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A Morphophonological Approach of Vowels Lengthening in Tagbana

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Abstract

In this article, vowel lengthening word internally in Tagbana, a Senufo language of Côte d'Ivoire is investigated. All vowels are underlyingly short, and all long vowels are the result of a lengthening process. Various lengthening processing are observed in Tagbana. (i) A lengthening due to the fusion of two independent morphemes, an aspect morpheme and a resumptive pronoun. (ii) Lengthening due intonation parameters where sentences last vowels are lengthening for interrogation purposes. See section 2.5 for these lengthening forms. (iii) Vowel lengthening due to the presence of two consonantal segments [l] and [r] in certain morphological environments.

It is this late form of lengthening that attract my intention in this paper. It is proposed then that these consonantal segments have a double skeletal position which one is filled by the preceding vocalic segment. The consonants that trigger lengthening function as domain delimiters where both phonology and morphology play important roles. While [r] regularly triggers lengthening in Tagbana, some exceptions arise with [l]. A possible alternative is explored: It is proposed that lengthened vowels by lateral [l] get prominence during their pronunciation, as a consequence of lexical accent. Lengthening is accounted for by using locality conditions as proposed in Distributed Morphology.

1. Introduction

A large number of languages use long vowels in their communication system and vowel length is perceived as the duration of a vowel during its production. Vowel length has different origins in the world's languages. Some languages use contrast in vocalic length in their phonemic system, and in some others, lengthening is the result of a process. In most Bantu languages, for example, vowels are long on the surface before a nasal and a consonant cluster 'NC' see Clements (1986) [8, 9] who proposed that relevant sequences are initially syllabified with a nasal coda (VN]_[C) which is therefore assigned a mora. The nasal then resyllabifies into the following onset, either as a cluster or as part of a complex segment, where the vowel compensatorily lengthens to fill the mora vacated by the nasal. According to Archangeli & Pulleyblank (2018) [3], the phenomenon of compensatory lengthening is also analyzed as length from an underlying segment being realized on a different segment, see Hayes (1989) [21] and Kiparsky (2010) [30] for discussion. There are many studies on lengthening processes in different languages. See for example Downing (1991, 1996, 2005) [11, 10, 13] who proposed that the mora results from the NC cluster having a geminate place-linked structure and Bickmore (1991) [5] who proposed that the mora results from the prosodification of an unsyllabified nasal.

The phenomenon of lengthening observed in Tagbana is different from the compensatory lengthening found in Bantu languages. It is due to the presence of two consonantal segments [l] and [r] that have a lengthening effect on the preceding vowel in certain environments. It is proposed here that these consonantal segments have a double skeletal position and that one of them can be filled by the preceding vocalic segment. See for example Clements (1986) [8, 9], Levin (1985) and Sagey (1990) for similar analysis of lengthening cases in LuGanda.

This paper investigates the vowels and the vowels lengthening in Tagbana, a Senufo language of Côte d´Ivoire, classified as a Gur[1] language in the past, see Mensah & Zakari (1983). Tagbana is characterized by a dialectal differentiation in their tonal

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[1] Bodomo (1993) refers to these languages as the Mabia (*ma* 'mother' and *bia* 'child') languages based on a sibling relationship between these languages.

and melodic structure that slightly distinguishes the dialects from each other. But they are all intelligible among each other and all speakers identify themselves as Tagbana speakers, see also Mensah and Tchagbale (1983) [35] who proposed three groups of subdialects: 1) The dialect around Katiola very close to the that of Fronan (Fròʔò) the one studied in the present paper, 2) the dialect of the region of Niakaramandougou known as (*takpɛr*) and 3) the group of Tafiré. All these dialects contain subgroups. Tagbana is rapidly disappearing because of the dominance of larger languages, such as Dioula, a widely spoken language in West Africa, and French, the official language taught in schools in Côte d´Ivoire.

From my investigation, no study exists on the vowel lengthening in this language so far. Therefore, the present research is a contribution to the documentation of this underdescribed language. The first section is devoted to an overview of some aspects of Tagbana including segment inventory, syllable structure and phonotactics, see also Traoré (2020) [45]. The second section deals with the long vowels and their environments, and develops a theoretical analysis of the phenomenon. The third part is about the lengthening in loanwords and their adaptations. The fourth and fifth sections contain respectively a brief discussion that opens interrogations for future research, such as stem alternations and contextual allomorphy of certain morphemes and the conclusion.

Overview

Section 1.1 briefly discusses the segments of Tagbana. Section 1.2 introduces the syllable structure and the phonotactics of the language and Section 1.3 shows the short vowels.

1.1 The segments of Tagbana

Tagbana distinguishes 22 consonants with different places and manners of articulation, 11 of which are stops. There are eight sonorants including four nasals [m], [n], [ɲ], and [ŋ], two glides, [w] and [j], one lateral [l], and one rhotic [r]. The consonant system resembles that of some Gur languages, especially Koulango, Lohoron, Lomaka, and Nafanran, see Mensah & Tchagbale (1983) [35], although some differences appear as well, as testified by the absence of voiced fricatives in Tagbana and their presence in many Gur languages. The laryngeals [h] and [ʔ] are present in Tagbana, but they are lacking in further Gur languages, like Fodonon and Dugubɛrɛ. See Table 1 from Traoré (2020) [45] for the consonantal segments of Tagbana.

Table 1: Consonants of Tagbana

		labial	coronal		dorsal		
		labial	alveolar	palatal	velar	labiovelar	glottal
	voiceless	p	t	c	k	kp	ʔ
	voiced	b	d	ɟ	g	gb	
Fricative		f	s				h
Nasal		m	n	ɲ	ŋ		
Glide				j		w	
Lateral			l				
Rhotic			r				

Fròʔò has seven underlying short vowels. Long vowels are the result morphological process which have they origin in phonology. There are five [+ATR] vowels and two [-ATR] ones. Only the mid vowels can have both an advanced and a retracted tongue root; the high and the low ones are always [+ATR]. All vowels have additional nasal equivalents, except for [e] and [o] as shown in (1). Word-initial vowels are prohibited, except for [a].

(1) Tagbana´s vowels

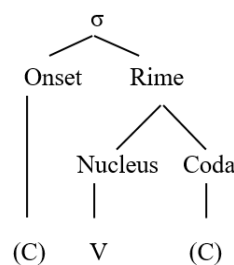| a. Short vowels	b. Long vowels	c. Nasal vowels
i u	i: u :	ĩ ũ
e o	e: o:	
ɛ ɔ	ɛ: ɔ:	ɛ̃ ɔ̃
a	a:	ã

As for consonants, only the glottal stop and [r] are prohibited word-initially, all other consonants can appear in this position. Word-medially all 22 consonants mentioned in Table 1 can be a syllable onset, including glottal stop.

1.2 The syllable structure

This section reviews the sound organisation in form of syllables. Connected speech consists of discrete sounds organized hierarchically. Phonemes have a physical reality and are grouped into larger entities governed by higher prosodic constituents called syllables. The syllable organizes the segments into prosodic units located in the prosodic hierarchy between the mora and the foot. It plays an important role in the phonology of the language, as shown by Traoré (2020) [45] and Traoré & Féry (2019) [46].

