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Abstract: This paper presents a detailed analysis of nasality in Dagbani, a Gur language of Ghana, and the role it plays in Dagbani prosody. It demonstrates that the nasal is at the centre of defining the range of what is possible in Dagbani prosodic patterns. Nasals provide the basis for determining the full range of syllable types and the tone bearing unit of Dagbani; nasals are the only coda consonants that licence vowel lengthening; and nasals provide the only cases of phonological non-vocalic geminates. The overall effects of the influence of nasality is the emergence of complex prosodic structures. Contrary to the cross-linguistically acclaimed marked position of the coda, the CVN syllable is the default, unmarked syllable in Dagbani.

Keywords: nasality, prosodic structure, tone, syllable structure, markedness

1 Introduction

This paper presents a study of nasality in Dagbani and the role it plays in understanding aspects of Dagbani prosody. While much is known about nasality from previous studies of Dagbani phonology, the unique contribution of nasals to the understanding of Dagbani prosody has not been sufficiently highlighted. That is what the paper seeks to do. Some of the issues discussed here are previously known or assumed about nasality in Dagbani. However, there is still the need for a further exploration of the implication of their behaviour for the understanding of Dagbani prosody. Many aspects of the analysis presented here assume a syllable-based approach, recognising the central role of the syllable as the domain of phonotactics.

The analysis highlights several broad observations. First, nasals provide the basis for determining the tone bearing unit in Dagbani. In coda position, nasals bear length and tone, showing that the tone-bearing unit in Dagbani is the mora (e.g. *kpám̂*: 'oil'). Oral coda consonants neither bear tone nor length. Without

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nasals, it would have been difficult to establish the mora as the tone-bearing unit. Second, the phonological behaviour of nasals is required for a fuller understanding of the syllable types permitted in Dagbani. Thus, while five oral consonants and six nasals surface in coda position, nasals are the only coda consonants that licence vowel lengthening. In an underlying CVC syllable, lengthening of the vowel requires nasalisation of the coda if it is not an underlying nasal (*zàl* 'position', *zà:n-dá* 'position-progressive'). Nasals are also the only segments whose syllable positions can be difficult to determine in some contexts (e.g. *kɔ̀.hm:â* 'selling'). We invoke the notion of ambisyllabicity to resolve such cases.

Third, nasalisation is the only process meant solely to satisfy a prosodic requirement. When oral consonants are nasalised, the goal is to realise a nasal in the coda and eliminate oral segments in the same position (e.g. /*pál-lí*/ → [*pan.li*] road-SG, [*pál-á*] road-PL). Similarly, the application or blockage of processes such as vocalic and consonantal insertion, coalescence, vocalic elision or compensatory lengthening is often conditioned on the realisation of a surface syllabic nasal or a nasal in coda position. Oral consonants do not enjoy this privilege as no phonological process in Dagbani is known to position an oral consonant in a unique prosodic position. Insertion, for instance, is triggered in many contexts to eliminate an underlying consonant cluster (e.g. *mʊ̀ ʔ.s*[*i*] *tí* 'disturb us'), unless the second of the cluster is a nasal, in which case insertion is blocked and the nasal becomes the nucleus of the syllable (e.g. *gbí ʔń̩.-lí* lion-SG). Word-final deletion happens only when it will result in a nasal in final position and word-final vowels often delete and compensatorily lengthen the preceding consonant when it is a nasal (e.g. /*bʊ̀ŋá*/ [*bʊ̀ŋ́:*] 'donkey'). These processes take place in spite of the acclaimed marked position of both syllabic consonants and codas.

For nasals to have the observed impact on the prosody, the phonology must ensure that they are preserved on the surface. Thus, one glaring asymmetry between nasals and oral consonants is that nasals are typically triggers of processes that result in the loss of segments but targets of processes that enhance the presence of segments. Of all the phonological processes discussed in this paper, only one case of deletion affecting nasals is observed. The remaining processes either enhance nasality on the surface or leave nasals unaffected. These include coalescence of stem-final nasals with oral segments in which the nasality is maintained, nasal insertion in different contexts, the gemination of singleton nasals, and the nasalisation of laterals. Where a nasal is impervious to a process, the outcome of that process may nevertheless enhance the prosodic role of the nasal by changing its position from an underlying, inert onset, to a moraic position of nucleus or coda. Similarly, in the tonal system, the deletion of a nominal vocalic

suffix, while not targeting a nasal, produces contour tone-bearing geminate nasals.

We employ Mora Theory (Hayes 1989) to show the representation of various syllable structures. Beyond this, we do not make use of any formal phonological theoretical machinery in our analyses. While theories such as Optimality Theory or Autosegmental Theory could conceivably provide a further insight into the issues discussed here, we do not think that the use of any of these theories in a syllable-oriented analysis would necessarily make any difference in the conclusions that we arrive at.

Most of the phonological issues discussed here surface in the morphophonology. Dagbani words (and those of other Gur languages) typically consist of one or two syllables, (mostly a CV or CVC) at the root level. Affixation and other morphological processes are required to build a relatively larger phonological word that is the domain of most segmental phonological processes. Regular Dagbani nouns and adjectives are morphologically complex in their basic, citation forms as they consist of a lexical root and a suffix that encodes number, among other functions. In citation forms, the singular form is assumed. In plural forms, the nominal suffix that marks singular number is replaced by the one that marks plural number (e.g. *bí-a* child- SG 'a child', *bí-hí* child- PL 'children'). In compounds, the lexical roots of the individual words are put together along with the suffix of the last noun in the compound (e.g. *bí-wɔ̀ʔń-lɪ́* child-tall-SG 'a tall child'). Some verbs also consist of roots that are bound to a suffix, although this is mostly limited to nouns and adjectives (See Hudu (2005, 2010, 2014a); Olawsky (1999) for a more extensive discussion on the morphology.). For this reason, analysis of virtually every segmental or prosodic phonological phenomenon requires a recourse to the morphology.

The data are from a combination of the native-speaker intuitions of the authors, who speak different dialects of Dagbani, and data from the literature which are duly cited. The study is cross-dialectal in nature. Many of the issues discussed apply to one dialect and not others. Data and discussion on such dialect-specific issues are noted. Where there is no specific mention of dialects, it means the data or the process applies to all dialects of Dagbani. Tone marking is restricted consistently to the Eastern Dialect. Because this study does not focus on tone, we have not marked detailed changes in pitch that would produce downstepped high tones.

The rest of this introduction provides a brief background on Dagbani and the sound inventory. Section 2 discusses the place of nasals in Dagbani tonology. Section 3 looks at the unique role nasals play in determining the range of syllable types permitted in the language. Section 4 shows that nasals play a central role in syllable-structure processes. Section 5 also shows that nasals are at the centre of

Table 1: Consonant inventory of Dagbani.

