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Moraic preservation and equivalence in Gújjolaay Eegimaa perfective reduplication

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Abstract: The role of syllable weight in Gújjolaay Eegimaa, an Atlantic language spoken in south-western Senegal, is evidenced by reduplicative patterns in the perfective stem, where we witness a difference in the surface representation of verb roots with underlying voiced obstruents from those with underlying voiceless obstruents. We argue that voiced plosives are weight bearing and therefore considered as moraic when in coda position in this language. We attribute the triggering of the gemination in the reduplicative perfective with roots having final voiced plosives to compensatory lengthening in order to make up for the loss of a mora as motivated by Hayes (1989). Gemination, rather than vowel lengthening, occurs because, as stated by de Chene and Anderson (1979) compensatory lengthening of vowels only occurs in a language where vowel length is contrastive. In this paper, we show evidence to support the proposition that there are no long vowels in this variety of Eegimaa, and therefore gemination (which is a contrastive feature in the language) is the repair strategy employed to compensate for the loss of a mora. Through a description of the weight-related processes observed in perfective reduplication in Eegimaa, we will detail the moraic analysis of the various patterns and discuss general phonological implications.

Keywords: mora preservation; reduplication; sonority hierarchy; Jóola/Diola; Gújjolaay Eegimaa

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Eegimaa abstract: Ñammeŋe uomal me n'elob, pan úgulenoral bavvoger babu baa waf wawu wo nulobale me mala wo. Uno me n'eggitten búoh an natebe waf, nújue uoh natetteb. Eno bi epikkor bavvoger babu, pan uoh na teb-teb. Burokk babu bo joom me n'ekkan toute, eggitten wa ukkane, ni bu balober ti boubu nahi búgulenori.

1 Introduction

Gújjolaay Eegimaa (hereafter known as Eegimaa), displays a complex pattern of reduplication in the perfective. Verb roots which contrast solely on the basis of the presence or absence of voicing in the root-final consonant are presented in (1).[1]

(1) Minimal Pairs

a. [ɛ-kɔk] 'to attach' [nɪ-kɔk-ɛ] 'I attached' [nɪ-kɔ-kɔk] 'I had attached'
b. [ɛ-kɔg] 'to be close' [nɪ-kɔg-ɛ] 'I was close' [nɪ-kɔ-kkɔg] 'I had been close'

By comparing the reduplicated perfective form of the verb stem in (1a) with that of (1b), we see that the final consonant of the base verb has been omitted in both, but the latter surfaces with a geminated consonant whereas the former is faithful to the root form. The process of gemination in (1b) has been previously analyzed as being the result of assimilation (Sagna 2008) or assimilation along with mora preservation (Bassène 2012).

Here, following up on Bassène (2012) we argue that the patterns of gemination formation witnessed in the reduplicated perfective can be better understood as motivated by moraic preservation. While in certain ways our analysis is similar to Bassène (2012), it differs from him especially in the analysis of the behavior of vowel-initial roots and roots with initial geminates in the reduplicative perfective. Moreover, our analysis emphasizes the requirement of moraic equivalence between the reduplicant and the base. That is, in perfective reduplication the reduplicant and the base surface with the same number of moras.

Before presenting the data and our analysis, we briefly present background information on Eegimaa and the relevant phonological characteristics of the language in Section 2. Sections 3 and 4 present the reduplication data where we detail our analysis in terms of mora preservation and moraic equivalence. Section 5 discusses some of the implications of the analysis for phonological theory and Section 6 offers a conclusion.

1 Note that while postvocalic singleton obstruents in Eegimaa undergo lenition as presented in Section 2.2, for. sake of simplicity, we transcribe obstruents in this paper as phonemic forms even when discussing surface forms.

2 Background

Eegimaa is a variety of Jóola spoken in Southwestern Senegal. Eegimaa is one of a cluster of languages and dialects, also represented in the literature as Diola that is classified as being a Bak language within the Atlantic branch of Niger-Congo. In the phonological literature, the best-known language of this cluster is Diola Fogny documented by Sapir (1965); the syllable patterns have been analyzed by Itô (1986) and Kager (1999) among many others. The discussion and data in this paper are based on the work of Sagna (2008) and Bassène (2012) as well as the fieldwork of the first two authors. Additional insights regarding Eegimaa phonology are provided by Bassène (2007). The particular variety of Eegimaa being described in this paper is Eegimaa Essil and at times we will reference neighboring Eegimaa Banjal for comparison. Consequently, when we use the language name Eegimaa in this paper we are referring to Eegimaa Essil.

Salient phonological properties of Eegimaa are presented here; the vowel inventory in Section 2.1, the singleton consonant inventory in Section 2.2, and the geminate consonant inventory in Section 2.3. Our study focuses on verbs since the reduplication process witnessed in the perfective stem constitutes an interesting case of mora preservation. We differentiate verb roots from verb stems in Eegimaa whereby the former constitutes an underlying, and therefore abstract, mono-morphemic unit, the latter is the surface, phonetic form, composed of (in most instances) an inflectional person prefix and optionally inflectional and derivational suffixes.

2.1 Vowel inventory

The vowel inventory of Eegimaa is a 10 vowel system with an overt contrast between all vowel heights for the feature [ATR]: /ɪ i ɛ e a ə ɔ o u ʊ/ where /ə/ is a [+ATR] low vowel. Verb roots spread their [ATR] feature to unspecified affixes, such as the infinitival prefix, as illustrated in (2). We represent the underlying [±ATR] specification of the prefix as being [−ATR] because that feature is more common in the language although we note that [±ATR] value of the infinitival prefix vowel could also be represented as underspecified.[2]

2 An anonymous reviewer suggests that evidence in favor of a default [−ATR] feature in the language is found among certain suffixes specified with the [+ATR] feature and that spreads leftward to the beginning of the word. While this can be interpreted as an instance of [+ATR] dominance, we leave the matter of the exact nature of Eegimaa [ATR] vowel harmony to future research since it does not bear on the reduplicative phenomenon that is the focus of this article.

(2) Minimal [±ATR] pairs

	Input	Output	Gloss		Input	Output	Gloss
a.	/ɛ-med /	[emed]	‘to swallow’	f.	/ɛ-sɛn /	[ɛsɛn]	‘to give’
b.	/ɛ-ccik /	[eccik]	‘to shave’	g.	/ɛ-tɪkk /	[ɛtɪkk]	‘to stuff’
c.	/ɛ-dop /	[edop]	‘to step back’	h.	/ɛ-tɔpp /	[ɛtɔpp]	‘to deafen’
d.	/ɛ-jjuk /	[ejjuk]	‘to be ripe’	i.	/ɛ-pʊt /	[ɛpʊt]	‘to rot’
e.	/ɛ-bəko /	[ebəko]	‘to turn’	j.	/ɛ-ban /	[ɛban]	‘to finish’

Verb roots with an underlying [−ATR] specification leave the infinitival prefix unchanged from its underlying [−ATR] value (2f–j) while those with underlying [+ATR] vowels (2a–e) change the value of the infinitival vowel to harmonize with that of the root.

There are no phonemic nasalized nor phonemically long vowels in the inventory. That is, in derived environments, when two vowels occur in sequence in Eegimaa in the dialect of Essil, as in [e.it] ‘to fly’, the adjacent vowels are in distinct syllables. That is, vowel hiatus is allowed to occur (see both Bassène (2012) and Sagna (2008) on hiatus). To this end, we follow (Sagna 2008: 76), “[I]n the variety of G.E. spoken in Essil, adjacent vowels are always heterosyllabic”. While the vowel inventory is otherwise fairly uncontroversial in the literature on Eegimaa, the consonantal inventory is subject to debate as outlined in the following subsection.

