Nasality and the Gengbe syllable

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1. Introduction

Although nasality is realized on segments (nasal consonants and vowels), analyzing the phonological patterns of nasality in a language may require the consideration of a second, abstract level of representation (Leben 1973). Rather than tying nasality to consonants and vowels, then spreading nasal features to adjacent segments, such a suprasegmental analysis can specify the domain or span of a feature's realization as the mora or syllable. The object of this study is to present data from Gengbe, a Gbe language spoken in Southern Togo and Benin, which support a view of Gengbe nasality as a suprasegmental feature associated with the syllable. Section 2 of the paper offers background on Gengbe and other Gbe languages. Section 3 describes our data collection and methodology. Section 4 describes the phonetic inventory of Gengbe with particular focus on the segments on which nasal features are realized, previous accounts of nasality in Gbe languages, and relevant background on suprasegmental phonology. Section 5 presents a discussion of how nasality is mapped onto syllables rather than segments, and Section 6 concludes the paper with a discussion of the advantages of a syllable-based analysis over a segmental analysis for nasality in Gengbe.

2. Gengbe and other Gbe languages

Gengbe, also known as Mina, Gɛ̃, Gen, Mina-Gen, or Popo is a Gbe language spoken in Southern Togo and in the Mono sub-region of Benin. It belongs to the broader Niger-Congo language family and is sub-classified under Left Bank, a subsidiary of the Kwa group of languages. The Gbe languages, of which the most widely spoken and studied is Ewe, form a continuum across the West African coast from eastern Ghana to western Nigeria. Capo (1991) divides the Gbe language phylum into five major groups, namely: *Vhe* (including Ewe), *Fon, Ajá*, *Phla-Pherá*, and *Gen*. Gbe language speakers are often multilingual, and Gengbe is spoken in communities alongside Ewe and other Vhe varieties, so code-switching, code-mixing, and borrowing from Ewe into Gen are commonplace. Capo (1991) refers to Gen dialects based on cities in the region where they are spoken: Anéxɔ (or Aného, Togo), Agɔ́i (Agoué, Benin), and Glijí (or Glidji, Togo); he notes that these dialects are "without noticeable variations" (p. 13). Gengbe is a language of wider communication spoken by nearly 400,000 people, mostly in Togo, where over 200,000 people speak it as their mother tongue, and about 50,000 people—mainly the Aguna, Aja, Ginyanga, Kpessi, and Western Xwla Gbe—speak it as a second language. In Benin, about 150,000 speak Gengbe as either their L1 or L2 (K. Dorvlo, personal communication, October-August 2016; see also Lewis, Simons & Fennig, 2015).[1]

[1] Komla Dorvolo is Dean of Arts at the University of Allied Health at Ho in Ghana's Volta Region. He speaks Ewe as a native speaker and understands Gengbe with near-native proficiency. Information on Gengbe was given to Samuel Obeng in a series of interviews from August to October 2016.

By far, the most detailed scholarly works on Gengbe have been those by Bole-Richard (1983), Kangni (1989), Capo (1991), and Lewis (1992). A substantial amount of the work done by these authors on Gengbe has been on the subjects of segmental phonology, morphosyntax, and semantics. Nasality in the Gbe languages was addressed in Westermann (1930), Ansre (1961), Stahlke (1971), and Capo (1977; 1981), though the discussion (elucidated in Capo 1981) concerned mainly whether Gbe nasality was phonemic in consonants, vowels, or both. Apart from Abaglo and Archangeli (1989), who propose a disyllabic minimal word condition for Gengbe based on both tonal and vowel length data, very little research has been done on Gengbe's suprasegmental phonology outside of the domain of tone. However, given the considerable importance of moraic and syllabic structure in understanding the morphophonology of Kwa languages, extensive phonological and morphological description of the interconnectedness between nasality and suprasegmental units (i.e., moras and syllables) is essential. This paper makes a modest contribution to fulfilling this need by examining syllable structure and its interaction with nasality in Gengbe.

3. Data and methods

The data that form the basis of this study were elicited from two consultants—A and B. Data from Consultant A were recorded at Indiana University in Bloomington, Indiana, from 2014 to 2016, and those from Consultant B were recorded in Ghana in March 2016. Consultant A is a 53-year old native speaker of Gengbe from Batonou, a village near Gliji in the Republic of Togo. Consultant B is a 66-year-old retired teacher, also a native speaker of Gengbe from Batonou, living in Ghana. The residents of Batonou speak mainly Gengbe and Wachi (a Vhe variety), but other Gbe languages are also spoken in the area. Both consultants are polyglots who, besides Gengbe, are also fluent in the Ghanaian languages Akan, Ewe, and Ga. Both consultants also speak or understand the Gbe languages Wachi (Ouatchi), Fon (Fongbe), and Aja (Ajagbe). Furthermore, both consultants are fluent in French and English—Consultant A is also fluent in Russian. Both consultants spent most of their childhood and teenage years in Togo. Consultant A was a graduate student at Indiana University-Bloomington (IU-B) and a consultant for a *Field Methods in Linguistics* class at IU-B. He had his early education in Togo. He maintains residence in both Togo and Ghana.

The majority of our data (those from Consultant A) were elicited in a *Field Methods* and *Advanced Field Methods* classroom and also recorded in the Phonetics and Phonology Lab recording room of the Linguistics Department at Indiana University. The data collected from Consultant B—the 66-year-old man—were collected in the Linguistics Department at the University of Ghana between January and March 2016.

4. The realization of nasality on segments

Before offering our syllable-based account of Gengbe nasality, we first turn to our attention to the segments on which nasality is realized in the language. In Section 4.1, we present the phonetic vowel and consonant inventories of Gengbe, and in Section 4.2, we offer evidence, as noted in previous literature on Gbe, that vowel nasality is contrastive, but consonant nasality is allophonic.

