Length harmony in Leggbó:
a counter-universal?

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1 Introduction

Studies on vowel harmony typically assume that the features involved in VCV assimilations are restricted to Color (Front, Round) and Aperture (Open/Close, ATR/RTR). In this chapter we present a possible case of length harmony from Leggbó, an Upper Cross language spoken in Nigeria. The possibility of length harmony raises serious questions concerning the nature of vowel harmony (e.g. whether a non-feature, length, can harmonize, and, if so, how does lengthening fit in with the relation of vowel harmony to reduction?) or the nature of length itself (e.g. should [along] be reintroduced into phonology?). After presenting all of the relevant facts from Leggbó, we attempt to drive the demonstrated lengthening agreement by principles other than harmony.

Among the features known to be active in vowel harmony (VH) 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 property may harmonize. \(^2\)

\(^1\) This paper grew out of the first author’s year-long field methods course offered at Berkeley during the 2001/02 academic year with the second author serving as linguistic consultant. We are grateful for the many contributions of all of the participants: Jeff Good, Ian Maddisson, Ahmadu Kamu, Julie Larson, Helko Narrog, Mary Paster and Keith Sanders. We also would like to thank Bruce Hayes, Sharon Inkelas and René König for responding to our SOS’s concerning the unusual Leggbó length data. Earlier versions of the paper were presented to the Groupe de Recherches de Phonologie (Paris), and at the University of California, Berkeley, the Summer School in Linguistic Typology (University of Cagliari), and the Workshop on the Phonology of African Languages (University of Vienna).

\(^2\) Van der Hulst & van de Weijer (1995) also mention retroflex harmony in Yoruba. In addition, an original VH process may appear partially arbitrary, due to restructuring, 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.
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 VH, either implicitly by omission or by an explicit statement, indicate that length harmony is unattested (Krimmer 2003: 17). The question is whether a language with the properties in (2) is possible:

(2) What length harmony might look like

\[
\begin{align*}
  \text{a. } /\text{im-il}-e/ &\rightarrow \text{lim-il-e} \\
  /\text{im-an-a}/ &\rightarrow \text{lim-an-a} \\
  /\text{im-il-ee}/ &\rightarrow \text{lim-il-ee} \\
  /\text{im-an-aa}/ &\rightarrow \text{lim-an-aa}
\end{align*}
\]

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 language, Bantu or otherwise, 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, as general linguists we seek 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 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 [+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 restate either the representation of length as [+long] or the implementation of VH as copying, as in preautosegmental 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 co-articulation (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, o/. 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 in length 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 Gldabal (Kistowski & Kisselberth 1977).

Second, let us assume 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 affix 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 perspicuous 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 VH.\(^4\) I will therefore assume that it will be sufficient to identify a case of vowel assimilation as VH if it is unbounded.\(^5\)
2. The Leggbó facts

With all of the above in mind, we now turn to consider the facts of Leggbó, an Upper Cross language spoken by an estimated 60,000 Agbo people in two local government areas, recently named Abi and Yakurr, in Cross River State, 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  kp
     b  d  g  gb  bb  dd  jj  gg  ggb
     v  z  ss
     l  y  w  vv  ddz  lli  yy  ww
     m  n  η  mm  nn  mny  ηη
   b. short vowels  long vowels
     i  u  ii  uu  NB. [ii, uu] occur almost entirely
     e  o  ee  oo  in derived forms
     a  a

As seen, Leggbó has both short and long consonants and vowels, although the 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. 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.

(4) Shapes of verb lexemes
   a. monosyllabic
      L verbs
      CV  vi  ‘kill’
      CCV  kko  ‘vomit’
      CVC  wà  ‘want’
      CVVC  mmbà  ‘swallow’
   M verbs
      du  ‘beat’
      bbo  ‘die’
      zoo  ‘find, search for’
      wam  ‘bear fruit’
      sseq  ‘go’
      wos  ‘flog’
   b. bisyllabic (root + lexical -i or -a, the latter assimilating to a preceding mid vowel)
      L verbs
      CVC-i  bali  ‘step on’
      CVC-a  mana  ‘catch, hold’
      CVVC-i  vëëni  ‘drip’
      CVVC-a  mëëo  ‘return’
      CCVC-i  vëëmi  ‘beg’
      CCVC-a  bëëla  ‘remember’
      CCVC-i  këëni  ‘feed’
      CVCC-a  vëëg  ‘pass’
      CCVC-i  gëëke  ‘lift up, raise’
      CCVC-a  wëëi  ‘carry’
      CCVC-i  mëëo  ‘return’
      CVCC-i  à  ‘be rough’
      CVCC-a  mëëo  ‘return’

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 pluractional suffix and/or reduplicating the first syllable.