2.2 Consonant inventory

As shown in (3), the Eegimaa singleton consonantal inventory consists of a series of voiced and voiceless plosives and voiced nasals at the bilabial, alveolar, palatal, and velar place of articulation. Fricatives contrast in voicing at the labiodental place of articulation and the only other fricative phoneme is the voiceless alveolar /s/. The remaining phonemes are the lateral approximate /l/ and the two glides /j w/.

(3) Phonemic inventory of singleton consonants in Eegimaa

	Bilabial		Labdent		Alveolar		Palatal		Velar	
Plosive	p	b			t	d	c	ɟ	k	g
Nasal		m				n		ɲ		ŋ
Fricative			f	v	s					
Approx								j		w
Lateral Approx						l				

The most disputed consonants are the representation of voiceless velar plosive and its fricative counterpart. While Sagna (2008) provides convincing evidence that [x] is not a phoneme in the language, Bassène (2012) gives an analysis which crucially hinges upon underlying forms with /x/. As presented below in Section 2.3, each singleton phoneme in Eegimaa has a geminate counterpart. Sagna (2008) argues for the implausibility of a phoneme /x/ due to the fact that there is no geminate */xx/ in the language. Further, this paper illustrates that a process of gemination occurs in the language whereby a singleton consonant effectively doubles. When a surface [x] geminates, [kk] is produced rather than the geminate [xx]. Thus, following Sagna (2008) and differing from Bassène (2007) and Bassène (2012), we do not consider the voiceless velar fricative to be a phoneme.

All singleton consonants in Eegimaa are subject to a process of lenition post-vocalically. The conditions that trigger lenition are disputed and beyond the scope of this paper, but for a detailed overview and analysis see Hantgan-Sonko (2017) as well as Bassène (2007), Sagna (2008), and Bassène (2012). Briefly, both voiced /b d ɟ g/ and voiceless plosives /p t c k/ lenite post-vocalically to [β r ʝ ɣ] and [ɸ t ɕ x], respectively. Stem finally, only voiceless plosives lenite while voiced plosives devoice. For the sake of simplicity and to focus on the reduplicative phenomenon to be considered in this paper, we transcribe obstruents in this paper in their phonemic representation even when discussing surface forms.

2.3 Geminates and historic vowel length

Each singleton consonant phoneme presented in (3) has a phonemic geminate counterpart in Essil Eegimaa. Geminates can occur in root-initial position, as shown by the comparison of the two columns of data in (4), but because stems almost always surface with a prefix (with few exceptions), there are no examples of word forms where a geminate would be in absolute stem-initial (i.e., word-initial) position. Examples of verb roots demonstrating contrastive geminates are given in (4).

(4) Root-initial singleton-geminate minimal (or near minimal) pairs

	Root	Gloss		Root	Gloss
a.	/-**b**ɔɲ/	‘(to) send’	b.	/-**bb**ɔɲ/	‘(to) fold’
c.	/-**p**ap/	‘(to) dust’	d.	/-**pp**ɔɲ/	‘(to) be full’
e.	/-**t**aɟ/	‘(to) fight’	f.	/-**tt**aɟ/	‘(to) be stuck’
g.	/-**d**af/	‘(to) suckle’	h.	/-**dd**aɟ/	‘(to) pound (nail)’
i.	/-**c**ɔb/	‘(to) chose’	j.	/-**cc**am/	‘(to) pay’
k.	/-**ɟ**ʊk/	‘(to) see’	l.	/-**ɟɟ**uk/	‘(to) be ripe’
m.	/-**b**ʊtt/	‘(to) deceive’	n.	/-**bb**ʊt/	‘(to) fish (with a rod)’

The phonemic contrast between singleton and geminate consonants occurs intervocalically, but in stem-final position (with one known exception, ‘jump’ /-ɲəgg/, pronounced as [eɲəg̊]) the only geminates allowed root-finally are voiceless stops, which in turn simplify to singleton plosives stem-finally.

As stated above, all singleton consonant phonemes have phonemic geminate counterparts in the Essil dialect of Eegimaa discussed in this paper. Where this dialect displays geminate consonants, neighboring dialects of Eegimaa have a singleton consonant followed by a long vowel. Examples of roots with geminates in the Essil variety of Eegimaa are compared with those in the neighboring dialect Banjal in (5).

(5) Long vowel – geminate correspondences (Sagna 2008, p. 78)

	Eegimaa Essil		Eegimaa Banjal	Gloss
a.	/-**mm**ɪlʊm/	b.	/-m**ɪɪ**lʊm/	‘ceiling’
c.	/-**pp**an/	d.	/-p**aa**ŋ/	‘kind of fish trap’
e.	/-**ss**ana/	f.	/-s**aa**na/	‘dugout canoe’

While these roots surface as stems with an inflectional prefix, the fact remains that where geminates appear in the Essil variety of Eegimaa, long vowels occur in Banjal, as well as in other Jóola languages. Hantgan-Sonko (2020) proposes that Essil, along with some other varieties of Eegimaa, have developed geminate consonants from historically long vowels. The synchronic consequence of this diachrony is that the geminate consonants of Essil can be viewed as being underlying moraic in that they preserve the extra mora from the historical long vowel from which they are derived.

2.4 Syllable phonotactics

According to both Sagna (2008) and Bassène (2012) the maximal syllable in Eegimaa is CVC where the nucleus is the only obligatory element. Stem-initially, any singleton consonant may occur. Stem finally, any consonantal phoneme may appear (with some surface phonetic restrictions on voicing and manner). Moreover, as noted by Bassène (2012: 75–76), both voiceless geminates and nasal-plus-voiced stop clusters can occur in stem-final position, but these simplify on the surface when they are in absolute word-final position: a voiceless geminate reduces to a singleton and a nasal-plus-voiced stop cluster reduces to the nasal component. With respect to the initial position, as noted in the previous subsection, roots can begin with a geminate consonant, but since this is almost always preceded by a prefix, the stem-initial geminate is heterosyllabic, forming the coda of the prefixal syllable and the onset of the following syllable. Stem-internal consonant clusters (maximally two) are heterosyllabic and always obey syllable contact (i.e., there is a complete avoidance of rising sonority clusters over a syllable boundary). The sonority hierarchy we reference is that outlined by Zec (1995, 2007), and Parker (2011), where we highlight a sonority distinction in the voicing of obstruents, which does not play a role in the sonority hierarchy of many languages, but will be shown to play a role in Eegimaa.

Vowels > Glides > Liquids > Nasals > Voiced Obstruents > Voiceless Obstruents

Furthermore, as in Diola Fogny (Itô 1986), Coda Condition (CODACON) is strictly respected in Eegimaa. The Coda Condition states that all stem-internal coda consonants share place features with a following onset. In other words, a coda does not license its own place features, meaning that a stem-internal coda can only surface if it shares place feature with the following onset. It is the onset that can license place features. In Eegimaa, the only stem-internal codas allowed are the first part of a geminate or a nasal followed by a homorganic voiced plosive. (In Diola Fogny, a coda nasal may be followed by a homorganic voiceless plosive. The cognate of a Fogny nasal-voiceless plosive cluster in Eegimaa Essil is a voiceless geminate plosive, but only surface stem-internally; stem-finally, geminates and nasal-consonant clusters are reduced to singleton plosives.) An example from the reduplicated perfective in Eegimaa shown in (6) illustrates the repair strategy, which occurs to avoid a potential violation of CODACON.

(6) Eegimaa reduplicative perfective
/nɪ-bɔ**k**-bɔk/
1S-dance-RED
[nɪbɔ**b**ɔk]
'I danced.'

