Category Change as Vowel Reduction: High Vowels in Yoruba

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Introduction

In this paper, I discuss an interesting alternation between high vowels and syllabic nasals in Yoruba, first reported by Oyelaran (1971). I will argue that this neutralization is better viewed as vowel reduction, and reduction of sonority.[1] I show that Yoruba syllabic nasals may arise from the nasal consonants /m/ and /n/, as well as from the high vowels /i/ and /u/, following research by Oyelaran (1971, 1976, 1991).

The core of the formal proposal here is that the high vowel – syllabic nasal alternation in Yoruba represents a case of vowel reduction in a weak environment. This is parallel to the reduction of vowels seen in languages like English in "weak" (or unstressed) syllables. The process is like the reduction of a full vowel to a schwa observed in languages where such is permitted. The weak environment in the case of Yoruba is a "deformed" syllable with a high vowel.

The goal here is to provide a formal insight into Oyelaran (1971)'s original observation. In doing so I rely heavily on data from Oyelaran's research, while supplying additional evidence from other dialects.

1. Nasal contrast and syllabic nasals

Oyelaran (1976) notes that there are two non-syllabic contrastive nasals in Yoruba: /m/ and /n/, as seen in the left columns in (1). Note that [l] alternates with [n] before oral vowels in Yoruba, as seen in the transcriptions of the first examples in (1a) and (1b). (Note that [k͡p], [g͡b] are labiovelar stops.)

(1a) Nasal Contrast

ni	identity marker	Sopé **ni** ọ̀ta	[sok͡pé lɔ̀ta]	'Sope is winner'
mi	'I' (cf. mo)	**mi** ò lọ		'I didn't/wont go'

(1b)	**nḯ**	'have'	Sopé **nḯ** owó	[sok͡pé lówó]	'Sope has money'
			ó **nḯ** bàbá	'he has (a) father'	
	mḯ	'prog. marker,'	mọ **mḯ** lọ	'I am going' (as in Ijesa/Ife)	

Both of these nasals can become syllabic, constituting the only segment in the syllable. The syllabic nasal assumes the place of articulation of the following consonant. The syllabic nasal is

[1] Earlier versions of this paper were presented at CALL 36 (2006) in Leiden, and at GLOW XXX (2007) in Tromso. I am grateful to the audiences at these conferences, especially Maarten Mous and Thilo Schadeberg, for comments and suggestions. I have benefited from discussions with Paul de Lacy, Victor Manfredi, and Olanike Ola-Orie in preparing this version of the paper, and I thank them for input on the theory and analysis. They are in no way to blame for the errors in the paper.

non-contrastive, and may be exemplified as follows (See Bamgbose 1969). In the orthography, only the two nasals (in (1)) are written, as the orthographic forms in the right column in (2) show. Throughout this paper, I will sometimes employ both orthographic and IPA transcriptions of the data, to make clear the alternations being illustrated.

(2a) Within words

Transcription		Orthography
[ò**m̀**bó]	'orange'	ò**m̀**bó
[bó**ŋ́**fò]	'short skirt'	bó**ń**fò
[k͡pa**n**la]	'stockfish'	pa**n**la
[ì**ɲ̀**ɲá]	'bits and pieces (of meat)'	ì**ǹ**já
[ò**ŋ̀**gò]	'ostrich'	ò**ǹ**gò
[g͡ba**ŋ̀m̀**g͡ba]	'plain view'	gba**n**gba

(2b) In phrases (aspectual marker)

[ó **ḿ** bɔ̀]	'he is coming'	ó **ḿ** bọ̀
[ó **ŋ́** fò]	'he is jumping'	ó **ń** fò
[ó **ń** lɔ]	'he is going'	ó **ń** lọ
[ó **ɲ́** ɟó]	'he is dancing'	ó **ń** jó
[ó **ŋ́** ké]	'he is crying'	ó **ń** ké
[ó **ŋ́** hó]	'it is boiling'	ó **ń** hó
[ó **ŋ̀ḿ** gbɔ́]	'he is hearing'	ó **ń** gbọ́

Before vowels, the syllabic nasal occurs only in phrases. In this context it is the alternant of the first person clitic before the negative particle, and it is always a velar nasal. In the orthography, it is written as [n], as in the right column.

(3) **mi** ò lɔ → [**ŋ** ò lɔ] 'I didn't/wont go' **n** ò lọ
I neg. go

mi ò ì lɔ → [**ŋ** èè lɔ] 'I have not gone' **n** èè lọ
I neg. asp. go

The above forms (in (2)) can be easily accounted for by assuming a constraint that calls for the place of articulation of the syllabic nasal to be the same as that of the following consonant. The assumed underlying form of the syllabic nasal is irrelevant in this case. If we were to take a rigorous phonemic approach, we would have to assume that the underlying form of the syllabic nasal in all of the forms in (2) is the velar nasal [**ŋ**], since this is the form that occurs both before the glottal consonant /h/, as well as before vowels (3). The place assimilation of the syllabic nasal is an "everywhere" process. The assimilation applies within words, as in (2a), as well as in phrases, as in (2b) and (3).

1.1 **Analysis**

Descriptively, the assimilation of syllabic nasals before consonants is quite straightforward, within any of the theories of feature geometry. The PLACE node of a consonant spreads to the preceding nasal consonant. (But see Ni Chiosain and Padgett 2001 who suggests that individual place specifications are spread in assimilations.) What is interesting is the place of articulation of the syllabic nasal before a vowel, and before /h/. In this case it is a velar nasal (Bamgbose 1966:8). This suggests that the default place of the syllabic nasal is the dorsal place, rather than the coronal place as earlier assumed (See Bamgbose (1966), Oyelaran (1971) for proposals on Yoruba. See Rice (1996) on velars as default.) In that case we can assume that when there is no consonantal place to assimilate to, the syllabic nasal assumes the underlying dorsal place. This accounts for the occurrence of the dorsal place before vowels and before /h/. (See de Lacy 2006 for arguments that some phonetically velar nasals are phonologically glottal.)

