The syllabification of VV-sequences in Dàgáárè*

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Previous work on the prosodic structure of Dàgáárè has shown the presence of a minimally bimoraic foot in lexical words, despite the lack of clear evidence for stress (Antilla and Bodomo 2009, 2019; hereafter A and B). Specifically, A and B have proposed that vowel length alternations in nominal number inflection and in the formation of action nominalizations are driven by a phonological minimality condition, which strives to create a bimoraic foot, $(\mu\mu)_{\varphi}$.

This proposal, however, remains ambiguous at the level of the syllable. While A and B (2009, 2019) are clear that minimality play a central role in accounting for vowel length alternations, the intervening level of prosodic structure is left unspecified. It is possible for a foot to be bimoraic in two ways: monosyllabically $[(\mu\mu)_{\sigma}]_{\varphi}$, or bisyllabically $[(\mu)_{\sigma}(\mu)_{\sigma}]_{\varphi}$. This paper brings together previously published data in order to make explicit the generalizations that illustrate both monosyllabic and bisyllabic feet are necessary in addition to the minimally bimoraic foot. By looking at the surface tonal patterns, the distribution of diphthongs, and the morphological structure of a form, we show that the syllabification of VV-sequences is not uniform across environments. We present an explicit proposal regarding the syllable structure in order to account for these generalizations. This leads us ultimately to a reanalysis of the number marking data presented in A and B (2009).

1. Vowel lengthening

This section looks at three morphological environments where the root vowel is lengthened. We will see that, in each case, the tone over the lengthened vowel remains level, regardless of any tonal changes.[1]

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[1] The data here come from two different sources and have slightly different analyses of underlying root forms and their surface citation form. Data from A and B (2009) is analyzed as having both H and L tone underlyingly, whereas data from A and B (2019) is analyzed as having either L tone or H tone underlyingly, and with underlying toneless roots surfacing with L tone in citation form. Throughout, we will retain the underlying root forms presented in the original source. It is clear that the analysis of underlying forms in A and B (2009) can be recast into the underlying tone system of A and B (2019) to better capture the interaction with polar tones on suffixes, for example. While ultimately such a change may in fact be necessary (for example in (1d, e)), we do not make such a move here.

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1.1 Number marking in /-rI/

A and B (2009) investigate length alternations present in nominal number morphology. We will return to their analysis below, but first turn to root-vowel lengthening which accompanies one class of number inflection, specifically lexical items which are suffixed with /-rI/. Note that the suffix vowel is underlyingly unspecified for tongue root position, and its ATR-harmonic with the root vowel. Further, the semantics of this suffix is not specific to either singular or plural interpretation, but rather varies lexically (on this "polar morphology", see A and B (2009)). Finally, the lengthening of the root-vowel does not occur in all instances where /-rI/ is present, such as in (2), and is also lexically conditioned. For the rest of the paper, we present only the data in which the relevant length alternation is present.

(1) Root vowels lengthen (A and B 2009)

	ROOT		SURFACE	GLOSS
a.	/bì/	⟶	[bíí-rí]	'child-PL'
b.	/tì/	⟶	[tìì-rí]	'tree-PL'
c.	/pì/	⟶	[pìì-rí]	'rock-SG'
d.	/kù/	⟶	[kùù-rí]	'hoe-SG'
e.	/kù/	⟶	[kúú-rí]	'wild.rat-PL'
f.	/pò/	⟶	[pòò-rí]	'stomach-PL'
g.	/wò/	⟶	[wóó-rí]	'wallet-PL'
h.	/bò/	⟶	[bóó-rí]	'goat-PL'

(2) Root vowels do not lengthen (A and B 2009)

a.	/yí/	⟶	[yí-rì]	'house-SG'
b.	/mí/	⟶	[mí-rì]	'rope-SG'

The generalization we would like to focus on here is the fact that in lengthening, the root vowels maintain a steady tone regardless of whether the tone changes or not.[2] In other words, both moras of the long vowel surface with the same tone.

1.2 Action nominalization

Further cases of lengthening are presented in A and B (2019). The following examples are of deverbal action nominalizations. Preceding the nominalizer /-UU/, short root vowels lengthen (see A and B (2019) for further discussion on the allomorphy of the nominalizer).