4.1. The phonetic inventory of Gengbe

Gengbe's sound system features both nasal vowels and nasal consonants. As shown in (1), Gengbe makes use of seven oral vowels ([**i**], [**e**], [**ɛ**], [**a**], [**ɔ**], [**o**], and [**u**]) and five nasal vowels ([**ĩ**], [**ɛ̃**], [**ã**], [**ɔ̃**], and [**ũ**]). Nasality is contrastive in front and back vowels and in all vowel heights. Mid vowels show an additional tense/lax contrast that is present in oral but not nasal vowels.

(1) The phonetic vowel inventory of Gengbe

i/ĩ u/ũ

e/ɛ/ɛ̃ o/ɔ/ɔ̃

ɑ/ɑ̃

Gengbe contrasts nasal stops at four places of articulation: bilabial [**m**], alveolar [**n**], palatal [**ɲ**], and velar [**ŋ**]; the alveolar and velar nasals may also appear as syllabic segments (as argued in Section 5.1) that are realized as homorganic to the following stop, as in **ǹdɔ̀** 'afternoon' and **ŋ̀kú** 'eye.' The labio-velar [**ŋm**] only appears as a syllabic segment preceding a labio-velar stop ([**gb**] or [**kp**]), as in **ŋm̀gbé** 'back' and **ŋm̀kpɛ̀̃** 'shame.' In C_1C_2V syllables, the nasal liquids [**l̃**] and [**ɾ̃**] and the nasal glides [**j̃**], [**w̃**], and [**q̃**] may appear in C_2 position, as in **glɛ́̃** 'to adjust,' **ɲɾɛ́̃** 'to sharpen,' **ɦj̃ɛ́̃** 'to need,' **ɦw̃ɛ́̃** 'to stink,' and **àɲq̃ɪ̃̌** 'low tide.' In addition, the nasal liquid [**l̃**] may appear as a single onset before a nasal vowel, as in **èl̃ɑ̃̀** 'animal/meat.' (2) presents the phonetic inventory of Gengbe consonants for reference.

(2) The phonetic consonant inventory of Gengbe

	Bilabial	Labio-dental	Alveolar	Post-alveolar	Retroflex	Palatal	Velar	Glottal	Labio-velar	Labio-palatal
Stop	p b		t d		ɖ		k g		kp gb	
Nasal	m		n			ɲ	ŋ		ŋm	
Fricative	ɸ β	f v	s z	ʒ			x	ɦ		
Affricate				tʃ dʒ						
Flap			ɾ							
Nasal Flap			ɾ̃							
Lateral			l							
Nasal Lateral			l̃							
Glide						j			w	ɥ
Nasal Glide						j̃			w̃	ɥ̃

All Gengbe tone bearing units (i.e., moras, as discussed in Section 5) are realized with tone. We keep with Bole-Richard (1983) in considering two phonemic register tones: (H)igh (symbolized with an acute accent, i.e., **x́**) and (L)ow (symbolized with a grave accent, i.e., **x̀**). Contour tones are realized on phonetically longer vowels; we mark Rising (LH) and Falling (HL) pitch pattern realizations as **x̀x́** and **x́x̀**, respectively. Morphophonological processes that produce long vowels and contour tones are discussed in Section 5.

4.2. Previous work on in Gengbe nasality

Gengbe is described in Capo (1981) and Bold-Richard (1983) as having a phonemic opposition between oral and nasal vowels. This assertion follows from several observations. First, there are numerous consonants ([k], [g], [t,], [d], [gb], [kp], [ɸ], [β], [f], [v], [s], [z], [x], [ɦ], [dʒ], and [tʃ]) which appear before both oral and nasal vowels as a single onset. (3) presents examples of each of these consonants preceding both oral and nasal vowels, including minimal pairs in (3d, i, k, p). In the coming analysis, we refer to the consonants listed in (3) as those able to license nasal features.

(3) Consonants occurring before both oral and nasal vowels

		CV		**CṼ**	
a.	/k/	àkáˊ	coal	kấ	to take a bit of
b.	/g/	àgùtóˊ	mushroom	ègṵ̀	hole
c.	/t/	tèɸéˊ	place	tɛ̃̌	to swell
d.	/d/	èdɔ̀	sickness	èdɔ̃̀	gutter
e.	/gb/	ègbàˋ	load	gbɑ̃̌	to crush
f.	/kp/	kpɔ́	to see	èkpɔ̃̀	tiger
g.	/ɸ/	àɸáˊ	shout	èɸɑ̃̌	belch
h.	/β/	àβàˋ	war	èβɑ̃́	spear
i.	/f/	fáˊ	to cool	fɑ̃̀	to cry
j.	/v/	vòvòˋ	freedom	vɔ̃́	to be scared
k.	/s/	sìˋ	to mature	sĩ̀	to grow old
l.	/z/	zòzɾòˋ	flying	zɔ̃̀	to walk
m.	/ɦ/	ɦéˊ	white	ɦɛ̃̀ɦĩ̃ɛ̃̀	reading
n.	/x/	xɔ̀	to cost	èxɔ̃́	tick
o.	/dʒ/	dʒèˋ	to buy liquid	dʒɛ̃́	red
p.	/tʃ/	tʃáˊ	to join	tʃɑ̃̌	also

Capo (1981) takes the next step, arguing (contra Westermann 1930; Stahlke 1971; and Bole-Richard 1976) that Gengbe has no phonemic nasal consonants, only phonemic nasal vowels. This analysis, then adopted in Bole-Richard (1983) and Capo (1991), states that all Gbe varieties have phonemic oral and nasal vowels rather than consonants.[2] As further evidence supporting the phonemic status of nasal vowels rather than consonants, all nasal onsets ([m], [n], [l̃], [ɲ], and [ŋ]) must be followed by nasal vowels in CV syllables, and five oral consonant onsets ([b], [ɖ], [l], [j], and [w]) must be followed by oral vowels. This evidence has led Capo (1981; 1991), Bole-Richard (1983), and Kangni (1989) to adopt the following allophonic rules, henceforth referred to as *Oral-Nasal Onset Allophony Rules* (ONOAR):