Under a theory in which front vowels are coronal and back vowels are dorsal or labial dorsal (Clements and Hume 1995), we expect a velar nasal only before dorsal or labial dorsal vowels. However, under a theory in which all vowels place nodes are under a dorsal node (Sagey 1986, McCarthy 1988), a syllabic nasal can become velar before any vowel. I will set aside the assimilation before vowels, since it only takes place before the negative marker **/(k)ò/**, whose input form actually contains a dorsal consonant.[2]

1.2 **Formal Account**

I propose the following formal sketch of the straightforward place assimilation cases of the syllabic nasal. The nasal consonant assumes the CPLACE specification of the following consonant. For this to happen, the nasal consonant must succumb to pressures not to retain its assumed place of articulation. I state the constraints responsible as in (4), and the ranking as in (5).

(4) Constraints for nasal place assimilation.

AGREE-CPLACE$_{NASAL}$
A nasal consonant agrees in place of articulation with a following consonant.

IDENT-PLACE$_{NASAL}$
The input-output place specifications of a nasal consonant are the same.

ONSET-ID-PL$_{NAS}$
The input-output place specifications of an ONSET nasal consonant are the same.

For the nasal assimilation to take place, AGR-PL$_{NAS}$ must dominate ID-PL$_{NAS}$ (5a). However when a nasal consonant occupies an onset position, it does not change its place of articulation (5b).

(5) Constraint rankings for nasal place assimilation.

(a) AGR-PL$_{NAS}$ >> ID-PL$_{NAS}$

[2] De Lace (personal communication) has suggested that the nasal and the negative marker's /k/ may be coalescing, keeping the Place of Articulation of the /k/ and the nasality of the nasal, forming [ŋ].

The preference is for the nasal consonant's place of articulation to agree with that of the following consonant, rather than retain its underlying place of articulation.

(5b) ONSET-ID-PL_{NAS} >> AGR-PL_{NAS}
This would explain why syllabic nasals undergo assimilation, but onset nasals don't.

The tableaux in (6) and (7) show the resulting optimal outputs from the ranking of the three constraints in (4) and (5). The tableau in (6) shows the basic assimilation of place of articulation to the onset consonant; while the one in (7) shows that onset nasals do not undergo place assimilation.

(6) òro**m̀**bó 'orange'

òro**ŋ̀**bó	ONS-ID-PL_{NAS}	AGR-CPL_{NAS}	ID-PL_{NAS}
☞ òro**m̀**bó			*
òro**ŋ̀**bó		*!	
òro**ǹ**bó		*!	*

(7) ó **nḯ** bàbá he has (a) father

nḯ bàbá	ONS-ID-PL_{NAS}	AGR-CPL_{NAS}	ID-PL_{NAS}
☞ nḯ bàbá			
mḯ bàbá	*!		*

In all the examples in (2) and (3) a nasal consonant underlies the syllabic nasal; but this is not the only source of the syllabic nasal in Yoruba. In the rest of this paper the focus is on the other sources of the syllabic nasal.

2. **Syllabic nasal alternations: sources of the syllabic nasal**

Among Yoruba scholars, Oyelaran was the first to notice that there is a connection between high (nasal) vowels and the Yoruba syllabic nasal. In a series of papers (1971, 1976, 1991), he made the case that some of the surface syllabic nasals derive from underlying high (nasal) vowels. Writing in 1970 in the pre-feature geometric days, it was understandably difficult for Oyelaran to derive a consonant from a high vowel, but he concluded in his 1991 paper that high nasal vowels "neutralize" to the syllabic nasal. Superficially therefore, it would appear that the Yoruba syllabic nasals arise from several different sources. The syllabic nasal may alternate with (or derive from) (a) a nasal CV, (b) a nasal high vowel, (c) an oral CV, and (d) an oral high vowel. In the following subsections I split the sources into two: nasal segment sources (a, b) and non-nasal segment sources (c, d).

In addition, I will also discuss another source: word initial high oral vowels, drawing data from both standard Yoruba, as well as from other dialects.

2.1 **Nasal segment sources**

In normal speech, vowel deletion occurs in the formatives (with a nasal consonant) in (1) above and (8a) below. The remaining (onset) nasal consonant becomes syllabic, and homorganic with the following consonant (Oyelaran (1971, 1976). See also Owolabi (1989:197)). In the case

of a following vowel, the syllabic nasal is realized as a velar nasal (Bamgbose 1966: 8), as noted above. The forms in (8b) and (8c) are derived from sonorant consonant deletion before high vowels and "nasal syllabification" of the high vowel.

Nasal Consonant+Vowel (consonant or vowel could be nasal)

(8a) /**mi** ò lɔ/ → [**ŋ** ò lɔ] 'I didn't/wont go'
I neg. go

/mo rí i **ní** ilé/ → [mo rí i **ń**lé] 'I saw him at home'
I see 3sg. **at** house

(8b)

/ò**mì**nira/	→	[ò**ǹǹ**nira]	'independence'	(< ara 'body')
/ò**mù**wɛ̀/	→	[ò**ŋ̀**wɛ̀]	'swimmer'[3]	(< wɛ̀ 'swim/bathe')
/ò**mù**gɔ̀/	→	[ò**ŋ̀**gɔ̀]	'idiot'	(< gɔ̀ 'unintelligent')

(8c) Personal Names

/oyè**rĩ̀**dé/	→	[oyè**ǹ**dé]	**/rĩ/**	→	**[ǹ]**
/ɔlá**rĩ̀**dé/	→	[ɔlá**ǹ**dé]	**/rĩ/**	→	**[ǹ]**
/à**yĩ̀**dé/	→	[à**ǹ**dé]	**/yĩ/**	→	**[ǹ]**
/ɔ̀**rṹ**tɔ́/	→	[ɔ̀**ń**tɔ́]	/**rṹ**/	→	**[ń]**

On the other hand, the syllabic nasal can also result from an underlying high nasal vowel, as in (9).

