+L constructions above (6g). Here, there is a default H tone on both the penultimate and final morphemes. It is likely that this outcome arises because an adjective and its derivative suffix act as one unit and are conjoined at a stage of word formation prior to compounding.

The more complex nominal constructions in (7) also exhibit CT tonal patterns. These include the conjunction of a noun and its qualifying postposition (PP) followed by another noun or verb, and those instances where adverbs of manner are conjoined with a nominal element to yield an abstract nominal or verbal compound.

## (7) Tonal Compactness in N +PP + N/V

Isolated	Conjoined	Literal	Gloss
a. <b>bóló + lá + nègé</b>	<b>[bólólánégé]</b>	hand + on + iron	‘bracelet’
b. <b>nún + kòró + síí</b>	<b>[núnkórósíí]</b>	nose + under + hair	‘moustache’
c. <b>fàlí + bálá + yèlén</b>	<b>[fàlibàlàyélén]</b>	donkey + upon + climb	‘to ride a donkey’
d. <b>mànàmáná + kúmá</b>	<b>[mànàmànakúmá]</b>	unimportant + speech	‘worthless speech’
e. <b>dákábáná + mìsírí</b>	<b>[dákábánámísírí]</b>	amazing + mosque	‘grand mosque’

Many nominal derivative constructions are also tonally compact, as in (8). This list is not exhaustive but illustrates several of the more common suffixes of this type. An extensive list of related nominal suffixes is found in Dumestre (2003:57-78).

(8) Tonally compact nominal derivatives<sup>4</sup>

Isolated	Conjoined	Literal	Gloss
a. <b>bálikú + ya</b>	<b>[bálikúyá]</b>	adult + abs.	‘adulthood’
b. <b>silàmé + ya</b>	<b>[silàmèyá]</b>	Muslim + abs.	‘Islam’
c. <b>wárí + ntan</b>	<b>[wárintán]</b>	money + neg.	‘poverty’
d. <b>jìgí + ntan</b>	<b>[jìgĩntán]</b>	hope + neg.	‘hopeless’
e. <b>súnkúrún + ba</b>	<b>[súnkúrúnbá]</b>	young woman + aug.	‘prostitute’
f. <b>jàbá + ba</b>	<b>[jàbàbá]</b>	onion + aug.	‘big onion’ (not shallot)
g. <b>síné + nin</b>	<b>[sínénín]</b>	gazelle + dim.	‘Dorcas gazelle’
h. <b>filá + nin</b>	<b>[filànín]</b>	two + dim.	‘twins’

Verbal constructions formed by suffixal derivation, as in (9), are also tonally compact. These include words formed via the verbalizing suffix **ya**, the deverbal suffix **ya**, and the suffix **ma**.

## (9) Tonally compact verbal constructions

Isolated	Conjoined	Literal	Gloss
a. <b>télí + ya</b>	<b>[télíyá]</b>	fast + denom.	‘to hurry’
b. <b>bòn + ya</b>	<b>[bònyá]</b>	big + denom.	‘to increase’
c. <b>kúmá + ya</b>	<b>[kúmáyá]</b>	to speak + deverb.	‘sentence’
d. <b>jìgí + ya</b>	<b>[jìgĩyá]</b>	to hope + deverb.	‘hope (n.)’
e. <b>táá + ma</b>	<b>[táámá]</b>	to go + ma	‘to voyage’
f. <b>kònkón + ma</b>	<b>[kònkònmá]</b>	to prepare + ma	‘to ready oneself for attack’

<sup>4</sup> Dumestre (2003) suggests that derivational suffixes in Bambara (with few exceptions) are not specified for tone. This appears to stem from the fact that constructions formed by these affixes are exclusively tonally compact, and therefore, there is no overt evidence for contrastive tone. For each, the suffix receives a default H tone. Furthermore, because these affixes are bound, one cannot witness their tone in isolation. With no evidence to the contrary, I adopt the same position here.