The root /-bɔk/ of the stem 'to dance' [ɛ-bɔk] ends in a consonant which, when suffixed as a reduplicant onto the base in the perfective aspect, could result in a potentially impermissible consonant cluster *[kb]. The violation of CODACON is avoided by the deletion of the base-final consonant /k/.[3]

With respect to the representation of coda consonants, the distinction between a singleton voiceless consonant in coda position and a geminate consonant reflects moraic structure. We follow Hayes (1989) in viewing geminate consonants as being underlyingly moraic. We also present evidence, following Bassène (2012), that a voiced consonant in coda position can be analyzed as being moraic in Eegimaa. However, unlike a geminate, the voiced coda consonant is not underlyingly moraic but acquires a mora by Weight-by-Position (Hayes 1989); this is a rule (or constraint) that assigns a mora to a coda, and as Zec (1995) shows, may be

3 Ito (1986) discusses examples from Diola Fogny to illustrate deletion as a possible repair strategy for a violation of CodaCon.

sensitive to the sonority of the coda. As we have noted above, the language does not have a phonemic contrast between voiced singleton consonants and corresponding voiced geminate consonants in stem-final position. The difference between moraic and non-moraic consonants in the language will be shown to play an important role in the phonological analysis of the reduplicative perfective.

3 Data presentation and moraic analysis

Before illustrating cases of reduplicative forms involving alternations, we first present cases of full reduplication in order to show that it is the verbal root that reduplicates in the formation of the perfective stem. Most, but not all, monomorphemic roots in Eegimaa are also monosyllabic. Roots that end in a vowel illustrate complete, or faithful, reduplication of the verb root in the perfective aspect as shown in (7). As in the case of the infinitival prefix, we assume a default [−ATR] value for the pronominal prefixes that can be overridden by the [+ATR] value of a root or suffix specified as such.

(7) Vowel-final roots reduplicated

	Root	Faithful RED	Output	Gloss
a.	/lɔ/	/nɪ-lɔ-lɔ/	nɪ-lɔ-lɔ	'I fell'
b.	/fa/	/nɪ-fa-fa/	nɪ-fa-fa	'I continued'
c.	/sudo/	/nɪ-sudo-sudo/	ni-sudo-sudo	'I burnt myself'

Examples (7a–b) show the more common type of root in Eegimaa: monosyllabic, mono-morphemic roots. Roots with final vowels remain intact in the perfective reduplicated stem. Likewise, a bisyllabic root with a final vowel such as (7c) remains faithful to the underlying form in the reduplicated stem. The example in (7c) makes clear that it is the verbal root that reduplicates.

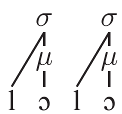
Although Bassène (2012) views the reduplicant as prefixal, we accept arguments from an anonymous reviewer to the contrary; that in fact the reduplication is suffixation. As the reviewer points out, and we confirm, object pronouns, when present, suffix to the first verb, as do other inflectional and/or derivational affixes. Although we do not treat complex reduplicative perfective stems in this paper, the example shown in (8) provides evidence to support this reasoning.

(8) Complex Eegimaa reduplicative perfective stem
/fu-mʊk-i-mʊk/
3SG-kill-2SG.DO-RED
[fʊmʊkɪmʊk]
'It (war) kills you.' (Sagna 2008: 90)

That is, as the reviewer accurately states, all additional material to the Eegimaa verb stem is inserted between the two reduplicative components, thus it stands to reason that if it were indeed prefixation, we would expect the object marker and other suffixes to follow the second instance of the verb rather than the first.

A prosodic representation of the syllabic structure of the output in (7a) is given in (9) where the vowel is indicated as being moraic.

(9) Syllabic analysis of (7a)



Because no violation of CODACON is incurred in verb roots with final vowels in the reduplicative perfective, no consonantal deletion is necessary; the reduplicative stem is faithful to the input segmental and prosodic structure. In the next section we explore examples of verb stems with obstruent-final and nasal-final roots in which we see the repercussions of deletion in the reduplicative perfective to avoid impermissible clusters.

3.1 Mora preservation

The role of mora preservation in Eegimaa reduplication can be seen by the comparison of stems that end in voiceless obstruents and voiced obstruents. Similar data for Eegimaa have been discussed by both Sagna (2008) and Bassène (2012). Like Bassène (2012), we will pursue a moraic analysis, but with some differences. First, in (10) we present examples of roots ending in voiceless obstruents. The column marked 'Faithful RED' indicates the reduplication of the stem without any of the phonological changes; the column marked 'Output' shows the output with the relevant phonological changes at the reduplicative boundary (where, as mentioned above, the root reduplication is viewed as being suffixal rather than prefixal). We do not indicate lenition of obstruents in the output forms so as to focus on the alternations that are specific to the reduplicated forms.

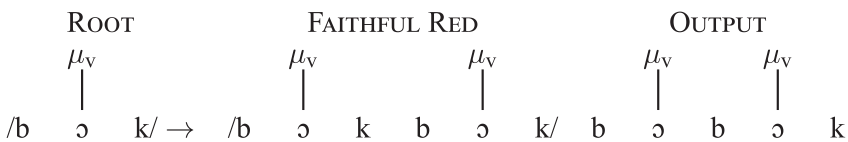
(10) Voiceless obstruent-final roots reduplicated

	Root	Faithful RED	Output	Gloss
a.	/bɔk/	/nɪ-bɔ**k**-bɔk/	nɪ-bɔ**b**ɔk	'I danced'
b.	/kic/	/nɪ-ki**c**-kic/	ni-ki**k**ic	'I wrote'
c.	/pit/	/nɪ-pi**t**-pit/	ni-pi**p**it	'I harvested'
d.	/tɔs/	/nɪ-tɔ**s**-tɔs/	nɪ-tɔ**t**ɔs	'I moved'
e.	/somut/	/na-somu**t**-somut/	nə-somu**s**omut	's/he is sick'

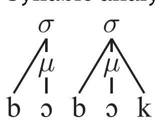
Examples (10a–d) illustrate CVC verb roots which, if reduplicated faithfully, would incur violations of CODACON due to the restrictions on non-homorganic obstruent clusters. The deletion of the voiceless final obstruent of the root (base) before the suffixal reduplicant serves to prevent a potential violation of CODACON. The example in (10e) illustrates that bisyllabic roots with final voiceless obstruents also adhere to the same condition and undergo the same repair in deleting the final obstruent of the verb base in the reduplicant output stem.

In (11) we provide a prosodic perspective of our analysis illustrating the moraic structure of the first word from (10), followed by the syllabic representation of the output in (12).

(11) Moraic analysis of (10a)



(12) Syllabic analysis of the output of (10a)



We see from (12) that although the final obstruent of the input root is deleted in the faithful reduplicant, we witness no compensatory lengthening (Hayes 1989; Hyman 1985) in the output perfective stem. We argue that the reason for the deletion of root-final /k/ is due to its potentially creating an impermissible consonant cluster. As Itô (1986) has shown for Diola Fogny, deletion is the general strategy for avoiding a violation of CODACON. The absence of syllable weight compensation is due to our supposition, following Bassène (2012) that singleton voiceless obstruents do not gain a mora in Eegimaa. This keeps them distinct from the stem-final voiceless geminate consonants which are inherently moraic.

To further the claim that singleton voiceless obstruents are not moraic in Eegimaa, the data in (10) illustrating roots with final voiceless obstruents should be contrasted with those in (13) with final voiced obstruent roots. While all root-final obstruents delete in the root of the reduplicative base, irrespective of the verb root's underlying voicing specification, roots which end in final voiced obstruents differ from those which end in voiceless obstruents in a secondary strategy, for which we argue is due to mora preservation. The processes whereby a root undergoes both deletion and subsequent gemination are shown in (13).

