

Length harmony in Leggbó: A counter-universal?¹

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Among the features known to be active in vowel harmony systems are those shown in (1).

- (1) Features participating in vowel harmony
- a. ATR/RTR (cross-height harmony; tense-lax harmony)
 - b. Front (palatal harmony)
 - c. Round (labial harmony)
 - d. Open/Close (height harmony)

That is, whether referring to the color or aperture of a vowel, and whether involving the tongue body, tongue root, or the lips, virtually any vowel feature may harmonize.²

A major exception to this statement concerns vowel length. No language has been reported in which all vowels within a stem or word must agree in length. General treatments of vowel harmony, henceforth VH, either implicitly by omission or by an explicit statement, indicate that length harmony is unattested (Krämer 2001:14). The question is whether a language with the properties in (2) is possible:

- (2) What length harmony might look like

- | | | | | | |
|----|------------|----------|----|-------------|-------------|
| a. | /lim-il-e/ | lim-il-e | b. | /liim-il-e/ | liim-iil-ee |
| | /lim-an-a/ | lim-an-a | | /liim-an-a/ | liim-aan-aa |

In these hypothetical forms, we have chosen Bantu-looking forms with CVC vs. CVVC roots and the suffix sequences -il-e and -an-a. These suffixes are realized with a short vowel in (2a), but with a long vowel in (2b).

Although different Bantu languages have been shown to exhibit all of the listed vowel harmonies in (1), no Bantu language has been found with the properties in (2). Can such a system exist? Is this important? We think so, for three reasons of ascending importance:

First, we are concerned to know what is possible in phonological systems, in this case whether we should add length harmony to the list of attested phenomena. While having a complete inventory of phonological processes is a desirable goal, it is the least significant reason to question the existence of length harmony.

Second, the occurrence of length harmony could have implications for how (vowel) length should be represented in general. Following Clements (1977), autosegmental accounts of VH have assumed that

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²Van der Hulst & van de Weijer (1995) also mention retroflex harmony in Yurok. In addition, restructuring may obscure the original featural nature of the VH process, as frequently discussed for Nez Perce (but cf. Hall & Hall 1980). Other processes such as nasal harmony, emphatic harmony, laryngeal harmony are not listed in (1), since these features characterize not only vowels but also consonants. Hence, these harmonies are often described as involving full syllables.

the features in (1) spread from one vowel to another. Within the same approach, length is represented in quantitative terms: A long vowel has a single featural representation linked to two V slots (McCarthy 1981, Clements & Keyser 1983) or two moras (Hyman 1985, Hayes 1989), while a short vowel has only one. A featural representation of vowel length oppositions as [\pm long] seems to have been rejected by phonologists of all persuasions (see especially Hayes 1986). If length can harmonize in the same way as the features in (1), and if all assimilations are the result of autosegmental spreading, we may be forced to resuscitate either the representation of length as [\pm long] or the implementation of VH as copying, as in pre-autosegmental phonology.³

Finally, and most importantly, the (im)possibility of length harmony may contribute to answering the most basic questions concerning VH: What is VH? Why do languages have VH? Where does VH come from? How is VH the same vs. different from other harmonies (disharmonies, etc.)? While we have only partial answers to such questions, there is general agreement concerning two fundamental properties of VH: assimilation and reduction. While VH is definitionally assimilatory in nature, it is not clear whether it arises through the phonologization of VCV coarticulation (or coperception). Such an origin cannot explain why VH processes are typically unbounded, targeting successive vowels which meet the structural description of the rule. This contrasts with other assimilations, such as tone spreading, which can either be bounded or unbounded.

It also is not clear if a VCV co-articulation origin can explain why VH is root-controlled (Clements 1981): The prototypical VH system is one where affix vowels assimilate to a feature in a root. This is not a necessary condition on other assimilatory processes. Cases where tone spreading is strictly root-controlled are rare—again indicating important differences between VH and tone (Hyman 2002). Besides assimilation, the second fundamental property of VH is said to be reduction (cf. Beckman 1997): affixes which assimilate to roots begin with a reduced set of vowel oppositions. Whereas the five vowels /i, e, u, o, a/ contrast in root-initial syllables in Shona, VC suffixes show only a three-way opposition, which we can symbolize as /i, u, a/. By a process of asymmetric vowel height harmony (Hyman 1999), /i/ → [e] after /e, o/, and /u/ → [o] after /o/. Thus, not only is the underlying inventory reduced, but since the harmonized outputs are less distinct, derived [e, o] can be seen as further reductions in a syntagmatic sense.

How can we apply this dual nature of vowel harmony to length?

First, with respect to assimilation, there is no known process by which a short vowel assimilates to a long vowel in a neighboring syllable. Quite to the contrary, long vowels have been known to shorten in the context of another long vowel, as in Slovak and Gidabal (Kenstowicz & Kisseberth 1977).

Second, let us presume that the language in (2) has a long/short vowel opposition only in root syllables, but that there is no length opposition in affixes. When the two suffixes lengthen their vowel in (2b), there therefore is no neutralization. However, with respect to reduction, if anything, we expect that the process will make the targeted affixal vowels less fully articulated or less perceptually distinct. It is hard to interpret assimilatory vowel lengthening in this light.

This leads us to the following conclusion: If length harmony is not an assimilatory possibility nor represents a reduced articulation, it ought not to exist. On the other hand, the hypothetical data in (2) would constitute a particularly persuasive case of length harmony, since they show the two expected properties of VH in general: unboundedness and root-control. While there is a temptation to make both of these definitional requirements of VH, there are very clear cases of (unbounded) suffix-controlled

³In the latter case we would still have to distinguish between copying of features vs. copying of quantity (V vs. VV). It is not clear to me whether recent suggestions to implement VH as a kind of agreement would welcome this latter result (see Bakovic 2000). We note, however, that dissimilation and polarity effects may affect either features or (vowel) length.