The syllable is usually considered as consisting of an obligatory nucleus preceded by one or more optional consonants called onset and followed by one or more optional consonants known as the coda; see (2). It can be understood as a sequence of sounds governed by rules and principles through which languages express much of their phonology. It is important for the expression of statements of phonotactics, the principles of the language that describe which strings of the speech sounds or segments are found syllable initially, medially and finally, see Kenstowicz (1994) and Goldsmith (1995) [19] among others. It also refers to limitations on the distribution of sounds and sound sequences like lengthening at various points in phonological words and phrases. Phonotactic processes also govern patterns of deletion and epenthesis of segments.

(2) Universal syllable structure

```
              σ
           /     \
       Onset     Rime
         |       /   \
         |   Nucleus  Coda
         |      |      |
        (C)     V     (C)
```

Languages vary in which sounds are allowed in the onset, the nucleus and the coda of a syllable according to the phonotactics of each of them. Between the sounds and the syllable, an intermediate level or tier known as CV structure tier has been proposed by Clements and Keyser (1983) [7]. Without the CV tier, the syllable node σ would immediately dominate the segments. This intermediate level of representation has a twofold motivation: firstly, it may represent segmental length, and secondly it stands for the

syllabicity of the segments, i.e. whether they are part of the nucleus of a syllable. Previous works on the syllable structure in general and on West-African languages in particular are among others Firth (1957) [17], Vennemann (1974) [49], Hooper (1976) [22], Kahn (1976) [27], Clements & Keyser (1983) [7], Clements (1986) [8, 9], Mohanan (1986) [36], Féry & van de Vijver (2003) [16] and Antila & Bodomo (2007) [2].

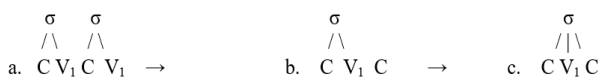### 1.3 Syllable structure and phonotactic restrictions

In this section, a distinction is made between underlying and surface syllable structure. Surface syllable structure is the result of resyllabification processes (deletion, liquid metathesis and fusion), see Traoré (2020) [45] and Traoré & Féry (2019) [46] for a detailed discussion. Underlying syllables can only have the structures CV, CCV or V. The onset has maximally two positions, and the nucleus consists of a short or a long vowel. Two underlying syllable structures in Frò?ò are assumed: either a simple nucleus (only a nucleus consisting of a vowel V (3)a or a nasal (3)b), or an onset and nucleus, see (3)c.

(3) Frò?ò underlying syllable structures

$$\sigma \qquad \sigma \qquad \sigma$$
$$\mathrm{a.}\;\; V \qquad \mathrm{b.}\;\; n \qquad \mathrm{c.}\;\; C(C) \;\; V$$
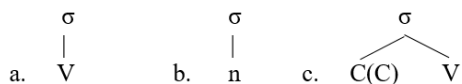
The underlying onset consists of one consonant C or of two consonants CC. However, in addition to underlying complex onsets, complex onsets often derive from phonological processes licenced by the morphology such as segments deletion. Two kinds of deletion are observed, consonant deletion and vowel deletion that occur in different domains. The former lead to complex onset simplification mostly found in the plural formation of nouns and the later to complex onsets formation or coda formation as in (4). This type of deletion has two consequences for vowel lengthening. The first deletion process leads to coda formation as illustrated in (4). A disyllabic word where two syllables are made by consonants and vowels as in (4)a. The second syllable gets rid/looses of its vowel in the process and only its onset remains, see (4)b. A reparsing of the remaining segments leading to resyllabification is required, see (4)c. The onset of the second syllable attaches to the precedent one resulting in a syllable coda.

(4) Coda through vowel deletion

$$\sigma \;\; \sigma \qquad\qquad \sigma \qquad\qquad \sigma$$
$$\mathrm{a.}\;\; C\,V_1\,C\,V_1 \;\; \rightarrow \qquad \mathrm{b.}\;\; C\,V_1\,C \;\;\; \rightarrow \qquad \mathrm{c.}\;\; C\,V_1\,C$$

Some examples are shown in (6). This resyllabification happens in complex nominal phrases like subject object or phrases syllabification. A distinction is made between simplex and complex nominal in Tagbana. Before showing this distinction, a brief overview on morphemes categorisation according to Distributed Morphology (DM) is made.

Distributed Morphology crucially assumes that syntactic structure is the input to morphology, which then provides phonological material by the process of Vocabulary Insertion (VI). The structure of lexical items is assumed to contain a category-less root, to which a category-defining head x° obligatory attaches, thus making it a noun, verb, etc as follows in (5).

(5)

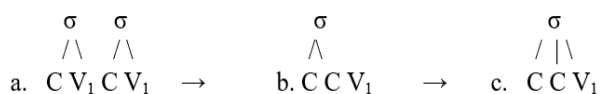$$\sqrt{\mathrm{ROOT}} \quad \mathrm{x}$$
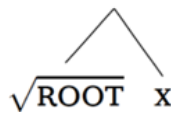
Two main grammatical categories, nouns and verbs, are considered in this paper for the analysis of lengthening. Nouns consist of a root and a covert or an overt class marker (CM) which is also playing the role of the category-defining morpheme. In case of overt CM, a morphemic boundary is set between the root and the CM, Traoré (2020) [45]. Rialland, Traoré and Féry (2020) [41] propose prosodic structures for nouns, e.g. a minimal prosodic word for root and CM. Remember that vowel lengthening is observed on vowels that precede a syllable whose onset is r or l, such as category-defining morphemes or CM. The domain of application of lengthening can thus be accounted for by using locality conditions as proposed in Distributed Morphology (DM); Halle & Marantz (1993) [20]. Coming back to the distinction between complex and simplex nouns, it is proposed that simplex nouns consist of a lexical root (√root), and a category-defining morpheme n^0 (the class marker) which also plays the role of a nominalizer as in (8). bellow. They are said to be bimorphemic at least those with overt class marker (CM). In term of categorisation of the units, the CM in Tagbana is the head in the construction of words qualified as root domain, Marantz (2001). As for the complex nouns or the complex nominal phrases, they consist of more than one lexical root which roots are preferably nominal, preferably verbal, or preferably adjectival, see Traore and Féry (2018) [47] and Traore (2020) [45]. Some examples of the complex nouns are provided in (6) where the leftmost arrow element are nouns in their citation forms and those on the right sides of the arrows are the complex ones.

(6)

kà.-ʔà	pìɔ̀.1	→	kàʔ.pìɔ̀.1²
village-CM5	'child'		'village's child'
'village'			
cá̄.-lá̄	krɔ̀.-ʔɔ̀	→	cá̄l.krɔ̀.-ʔɔ̀
market-CM5	car-CM5		market's car-CM5
'market'	'car'		'market's car'

The second consequence of vowel deletion is complex onset. In this case it is the first vowel of a word, the root vowel that is deleted as in (7).

(7) Complex onset via vowel deletion

$$\sigma \;\; \sigma \qquad\qquad \sigma \qquad\qquad \sigma$$
$$\mathrm{a.}\;\; C\,V_1\,C\,V_1 \;\; \rightarrow \qquad \mathrm{b.}\;\; C\,C\,V_1 \;\;\; \rightarrow \qquad \mathrm{c.}\;\; C\,C\,V_1$$

This second resyllabification takes place in denominal or deverbalisation processes: a nominal category is produced by adding a morpheme to an existing nominal or a verbal category. Some examples are shown in (8).