Other tonally compact constructions are not easily grouped into these categories, e.g. the conjunction of the reflexive element **yèré** ‘self’ with a verb, e.g. **yèré** + **mìné** → [**yèrémíné**] ‘self-control’, lit. oneself + to seize. More unusual are nominal conglomerates formed via the conjunction of two verbs with the connective particle **kà**, e.g. **sà-kà-kúnún** → [**sàkàkúnún**] ‘resurrection’, lit. to die + and + to raise oneself. Marginal cases include multi-word expressions formed most often by the conjunction of a noun or verb with a pronoun and a postposition, e.g. **sigi-ń-fe** → [**sigĩnfé**] ‘drifter’, lit. to sit + 1<sup>st</sup> singular + with.

## 2.2 A MECHANISM FOR CT

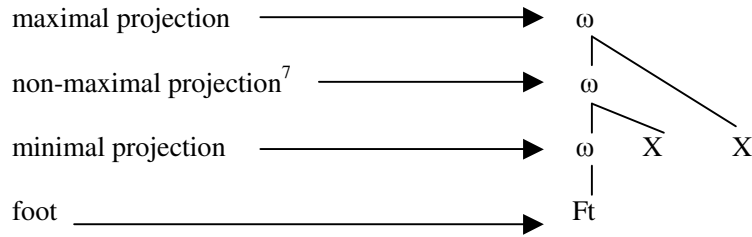
Generally speaking, CT creates constructions with one of two surface tonal melodies, i.e. all-H (high CT) or LH (low CT). More complex constructions in which CT does not occur are taken up in §3. This section introduces a formal phonological account of CT that necessarily refers to the higher prosodic structure of Bambara words. This account illustrates that a tone associated with the head of the leftmost input PW of a construction will spread within a PW domain that is immediately dominated by the PW maximal projection when triggered to do so by rightward adjunction to the maximal projection. The tone spreads rightward, but only within the bounds of the leftmost non-maximal PW domain. The tone cannot spread across the boundary of this domain, and the TBUs of the newly adjoined element receive a default H tone. If the newly adjoined element has more than one syllable, the H tone will be assigned to the head of the tonal foot and spreads rightward until it encounters a boundary. While the mechanism to be presented readily applies to ‘high’ CT, the tonal alternations seen in ‘low’ CT offer a better visualization of the process. This section argues that the PW domain plays a defined role in providing a domain of application for CT tone spreading. Earlier work (e.g. Bamba 1991; Green 2010; Leben 2002, 2003) has discussed a role for prosodic or tonal feet as a domain of application for other phonological processes in the language.

The mechanism offered below assumes a variation on Prosodic Phonology (e.g. Nespor and Vogel 1986) explored in detail by Ito and Mester (2007, 2009, 2010, 2013) wherein recursion of prosodic layers results from adjunction.<sup>5</sup> By this theory, the PW domain immediately dominates a foot. Via adjunction, additional PW projections are generated, as illustrated in (10). Ito and Mester discuss that certain phonological processes apply only within a particular projection and may be restricted from occurring in others.<sup>6</sup>

<sup>5</sup> For a complementary viewpoint on recursion, see Selkirk (2011).

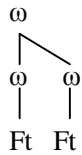
<sup>6</sup> Examples include Japanese Rendaku voicing, which Ito and Mester illustrate is restricted to non-maximal prosodic word projections. Analogously, the presence or absence of junctural accents in word vs. phrasal compounds in Japanese can be expressed by referencing similar structural domains within the prosodic hierarchy.

## (10) Prosodic word adjunction



One can observe that CT is a morphophonological process which occurs only in instances of word formation by compounding or derivation, and specifically via suffixation. Consider the prototypical outcome of ‘low’ CT in (11).

## (11)



**fàlí** + **kòró** → **fàlikóró** ‘old donkey’  
 donkey + old

In (11), the compound is formed from two words that are disyllabic LH feet and that we will assume are left-headed trochees.<sup>8</sup> The LH tonal melody associated with the leftmost input word is responsible for determining the resultant compact tonal melody on the compound. Had the first word been the lexically H-tone word [jégé] ‘fish’, the tonal outcome would be entirely different, i.e. [jégékóró] ‘old fish’. These tonal outcomes, alongside other factors, lead me to posit that the first syllable of the leftmost foot is the prosodic head of the construction. Left-edge positions have also been argued to be segmentally prominent in Bambara (Green 2010). In (11), the LH melody of the noun in isolation is altered by CT when an adjective is adjoined, i.e. adjunction acts as a trigger for tone spreading. Rather than spreading across the entire compound, however, tone spreading occurs only within the bounds of the PW domain immediately dominated by the maximal projection, generating a compact LLHH melody.