High (Nasal) Vowel

(9) **ũ → n**

[o**ṹ**ɟɛ] ~ [o**ɲ́**ɟɛ] 'food' (< oũ + ɟɛ 'thing + eat')
[ò**ṹ**g͡bɛ] ~ [ò**ŋ̀m̀**g͡bɛ] 'thirst' (< oũ + g͡bɛ 'thing + be dry')

(Osun dialect, Barber 1976:288)
/ò**ũ** ló g͡baya ɛ̀ lɔ́wɔ́ ɔ̀ mi/ → [**n** ló g͡baya ɛ̀ lɔ́wɔ́ ɔ̀ mi]
3sg. foc-3sg take-wife 3sg. from-hand me "It is he who snatched his wife from me"

We can make the following generalizations from the data in (8) and (9). The data in (8a) derives from vowel deletion, and syllabification of the nasal consonant. The analysis of these forms must be similar to the one given for the forms in (2) in the preceding section, since the inputs contain a nasal consonant. The data in (8b, c) and (9) derive from consonant deletion (when one is present as in (8c) and subsequent change of the nasal vowel to syllabic nasal. (But

[3] Oyelaran (1991:13) proposes **òǹinira** and **òwìwɛ̀** as the respective underlying forms for [**òǹnira**] 'independence' and [**òŋ̀wɛ̀**] 'swimmer'. While his suggested inputs make the derivations easier the actual surface alternations are between the input and output forms in (8b).

see Oyelaran (1991) for a different analysis.[4]) See Abimbola and Oyelaran (1975) and Akinlabi (1991, 1993, in prep) for deletions of different types of sonorant consonants.[5]

These data reveal that the syllabic nasal can derive from a nasal consonant [n] or [m], as well as from a high nasal vowel. I will provide a unified account of the forms with a high nasal vowel and forms with a high oral vowel below.

2.2 **Non-nasal segment sources**

The more interesting examples are those of syllabic nasals derived from function words Oyelaran (1991). The function words optionally lose their initial consonants, except when they occur utterance initially. I will also split these examples into oral Consonant+Vowel (CV) forms and oral vowel (V) forms. The forms include the gerundive formative (**Cí**), the relative clause marker [**tí**] (= CV), and the negative affix [**ì**] (= V), among others. In all cases we must derive the syllabic nasal from a high vowel.

Oral CV

(i) Gerundial formative (focused verb):

The gerund is marked in Yoruba by prefix consisting of high-toned vowel [í] and a copy of the consonant of the verb stem (Akinlabi 2006). This form alternates with one in which the gerund is marked by a syllabic nasal, as in (10a) and (10b) respectively. (**k͡pé** 'be late')

(10a) **k͡pí**k͡pé ni yóò k͡pé, akólòlò yóò k͡pe 'bàbá' ([**k͡pí**k͡pé])
being late – FOC – FUT – be late, stammer – FUT – call – 'father'

(10b) **ŋ͡mí**k͡pé ni óò k͡pé, akólòlò óò k͡pe 'bàbá' ([**ŋ͡mí**k͡pé])
It may take long, the stammer will pronounce 'father'.

The gerund can also occur in 'incantations'. The forms in (11) show that alternation is possible whenever there is a gerundial formative. (**yɛ** 'be well with, befitting'; **rɔ̀** 'be soft')

(11a) ó ní **yí**yɛ ní í yɛ ɛyɛlé → ó ní **ɲ́**yɛ ní í yɛ ɛyɛlé ([**yí**yɛ]~[**ɲ́**yɛ])
3sg. – say - being well – FOC – be well – pigeon He says all is always well with the pigeon.

(11b) **rí**rɔ̀ ní í rɔ àdàbà lɔ́rṹ → **ń**rɔ̀ ní í rɔ àdàbà lɔ́ṹ ([**rí**rɔ]~[**ń**rɔ])
being soft – FOC – be soft – dove – at neck It is never difficult for the dove.

The idea in (10) and (11) above is that the consonant of the gerundial prefix ([**k͡p**], [**y**], [**r**]) is deleted, and the remaining high vowel becomes a syllabic nasal, which then assimilates the place of articulation of the following consonant as usual.

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[4] It is also possible to derive the examples in (8a) by deleting the nasal consonant and consequent change of the high vowel to a syllabic nasal, just as in the examples in (8c) and (9). The problem with this is three-fold. First we must assume that nasal consonants are deletable in this context. Secondly, the well-known Yoruba [l] ~ [n] alternation is no longer one between [l] and [n], but one between [l] and a high vowel. Thirdly, this solution raises a problem for the independent process of vowel deletion, which regularly deletes "high vowels" before another vowel in this context. Because of these problems, I assume that it is the nasal consonant, rather than the high vowel, that underlies the syllabic nasal in (8a).

[5] The nasal consonant deletion in (8b) is unproductive.

(ii) The relative clause marker [**tí**]

The consonant [t] of the relative clause marker [**tí**] may be deleted, leaving behind the high vowel [i]. As in the gerundial prefix the high vowel becomes a syllabic nasal, which takes the place of articulation of the following consonant.