(5) Structure of the Leggbó verb

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verb  (redup)
   root  (suffix)
      -i, -a, -azi (pl.)
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e.g. wëëi ‘arri ve’  → wë-wëëi-azi ‘really arrive’ (pl.)

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

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. Compare the minimally contrastive forms in (7).

(7) Minimally contrasting forms
a. CVV : ba 'ask'
b. CCV : bāa 'block, obstruct'
c. CVV : bāa '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. baa '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
- ní 'me'
- sú 'us'
- e 'you sg.'
- ba 'you pl.'
- 'him/her/it'
- be 'them'

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

(9) Illustration of 3sg -sú and 2sg -sú
a. CV du-e 'beat him'
dú-sú 'beat you'
kpe-e 'teach him'
kpe-sú 'teach you'
dzè-e 'forget him'
dzè-sú 'forget you'
b. CCV lli-sú 'bury it'
ll-sú 'bury you'
ssu-e 'peck at him'
ssu-sú 'peck at you'

This includes monosyllabic verbs whose root vowel is other than (short) /e/ 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 -sú and -sú follow a /Ce/ or /Ca/ verb (with a tensis initial consonant). On the other hand, CCV monosyllabic verbs that end in short /e/ or /a/ fuse with these two enclitics, producing the derived long vowels in (10b).

(10) /Ce/ and /Ca/ verbs + -sú
a. Ce vè 'kill'
   vé-sú 'kill him'
   vé-sú 'kill you'
   Ca bā 'ask'
   ba-sú 'ask him'
   ba-sú 'ask you'
b. CCa te 'shoot'
   te-sú 'shoot him'
   te-sú 'shoot you'
   CCa tta 'shoot'
   tta-sú 'shoot him'
   tta-sú 'shoot you'

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

(11) underlying surface + -sú 'him'

a. /fìnn-a/ fìnn-a 'touch'
   fìnn-sú 'touch him'
   fìnn-sú 'touch you'
   /tùm-a/ tùm-a 'stop'
   tùm-sú 'stop him'
   tùm-sú 'stop you'
   /man-a/ man-a 'hold'
   man-sú 'hold him'
   man-sú 'hold you'
   /kak-e/ kak-e 'choose'
   kak-sú 'choose him'
   kak-sú 'choose you'
   /dëdë/ dëdë 'know'
   dëdë-sú 'know him'
   dëdë-sú 'know you'

Concerning the surface verb forms on the left, in (11a), the underlying /-a/ is realized as such after the root vowels /i, u, u/, while in (11b) the /-a/ suffix assimil-
lates to the preceding mid vowel. In either case, the encliticized forms to the
right in (11a,b) show that both -e and -a coalesce with the second vowel to pro-
duce a long -ee or -dd—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 con-
sonant is fortis (after which an underlying long vowel is however prohibited):

(12) underlying surface \+ -e 'him' \+ -a 'you sg.'

a. /bbyaaq-/ bbyaaq 'deceive' bbyaaq-ee bbyaaq-dd
   /ffen-/ ffen-e 'shave' ffen-ee ffen-dd
   /ttan-/ ttan-o 'tell' ttan-ee ttan-dd

b. /gadd-/ gadd- 'step over' gadd-ee gadd-dd
   /temm-/ temm-e 'embrace' temm-ee temm-dd
   /yomm-/ yomm-o 'mimic' yomm-ee yomm-dd

c. /beel-/ beel-e 'place' beel-ee beel-dd
   /zeen-/ zeen-e 'hang' zeen-ee zeen-dd
   /toon-/ toon-o 'praise' toon-ee toon-dd

d. /zla-/ zla- 'let go' zla-ee zla-dd
   /bua-/ bua- 'follow' bua-ee bua-dd
   /mmi-/ mmi- 'hug' mmi-ee mmi-dd
   /ggua-/ ggua- 'pull out' ggua-ee ggua-dd

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 reiter-
ate 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 -e or -a fuse with the vowel of a
bisyllabic verb

a. vila-ee \rightarrow vili-e \text{ 'be far from him'} vs.
b. vili + -e \rightarrow vili-e \text{ 'cut it'}