(8)

cɛ̄-lɛ̀	→	c.lɛ̄- mṹ	→	clɛ̄-mṹ
woman-CM1				womanhood-CM7
'woman'				'womanhood'
cɛ́.lé	→	c.lé-mṹ	→	clé-mṹ
charlanter				charlanter-CM7
'to charlanter'				'the fact of charlantin;
wé.lé	→	w.lé-ʔé	→	w.lé-ʔé
look				look-CM5
'to look'				'the look'

1.4 Short vowels in Tagbana
This section introduces short vowels in words in their citation forms. All vowels can occupy any position in a word as illustrated in (9), except for the word-initial position. In this position, only [a] and its nasalized version [ã] are allowed, see (10).

(9) Examples of vowels

[i]:	tī-ʔī	[e]:	kē:rè	[ɔ]:	lɔ̄-ʔɔ̄
	tree-CM5		field-CM6		river-CM6
	'tree'		'field'		'river'
[ĩ]:	flì-ʔì	[o]:	klō-ʔò	[ɔ]:	kɔ̄lɔ̄
	a boil-CM5		road-CM6		darling-CM1
	'boil'		'road'		'darling'
[u]:	frù-ʔù	[ɛ]:	jɛ̄-lɛ̄	[a]:	fá-ʔá
	mat-CM5		year-CM3		cloud-CM6
	'mat'		'year'		'cloud'
[ũ]:	pū.1	[ɛ]:	hrɛ̄-ʔɛ̄	[ã]:	fà.1
	'dog'		honey-CM6		'bambu tree'
			'honey'		

(10)   Word-initial [a]/[ã]

a.   à.gù.1   b. à.plè.3   c. á.kpá.1
   'traditional dance'   'shade'   'rice'

There are also words like in (11)a. that combine two vowels in a row and the vowels of such a cluster are the high vowel [i] and [u]. These vowel clusters can be found on all the syllable structures and they bear the same tone, either HH, MM or LL. Tagbana has three level tones Low, Mid and High (L, M, H) that can be found on all kind of syllable and two floating tones (H) and (L), see and Rialland & Traoré, and Féry (2020) [41]. The examples (11)a. show words with double vowels and those in (11)b. show the the three tones on syllables.

(11)

a.   fīɛ̄   kùɔ̀.1
   'to blow'   'salt'
   fīɔ̄   pūɔ̄
   'to soak'   'to attach'
   cīɛ̄   fúɔ́
   'to complain of plain'   'to braise'

b.   àtò.1   àplè′.3   álégē.5
   'spoon'   'ladle'   'utensils'
   ákpá.1   ālīɛ̄`.1   ācɛ̄-lɛ̄
   'rice'   'ferment'   pregnancy-CM3
   'pregnancy'

2. Long vowels in Tagbana
Various lengthening processing are observed in Tagbana. (i) A lengthening due to the fusion of two independent morphemes, an aspect morpheme and a resumptive pronoun. (ii) Lengthening due intonation parameters where sentences last vowels are lengthening for interrogation purposes. See section 2.5 for these lengthening forms. (iii) Vowel lengthening due to the presence of two consonantal segments [l] and [r] in certain morphological environments. It is this late form of lengthening that attract my intention in this paper. It is proposed then that these consonantal segments have a double skeletal position which one is filled by the preceding vocalic segment. Two types of lengthening are observed in Tagbana. The first one is triggered by the liquids [r] and [l] where some restrictions are observed with [l]: vowels preceding these segments become long. Some comments on the other types of lengthening appear in Section 2.5 bellow. In this section, the first phenomenon is introduced. Let us start with the investigation of the lengthening due to the presence of [r]. We will turn to the effect of [l] in Section 2.2.

2.1 Lengthening due to [r] in nouns
Lengthening due to [r] is a widely observed phenomenon in Tagbana. It is only seen in nouns but also in other grammatical categories such as verbs, adjectives for example. I propose accounting for the lengthening due to r by assuming that r has an associated second empty position marked (X) which is filled by a preceding vowel as shown in (12). One of the key reasons for this assumption comes from the phonotactics of Tagbana that disallows r to appear word initially if not preceded by at least another consonantal segment. This lengthening process is similar to feature sharing effect between segments. It has been the subject of various analyses in different languages, among others by McCarthy (1979), Levin (1985) [31, 32], Lowenstamm and Kaye (1986) [33].

(12)   Example of vowel lengthening process

k   ē: r   è   =   kē:rè 'field'
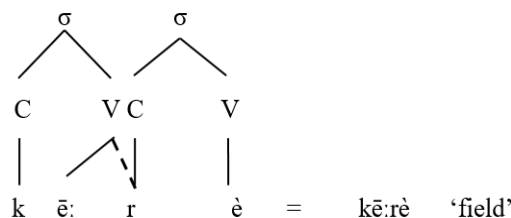
kà:rà	→	'villages'
kɛ́:rɛ́	→	'to go'
kɛ́:rɛ́	→	'to sell'

2.1.1 Lengthening due to [r] simplex nominal
The structure of lexical items in general contains a category-less root, to which a category-defining head X^0 obligatory attaches, thus making it a noun or a verb respectively when the X^0 is n^0 or v^0. In this section, the morphological structure of nouns is first described before the lengthening is addressed.

Nouns in Tagbana can be simplex or complex. Simplex nouns involve a single lexical root plus a class marker (CM) that attaches to this root. The CM is analysed as the realisation of the category-defining head n^0, as illustrated in (15)a, see Traoré & Féry (2018) [47] and Traoré (2020) [45], who give a detailed account of the noun class system of Tagbana, some examples appear in (13).

(13)

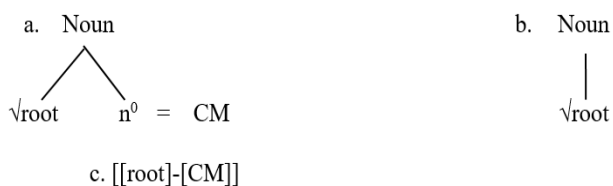|	
bàgrà-ʔà	tī-ʔī
hoe-CM5	tree-CM5
lō-ʔō̃	fã́-ʔã́
mango-CM5	cloud-CM5

As for complex nouns, they consist of more than one lexical root plus one CM, attached to the last lexical root. Two kinds of compounds are observed here. First, those with only one CM attached to the end of the complex noun and second, those with traces of the CM in the first noun of the compound, plus the full one at the end of the noun. The latter ones are considered complex nominal phrases as mentioned in Traoré (2020) [45]. In both cases, only one CM is taken into account in the agreement system, see examples (20)b: that of the second noun is the one agreeing with associate morphemes related to that complex noun. The CM is generally overt, but it also can be covert, i.e phonetically null. In this case, the nouns phonetically only consist of a root, as illustrated in (15)b. See (14) and section 2.1.2 for more examples of complex nominal items.

(14)

Root1		Root2		CM of root2		Complex nouns
nɔ́	+	cīē	+	CM3(-lè)	→	nɔ́-jíé-lé
guinea.fowl		foot				'foot of guinea fowl'

Most nouns with a covert CM are monosyllabic, though some are disyllabic or trisyllabic. In (15) are shown the nominal structures, the ones with an overt CM and the others with a covert CM following DM. I propose that these nominal structures are constituted by prosodic morphemes which is similar to the *min-max* model of Ito and Mester (ref?). This model proposes recursivity of the highest prosodic domains such as the ω-word, ϕ-phrase and ι-phrase. The term 'recursivity' refers to the fact that a category of level p can dominate a constituent of the same category p, Féry (2017) [15]. In Tagbana, the covert or overt prosodic constituent, the CM, dominates its sister root in the sense that it provides the grammatical category of the higher node.