1. /b/ is realized as [m] before a nasal vowel
2. /ɖ/ is realized as [n] before a nasal vowel
3. /l/ is realized as [l̃] before a nasal vowel
4. /j/ is realized as [ɲ] before a nasal vowel
5. /w/ is realized as [ŋ] before a nasal vowel

Though some attempt has been made to unify these rules, there is no good synchronic natural class that encompasses all five phonemes. Capo (1981) notes a personal communication with Mary-Esther Kropp-Dakubu suggesting that these five phonemes may have all developed diachronically from a class of "lenis" consonants; however, such an analysis does not help us to identify a synchronic natural class, except in the nasal allophones, which are all nasal stops. This observation lead Capo to posit that a denasalization rule for all nasal stops may be more apt than a nasalization rule for this set of five consonants. For our purposes, we will adopt the ONOAR since the identification of the underlying phoneme is not crucial to our analysis.

Our data confirms to the ONOAR with few exceptions—and only to Rule 5. First, we find instances of optional [**w̃**]-epenthesis between vowels, resulting in a single-onset [**w̃**] as in **téṹ/téw̃ṹ** 'to be able to.' We also find [**w̃**] as a single onset in the words **w̃ṵ̃kpɛ̃̀** 'shame' (which is also optionally pronounced as

[2] To maintain this analysis for Gbe broadly, Capo (1991) posits a (possibly diachronic) denasalization rule for Adángbe, the one apparent exception where nasal vowels are only found following nasal consonants.

ŋm̀kpɛ̃̀) and **w̃ã̀á́** ‘that,’ for which Bole-Richard (1983) gives the fully nasalized **ŋá** ‘that.’ This difference in our data may be rooted in dialectal, intra-speaker, and/or inter-speaker variation, but further research is needed to address this question.[3] For now, it is sufficient to note that there is some link (diachronic, synchronic, and/or socio-linguistic) between Gengbe nasal sounds with some velar occlusion: [**w̃**], [**ŋ̰**], [**ŋm͡**], [**ũ**], and the syllable [**w̃ũ**].

The other notable exception to these rules has to do with the nasalization of C_2 in C_1C_2V syllables. A complex onset in Gengbe may take the shape *consonant-liquid-vowel* (CLV) or *consonant-glide-vowel* (CGV). In a CLV syllable, the realization of L is dependent on both the place of articulation of the preceding consonant and the nasality of the following vowel: [**ɾ**] follows coronal consonants as in **jɾá** ‘to bless,’ while [**l**] follows non-coronal consonants as in **blɛ̀** ‘to deceive.’[4] As mentioned above, C_2 liquids are nasalized (as [**ɾ̃**] and [**l̃**], respectively) before a nasal vowel, as in **ɲɾ̃ɛ́** ‘to sharpen’ and **vlṹ** ‘to unfold,’ and C_2 glides (/**w**/ and /**j**/) are nasalized before a nasal vowel and realized as [**j̃**] and [**w̃**], as in **ɦj̃ɛ́** ‘to need,’ **ɦw̃ɛ́** ‘to smell.’ The nasalization of glides /**j**/ and /**w**/ as nasalized glides [**j̃**] and [**w̃**] in C_2 position rather than as nasal stops [**ɲ**] and [**ŋ**] allows the language to avoid consonant-nasal (CN) clusters such as ***ɦɲ** and ***ɦŋ**. Despite irregularities in the realization of /**w**/ as the nasalized glide [**w̃**] or nasal stop [**ŋ**], we consider five C_1 phonemes (/**b**/, /**ɖ**/, /**l**/, /**j**/, and /**w**/) and all three C_2 phonemes (/**l**/, /**j**/, and /**w**/) to be able to license nasal features. In summary, nasality in a C_1V syllable is always realized on the vowel and is realized on C_1 if and only if it is listed in the ONOAR. The same observation applies to nasality in C_1C_2V syllables, with the additional note that where the vowel is nasalized, C_2 is nasalized.

For Bole-Richard (1983), the processes described in ONOAR worked as a derivation, considering nasality to be a property of the vowel and offering the conditioning environment for onset nasalization. This derivation can be restated in terms of leftward spreading of nasal features from the syllable nucleus to the syllable onset. For syllables with complex onsets (C_1C_2V), nasality always spreads leftward onto C_2, as in **kl̃ã́** ‘to bid farewell to,’ and nasality will continue to spread onto C_1 if it is one of the five consonants able to license nasal features, as in **mj̃ɔ̃́** ‘to squeeze’ (>**bj̃ɔ̃́**). In sum, if a syllable has nasal features, it will always be realized on C_2 and V, and always on C_1 /**b**/, /**ɖ**/, /**l**/, /**j**/, and /**w**/. In other words, if a segment within a syllable with nasal features can license nasal features, it will—it is thus not possible to determine a direction of spreading or origin for nasal features in CV and CCV syllables.

According to this observation, if a single onset is unable to license nasal features, as in **ɛ̀gɛ̃̀** ‘beard,’ nasality is only realized on the vowel, while if it is able to license nasal features, nasality will be realized on the syllable onset, as in **ɛ̀ɲl̃̀** ‘cow.’ As can be seen in the previous example and in **ɛ̀l̃ã̀** ‘meat,’ nasality will not spread across a syllable boundary onto a preceding vowel. It is also worth noting that nasality does not spread rightward across a syllable boundary from a nasal vowel onto a consonant, as evinced by words such as **mɔ̃̀fj̃ɔ́lɔ̀ví** ‘forefinger’ (lit. way-show-hand-DIMINUTIVE) where non-nasal [**l**] follows the nasal vowel [**ɔ̃**]. The inability to determine direction of spreading within a syllable and the general lack of tone and nasal spreading between syllables in Gbe languages led Capo (1981) to explore a possible prosodic analysis for Gbe wherein both tone and nasality are prosodies tied to the syllable. Though we do not tie tone to the syllable, we do support an analysis for Gengbe wherein nasality is bound to the syllable.