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

3 Analyses

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 ac-
count 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. * [σ τ] \rightarrow [σ τ]
i.e. μ μ μ

b. vila-ee \rightarrow vili-ee \rightarrow vili-ee

c. vili-e \rightarrow vili-ee \rightarrow (vili-ee)

As a result, lengthening applies in (14b) to create a bisyllabic spondee. Length-
ening does not apply in (14c), where the trisyllabic verb vili-e is not subject to
the constraint in (14a). We are not aware of any language which converts lambs
to spondees in this way. We might try to motivate the constraint in (14a) by not-
ning that lexical verbs may not have the shape *CVVVV. However, as was indi-
cated in (6c), they may also not have the shape *CVVV. Since both lambs
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 metrical interpretation. We may instead analyze foot structure in
terms of moras, as in (15b).

(15) Foot-based options

a. bisyllabic spondee: * [CV.CV]f \rightarrow [CV.CV]f

b. bimoraic trochees: * CV [CV]f \rightarrow [CV]f[CV]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: 13) points out there are actually two prosodic repair strate-
gies available to fix up inputs such as (15b). One can delete a mora to shorten
the vowel of the second syllable, as in (16a); or, one can add a mora to lengthen
the vowel of the first syllable, as in (16b).
(16) Two "prosodic repair strategies" (cf. Mester 1994: 15)

a. REMOVE-µ (iambic shortening)
   \[ \mu \sigma \uparrow [\mu] \sigma \]

b. ADD-µ (trochaic lengthening)
   \[ [\mu] \sigma \uparrow [\mu \mu] \sigma \]

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 *da 'give'!

The problems associated with extending this analysis to Leggbó are seen in the possible stem structures in (17).

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

a. monosyllabic
   \[ CV \quad CVV \quad CVC \quad CVVC \]

b. bisyllabic
   \[ CV.CV \quad CVV.CV \quad CVC \quad CVV.CVC \]

c. trisyllabic
   \[ CV.CV.CV \quad CVVC.CVC \quad CVC.CV \quad CVCV.CVC \]

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 binomoraic 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 CVVCVCV in (17c). None of these underlined monomoraic syllables ever undergo lengthening. Rather, it is only the initial syllable in (18) which is subject to lengthening:

(18) \[ CV.CV \quad CVV \rightarrow CVV.CV \]

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 -e or -s. Why should this be?

Although Leggbó does not have stress-accent, one might still propose that the first (or root) syllable has stem-initial metrical prominence (which we will mark by \(\downarrow\)). As seen in (19), there would then be a conflict between the metrical 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).

(19) Conflict between metrical prominence of \(\sigma_1\) vs. length prominence of \(\sigma_2\)

a. \[ CV.CV \rightarrow CV . CV = \text{ iambic shortening} \]

b. \[ CV.CV \rightarrow CVV.CV = \text{ Leggbó 'length harmony'} \]

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?\(^10\)

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
   \[ e-bó 'arm' \quad ge-zé 'thorn' \]

b. other
   \[ a-di 'this (other)' \quad é-dé 'when' \]

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:

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\(^9\) René 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).

\(^10\) We might evoke Walker's (2005) notion of "weak triggers" to say that agreement occurs with the length of the final syllable because the latter is in a weak position from the point of view of perception. While there are numerous unmarked-like harmonies that have a suffixed trigger, we still would have no explanation for why length agreement has thus far been found only in Leggbó.
(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'
      zêk 'walk' → zê-zêk 'really walk'
      zëm 'find' → zë-zëm 'really find'
      kôm 'vomit' → kô-kôm 'really vomit'

   b. productive CV-diminutive reduplication in nouns (-wê = suffix < wâhê 'child')
      
      gê-bôô 'cloud' → gê-bôô-bôô (-wê) 'small cloud'
      ê-kâk 'argument' → ê-kâ-kâk (-wê) 'small argument'
      a-môô 'cup, jug' → a-môô-môô (-wê) 'small cup'
      gê-zêk 'journey' → gê-zê-zêk (-wê) 'small journey'

   c. lexicalized nouns
      
      gê-gbagba 'funnel' ë-înëë 'caterpillar (sp.)'
      ge-yêëyê 'hiccup' lê-kôkôôl '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 produce a knock-out argument for or against the metrical analysis. However, it is troubling that length harmony provides the only clear evidence of metrical structure playing a role in Leggbô phonology—and that its effects are restricted to derived CV-CVV verb forms.11

As an alternative, perhaps we can derive this effect by making the three assumptions in (22).