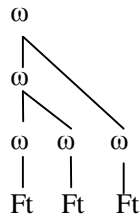
This mechanism and the role played by the non-maximal PW projection as a domain of application for tone spreading is further defined in successive rounds of word

<sup>7</sup> Ito and Mester (2013) refer to these projections as ‘intermediate’ projections, and citing other work, they suggest that binary projection features could be used to define such projections as [-maximal, -minimal]. In her work on Conamara Irish, Elfner (2012) is concerned with phonological processes targeting intermediate, non-minimal projections. Similarly, Martínez-Paricio (2012) motivates ‘superfeet’ through recursion at the foot level. It will be illustrated in this paper that the domain of note in Bambara is the first non-maximal projection (i.e. the projection immediately dominated by the maximal projection).

<sup>8</sup> This follows Green (2010), but for other perspectives on the headedness of prosodic feet in Bambara, see Leben (2002, 2003), Weidman and Rose (2006), and Vydrine (2010).

formation. Consider (12), where the tonally compact output in (11) serves as one element of the input.

(12)

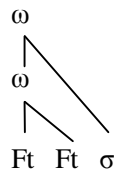


**fàlikóró + tígí → fàlikòròtígí** ‘old donkey owner’  
old donkey + possessor

When a rightward morpheme is adjoined to the output in (11), the resulting compact L melody again stems from the tone associated with the proposed prosodic head of the construction, i.e. the leftmost input PW. It should be clear that CT is not necessarily a morphologically-bounded process, as the span of tone spreading now expands beyond word internal morpheme boundaries. Tone spreading, however, is constrained by the boundaries of the non-maximal PW domain immediately dominated by the PW maximal projection.

These same principles apply in instances of word formation via suffixing derivation; however I propose that rather than comprising a foot and PW of its own, the derivational suffix is directly dominated by the PW maximal projection. Consider (13), where the abstract suffix [-ya] is adjoined to the noun [silàmé] ‘Muslim’. As above, the tone associated with the prosodic head of the construction spreads within the non-maximal PW domain until it encounters the domain boundary. A default H tone is assigned to the remaining TBU that is dominated by the maximal projection. The result is a tonally compact PW.

(13)



**silàmé + yà → silàmèyá** ‘Islam’  
Muslim + abstract

CT occurs in constructions involving constituents of different types. Some constructions, however, fail to exhibit CT. This is clear from their retention of their lexical tonal melodies. From the characteristics of Bambara prosodic structure introduced above, alongside other morphophonological and morphosyntactic properties of the language, §3 shows that these sequences are, in fact, predicted not to accommodate CT, as they do not meet the structural conditions necessary to trigger the process.

## 3. NON-TONALLY COMPACT CONSTRUCTIONS

Far fewer constructions fail to exhibit CT compared to those allowing the process. The prosodically-based mechanism for CT introduced in this paper, however, offers a principled explanation for the appearance of non-tonally compact melodies associated with this smaller set of Bambara words. Consider one type of non-tonally compact construction in (14) where a noun+verb yields another verb. Note that when this combination creates a noun, the construction is tonally compact. Examples (14a-b) show non-tonally compact verbal outcomes.

(14) Noun + Verb Conjuncts

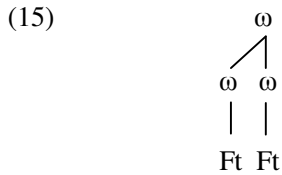
- |    |  |                        |
|----|--|------------------------|
| a. | <b>dá</b> + <b>mìnέ</b> → [ <b>dámìnέ</b> ], * <b>[dámínέ]</b>       | ‘to begin’             |
|    | edge + to seize  |                        |
| b. | <b>kán</b> + <b>tíkέ</b> → [ <b>kántíkέ</b> ], * <b>[kántíkέ]</b>    | ‘to slit one’s throat’ |
|    | neck + to cut  |                        |
| c. | <b>yèré</b> + <b>mìnέ</b> → [ <b>yèrémínέ</b> ], * <b>[yèréminέ]</b> | ‘self-control’         |
|    | self + to seize  |                        |