The lack of nasal spreading between syllables is noted in As described in the sections to come, our analysis differs from that of Bole-Richard (1983) in assigning nasality to the entire syllable, then segments able to license nasal features nasalize accordingly. One advantage of this analysis is that we

[3] Some diachronic evidence of the relationship between these nasal and non-nasal allophones comes from Capo (1991), who concludes that the development of [**ŋ**] from /**w**/ is an innovation present in the Gen, Vhe and Ajá groups, but absent in other Gbe languages. The contact between Gbe varieties with and without [**ŋ**] may account for the variation between [**w̃**] and [**ŋ**].

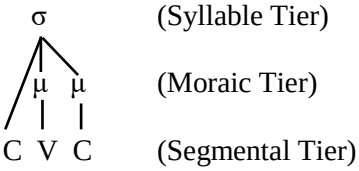
[4] Since [**ɾ**], [**ɾ̃**], and [**l̃**] are found in more limited environments than [**l**], we consider /**l**/ to be the underlying phoneme.

need no extra stipulation to explain why nasality is blocked from spreading leftward from an onset onto the nucleus of the preceding syllable. In pursuing a syllable-based analysis, we turn to previous work on suprasegmental assignment and moraic phonology.

4.3 Levels of representation: The mora and the syllable

Syllable weight is an integral part of morphophonological theory, interacting with segments, such as in the process of deletion and compensatory lengthening, as well as with suprasegmental phenomena, such as tone assignment. Various models capturing syllable weight have been proposed that account for this distinction by associating segmental information (C and V) with an abstract skeleton, allowing phonological analyses to make reference to abstract units rather than segments (McCarthy 1979; Hyman 1985; Levin 1985; Lowenstamm and Kaye 1986; Hayes 1989). For our discussion of weight, we follow moraic phonology, which associates segments to abstract weight units called moras (Hayes 1989). The mora and the syllable are represented on different tiers (abstract, hierarchical levels). In this theory, onsets are weightless (Hyman 1984) and link directly to the syllable, while segments in the nucleus and coda of the syllable are linked to moras.[5] A diagram of this configuration is given in (4).

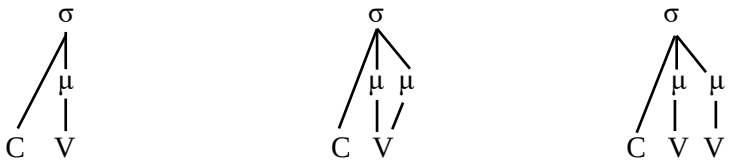
(4) Segmental and suprasegmental tiers



In moraic theory, the difference between a long and short nucleus is one of phonological quantity (Davis 2011)—for example, a short vowel is the realization of a single mora associated to a single vowel (5a), while a long vowel is the realization of two moras associated to a single vowel (5b), and a syllable with two different vowels is the realization of separate vowels with separate associated moras (5c)

(5) Long and short vowels as moraic quantity

a. Short vowel b. Long vowel c. Syllable with two nuclei



The goal of this work is to argue that Gengbe syllable structure allows for CVV (and CCVV) syllables, that nasality in Gengbe is associated with the syllable, and that nasality is realized on all segments able to license nasal features within that syllable.

5. Nasality and syllable structure

Duthie (1996), writing on Ewe, describes the syllable in terms of three parts: nucleus (made up of a vowel—oral vowel V, nasal vowel Ṽ, or syllabic nasal N), margins (a single or complex onset—C or

[5] More recently, the non-moraic status of onsets has been challenged, for example in Topintzi (2010), but our data offers no evidence that Gengbe onsets are moraic.

CC), and tone (H or L). All syllables, in Duthie's account, must have both tone and a nucleus, but may have zero (V or N), one (CV), or two margins (CCV). Duthie's assertions hold for Gengbe, however, we extend our analysis to permit syllables with a complex nucleus (CVV) without requiring the splitting of such sequences into two syllables (CV.V where the period marks a syllable boundary). Furthermore, we assert that it is nasality, rather than tone, that is a property of the syllable. In doing so, we adopt an analysis wherein the Gengbe tone-bearing unit is the mora rather than the syllable. This assignment of tone to moras accounts for syllables with long vowels and contour tone such as **àgl̃ã́ã̀** 'crab.' In Ewe, this word is **àgálã̀** (Westermann, 1928/1973), and while both words have identical tone patterns, the Ewe example shows the final HL sequence realized on two syllables, while the Gengbe example shows HL realized on the same syllable, requiring a smaller unit than the syllable (i.e., the mora) be given the title of tone bearing unit.

Given our claim that the suprasegmental unit of import to nasality in Gengbe is the syllable, in Section 5.1, we present evidence that initial and final nasals constitute independent syllables, based both on tone assignment data and evidence that nasality never spreads leftward or rightward from nucleus-only (Ṽ or N) syllables. We explore apparent leftward nasality spreading in Section 5.2 and apparent rightward nasal spreading in Section 5.3, arguing that nasality is a feature of syllables that does not spread between syllables. Section 5.4 discusses the placement of nasal features as tied to the syllable rather than the vowel.

5.1 Nasality in nucleus-only syllables

Nucleus-only syllables (V or N), as exemplified in Table 2, always appear as part of a larger prosodic word in Gengbe, and Duthie (1996) states that in Ewe, they are limited to high frequency words. In our data, the only examples of nucleus-only syllables outside of a few examples in words that are not transparently morphologically decomposable (such as 6a) are bound morphemes, as in the nominal prefixes **è-** and **à-** in (6b-d), initial syllabic nasals which are realized as homorganic to the following stop as in (6e-i), and clitics like the DEF enclitic in (6d) and the 1PSA enclitic in (6j-k).[6] As has been noted for Ewe (Duthie 1996), Gengbe allows what look like coda nasals in ideophones and loanwords as in (6l-m).