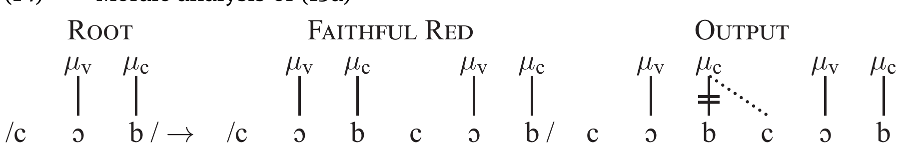
(13) Voiced obstruent-final roots reduplicated

	Root	Faithful RED	Output	Gloss
a.	/cɔb/	/nɪ-cɔ**b**-cɔb/	nɪ-cɔ**c**-cɔb	'I chose'
b.	/bɛd/	/nɪ-bɛ**d**-bɛd/	nɪ-bɛ**b**-bɛd	'I laughed'
c.	/dɛg/	/nɪ-dɛ**g**-dɛg/	nɪ-dɛ**d**-dɛg	'I annoyed'
d.	/tɔɟ/	/nɪ-tɔ**ɟ**-tɔɟ/	nɪ-tɔ**t**-tɔɟ	'I closed'

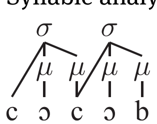
We see in (13), as was shown for roots which end in voiceless obstruents in (10), that the base-final obstruent deletes before the initial consonant of the suffixal reduplicant in the perfective stem. We maintain that the deletion is a strategy to prevent a violation of CODACON. The difference we see between roots with final voiceless obstruents (11) and those with final voiced obstruents is an additional process of gemination in the output of the examples in (13). We attribute the gemination of the base-final obstruent in Eegimaa to a process of mora preservation by compensatory lengthening (Hayes 1989; Hyman 1985). That is, voiced obstruents are considered moraic in coda position and thus the deletion of a voiced obstruent triggers compensatory lengthening. Although compensatory lengthening is often understood to be a process which affects vowels (de Chene and Anderson 1979), as noted above, there is no contrast for length among vowels in Eegimaa, therefore the base-initial obstruent is geminated to preserve the underlying mora.

In (14) we show the prosodic (moraic) representation of our analysis of the first word in (13) along with a syllabic representation of its output in (15).

(14) Moraic analysis of (13a)



(15) Syllabic analysis of output (13a)



As was shown in (11), the underlying root-final obstruent of the base is deleted so as to avoid an impermissible obstruent cluster that would occur in a faithful reduplicative perfective stem. The difference that is clearly illustrated by the moraic structure in (14) is that the voiced obstruent in coda position is associated with a consonantal mora. Whereas in (11) no compensation occurred, here we see that the deletion of the voiced obstruent causes the following consonant to geminate.

When the segmental material of the base coda is removed, its mora is preserved by the spreading of the first obstruent of the suffix to form a geminate. As shown in (15), the initial part of the geminate in the output forms the coda of the first syllable and the second part forms the onset of the second syllable.

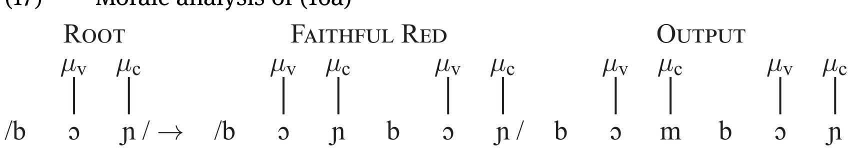
As mentioned earlier in Section 2, in the discussion on syllable phonotactics, Eegimaa allows for a nasal coda followed by a voiced obstruent, but not a nasal coda followed by a voiceless obstruent. This difference is shown to play a role in the reduplicative perfective. Consider the data in (16) where CVC roots begin with a voiced plosive and end in a nasal.

(16) Reduplication of roots ending in a nasal consonant (with a root-initial voiced obstruent)

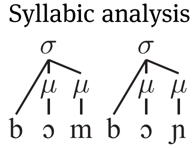
	Root	Faithful RED	Output	Gloss
a.	/bɔɲ/	/nɪ-bɔ**ɲ**-bɔɲ/	nɪ-bɔ**mb**ɔɲ	'I sent'
b.	/dɛm/	/nɪ-dɛ**m**-dɛm/	nɪ-dɛ**nd**ɛm	'I drank'
c.	/ɟʊn/	/nɪ-ɟʊ**n**-ɟʊn/	nɪ-ɟʊ**ɲɟ**ʊn	'I am isolated'
d.	/gan/	/nɪ-ga**n**-gan/	nɪ-ga**ŋg**an	'I have lost weight'

In the second column of (16), we see that a nasal appears in the coda of the base root, followed by an initial voiced plosive of the suffixal reduplicant. As seen in the output, the nasal consonant partially assimilates to the place of articulation of the voiced plosive. No deletion is incurred in the output because there is no violation of CODACON. That is, in the output, the nasal coda shares the place features of the following voiced plosive. This analysis is represented in (17) with the syllabic representation provided in (18).

(17) Moraic analysis of (16a)



(18) Syllabic analysis of (16a)



In Eegimaa, all nasal consonants in coda position are moraic. Further, nasal-voiced consonant clusters are attested as permissible clusters in Eegimaa. Therefore, among roots with initial voiced consonants and final nasals, at the morpheme boundary between the root base and the reduplicative verb stem, a violation of CODACON is not incurred, unless the obstruents are non-homorganic. If the obstruents in contact are not homorganic, as in the example diagramed in (17), the only necessary repair is a simple process of place assimilation. No change is made to the underlying moraic structure from the faithful reduplicant to the output.

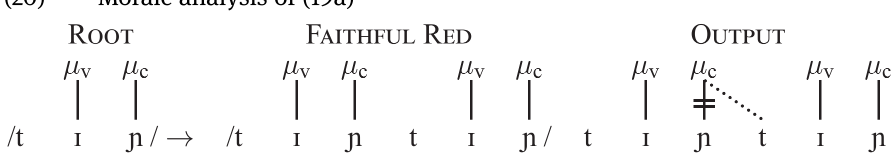
As we have seen thus far, the deletion of a voiced obstruent in coda position of a verb stem incurs compensation while the deletion of a voiceless obstruent does not. In contrast to the data shown above in (16), data in the second and third column of (19) show that a nasal in the coda of a base stem which precedes a voiceless plosive of the reduplicative suffix does not undergo partial assimilation. For example, the third form in (19) does not surface as *__nɪ-pɪmpɪn__ (and is unlike what occurs in Diola Fogny where partial assimilation does occur before a voiceless obstruent; see Itô 1986).

(19) Reduplication of roots ending in a nasal consonant (with a root-initial voiceless obstruent)

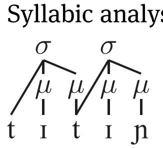
	Root	Faithful RED	Output	Gloss
a.	/tɪɲ/	/nɪ-tɪ**ɲ**-tɪɲ/	nɪ-tɪ**tt**ɪɲ	‘I ate’
b.	/sɛn/	/nɪ-sɛ**n**-sɛn/	nɪ-sɛ**ss**ɛn	‘I gave’
c.	/pɪn/	/nɪ-pɪ**n**-pɪn/	nɪ-pɪ**pp**ɪn	‘I counted’
d.	/faŋ/	/nɪ-fa**ŋ**-faŋ/	nɪ-fa**ff**aŋ	‘I surpassed’

Instead, the nasal consonant in the coda deletes, triggering gemination of the following consonant. This can be viewed as another instance of mora preservation under the view that the nasal coda obstruent, being voiced, is moraic, as illustrated below in (20) and (21).

(20) Moraic analysis of (19a)



(21) Syllabic analysis of (19a)



As discussed above, the only nasal-oral consonant clusters permitted in Eegimaa are those in which the oral consonant is a voiced plosive. In cases where there is a following voiceless stop as in the faithful reduplicant of (16), there is no voicing of the plosive (with subsequent nasal place assimilation); rather the final nasal of the base root deletes. Since the deleted nasal is moraic, its deletion does not entail the deletion of its mora. The mora is then realized by the spreading of the following voiceless consonant, resulting in gemination. The first part of the voiceless geminate serves as the coda of the preceding syllable and the second part becomes the onset of the following syllable as shown in (21).