(22) Metrical analysis of Leggbô
   a. Stems are parsed into bimoraic trochees
   b. Only the rightmost foot can be monomoraic (subminimal)12
   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)
   a. monosyllabic
      
      (CV) (CVC) (CVV) (CVCV)13

b. bisyllabic
      
      (CVCV) (CVV)
      (CVCV) (CVV)(CV)
      (CVV)(CV)

   c. trisyllabic
      
      (CVCV)(CV) (CVV)(CV)(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 trisyllabic stem will be footed as (CVCV)(CV) rather than *(CV)(CVCV).14

Assuming the above analysis, let us reconsider the contrasting encliticized CV-CVV forms from (13). These will be footed as follows:

(24) Foot structure of CV-CVV stem + vocalic enclitic
   a. viï + -ë → (viï)(e) 'cut it'
   b. viïa + -ë → (viïa)(ëëe) '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 viïa as *(viïe)(ë). It also cannot be footed as *(viï)(ëëe), since a monomoraic foot is permissible only stem-finally. Finally, assuming that full footing is required, the output also cannot be *(viï)(ëëe). Thus, Leggbô chooses to satisfy all of the requirements in (22) by lengthening the first vowel, thereby producing the output (viï)(ëëe).

4 Discussion

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 Leggbô? Perhaps we shall find corroborating evidence elsewhere, but it would be reassuring to find more evidence within Leggbô itself. Let us reconsider, for example, the prohibition against lexical *CVCV, e.g. ita '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 trisyllabic foot, while *(tta)(a) would split a long vowel into two feet. Unfortunately we would still need to explain why /tta+ë/ "shoot him" is allowed to surface as (tëë). Similarly, the plurational form itaazë is acceptable. The prohibition

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11. Stem-initial syllables exhibit positional prominence effects, but there is no stress-affect in Leggbô.
12. As seen in (20) and (21), this condition excludes both prefixes and reduplicants.
13. Technically we don't have any evidence whether codas consonants count as a mora or not. The syllable is the tone-bearing unit, and codas appear only stem-finally.
14. 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.
against CCVV sequences seems to hold only of non-derived forms.\(^{15}\) 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 al-
leged length harmony will occur only in the environments we have seen: bisylla-
labic verbs ending in /-u/ followed by /-e/ or /-ə/.

First, only these two enclitics have the vocalic shape /-i/-/V/.\(^{16}\)

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

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

a. CV(V)C verbs

- *sɪp* → *sɪp-azi* ‘fight’
- *gɛm* → *gɛm-azi* ‘be big’
- *vaan* → *vaan-azi* ‘wrestle’
- *wɛɛl* → *wɛɛl-azi* ‘come, arrive’

b. CV(V)VC verbs

- *vili* → *vili-azi* ‘cut’
- *cɛmɛ* → *cɛmɛ-azi* ‘divide’
- *maan* → *maan-azi* ‘burst’
- *zɛbɛ* → *zɛbɛ-azi* ‘hang’

Unfortunately, these trisyllabic verbs end in the vowel [i], so there there will be
no coalescence with the enclitics /-e/ and /-ə/. 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))

<table>
<thead>
<tr>
<th>RED + verb</th>
<th>RED + -e ‘him’</th>
<th>RED + -ə ‘you sg.’</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>fli-fli̇n-a</em> ‘really touch’</td>
<td><em>fli-fli̇n-ə</em></td>
<td><em>fli-fli̇n-ə</em></td>
</tr>
<tr>
<td><em>tii-tim-a</em> ‘really stop’</td>
<td><em>tii-tim-ə</em></td>
<td><em>tii-tim-ə</em></td>
</tr>
<tr>
<td><em>ma-man-a</em> ‘really hold’</td>
<td><em>ma-maən-ə</em></td>
<td><em>ma-maən-ə</em></td>
</tr>
<tr>
<td><em>kkek-kkèl-ə</em> ‘really choose’</td>
<td><em>kkek-kkèl-ə</em></td>
<td><em>kkek-kkèl-ə</em></td>
</tr>
<tr>
<td><em>ddzè-ddzèl-ə</em> ‘really know’</td>
<td><em>ddzè-ddzèl-ə</em></td>
<td><em>ddzè-ddzèl-ə</em></td>
</tr>
<tr>
<td><em>ttò-ttòn-ə</em> ‘really tell’</td>
<td><em>ttò-ttòn-ə</em></td>
<td><em>ttò-ttòn-ə</em></td>
</tr>
<tr>
<td><em>kà-kɔm-ə</em> ‘really hear’</td>
<td><em>kà-kɔm-ə</em></td>
<td><em>kà-kɔm-ə</em></td>
</tr>
</tbody>
</table>