	Labial		Alveolar		Palatal		Velar		Labial-velar		Glottal
Stop	p	b	t	d [ɾ]	tʃ	dʒ	k	g	kp [tp]	gb [db]	[ʔ]
Fricative	f	v	s [ʃ]	z [ʒ]			[x]				[h]
Lateral				l							
Nasal		m		n		ɲ		ŋ		ŋm [nm]	
Appr.						j				w	

other segmental processes that have implications for surface prosodic structure. Section 6 concludes the paper.

1.1 Background on Dagbani

Dagbani (Gur, Ghana), is spoken natively by the Dagomba (*Dagbamba* among natives) and Nanumba ethnic groups and largely intelligible to Mamprusis, who speak Mampruli. The three ethnic groups share geographical boundaries and a common ancestry. Two (of three) major dialects of Dagbani are spoken by the Dagomba, each of which has subdialects. These are the Western/Tomosili Dialect and the Eastern/Nayahili Dialect. The word *Tomo* is the Dagbani word for the Western part of Dagbon and includes Tamale, the largest city in northern Ghana and the administrative capital of the Northern Region. *Naya* is the traditional name for Yendi, the traditional capital of the Dagbon State, which is located in the Eastern part of the Dagbon Kingdom. A third major dialect is Nanuni, named after the Nanumba whose traditional towns include Bimbilla and Wulensi to the south of Dagbon.

1.2 Dagbani nasal segments

What is known from past researchers on Dagbani (e.g. Hudu 2010, 2014a, 2018; Olawsky 1999) is that the language has five contrastive nasal segments in all dialects: /n, m, ŋ, ɲ, ŋm/. The labial-velar surfaces as [nm] in all but the Nanuni Dialect before front vowels, a process that affects other labial-velar segments and produces surface [tp] and [db] from /kp, gb/, respectively (Ladefoged 1968). Nasality is not contrastive for vowels. The consonants in Dagbani are shown in Table 1.

The contrastive vowels in the language are the short vowels /i, ɛ, ɨ, ʊ, ɔ, a/ and the long vowels /iː, eː, aː, oː, uː/. The short vowels have the variants [ɛ ~ e, ɔ ~ o, ʊ ~ u, a ~ ʌ]. The difference between each pair is in the feature [ATR] (Hudu 2010, 2014b). All contrastive nasals surface in onset and coda positions. In a word-final position, only /ŋ, m/ surface.

2 Nasals in Dagbani tonology

Most studies on Dagbani tonology (e.g. Hyman 1993; Hyman and Olawsky 2004; Olawsky 1999; Wilson 1970) view Dagbani as a two contrastive tone (High and Low) language. Hyman and Olawsky further show that tonal spreading and assimilation in certain contexts result in falling tones and downstepped high tones. All these studies (and most classical linguistic researches on Dagbani) focus on the Western Dialect. Beyond passing observations, no focused study on the tonal system of the Eastern or Nanuni Dialect exists to date.

However, there are clear indications that the conclusions on Dagbani tonal inventory may not hold for the other two dialects. Indeed, no aspect of the phonology of Dagbani produces a clearer manifestation of dialectal differences than tone. Speakers are more likely to detect the difference between the dialect they speak and that of their interlocutor using tonal differences than any other aspect of the grammar. Hudu (2010), for instance, shows that falling tones may be contrastive in the Eastern dialect. In addition to being a product of tone spreading, falling tones are observed in simple lexical roots (e.g. *bâ* 'father') and nominal affixes (e.g. *pʊ́-lî* stomach-SG 'a stomach'). The distribution of falling tones in Dagbani, including falling tones on nasals are well illustrated in this paper. Nanuni also differs substantially from the other two major dialects in its tonal melody.

In Dagbani tonology, nasals are unique for being the only non-vocalic tone-bearing units. This is part of the evidence presented in past studies for positing the mora as the tone-bearing unit in Dagbani and coda consonants as moraic. While coda consonants include nasals and five oral consonants (l, r, b, ʔ, h), only nasal codas may bear tone. This is illustrated copiously in (1), (3), and other places in this paper. In the Eastern Dialect, nasals even bear a falling tone, like vowels, in word-final positions.

(1) Nasals with falling tones (Eastern Dialect)
   a. *kpám̂ː* 'oil'
   b. *dám̂ː* 'alcoholic drink'
   c. *kɔ̀m̂ː* 'water'
   d. *tárm̂* 'a non-royal'

As shown in (1), in CVN syllables, the nasal coda may bear tones, including a falling tone, independent of the nucleus. Such a possibility is ruled out in a language that has the syllable as tone-bearing unit.

3 Nasals in Dagbani syllable structure

This section describes the structure of the syllable in Dagbani and the role nasals play in determining the full range of syllable types in the language. Section 3.1 looks at the syllable types the language has when nasals are not considered. Section 3.2 shows that the syllable types extend beyond the basic syllable types when nasals are considered. Section 3.2 takes a further look at nasal gemination and the complexity produces in the syllable typology.

3.1 Dagbani syllable types with vowels and oral consonants

Structurally, Dagbani has three main syllable types: CV, CV: and CVC. Onset-less syllables in the form of vocalic (V) also surface, though they are not as common as the other syllable types. The CV syllable is the most common, a reflection of its crosslinguistically unmarked position. There is no restriction on the distribution of consonants in onset position except when the onset is also word-initial, where the non-contrastive sounds [ɾ, ʔ, x] do not surface. The glottal fricative [h] also surfaces word-initially in loanwords.

In closed syllables, the only oral coda consonants are five: [b, l, ɾ, ʔ, h]. Of the oral coda consonants, /b, l/ are the only contrastive consonants that surface in coda. The rest [ɾ, ʔ, h] are postvocalic variants of /d, g/k, s/ respectively. What the language lacks completely are syllables with consonant clusters, neither in onset nor coda positions. A summary of the syllable types is shown in Table 2.

With the inventory just shown, Dagbani can be said to have a relatively unmarked syllable structure. Of the four syllable types, only V(:) lacks the (unmarked) onset; and only one (CVC) has the marked syllable position, the coda. What is more, these two are the least common. Onset-less syllables are hardly found in native lexical forms. They are only tolerated as proclitics and in loanwords. Coda consonants are also very much restricted in several respects. The number of consonants is restricted, and they never surface in word-final positions. In words with underlying CVC and CVCC, a word-final vowel epenthesis takes place to change the final consonant into an onset. This is discussed by (Hudu 2010; Nindow 2017). This is common in verbs, as illustrated in (2).

Table 2: Dagbani syllable types (with vowels and oral consonants).

Syllable type	Details	Remarks
CV	All consonants surface in onset, except [r, ʔ, x] in word-initial position	The most common syllable type.
CV:	/i:, u:, e:, o:/ are the contrastive long vowels.	Relatively common, but may be due to coalescence of two vowels.
CVC	Only nasals and [b, l, r, ʔ, h] are in coda; only /m, ŋ/ word-finally.	Not so common. CVN the most common type of CVC.
V(:)	Typically [a] and the [+ATR] short and long vowels [i, i:, u, u:, e, e:, o, o:]	The least common, typically proclitics and initials of loans.