(14c) shows a tonally compact nominal outcome for comparison, which is analytically identical to words discussed in §2. It exhibits a typical tonally compact melody, therefore differing from words like (14a-b). These appear to be instances of noun incorporation (NI), which typically occurs when a preverbal noun and a verb stem or root form a single morphological unit that resembles an N+V compound.<sup>9</sup>

The non-compact surface tonal melody of the words in (14) suggests two possible scenarios. One possibility is that NI may apply at a point early in the grammar before compounding and derivation, such that CT cannot apply or that incorporated forms are not affected by CT overall. This might explain why, although the incorporated noun and its verb are identifiable as separate morphemes, they retain their lexically associated tones. The fact that such constructions are capable of exhibiting CT upon additional instances of word formation, however, must still be explained. Recall from (3) and (4) that tonally non-compact [**dábílá**] became the tonally compact construction [**dábílábálí**] upon the addition of the suffix **-bali**. A second possibility follows from the mechanism introduced in §2. In these instances of NI, arguably, the verb is the prosodic head of the construction to which the noun is prefixed. We have seen, thus far, that CT is triggered by rightward adjunction to the PW maximal projection, and thus it appears that the appropriate structural condition would not be created by NI constructions to allow the CT process to

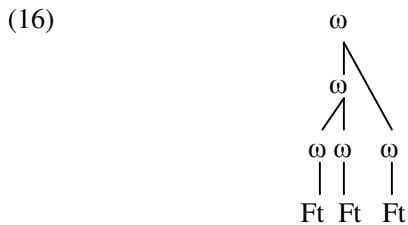
<sup>9</sup> The incorporated nouns found in these Bambara constructions appear similar to ‘classifier’ NI discussed in Rosen (1989) and Gerds (1998). In this type of NI, the incorporated noun resembles an object; however the incorporated noun and verb function together as a single predicate. The valency of the verb does not change, i.e. the predicate functions as a transitive verb, taking a direct object. Other manifestations of NI (i.e. compound incorporation) change the valency of a verb by removing its ability to take a direct object. In Bambara, (i) a verb and its incorporated noun function as a single word, (ii) the nouns permitted to incorporate are very limited, and (iii) the verb created by incorporation is often more idiomatic than compositional.

apply. Leftward adjunction to the PW maximal projection, therefore appears not to initiate CT. This state of affairs is shown in (15).



**dá + bìlá → dábílá** ‘to stop’

Assuming that this is correct, and drawing on what we have seen of rightward adjunction triggering CT in other constructions, the fact that the outcome in (15) is subject to CT in later rounds of word formation via suffixation is now motivated. NI forms comprise a single PW, and when an additional element is rightward adjoined to the PW maximal projection, the structural condition needed to trigger CT is now met, and the tone associated with the prosodic head of the construction (that parametrically assigned to the leftmost input PW) can now spread within the non-maximal PW domain immediately dominated by the PW maximal projection. This is illustrated in (16).



**dábílá + bali → dábílábálí** ‘incessant’

In addition to NI, CT is not possible in words derived by prefixation of **lá-** or **mă-** to a verb stem. Following discussion in Leben (2002, 2003), it is assumed that these prefixes occupy a foot of their own. This assumption is extended here to consider these prefixes to constitute a PW, as they too can serve as the prosodic head of a construction in additional rounds of word formation via suffixation. Examples of words with **lá-** and **mă-** are in (17) for both L-tone and H-tone verb stems.