(15)

```
    a.  Noun                          b.  Noun
         /\                                |
        /  \                               |
   √root   n⁰  =  CM                      √root

         c. [[root]-[CM]]
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Certain nodes in the structure function as domain delimiters and phonological processes operate within such domains, such as vowel lengthening as it is shown bellow in section 4. On DM account of lengthening domains. Vowel lengthening due to [r] is particularly productive in nominal plural formation. The prosodic structure is made by two domains, as exemplified in (15)c: the root domain and the category-defining morpheme domain. The phonological operation of vowel lengthening is conditioned on the one hand by these domains aspect but also especially by the quality of the following segment, i.e. [r].

Two different types of lengthening are observed in the plural formation. The first one is when the prosodic word, the onset of the CM is [r]. Always, short vowels become long. Some examples of this type of plural formation are shown in (16).

(16)   Long vowel in the plural formation

	Singular	Plural
a.	kà-ʔà	kà:-rà
	village-CM5	village-CM6
	'village'	'villages'
b.	lō-ʔō̃	lō:-rō̃
	river-CM5	river-CM6
	'river'	'rivers'
c.	nṵ̀	nḭ̀:-rḭ̀
	'ox'	oxen-CM6
		'oxen'

In some cases, like (16) c, the morphology of the noun change that brings additional phonological changes, as for instance the syllable structure and the modified vowel. In this particular case, a monosyllabic form in the singular becomes a disyllabic form in the plural. In (16), back and short vowel becomes front and long, see the derivational rule in (17).

(17)

$$V \rightarrow V: /\ \_\_r$$

Second, long vowels are also found in mass nouns and other nouns that have no plural equivalent and that contain [r] as the onset of their final syllable. As it is observed in (18), the vowels that precede [r] are long without any morphological operation like plural formation as it is in (16).

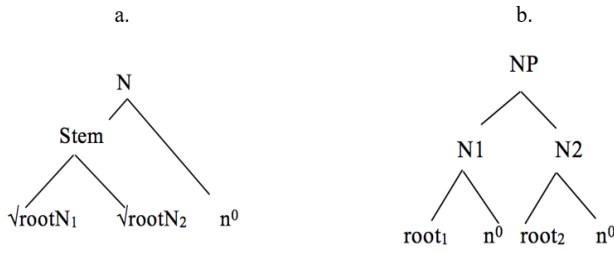(18)   Long vowels in non plural nouns.

	Nouns		
a.	kē:rè	b.	kò:rò
	'field'		'cola nut'
c.	fiè:rè	d.	jà:rà
	'shame'		'lion'

In the citation form of nouns, lengthening applies and the two ways of lengthening compete both in the morphology and the phonology. Based on the result in (16), lengthening could be related to the prosodic constituents of words, at the boundary of lexical roots and their CMs. To show this, a further phenomenon needs to be investigated in the next section.

2.1.2 Lengthening due to [r] in complex nouns
This section is dedicated to complex nouns (or nominal compounds) whose constituents contain a lengthened vowel. Compounds are not discussed in detail here, but see Traoré in preparation. There are two kinds of compounds in Tagbana differing in their morphological constituency as shown in the structures in (19): On the one hand, those with a single class marker (CM) on the second constituent (19)a. and (20)a., and on the other hand, the compounds with two CMs or traces of CM materialised by its onset (19)b. and (20)b. The later form is referred to as complex nominal phrase.

(19)   Compound structures

a.   b.

```
              N                                      NP
           /     \                                 /    \
        Stem      \                              N1      N2
       /    \      \                            /  \    /   \
   √rootN₁  √rootN₂  n⁰                      root₁  n⁰ root₂  n⁰
```

(20)   a. N + N complex noun formation

Root1		Root2		CM of root2		Complex nouns
gū.1	+	krɔ̄.5	+	CM5-(ʔɔ̄)	→	gū-grɔ̄ -ʔɔ̄
tortoise		carcass				'tortoise shell'
nɔ́.5	+	cīē.3	+	CM3-(-lè)	→	nɔ́-jíé-lé
guinea.fowl		foot				'foot of guinea fowl'

b. Examples of complex NP (inalienable relationship)

hīē-mē	+	jù-	+	CM5 (gò)	→	hīēm.jū-gō
'family'		'head'				'head of a family'
kà-ʔà	+	pìɔ	+	CM1 (covert)	→	kàʔ.pīɔ
'village'		'child'				'child/son of village'

In the examples below illustrating agreement, the functional words kī and gī on one hand and lī and lī on the other hand agree with the last nominal root in the compound.

(21)   Agreement

a. gū.1 + krɔ̄-ʔɔ̄ + kī gī → gū-grɔ̄ʔ kī gī
    tortoise carcass-CM5 PRO5 PRES5   'it is the tortoise shell'
    'it is the tortoise shell'

b. hũ-mũ + jìɔ5 + jú-gó + wíé-lé lī lī → hũm-jìò-jú-gó-wíél lī
    wine-CM7 house head wall-CM3 PRO3 PRES3   wine-house-head-CM3
    'it is the roof of the wine shop'

During the process of compounding, phonological operations such as segment deletion, resyllabification, and sound changes take place, see Traoré (2020) [45]. See for example (21) where dissyllabic nouns krɔ̄-ʔɔ̄, hũ-mũ and wíé-lé become monosyllabic with a resyllabification leading to coda syllables.

Consider the following examples in (22) where vowels are lengthened before [r], but remain short when [r] is absent. The segment r has a controversial status due to its appearance restriction in the language. According the phonotactics of the language it cannot appear word initially. However, [r] as well as other segments such as [l] and [m] are good coda and occupies the second position in a CC cluster in a complex onset.

(22)

Lengthening due to r	No lengthening
gbé:ré	kpá.kò
'cassava'	'coconut'
kà:rà	klɔ̄.ʔɔ̄
'villages'	'forest'

In the examples in (23), the CM of the first element has been deleted due to the well-formedness properties of compounds such as keeping on CM. The lengthening in the root is retained, even though the trigger of the lengthening is not present anymore.

(23)   Lengthening in compounding

gbé:ré	+	kē:rē	→	gbé:-ké:ré
'cassava'		'field'		'field of cassava'
kē:rè	+	kā:-rā	→	kē:-kà:-rà
'field'		'meat'		'meat of/for field'
kē:rè	+	kɔ̀:-rɔ̀	→	kē:-kɔ̀:-rɔ̀
'field'		'cars'		'car for field'

There are two explanations for this fact. First, r triggers the lengthening, before deleting the CM. The lengthening remains unchanged after deletion. Second, an effect called 'paradigm uniformity' applies. The paradigm uniformity posits that a morpheme keeps the same form in different occurrences. *kē:-krɔ̀:-rɔ̀* constitutes two prosodic words where each is a domain with only one lengthened vowel (not two).

In a domain like the nominal domain as shown in (23), every separate prosodic word is independent. Anything happening in that prosodic word does not affect any other neighbouring prosodic word. However, a prosodic word may be embedded into each other, with a recursive structure. The largest prosodic word is called maximal prosodic word (ω^{max}) by Ito & Mester (2013) and it corresponds to the morpho-syntactic domains, as illustrated in (24).

(24)

Prosodic domains		Morpho-syntactic domains
ω^{max}	Prosodic word Max	(N.N, N.Adj, N.V compound)
ω^{min}	Prosodic word Min	(noun+CM), (noun)

In that ω^{max} formation many phonological processes like deletion and tone changes take place. Concerning the deletion, either the last vowel of the first prosodic word is deleted or the CM of that prosodic word is deleted. The result of the compound word is a maximal prosodic word which allows two lengthened vowels in the output. As it is seen in (23), we could expect absence of the first lengthening in the profit of the second as would prefers the OCP. But, there is no violation of the OCP against two adjacent long vowels in (23) because both of them are not only underlying but they are also from independent prosodic constituents.

2.2 Lengthening due to [r] in verbs
This section addresses lengthening in verbs. The verb structure in Tagbana is shown in (25) following word categorization of Distributed Morphology (DM) which assumes that words acquire their categories by adjunction of a category-defining morpheme as shown in (15) for nouns. Verbs in Tagbana are often monosyllabic, disyllabic, or have more than two syllables. Thus, their category-defining morphemes are covert in contrary to the most nouns. Verbs can also arise by compounding between a noun and a verb. However, Traoré (in prep.) Analyse them as verbal phrases.

(25)