(2) Verb-final epenthesis

a.	*ʃĩ.h*[ĩ]	'touch'	*ʃĩ.h ó*	'touch 3SG.ANIM'	
b.	*bɛ̀.l*[ɪ̀]	'accompany'	*bɛ̀.l á*	'accompany 2SG'	
c.	*tɪ̀.ɾ*[ɪ̀]	'point at'	*tɪ̀ɾ-má*	'point-IMP'	
d.	*lá.b*[ɪ́]	'throw'	*láb. lɪ̂*	'throw 3SG.INANIM'	
e.	*kɔ́.ʔ*[ɪ́]	'brew'	*kɔ́ʔ.-bʊ̂*	'brew-ing'	
f.	*mʊ̀ʔ.s*[ɪ̀]	'disturb'	*mʊ̀ʔ.s*[ɪ̀]. *tɪ́*	'disturb 3SG'	*mʊ̀ʔs á* 'disturb 2SG'
g.	*wɔ́l.g*[ɪ̂]	'separate'	*wɔ́l.g*[ɪ̂].*-bʊ̂*	'separating'	*wɔ́l.g ó* 'separate 3SG'

In (2), each word in the left column ends underlyingly in an oral consonant, as in (2a–e), or even a consonant cluster, (2f–g). The vowel is epenthesised to block an oral consonant in final position. In the case of the data in (2f–g), in addition to blocking a word-final oral consonant, the epenthesis also blocks a consonant cluster by making the first of the two consonants the only coda of the initial syllable and the second consonant an onset of the epenthesised vowel.

The fact that all these words end in [ɪ] supports the analysis that this is a case of epenthesis. But more concrete evidence is seen in the words in the middle and right columns. When these words are followed by a vowel enclitic that can provide a nucleus for the underlying final consonant, the final [ɪ] is missing. This is seen in (2a–b), and (2f–g). In the same way, a following CV clitic or suffix blocks the epenthesis by making the underlying final oral consonant non-final, as shown in (4c–e). Where a CV enclitic or suffix follows an underlying word-final consonant cluster, the epenthetic vowel surfaces to break a consonant cluster, which is

banned in all positions, (2f–g). An alternative analysis where the vowel [ɨ] is seen as underlying, is weaker because it would imply, without independent evidence and contrary to cross-linguistic and language-internal evidences, that underlying CVCV words delete their final V when they receive CV suffixes (/CVCV-CV/ → [CVC-CV]). By contrast, the insertion of vowels as a coda-avoiding measure is well-established in Dagbani and crosslinguistically.

3.2 Dagbani syllable types with vowels and all consonants

The phonotactic restrictions on oral consonants largely do not apply to nasals. All nasals occur in coda position, except that /ŋm, ɲ/ only surface in coda as products of assimilation while the two nasals /m, ŋ/ are the only final consonants of lexical words. The generalisations noted in the preceding section about Dagbani syllable structure change significantly when nasals are considered, as more marked syllable types surface. These include an open syllable with a syllabic nucleus (C$\underset{\cdot}{\text{N}}$) and a closed syllable with a long vowel as nucleus (CV:N). The other syllable types are closed syllables with a nasal as coda (CVN) and a syllabic nasal without an onset or coda (N). CVN syllables are relatively more common than CVC and have a lesser restriction on their distribution as they surface in word-final positions. Thus, with nasal codas, the number and distribution of closed syllables increase significantly. Syllabic nasals surface either as proclitics or in root- and stem-final positions. Both are illustrated in (3). The nasal clitics shown here are the infinitive marker and the first-person singular possessive marker.

(3) Syllabicity of nasals

a.	*m̩. bʊ̀.hm̩*	'to share someone else's possession'			
b.	*ŋ̩. kɔ̀.hm̩*	'to cough'			
c.	*n̩. tá.rm̩*	'my non-royal'			
d.	*ŋ̩. gbí.ʔn̩.-lí*	'my lion-SG'	cf. *gbíʔ.m-á*	'lion-PL'
e.	*n̩ zàʔ. wɔ́.ʔn̩-lí*	'my tall-SG'	cf. *wɔ́ʔ.-lá*	'tall-PL'

While there is no doubt about the underlying syllabicity of the nasals in (3), as corroborated by the plural forms– derived forms and syntactic attributes of the words in (3d–e) – the present analysis that there are syllabic nasals in CN sequences may be a subject of dispute. In some previous studies (e.g. Olawsky 1999; Hudu 2010), what is syllabified here as C$\underset{\cdot}{\text{N}}$ is argued to have a weak vowel between the oral and nasal consonants. Such a weak vowel will clearly be epenthetic as the plural forms show that they are not underlying. A summary of the new syllable types produced by nasals is shown in Table 3. The emergence of CV:N syllables is discussed further and in detail in Section 4 and Section 5.

The different syllable types are illustrated in (4), using Moraic Theory (Hayes 1989).

(4) Dagbani syllable types

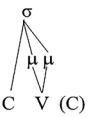
a. Light syllables

i. Vocalic nucleus

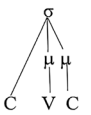
ii. Syllabic N

b. Heavy syllables

i. Heavy nucleus



ii. Coda



One syllable type not included in the above classification is N̩:. This syllable type may either be underlying or surface through gemination of an underlying short nasal. Where nasal lengthening takes place, it gives rise to ambisyllabic segments, as discussed in the next section.

The position of nasals as the only syllabic consonants in Dagbani produces an interesting markedness issue. The syllabicity of consonants is closely linked to the position of a segment on the sonority hierarchy (Blevins 1995; Clements 1990; McCarthy 2003; Prince and Smolensky 2004; Selkirk 1982). The higher a consonant on the sonority hierarchy, the greater the likelihood of it being syllabic. Within the class of consonantals, Blevins (1995) posits rhotics as the most likely syllabic segments based on their position on the hierarchy. This is followed by laterals, nasals, fricatives and stops. This predicts that languages are less likely to assign syllabicity to nasals than to liquids, and any language with syllabic nasals is also expected to assign syllabicity to liquids. It also predicts the existence of languages such as Sanskrit (Whitney 1889) with only rhotics as syllabic consonants;

Table 3: Dagbani syllable types (when nasals are considered).