VH.⁴ I will therefore assume that it will be sufficient to identify a case of vowel assimilation as VH if it is unbounded.⁵

With all of the above in mind, we now turn to consider the facts of Leggbó, an Upper Cross language spoken in Nigeria.

The consonant and vowel systems of Leggbó are given in (3).

(3) Consonant and vowel systems of Leggbó

a.	lenis consonants	fortis (geminate) consonants	coda consonants
	p t c k kp	pp tt cc kk kkp	
	b d g gb	bb dd jj gg ggb	
	v z	ff ss	
	l y w	vv ddz ll yy ww	l
	m n ŋ	mm m nny ŋŋ	m n ŋ
b.	short vowels	long vowels	
	i u	ii uu	NB. [ii, uu] occur almost entirely
	e o	ee oo	in derived forms
	ε ɔ	εε ɔɔ	
	a	aa	

As seen, Leggbó has both short and long consonants and vowels, although limited literature on Leggbó refers to the consonantal opposition as one of fortis vs. lenis consonants (Bendor-Samuel & Spreda 1969; Spreda & Spreda 1966). Both the phonetic and phonological properties that we have uncovered suggest that the “fortis” consonants are in fact geminate.⁶ This is seen from the restrictions on roots. We shall restrict attention to verbs, which also provide the source of the putative length harmony we shall discuss.

As seen in (4), verb lexemes are either mono- or bisyllabic.⁷

⁴Besides a number of ATR systems, e.g. Kinande (Archangeli & Pulleyblank 1994, in press; Mutaka 1995), a particularly clear case of suffix-control involving both labial and palatal harmony is found in Punu (Hyman 2002).

⁵Two other situations fail this test. First, if a vowel assimilation is unambiguously bounded, it need not be classified as VH, e.g. if a language allows multiple affixation, but only the root-adjacent affix assimilates. Second, if a vowel assimilation is ambiguously bounded, it need not be classified as VH. This would be the case in a language in which there is the word is maximally bisyllabic or in which there is only one potentially harmonizing affix “slot”. Since we cannot tell what would have happened in non-existing longer words (or multiple affixes), identifying a VCV assimilation as VH is problematic. As we shall see, this is a problem for the interpretation of the Leggbó length facts we treat below.

⁶This was verified instrumentally by Julie Larson and Ian Maddieson.

⁷Leggbó distinguishes three levels of tone, L (˘), M (unmarked) and H (ˉ). The forms in (4) show how verb tones are realized in the imperative singular. As seen, there is a binary opposition between what we refer to as L vs. M verbs, the tone on the first syllable. In the imperative, there is also a suffixal M tone that is realized on bisyllabic (and ultimately trisyllabic) verbs.

(4) Shapes of verb lexemes

a. monosyllabic

	L verbs		M verbs	
CV	vè	'kill'	du	'beat'
CCV	lì	'bury'	bbo	'die'
CVV	kòò	'vomit'	zoo	'find, search for'
CVC	vòṅ	'want'	wòm	'bear fruit'
CCVC	mmèṅ	'swallow'	ssèṅ	'go'
CVVC	màan	'give birth'	wòl	'flog'

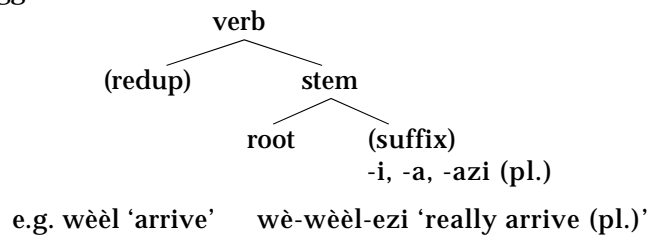
b. bisyllabic (root + lexical /-i/ or /-a/, the latter assimilating to a preceding mid vowel)

	L verbs		M verbs	
CVC-i	bàli	'step on'	zumi	'extinguish'
CVC-a	mìna	'lie down'	mana	'catch, hold'
CVVC-i	vèèli	'lend'	tòṅi	'drip'
CVVC-a	mòṅò	'return'	tòṅò	'cough'
CCVC-i	vvèmi	'beg'	ttali	'untie'
CCVC-a	bbàla	'remember'	kkana	'imitate'
CVCC-i	kènni	'feed'	wukki	'be rough'
CVCC-a	yòṅò	'pass'	vemmè	'be small'
CCVCC-i			ddaddi	'rejoice'
CCVCC-a			ggwekke	'lift up, raise'

Monosyllabic verbs may have a long or short vowel and may end in a nasal or liquid coda consonant. Bisyllabic verbs end in a frozen lexical suffix -i or -a, the latter assimilating to a preceding mid vowel.

As shown in (5), longer verb forms are obtainable by either adding the -azi plural suffix and/or reduplicating the first syllable.

(5) Structure of the Leggbó verb



As shown in the example, the maximum number of syllables found on any verb form is four.

Of importance to this study are the lexical restrictions in (6).

(6) Distributional restrictions on verb lexemes

- A long vowel may not precede a fortis (geminate) consonant: *CVVCCV
- A long vowel may not follow a fortis (geminate) consonant: *CCVV
- A bisyllabic verb cannot end in a long vowel: *CVCVV, *CVVCCV

While it is not surprising that a long vowel may not precede a geminate consonant, it is striking that a long vowel may also not follow a geminate, as seen in the minimally contrastive forms in (7).