(6) Nucleus-only syllables

	Gengbe	English Gloss
a.	**á**dɾɛ́	'seven'
b.	**è**gà	'metal' or 'money'
c.	**à**tɔ́	'apple'
d.	**à**tɔ́=**á**	apple=DEF 'the apple'
e.	**ǹ**dɔ	'afternoon'
f.	**ŋ̀**kɔ	'in front of'
g.	**ŋ̀**kú	'eye'
h.	**ǹ**tí	'orange
i.	**ńt**í	'about,' 'skin,' or 'body'
j.	dù=**m̀**	bite=1PSA 'bite me'
k.	tá=**m̀**	draw=1PSA 'draw me'
l.	gbú**m̀**	the sound of a loud gunshot
m.	kápí**ǹ**tà	'carpenter'

[6] In this paper, we employ the following glosses for clitics: 1PSA=1st person singular accusative clitic, DEF=definite determiner, NEG=negation clitic, and Q=question clitic.

While the syllabic status of vowels in (6a-d) is not controversial, in this chapter we establish the syllabic status of the initial nasals (6e-i), enclitic nasals (6j-k), final nasals in ideophones (6l), and medial nasals in loanwords (6m). We do so by first showing that such nasals are targets for tone assignment in section 5.1.1, are underlyingly V or CV sequences in Section 5.1.2, and do not spread their nasal features to other segments in Section 5.1.3.

5.1.1 Tone assignment to nasals

Tone assignment serves as a diagnostic for syllable structure in a language where the syllable is the tone bearing unit, but in our proposed structure, tone is assigned to the mora. This section shows that tone assignment will serve as a diagnostic for the syllabic status of initial nasals, but not that of final nor of medial nasals. Capo (1991) states that Gbe initial nasals in NC sequences are syllabic since they are targets for tone assignment. We exemplify this for Gengbe in (6h-i), where the initial nasal is shown to be assigned tone independent of the following H-tone vowel, creating a minimal pair only contrasted by the tone of the initial nasal: L in (6h) and H in (6i). As mentioned above, we do not consider Gengbe onset consonants to be moraic, so a nasal stop associated with a mora before a CV syllable must have a mora for tone assignment and must thus constitute its own syllable.

Unlike onset consonants, we consider codas to be moraic, so tone assignment alone will not work as a diagnostic to distinguish whether final nasals are independent syllables (CV.N) or nasal codas (CVN). To illustrate, enclitic nasals are also assigned tone independent of the tone of the preceding vocalic nucleus—(6j-k) shows the 1PSA enclitic **=m̀** has L tone regardless of the preceding vowel's tone, which is L in (6j) and H in (6k). In ideophones, these nasals may also appear with tone independent from the preceding vocalic nucleus, for example (6l) shows H tone on the vowel, but L tone on the nasal. In (6k), both analyses (**tá.m̀** and **tám̀**) leave the final nasal with a mora available for tone assignment: one in the nuclear position of its own syllable and the other in the coda position of the monosyllable. Likewise, in (6m) the transition from the second syllable H to the third syllable L occurs during the nasal, suggesting it is associated with L tone (since the fall does not occur on the final syllable **tù**), an observation that tells us only that the nasal is moraic, not syllabic. Tone assignment thus also cannot determine the syllabic status of the medial nasal in (6m). For the same reason CVN may be one or two syllables, CVCVNCV may be three (CV.CVN.CV) or four syllables (CV.CV.N.CV).

5.1.2 Syllabic nasals are underlying V or CV

As argued in Bole-Richard (1976) and Capo (1981), there is diachronic and cross-dialectal evidence that syllabic nasals are underlyingly CV syllables. Our data suggests that this is true of [**m̩**], but [**ŋ̩**] is underlyingly vocalic. When the 1PSA enclitic **=m̩** is emphasized in (6j), the full pronominal form surfaces, as in **éɖù mũ̀** 'It bit ME,' where the underlying CṼ syllable surfaces. We have no evidence of an alternation between [**mũ**], [**m̩**], and [**ũ**], for example **étá=m̩** 's/he drew me' cannot also surface as ***étá=ũ̀**. Furthermore, in words not decomposable to a root and clitic, like **téű́** 'to be able to,' a final nasal vowel cannot optionally be realized as [**m**], as in ***téḿ**. If there is a correspondence between [**ũ**] and a final consonant, it should be with the velar [**ŋ**]. Morley (2010) notes that Ajagbe, which does not have a **w**/**ŋ** correspondence, has the cognate **teŋ** 'to be able to,' offering further evidence for the relationship between final [**ũ**] and [**ŋ**]. Variation in initial NC sequences supports this view as well.

The consonant [**m**] is unavailable in NC sequences, so the [**m̩**]-[**mũ**] correspondence cannot be supported in this environment; however, variant pronunciations offer more evidence that other syllabic nasals are underlyingly vowels. For example, Consultant A offered **ù̀kú** 'eye' and **ű́tí** 'body' as possible pronunciations of (6g-h), where the initial nasal vowel [**ũ**] is in free variation with the syllabic nasal consonant [**ŋ̩**]. There are two words we have elicited where [**ũ**] (but not the homorganic nasal consonant [**n**]) appeared before sibilants: **ű́sù** 'man' and **ű́sɛ́** 'strength.' If we assume that the more restrictive

environment reveals the underlying phoneme, we conclude that an initial nasal vowel may be realized as a homorganic syllabic nasal stop preceding an oral stop ($\tilde{V} \rightarrow N̩ / \_C_{[-continuant]}$).