3.2 Interim summary

In summary thus far, we have seen from (7) that roots which end in vowels reduplicate fully and faithfully in the perfective aspect. Following, those roots that have a voiceless obstruent in the coda, as shown in (10), delete the base-final obstruent in the perfective stem. Next, we saw that roots which end in voiced obstruents in (13) also delete the final obstruent of the base in the perfective aspect, but with the additional step of geminating the reduplicant-initial obstruent. In this case the deleted segment is moraic, and its deletion triggers compensatory lengthening to preserve the mora.

We propose that a broader consideration of the data shown thus far is that mora preservation of the deleted moraic coda of the faithful reduplicant takes place only among roots with final voiced obstruents, such as those represented in (13). Specifically, among roots with final voiced consonants, from a derivational perspective, when the voiced coda obstruent of the reduplicant deletes to satisfy CODACON, gemination of the onset is triggered by mora preservation of the deleted voiced coda obstruent. There is no gemination among the data in (10) because single voiceless obstruents are not assigned a mora (a sonority-based difference).

4 Previously unanalyzed verb roots

As noted above, previous analyses of the behavior of the reduplicative perfective in Eegimaa give an assimilatory explanation as the implementation of geminates. The moraic analysis we provide here is substantiated with hitherto unresolved data such as verb roots with initial vowels, where assimilation would not be an issue.

4.1 Evidence against assimilation

Further evidence that there is a moraic distinction between voiced and voiceless coda consonants comes from the reduplication of vowel-initial roots shown in (22) and (26). First consider VC roots that end in a voiceless consonant as given in (22).

(22) Vowel-initial, voiceless consonant-final roots reduplicated

	Root	Faithful RED	Output	Gloss
a.	/ap/	/nɪ-a**p**-ap/	nɪ-**aa**p	'I forged'
b.	/ɪf/	/nɪ-ɪ**f**-ɪf/	nɪ-**ɪɪ**f	'I breathed'
c.	/ɛs/	/nɪ-ɛ**s**-ɛs/	nɪ-**ɛɛ**s	'I sliced'
d.	/ak/	/nɪ-a**k**-ak/	nɪ-**aa**k	'I weeded'

Surprisingly, a final voiceless consonant of the base deletes before the vowel-initial suffixal reduplicant in the perfective stem. In order to understand why this happens we must consider the faithful reduplicant shown in the middle column of (22). First, if the base-final voiceless consonant were to be syllabified in the coda of the penultimate syllable, as in the hypothetical example in (23a) below, then the coda consonant of the base would delete because of the violation of the Coda Condition which stipulates that a word-internal coda must not license its own place features. Moreover, the base-final voiceless consonant does not re-syllabify as the onset of the reduplicant suffix syllable as shown in the hypothetical example (23b).

(23) Potentially viable candidates for (22a)

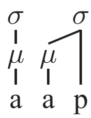
Faithful Syllabification	Re-syllabification	Attested Output
a. *[nɪ.a**p**.ap]	b. *[nɪ.a.**p**ap]	c. [nɪ.a.ap]

While the re-syllabified output in (23b) seems phonotactically possible in the language, we note following McCarthy and Prince (1986) and Downing (2006) that a reduplicative boundary can have its own special properties different than a boundary between a stem (or root) and an affix. In Eegimaa, re-syllabification typically applies when a vowel-initial suffix occurs after a root-final consonant, but as we see in (23), re-syllabification of a coda consonant over a reduplicative boundary is blocked. This observation may reflect the special boundary strength between the base and the reduplicative suffix; such has been noted in other languages (e.g., Downing 2006; McCarthy and Prince 1986). Consequently, the base-final voiceless obstruent deletes as shown by the output form in (23c), resulting in hiatus. The syllabification of the attested output is shown in detail in (24) and (25).

(24) Moraic analysis of (22a)

Root		Faithful RED				Output		
μ_V		μ_V		μ_V		μ_V	μ_V	
|		|		|		|	|	
/a	p/ →	/a	p	a	p/	a	a	p

(25) Syllabic analysis of (22a)



Previously, in (10) we saw that roots with final voiceless obstruents when reduplicated undergo deletion to prevent an impermissible consonant cluster. Interestingly, although there is no potential impermissible consonant cluster to avoid among roots with initial vowels, the base-final consonant still deletes. The actual output shown in (25) maintains the moraic structure of the faithful reduplicant shown in (24).

Among roots with final voiceless obstruents shown in (22), we do not witness compensatory lengthening since the deleted voiceless consonant is not moraic. Strong evidence for the moraic nature of voiced coda consonants comes from reduplication of VC roots ending in voiced consonants shown in (26). Verb roots with initial vowels and final voiced obstruents also provide crucial evidence that the process in question is not assimilation. (Roots (26e, f, g) are drawn from Bassène (2012: 104, 103, 145) respectively but are not formally analyzed there.)

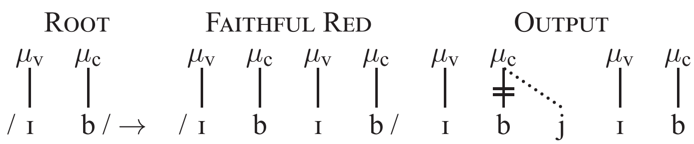
(26) Vowel-initial, voiced consonant-final roots reduplicated

	Root	Faithful RED	Output	Gloss
a.	/ɪb/	/nɪ-ɪ**b**-ɪb/	nɪ-ɪ**jj**ɪb	'I cut'
b.	/iɟ/	/nɪ-i**ɟ**-iɟ/	ni-i**jj**iɟ	'I pulled water from the well'
c.	/aɲ/	/nɪ-a**ɲ**-aɲ	nɪ-a**ww**aɲ	'I cultivated'
d.	/al/	/ɛ-a**l**-al/	ɛ-a**ww**al	'it is ripe'
e.	/ɛl/	/ɛ-ɛ**l**-ɛl/	ɛ-ɛ**jj**ɛl	'it resonated'
f.	/ʊn/	/nɪ-ʊ**n**-ʊn/	nɪ-ʊ**ww**ʊn	'I heard'
g.	/ɔŋ/	/nɪ-ɔ**n**-ɔŋ/	nɪ-ɔ**ww**ɔŋ	'I offered (to share a meal)'

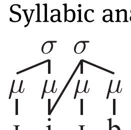
The comparison between the faithful reduplicant in the second column in (26) with the actual output in the third column demonstrates that the final consonant of the base (highlighted in bold) deletes when followed immediately before a vowel-initial, voiced consonant-final reduplicant. The consequence of deleting the final voiced consonant, illustrated by the consonants in bold in the middle two columns of (26), is the insertion of a glide, which is then geminated in order to preserve the mora of the deleted consonant. The place of articulation of the inserted glide is determined by the backness of the surrounding vowels: front vowels (26a, b, e) trigger a palatal glide and back vowels (26c, d, f, g) cause the labiovelar glide to surface. We argue against an analysis that the glide would be part of the underlying root in these forms, as suggested by Bassène (2012), since the glide is always predictable based on the frontness/backness of the root-initial vowel.

Similar to verb roots with an initial vowel and a final voiceless obstruent shown above in (22), we propose that the reason for the base-final deletion among roots with initial vowels and voiced final obstruents shown in (26) is due to a constraint banning the re-syllabification of a coda into an onset over a reduplicative boundary. If the output of (26a) /na-ɪb-ɪb/ were faithful to the input, the default syllabification would be *[na.ɪ.bɪb], with the root-final consonant becoming the onset of the reduplicant. While there is nothing phonotactically illicit with the specific output, the form is disallowed since the [b] in the onset of the final syllable originates as a base coda. As represented in the output shown in (27), the repair is, as an intermediate step, the deletion of the base-final consonant [na.ɪ.ɪb], rather than the gemination of the base-final consonant with root-final voiceless obstruents *[na.ɪb.bɪb], as a coda does not license place features. The loss of the moraic voiced consonant must be compensated for but, because the language does not permit tautosyllabic long vowels, a glide which shares features with the following vowel is inserted and then geminated to preserve the underlying moraic structure of the verb root.