(12)	ìgbà **tí** mo yègò nígbàlè	→	ìgbà **ḿ** mo yègò nígbàlè	([**tí**]~[**ḿ**])
Time - **that** – I – dodge costume – in grove			When I dodged the (egungun) costume in the sacred grove	

On the oral CV forms in (10) – (12) above, Oyelaran (1991:15) concludes that:

> "when, in Yoruba, derivational morphemes and function words lose their consonants, if the vowel tautosyllabic with the consonant … is a high front vowel, the vowel may optionally neutralize to a syllabic nasal…"

This statement aptly describes the alternation context. However, we should note that it does not matter whether the (deleted) formative consonant is oral or nasal, and it does not matter whether the (remaining) high vowel [i] is oral or nasal.

Oral High Vowels

(i) The Infinitive [i]

The infinitive marker [**í**] can alternate with a syllabic nasal (13a), or assimilate to the vowel of the preceding verb (13d), or remain unassimilated (13b,c), as the following examples from Gelede music show.

(13) From Gelede music (Oyedepo 1979:17)

	aɟógèlèdè	Dancer of Gelede music	
(a)	mo fẹ́ **ń** ʃàdúrà kã	I want to say a prayer	(infinitive [**í**] **becomes [ń]**)
	I – want – **to** – say prayer – one.		
(b)	mo fɛ́ **í** ʃàdúrà kã	(unassimilated [i])	
(c)	mo fɛ́ **ʃí**ʃàdúrà kã	(unassimilated [i])	
(d)	mo fɛ́ **ɛ́** ʃàdúrà kã	(assimilated [i])	

It is crucial to digress at this point to give a unified explanation for the examples in (10) – (13). While it is obvious that the high-tone [**í**] underlies the syllabic nasal in all these examples, it is not crucial to assume that consonant deletion is involved in all cases, especially in (10), (11) and (13). Compare the examples in (13b, c, d) with those in (10) and (11). It is a well-known fact of Yoruba that vowel initial nouns are never also high-tone initial. If we extend this position slightly, we can say that there are other ways in which an initial high-toned vowel can be protected. One is by providing an onset with a copy of a consonant of the stem (as in the (10a), (11), and (13c)). Another possibility is to turn the high vowel [**í**] into a syllabic nasal, as we see here in (10b), (11) and (13a). A third possibility is assimilating the high vowel to the preceding vowel, as in (13d). In fact, the so-called verb-infinitive high–tone vowel [**í**] (in 13) is usually

assimilated in fluent speech, and never occurs as [**í**]. (See also Bamgbose (1969) for the opinion that there is a connection between the syllabic nasal and the high tone [**í**].)

The idea just sketched above follows completely if we assume the proposal that the deverbal noun (or gerundial) prefix is [**í**] (Akinlabi 2004, to appear) (see also Ola (1995) and Pulleyblank (2004) for similar proposals), and that the copy of the consonant of the verb is necessary to protect the high tone prefix [**í**], which is otherwise banned in Yoruba.

I will conclude therefore that all of the forms in (10) – (13) involve an alternation between [**í**] and a syllabic nasal.

(ii) Reduplication in Aro traditional Yoruba poetry

The syllabic nasal is also derivable from a low-tone [**ì**] via consonant deletion. The deleted consonant itself arises from an obviously reduplicated stem. The first onset consonant is deleted in the (V)-**C**VCV context because it is identical to the consonant in the next syllable. The remaining high vowel alternates with a syllabic nasal.

(14)	ò**tì**tɛ̀	→	ò**ǹ**tɛ̀	(<ò**ì**tɛ̀)	'stamp' (of authority) (tɛ̀ 'press')
	ò**g͡bì**g͡bɛ	→	ò**ŋ̀m̀**g͡bɛ	(<ò**ì**g͡bɛ)	'thirst' (g͡bɛ 'dry up')
	ò**k͡pì**k͡pa	→	ò**ŋ̀m̀**k͡pa	(<ò**ì**k͡pa)	'thresher' (k͡pa 'weed')
	ò**g͡bì**g͡bĩ̀	→	ò**ŋ̀m̀**g͡bĩ̀	(<ò**ì**g͡bĩ̀)	'planter' (g͡bĩ̀ 'plant')
	ò**hì**hù	→	ò**ŋ̀**hù	(<ò**ì**hù)	'germinator/ he who makes germinate' (hù 'germinate')
	ò**dì**dà**g͡b**à	→	ò**ǹ**dà**g͡b**à	(<ò**ì**dà**g͡b**à)	'he who grows/developer' (di à**g͡b**à 'become grown')

Related to the derived nouns above are the forms in (15). The first form in (15) has the same shape ((V)-CVCV) as the derived ones in (14), but there is no separate CV stem here. The same process of first onset deletion applies.

(15)	**dì**de	→	**ǹ**de
	rise, stand up		
	à -ɟí -**dì**de	→	à**ɟí ǹ**de
	resurrection (Easter)		'(act of) waking up and walking, rising'

(iii) The negative marker [**ì**]

Finally, the negative formative [**ì**] is employed in a nominalization process, which involves two copies of a verb. The negative formative [**ì**] occurs between the two copies. The verb [**tá**] "finish" is added ("suffixed") to the stem, and finally a noun is formed from this complex verbal structure by adding a prefix [**à**-]. The nominal structure has the meaning "Doing X without end". In this structure, the negative formative [**ì**] alternates with a syllabic nasal.

(16) àwɔ́ **ì** wɔ́ tá̋ → àwɔ́ **ŋ̀** wɔ́ tá̋
flowing – NEG – flow – finish that which flows (of gown) without end
àɟɛ **ì** ɟɛ tá̋ → àɟɛ **ɲ̀** ɟɛ tá̋
eating NEG eat finish that which is consumed (as in glory of God) without end
àbù **ì** bù tá̋ → àbù **m̀** bù tá̋
scooping NEG scoop finish that which is scooped (of liquid) without end

(iv) Forms derived from /r/ deletion

The consonant [r] may be deleted before or after high vowel in Yoruba (see Akinlabi 1993 for details). In some of these forms, there is a choice between assimilating the "orphaned" high vowel to the preceding vowel and alternating with a syllabic nasal.