[2] As noted in the note above, the underlying representations might be recast so that in these forms, surface low tones are underlying whereas surface high tones are inserted by some default mechanism, as is implicitly assumed in the analysis presented in A and B (2019). In any case, both vowels behave identically with respect to tone assignment.

(3) Root vowel lengthens (A and B 2019)

	ROOT		SURFACE	GLOSS
a.	/ba/	⟶	[báá-ó]	‘stick.into.ground-NMLZ’
b.	/da/	⟶	[dáá-ó]	‘buy-NMLZ’
c.	/wa/	⟶	[wáá-ó]	‘come-NMLZ’
d.	/kpá/	⟶	[kpáá-ò]	‘boil-NMLZ’
e.	/la/	⟶	[láá-ò]	‘laugh-NMLZ’
f.	/mí/	⟶	[míí-ù]	‘rain-NMLZ’
g.	/bó/	⟶	[bóó-ò]	‘come.(of.rain) -NMLZ’
h.	/bú/	⟶	[búú-ù]	‘measure/calculate-NMLZ’
i.	/nyu̱/	⟶	[nyu̱u̱-u̱]	‘drink-NMLZ’
j.	/zú/	⟶	[zúú-ù]	‘steal-NMLZ’
k.	/tá/	⟶	[táá-ò]	‘reach-NMLZ’
l.	/ɪ/	⟶	[íí-ó]	‘do-NMLZ’
m.	/dî/	⟶	[díi-̌ó]	‘take-NMLZ’
n.	/dì/	⟶	[díí-ú]	‘eat-NMLZ’
o.	/kʊ/	⟶	[kóó-ó]	‘give-NMLZ’
p.	/yí/	⟶	[yíí-ù]	‘divorce.a.male-NMLZ’

Again, we can make the same generalization as above that the surface tones over the root VV-sequence are identical. In particular, (3m) shows that even when a contour is present underlyingly, the surface form is level, showing that even in cases where additional tones are available, derived VV-sequences surface with identical tones. Additionally, these nominalizations present an interesting case of three vowels in sequence. Note, however, that tone across the root vowels and the vowel of the nominalization suffix does not conform with the tonal generalization so far – cases such as (3g) show that the tone over the root vowel and the nominalization suffix may vary even if the vowel quality is the same. We will discuss this further in section 2.

1.3 Imperfectives

Finally, turning to the verbal domain, we see that the imperfect has a similar lengthening pattern as the two environments above.

(4) Root vowel lengthens (A and B 2019)

	ROOT		SURFACE	GLOSS
a.	/ba/	⟶	[bàà-rá]	‘stick.into.ground-IPFV’
b.	/da/	⟶	[dàà-rá]	‘buy-IPFV’
c.	/wa/	⟶	[wàà-rá]	‘come-IPFV’
d.	/kpá/	⟶	[kpáá-rà]	‘boil-IPFV’
e.	/la/	⟶	[làà-rá]	‘laughv’
f.	/mí/	⟶	[míí-rè]	‘rain-IPFV’
g.	/bó/	⟶	[bóó-rɔ̀]	‘come.(of.rain) -IPFV’

h.	/bú/	⟶	[búú-rò]	‘measure/calculate-IPFV’
i.	/nyu̱/	⟶	[nyu̱u̱-rò]	‘drink-IPFV’
j.	/zú/	⟶	[zúú-rò]	‘steal-IPFV’

Once again, the VV-sequence of the root surfaces with level tone. So far, in all three lengthening environments, the following generalization holds.

Table 1. Summary of generalizations

Generalization	Lengthening environment
Tones of VV-sequences identical	✓

1.4 Diphthongs

In the data presented above, examples of roots with mid-vowels have been omitted. This is due to a pattern where Dàgáárè restricts the distribution of long mid-vowels – specifically, there is a ban on *phonologically-derived* long mid-vowels (A and B 2019). That is, environments where a mid-vowel is predicted to lengthen will lead to diphthongization. This does not, however, ban all mid-vowel sequences on the surface, as we will see in the following section. The examples below are taken from the three environments above, where the root vowel is mid.