Syllable type	Details	Remarks
CN̩	Any consonant may surface in onset; [r, ʔ, x] are not in word-initial position.	More common in word-final positions.
CVN	Any nasal can be coda; only /m, ŋ/ in word-final position.	More common, relative to CVC.
CV:N	Any long vowel as nucleus; any nasal can be coda.	Quite common; vowel lengthening licenced by nasal.
N̩	Can be any nasal.	The least common; typically proclitics.

languages such as Lendu (Tucker 1940) with rhotics and laterals but not nasals as syllabic consonants, and others such as English with all sonorants as syllabic consonants. The fact that Dagbani has syllabic nasals but not syllabic liquids shows a violation of this tendency.[1]

3.3 Nasal gemination and the emergence of complex syllables

Dagbani lacks contrastive tautosyllabic geminates in lexical roots. Contrastive geminates are found marginally in affixes. All in all, five consonants get lengthened and surface as geminates. These are /n, m, ŋ, l, b/. However, in most cases, the surface geminates are not phonological geminates, as the lengthening typically arises out of morphological concatenation, with the first half of the geminate belonging to the root and the second half to the suffix. Examples representative of the Eastern and Western dialects are shown below. In the Nanuni Dialect, heteromorphemic geminate [l] does not surface due to lateral nasalisation discussed in Section 5.2.

(5) Oral geminates in Dagbani

	Geminate		Singleton	
a.	*pál-lí*	'road'	*pál-á*	'roads'
b.	*jíl-lí*	'song'	*jíl-á*	'songs'
c.	*sáb-bô*	'(the act of) writing'	*sáb*[í]	'write'
d.	*ŋúb-bô*	'(the act of) chewing'	*ŋùb*[ì]	'chew'
e.	*sí̀b-bô*	'(the act of) uprooting'	*sí̀b*[î]	'uproot'

The only examples of surface tautosyllabic long consonants involve the nasals [m, ŋ]. Examples with the velar nasal are shown in (6) where the lengthening is done to compensate for the loss of a vowel that would otherwise follow the nasal.

(6) Compensatory lengthening of nasals (Hudu 2014a: 15)

	Singular	Plural	
a.	*kɔ̀n.-gá* [kɔ̀ŋá]~[kɔ̀ŋ́ː]	*kɔ̀n-sí̀*	'leper'
b.	*zɔ́n.-gá* [zɔ́ŋá]~[zɔ́ŋ́ː]	*zɔ́n-sí̀*	'bat'
c.	*bʊ̀n.-gá* [bʊ̀ŋá]~[bʊ̀ŋ́ː]	*bʊ̀n-sí̀*	'donkey'
d.	*sʊ̀m.-gá* [sʊ̀ŋ́ː]	*sʊ̀m-á*	'good'
e.	*pɔ́m.-gá* [pɔ́ŋ́]	*pɔ́m-á*	'rotten'

1 We are not making the claim that Dagbani is unique in being an exception to this prediction. This markedness generalisation appears to be a weak tendency. There appears to be many languages in Ghana and Africa more generally (e.g. Yoruba) that assign syllabicity to nasals but are not reported to assign syllabicity to liquids.

Hudu (2018) also shows that a verb-final [m] optionally lengthens when followed by the pronominal clitics [a, o].

(7) Labial nasal gemination (Hudu 2018: 217)

a.	/*làʔm*/ [*là.ʔm̩ː. ó*]~[*làʔ.m ó*]	‘meet him/her (euphemism for sexual intercourse)’
b.	/*sàʔm*/ [*sà.ʔm̩ː. á*]~[*sàʔ.m á*]	‘spoil you’
c.	/*jɔ́hm*/ [*jɔ́.hm̩ː. á*]~[*jɔ́h.m á*]	‘deceive you’
d.	/*bɛ̀hm*/ [*bɛ̀.hm̩ː. ó*]~[*bɛ̀h.m ó*]	‘doubt him/her’
e.	/*ʧĩlm*/ [*ʧĩ.lm̩ː. ó*]~[*ʧĩl.m ó*]	‘delay him/her’

A contrastive geminate [m] is also illustrated in (8). The suffix that changes a Dagbani verb into a self-ingratiating activity has a long [m], making it different from the imperative marker.[2]

(8) Contrast between geminates and singletons in Dagbani

	Root		Geminate suffix		Singleton (imperative) suffix	
a.	*kɔ̀h*[*i̯*]	‘sell’	*kɔ̀.hmːâ*	‘selling’	*kɔ̀.h*[*i̯*]*má*	‘sell!’
b.	*dà*	‘buy’	*dàmːâ*	‘purchasing’	*dà.má*	‘buy’
c.	*ɲá*	‘obtain’	*ɲàmːâ*	‘gain/earning’	*ɲà.má*	‘see!’
d.	*bò*	‘seek’	*bɔ̀mːâ*	‘seeking activity’	*bɔ̀.má*	‘seek!’
e.	*dì*	‘eat’	*dìmːâ*	‘livelihood’	*dì.má*	‘eat!’
f.	*ɲú*	‘drink’	*ɲʊ̀mːâ*	‘drinking’	*ɲʊ̀.má*	‘drink!’

In other cases, compensatory lengthening is not synchronic but diachronic. Data from the Eastern Dialect show that the length of the word-final nasals may be a relic of a vowel segment serving as a nominal suffix. There are several observations supporting this conclusion. First, the long [m] always surfaces in final positions and only in nouns. They do not surface in verbs, which do not require an obligatory suffix. Second, the long nasal bears tone, which is a diachronic illustration to the synchronic process shown in (6), where nasal length and tone are due to the loss of a following vowel. Third, the vowel in the plural forms of such words bear the same tone as borne by the long final nasal in the singular forms. This indicates that the tone on the nasal is a persevered tone that is re-linked to the nasal after the loss of its initial tone bearing unit. The data are shown in (9), and include a verbal

2 The words in each pair are not minimal pairs since the final vowels have different tones. Besides, this contrast is very limited. These two observations make it difficult to argue for a long [m] as a phoneme in Dagbani.

segmental minimal pair for each word that neither has a long nor a tone-bearing nasal.

(9) Diachronic Nasal length (Eastern Dialect)

	SG	PL		verb minimal pair
a.	*tàm̩ː*	*tàm-á*	‘manure’	*tàm* ‘forget’
b.	*dám̩ː*	*dám-â*	‘alcoholic drink’	*dàm* ‘shake’
c.	*kɔ̀n̩ː*	*kɔ̀m-â*	‘water’	*kám* ‘any’
d.	*làm̩ː*		‘cowitch’	*lâm* ‘taste’

The diachronic loss of a suffix vowel in the underlying CVN-V nominal has no effect on the number of syllables on the surface: the words remain disyllabic. Further synchronic data suggest that the vocalic singular nominal suffix must have been [ɨ]. In nouns with a CVN-ɨ structure where the final weak [ɨ] is the singular nominal suffix, the vowel is maintained if the nasal is [n]. The failure to elide the vowel is expected, given that [n] is not a word-final nasal. In (10), the crucial phonological issues noted about the data in (9) are also applicable, including identical tones on the nominal suffixes and ‘-a’ as a plural suffix.