(17) /**u**/ → [**n**]

ò**rù**lé	→	ò**ǹ**lé ~ ò**ò**lé	rooftop
ò**rù**ka	→	ò**ŋ̀**ka ~ ò**ò**ka	ring (finger)
ò**rù**g͡bɛ	→	ò**ŋ̀m̀**g͡bɛ ~ ò**ò**gbɛ	thirst (see also the same form in (11))

It is apparent from the foregoing that there are three sources of high vowels turning to syllabic nasals:

(18) High vowel sources of the syllabic nasal.
(a) Nasal consonant plus high vowel.
(b) Non-nasal consonant plus high vowel.
(c) An underlyingly onsetless high vowel.

The above evidence is compelling enough to show that Yoruba high vowels ([**i**], [**u**]) alternate with a syllabic nasal. The important question is how can we derive one from the other? Another way of putting this question is to ask what high vowels have in common with nasals. The place of articulation of the high vowel does not appear to be important, since the surface place of articulation of the resulting syllabic nasal is determined by that of the following segment.

2.3 **Non-high vowels do not alternate with syllabic nasals**

To complete the picture it is necessary to show what happens with non-high vowels in function words. Underlying or derived non-high vowels in function words do not alternate with the syllabic nasal, the way high vowels do. An example of this is the aspectual marker [í], which is used in the negative habitual, as in (19).

(19) /olú kò í lɔ/ 'Olu does not (usually) go'
Olu-neg.- asp-go

The various possible outputs of the forms in (19) are:
(20a) [olú kò ń lɔ] 'Olu does not (usually) go
(20b) [olú kì í lɔ] 'Olu does not (usually) go'

(20c) [olú kì ń lɔ] ‘Olu does not (usually) go’
(20d) [olú kè é lɔ] ‘Olu does not (usually) go’
(20e) *[olú kè ń lɔ]

(21) /olú kò lɔ/ → [olú ò lɔ] “olu did not go”
*[olú ǹ lɔ]

All of the forms in (20) have (19) as their input. The form in (20a) is one in which the high vowel [i] of (19) simply becomes a syllabic nasal. (20b) is the output of (19) with regressive assimilation, which occurs in phrases. (20c) combines (opaque) regressive assimilation with the alternation of [i] with a syllabic nasal. (20d) is the output of (19) when the vowel [o] of [kò] coalesces with the aspectual [i]. Finally, unlike (20c) which shows that any onsetless [i] can alternate with a syllabic nasal, [e] cannot alternate with a syllabic nasal (cf 20d). In addition, though it is possible to delete the onset of the negative marker [(k)ò], the onsetless [o] of the negative marker in (21) cannot alternate with a syllabic nasal.

2.4. **More on high vowel and syllabic nasal relatedness**

There is independent evidence within Yoruba phonology showing a strong connection between syllabic nasals and high vowels. Yoruba has a tongue root vowel harmony system within which vowels in a prosodic word agree in tongue root specification. The tongue root quality of the vowels in a prosodic word is controlled by the tongue root specification of the stem vowel. Since Yoruba is a prefixing language, harmony operates in a right to left direction.

Syllabic nasals, derived from high vowels like those in (18), are **opaque** to vowel harmony (they block the propagation of [-ATR] from the stem to the prefix), just like the high vowels they are derived from. On the other hand non-syllabic nasals (and indeed all other consonants) are not.

(22) Non-syllabic nasal consonants do not block harmony

ɛmɔ́	‘bush rat’	*emɔ́
ɔmɔ	‘child’	*omɔ
ɛnà	‘code, jargon’	*ènà
ɔ̀nà	‘way, road’	*ònà

(23) High vowels block [-ATR] spreading from right to left

or**ú**kɔ	name	***ɔ**rúkɔ
èk**ù**rɔ́	palmnuts	*è**ɛ**kùrɔ́
èl**ù**bɔ́	cassava or yam powder	*è**ɛ**lùbɔ́

(24) Syllabic nasals derived from high vowels block [-ATR] spreading from right to left

ò**mù**gɔ̀	→	ò**ŋ̀**gɔ̀	‘idiot’	*ɔ̀ŋ̀gɔ̀
ò**tì**tɛ	→	ò**ǹ**tɛ̀	‘stamp’	*ɔ̀ǹtɛ̀

If the syllabic vowels are assumed derived from high vowels as proposed here, their similar behavior in ATR harmony is completely explained.

The above shows that Yoruba syllabic nasals actually share a relationship with high vowels. I now turn to account for the alternation between high vowels and syllabic nasals.

3. **A Proposal**

The goal here is to derive the neutralization of high vowels to syllabic nasals, in a weak environment.

What is a deformed/weak syllable?

There are at least three things that point to the fact that the vowel in this context is reduced. First, the vowel itself is prosodically weak. The alternation involves a high vowel and never any other vowel. High vowels are known to be prosodically weaker than non-high vowels. Therefore among vowels, they make the worst nuclei (outside of the central vowel [*ə*]). Secondly, the vowel is located in a syllable that has been deformed by deletion of its onset, or that is underlyingly onsetless. Ola (1995) proposes that the only full syllables in Yoruba are those with onsets, and that vowel-only syllables are only moras and not full syllables. Thirdly, the equivalent of a weak position here is a functional word or a derivational morpheme, which are known to be subject to cliticization.

This neutralization is intuitively similar to sonority driven vowel reduction in stress systems (Crosswhite 1999, 2000), depending on how a "non-prominent syllable" is defined in a non-stress language. I propose that the definition of non-prominence should include both prosodically and morphologically weak positions, as done above.

Vowel reduction may therefore result in category change, from vowel to consonant, through reduction in sonority. By implication therefore, the end result of the reduction may vary, depending on the least sonorous segment the language in question allows in nuclei.