(27) Moraic analysis of (26a)



(28) Syllabic analysis of (26a)



As illustrated in (28), showing the prosodic structure of the reduplicated stem in (26a), the bisyllabic stem consists of four moraic elements; the second element of the inserted geminated glide fills the mora slot of the underlying final voiced plosive of the base.

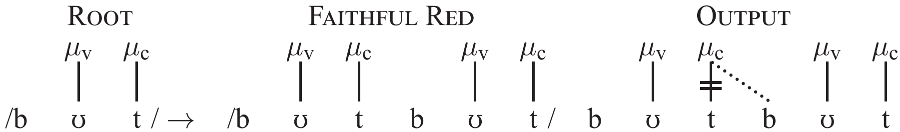
Noted above in Section 2, the only underlying geminates that may surface in stem-final position are those which are voiceless. Irrespective of the fact that all root-final geminates are voiceless, we consider all underlying geminate segments in Eegimaa to be moraic. One reason for this is, as discussed in Section 2.3, that many of the geminates in Eegimaa Essil historically come from roots with long vowels. (Other geminates come from roots that historically ended in a nasal followed by a voiceless consonant; this can be seen in the comparison with Diola Fogny, which still allows for such structures. See Bassène (2012) for more discussion on the comparison between Eegimaa and Diola Fogny.) Evidence for the moraic interpretation of root-final (voiceless) geminates in Eegimaa comes from their behavior in the perfective reduplication. Examples in (29) illustrate that a base-final geminate apocopates when followed by the suffixal reduplicant in the reduplicative perfective stem.

(29) Geminate-final roots reduplicated

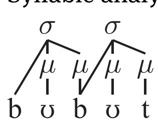
	Root	Faithful RED	Output	Gloss
a.	/bʊtt/	/nɪ-bʊ**tt**-bʊtt/	nɪ-bʊ**bb**ʊt	'I deceived'
b.	/tɪkk/	/nɪ-tɪ**kk**-tɪkk/	nɪ-tɪ**tt**ɪk	'I stuffed'
c.	/sɔpp/	/nɪ-sɔ**pp**-sɔpp/	nɪ-sɔ**ss**ɔp	'I poked someone's eye'
	(compare with 10):			
d.	/bɔk/	/nɪ-bɔ**k**-bɔk/	nɪ-bɔ**b**ɔk	'I danced'

As shown in the prosodic format in (30), to compensate for the loss of the mora which occurs from the deletion of the root-final geminate, the reduplicant-initial consonant geminates, just as we witnessed among roots with final singleton voiced obstruents above in (13) and (26), and those with final nasals in (19). We maintain that the reason for the compensation in (29) is due to the loss of a moraic segment, i.e., the voiceless geminate, so that its mora can be preserved.

(30) Moraic analysis of (29a)



(31) Syllabic analysis of (29a)



In (30) and (31) we prosodically represent the final voiceless geminate as a single articulation but being underlyingly moraic, thus distinguishing it from a singleton voiceless consonant as in (10) and (11) which is not underlyingly moraic. The reason that the voiceless geminate consonant of the base deletes in (30) is because of the Coda Condition: the geminate would be entirely within the coda of the syllable having its own place features. As shown in the output of (30), the geminate consonant deletes but its mora is maintained through the gemination of the following onset in a way similar to what we have seen in (14) for roots with final voiced consonants. These data strongly argue for the underlying moraic nature of geminate consonants as discussed in Davis (2011a).

Root-initial geminates also appear in the language. When a root with an initial geminate is reduplicated in the perfective stem, the reduplicant actually undergoes degemination. Examples are shown in (32).

(32) Geminate-initial, voiceless consonant-final roots reduplicated

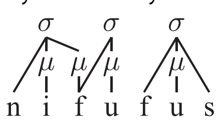
	Root	Faithful RED	Output	Gloss
a.	/ttɛp/	/nɪ-tte**p**-ttɛp/	nɪ-ttɛ-**t**ɛp	‘I built’
b.	/kkɪc/	/nɪ-kkɪ**c**-kkɪc/	nɪ-kkɪ-**k**ɪc	‘I marked’
c.	/ffus/	/nɪ-ffu**s**-ffus/	ni-ffu-**f**us	‘I reached’
d.	/llɪk/	/nɪ-llɪ**k**-llɪk/	nɪ-llɪ-**l**ɪk	‘I measured’
e.	/bbat/	/nɪ-bba**t**-bbat/	nɪ-bba-**b**at	‘I swore’

Examples in (32) illustrate that roots with both voiceless (32a–c) and voiced (32d–e) initial geminates degeminate in the reduplicant of the reduplicated perfective stem. Bassène (2012) proposes that the reason for the degemination is that a geminate in root-initial position is not moraic so it surfaces as a singleton in the output root as shown in (32). Here we suggest a different reason for the root degemination in (32). Given the historical origins of root-initial geminates from roots with long vowels as shown in (5) of Section 2.3, we maintain that root-initial geminates in Eegimaa Essil are indeed underlyingly moraic. Instead, we suggest that the reason that they degeminate in (32) relates to an observation that can be made about perfective reduplication, namely, that in all our data, the syllables containing the reduplicative affix and the syllables containing the base always have the same number of moras. From a perspective of Optimality Theory, one could say that there is a high-ranked constraint requiring this (and see Bassène (2012) for a similar view). The degemination shown in (32) and prosodically illustrated in (33) occurs because the mora of the initial geminate of the base is realized as the coda of the syllable with the initial prefix. The consequence of this is that the root (base) syllable only has a single vocalic mora, namely that contributed by the vowel. The unexpected degemination of the initial geminate of the suffixal reduplicant occurs so that the number of moras between the base and the reduplicant suffix are the same. Moreover, if the geminate at the beginning of the reduplicant syllable were to resyllabify so that it would also form the coda of the syllable containing the base, the result would be a moraic mismatch between the two syllables with the syllable containing the original base having two moras and the reduplicant syllable having just one. Thus a possible output like [ni-f.fuf.fus] for (32c) would be disallowed since the second syllable, which contains the base, would have two moras but the final syllable of the reduplicant would be monomoraic. Consequently, degemination occurs so that there can be moraic equivalence between the syllables that contain the base and the reduplicant. This is illustrated in (34) where the stem-final reduplicant syllable and the penultimate base syllable each consist of a single mora.

(33) Moraic analysis of (32c)

Root					Faithful Red								Output						
	μ_V	μ_C	μ_V			μ_V	μ_C	μ_V		μ_C	μ_V			μ_V	μ_C	μ_V		μ_V	
/n	ɪ	f	u	s/ →	/n	ɪ	f	u	s	f	u	s/	n	i	f	u	f	u	s

(34) Syllabic analysis of (32d)



As further support for the analysis that root-initial geminates are underlyingly moraic, we provide examples where degemination does not occur, namely, in roots with final voiced obstruents; relevant forms given in (35).

(35) Geminate-initial, voiced consonant-final roots reduplicated

	Root	Faithful RED	Output	Gloss
a.	/bbud/	/nɪ-bbu**d**-bbud/	nɪ-bbu-**bb**ud	'I missed'
b.	/nnɔm/	/nɪ-nnɔ**m**-nnɔm/	nɪ-nnɔ-**nn**ɔm	'I bought'
c.	/mmag/	/nɪ-mma**g**-mmag/	nɪ-mma-**mm**ag	'I borrowed'
e.	/ssɪb/	/nɪ-ssɪ**b**-ssɪb/	nɪ-ssɪ-**ss**ɪb	'I refused to share'

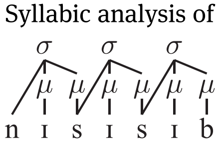
The data shown in (35) further substantiate the claim that root-initial geminates are, in fact, moraic, and that both the simplification of the geminate to a singleton among voiceless final roots in (32) and the preservation of the mora associated with the final voiced consonant of the base in (36) reflects moraic equivalency between the base and the reduplicant as shown in (37).