Thus, the final /-i/- of /-azi/, the non-transfer of length in reduplication, and the
limited size of Leggbọ verbs all conspire to produce the unfortunate consequence
that there is no way to see if length harmony might be an unbounded process. In

\(^{15}\) While we have found cases like /ba-ə/ ‘marry’, which consist of a CV root + a lexical /-ə/-
suffix, there appear to be no such verbs beginning with a geminate, e.g. *ba-ba-a/.

\(^{16}\) An exceptional possessive enclitic /-e/ also occurs on a small set of personal nouns, e.g. *kàkì-
‘his/her mother’ (k-ko), *kò-a ‘his/her father’ (k-ко), *mà-ba ‘his/her in-law’ (m-bà), *gùdà ‘his
wife’ (gùdà-n ‘woman’), *dà-a ‘her husband’ (dà-a), *dà-yì ‘his/her friend’ (dà-yì). None of
these involves length harmony, however.
b. CVCV → CVCC-i
stem prog stem prog
bila bidd-i 'climb' dûma dûmm-i 'draw water'
cême cêm-i 'divide, share' wâb wâd-d 'be rich'
kpepp kpepp-i 'be intelligent' mana mann-i 'hold, catch'
c. CVC → CVCVCC-i
stem prog stem prog
migg mûnn-i 'suck' gbon gbonn-i 'prevent'
mîg mûnn-i 'swallow' pâm pûmûm-i 'rise, do sth. early'
dum dûmm-i 'bite' bâl bâll-i 'remove oil/palm nut'

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. Most relevant to our concerns, in (29c), both consonants of CVC verbs are lengthened in the progressive. While consonant forlorn 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.

5 Summary and conclusion

To summarize, it is hard to be confident in a metrical characterization of the vowel lengthening process we have documented. We could, of course, assert 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 CVCCV becomes CVVCV, rather than, say, CVCCV. We would also need to explain why the Leggbô phenomenon is 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, -e and -i. This unfortunate limitation makes it possible to refer to lengthening as strictly morphologically conditioned, as stated in (30).

(30) Arbitrary morphological conditioning of apparent length agreement

CVCC-a verbs have a corresponding CVCC-a stem shape conditioned by the presence of [+1pers] and [+2pers] singular enclitics

17 Most 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 pronominal suffix -azi to form a progressive.

In this interpretation, it would be just an accident that length agreement occurs whenever stem-final -a fuses with the enclitics -e and -i. On the other hand, if the two enclitics had instead, conditioned an unbounded labial, palatal or height agreement, we doubt that linguists would have hesitated to call this VH. This raises the interesting question of whether, and if so, how morphologically conditioned phonological rules may differ from rules whose conditions are strictly phonological (cf. Anderson 1975).

Finally, we should like to demonstrate on the basis of tonal evidence that the lengthening process must be phonological rather than attributable to phonetic implementation. Consider, first, how the ML tonal melody is mapped onto verbs in the irrealis:18

(31) ML verb tone melodies + -e, -i in the irrealis ('he will...him/you')

\[
\begin{array}{llll}
\text{schema} & \text{example} & + -e & + -i \\
\hline
\text{a. } & /\text{CV}-/ & \text{yumi} & \text{'awaken'} & \text{â-yumi} & \text{â-yumi-i} \\
\text{CVCC-azi} & & \text{dumzi} & \text{'bite pl.'} & \text{â-dumzi} & \text{â-dumzi-i} \\
\text{b. } & /\text{CVCC-azi}/ & \text{dum} & \text{'bite'} & \text{â-dum} & \text{â-dum-i} \\
\text{CVCC} & \text{toom} & \text{'send'} & \text{â-toom} & \text{â-toom-i} \\
\text{CVV} & \text{zoo} & \text{‘find’} & \text{â-zoo} & \text{â-zoo-i} \\
\text{c. } & /\text{CV-azi}/ & \text{mana} & \text{‘hold’} & \text{â-maan} & \text{â-maan-i} \\
\text{CV-azi} & \text{doo} & \text{‘hide’} & \text{â-duo} & \text{â-duo-i} \\
\end{array}
\]