(7) Minimally contrasting forms

- | | | | | |
|----|------|---|-------|-------------------|
| a. | CV | : | ba | ‘ask’ |
| b. | CCV | : | bba | ‘block, obstruct’ |
| c. | CVV | : | baa | ‘tie’ |
| d. | CCVV | : | *bbaa | |

To these we can add the verb *baa* ‘marry’ /ba-a/, which consists of a /Ca/ root followed by a lexical -a suffix. While *baa* ‘tie’ and *baa* ‘marry’ are phonetically identical when carrying M tone (as in the imperative), when these verbs take a ML melody elsewhere in the paradigm, they are distinct: *baa* ‘tie’ vs. *baà* ‘marry’. As we shall confirm below, underlying long vowels count as one tone-bearing unit (TBU), while derived long vowels count as two. With this background, we can now turn to the issue of length harmony.

In (8) we present the six object enclitics in Leggbó:

(8) Object enclitics in Leggbó

-mí	‘me’	-mán	‘us’
-ś	‘you sg.’	-bɔ	‘you pl.’
-ε	‘him/her/it’	-be	‘them’

As indicated, two of these consist of a single vowel and will be the focus of our study: 2sg -ś (with H tone) and 3sg -ε (with M tone). These are realized without further modification on verb forms such as in (9).⁸

(9) Illustration of 3sg -ε and 2sg -ś

a.	CV	du-ε	‘beat him’	du-ś	‘beat you’
		kpe-ε	‘teach him’	kpe-ś	‘teach you’
		dzò-ε	‘forget him’	dzò-ś	‘forget you’
b.	CCV	lì-ε	‘bury it’	lì-ś	‘bury you’
		ssu-ε	‘peck at him’	ssu-ś	‘peck at you’
c.	CVV	zoo-ε	‘find him’	zoo-ś	‘find you’
		baa-ε	‘tie him’	baa-ś	‘tie you’
d.	CVC	dum-ε	‘bite him’	dum-ś	‘bite you’
		tɔl-ε	‘pull it’	tɔl-ś	‘pull you’
e.	CCVC	ssiŋ-ε	‘fight him’	ssiŋ-ś	‘fight you’
		kkpèn-ε	‘last him’	kkpèn-ś	‘last you’
f.	CVVC	wèl-ε	‘visit him’	wèl-ś	‘visit you’
		tɔm-ε	‘send him’	tɔm-ś	‘send you’
g.	CVC-i	bini-ε	‘carry him’	bini-ś	‘carry you’
		bàli-ε	‘step on him’	bàli-ś	‘step on you’
h.	CVVC-i	beeli-ε	‘escort him’	beeli-ś	‘escort you’
		tèmi-ε	‘hit him’	tèmi-ś	‘hit you’
i.	CCVC-i	vvèmi-ε	‘beg him’	vvèmi-ś	‘beg you’
		ssɔŋi-ε	‘look at him’	ssɔŋi-ś	‘look at you’

⁸Leggbó uses the unmarked object enclitics also for reflexives. Hence *du-ś* and *kpe-ś* can be translated ‘beat yourself!’, ‘teach yourself!’ etc.

j.	CVCC-i	kènni-ε	‘feed him’	kènni-ó	‘feed you’
		gabbi-ε	‘embrace him’	gabbi-ó	‘embrace you’

This includes monosyllabic verbs whose root vowel is other than (short) /ε/ and /a/ or which end in a consonant, as well as bisyllabic verbs which end in the lexical suffix -i.

In (10a) we see that there are no modifications when -ε and -ó follow a /Cε/ or /Ca/ verb (with a lenis initial consonant). On the other hand, CCV monosyllabic verbs that end in short /ε/ or /a/ fuse with these two enclitics, thereby producing the derived long vowels in (10b).

(10) /Cε/ and /Ca/ verbs + -ε / -ó

a.	Cε	vè	‘kill’	vè-ε	‘beat him’	vè-ó	‘kill you’
	Ca	ba	‘ask’	ba-ε	‘ask him’	ba-ó	‘ask you’
b.	CCε	ddè	‘greet’	ddè-ε	‘greet him’	ddò-ó	‘greet you’
	CCa	tta	‘shoot’	ttε-ε	‘shoot him’	ttó-ó	‘shoot you’

Now consider the crucial data in (11), which concern bisyllabic verbs which end in an underlying lexical -a suffix:

(11)	underlying	surface		+ -ε ‘him’	+ -ó ‘you sg.’
a.	/ffin-a/	ffin-a	‘touch’	ffiin-εε	ffiin-óó
	/tùm-a/	tùm-a	‘stop’	tùùm-εε	tùùm-óó
	/man-a/	man-a	‘hold’	maan-εε	maan-óó
b.	/kkel-a/	kkel-e	‘choose’	kkeel-εε	kkeel-óó
	/ddzel-a/	ddzεl-ε	‘know’	ddzεel-εε	ddzεel-óó
	/ttòn-a/	ttòn-o	‘tell’	ttòòn-εε	ttòòn-óó
	/kòm-a/	kòm-ó	‘hear’	kòòm-εε	kòòm-óó

Concerning the surface verb forms on the left, in (11a), the underlying /-a/ is realized as such after the root vowels /i, u, a/, while in (11b) the /-a/ suffix assimilates to the preceding mid vowel. In either case, the encliticized forms to the right in (11a,b) show that both -ε and -ó coalesce with the second vowel to produce a long -εε or -óó—exactly as one might expect of an underlying /-a/ suffix.