```
        Verb
          |
        √root
```
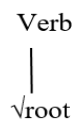
In verbs, r also triggers lengthening of the preceding vowel as shown in (17) and exemplified in (26).

(26)   Lengthening in verbs

c.	pɔ̄:rɔ̄	f.	fɛ̃:rɛ̃
	'to marry'		'to pinch, to trap'
g.	hã̄:rã̄	b.	jē:rē
	'to repair'		'to call'

2.2.1 Lengthening due to [r] in deverbalisation

Next, we examine vowel lengthening in a deverbalisation process, a morphological process where verbal morphemes are suffixed by a nominal category-defining morpheme, resulting in a noun as in (27) where C and V stand respectively for consonant and vowel of a CM.

(27)   Deverbalisation
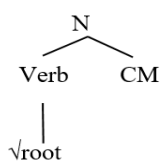
Three morphemes CM3, CM5, CM6 and CM7 are such suffixes. Both CM6 and CM3 starts with [l] and triggers vowel lengthening. Here, consider CM5, CM6 and CM7 are considered with the verb *hrà* 'to hide'. CM3 is the subject of Section 2.2, where lengthening due to [l] is discussed. First, CM5 and CM7. These suffixes do not trigger lengthening.

(28)

Verbs	Deverbalised words
hrà	hrà-ʔà
'to hide'	hide-CM5
	'the fact of hiding'
hrà	hrà-mũ̀
'to hide'	hide-CM7
	'the hiding'

There is also a deverbalisation suffix with CM6 -rV as shown in (29) which is found only with this word.

(29)   Deverbalisation with CM6 -rV

Verb root:	V-root	cá̰	'to struggle, to fight'
Lengthening	V-root + -rV	cá̰:rá̰	'struggle, fight'

Lengthening appears at the boundary of the prosodic constituents made by the verbal roots and the CM.

Both morphology and phonology equally participate to lengthening: a purely morphological process (plural formation) triggers a phonological process, i.e. lengthening and changes of the syllable structure. This is observed largely in verbs and in some nouns as summarised in (30).

(30)
a. Morphological processes: Singular → plural = lengthening (the morphology triggers a phonological change) a sort of feeding or activation of the phonological processes by the morphology.
b. Phonological process: Any time r is present in a morpheme, the preceding vowel is lengthened.

2.3 Lengthening due to [l]

The section deals with the morphological environments in which vowel lengthening is triggered by [l]. The first cases of lengthening due to [l] is in the nominal, both in the singular and the plural. Note that it is not rare to find V_1V_2 structure before [l] without lengthening where V_1 and V_2 are different i.e *cīēlè* 'foot'. These forms are not productive here thus are not taken into in this paper. The second environment is observed in verbs and deverbalisation processes resulting in a noun. The last point of this section is devoted to the lengthening in compounding.

2.3.1 Lengthening due to [l] in singular nouns

Some nouns in their citation forms have long vowels as in (31). All these nouns belong to class 3. The last vowel of the root is lengthened because it is followed by a CM which onset is the lateral.

(31)

a.	kàbā:-lā	b.	kàdā:-lā	c.	kótó:-ló
	bowl of toho-CM3		palm-CM3		bullet-CM3
	'bowl of toho'		'palm'		'bullet'

The examples in (31) raise two questions related to the statute of the lengthening. (1) The lengthening is triggered by the presence of l, the onset of the CM, in which case words like *wélé* 'to look' would have a long vowel before l. But it is not the case. (2) The lengthening is incorporated in the underlying form of the word for its well-formedness. A form of syncretism unifying both morphological (well formedness) and the phonological (lengthening) features in one output form.

2.3.1.1 Lengthening due to [l] in the plural formation

This section introduces lengthening due to the presence of the lateral. After the morphology has been completed, i.e. plural formation, the results are transferred into the phonology which licences the well-formed morphological form by defining clearly prosodic domains within which phonological operations such as lengthening apply, see also (33). Monomorphemic constituents, monosyllabic or disyllabic with a hiatus become disyllabic CV.CV where [l] is the onset of the second morpheme, the CM. As shown in (32), the lengthening of the root vowel is due to the presence of [l] in the CM.

(32)   Lengthening in plural nouns

	Singular	Plural
c.	pìɔ̀	pì:-lì
	'child'	child-CM2
		'children'
d.	nũ̄	nĩ̄:-lĩ̄
	'mother'	mother-CM2
		'mother'
e.	pũ̄	pũ̄:-lũ̃
	'dog'	dog-CM2
		'dogs'

Two effects take place in (32): On the one hand, morphological process of plural formation and on the other hand, the phonological process of vowel lengthening coming along with a change in the syllable structure. The morphology feeds the phonology as shown in (33).

(33)

Rule ordering	
Morphological effect	Phonological effects
Plural formation	Syllable structure change
	CV → C₁V₁-C₂V₂, where C₂ is [l] and {V₁=V₂}
	Lengthening
	V₁ → V: / -l

In other prosodic words, the lateral does not trigger lengthening unless phonological repairs are made, see (34). Roots are changed from the singular to the plural forms. In such cases, the phonology is decisive for the application of the morphological processes (plural formation) after which new prosodic words are formed with new prosodic delimitations. Lengthening then applies within this new prosodic delimitation following (33).

(34)

a. pɔ̄-lɔ̄   pīɛ̄:-lɛ̄
   husband-CM1   husband-CM2
   'husband'   'husbands'
b. cɛ̄-lɛ̀   cíɛ́:-lɛ́
   woman-CM1   woman-CM2
   'woman'   'women'
c. cɔ̄-lɔ̀̄   cīɛ̄:-lɛ̄
   small brother-CM1   small brother-CM2 (younger brother?)
   'small brother'   'small brothers'
d. kɔ́-lɔ̄   kúɔ́:-lɔ́
   monkey-CM1   monkey-CM2
   'monkey'   'monkeys'
e. hɔ́-lɔ́   húɔ́:-lɔ́
   mouse-CM1   mouse-CM2
   'mouse'   'mice'

The morphology (here the plural) is fulfilled after the phonology has applied. The next section examines the effects of nominal deverbalisation, a derivational process.

2.3.2 Lengthening due to [l] in verbs

Some verbs show vowel lengthening before [l] in their citation forms, as in (35)a, and others do not, as in (35)b.

(35)
a. lengthening before [l] in citation verbs