(10) Preservation of suffix vowel in CVn- roots

	SG	PL	
a.	*tàn-ɨ́*	*tàn-á*	‘fabric’
b.	*pàn-ɨ́*	*pàn-á*	‘vagina’
c.	*gɔ̀n-ɨ́*	*gɔ̀n-á*	‘expert’
d.	*gbàn-ɨ́*	*gbàn-á*	‘gristle’

The analysis of the morphological geminates is more straightforward than that of the true phonological geminates. In a moraic analysis, the word *pál-lɨ́* ‘road’-SG does not deserve a different analysis from *bɔ̀n-sɨ́* ‘donkey’-PL. Both are two-syllable words, with two consonants in sequence: the first serving as a coda and contributing to the weight of the syllable, the second as an onset of the final vowel that is linked directly to the syllable node. The fact that in one of them, the coda and onset are identical is accidental.

(11) Structure of morphological geminates and non-geminate sequences

a. A morphological geminate

b. A non-geminate consonant sequence

We adopt the notion of ambisyllabification (Kahn 1976; Rubach 1996 etc.) to capture the difference between morphological geminates and phonological geminates. This notion was introduced to analyse ambiguous and problematic data on English syllabification and similar data in other languages. While the issues this notion was proposed to address are more complicated than the geminate consonants discussed here, we nonetheless find it appropriate for the purpose of providing distinct representations for the morphological and phonological geminates under discussion.[3]

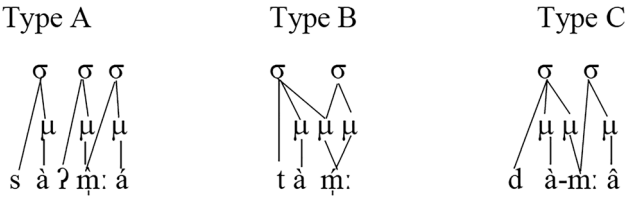
Each nasal geminate is a syllabic nasal. The problem that the notion of ambisyllabification is needed to address, is the obfuscation of the boundaries of the syllables on opposite ends of the syllabic nasal occasioned by the membership of the nasal to both syllables. The notion of ambisyllabicity is needed to determine the syllable positions the syllabic nasal occupies in the two syllables. When all the geminate forms in (6), (7), (8), and (9) are considered, three types of ambisyllabic nasals can be distinguished.

(12) The typology of Dagbani ambisyllabic nasals

- Type A An Ambisyllabic segment as a nucleus of the syllable to its left, an onset of the syllable to its right, as in the forms in (7) (e.g. là.ʔm̩ː. ó).
- Type B An Ambisyllabic segment as a coda of the syllable to its left, a nucleus of the syllable to its right. The word-final geminates in (6) and (9) (e.g. kɔ̀ŋ́ː, tàḿː).
- Type C An Ambisyllabic segment as a coda of the first syllable, an onset of the second syllable. This is exemplified by the pattern in (8) (e.g. *dà-mːâ*).

The various syllable types are illustrated in (13).

(13) Representation of Dagbani ambisyllabic nasals



3 For a critique of ambisyllabification and an alternative approach, see Jensen (2000) and Selkirk (1982).

Of the three types, Type B is unique in being the only case where two syllables share one mora. While the remaining two are ambisyllabic only at the segmental level, Type B is ambisyllabic at both the segmental and moraic levels. That is because the word-final geminate is a case of an onset-less, coda-less bimoraic syllable. The contrast between this and a monomoraic nasal is illustrated in (14).

(14) a. a bimoraic nasal b. a mono-moraic nasal

In terms of tonal melody, (14a) has a one-to-many association. One tone is associated with two morae. Section 4 discusses phonological processes that alter the surface structure of a syllable.

4 Nasals in syllable structure processes

Nasals are at the centre of many phonological processes that inherently alter the surface structure of syllables. These include deletion, insertion, coalescence and compensatory lengthening. The application of these processes most often results in a more marked syllable, as they result in the surfacing of a coda.

4.1 Nasals as targets of deletion

In Dagbani phonology, consonants that get deleted are nasals and [l]. The nasals, especially /m/, and the lateral typically get deleted in some coda positions (e.g. *jí.l-ɪ̂* house-SG, *jíl. sóŋ* 'a good house' **jíl-jâ* [*jí-jâ*] house-PL) (see Hudu [2014a] for a further discussion on [l] deletion). As already noted, [m] is unique for being one of the only two word-final consonants, the other consonant being /ŋ/. However, in some word-final contexts, it gets deleted. This happens in the same word forms that are subject to diachronic lengthening discussed in Section 3.3 and illustrated with data in (9).

As already discussed, the long [m] is an ambisyllabic nasal straddling a root syllable that has a vocalic nucleus and a second syllable consisting only of the nasal itself. Notice that that diachronically, the nasal is solely part of the root morpheme; synchronically, it is part of both root and suffix morphemes. In the

wider morphology of Dagbani, such as compound forms, the ambisyllabic segment deletes entirely, contrary to the general pattern in Dagbani, which preserves root segments in compounds.

(15) Deletion of /m/ in root compounds

	SG	PL		Compound	
a.	*kɔ̀m̂ː*	*kɔ̀mâ*	'water'	*kò-tʊ́l-ɭ́ɪ̀*	'hot water'
b.	*dám̂ː*	*dámâ*	'liquor'	*dá-bɛ́-ʔʊ́*	'bad liquor'
c.	*kpám̂ː*	*kpámâ*	'oil'	*kpá-káɦ̀ɪ̀-ɭ́ɪ̀*	'shea butter' (lit. 'unripe oil')
d.	*pɛ̂m*	*pɛ́má*	'bow'	*pɛ́- mɔ́l-ɭ́ɪ̀*	'arrow' (lit. 'bow's missile')

4.2 Nasals as triggers of deletion

In Dagbani morphology, the progressive marker is *-da ~ -dɪ*. The *-da* form is common in citation forms and utterance-final positions. The vowel undergoes reduction, and the suffix is realised as *-dɪ* in non-final positions. The agentive marker is also the same except that in the Eastern Dialect it triggers a leftward tonal assimilation of the stem vowel, making it high (e.g. *màl*[ɪ̀] 'make', *máːn-dá~máːn-á* 'a maker', *máːn-dɪ́-bá~máːn-ɪ́-bá* 'makers').

When any of these suffixes is added to a transitive verb with underlying CVl structure, three processes occur: a nasalisation of the liquid, a lengthening of the vowel and an optional deletion of the suffix [d]. Nasalisation and vowel lengthening are discussed further in Section 5. The focus of this section is the deletion of the suffix onset. The data in (16) show that in such words, the progressive form of the verb stem assumes the structure CV:n, and the articulation of the suffix onset [d] is optional. In (16), the perfective and nominalised forms of the verbs are included to show that the underlying form of the verbs indeed has a coda [l]. The effect of this is that a marked CV:N syllable is avoided in what would have been a word with CV:N.CV word, in favour of a less marked CV:.