In some cases, Consultant A also offered CV variants for nasal vowels and syllabic nasal consonants. For example, he offered three variants of the word meaning 'daybreak' or 'daytime' (**ŋ̀kèkè**, **ũ̀kèkè**, or **èw̃ũ̀kèkè**), where the initial nasal syllable was elicited as the consonant [**ŋ̀**], the vowel [**ũ̀**], or the full word [**èw̃ũ̀**]. Consultant A suggested the word **èw̃ũ̀** (optionally **ũ̀**- or **ŋ̀**-) means 'sun' in this compound (although he offered the word **èwè** as the free morpheme meaning 'sun'), and **kèkè** means 'rising' or 'breaking.' It is peculiar that this word would make use of the consonant [**w̃**] since the ONOAR predicts /**w**/ be nasalized as [**ŋ**]. One explanation is that the noun is underlyingly just a nasal vowel as surfaces in the variant **ũ̀kèkè**. To explain, initial nominal prefixes are often dropped in Gbe languages, so when the prefix is dropped, the initial vocalic nasal may surface faithfully as [**ũ̀**], or it may optionally be realized as the homorganic nasal stop [**ŋ̀**] before the oral stop [**k**], as discussed above. When the prefix appears, rather than form the VV sequence (*[**èũ̀**]) Consultant A inserts an epenthetic [**w̃**], leaving [**èw̃ũ̀**]. Bole-Richard (1976) and Capo (1981) suggest a ban on initial VV sequences with non-identical vowels in Gbe, a constraint that motivates the insertion of an epenthetic [**w̃**] in this case.[7] Variation reported in previous literature between and within Gbe varieites as well as that reported by Consultant A suggests that enclitic the syllabic nasal [**m̀**] is underlyingly CV and that nasals in nasal-stop sequences are underlyingly V. Being underlying CV suggests that the 1PSA is in fact syllabic, but does nothing to clarify the syllabic status of other nasals. For that, we turn to the lack of nasal spreading from such nasals in the next section.

5.1.3 Syllabic nasals do not share their nasal features

As observed above, nasality does not spread between syllables in Gengbe. In this section, we present that syllabic nasals also do not offer their nasal features to adjacent segments—further evidence for the syllabic status of final and medial nasals. Enclitic nasals in (6j-k) do not nasalize the preceding vowels, which should now not be surprising since we have determined that they are underlyingly CV sequences (i.e., independent syllables unable to share nasality). Ideophones and loanwords, which Duthie (1996) claims allow nasal codas in Ewe, also do not share their nasality, as illustrated in (6l-m). If it were the case that **gbúm̀** exemplifies a CVC syllable, it may come as no surprise since ideophones are known to take on structures prohibited elsewhere in a language (Samarin 1970; Newman 2001); however, the lack of nasality on the preceding vowel suggests that even ideophones do not break the strict ban on coda consonants in Gengbe. Native words with medial nasals also keep their nasality to themselves, as in **àkɔ́ǹtà** 'mathematics,' which does not spread its nasal features leftward from the syllabic nasal [**ǹ**] onto the preceding oral vowel [**ɔ́**] (***àkɔ̃́ǹtà**). We take the lack of nasal spreading from the syllabic nasals in NC sequences as evidence that nasality is confined to those syllables.

In this section, we have offered evidence that that initial nasals in NC sequences, word-final nasals, and in word-medial nasals are syllabic. First we showed that they are assigned tone, indicating that they are moraic, which in the case of initial nasals indicates that they are also syllabic. For final and medial nasals, we also presented evidence that they are underlyingly vocalic (and, in the case of the 1PSA enclitic **=m̀**, underlyingly CV) and that they do not spread their nasal features to other segments that are able to license nasal features. While initial nasals in NC sequences and the 1PSA enclitic are more clearly syllabic, evidence that other final and medial nasals are syllabic is more suggestive than conclusive. We endeavor to continue to search for further evidence to clarify their syllabic status in future research.

For now, we conclude that the initial nasals like in **ǹtí** 'orange,' as schematized in (7a), and enclitic nasals like in **tá=m̀** 'draw me,' as schematized in (7b), are independent nuclei linked with tone through their associated moras and with nasality through the syllables associated with those moras, as illustrated in (7).

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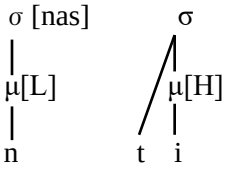
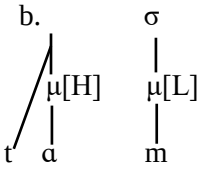
[7] In CVV sequences, non-obligatory epenthesis was elicited in words like **téṹ/téw̃ṹ** 'to be able to,' but epenthesis fails to explain initial [**w̃**] in the words **w̃ũ̀kpɛ̃̀** 'shame' (also pronounced **ŋm̀kpɛ̃̀**) and **w̃à**ã́ 'that.'

(7) Moraic structure in NC and CVN sequences

a. 

b. 

We now turn to the spread of nasality between nuclei and its consequences for the analysis of Gengbe syllable structure.

5.2 Syllables with complex nuclei and leftward nasal spreading

Gengbe CVV and CCVV syllables can be separated into those with a single long vowel, as in **vàá** 'to come (citation form)' where the syllable's two associated moras both attach to a single vowel, and those with two different vowels, as in **síá** 'every,' where the syllable's two associated moras each attach to a separate vowel. We present a brief overview of both types in this section, noting the differences in their moraic structure, illustrated in (8).