(36) Moraic analysis of (35d)

Root					Faithful Red								Output							
	μ_V	μ_C	μ_V	μ_C		μ_V	μ_C	μ_V	μ_C	μ_C	μ_V	μ_C		μ_V	μ_C	μ_V	μ_C (delinked)		μ_V	μ_C
/n	ɪ	s	ɪ	b/ →	/n	ɪ	s	ɪ	b	s	ɪ	b/	n	ɪ	s	ɪ	b	s	ɪ	b

Syllabic analysis of (35d)

(37)



Specifically, for the forms shown in (35) and illustrated in (36) and (37), the voiced coda consonant of the base in the faithfully reduplicated form deletes because of CODACON: it cannot surface because it would license its own place features. Its mora, however, is preserved when the first part of the initial geminate of the reduplicant resyllabifies as the coda of the base syllable. Notice that in the actual output, the base and the reduplicant both have two moras after the resyllabification has occurred. The moraic elements of the reduplicant consist of the vowel and word-final voiced consonant and the moraic elements of the base consist of the vowel and the coda, which is moraic since it is part of a geminate. Thus we see that a constraint requiring moraic equivalence between the base and the reduplicant plays an important role in the analysis of Eegimaa perfective reduplication.

4.2 Potentially problematic verb roots

Finally, we consider CVC roots with the same initial and final consonants, the latter of which deletes in the reduplicated perfective as shown by examples in (38). These further illustrate that not only is the process of gemination not one of assimilation, but also that a driving factor in the deletion of the final consonant of the base is one which conspires to preserve the moraic equivalence of the verb base and the reduplicant.

(38) Eegimaa palindromes reduplicated

	Root	Faithful RED	Output	Gloss
a.	/kɔk/	/nɪ-kɔ**k**-kɔk/	nɪ-kɔ**k**ɔk	‘I tied’
b.	/cac/	/nɪ-ca**c**-cac/	nɪ-ca**c**ac	‘I tore’
c.	/pap/	/nɪ-pa**p**-pap/	nɪ-pa**p**ap	‘I dusted’
d.	/gɔg/	/ɛ-gɔ**g**-gɔg/	ɛ-gɔ**gg**ɔg	‘it is narrow’

Faithful reduplicants with root-final voiceless obstruents such as *[nɪ.pap.pap] or *[nɪ.kɔk.kɔk] in (38a–c) are prevented from surfacing because if the geminate were to surface then the coda consonant of the output base (i.e., the first part of the geminate) would be moraic while the corresponding suffix-final consonant of the reduplicant would not be. The correct output stems in the third column preserve the moraic equivalence between the base and the reduplicant where both are monomoraic. The roots with voiceless obstruents (38a–c) can be contrasted with a root with a final voiced obstruent in (38d). We analyze the latter stem as entailing the gemination of the reduplicant initial obstruent, which occurs to preserve the mora of the deleted coda of the (base) root. In the output of (38d), both the base and the reduplicant are bimoraic.

There are other data that we have not considered so far that can be taken as supportive of the moraic preservation analysis. These are shown in (39) where the first two items involve verbal roots that end in a nasal plus a voiced plosive cluster.

(39) Further roots with final moraic consonants reduplicated

	Root	Faithful RED	Output	Gloss
a.	/famb/	/nɪ-famb-famb/	nɪ-fa**ff**amb	'I made a noise'
b.	/ɔnd/	/nɪ-ɔnd-ɔnd/	nɪ-ɔ**ww**ɔnd	'I prepared a corpse for burial'
c.	/akk/	/na-akk-akk/	na-a**ww**ak	'he is tough'
d.	/lɪŋ/	/nɪ-lɪŋ-lɪŋ/	nɪ-lɪ**ll**ɪŋ	'I am strong'
e.	/ɲəgg/	/nɪ-ɲəgg-ɲəgg/	ni-ɲə**ɲɲ**əg	'I jumped'

In examining the data item in (39a) where the verbal root contains an onset and a final nasal cluster, the faithful reduplicant [nɪ-famb.famb] cannot surface as such because the cluster in the coda of the base would not be able to appear before another consonant. We see from the output that the entire cluster deletes and the onset of the reduplicant syllable geminates. Given that the voiced coda of the nasal cluster would be moraic, the gemination preserves the moraic equivalence between the base and the reduplicant, both being bimoraic. The second example in (39) is of particular interest since the root is onsetless but ends in a nasal-voiced plosive cluster. If one considers the fully faithful output, /nɪ-ɔnd-ɔnd/, the coda cluster in the base cannot surface as such since it would violate CODACON in not being place-linked to the onset. The possible output [nɪ.-ɔn.d-ɔnd], where the /d/ of the base syllabifies as the onset of the reduplicant, while phonotactically possible, is not allowed since, as noted regarding vowel-initial roots in (22) and (26), the reduplication boundary prevents the resyllabification of a base consonant into the reduplicant. As a consequence the coda cluster of the base is deleted, but the mora associated with it is preserved by the insertion and gemination of the homorganic glide [w] in a way similar to what was shown in (27). The resulting output shown in (39b) maintains the moraic equivalence between the base and the reduplicant, each being bimoraic. The data item in (39c), where there is a vowel-initial root with a coda geminate, can be accounted for in a way similar to (39b). The last two examples in (39) involve reduplicants with voiced codas that cannot be realized because of CODACON; the coda deletes triggering gemination of the reduplicant onset. Again, the output maintains the bimoraic equivalency between the base and the reduplicant.

A final set of data is shown in (40) where the root contains a diphthong (or final glide).

(40) Glide-final roots reduplicated

	Root	Faithful RED	Output	Gloss
a.	/law/	/nɪ-law-law/	nɪ-la-law	'I requested'
b.	/lɔj/	/nɪ-lɔj-lɔj/	nɪ-lɔ-lɔj	'I swam'

Roots with final glides always show glide deletion in the base without compensatory lengthening. We follow Bassène (2012) in viewing a syllable-final (non-geminate) glide as part of a complex syllable nucleus (i.e., a diphthong). Since Eegimaa does not have long vowels, diphthongs are phonologically short (monomoraic). There is a stipulation that a base diphthong cannot appear before an initial consonant of the reduplicant.

In this Section 4 and in the preceding Section 3, we have given a detailed conception of the intricate patterns of perfective reduplication in Eegimaa. The patterns can be understood best with reference to mora structure as originally observed by Bassène (2012). The two types of consonants that are moraic in Eegimaa are voiced consonants in coda position and geminates (whether voiced or voiceless). The reduplicative patterns that seem to display the total assimilation of a voiced coda consonant of the base to a following onset of the reduplicant reflects not only mora preservation but also an output requirement that the base and reduplicant have moraic equivalence (i.e., the same number of moras). This perspective best explains the data in (26) where there is gemination without assimilation as well as the difference between verb roots with final voiceless geminates in (29) that undergo total assimilation and verb roots ending in singleton voiceless consonants in (10) that delete without triggering gemination. From a certain viewpoint it may seem odd that a geminate consonant would undergo total assimilation whereas its singleton counterpart in the same environment does not; we maintain that this reflects moraic preservation and equivalence and strongly supports the view that geminates in Eegimaa are always moraic. In the following section we will discuss some of the implications of our analysis.

5 Implications

In this section we briefly discuss some of the implications that the Eegimaa data have for phonological theory. In particular, we discuss coda sonority as it relates to moraic structure, the moraic status of underlying geminate consonants, and the analysis of reduplication including boundary effects, the interpretation of CODA-CON, and the status of intermediate forms.