(16) Optional deletion of suffix onset [d] in /CVl-da/ verbs

	Stem	Perfective	Nominalised	Progressive forms	
a.	*zàl*[ɪ̀]	*zàl-já*	*zál-bʊ̂*	*zàːn-dá~zàːn-á*	'position'
b.	*màl*[ɪ̀]	*màl-já*	*mál-bʊ̂*	*màːn-dá~màːn-á*	'make'
c.	*bɛ̀l*[ɪ̀]	*bɛ̀l-já*	*bɛ́l-bʊ̂*	*bɛ̀ːn-dá~bɛ̀ːn-á*	'accompany'
d.	*ʒìl*[ɪ̀]	*ʒìl-já*	*ʒíl-bʊ̂*	*ʒìːn-dá~ʒìːn-á*	'seat'
e.	*bɔ̀l*[ɪ̀]	*bɔ̀l-já*	*bɔ́l-bʊ̂*	*bɔ̀ːn-dá~bɔ̀ːn-á*	'call'

There is no deletion of [d] or vowel lengthening when the verb stem coda is underlyingly a nasal, as in (17).

(17) No deletion of onset [d] in /CVN-*da*/ verbs

	Stem	Perfective	Nominalised	Progressive form	
a.	*zàn*[i̯]	*zàn-já*	*zán-bô*	*zàn-dá*	‘stand’
b.	*pàn*[i̯]	*pàn-já*	*pán-bô*	*pàn-dá*	‘be excess’
c.	*ʒìn*[i̯]	*ʒìn-já*	*ʒín-bô*	*ʒìn-dá*	‘sit’
d.	*pì̯n*[i̯]	*pì̯n-já*	*pí̯n-bô*	*pì̯n-dá*	‘shave’
e.	*gʊ̀n*[i̯]	*gʊ̀n-já*	*gʊ́n-bô*	*gʊ̀n-dá*	‘circumcise’

4.3 Nasals as triggers of insertion: Post-nasal insertion

There are two cases of nasals triggering the insertion of oral consonants. In one, the epenthetic unit is a syllable *da*, inserted into a vowel-initial loanword when the loan is preceded by a nasal clitic. The insertion is meant to provide a buccal place for the underlyingly placeless nasal clitic to assimilate. Because the epenthetic unit is a syllable, the only other effect it has on the prosodic structure is a surface long vowel in order to avoid two identical vowels in hiatus. This process is discussed in detail in Hudu (2014a).

(18) Insertion of syllable *-da* (Hudu 2014a: 13)

a.	/*N àn.fòːní*/	[*n.-dàːn.fòːní*]	‘my picture’ (Akan)
b.	/*N àn.fàː.nḭ́*/	[*n.-dàːn.fàː.nḭ́*]	‘my grace’ (Hausa)
c.	/*N à.làh.ʒí.bá*/	[*n.-dàː.làh.ʒí.bá*]	‘my wonders’ (Arabic via Hausa)
d.	/*N à.lì̯.ʒíː.fʊ́*/	[*n.-dàː.lì̯.ʒíː.fʊ́*]	‘my pocket’
e.	/*N à.lì̯.zà.má*/	[*n.-dàː.lì̯.zà.má*]	‘my conversation’

The second case of post-nasal insertion happens in some lexical forms in various dialects where the alveolar nasal triggers the insertion of [d] and other consonants. The result of this insertion is the creation of a surface CVN syllable from an underlying CV syllable followed by a CV syllable. Examples are shown in (19).

(19) Nasal-triggered insertion

a.	/*jǐ.n-í*/ [*jin.-**d**i̯*]	‘one’ (Western Dialect)
b.	/*jǐ.n-í*/ [*jiŋ.-**k**a*/*jiŋ.-**g**a*]	‘one’ (Eastern Dialect)
c.	/*dʊ̀ nʊ́.-li*/ [*dʊn.**d**ɔ.-li̯*]	‘entrance’ (lit. ‘room’s mouth’)

The underlying form of the word in (19a) and (19b) is accepted in both Eastern and Western dialects. However, the respective epenthetic forms also surface for each dialect. The word in (19c) is a compound. The epenthetic [d] does not surface at the boundary of the words constituting the compound; rather, it surfaces within the

second word of the compound between the nasal onset and its nucleus making its underlying onset a coda of the first word. This results in the misalignment of the morpheme and syllable boundaries of the two constituents in the compound.

4.4 Homorganic nasal insertion

4.4.1 Pre-palatal [ɲ] insertion

In Dagbani, the imperative marker is a plain nasal [*m~ma~mi*]. The actual realisation depends on several factors including whether the verb has an object or a clitic besides the target of the imperative. However, when the imperative is directed at the second-person plural object, it is always realised as *-m* followed by the plural marker *ja*. This is the case in the Eastern and Western dialects. In the Nanuni Dialect, it is *-mi* before the plural marker with a homorganic nasal [ɲ] before *-ja*. This produces a surface *miɲ*. Examples are shown in (20).

(20) The imperative marker after singular pronouns

	Root	SG imperative	PL imperative	Nanuni epenthesis in PL forms
a.	*dì*	*dì-m̀. l̂ɪ̀*	*dì-ḿ-já*	*di-miɲ.-ja*
	eat	eat-IMP it	eat-IMP-2PL	
b.	*zànɪ̀*	*zàn(ɪ̀)-mɪ̀ kpé*	*zàn-mɪ́-já kpé*	*zani-miɲ.-ja kpe*
	stand	stand-IMP here!	stand-IMP-2PL here	
c.	*là*	*ó lá-má*	*là-ḿ-já*	*la-miɲ.-ja*
	laugh	3SG laugh-IMP	laugh-IMP-2PL	
d.	*jʊ̀l[ɪ̀]*	*jʊ̀l(ɪ̀)-mɪ̀ bâ*	*jʊ̀l-mí-já bâ*	*juli-miɲ-ja ba*
	Look	look-IMP 3PL	look-IMP-2PL 3PL	

This insertion occurs in other dialects as well, as shown in (21) where the plural object *-ja* follows a CV verb in non-imperative forms. The effect is a surface CVN from an underlying CV syllable.

(21) Homorganic [ɲ] insertion after CV verbs before plural object *ja* (Nindow 2017)

a. /*tì*/ [*tiɲ́ ja*] 'give you'
b. /*bá*/ [*báɲ́ já*] 'ride on you'
c. /*dì*/ [*diɲ́ já*] 'score against you'
d. /*dà*/ [*dàɲ́ já*] 'buy you'
e. /*là*/ [*làɲ́ já*] 'laugh at you'

4.4.2 Nasal insertion in verb reduplication

In Dagbani, when a CV verb is reduplicated, a homorganic nasal is inserted between the reduplicant and the base. This is discussed by Issah (2011) with the data below, which show CV reduplication marking iterativity or distributivity of the action depicted by the verb. The initial CVN is the assumed reduplicant. The reduplicant in such reduplicated verbs is the same as that of underlying CVN verbs (e.g. *dàm* → *dàm-dàm* 'shake').