(8) Bi-moraic syllables

a) vàá 'to come' b) síá 'every'

We begin with examples of CVV and CCVV syllables in (9). (9a-d) show long vowels with LH, HL, and HH tone patterns, as well as examples of both nasal vowels (9a) and oral vowels (9b-d); no examples of a long vowel of the type VṼ or ṼV were elicited from our consultants. (9e-h) illustrate examples wherein two different vowels are found adjacent to one another. (9e) shows a VV sequence where both vowels are oral; (9f) shows a VV sequence where both vowels are nasal; (9g) shows a VV sequence where only the first vowel is oral (VṼ); sequences where only the second vowel is oral (ṼV) are only attested using the NEG clitic addressed later in this section.[8]

[8] We pause for a moment to recognize the heterogeneity of these examples. The LH tone in (9a-b) can be derived phonologically—in certain other environments, these words appear with single H tone nucleus. (9c) is a monosyllabic loanword, which are usually assigned LH tone (to satisfy a bimoraic minimal word condition according to Abaglo and Archangeli (1989). (9d) may well be an ideophone, and Consultant A objected to variants of this word with a short vowel. (9e-g) show instances of VV sequences that may have been formed through compounding, but are not transparently decomposable. This mix of origins shows that VV sequences can be derived through a number of means and also that we must continue to probe Gengbe morphophonology for a more complete account of processes that them.

(9) CVV and CCVV syllables

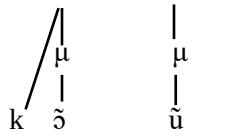
	Gengbe	English
a.	vɔ̀ɔ́	‘to be scared’
b.	ègbɔ̀ɔ́	‘goat’
c.	tíì	‘tea’
d.	kpóó	‘calmly’
e.	síɑ́	‘every’
f.	kɔ́ɔ̀	‘fermented akume’
g.	téɯ́	‘to be able to’

We analyze the long vowels in (9a-d) as bimoraic, allowing each mora independent tonal assignment, but since such vowels are always all oral or all nasal, these cases are little help to our analysis of nasality. Also, we do not wish to pursue any counterintuitive analysis that splits a long vowel into two independent syllables. For now, we move to examples of VV sequences where both vowels are not identical, although examples like (9e-f) offer us little information to distinguish the structure as mono- or disyllabic (CVV or CV.V, respectively). Each vowel is associated with its own mora, and both moras may be part of the same syllable—when that syllable has no nasal feature, both vowels are realized as oral in (9e); when that syllable has a nasal feature, both vowels are realized as nasal in (9f), as schematized in (10a). If each vowel, on the other hand, is associated with a separate syllable, then both syllables in (9f) may carry a nasal feature, as schematized in (10b).

(10) Two possible structures for **kɔ́ɔ̀** ‘fermented akume’

a.

b.



The inability to distinguish between the structures in (10), when both vowels agree in nasality, is a deficiency in our analysis and one which may require independent motivation from outside of the realm of nasality, so we leave it to future study. We instead focus on words where adjacent vowels do not agree in nasality, as in (9g), where leftward nasal spreading does not occur. As a reminder, we observed in Section 4.2 that nasality spreads leftward from a syllable nucleus to any nasalizable onset consonant, as schematized in (11).

(11) Leftward spread of nasality from nucleus to onset

a) **blè** ‘to deceive’ b) **mlĩ̀** ‘to roll in’

The key to leftward nasal spreading appears to be the presence of adjacent (in this case preceding) segments that are able to license nasal features. Why then is the nasality of the final vowel in **téɯ́** ‘to be able to’ unable to offer its nasal features to the preceding [**e**]? As established in the previous section, we

propose that it is for the same reason that nasality spreads leftward through the C_2 [**l̃**] in **mlĩ** 'to roll in' to nasalize C_1 (/**b**/→ [**m**]) but not through the C_1 [**l̃**] in **àl̃á́** 'sheep' to nasalize the preceding vowel ([**à**], *[**ã**])—that nasality does not spread between syllables. In sum, although nasality does not help us in the analysis of VV and ṼṼ segments as tautosyllabic or heterosyllabic, our analysis of VṼ sequences divides the two vowels into different syllables (CV.V) due to inability of nasality on a vowel to spread leftward onto the preceding oral vowel. This analysis leaves open the question of whether the division of VṼ sequences into two syllables can be attributed to a broader generalization in the phonology of Gengbe or whether it is lexically specified, a question that requires independent evidence and one that we will investigate in future research.

5.3 Syllables with complex nuclei and rightward nasal spreading

There are two clitics we point to in this section (DEF and Q) that we claim attach to the host syllable rather than simply to the prosodic word, forming instances of CVV syllables. Rightward spread from a nasal vowel to a following CV morpheme is unattested in Gengbe where a nasal vowel may precede our set of nasalizable onsets such as /**l**/ without nasality spreading rightward onto such onsets, as in the compound **mɔ́fjɔ̃lɔ̀ví** 'forefinger' (lit. way-show-hand-DIMINUTIVE) and the loanword **mɛ̀lè** 'Germany' (likely from the French *Allemagne*). Rightward nasal spreading is attested in Fongbe, as with the diminutive suffix –**ví**, which is specified in being a high front vowel with H tone, but the vowel may be nasalized by a preceding nasal vowel, as in **dɛ̃̀ví** 'little snake' (Lefebvre & Brousseau 2002). However, the cognate diminutive suffix in Gengbe is not nasalized following a nasal vowel, as in **àʒjɛ̃̀ví** 'fiance.' Thus, nasality does not spread rightward from a nucleus to a following CV syllable in Gengbe as it does in Fongbe, even one with an onset able to license nasal features, as in the AGENTIVE suffix **-lá** in **nṹfjɔ̃lá** 'teacher' (lit. thing-teach-AGENTIVE), where the non-nasal [**l**] follows the nasal vowel [**ɔ̃**] without being nasalized. We now turn to examples of rightward nasal spreading between vowels.

The examples in (12) show three cliticization processes. (12a-d) show the definite determiner clitic (DET), which borrows both tone and nasality from the preceding vowel; (12e-h) show the question clitic (Q), which is always L tone, but borrows nasality from the preceding vowel; and (12i-l) show the negation clitic (NEG), which borrows neither tone nor nasality from the preceding vowel. Each set of four hosts for the clitic present oral vowels with L and H tone followed by nasal vowels with L and H tone.