   fīɛ̄:.lɛ̄   síɔ́:.lɔ́
   'to filter'   'to insult'
   lā:.lā   flō:.lō
   'to lap'   'to pull'
b. No lengthening before [l]
   wé.lé   wɛ̀.lɛ́
   'to look'   'to bark'
   jɛ̄.lɛ̄   ka.lā̄
   'to clean'   'to weed'

As shown in (35) a, no morphological operation occurs in these monomorphemic verbs, but lengthening does apply nonetheless. Two types of syllable are observed before -lV syllable: CVV and CV where in both cases the last vowel before [l] is lengthened. The CVV: structures are identical to the one observed in the nominals in (34) where phonological repairs were needed leading to a roots change or a slightly kind of stem alternations similar to what is proposed by Embick (2010:3) for Latin and English except the fact that in Tagbana, allomorphy is not mentioned. In contrast to (34), the forms of the verbs in (35)a. are underlying and the lengthening is due to the presence of the lateral, see

examples in (31) for nouns. The distinction is clearly established in (35) and no explanation is proposed for that yet.

I explore a possible alternative that could explain why lengthening applies to some vowels (in the nominals) and fails to apply to others (verbs) given they are completely similar by sharing the same environment. In many tone languages, there is evidence of accent in addition to lexical tones. In some languages it is hardly more than a diacritic meaning accents are more than making distinction between segments or morphemes and in others it is a fully-fledged pitch accent, see Anttila and Bodomo (1996) [1]. These authors proposed that in Dagaare, stress interacts with both lexical and derived tones, but cannot be fully identified with either of them. Toned vowel or toned syllable can also be stressed or accented, creating prominence leading to lengthening[2]. Stress or accent in phonology characterizes emphasis or prominence on a syllable in a word. In Tagbana, lengthened vowels in (35) get more accentuation than unaccented ones. Researches have proved that accent is typically expressed by vowel length, full articulation of the vowel, see Newman (1947) [39], Fry (1955) [18], van der Hulst (2009) as well as Hyman (2010) [23] and Féry (2017) [15] among many others. It is to be noted that stress and accent are distinct from one another. When prominence (or emphasis) is produced through pitch alone, it is called pitch accent, and when it is produced through length alone, it is called quantitative accent.

As for Tagbana, the examples in (35) provides evidence for lengthening triggered by accent. Accent is not due to any morphological or phonological operation, rather it is an underlying and lexical property of the words themselves.

2.4 Lengthening in deverbalisation
Recall the deverbalized nouns when CM5, CM6 or CM7 is suffixed to a verbal root. Here I am concerned with CM3 which onset is the lateral [l].
The change of the lexical category brings new phonological shapes due to segment deletions or additional segments as it is the case for the monosyllabic forms, see (36).

(36)

Citation for of verbs	Deverbalisation	Deverbalised words
wé.lé	wé.lé-lV	wlé:-lé
'to look'	to look-CM3	'the look'
kpē	kpē-lV	kpē:-lē
'to take'	to take-CM3	'the catch'
pā̄	pā̄-lV	pā̄:-lā
'to come'	to come-CM3	'the coming'

In these deverbalized nouns, lengthening appears at the boundary of the prosodic constituents of the outputs made by verbal roots and CM3. Lengthening and deletion depend on the morphological context, the deverbalization, with some phonological effect like deletion, resyllabification and new syllable shapes which are not discussed here.

(37)

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[2] A closely related effect is also seen in Luganda, Hyman and Katamba (1993) where the second mora bears an accent which induces H tone attraction and lengthening and blocks consonant deletion or mutation

a. CV or CV.CV   verb roots
b. CV or CV.CV + CM3   → CV:-CM3   suffixation of CM3 leading to nominalisation
c. CV: or C(V)CV:-CM3   lengthening of the last vowel of the root

After deverbalization and lengthening have applied, the lengthening is avoided to apply twice as shown in (38) because of the Obligatory Contour Principle (OCP) which states that consecutive identical features or other phonological constituents are banned. Ideally, the minimal prosodic word, introduced in Section 2.1.2, more precisely in (24) is identical to the root and the intermediate prosodic word consists in a root and a class marker (see Rialland, Traoré & Féry, submitted). Recall that in (23), the OCP was not violated despite the same two occurrences of lengthening. The compound mentioned there combined two intermediate prosodic words in contrast to (38) which combines a prosodic word and a prosodic constituent (CM).

(38)

Verb	fɪ̃ɛ̃:.lɛ̃	citation form
Deverbalization	fɪ̃ɛ̃:.lɛ̃ + CM3	morphological operation {CM3 = lV}
•	fɪ̃ɛ̃:.lɛ̃:-lɛ̃	phonological operation, lengthening due to -lV
Noun	fɪ̃ɛ̃.lɛ̃:-lɛ̃	phonological operation, application of OCP, deletion of the first lengthening

In sum, [l] has a double function in the prosodic constituents. As the onset of CM3, a deverbalizer morpheme, it obligatorily triggers either direct lengthening of the last vowel of the root or lengthening by prominence accentuation on the previous syllable in both nominal or verbal categories. In both cases two forms of roots/stems alternations are observed. The ones shown in (34) where root change in the plural, and the other ones that apply to a certain morpheme which are triggered by a particular morpheme such as the Nominalizer (or the CM3) as in (38) and which is referred to as morpheme-morpheme alternation see also Embick (2010) [14]. The analysis of morphemes alternations leads to controversial debates in the literature where two theories are competing. On the one hand, morphophonological theories which assume a form β to be derived by rule from another form α, for instance *kúɔ́:-lɔ́* is derived from *kɔ́-lɔ́*) and on the other hand, stem storage theories which argues in favour of stored allomorphs where β and α are stored allomorphs meaning that *kúɔ́:-lɔ́* and *kɔ́-lɔ́* are both stored allomorphs in speakers' memory, see also Embick (2010) [14].