In Yoruba, short of outright deletion, there are two choices available for this deformed syllable to be realized:

(25) (a) the high vowel may be completely assimilated to the preceding vowel, or
(b) the vowel may be completely reduced to the least sonorous sound that is permitted to be a syllable peak in Yoruba. This is the nasal consonant.

4. **A sketch of a formal analysis**

In this section, I will attempt to give a formal account to the generalization from the preceding section. The generalization is that a weak vowel (high vowel) becomes a weak sonorant (syllabic nasal) in a weak position (an onsetless syllable). I will analyze this as a preference for a syllabic nasal nucleus in a weak position; other onsetless (non-high) vowels do not change to syllabic nasals because they are prevented from doing so.

It is a well-known fact that vowels differ in their intrinsic sonority. Parker (2002) presents both acoustic and aerodynamic evidence that a height-based scale of sonority (in 26) is cross-linguistically motivated. (See also Kent and Read 2002.)

(26) Relative sonority of vowels:

LOW >	MID >	HIGH
æ, a, . . .	e, o, . . .	i, u . . .

That is, low vowels are more sonorous than mid vowels, which are in turn more sonorous than high vowels. (See also Howe and Pulleyblank 2004.) Thus, among vowels, high vowels are the least sonorous.

Apparently, if a syllable is deformed such that what remains is the least sonorous vowel, this is further reduced to the least sonorous element that can be moraic in Yoruba. I will leave the question open as to whether or not such elements are just moras or still full syllables (Ola 1995).

It is also well known that all segments can be grouped into four classes in terms of sonority, vowels being the most sonorous and obstruents being the least sonorous (Clements 1990). Translating this into relative harmony in terms of sonority, we have:

(27) Relative sonority of major sonority classes

vocoid > liquid > nasal > obstruent

Clements (1990) and Clements and Hume (1995) propose the following ranking of the major sonority classes, based on the plus values of their features [sonorant], [approximant], and [vocoid], with vocoids having all pluses and obstruents having all minuses.

(28) Sonority rank of segment classes

Obstruent	0
Nasal	1
Liquid	2
Vocoid	3

Based on this hierarchy, we can assume that a nucleus in Yoruba must have at least a sonority level of 1. That is, obstruents are banned from the nucleus position. However, what is crucial to our analysis is that taking the harmony in (27) and (28) together, the least sonorous vowels may reduce to the least sonorous segments (allowed as nuclei) in the weakest syllables.

4.1 **Constraints and Constraint Ranking**

Before proceeding to give the technical formal derivation, it is important to highlight the main points descriptively:

(29) (a) Among vocoids, it appears that high vowel nuclei are the least sonorous, except of course the language has [*ə*].
(b) An onsetless nasal is preferred to an onsetless non-high vowel, which is in turn preferred to an onsetless high vowel.
(c) Having an onsetless nonhigh vowel is preferred to changing it.
(d) Changing a high vowel is preferred to having it as an onsetless high vowel.
(e) Finally, since the least offensive onsetless nucleus is the syllabic nasal, this is the result of the high vowel change.

I will assume that (27) converts to the following, in terms of occurrence in nuclei.

(30) *NUC/obs >> *NUC/nas >> *NUC/liq >> *NUC/voc

Among vocoids, it appears that high vowel nuclei are the least preferred. The ranking in (26) expresses this formally.

(31) *NUC/high >> *NUC/non-high

Prince and Smolensky's (1993/2004) prominence alignment have been employed for alignment of segment to syllable positions, sonority driven stress (Kenstowicz 1994), sonority driven vowel reduction (Crosswhite 1999, 2000), etc. Here I propose that a species of these constraints can be employed to account for high vowel/nasal consonant alternations.

I will adopt the same constraint families used by Kenstowicz (1994) to predict stress placement in sonority-driven stress situations:

(32) (a) Stress targeting low-sonority:
*Stressed/ə >> *Stressed/i,u >> *Stressed/e,o >> *Stressed/a

(b) Stress targeting high sonority:
*Unstressed/a >> *Unstressed/e,o >>*Unstressed/i,u >> *Unstressed/ə

Crosswhite (1999, 2000) has extended this model to sonority-driven vowel reductions. However, since Crosswhite dealt with vowel reductions in languages with stress prominence, further extension of this model is necessary to cover the type of syllabic "weak" position as defined above. I propose the following ranking, making only a broad separation between non-high and high vowels.

(33) Sonority-Driven Reduction in a non-stress language
*[$\sigma_{\text{HIGH-V}}$ >>…>> *[$\sigma_{\text{NON-HIGH-V}}$ >>…>> *[$\sigma_{\text{NASAL-C}}$
([σ_X: "x is the first segment of the syllable")

The ranking in (33) claims that an onsetless nasal consonant is preferred to an onsetless non-high vowel, which is in turn preferred to an onsetless high vowel, in Yoruba.

Howe and Pulleyblank (2004) capture the weakness of high vowels by proposing that faithfulness to them (specifically MAX or DEP) is ranked lower than faithfulness to non-high vowels. I will assume that all faithfulness constraints to high vowels are ranked low, including IDENT constraints.

By itself the ranking in (33) predicts that all onsetless vowels should become syllabic nasals in Yoruba. To prevent this from happening, the identity of non-high vowels must be protected by the IDENT (and MAX) family of constraints. I will therefore assume the ranking of IDENT in (34) and (35) with respect to the sonority constraints in (33). I will simply use $\text{IDENT}_{\text{NON-HIGH}}$ and $\text{IDENT}_{\text{HIGH}}$.

(34) $\text{IDENT}_{\text{NON-HIGH}}$ >> *[$\sigma_{\text{NON-HIGH-V}}$
The ranking in (34) proposes that having an onsetless non-high vowel is preferred to changing it.