What is not expected, however, is the indicated lengthening of the preceding root vowel. As seen in the examples in (12a), this occurs even if the initial consonant is fortis (after which an underlying long vowel is however prohibited):

(12)	underlying	surface		+ -ε ‘him’	+ -ó ‘you sg.’
a.	/bbyaη-a/	bbyaη-a	‘deceive’	bbyaη-εε	bbyaη-óó
	/ffèn-a/	ffèn-ε	‘shave’	ffèèn-εε	ffèèn-óó
	/ttòn-a/	ttòn-o	‘tell’	ttòòn-εε	ttòòn-óó
b.	/gàdd-a/	gàdd-a	‘step over’	gàdd-εε	gàdd-óó
	/tèmm-a/	tèmm-e	‘embrace’	tèmm-εε	tèmm-óó
	/yómm-a/	yómm-ó	‘mimic’	yómm-εε	yómm-óó
c.	/beel-a/	beel-e	‘place’	beel-εε	beel-óó
	/zèèn-a/	zèèn-ε	‘hang’	zèèèn-εε	zèèèn-óó
	/tɔɔη-a/	tɔɔη-ó	‘praise’	tɔɔη-εε	tɔɔη-óó

d.	/zì-a/	zia	‘let go’	zìi-εε	zìi-òó
	/bù-a/	bùà	‘follow’	bùù-εε	bùù-òó
	/mmi-a/	mmia	‘hug’	mmii-εε	mmii-òó
	/ggu-a/	ggua	‘pull out’	gguu-εε	gguu-òó

In contrast, lengthening cannot occur in (12b), where the vowel is followed by a geminate consonant. (12c) shows that if the input vowel is already long, this length will simply carry over into the encliticized forms. The examples in (12d) show that there does not have to be an intervening consonant for the root vowel to lengthen.

As seen in the comparison of the two outputs in (13), it is important to reiterate that the observed lengthening of the root vowel will only occur if a vocalic enclitic fuses with the vowel of a bisyllabic verb, as in (13a), but not if the result is a vowel sequence, as in (13b).

(13) Length harmony only occurs if -ε or -ó fuse with the vowel of a bisyllabic verb

- | | | | | |
|----|-----------|--------|-------------------|-----|
| a. | vila + -ε | vìi-εε | ‘be far from him’ | vs. |
| b. | vili + -ε | vìlì-ε | ‘cut it’ | |

It is this requirement that suggests that this may be a case of length agreement or length harmony.

The lengthening process just illustrated is quite regular. The generalization is clearly that a root vowel lengthens whenever followed by a long vowel—which, in turn, is always the result of vowel coalescence. For the moment, let us set aside the possible interpretation of these facts as length harmony. A perhaps promising alternative strategy would be to develop a metrical analysis. To account for (13a), metrical structure might be invoked in one of two ways. First, if we attempt to group both syllables into a single foot, there would have to be a constraint against iambic feet, as in (14a).

(14) Constraint against iambic feet (?)

- | | | | | | |
|----|-------------------------------|----|--------|---------|-------------|
| a. | * [] _f | b. | vila-ε | vì.lεε | vìi.lεε |
| | / \ | | | | |
| | μ μ μ | c. | vili-ε | vì.lì.ε | (*vìi.lì.ε) |

As a result, lengthening applies in (14b) to create a bisyllabic spondee. Lengthening does not apply in (14c), where the trisyllabic verb *vì.lì.ε* is not subject to the constraint in (14a). We are not aware of any language which converts iambs to spondees in this way. We might try to motivate the constraint in (14a) by noting that lexical verbs may not have the shape *CVCVV. However, as was indicated in (6c), they may also not have the shape *CVVCVV. Since both iambs and spondees are prohibited among lexical verb forms in Leggbó, it is not clear why the former should be converted to the latter in derived verb forms.

Conversion of a bisyllabic iambic foot into a spondee, as in (15a), is not the only possible interpretation. We may instead analyze foot structure in terms of moras, as in (15b).

(15) Foot-based options

- | | | | |
|----|---------------------|---------------------------|---|
| a. | bisyllabic spondee: | * [CV.CVV] _f | [CVV.CVV] _f |
| b. | bimoraic trochees: | * CV [CVV] _f | [CVV] _f [CVV] _f |

If metrical feet in Leggbó have the structure of bimoraic trochees (Mester 1994, Hayes 1995), the input in (15b) is ill-formed because the first CV is subminimal. As shown in the output, by lengthening the first vowel, two bimoraic trochees can be constructed.

As Mester (1994:15) points out there are actually two prosodic repair strategies available to fix up inputs such as (15b). By removing a mora in (16a), one can shorten the vowel of the second syllable; or, one can add a mora in (16b) to lengthen the vowel of the first syllable:

(16) Two “prosodic repair strategies” (cf. Mester 1994:15)

- | | |
|--|--|
| a. REMOVE- μ (iambic shortening) | b. ADD- μ (trochaic lengthening) |
| [μ] _s [$\mu\mu$] _w | [μ] _s [$\mu\mu$] _w |
| [μ] | [$\mu\mu$] |

The first process is termed iambic shortening and although best known from Latin, it is in fact quite frequent (Allen 1973, Mester 1994, Hayes 1995).⁹ In support of trochaic feet in Latin, Mester shows that the language does not allow monomoraic content words, hence feet, and that, in addition to iambic shortening, there are situations where the augmentation process in (16b) also applies in Latin, e.g. the imperative of dare ‘to give’, which should be *da, is instead realized as daa ‘give!’.