(5) Number marking

	ROOT		SURFACE	GLOSS
a.	/nɔ́/	⟶	[nóɔ́-rì]	‘mouth-SG’
b.	/pò/	⟶	[pùò-rí]	‘back-SG’
c.	/yó/	⟶	[yúó-rì]	‘name-SG’
d.	/yɔ̀/	⟶	[yòɔ̀-rí]	‘penis-SG’

(6) Action Nominalization

	ROOT		SURFACE	GLOSS
a.	/kyɛ/	⟶	[kyíɛ́-ó]	‘cut-NMLZ’
b.	/kpɛ/	⟶	[kpíɛ́-ó]	‘enter-NMLZ’
c.	/gyɛ́/	⟶	[gyíɛ́-ò]	‘refuse.to.take-NMLZ’
d.	/ŋmɛ/	⟶	[ŋmíɛ́-ó]	‘beat-NMLZ’
e.	/gbe/	⟶	[gbíé-ú]	‘grind.roughly-NMLZ’
f.	/bɔ́/	⟶	[bóɔ́-ù]	‘want/look.for-NMLZ’
g.	/kɔ́/	⟶	[kóɔ́-ù]	‘farm-NMLZ’
h.	/yɔ́/	⟶	[yóɔ́-ù]	‘roam-NMLZ’
i.	/ko/	⟶	[kúó-ù]	‘dry-NMLZ’
j.	/kó/	⟶	[kúó-ù]	‘get.ready.for.rain-NMLZ’
k.	/tɛ́/	⟶	[tíɛ́-ò]	‘display-NMLZ’

(7) Imperfective

	ROOT		SURFACE	GLOSS
a.	/kyɛ/	⟶	[kyìɛ́-rɛ́]	‘cut-IPFV’
b.	/kpɛ/	⟶	[kpìɛ́-rɛ́]	‘enter-IPFV’
c.	/gyɛ́/	⟶	[gyíɛ́-rɛ̀]	‘refuse.to.take-IPFV’
d.	/ŋmɛ/	⟶	[ŋmìɛ́-rɛ́]	‘beat-IPFV’
e.	/gbe/	⟶	[gbìé-ré]	‘grind.roughly-IPFV’
f.	/bɔ́/	⟶	[bɔ́ɔ́-rɔ̀]	‘want/look.for-IPFV’
g.	/kɔ́/	⟶	[kɔ́ɔ́-rɔ̀]	‘farm-IPFV’
h.	/yɔ́/	⟶	[yɔ́ɔ́-rɔ̀]	‘roam-IPFV’

In conformity with the generalization on tone above, we observe that the tones over the diphthongs found in lengthening environments are identical. One additional generalization that we can make is regarding the quality of surface VV-sequences that are created through this process: the only sequences to appear in lengthening environments are {uo, ʊo, ie, ɪɛ} – that is, if we treat them as diphthongs, opening diphthongs agreeing in [±BACK].

Table 2. Summary of generalizations

Generalization	Lengthening environment
Tones of VV-sequences identical	✓
VV-sequences limited to identical vowels or {uo, ʊo, ie, ɪɛ}	✓

Finally, there is a counterexample to the diphthongization pattern noted in A and B (2019: 27n). Instead of the expected diphthongization, we get a long-mid vowel.

(8) Counter examples to regular diphthongization (A and B 2019: 27n)

	ROOT		SURFACE	GLOSS
a.	/zo/	⟶	[zóó-ú]	‘run-NMLZ’
b.	/nyɛ́/	⟶	[nyáá-ɔ̀]	‘see/understand-NMLZ’

Crucially, the generalizations above in Table 2 are not disrupted.

2. Intervening morphological boundaries

In this section, we will see cases of dissimilar tones surfacing on adjacent vowels, in apparent contradiction to the generalizations of the previous section. These environments, however, differ with respect to their morphological structure. We first present cases where this is clearly the case, before turning to more ambiguous cases.

2.1 Action Nominalizations

We have already seen instances of VV-sequences with dissimilar tones in the previous section, in the presentation of action nominalizations. We reproduce some examples here in (9).