In discussing the phonotactics of Eegimaa in Section 2.4, we noted a difference between a stem-final coda and a stem-internal coda. Any singleton consonant could occur stem- (or root-) finally, but stem-internally the only coda consonants allowed were ones that obeyed the Coda Condition. That is, a stem-internal coda can either be a nasal homorganic to the following voiced plosive or the first part of a geminate. In our analysis of reduplication we maintain that there is a difference between a word-final (singleton) voiceless coda and a word-final voiced coda: the latter gets assigned a mora but the former does not. Evidence for a weight-based difference between voiceless and voiced consonants in coda position comes from the reduplication pattern discussed in Section 4 and is also noted by Bassène (2012). Independent evidence for this distinction in Eegimaa beyond reduplication is hard to come by, but we give two examples, one internal to the language and one based on typology. Internal to Eegimaa, an important observation discussed in Section 2.3 is that (with the one exception of (39e) the only word-final geminates are voiceless consonants. Assuming that a geminate is inherently moraic (Hayes 1989; Morén 1999), a word-final singleton voiceless consonant would not be assigned a mora because it would be non-contrastive with the word-final geminate. On the other hand, given that voiced geminates do not occur word-finally, a voiced consonant (including voiced obstruents) can be assigned a mora without neutralization of the contrast. This difference then becomes salient in the different patterning of reduplication depending on whether the root-final consonant is a voiceless singleton (non-moraic) or voiced (moraic). The typological evidence for a weight difference between voiceless and voiced consonants comes from the work of Zec (1988: 9) on coda moraicity. She illustrates that there are languages where a full range of consonants can appear in coda position, but where only those on the higher end of the sonority scale can be assigned a mora. While Zec only discusses languages such as Lithuanian where coda sonorants are assigned a mora but not coda obstruents, Parker (2002: 1) argues for an elaborated sonority hierarchy in which voiced obstruents are more sonorous than voiceless ones. Given the more elaborate sonority hierarchy argued for by Parker, Eegimaa can be viewed as a language in which voiced obstruents are assigned a mora but (singleton) voiceless ones are not.

A second implication relates to the moraic status of underlying geminates. Since Hayes (1989) posited that geminate consonants differ from their singleton counterparts in being underlyingly moraic, there has been an extensive discussion in the literature on the representation of geminates where various positions are taken. This includes a view that a geminate underlyingly has two skeletal slots (e.g., Ringen and Vago 2011), two root nodes (e.g., Selkirk 1991), various composite views (e.g., Curtis 2003) in addition to the moraic view (see Davis (2011b) for an overview). The word-final root geminates of Eegimaa provide strong support for the moraic perspective of geminates. The most straightforward case is the difference between the outcomes of the reduplication of roots with final (voiceless) geminates and roots with final voiceless singleton consonants. As seen in (29) and exemplified in (30) and (31), the deletion of the root-final geminate in the base triggers compensatory lengthening while the deletion of the singleton voiceless consonant does not. If one views compensatory lengthening along the lines of Hayes (1989) that it occurs to preserve a mora of a deleted segment, then the

Eegimaa case is an interesting example of this. The lack of compensatory lengthening in (22) where a single voiceless consonant of the base coda deletes can be readily accounted for under the view here (and in Bassène 2012) that a voiceless (singleton) coda does not constitute a mora. With respect to root-initial geminates, we have maintained contrary to Bassène (2012) that they are also underlyingly geminate. As mentioned in Section 2.3, in Eegimaa Essil, root-initial geminates historically come from CVV sequences where the historical long vowel is realized as short in Eegimaa Essil and the extra mora of the long vowel is preserved as gemination of the initial consonant. The observation from the data in (32) that the root-initial geminate of the reduplicant degeminates in the reduplicated form can be seen as a consequence of the requirement that in perfective reduplication the base and the reduplicant must show a moraic equivalence as illustrated in (33) and (34) and discussed in Section 4.1. We thus contend that both the diachronic and synchronic evidence in Eegimaa Essil strongly support the moraic representation of geminates.

A third implication of our analysis of Eegimaa perfective reduplication relates to the details of analyses involving reduplication, specifically the nature of the boundary between the base and the reduplicant, CODACON, and the importance of the fully faithful reduplicant. One of the interesting phenomena in Eegimaa perfective reduplication relates to the nature of syllabification over the boundary between the base and the reduplicant. Bassène (2012: 117) specifically observes that resyllabification of the final consonant of the verb root into the onset of a vowel-initial suffix takes place as in the example /a-famb-ʊt/ 's/he did not make noise', which is realized as [a.fam.bʊt]. However, no such resyllabification takes place over the boundary between the base and the reduplicant. Thus, in (22), the reduplication of /ap/ 'forge' as /ap-ap/ is not realized as [a.pap] with resyllabification of the base-final consonant into the onset, but as [aap] with the consonant deleted. Moreover, gemination of the root-final consonant does not occur either so that [ap.pap] is not a possible outcome of reduplicating /ap/. Similarly, in (39) the reduplication of the root /ɔnd/ 'prepare a corpse for burial' as /ɔnd-ɔnd/ is not realized as [ɔn.dɔnd] but as [ɔw.wɔnd] with the entire nasal cluster in the base deleted. While the resyllabification of a base coda into the onset of the reduplicant syllable never occurs, there are instances where the onset of the reduplicant syllable geminates and thus syllabifies as the coda of the base, such as in the forms in (13) with roots ending in voiced obstruents. In the reduplication of /cɔb/ 'choose' as /cɔb.cɔb/, the realization is [cɔc.cɔb] where the reduplicant initial onset /c/ of the final syllable geminates after the deletion of [b] of the base coda. The issue that these data raise is why resyllabification cannot occur from the base coda into the onset of the reduplicant syllable given the example /a-famb-ʊt/ 's/he did not make noise' is realized as [a.fam.bʊt]. As mentioned above, such resyllabification occurs over a suffixal boundary. Here we follow McCarthy and Prince (1986) and Downing (2006) in maintaining that the boundary between a reduplicated root (or stem) and its base may not be the same as that between a base and an affix; the reduplicative boundary may impose its own constraints. That said, we still need to explain why resyllabification (i.e., gemination) is permitted from an onset into a coda as in the example of /cɔb/ 'choose' reduplicating as [cɔc.cɔb] but not in the case of /ap/ 'forge', which reduplicates as [a.ap] rather than [a.pap]. Here we suggest that CODACON has a strict interpretation in its application between a base and reduplicant. CODACON states that a coda does not license its own place features. In the possible output of [a.pap] for the reduplication of /ap/ 'forge', the onset [p] of [a.pap] would have its source in a coda, preventing it from resyllabifying into an onset. This then reflects the special nature of the reduplicative boundary. On the other hand, /cɔb/ 'choose' can reduplicate as [cɔc.cɔb] since the [c] in the coda of the base has an onset as its source and it is the onset that licenses the place features.

A final theoretical consequence of Eegimaa perfective reduplication relates to the importance of the fully faithful intermediate form in reduplication, specifically as it relates to its prosodic (i.e., moraic and syllable) structure. In Eegimaa perfective reduplication, the prosodic structure of a fully faithful (but non-occurring) reduplicant is crucial in determining the actual reduplicated output whether it would be to prevent the resyllabification of a base coda into the onset of the reduplicant, as just discussed in the paragraph above, or in the determination of gemination so that mora equivalence (and preservation) is maintained. As Davis (2000) has shown by an analysis of a somewhat similar pattern of reduplication found in the Austronesian language Ponapean, this can be handled through Sympathy Theory (McCarthy 1999) or Harmonic Serialism (McCarthy et al. 2012). We leave the technical details of this for future research.

6 Conclusion

To conclude, this paper has elaborated on the description and analysis of perfective reduplication in Eegimaa, which has been previously discussed by Sagna (2008) and Bassène (2012). We have argued that Eegimaa reduplication can best be understood through moraic structure and that the interesting phonological alternations in the reduplicated forms reflect a constraint on moraic equivalency between the base and the reduplicant. Our analysis has theoretical implications for moraic theory, the nature of the CODACON and the analysis of reduplication as well as diachronic implications for the understanding of Jóola languages and dialects, which we leave for future research.

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