(12) Nasality and tone spreading in cliticization

a.	èzò=à	'fire=DEF'
b.	ètó=á	'ear=DEF'
c.	àzĩ̀=ã̀	'egg=DEF'
d.	ènṹ=ã́	'thing=DEF'
e.	èzò=à	'fire=Q'
f.	ètó=à	'ear=Q'
g.	àzĩ̀=ã̀	'egg=Q'
h.	ènṹ=ã̀	'thing=Q'
i.	èzò=ò	'fire=NEG'
j.	ètó=ò	'ear=NEG'
k.	àzĩ̀=ò	'egg=NEG'
l.	ènṹ=ò	'thing=NEG'

Our analysis offers an explanation for this behavior: the DEF and Q clitics are incorporated into the syllable to form a complex nucleus (CVV) while the NEG clitic remains a separate syllable (CV.V), one not carrying a nasal feature. Why then is the low vowel [**ɑ**] able to license nasal features when [**o**] is not.

We offer two possibilities that merit further investigation. First, [**ɑ**] is the most sonorous segment, so in order to ensure that there is always a sonority rise within a syllable (never a fall, since Gengbe does not permit coda consonants), [**ɑ**] is allowed to join the syllable, but rather than chance a sonority fall, [**o**] is never let into the syllable. The other possible explanation is that [**o**] is not nasalized as [**õ**]; this would suggest that [**o**] is (possibly the only Gengbe vowel) not able to license nasal features. If this is the case, we again have an ambiguity between structures since we could consider the NEG clitic to be incorporated into the syllable, but not accepting of the syllable's nasal feature. We leave the use of segmental evidence for the existence of CVV syllables in Gengbe to future research, turning instead to the advantages our suprasegmental analysis of Gengbe nasality has over previous analyses based on segmental phonology.

5.4 The location of nasal features

Like Capo (1981), we observe that nasality in Gengbe is tied to the syllable and realized on all segments within that syllable that are able to license nasal features. However, this observation can also be described in terms of nasal features belonging to a vowel that spread to all segments capable of licensing them within the syllable, or percolate up to the syllable node and then are licensed by all segments capable of doing so. We find that these analyses also account for the data, although there is one piece of evidence presented in this paper that would suggest tying nasality to the vowel creates an opacity problem, we would rather avoid. In Section 5.1.2, we posit that the 1PSA enclitic **=m̀** is underlyingly the CV sequence /**bu**/. If nasality is tied to the syllable, it is realized on both the consonant and vowel when both are present, and the consonant only when the vowel is absent. If nasality is tied to the vowel, it must spread to nasalize the onset before the feature is deleted with its host vowel, creating a counterbleeding relationship between feature spreading and deletion. We remain open to the possibility that nasal features originate from vowels, since all other processes noted in this paper appear agnostic to the distinction absent other cross-linguistic or theoretical concerns.

6. Summary and conclusions

Previous work on Gengbe has considered nasality to be a property of vowels, spreading leftward to nasalize onset consonants that are able to license nasal features, and rightward onto certain clitics. These segmental descriptions are developed to account for the observation that five nasal consonants ([**m**], [**n**], [**ɲ**], [**Ĩ**], and [**ŋ**]) can be analyzed as underlying oral (/**b**/, /**ɖ**/, /**l**/, /**j**/, and /**w**/). In such a segmental analysis, the phonemic nasality of vowels is instantiated with minimal pairs, such as **èdɔ̀** 'sickness' and **èdɔ̃̀** 'gutter,' and nasal vowels are presented as the origin of the nasal features realized on consonants. However, we argue against the vowel as the locus of nasality, rather assigning a nasal feature to the syllable where it is realized on all segments able to license nasal features.

We pursue such an analysis because describing Gengbe nasality in terms of spreading processes is possible but stipulative. A segmental approach requires rules for both leftward spreading from vowels onto consonants and rightward spreading from vowels onto some clitic vowels. In the case of CV and CCV syllables, it also needs to specify that nasality spreads leftward and rightward to a syllable boundary or alternatively that nasality spreads leftward from vowels to consonants only and rightward from vowels to vowels only. When enclitics consisting of a single vocalic nucleus (V) appear, segmental spreading rules must specify which enclitics act as targets for nasal spreading and which do not.

Our analysis differs from these descriptions in that we assign nasality as a feature to the syllable where it is then realized on all segments able to license nasal features, including vowels, all C_2 consonants, and five C_1 consonants (/**b**/, /**ɖ**/, /**l**/, /**j**/, and /**w**/). In support of our conclusions, we presented data showing that nasality does not spread leftward or rightward between syllables, even onto segments able to license nasal features, suggesting that even a segmental approach needs to make reference to syllable boundaries

for spreading. We also presented evidence that nasal consonants in NC sequences and apparent coda nasals are syllabic, and since the nasality of syllabic nasals is tied to their associated syllable, their nasal features do not spread leftward onto preceding vowels. We also account for the nasalization of certain enclitics by claiming those that accept nasality are incorporated into the syllable carrying those nasal features, while other enclitics with invariant nasality constitute their own syllable. Both of the enclitics we found to accept the nasality of the preceding vowel consisted of the low vowel /**ɑ**/, suggesting that the incorporation of these enclitics into the syllable is linked to forming a syllable with a sonority rise, but no sonority fall. This assertion allows certain morphophonological processes in Gengbe to derive CVV syllables. Further work on Gengbe syllable structure is necessary to independently motivate our analysis, but our suprasegmental account is promising in that it straightforwardly accounts for our Gengbe data without needing to specify barriers for nasal spreading and it avoid opacity in the case of 1PSA enclitic reduction. We suspect that continuing to probe the distribution of nasality in Gengbe is vital to developing a better understanding its syllable structure and morphophonology.

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