(9) Action nominals

	ROOT		SURFACE	GLOSS
a.	/bú/	⟶	[búú-ù]	'come.(of.rain) -NMLZ'
b.	/kyɛ/	⟶	[kyíɛ́-ú]	'cut-NMLZ'

These forms all contain VVV-sequences which are a priori highly ambiguous in terms of their syllabification. However, note that in (9a) *búúù*, the there is a different tone on the final [ʊ] of the nominalizing suffix. Additionally, in (9b) *kyíɛ́ú*, only one of these sequences conforms to the general pattern of regular diphthongization – while the distribution of [ɪɛ]-like sequences is a result of mid-vowels in otherwise lengthening environments, [ɛʊ]-like sequences are only found when separated by a morphological boundary.

2.2 Plural marking in /-E/

We now turn another class of number marking, this time specifically of marked plurals in /-E/. The suffix /-E/ is not accompanied by lengthening of the root-vowel and is invariably /-E/, abstracting away from the harmonic ATR feature, and the tone is polar with respect to the root-tone.

(10) Plural marking with /-E/ (A and B 2009)

	ROOT		SURFACE	GLOSS
a.	/gbɛ́/	⟶	[gbɛ́-ɛ̀]	'leg-PL'
b.	/lɛ̀/	⟶	[lɛ̀-ɛ́]	'bead-PL'
c.	/kpɛ́/	⟶	[kpɛ́-ɛ̀]	'malt-PL'
d.	/nɔ́/	⟶	[nɔ́-ɛ̀]	'mouth-PL'
e.	/pò/	⟶	[pò-é]	'back-PL'
f.	/yó/	⟶	[yó-è]	'name-PL'
g.	/yɔ̀/	⟶	[yɔ̀-ɛ́]	'penis-PL'
h.	/bí/	⟶	[bí-è]	'seed-PL'
i.	/pì/	⟶	[pì-é]	'rock-PL'
j.	/yí/	⟶	[yí-è]	'house-PL'
k.	/mí/	⟶	[mí-è]	'rope-PL'
l.	/kù/	⟶	[kù-é]	'hoe-PL'

Once again, we find that the surface tone pattern between the VV-sequences above is distinct from that found on the VV-sequence found in section 1. Furthermore, we have cases of long-mid vowels, though once more separated by a morphological

boundary. These cases, such as (10a) are noted as an exception to the general ban on derived long mid vowels by A and B (2009) due to "morphological concatenation".

Taking both the distribution of tone and the vowel qualities in VV-sequences within and across morpheme boundaries, a descriptive asymmetry arises. Specifically, morpheme internal VV-sequences have identical tone and the possible sequences vowel qualities is constrained to identical non-mid[3] vowels (as in lengthening) or four opening diphthongs {uo, ʊo, ie, ɪɛ} (as in diphthongization of mid-vowels). VV-sequences across morpheme boundaries, however, may have differing surface tones and the vowel qualities are not constrained in a similar way to morpheme-internal VV-sequences.

Table 3. Summary of generalizations

Generalization	Morpheme-internal	Across morpheme-boundary
Tones of VV-sequences identical	✓	✗
VV-sequences limited to identical vowels or {uo, ʊo, ie, ɪɛ}	✓	✗

2.3 Singular marking with V

The final environment we will look at is the class of nominal number marking analyzed by A and B as "vowel epenthesis compelled by the bimoraicity requirement" (A and B 2009). These forms fall into two classes: the non-root vowel is inserted at the end of the word (11) or word-medially (12).

(11) Non-root vowel is word-final

	ROOT		SURFACE	GLOSS
a.	/bì/	⟶	[bíé]	'child.SG'
b.	/kù/	⟶	[kúó]	'wild.rat.SG'
c.	/pò/	⟶	[pʊ́ɔ́]	'stomach.SG'
d.	/wò/	⟶	[wʊ́ɔ́]	'wallet.SG'
e.	/bò/	⟶	[bʊ́ɔ́]	'goat.SG'

(12) Non-root vowel is word-medial

	ROOT		SURFACE	GLOSS
a.	/gbè/	⟶	[gbìé]	'forehead.SG'
b.	/dè/	⟶	[dìé]	'room.SG'
c.	/pɛ̀/	⟶	[pìɛ́]	'basket.SG'
d.	/wɛ̀/	⟶	[wìɛ́]	'farm.SG'
e.	/dò/	⟶	[dùó]	'pig.SG'
f.	/dɔ̀/	⟶	[dʊ̀ɔ́]	'dawadawa.SG'

[3] But note the exceptional (8a).