The problems associated with extending this analysis to Leggbó are seen in the possible stem structures in (21).

(17) Possible stem (root + suffix) structures [ignoring reduplication and enclitics]

- | | |
|----------------------------|--------------------------------|
| a. monosyllabic | c. trisyllabic |
| <u>CV</u> CVC | <u>CV.CV.CV</u> <u>CV.V.CV</u> |
| CVV CVVC | CVV.CV.CV |
| b. bisyllabic | |
| CV.CV CV.V | |
| <u>CVV.CV</u> <u>CVV.V</u> | |

First, Leggbó shows no sign of disfavoring subminimal feet. As we have seen, a verb may consist of a single CV. In fact, all of the underlined forms with an odd number of moras will fail to be exhaustively parsed into bimoraic trochees. In (17a) CV stems (possibly also CVC) would have to constitute monomoraic feet. The verb forms with long vowel syllables in (17b) would also present problems as would trisyllabic CVCVCV in (17c). None of these underlined monomoraic syllables ever undergoes lengthening. Rather, it is only the initial syllable in (18) which is subject to lengthening:

(18) CV.CVV CVV.CVV

That is, a short vowel is lengthened only when followed by a long vowel in the next syllable—which, as we have seen, is always derived via fusion with -ε or -ó. Why should this be?

If we assume that the first (or root) syllable has lexical prominence, which I will call “stress”, then, as seen in (19), there is a conflict between the stress prominence of the first syllable and the length prominence of the second. Instead of resolving this prominence conflict by deleting a mora from the second syllable in (19a), Leggbó adds a mora to the first syllable as in (19b):

⁹René Kager (personal communication, 2002) asked whether this might not instead be referred to as “trochaic shortening”. Either term would seem appropriate, since the structure in (16a) is iambic from the point of view of moraic structure (short-long), but trochaic from the point of view of stress (s-w).

(19) Conflict between stress-prominence of σ_1 vs. length-prominence of σ_2

- a. σ_1 CV . CVV σ_2 CV . CV = iambic shortening
 b. σ_1 CV . CVV σ_2 CVV . CVV = Leggbó “length harmony”

However, if this is what is going on, why doesn't it happen more frequently, especially in the Nigeria-Cameroon borderland, where many languages exhibit stem-initial prominence as well as contrasting vowel length?

Whatever the analysis, note in (20) that the relevant domain would have to exclude prefixes, which regularly produce short-long sequences:

(20) Footing must exclude prefixes (i.e. begin with the stem)

- a. nouns
- | | | | |
|--------|----------|--------|-----------|
| gè-bɔɔ | ‘arm’ | ge-zèè | ‘thorn’ |
| è-yòò | ‘friend’ | ε-báá | ‘red yam’ |
- b. other
- | | | | |
|--------|-----------------|--------|------------------|
| a-dàa | ‘this (other)’ | é-dèè | ‘when’ |
| mí-bòó | ‘some, certain’ | bá-weè | ‘they will swim’ |

These monomoraic prefixes would either have to be extrametrical or alone in their foot. Similar issues would have to be dealt with in (21), which shows that there is no length transfer in reduplication. Thus, a CV reduplicant may produce an acceptable short-long sequence:

(21) A CV reduplicant may produce acceptable CV-CVV (= separately footed?)

- a. productive CV- intensive reduplication in verbs (marking ‘really do something’)
- | | | | |
|-----|---------|--------|----------------|
| wee | ‘swim’ | we-wee | ‘really swim’ |
| zèè | ‘walk’ | zè-zèè | ‘really walk’ |
| zoo | ‘find’ | zo-zoo | ‘really find’ |
| kòò | ‘vomit’ | kò-kòò | ‘really vomit’ |
- b. productive CV- diminutive reduplication in nouns (-wé = suffix < wàhé ‘child’)
- | | | | |
|--------|------------|-----------------|------------------|
| gè-bòò | ‘cloud’ | gè-bò-bòò (-wé) | ‘small cloud’ |
| è-kàà | ‘argument’ | è-kà-kàà (-wé) | ‘small argument’ |
| à-móò | ‘cup, jug’ | à-mó-móò (-wé) | ‘small cup’ |
| gè-zèè | ‘journey’ | gè-zè-zèè (-wé) | ‘small journey’ |
- c. lexicalized nouns
- | | | | |
|------------|----------|-----------|---------------------|
| gè-gbagbaa | ‘funnel’ | lè-nenèél | ‘caterpillar (sp.)’ |
| ge-yéyèè | ‘hiccup’ | lè-kòkóól | ‘stream’ |

Finally, compounded stems would have to be treated as separate feet, and any problems arising from borrowings would have to be set aside.

None of these complications provide a knock-out argument one way or the other. However, it is troubling that length harmony provides the only clear evidence of metrical structure (including stress) playing a role in Leggbó phonology—and that its effect is restricted to derived CVCVV verb forms.

Perhaps we can derive this effect by making the three assumptions in (22).

(22) Metrical analysis of Leggbó

- a. Stems are parsed into bimoraic trochees

- b. Only the rightmost foot can be monomoraic (subminimal)¹⁰
- c. Both moras of a long vowel must appear in the same foot.

With these assumptions, the foot structures of the stem shapes in (17) would be analyzed as in (23).