The tableau in (35) illustrates this ranking. In (35) an onsetless vowel [ò] from the negative marker [kò] (from (21) above) does not alternate with a syllabic nasal.

(35) /olú kò lɔ/ → [olú ò lɔ] "olu did not go"

kò lɔ	$\text{IDENT}_{\text{NON-HIGH}}$	$*[\sigma_{\text{NON-HIGH-V}}$
☞ ò lɔ		*
ǹ lɔ	*!	

(36) $*[\sigma_{\text{HIGH-V}}$ >> $\text{IDENT}_{\text{HIGH}}$
Changing the features of a high vowel is preferred to having it as an onsetless high vowel.

The ranking in (36) is exemplified in tableau (37). Here the onsetless negative habitual marker [í] alternates with a syllabic nasal, instead of remaining a vowel.

(37) /olú kò í lɔ/ → [olú kò ń lɔ] (or [olú ò ń lɔ]) "olu does not go"

kò í lɔ	$*[\sigma_{\text{HIGH-V}}$	$\text{IDENT}_{\text{HIGH}}$
☞ kò ń lɔ		*
kò í lɔ	*!	

The combined ranking of both of these predicts that only onsetless high vowels will change:

(38) $\text{IDENT}_{\text{NON-HIGH}}$, $*[\sigma_{\text{HIGH-V}}$ >> $*[\sigma_{\text{NON-HIGH-V}}$ >> $\text{IDENT}_{\text{HIGH}}$

Finally, since the least offensive onsetless nucleus is the syllabic nasal, this is the result of the high vowel change, as predicted by the ranking in (39).

(39) $\text{IDENT}_{\text{NON-HIGH}}$, $*[\sigma_{\text{HIGH-V}}$ >> $*[\sigma_{\text{NON-HIGH-V}}$ >> $*[\sigma_{\text{NASAL-C}}$, $\text{IDENT}_{\text{HIGH}}$

The tableau in (40) exemplifies the optimal form that emerges from the ranking in (39). The relevant form here is the output in which both the negative marker [(k)ò] and the negative habitual [í] occur without an onset. In this case, only the negative habitual [í] can alternate with a syllabic nasal, though both of these vowels occur onsetless in function words.

(40) /olú kò í lɔ/ → [olú kò ń lɔ] / [olú ò ń lɔ] "olu does not go"

kò í lɔ	$\text{ID}_{\text{NON-HIGH}}$	$*[\sigma_{\text{HIGH-V}}$	$*[\sigma_{\text{NON-HIGH-V}}$	$*[\sigma_{\text{NASAL-C}}$	$\text{IDENT}_{\text{HIGH}}$
☞ ò ń lɔ			*	*	*
ǹ ń lɔ	*!		**		
ò í lɔ		*!			
ǹ í lɔ	*!	*!		*	

(This tableau excludes constraints responsible for [k] deletion, which is independent of the process under discussion.)

The hasse diagram in (41) presents the overall ranking of the above relevant constraints.

(41) $\text{IDENT}_{\text{NON-HIGH}}$ >> $*[\sigma_{\text{HIGH-V}}$

$*[\sigma_{\text{NON-HIGH-V}}$ >> $\text{IDENT}_{\text{HIGH}}$

$*[\sigma_{\text{NASAL-C}}$

The above broadly accounts for the reduction of onsetless high vowels to nasal consonants. Two remaining issues need to be addressed. First, it is that not all onsetless high vowels become syllabic nasals in standard Yoruba. For example, high vowels of words in isolation or in absolute initial positions do not become syllabic nasals. I take this to result from the protection of segments in absolute initial position, that is "positional faithfulness" (Beckman 1998 and others).

Secondly, why is it not possible to turn all high vowels into syllabic nasals, regardless of whether they have onsets or not. After all, nasals do constitute syllable peaks crosslinguistically (e.g. English). We must assume that this is impossible in Yoruba because an onset cannot occur with a nasal consonant as the nucleus. This will be enforced by an OCP-type constraint that forbids two [+consonantal] segments in a syllable, σ-OCP[+consonantal].[6] This constraint must dominate $*[\sigma_{\text{HIGH-V}}$.

5. **Further evidence from Yoruba dialects:** Cognates in Onko Dialect

Standard Yoruba is not the only dialect in which onsetless high vowels alternate with syllabic nasals. There are in fact other Yoruba dialects that regard all such syllables as weak. In Onko dialect, all onsetless word initial [i] in the standard dialect are realized as syllabic nasals.

(42) Cognates in S.Y. and Onko

Onko	SY	Gloss
nlé	ilé	house
nsó	isó	fart
ɲyà	ìyà	punishment
ɲcɛ́	iʃɛ́	work
ǹtɔ̀	ìtɔ̀	urine
n͡gb͡ɛ́	ìgb͡ɛ́	feaces
mbo	ibo	where?
mmí	imí	feaces
nrɔ́	irɔ́	lie

Ola (1995) provides further evidence from distributive reduplication confirming the alternation between initial /i/ and the syllabic nasal in Onko. Distributive nouns are formed by prefixing a minimal noun, a VCV, to the base. If the base is VCV, then the form is copied. However, if the base is larger than a VCV, then only the initial VCV is copied. (See Akinlabi 1985, Pulleyblank 1988 for details.) The final vowel of the VCV prefix assimilates all the features of the following base vowel. The gloss in each case is "noun/every noun".

[6] Thanks to Paul de Lacy, for pointing this out to me.