The data in (11) shows another instance of diphthongization, this time due to a constraint on derived word-final high vowels (A and B 2009). The data in (12) shows a distinct pattern where the additional segment is word-medially.[4]

The above data is taken by A and B (2009) as arguing against any affixal analysis, since it is unclear what would distinguish the forms in (12) from including a suffix forms as in (10), where the suffix surfaces invariably word-finally. Instead, these forms are presented as "vowel epenthesis compelled by the bimoraicity requirement" (A and B 2009). They present their analysis in terms of the interaction between phonotactic constraints which derive the word-medial epenthesis in (12) but allow the word-final epenthesis in (11). Crucially, the cases in (11) and (12) are taken to be result of the same processes. We will return to this analysis below.

In terms of the generalizations we have been presenting so far, the forms in (11) conform exactly with the morpheme internal generalizations. The forms in (12), however, do not: the have dissimilar tone on the two vowels of the VV-sequence despite conforming to the set of diphthongs seen in lengthening environments. The following section proposes an account for the asymmetries in Table 3 and shows that the forms in (11) and (12) cannot both be treated as unmarked or epenthetic.

3. Towards an analysis

The primary goal of in building this analysis is to account for the asymmetry found in the generalizations above. Specifically, we will explicitly formalize the syllable structure of Dàgáárè and show that the asymmetry in tone/vowel quality restrictions within morphemes vs. across morpheme boundaries arises due to the constraints on tone association. We then show that such a picture is incompatible with A and B's (2009) analysis of vowel-epenthesis for cases like (11) and (12) and propose an optimality-theoretic analysis consistent with the view of syllable structure presented here.

Previous work on the prosodic structure of Dàgáárè has been focused mostly on the foot (A and B 2009, 2019). There are scattered instances of the syllable structure being explicitly spelled out, but not in an extensive enough way to disambiguate the syllabification of VV-sequences. For instance, in A and B (2019: 32) the full prosodic structure of *bááǘ* is spelled out as $[(\text{báá})_{\sigma}]_{\varphi}(\text{ǘ})_{\sigma}$, following some assumptions made therein about extrametrical syllables. These references to syllable structure are consistent with our proposal, and this paper's aim is to lay out a more explicit account with specific reference to VV-sequences which are prima facie ambiguous. To recapitulate, the asymmetry that we have seen in the data above are as follows:

i. morpheme-internal VV-sequences have (a) identical tones and (b) are limited to long vowels or {uo, ʊo, ie, ɪɛ}

[4] Interestingly, the plural counterparts to the forms in (11) include the /-rI/ suffix and are "possibly accompanied by high vowel lengthening" whereas the plural counterparts to those in (12) include the /-rI/ suffix but never include root-vowel lengthening. While this may suggest that they do in fact belong to different classes (with different number marking strategies), it remains to be investigated whether this is an accident of the data as presented in (A and B 2009).

ii. VV-sequences across morpheme boundaries are not constrained as in (i).

3.1 Lengthening and diphthongization

The lexical items whose roots lengthen in the presence of certain suffixes, such as those in the lengthening environments discussed in section 1, all create a morpheme-internal bi-moraic foot. We follow A and B's (2019) proposal regarding the nominalizer that this is due to the prosodic subcategorization by the suffix for a foot, together with minimality conditions on the foot.[5] There are additional phonotactic constraints assumed by A and B (2009, 2019) which are additionally used in this analysis. It should be noted that these phonotactic constraints are highly specific and are ideally reduced to more general principles (or the interactions between more general constraints) but will suffice as our goal is to present a brief analysis of syllable structure.

Table 4. Constraint Definitions 1

CONSTRAINT	DEFINITION
FTBIN	Assign a violation for all feet that do not contain two moras
*STRUC(σ)	Assign a violation for all syllables
*I]	Assign a violation for all word-final [+HIGH] vowels (A and B 2009)
*[mid][mid]	Assign a violation for adjacent mid vowels (A and B 2009)

Consider Tableau 1, illustrating lengthening cases as in (1). The suffix is omitted for clarity, but morpheme boundaries are represented by a dash (-). Syllables are represented with parentheses and feet are represented with square brackets.