The forms in (31a) establish the ML melody, which is clearly visible on stems which have two or three syllables. In (31b), however, only the M of the ML melody surfaces on monosyllabic stems—even those such as too and zood, which have a long vowel. Now compare this with the -a final verbs (31c) which fuse with the enclitic and condition length harmony. As seen, the tone on the stem syllable is ML, not M. Clearly, -main- and -dui- consist of two tone-bearing units. This establishes that the harmonized or copied length is categorial (i.e. phonological).

The length of the pronoun is also seen in (31c), where the second person singular enclitic -i is realized as a rising tone—vs. (31a, b). There is a further tonal argument. The locative marker in (32) has two variants:

(32) Locative ụ-ke 'in, at' (→ -ük-e)

\[
\begin{array}{lll}
\text{a. } & \text{e-ké} & \text{e-vva} & \text{e-ük-e} \\
\text{b. } & \text{e-tto} & \text{e-tto} & \text{e-tto} \\
\text{L } & \text{M } & \text{H} \\
\end{array}
\]

'He put the dog in the house.'

18 For more on the Leggbô tone system, see Hymn et al. (2003), Hyman & Udoh (2003) and Pester (2003).
b. e-kë e-vvá ke e-tto (idem.) (*e-vvá
\[ \begin{array}{ll}
L & M \\
H \\
\end{array} \]

In (32a), the locative has a H tone velar prefix. In (32b), 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 [vvá] is simplified to H.

With this in mind, now compare in (33) the realize of this floating H tone when preceded by the M tone enclitic -e:

(33) Enclitic -e 'him, her' + -ke 'in, at'

a. du-e → du-ë ke e-tto 'beat him in the house'
   (*du-ë, zo-ë, etc.)
   zoom-e → zoom-ë ke e-tto 'find him in the house'
   dum-e → dum-ë ke e-tto 'bite him in the house'
   toom-e → toom-ë ke e-tto 'send him into the house'
   beeli-e → beeli-ë ke e-tto 'escort him into the house'

b. mana-e → maan-ë ke e-tto 'catch him in the house'
   (*maan-ë, *duu-ë etc.)
   dua-e → duu-ë ke e-tto 'hide him in the house'
   yoomo-e → yoom-ë ke e-tto 'mimic him in the house'

In (33a), where we have predicted a short enclitic vowel -e, this vowel is realized with a H tone before the locative, as expected. In (33b), where we have predicted a long, fused vowel -ë, 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 -ë is indeed a long vowel.

So is this Leggbó process a case of otherwise unattested length harmony? A scoreboard is provided in (34).

(34) Is this "length harmony"?

a. arguments in favour
   1. a short root vowel lengthens when followed by a long vowel (= an assimilation)
   2. alternative metrical account could be construed as "ad hoc"
   3. alternative morphological account is not "explanatory"

b. arguments against
   1. no evidence that lengthening is unbounded (but due to word size restriction etc.)
   2. limited to two trigger morphemes, -e and -o (but these alone create the CVCCV 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 the correct interpretation is one of assimilation or agreement, is this a case of "length harmony"? Or, should we instead refer to the process as "length umlaut" or "length metaphony"? Whatever terminology we adopt, this hardly changes the fact that length assimilation of a short vowel to a neighboring long vowel is quite a rare phenomenon. The one thing we can conclude is that this is neither a case of feature spreading nor 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 conclude to reject any attempt to treat vowel length oppositions as [ë-fon].

This last point at least represents a partial (positive) result: we can continue to represent length in prosodic terms.

References


19 As we have indicated, underlying /CVV/ and /CCVVC/ count as one TRU, while /CVVV/ and the VV derived by length agreement count as two. The difference may either be attributed to moraic (ultimately syllabic) structure - or it may have to do with underlying vs. derived length. While one might try to invoke Clements & Keyser's (1983) distinction between VV vs. VVV long vowels, note that verbs such as i:ru 'send' would have to have a CVVC structure otherwise unattested in the language. Thanks to François Dell for discussion of this point.


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