(23) Footed stem structures (root + lexical suffix)

- | | | |
|--|--|--|
| <ul style="list-style-type: none"> a. monosyllabic (CV) (CVC) (CVV) (CVVC)¹¹ | <ul style="list-style-type: none"> b. bisyllabic (CVCV) (CV.V) (CVV)(CV) (CVV)(V) | <ul style="list-style-type: none"> c. trisyllabic (CVCV)(CV) (CV.V)(CV) (CVV)(CVCV) |
|--|--|--|

As seen, the first and second assumptions result in all stems being parsed into one or two feet. Since a monomoraic foot can only appear finally, a trimoraic stem will be footed as (CVCV)(CV) rather than *(CV)(CVCV).¹²

Assuming the above analysis, let us reconsider the contrasting encliticized CVCV=V forms from (13). These will be footed as follows:

(24) Foot structure of CVCV stem + vocalic enclitic

- a. vili + -ε (vili)(ε) 'cut it'

¹⁰ As seen in (20) and (21), this condition excludes both prefixes and reduplicants.

¹¹ Technically we don't have any evidence whether coda consonants count as a mora or not. The syllable is the tone-bearing unit, and codas appear only stem-finally.

¹² While this may appear to be the result of left-to-right parsing, the derivation of the encliticized outputs in (24) show that directionality may not be needed.

- b. vila + -ε (vii)(lεε) ‘be far from him’

As indicated in (24a), when the output contains a surface vowel sequence, the three moras are grouped into a sequence of a bimoraic followed by monomoraic foot. In (24b), however, where vowel coalescence is obligatory, a problem arises. The assumption in (22c) is that the two moras of a long vowel cannot be assigned to two different feet. In (24b) we thus cannot foot vilεε as *(vilε)(ε). We also cannot foot the input as *(vi)(lεε), since a monomoraic foot is permissible only stem-finally. Finally, assuming that full footing is required, the output also cannot be *vi(lεε). Thus, Leggbó chooses to satisfy all of the requirements in (22) by lengthening the first vowel, thereby producing the output (vii)(lεε).

The above metrical account of lengthening rests on the three assumptions in (22). Since they seem reasonable to us, if correct, we are faced with the question of why more languages don't do as Leggbó? Perhaps we shall find corroborating evidence elsewhere, but it would be reassuring to find more evidence within Leggbó itself. Let us reconsider, for example, the prohibition against lexical *CCVV, e.g. tta ‘shoot’, but *ttaa. If we assume that a stem-initial geminate counts as a mora, then there would be no way to parse a hypothetical verb *ttaa without violating one of the assumptions in (22): *(ttaa) would contain a trimoraic foot, while *(tta)(a) would split a long vowel into two feet. Unfortunately we would still need to explain why /tta+ε/ ‘shoot him’ is allowed to surface as (ttεε). Similarly, the pluractional form ttaazi is acceptable. The prohibition against CCVV sequences seems to hold only of non-derived forms.¹³ It would be nice to have stronger evidence than this for our analysis, e.g. other examples where a short vowel becomes long for metrical reasons.

Unfortunately, the language “conspires” in several ways to guarantee that alleged length harmony will occur only in the environments we have seen: bisyllabic verbs ending in /-a/ followed by -ε or -ó.

First, only these two enclitics have the vocalic shape -V.¹⁴

Second, only bisyllabic verbs will be affected, because, as shown in (25), trisyllabic verb stems arise only by means of the -azi pluractional suffix:

(25) Trisyllabic verbs arise only from the -azi pluractional suffix

a. CV(V)C verbs

siŋ	siŋ-azi	‘fight’	vaan	vaan-azi	‘wrestle’
gɛm	gɛm-ezi	‘be big’	wèel	wèel-ezi	‘come, arrive’

b. CV(V)CV verbs

vili	vil-azi	‘cut’	maanji	maanji-azi	‘burst’
cème	cèm-ezi	‘divide’	zèènɛ	zèèn-ezi	‘hang’

Unfortunately, these trisyllabic verbs end in the vowel [i], so there there will be no coalescence with the enclitics -ε and -ó. The only other source of trisyllabic verbs is from CV reduplication, and as was already seen in (21), length, whether underlying, or whether derived by length harmony as in (26), does not transfer in reduplication:

(26) No transfer of length in CV reduplication (cf. (21))

¹³ While we have found cases like /ba+a/ ‘marry’, which consist of a CV root + a lexical /-a/ suffix, there appear to be no such verbs beginning with a geminate, e.g. */bba-a/.

¹⁴ An exceptional possessive enclitic -ε also occurs on a small set of personal nouns, e.g. è-kèε ‘his/her mother’ (è-ka), è-ttεε ‘his/her father’ (è-ttε), è-nrèε ‘his/her in-law’ (è-nrè), à-ggwèε ‘his wife’ (ggwàno ‘woman’), èduum-ε ‘her husband’ (è-duum), è-yòòε ‘his/her friend’ (è-yòò). None of these involves length harmony, however.

	RED + verb		RED + -ε 'him'	+ -ó 'you sg.'
a.	ffi-ffin-a	'really touch'	fi-ffiìn-εε	ffiffiìn-òó
	tù-tùm-a	'really stop'	tù-tùùm-εε	tù-tùùm-òó
	ma-man-a	'really hold'	ma-maan-εε	ma-maan-òó
b.	kke-kkel-e	'really choose'	kke-kkeel-εε	kke-kkeel-óó
	ddzε-ddzεl-ε	'really know'	ddzε-ddzεel-εε	ddzε-ddzεel-óó
	ttò-ttòn-o	'really tell'	ttò-ttòòn-εε	ttò-ttòòn-òó
	kò-kòm-ó	'really hear'	kò-kòòm-εε	kò-kòòm-òó

Thus, the final -i of -azi, the non-transfer of length in reduplication, and the limited size of Leggbó verbs all conspire to produce the unfortunate consequence that there is no way to see if length harmony might be an unbounded process. In fact, depending on the analysis, we make three different predictions, as shown in (27).