Tableau 1. Lengthening of a root non-mid vowel before suffix

	/bi-/	FTBIN	*STRUC(σ)
	a. [(bi)]-	*!	*
☞	b. [(bii)]-		*
	c. [(bi)(i)]-		**!

Now consider diphthongization, which occurs in two instances: (i) when the root-vowel is mid (section 1.4); and (ii) when the root-vowel is high (11). The first case is due to the constraint on adjacent mid vowels as shown in Tableau 2, while the latter is due to the constraint on word-final [+HIGH] vowels as shown in Tableau 3. Note that for the following tableaux, we are assuming a relatively high ranking of the IO-faithfulness

[5] With respect to the *lack* of lengthening in certain lexical items (2), the prosodic subcategorization approach encounters complications, but we will put this aside for now.

constraints, DEP-IO and MAX-IO, in order to account for the generalization that these constraints hold only for derived segments (A and B 2009, 2019). We will combine these two constraints in the tableaux for space as FAITH-IO.

Tableau 2. Diphthongization of a root mid vowel

	/po-/	FTBIN	FAITH	*[mid][mid]	*I]	*STRUC(σ)
	a. [(po)]-	*!				*
	b. [(poo)]-		*	*!		*
	c. [(po)(o)]-		*	*!		**
☞	d. [(puo)]-		*			*
	e. [(pou)]-		*		*!	*

Tableau 3. Diphthongization of a root high vowel word-finally

	/ku-/	FTBIN	FAITH	*[mid][mid]	*I]	*STRUC(σ)
	a. [(ku)]-	*!			*	*
	b. [(kuu)]-		*	*!	*	*
	c. [(ku)(u)]-		*	*!	*	**
☞	d. [(kuo)]-		*			*
	e. [(ku)(o)]-		*			**!

In all the cases above, the interaction of the constraints creates a surface representation where the two vowel's moras are syllabified monosyllabically. Specifically, *STRUC(σ) excludes the string-identical prosodic structure where the moras are heterosyllabic. Consequently, the tonal generalization can be accounted for under the assumption that the tone-bearing unit (TBU) is a syllable (A and B 2009, 2019). This predicts the generalization that VV-sequences in lengthening environments will surface with the same tone on both vowels.[6]

3.2 Plural marking in /-E/

The asymmetry in our generalizations arises in forms which include a morpheme boundary. We capture this here by restricting the creation of syllables across morphemes. This analysis is consistent with the idea that certain suffixes may subcategorize for prosodic units, such as the foot in A and B (2019). In this case, suffixes will

[6] This also predicts that these tones will always behave uniformly, independently of the analysis of tonal processes in the language.

preferentially align to a syllable boundary.[7] This is formalized with the following constraint in Table 5, implemented in Tableau 4.

Table 5. Constraint Definition 2

CONSTRAINT	DEFINITION
ALIGN[SUFFIX, L, σ, R]	Assign a violation for all suffixes whose left edge does not correspond to the right edge of a syllable

Tableau 4. No association to syllables across morpheme edges

	/lɛ-E/	FTBIN	FAITH	*[mid][mid]	*I]	ALIGN	*STRUC(σ)
	a. [(lɛ-ɛ)]			*		*!	*
☞	b. [(lɛ)-(ɛ)]			*			*

This analysis has the advantage of explaining the tonal restriction on VV-sequences arising from lengthened vowels and the absence of these restrictions on their counterparts at morpheme boundaries. Additionally, this analysis disambiguates VV-sequences with differing qualities to show that sequences such as {ue, ɔɛ, oe} as seen in (10) are not diphthongs but rather instances of vowel hiatus. This constrains the possible diphthongs in the language to those found in lengthening environments, {uo, ʊo, ie, ɪɛ}.

3.3 Moraic affixes

We now turn to cases of singular marking with V, as presented in section 2.3. While the analysis so far correctly predicts the surface forms of (11) as instances of diphthongization as demonstrated in the tableau in (16), the forms in (12) are problematic. Recall that our working assumption is that tautosyllabic Vs will have the same tone. Consider, then, the form (12a) /gbè/ 'forehead.SG' whose surface form is [gbìé], suggesting a heterosyllabic analysis. If, following A and B (2009), these forms are treated as unmarked and diphthongization is due to minimality conditions, we predict the incorrect form as optimal, as in Tableau 5. A low-ranking CONTIGUITY-IO constraint is assumed, but not represented in the tableaux due to space.