(43)	Standard Yoruba		Onko Yoruba		
	Base	Reduplicant	Base	Reduplicant	Gloss
(a)	ò̀ru	ò̀rò̀-ò̀ru	ò̀ru	ò̀rò̀-ò̀ru	night
	ò̀wúrɔ̀	ò̀wò̀-ò̀wúrɔ̀	ò̀wúrɔ̀	ò̀wò̀-ò̀wúrɔ̀	morning
(b)	ì̀là	ì̀lì̀-ì̀là	ǹlà	ǹlì̀-ì̀là	line
	ì̀rɔ̀lɛ́	ì̀rì̀-ì̀rɔ̀lɛ́	ǹrɔ̀lɛ́	ǹrì̀-ì̀rɔ̀lɛ́	evening
	ì̀yálɛ̀ta	ì̀yì̀-ì̀yálɛ̀ta	ɲyálɛ̀ta	ɲyì̀-ì̀yálɛ̀ta	dawn

The forms in (43a) show that distributive reduplication in Standard Yoruba and Onko dialect are the parallel. Furthermore, since the final vowel of the reduplicant VCV is identical to the initial vowel of the base (because of assimilation), we know what the input vowel is. Finally, the examples also show that when the base of the reduplication has a non-high initial vowel, there is no change in the form of the initial vowel.

Now considering the Onko forms in (43b), the nasal only surfaces at the beginning of the reduplicant, but not at the beginning of the base, where we assume the underlying vowel surfaces. These examples do not make sense unless we assume that a form like [**ǹlì̀-ì̀là**] 'line' is derived from /**ì̀là-ì̀là**/. The final vowel of the prefix is assimilated to the initial vowel of the base, and the initial onsetless [i] becomes a homorganic nasal. We know that [i] must underlie this vowel because that is the vowel that surfaces in the following syllable.

It may seem at first look that there is nothing special about the Onko examples. For example it is possible that initial /i/ in S.Y. simply corresponds to an initial nasal in Onko. It is however possible to show that the high vowel /i/ underlies the initial nasals in these examples. In verb+noun combinations where the initial /i/ of the noun is not deleted, it shows up as /i/ instead of as a nasal consonant.

(44) /i/ underlies the initial nasal in Onko

ce	+	icɛ́	→	cicɛ́	work (verb) (cf. ɲcɛ́ 'work')
do		work			
ɟɛ	+	ì̀yà	→	ɟì̀yà	suffer (verb) (cf. ɲ̀yà 'punishment')
eat		punishment			
k͡pa	+	irɔ́	→	k͡pirɔ́	lie (verb) (cf. nrɔ́ 'lie')
kill		lie			

Therefore we must conclude that initial /i/ in Onko become syllabic nasals. The Onko dialect examples cannot be explained unless we assume the vowel reduction hypothesis, for two reasons:

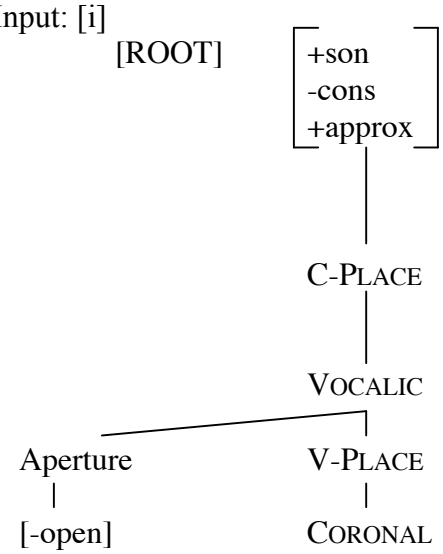
(a) As in the Standard dialect, nasalized vowels are prohibited in absolute word initial positions, and so this cannot be explained by assuming a procedure including inserting nasality on an initial vowel and then turning it into a consonant.

(b) It is not clear why only [i] will attract nasal insertion, and why only initial [i].

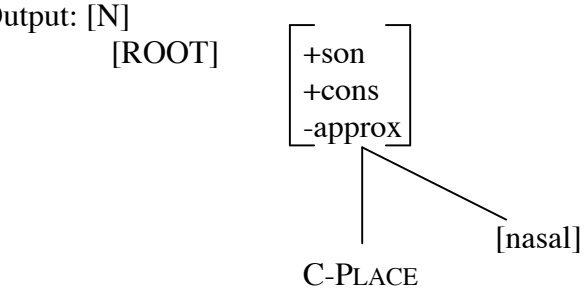
6. **An Alternative Analysis: Nasal epenthesis**

Given most of the theories of segment feature geometry today (see McCarthy 1988, Clements and Hume 1995, Halle 1995, among others), this process cannot be straightforwardly derived. One must assume that the feature nasal is inserted on a stranded high vowel, and the [-cons] specification on the root node of the high vowel becomes [+cons]. Using Clements and Hume (1995)'s geometry for example, the input and output forms of this epenthesis and change process are represented in (45) and (46), ignoring irrelevant nodes:

(45) Input: [i]



(46) Output: [N]



The input-output "transformation" appears unconnected, unmotivated and completely arbitrary. There is no reason why an oral vowel [i] should change to a nasal consonant in this approach. The epenthesis argument cannot be correct for because epenthesis usually supplies a missing prosodic element, such as an ONSET, when onsets are required, or a NUCLEUS, when the syllable is otherwise disallowed for other reasons, including non-permissible clusters, or orphaned consonants. None of these is the case in the Yoruba data discussed here.

Regardless of which forms one assumes underlie the outputs with syllabic nasals, the important point is that the syllabic nasals ultimately derive from high vowels.

7. **Conclusion**

In this paper, I have shown that the high vowel – syllabic nasal alternation in Yoruba represents a case of vowel reduction in a weak or non-prominent environment. I have proposed a definition of

non-prominence that includes both prosodically and morphologically weak positions. I conclude that vowel reduction may therefore result in category change, from vowel to consonant, through reduction in sonority. By implication therefore, the end result of the reduction may vary, depending on the least sonorous segment the language in question allows in nuclei. The specific cases discussed here are from vowels to syllabic nasals.

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