(22) Nasal insertion in CV reduplication (Issah 2011: 42)

a.	*bú*	*bʊ́m-bʊ́*	'beat'
b.	*dà*	*dàn-dà*	'buy'
c.	*ɲú*	*ɲʊ́ŋ-ɲʊ́*	'drink'
d.	*kpè*	*kpèŋ-kpè*	'enter'
e.	*gbí*	*gbíŋ-gbí*	'dig'
f.	*gò*	*gòŋ-gò*	'travel'

When the stem has more than one mora (e.g. a CVC or CVCV), no nasal insertion takes place. Where the verb is underlyingly CVC, a final epenthetic vowel provides a second syllable. In the reduplicated form, the epenthetic vowel is optional. In rapid speech it does not surface but in slow speech it may be perceived.

(23) No nasal insertion in CVC reduplication

a.	*sáb*[í]	*sáb*[í]*sáb*[í]	'write'
b.	*tɪ̀b*[ì]	*tɪ̀b*[ì]*tɪ̀b*[ì]	'treat'
c.	*jʊ̀l*[ì]	*jʊ̀l*[ì]*jʊ̀l*[ì]	'look'
d.	*bàl*[ì]	*bàl*[ì]*bàl*[ì]	'select'
e.	*tàr*[ì]	*tàr*[ì]*tàr*[ì]	'distribute'

4.4.3 Other cases of nasal insertion

There are other instances of homorganic nasal insertion that are either diachronic, surface as dialectal variants or as part of the integration of loanwords into Dagbani morpho-phonology. In all such cases, an underlying CV surfaces as CVN, with the epenthetic nasal homorganic to the consonant that follows it. This is illustrated in (24).

(24) Other cases of nasal insertion

a.	/*nʊ́ tʊ́-á*/	[*nʊ́**n** tʊ́-á*]	‘ring’ (lit. ‘hand insertion’)
b.	/*já-á ná-á*/	[*jà:**n̂** ná:*]	‘Yaa-Naa’ (‘King of power’, the title of the King of Dagbon)
c.	/*ká.ti̋.ŋá*/	[*ká**n.**ti̋.ŋá*]	‘far away’ (Nanuni Dialect)
d.	/*ń. gɔ́.-já*/	[*ǹ gɔ́**ŋ.**-já*]	‘I have travelled’[4]
e.	/*kpɛ́. ŋɔ́*/	[*kpɛ́**ŋ.**ŋɔ́*]	‘here’ (lit. ‘here this’)
f.	/*ma.tan.ka.di*/	[*má**n.**táŋ.ká.li̋*]	‘a sieve’ (<Hausa)
g.	/*si.li.ki*/	[*si̋.li̋**ŋ.**ʧi*]	‘silk’(<Hausa < English)

5 Nasals in other segmental processes

5.1 Nasals licencing vocalic lengthening

Surface long vowels in Dagbani are of three types: underlying contrastively long vowels (e.g. *bá:ŋá* ‘a praise signer’ vs. *báŋá* ‘a bangle’), morphologically derived vowel length (e.g. /*bá-á*/ [*bá:*] dog-SG), and phonological lengthening licenced by nasals. The last category of long vowels is what interests us here.

The process of vowel lengthening takes place along with the nasalisation of an underlying lateral as discussed in Section 5.2. The surface nasal, which is a coda consonant, is required for the lengthening of its nucleus to take place. The only difference between the cases where vowel lengthening takes place along with nasalisation and where it does not, is the quality of the nucleus. Vowel lengthening affects all except [i], which lacks a long variant in Dagbani.

As shown in (25), the nasalisation (and concomitant vowel lengthening) is triggered by the progressive suffix *-da*. The lateral remains oral before suffixes that begin with other consonants such as the perfective suffix *-ja* and the imperative marker *-ma*.[5] What is more, for some speakers the epenthetic vowel that is realised in the non-suffixed form of the word is maintained before other CV suffixes, especially in slow speech.

4 The statement “I have traveled” is the typical response given by a person who is welcomed to a place.

5 The remaining morphemes that surface in (28) are the nominalising suffix *-bu* and the pronominal enclitics *ti* (1PL); *a* (2PL).

(25) Vowel lengthening after /l/ nasalisation in CVl verbs

a.	*bál[ɪ́]*	*bál[ɪ́]-bô*	*bà:n-dá*	'apply mascara'
b.	*pìl[ɪ̀]*	*pìl[ɪ̀]-já*	*pì:n-dá*	'start'
c.	*mɔ́l[ɪ̂]*	*mɔ́l[ɪ́] tí*	*mò:n-dá*	'announce'
d.	*bɛ̀l[ɪ̀]*	*bɛ̀l á*	*bè:n-dá*	'accompany'
e.	*kɔ̀l[ɪ̀]*	*kɔ̀l[ɪ̀]-má*	*kù:n-dá*	'intoxicate'

The result of this lengthening is a surface CV:N syllable. While syllables of this structure exist in Dagbani, it is relatively marked in simplex words. It appears to be more common in compounds. In simplex words with a CV:N syllable, the nasal typically assimilates the place features of the consonant. In some cases, the nasal and its homorganic consonant are maintained. In many other cases, some phonological processes take place affecting either the nasal or the consonant it precedes and blocking the surfacing of a CV:N syllable. We discuss three such instances below.

One context is where the homorganic consonant is a velar sound in a CV suffix, (CV:ŋ-gV or CV:ŋ-kV). In such forms, the pronunciation with CV:N is not universal, especially in the Western Dialect. Many speakers prefer to pronounce the words without the homorganic velar plosive. This simplifies the word into CV:.ŋV with the nasal coda becoming the onset of the second syllable; this is illustrated in (26), where the homorganic oral consonant in the plural forms is maintained.

(26) CV:N avoidance through velar deletion

	SG forms			PL forms	
a.	*/dà:N-gá/*	*dà:ŋ-gá*	[*dà:.ŋ-á*]	*dà:n-sɪ́*	'hearth'
b.	*/bá:N-gá/*	*bá:ŋ-gá*	[*bá:.ŋ-á*]	*bá:n-sɪ́*	'singer'
c.	*/tɛ̀:N-gá/*	*tɛ̀:ŋ-gá*	[*tɛ̀:ŋ-á*]	*tɛ̀:n-sɪ́*	'beard'
d.	*/dú:N-gá/*	*dú:ŋ-gá*	[*dú:ŋ-á*]	*dú:n-sɪ́*	'mosquito'
e.	*/nó :N-gá/*	*nó:ŋ-gá*	[*nó:ŋ-á*]	*nó:n-sɪ́*	'bird'

There are other lexical items in which an underlying long vowel in a CV:N syllable is shortened in some contexts. In all cases, this happens only in CV:N contexts. Unlike the preceding case, it is the singular forms of nouns that are affected. Such nouns have a vowel as singular nominal suffix. Vowel shortening results in a re-syllabification of the nasal into either an onset or a word-final coda.