[7] It appears necessary to have both alignment to the foot and to the syllable. In cases such as /ba-UU/ whose surface form is [[(baa)]-ʊ] (A and B 2019: 35), there is alignment to the foot. Another possible surface form is *[[(ba)-(ʊ)]ʊ] where alignment to the syllable is respected but alignment to the foot is not.

Tableau 5. The incorrect output

	/gbe/	FTBIN	FAITH	*[mid][mid]	*I]	ALIGN	*STRUC(σ)
	a. [(gbe)]	*!				*!	*
	b. [(gbee)]		*	*!			*
	c. [(gbe)(e)]		*	*!			**
	d. [(gbe)(i)]		*		*!		**
	e. [(gbei)]		*		*!		*
	f. [(gbi)(e)]		*				**!
☞	g. [(gbie)]		*				*

This would, by the logic of our analysis, suggest either **gbíé* or **gbìè* over the actual surface form *gbìé*. In other words, while the correct segmental information is ensured by the markedness constraints, treating these forms as monomorphemic predicts a syllable structure which, under our current assumptions about tone, derives the incorrect tonal melody.

In this light, let's consider an alternative analysis where the forms in (12) are not unmarked. Instead of being analogous to the forms in (11), we assume that these forms are morphologically marked with a mora, shown in Tableau 6. In this case, the mora will create a morpheme boundary and thus incur violations of ALIGN.

Tableau 6. Mora-affixation analysis

	/gbe-μ/	FTBIN	FAITH	*[mid][mid]	*I]	ALIGN	*STRUC(σ)
	a. [(gbe)-(i)]				*!		**
	b. [(gbe-i)]				*!	*!	*
☞	c. [(gbi)-(e)]						**
	d. [(gbi-e)]					*!	*

While both this analysis and A and B's (2009) analysis succeed in correctly capturing the segments and their order in these forms, our analysis unifies these forms under the general pattern of interaction between the morphology, tone, and segmental information in VV-sequences.

This analysis leads to the conclusion that forms in (11) and forms in (12) have distinct syllable structures, derived from distinct processes. (11) shows the hallmarks of lengthening (diphthongization) due to binarity requirements, while (12) is instead an instance of vowel hiatus derived here by a moraic affix.

3.4 Summary

The above analysis accounts for both tonal asymmetries and the diphthong inventory of Dàgáárè with reference to the syllable structure. The tone melody over VV-sequences

was shown to depend on whether the Vs are tautosyllabic, in which case they would have identical tone, or heterosyllabic, in which case they could bear distinct tone. The diphthong inventory was also shown to be more constrained that all possible VV-sequences. Possible diphthongs in Dàgáárè are {uo, ʊo, ie, ɪɛ}, while other sequences which occur at morpheme boundaries, were analyzed as vowel hiatus. Finally, this picture of syllable structure led to a reanalysis of once class of "unmarked" vowel epenthesis in the nominal number paradigm as the morphological marking of number with a mora.

4. Conclusion

Throughout this paper, we have shown that the tonal asymmetry from which we departed can be accounted for without much reference to tone itself. Together with a clearer picture of the syllable structure of Dàgáárè and the assumption of a one-to-one mapping of tone to syllable, the asymmetry in the restrictions found in morphologically simple vs. morphologically complex environments was accounted for. By clarifying the syllabification of VV-sequences, we hope to have provided a clearer picture of the intermediate prosodic structures of Dàgáárè, which will complement both prior and future investigations.

References

Antilla, Arto and Adams Bodomo. 2009. Prosodic morphology in Dagaare. In *Selected Proceedings of the 38th Annual Conference on African Linguistics: Linguistic Theory and African Language Documentation*, ed. Masangu Matondo, Fiona Mc Laughlin, and Eric Potsdam, 56-68. Somerville, MA: Cascadilla Press.

Antilla, Arto and Adams Bodomo. 2019. Metrically conditioned vowel length in Dagaare. In *Theory and description in African Linguistics: selected papers from the 47th Annual Conference on African Linguistics*, ed. Emily Elem, Peter Jenks, and Hannah Sande, 21-39. Berlin: Language Science Press.