2.5 Intonational and syntactic lengthening
This section introduced two additional forms of lengthening. The first one consists in fusing two adjacent independent morphemes, a pronoun or a resumptive pronoun and an aspect morpheme as in (39).

(39)   Lengthening as an aspect marker

a. wí   kɛ́:rɛ́   b. wí   rá   gɛ́:rɛ́
     PRO go.PAST   PRO ASP go.PAST
     'he went'   (close past action)   'he went' (past long time ago)
c. wí: gɛ́:rɛ́
     pro.asp   go.past
     'he went' (past long time ago)

The second lengthening is the one due to intonation parameters where sentences last vowels are lengthened for interrogation purposes on the other hand known as lax intonation, Rialland (2000, 2009) [42, 43] and illustrated in

(40). The spectrogram in (40)a. shows a declarative sentence while (40)b is an interrogative sentence in which the last vowel of the utterance is lengthened. Final lengthening is the only feature distinguishing declarative from interrogative mode.
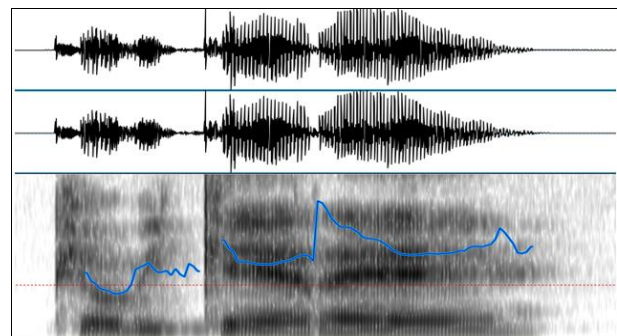
(40)   Lengthening at the end of a clause

a. No lengthening
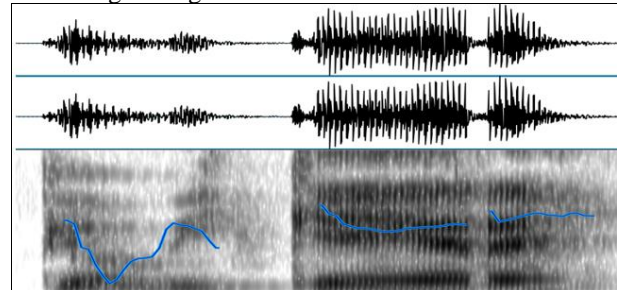
pìɔ̀.1 wí   kɛ́:rɛ́
child pro1 go
'The child went'

c.   Lengthening of last vowel

pìɔ̀.1 wí   kɛ́rɛ́:?
child pro1 go
'Did the child go?'

These two last forms of lengthening are different from those triggered by the liquids. They are not triggered by a segment, but are grammatical effects.

3. Lengthening in loanwords
Tagbana is surrounded by several neighbouring languages such as Mending, Baoulé, other Senufo languages and also several French dialects, as for instance Nouchi (a variety of French spoken mostly in Côte d´Ivoire), Standard and Popular French, all languages and dialects with their own phonological system. There are two main theories as to the question of the phonological theory of loanword adaptations vs. repairs as phonetically-based perceptual adaptations, and it may well be the case they are both justified in their assumptions, but that they apply to different cases. The perceptual analysis of Peperkamp & Dupoux (2003) [40] makes sense for speakers who are largely monolingual and do not have any plasticity in the use of several languages. Its defenders take for instance allophony between [r] and [l] in Japanese and Korean as an explanation of loanwords in terms of phonetic deafness, leading them to recode non-native sounds as native ones during perception. This allophony is part of the core native phonology of Japanese by Ito & Mester (1995) [25]. The phonological perspective assumes that the phonological forms of loanwords are

computed by the phonological grammar of the borrowing language, leading to massive repairs and restructuring. Accent adaptation in French is a good example. Since French has only phrasal tones and no lexical pitch accents, see Féry (2017) among others, tones are reinterpreted as phrasal tones, that can be assigned at different places, and not as immutable markers of lexical stress, as is the case in English or German, for instance. The study of loanwords is an excellent place to verify the generalizations about the syllable structure of a language. Loanwords in Tagbana were introduced and discussed in Traoré (2020) and Traoré and Féry (2019) [15]. It is shown there that the syllable structure of loanwords is adapted to the syllable's constraints that are made available in Tagbana. But some distinctions arise as well. It is the case of the vowel lengthening before [r] that does not consistently apply. The goal here is to examine how specific constraints on syllable structure and phonotactics bear on loanwords in Tagbana, especially in nouns where liquids are segments of these words. The first case addressed here is the repair of word-initial unallowed segments [r], after which it will be shown how codas in loanwords are adapted in Tagbana. The second case concerns the lengthening of the vowels of the loanwords which do not lengthen.

3.1 Word-initial unallowed vowels

As mentioned above, words in Tagbana preferably have an onset word initially, except for [a], the only vowel that can start a word. In case of a loanword with a word-initial vowel other than [a], [h] appears as an epenthetic consonant, see (41) for examples from French.

(41)   Words starting with unallowed vowel

	French			Tagbana	
a.	[elefã]	'éléphant'	→	[hēlēfã]	'elephant'
b.	[epɛːʁvie]	'épervier'	→	[hēpēːrvīē]	'sparrowhawk'
c.	[ɛgl]	'aigle'	→	[héglì]	'eagle'

Here, lengthening is as well visible as shown with the example (41)b. The vowel [ɛ] before r is lengthened.
Consider next the examples in (42) showing how French words starting with the unallowed initial consonant [ʁ] are adapted in Tagbana.

(42)   Loanwords

	French			Frò?ò	
a.	[ʁadjo]	'radio'	→	[ārājīō]	'radio'
	[ʁato]	'rateau'	→	[àràtó]/[hrātó]	'rake'
b.	[ʁobo]	'robot'	→	[hòròbó]/[hrōbó]	'robot'
	[ʁəgaʁde]	'regarder'	→	[hērēgādé]/[hrēgādé]	'to look'
	[ʁemi]	'Rémi'	→	[hèrèmí]/[hrēmí]	'name'

Two repair options are available in (42): When [a] is the first vowel in the first syllable, this vowel is copied and added word-initially. Recall that [a] is the only segment allowed word initially in Tagbana. When a French word starts with uvular [ʁ], this consonant is adapted as coronal [r] in Tagbana. It is shown that [r] is represented with a double position on the CV tier. This double position of [r] is illustrated in (43) where X stands for an unspecified segment, a vowel or a consonant. In (43)a, the first position is filled by [a], and in (43)b, it is either filled by [a] or by [h], (ʁato → [a.rato] / [hrato]), [hr] is a possible initial

complex onset. In (43)c, both effects apply: the first vowel is copied and an initial [h] is added because that vowel is not allowed word-initially. The observation made here is that the lengthening fails to apply on the preceding vowel in the loanword thought the position is filled.

(43)   Loanwords repair processes