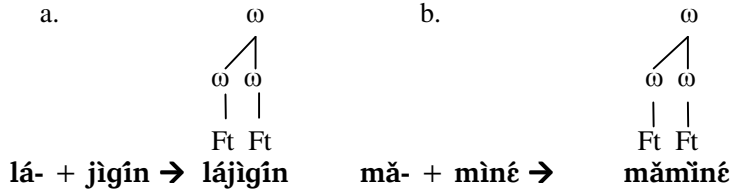
(17) Derivation via prefixation of **lá-** and **mă-**

- a. **lá-** + **bìn** → [**lábìn**], \***[lábíń]** ‘to make fall’  
**bìn** - ‘to fall’
- b. **lá-** + **jìgín** → [**lájìgín**], \***[lájígín]** ‘to make descend’  
**jìgín** - ‘to descend’
- c. **lá-** + **sírán** → [**lásírán**] ‘to frighten’  
**sírán** - ‘to be afraid’
- d. **mă-** + **mìné** → [**mămìné**], \***[màmíné]** ‘to become engaged to marry’  
**mìné** - ‘to seize’

- e. **mǎ-** + **kàsí** → [**mǎkàsí**], \***[màkàsí]** ‘to offer one’s condolences’  
           **kàsi** - ‘to cry’
- f. **mǎ-** + **gén** → [**màgén**] ‘to rescue’  
           **gén** - ‘to pursue’
- g. **mǎ-** + **fúra** → [**màfúra**] ‘to clean a space’  
           **fúra** - ‘to sweep’

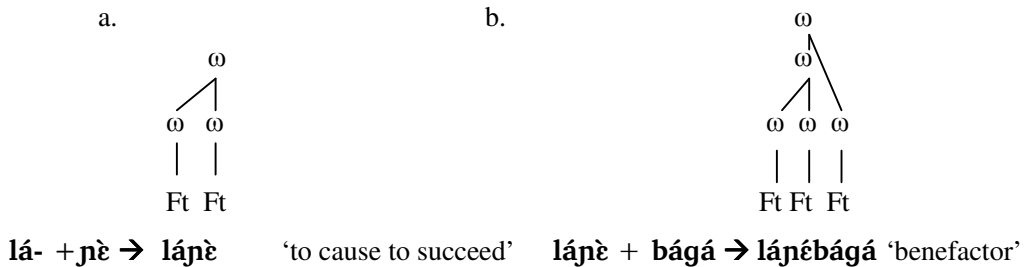
(17a-b) contain ‘low’ stems in isolation, which contrast with the **lá-** prefix to which they are attached. The surface outcome is a seemingly unusual HLH surface tonal melody, rather than a tonally compact outcome. This is predicted, however, by the proposed prosodically-motivated mechanism for CT, as no rightward adjunction to the PW maximal projection has occurred to trigger the process. An analogous outcome resulting in a LHLH melody is in (17d-e) for words with a **mǎ-** prefix. The outcome for constructions containing a H-tone verb (e.g. 17f-g) is less striking, as the H tone of the stem appears to absorb the H tone of the adjacent affix. The failure of CT to apply follows from the same argument offered for **lá-** prefixation. These outcomes are schematized in (18).

(18)



In further rounds of word formation, words derived by prefixation, like those in (17), can accommodate CT. Similar to (15) and (16), this outcome follows from the prosodic mechanism for the process, as shown in (19).

(19)



Four additional types of constructions introduced below are immune to CT. Each either retains the respective lexical tonal melodies of each input or has a partially compact tonal melody. Consider examples of the latter in (20).

(20) Non-tonally compact nominal constructions

- (a) **dén** + {**màlo** + **bali**} → [**dénmàlòbálí**], \***[dénmálóbálí]**  
       child + shame + without ‘shameless child’





#### 4. DISCUSSION AND CONCLUSION

The goal of this paper has been to offer a mechanism that formalizes a defined role for the Prosodic Word (PW) domain in Bambara phonology and, in doing so, to provide evidence in support of the existence of this domain in the language. An explicit role for this domain in the language's phonological grammar has perhaps been overlooked in earlier work because the PW, in the prosodic phonology literature, is most often discussed in relation to stress and/or accent, two components that are not characteristic of Bambara. This paper also offers an extension to other recent works (e.g. Green 2010; Green, Davis, Diakite, and Baertsch 2012; Leben 2002, 2003; Weidman and Rose 2006), that discuss a role for prosodic foot structure in Bambara.