(27) CV:N avoidance through vowel shortening

	SG	PL	Compound/larger syntax	
a.	*zɔ̂m*	*zó:m-bá*	*zó:m pá?-á*	'a blind woman'
b.	*sán-â*	*sá:m-bá*	*sá:n dó-ó*	'a male guest'
c.	*lán-á*	*lá:m-bá*	*lá:n só*	'a certain owner/guardian'
d.	*tʊ̌m-ô*	*tú:m-bá*	*tú:n sʊ̌m-á*	'good messengers'

The third process that results in the blocking of surface CV:N syllables is lateral deletion. In this process the lateral in an underlying /CV:m-lɪ/ noun is deleted after changing the nasal into [n]. The result of this is the opening of the initial CV:m syllable as the nasal gets re-syllabified into an onset position. This is discussed extensively in Hudu (2014a), the source of the data in (28).

(28) CV:N avoidance through lateral deletion (Hudu 2014a: 25)

	UR	UR SG	Surface SG	Surface PL	
a.	*ju:m*	/*jù:n-lɪ́*/	[*jù:n-ɪ́*]	*jʊ̀m-á*	'year'
b.	*tu:m*	/*tú:n-lɪ́*/	[*tú:n-ɪ́*]	*tʊ̌m-á*	'work'
c.	*ma:m*	/*má:n-lɪ́*/	[*má:n-ɪ́*]	*mán-â*	'okra'
d.	*mo:m*	/*mó:n-lɪ́*/	[*mó:n-ɪ́*]	*mɔ̌m-á*	'ripe'
e.	*go:m*	/*gò:n-lɪ́*/	[*gò:n-ɪ́*]	*gɔ̀m-á*	'fence wall'

There are two generalisations about the phonology of nasals that are of interest here. First, the nasal is the preferred coda consonant, and nasalisation of an underlying oral consonant ensures that this preference is realised. Already all nasals surface in coda underlyingly, unlike oral consonants for which only five are coda. Second, whereas various phonological processes in Dagbani serve the purpose of blocking CV:N syllables, nasals help to project this syllable type by licencing vowel lengthening. Significantly, in all cases where underlying CV:N syllables are avoided, the nasal is never the target of the process. It only loses its coda position through a process that targets either the long vowel or a consonant that follows the nasal.

5.2 Nasalisation and prosodic requirements

In addition to the pattern of nasalisation discussed in Section 5.1, laterals surface as nasals as a measure to avoid hetero-morphemic geminates. For instance, the word /*nà tɪ́-tál lánà*/ 'almighty' (lit. owner of great sovereignty) as used to refer to God, is often pronounced with the [l] of /tɪ́-tál/, surfacing as [m], [*nà tɪ́-tám lánà*]. This nasalisation as an anti-gemination measure is more systematic in the Nanuni

Dialect, where lateral geminates across a morpheme boundary in simplex words appear to be blocked entirely. The root /l/ in such forms becomes a homorganic nasal [n]. The plural forms of the words in (29), which surface in all dialects, show that the singular forms in Nanuni have an underlying root-final lateral.

(29) Lateral nasalisation to avoid lateral gemination in Nanuni

	SG	Nanuni SG	PL (all dialects)	
a.	*pál-lɨ́*	*pan.lɨ*	*pál-á*	'road'
b.	*jíl-lɨ́*	*jin.lɨ*	*jíl-á*	'song'
c.	*wʊ́l-lɨ́*	*wʊn.lɨ*	*wʊ́l-á*	'root/branch'
d.	*gbál-lɨ́*	*gban-lɨ*	*gbál-á*	'grave'
e.	*vɛ̀l-lɨ́*	*vɛn-lɨ*	*vɛ̀l-á*	'nice'

A second pattern of lateral nasalisation applies in all dialects of Dagbani where /l/ becomes
[n] before suffix -da. This was already illustrated in Section 5.1, where it was demonstrated that the resulting nasal also triggers vowel lengthening resulting in a surface CV:N syllable. In this section, this process is illustrated only with verbs containing the vowel /ɨ/, which is not affected by lengthening.

(30) /l/ nasalisation in CVl verbs before habitual/progressive *-da*

a.	*gɨ́l*[ɨ́]	*gɨ̀l-já*	*gɨ̀n-dá*	'go round'
b.	*pɨ̀l*[ɨ̀]	*pɨ̀l-má*	*pɨ̀n-dá*	'cover'
c.	*bɨ́l*[ɨ́]	*bɨ́l-bô*	*bɨ̀n-dá*	'geminate'
d.	*mɨ́l*[ɨ́]	*mɨ́l-tɨ̂*	*mɨ̀n-dá*	'wipe'
e.	*vɨ́l*[ɨ́]	*vɨ́l lɨ̂*	*vɨ̀n-dá*	'bandage'

The expected default surface forms in the *'-da'* suffixed forms is CVl-*da* words. An alternative to this is to have surface forms with an epenthetic [ɨ]. This would produce the unmarked CV.CV.CV words. Even deletion of the lateral would produce open syllables. Neither of these is chosen. The effect of the chosen process on Dagbani prosody is that a CV syllable is avoided in favour of a CVN syllable. From a markedness perspective, this is not what would be predicted considering the relatively marked position of the coda. The fact that it surfaces with a nasal as coda suggests that a CVN syllable is less marked in Dagbani than a CV.

6 Conclusions

When the full range of phonotactics of nasals and the phonological patterns affecting them are considered, the overall conclusion on their effect on Dagbani

prosody is that nasals trigger surface complex prosodic structures. Part of the reason for the lack of appreciation of the significant role of nasality in Dagbani prosody is the paucity of cross-dialectal studies on Dagbani phonology. Most studies of Dagbani phonology focus on one dialect, especially Tomosili. When the different processes from different dialects are considered, it becomes apparent that Dagbani has a rich array of phonological processes that alter the conclusions reached on individual dialects.

The present study shows that while different dialects of Dagbani use the nasals for different phonological purposes, these processes are unified in the role they play in shaping surface prosodic structures. For instance, Nanuni avoids lateral gemination across morpheme boundary by nasalising stem-final laterals. However, lateral nasalisation in this dialect is not driven by the need to avoid geminates, since the underlying forms are not phonological geminates. This provides support for the conclusion that the need to avoid surface geminates may not be the primary motivation for lateral nasalisation in Nanuni. Rather, it is driven primarily by the preference of nasals to oral consonants in coda position.

An important observation made in this paper is the preservation or enhancement of the presence of nasals. The projection of nasals on the surface makes typological sense. In order to preserve contrast, marked units, which nasals are relative to oral consonants, need to be preserved. Thus, such marked units may be protected from processes that diminish their surface presence even though such processes may affect unmarked units. What is not expected is the implication of such a preservation for the surface structure of prosodic units, especially the syllable. From a markedness perspective, the clear preference of CVN syllables to CV syllables is unexpected given that the coda is argued to be the most typologically marked syllable position. The present paper shows overwhelming evidence for CVN as the default unmarked syllable in Dagbani.

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