```
[ʁ]    →    [r]
 |          / \
 C         X r
```

a.	[ʁ]a	→	a.radio (aradio)	'radio'
b.	rV	→	hʁato (hrato)	'rake'
c.	rV	→	ho.robot (robot)	'robot'

In the cases illustrated above, [h] epenthesis is thus a process filling a position in need to be filled, see (44).

(44)   Repair process by adding [h]

$$rV \rightarrow X\ r\ V \rightarrow h\ r\ V$$
                     r
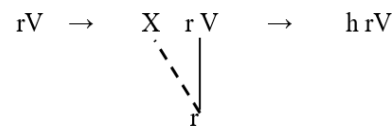
Word-internal coda [ʁ] is also repaired in at least two ways. In the first repair, coda [r] is deleted, as in *regarder* [ʁəgaʁde] → [ʁəgade] 'to look'. In the second repair process, [r] becomes the onset of an additional syllable: [hērēgādē] or [hrēgādē]. Additional cases appear in (45).

(45)   Word-internal coda [r] repairs

a. [ʁ] is deleted word-internally:

corde	[kɔʁd(ə)]	→	[kɔ́ː.dì]	'rope'
porte	[pɔʁt(ə)]	→	[pɔ́ː.tì]	'door'
écorce	[ekɔʁs(ə)]	→	[hè.kɔ́ː.sì]	'peel'

b. Word-internal vowel epenthesis: [ʁ] becomes an onset:

carcasse	[kaʁkas]	→	[kà.rà.ká.sì]	'carcass'
calme	[kalm(ə)]	→	[ká.lá.mǔ]	'calm'

In examples such as (45)a, the lengthening has applied on the vowel preceding [r], as the result of the doubling position of [r] and still remains after the reparsing of the segments to fulfil the phonological (syllable structures) and the word well-formedness requirements. I assume that /r/-initial words trigger two rules that are in a feeding relation to each other from the French words to the Tagbana ones, see (43) and (44). Further ordered rules appear in (46) to account for the [r] deletion and compensatory lengthening in loanwords. In compensatory lengthening, the vowel remains long in the absence of a liquid.

(46)

Rule 1:	Vowel Lengthening:	CVr	→	CV:r
Rule 2:	[r] deletion:	CV:r	→	CV:

Turning now to final coda consonants, these are not allowed in Tagbana. Final syllables are repaired by epenthesis of a final vowel. The epenthetic vowel is a high vowel alternating between [i] and [u] (the choice of which is partly determined by vowel harmony), see (45), as shown in (47). Thus, all final French CVC structures undergo a change and become CV.CV.

(47)

a.	hirondelle	[iʁɔ̃dɛl]	→	[hì.rɔ̀.dɛ́.lì]	'swallow'
	maître	[mɛtʁ(ə)]	→	[mɛ́.trì]	'teacher'
b.	robe	[ʁɔb]	→	[hɔ́.ró.bù]	'dress'
	rose	[ʁoz]	→	[hó.ró.zù]	'rose'

Word-internal codas also become onset, as exemplified by *carcasse* [kaʁkas] → [kà.rà.ká.sì] '*carcass.*' In this case, there is no lengthening of the preceding vowel.
Loanwords are adapted from neighbouring languages as well. Here are some examples from Bambara (48), a Manding language.[3] In (48) a trisyllabic of Bambara are reinterpreted in Tagbana as disyllabic noun and mostly they belong to the nominal class 1.

(48)

a.	bà.ràn.dá	→	bà.rā.1
	'banana'		banana
b.	sā.rā.kā	→	srā.ʔā
	'alms'		alms.CM1

Many phonological repair options are observed when loanwords are integrated into Tagbana. Liquids, especially [r], trigger the lengthening of the preceding vowel as mentioned in the above sections. It is thus expected that the first [a] in *a.ra.jio* becomes long when French [ʁadjo] is adapted in Tagbana. But it does not. The word *a.ra.jio* has an initial vowel [a] that constitutes a syllable on its own and is the copy of the first vowel in [ʁadjo] in repair of the phonotactics constraint. Recall that [a] is the only word-initial vowel, see the examples in (42) for such repairs, and recall that [r] isl prohibited word-initially. There are some other examples, like *ka.ra.ka.si* from French *carcasse ''*. Segments have been reparsed in agreement with the phonotactics of the language, which disallows most codas. The second syllable -*ra* and the last syllable -*si* are explained by coda avoidance repair. Loanword codas are repaired by epenthesizing either [i] or [u], in a non-perfect dependence on the preceding consonant, words finally as shown with -*si*. Words internally, a vowel copy is prioritised. *kar*- becomes *ka.ra* where the first vowel [a] is copied. In both repairs' cases, especially those concerning the coping before or after [r], no lengthening is observed. The copying process take into account all the feature of the copied segment of the loanword. Considering the fact that [a] is [-long] in the loanword, it can only be [-long] in the output form as well, the Tagbana form as illustrated in (49).

(49)

Input from loanword		Filling and repairs, output of step 1	Non application of lengthening
-V_1r.k-	→	-V_1.rV_1.k-	-V_1r-V_1-
|		|	|
kar.kas		ka.ra.ka.si	* ka:.ra.ka.si

If repair by copying does not trigger lengthening in the output of the loanwords, deletion is allowed in the output as it is observed in (48)a. where deletion is the first step of repair in the process of the word welformedness. These

cases are considered as blocking effects of the lengthening which applies mostly across two morphemes.

(50)   Blocking effect of the lengthening

	Words	Repair	No Lengthening in
a.	radjo	a.radjo	* a:radjo
	karkasi	karakasi	* ka:rakasi
b.	bà.ràn.dá	bà.rā.1	* bà:.rā.

Loanwords in Tagbana in general undergo the phonotactics constraints. However, some repairs constitute blocking effects as observed with the cases in (48) where lengthening fails to apply after the filling process as shown in (49).

4. A DM account of lengthening domains
This section proposes a brief theoretical account that serves as point of departure for further research on stem alternations and contextual allomorphy among other topics. The domain of application of vowel lengthening before [r] and [l] is accounted for by using locality conditions, Halle & Marantz (1993) [20]. Nodes in the prosodic structure function as domain delimiters and morphological processes are confined to operate within such domains, see also Embick (2010) [14], Bobaljik (2012) [6], Moskal (2015ab). Adjunction of x defines a domain that is closer to the root than y. The central idea here is that lengthening applies under some conditions and not others and the question is to determine whether liquids as onsets of x or y in (51) which are different domains trigger lengthening.
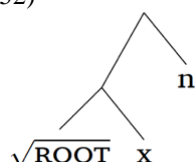
(51)
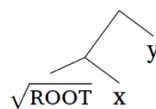
Some phenomena in linguistics, and more especially in phonology, appear in local environments and two types of locality should be distinguished. The first one concerns locality constraints on phonological interactions such as features sharing, place and voicing assimilation for example which affect adjacent segments. The same holds for tone interaction of adjacent syllables or other tone bearing units. And the second type of locality requires reference to extra-phonological morpho-syntactic information, see Wagner (2012) [50]. It is assumed that lengthening applies either at the boundary of the prosodic constituents in line with the syntactic representation in (51) where root, x and y are proposed to be independent morphemes constituting boundaries as well as in some mono-morphemic nominal constituents.
For a root that acquires noun status by a category x, lengthening compulsorily applies on the root's leftmost adjacent vowel especially when the onset of the category x is [r], see Section 2.1 the same also applies for [l] with the root alternations illustrated in Section XX. The syntactic figure in (52) refers to deverbalization cases where x triggers the verbal category to the root and n the nominalizer, a noun root attaching category. The morpheme -rV that triggered lengthening in root-attaching nominals here is out of competition. For a non-root-attaching nominals where n (nominalizer) occupies the y position, only -lV is responsible for lengthening.

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[3] The West-African Manding people are known under different names such as Bambaras in Mali, Dioulas in Côte d'Ivoire and Burkina Faso, and Malinkés in Guinea, Senegal and Gambia.

(52)

Two domains are distinguished, the one that determines the category to the root x, the inner category and the other n, the outer category, the one that changes the initial category. The n at y position shows also lengthening with root alternation.

The segment [r] has a restricted domain as it only triggers lengthening in the inner domain in contrast to [l] which lengthens the preceding vowel both in the inner and the outer domain. Lengthening due to [r] goes beyond morphemes boundaries but in the same grammatical domain such as root and CM for example and both phonology and morphology play an important role.

In terms of locality, it is assumed here that [r] shows a strict lengthening locality as its adjacency to any other leftmost vocalic segment trigger lengthening o that one and in all grammatical categories. This is not the case for the lateral which in monomorphemic structures triggers lengthening under a condition, the stem changes for example. But [l] in morpheme-morpheme structures as deverbalisation, locality condition applies to the preceding vocalic sound.

5. Conclusion

This article contains an overview of phonological vowel lengthening in Tagbana, a Senufo language of Côte d'Ivoire. In this language, all vowels are underlyingly short and long vowels are always the result of a lengthening process. It has been shown that vowel lengthening is triggered by a following liquid, [r] or [l], even though lengthening due to [l] is less systematic than lengthening due to [r]. It has also been shown that both phonology and morphology play an important role in the conditioning of the lengthening process. Class markers that function as category-defining morphemes and deverbal nominalizers are particularly active in the lengthening process. Lengthening triggered by liquids in Tagbana takes place either at the boundary of the prosodic constituent or in a mono-morphemic word, as is often the case in verbs. As for the phonological component, it has been proposed that liquids have two positions, one position occupied by the segment itself and a preceding position that triggers the lengthening of the the preceding adjacent vowel. In the last part of the article, it has been shown that loanwords undergo the phonotactic constraints of the language. Syllables respect most constraints of Tagbana, however lengthening is blocked in loanwords.

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