(27) How would hypothetical, non-occurring inputs *manana+ε* and *maanana+ε* be realized?

a.	unbounded harmony:	*manana-ε	maanaan-εε	
		*maanana-ε	maanaan-εε	
b.	bounded harmony:	*manana-ε	manaan-εε	
		*maanana-ε	maanaan-εε	
c.	metrical account:	*manana-ε	manan-εε	(mana)(nεε)
		*maanana-ε	maanaan-εε	(maa)(naa)(nεε)

In (27a), unbounded harmony would predict lengthening of all vowels before -εε. Thus, both **manana+ε* and **maanana+ε* would be realized as *maanaan-εε*. If length harmony were instead bounded, as in (27b), **maanana-ε* would still surface as *maanaan-εε*, but **manana+ε* would surface as *manaan-εε*, differing from (27a). Most interesting are the potential outputs in (27c). If lengthening were a rhythmic process, as we have suggested in setting up bimoraic trochees, **manana+ε* would not undergo lengthening at all, while **maanana+ε* would, as indicated. It is unfortunate that such inputs do not exist in the language.

We also get no help from vowel coalescence across word boundaries. As seen in (28), the stem-initial vowel does not lengthen in such cases:

(28) Coalescence across words does not trigger length harmony

a.	ffina # i-yo	ffin [ii]-yo	'touch bread'	*ffiìn [ii]-yo
b.	mana # i-nòn	man [ii]-nòn	'hold a chicken'	*maan [ii]-nòn

So, where are we? We seem to have a very intriguing case of length agreement which can potentially be interpreted either metrically or as harmony. We note in this context that the language also has a corresponding length prosody on consonants. As seen in (29), the progressive aspect is marked both by an -i suffix as well as by consonant gemination:

(29) Progressive aspect

a.	CV	CCV-i			
stem	prog		stem	prog	
bi	bbi-i	'be done (food)'	du	ddu-i	'beat, pound, crush'
kè	kkè-i	'put'	zò	ssò-i	'babysit'
vè	ffè-i	'learn, teach'	la	lla-i	'entangle'
b.	CVCV	CVCC-i			

stem	prog		stem	prog	
bila	bidd-i	‘climb’	dùma	dùmm-i	‘draw water’
cème	cèmm-i	‘divide, share’	wòlò	wòdd-i	‘be rich’
kpeṅa	kpeṅṅ-i	‘be intelligent’	mana	mann-i	‘hold, catch’
c. CVC CCVCC-i					
stem	prog		stem	prog	
mìṅ	mmìṅṅ-ì	‘suck’	gbon	ggbonn-i	‘prevent’
mèṅ	mmèṅṅ-ì	‘swallow’	pòm	ppòm-i	‘rise, do sth. early’
dum	ddumm-i	‘bite’	bàl	bbàll-i	‘remove oil/palmmut’

In (29a), the initial consonant of CV verbs is geminated and an -i suffix is added. In (29b), the second consonant of CVC-a verbs is geminated and the final underlying /-a/ is replaced by the -i suffix.¹⁵ Most relevant to our concerns, in (29c), both consonants of CVC verbs are lengthened in the progressive. While consonant fortition is morphologized, we would argue that the forms in (29c) also show a kind of harmony, which, in this case, has nothing to do with metrical structure.

To summarize, it is hard to be confident in a metrical characterization of the vowel lengthening process we have documented. We could, of course, still say that lengthening takes place so that the root vowel (= more prominent) will not be shorter than the derived long vowel which follows it, but we would still be unable to explain why *CVCVV becomes CVVCVV, rather than, say, CVVCV. In any case, why is the Leggbó phenomenon so sparsely attested? On the other hand, there are two reasons why we hesitate to say outright that this is a case of length harmony. The major reason is that we have not been able to establish evidence that the process is (even potentially) unbounded—a requirement we placed on VH in our earlier discussion. A second reason is that lengthening is conditioned only by two morphemes, -ε and -ó. This unfortunate limitation makes it possible to refer to lengthening as morphologically conditioned.¹⁶ On the other hand, if the two enclitics had instead, conditioned an unbounded labial, palatal or height harmony, we don’t think anyone would have hesitated to call this VH.

Finally, we should like to demonstrate that the lengthening process must be phonological in nature. That is, it is not possible to attribute the lengthening to phonetic implementation. Evidence in favor of phonological length harmony comes from tone. First, consider in (30) the ML tonal melody found on verbs in the irrealis:¹⁷

(30) ML verb tone melodies + -ε, -ó in the irrealis (‘he will... him/you’)

	schema	example		+ -ε ‘him’	+ -ó ‘you sg.’
a.	/CVC-i/	yumi	‘awaken’	é-yumì-ε	é-yumì-ó
	/CV-i/	nnui	‘push’	é-nnui-yε	é-nnui-yó
	/CVC-azi/	dumazi	‘bite pl.’	é-dumàzi-ε	é-dumàzi-ó
b.	/CVC/	dum	‘bite’	é-dum-ε	é-dum-ó
	CVVC/	tɔɔm	‘send’	é-tɔɔm-ε	é-tɔɔm-ó
	CVV/	zoo	‘find’	é-zoo-ε	é-zoo-ó

¹⁵Most verbs which end in -i, and most CVCC-a verbs, which already have one of the two marks of the progressive in their lexical form, instead use the pluractional suffix -azi to form a progressive.