From the segmental standpoint, Green, Davis, Diakite and Baertsch (2012) attribute the types of deletions that can/cannot occur (or co-occur) in Colloquial (Bamana) Bambara to constraints on the language's foot structure and the types of deletions that are allowed in and across the foot domain. They argue that disyllabic, trochaic (left-headed) feet are constructed iteratively from left to right in Bambara and that restrictions on deletions stem from an overall avoidance of creating iambic sequences.<sup>12</sup> From a tonal standpoint, Leben (2002, 2003) implicates tonal feet in Bambara as being responsible for the distribution of tonal melodies associated with trisyllabic words. Leben proposes that prosodic feet in Bambara could be either right- or left-headed and that headedness must be lexically specified. Weidman and Rose (2006) propose a different analysis, concluding that Bambara tonal feet are obligatorily right-headed. One can then ask what implications the mechanism provided in the current paper has for these earlier works that have focused on the foot domain.

The foot domain has previously been argued to be immediately dominated by the PW domain, as follows from the Strict Layer Hypothesis (e.g. Nespor and Vogel 1986; Selkirk 1984; among others). I have argued in this paper that CT is triggered by rightward adjunction to the PW maximal projection, following more recent proposals of prosodic adjunction and recursion (e.g. Booij 1996; Ito and Mester 2007, 2009, 2010, 2013; Selkirk 2011). While this offers a means by which the process is initiated, it should be clear that the span of the leftmost non-maximal PW domain of a construction and its associated lexical tone determine 1) the bounds of tone spreading via CT and 2) the representative tonal pattern of CT (H or L) found over the construction. This privileged status of the leftmost PW domain and indeed the head of its leftmost foot suggests not only that Bambara PWs are left-headed but also that the language's prosodic feet are similarly left-headed. That the leftmost position is privileged tonologically in this way provides at least preliminary support for the earlier stance that Bambara prosodic feet are left-headed. It remains unclear, however, whether segmental and tonal prosodic foot structure of this language can be conflated or if these structures must be considered unique entities that do not necessarily operate in parallel in all relevant instances. This must be left to future research.

As research continues, additional evidence may be brought to bear on the definition of the foot and PW domains in Bambara and other processes that may reference or rely upon one or both domain for their proper application. It is clear that CT has a conspicuous

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<sup>12</sup> For an alternative typological view on metrical feet in Mande languages, see Vydrine (2010).

outcome such that constructions in which CT applies are easily distinguishable from those where the process cannot occur. CT and analogous tonal processes must be further explored in lesser studied Mande languages, other languages of West Africa, and perhaps beyond. It is known, for example, that CT occurs in several varieties of Bambara and its Manding-East relatives, among them Kita Malinké (Creissels and Grégoire 1993), Kankan Maninka (Spears 1968), Burkinabe Dyula (Sanogo 1995), and Mankono Koyaga (Creissels 1988b). CT is absent, however, in other varieties, e.g. Kolona Bambara (Dumestre and Hosaka 2000). Analogous types of CT have also been described for Susu (Grégoire 1978) and Dialonké (Keita 1989). Additional research is called for to explore the typology of tonally compact constructions and to determine if CT is generally found only in some subset of constructions and if it must be triggered by a similar means as in Bambara. This would perhaps shed additional light on the role, if any, for the PW domain in these other languages. Additional research might also illuminate which surface tonal melodies can be compact and why others cannot be. In Bambara, the two tonally compact surface tonal melodies are identical to the two most common ‘major’ tonal melodies (i.e. H and LH) associated with simple lexemes in the language. There is much research to be done to uncover the finer details of this process, its possible vs. impossible outcomes, and its dependency on other factors.

This paper has considered the process of *Compacité Tonale* in Bambara and has offered a formalized phonological mechanism that makes explicit reference to the language’s prosodic structure above the level of the syllable for its initiation and the bounds of its characteristic tone spreading. The paper defines an explicit role for the PW domain in providing the boundaries of tone spreading while also offering some evidence suggesting that Bambara PWs are left-headed. While earlier groundbreaking work by Creissels (1988a) discussed the importance of Bambara morphosyntax in the outcome of *Compacité Tonale*, this paper provides a closer look at this process from a phonological perspective. It has been shown that the language’s morphosyntax and morphophonology necessarily interact to yield the observed outcomes of CT.

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