¹⁶One might even attempt a templatic statement: CVC-a verbs have a corresponding encliticized CVVCVV shape.

¹⁷For more on the Leggbó tone system, see Hyman et al (2002) and Paster (in press).

c.	/CVC-a/	mana	‘hold’	é-maàn-εε	é-maàn-ḍḍ
	/CV-a/	dua	‘hide’	é-duù-εε	é-duù-ḍḍ

The forms in (30a) establish the ML melody, which is clearly visible on such stems which have two or three syllables. In (30b), however, only the M of the ML melody surfaces on monosyllabic stems—even those such as *tɔɔm* and *zoo*, which have a long vowel. Now compare this with the -a final verbs in (30c) which fuse with the enclitic and condition length harmony. As seen, the tone on the stem syllable is ML, not M. Clearly, -maàn- and -duù- consist of two tone-bearing units. This establishes that the harmonized or copied length is categorical.

The length of the pronoun is also seen in (30c), where the second person singular enclitic -ḍ is realized as a rising tone—vs. (30a,b). There is a further tonal argument. The locative marker in (31) has two variants:

(31) Locative ḡ-ke ‘in, at’ (ḡ-ke)

a.	e-ké	è-vva	ḡ-ke	è-ttɔ	‘he put the dog in the house’	
	L	M	H			
b.	e-ké	è-vvḗ	ke	è-ttɔ	(idem.)	(*è-vvḗ)
		ḡ				
	L	M	H			

In (31a), the locative has a H tone velar prefix. In (31b), the prefix is deleted, with its H tone re-associating to the preceding vowel. As seen, since a MH contour is not allowed on a short, monomoraic vowel in Leggbó, the expected MH contour on [vvḗ] is simplified to H.

With this in mind, now compare in (32) the realize of this floating H tone when preceded by the M tone enclitic -ε:

(32) Enclitic -ε ‘him, her’ + ḡ-ke ‘in, at’

a.	du-ε	du-é ke è-ttɔ	‘beat him in the house’	(*du-ě, zoo-ě, etc.)
	zoo-ε	zoo-é ke è-ttɔ	‘find him in the house’	
	dum-ε	dum-é ke è-ttɔ	‘bite him in the house’	
	tɔɔm-ε	tɔɔm-é ke è-ttɔ	‘send him into the house’	
	beeli-ε	beeli-é ke è-ttɔ	‘escort him into the house’	
b.	mana-ε	maan-éé ke è-ttɔ	‘catch him in the house’	(*maan-éé, *duu-éé etc.)
	dua-ε	duu-éé ke è-ttɔ	‘hide him in the house’	
	yɔmmɔ-ε	yɔmm-éé ke è-ttɔ	‘mimic him in the house’	

In (32a), where we have predicted a short enclitic vowel -ε, this vowel is realized with a H tone before the locative, as expected. In (32b), where we have predicted a long, fused vowel -εε, this latter becomes MH before the locative. Since the contour cannot be simplified to H, we know that there are two tone-bearing units or moras and that this MH -éé is indeed a long vowel.

So is this Leggbó process a case of otherwise unattested length harmony? A scoreboard is provided in (33).

(33) Is this “length harmony”?

- a. arguments in favor
1. a short root vowel lengthens when followed by a long vowel (= an assimilation)

2. alternative metrical account could be construed as “ad hoc”
- b. arguments against
1. no evidence that lengthening is unbounded (but due to word size restriction etc.)
 2. limited to two trigger morphemes, -ε and -ό (but these alone create the CVCVV input)
 3. process is suffix- rather than root-controlled (but this is not a strong argument)

As seen, the arguments are fairly evenly distributed, and individual scholars may weight them differently. If this is not a case of “length harmony”, what is it? Should we refer to the process as “length umlaut” or “length metaphony” rather than “length harmony”? Whatever terminology we adopt, this hardly changes the fact that the assimilation of a short vowel to a following long vowel is quite a rare phenomenon. The one thing we can conclude is that this is not a case of feature spreading or feature copying: The long vowels which are derived on roots count as two tone-bearing units (vs. underlying long vowels), thereby indicating that at the minimum an additional moraic slot must be introduced to carry that tone. We thus can continue to reject any attempt to treat vowel length oppositions as [±long].¹⁸

This last point at least represents a partial (positive) result: We can continue to represent length in prosodic terms. We shall end by signaling the importance of still understudied Cross-River languages, which, among other things, appear to have much to contribute to our understanding of vowel length. As summarized in (34), each of the three Cross-River languages we are most familiar with has the indicated vowel length property of interest:

(34) Interesting vowel length properties in Cross-River languages

- a. Gokana (Lower Cross): “embarras de voyelles” (lack of syllables?): aè kò mm̄ kɛ̄ɛ̄ɛ̄ɛ̄ɛ̄ ‘he_i said I woke him_i up’ (Hyman 1985, 1990)
- b. Ibibio (Lower Cross): vowel length opposition only in closed syllables; vowels are redundantly short in open syllables (Urua 2000)
- c. Leggbó (Upper Cross): “length harmony”

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¹⁸As we have indicated, underlying /CVV/ and /CVVC/ count as one TBU, while /CV+V/ and the VV derived by length agreement count as two. The difference may either be attributed to moraic (ultimately syllable) structure—or it may have to do with underlying vs. derived length. While one might try to invoke Clements & Keyser’s (1983) distinction between VC vs. VV long vowels, note that verbs such as tɔ̀m ‘send’ would have to have a CVCC structure—otherwise unattested in the language. Thanks to François Dell for discussion of this point.

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