Two Cases of Adaptation Mismatches in Yoruba Loan Phonology

Ọlanikẹ Ọla Orie
Tulane University

1. Introduction

This paper examines two cases of loanword adaptation mismatches in Yoruba (Benue-Congo). The first case comes from the inconsistencies observed in the incorporation of English /l/. As will be shown, velarized /l/ is sometimes retained in borrowing, as in [púùlù] 'pool'; sometimes, it is borrowed as [r], as in [tébùrù] 'table'.[1] Given that /l/ and /r/ are contrastive sounds in English and Yoruba, one may expect liquid adaptation to match perfectly. However, the behavior of /l/ contradicts this expectation.

The second case comes from adaptation patterns involving non-contrastive nasal vowels, vowels derived when a coda nasal follows a vowel tautosyllabically in English (for example, pin [pĩn], pan [pæ̃n]). The pattern exhibited in this case is asymmetric in that forms with high vowels are adapted with nasality (pin →[pĩĩnĩ] *[pɪɪnɪ]), whereas forms with non-high vowels are adapted without nasalization (pan → [páànù] *[pããnu]. The pattern involving high nasal vowels is interesting because it contradicts the assumption that languages only borrow contrastive features (Paradis and LaCharité 1997, LaCharité and Paradis 2005).

Aside from the specific issues already raised, the adaptation inconsistencies raise a more general question of what role does phonology and/or phonetics play in shaping the output of loans. More precisely, these asymmetric patterns will shed light on a long-standing debate of whether borrowing is solely phonological (Paradis and LaCharité 1997, 2005, Paradis & Prunet 2000, etc.) or largely phonetic (Silverman 1992, Peperkamp and Dupoux 2003), or whether it is driven by a combination of both factors (Kenstowicz 2005, Yip 2006, etc).

In this article, I show that the adaptation of /l/ is both phonologically and phonetically constrained. It is phonologically constrained because /l/'s distinctiveness is retained in a prosodic domain: in the first two CV syllables of a loan noun. The disyllabicity of the prosodic domain follows from the independent requirement in the language that underived nouns be minimally disyllabic (Ọla 1995). Outside the prominent domain, that is the leftmost foot, acoustic factors involving low F3 specifications of low tones (Bakare 1995) and high back vowels (Ladefoged 1975) combine to motivate the choice of [r] rather than [l]. As work in phonetics (O'Connor, Gertsman, Libermann,

* This paper has benefitted from the comments and questions of Akin Akinlabi, Victoria Bricker, Laura Downing, Larry Hyman, Doug Pulleyblank, and the audience at ACAL 42 held at the University of Maryland. Thanks to two anonymous reviewers who provided comments and questions, which have improved both the presentation and substance of the paper. The usual disclaimers apply; thus, I assume full responsibility for all shortcomings.

[1] The examples in this paper are given in Standard Yoruba orthography. In Yoruba orthography, *ẹ* = [ɛ], *ọ* = [ɔ], *Vn* = nasalized vowel, *ṣ* = [ʃ], *ṗ* = [k͡p], an acute accent [́] = H(igh) tone, a grave accent [̀] = L(ow) tone, unmarked for tone = M(id) tone, a tone-marked nasal = syllabic nasal.

Delattre and Cooper 1957, Ladefoged 1975) show, one distinctive acoustic feature of [r] is its low F3 property. Thus, [r] is a more optimal choice than [l] in a prosodically weak domain that is acoustically saturated with a low F3. The differences in the adaptation domains, mentioned above, are supportive of the Harmonic Domain Ranking approach which states that the manifestation of constraints is stronger in smaller domains than larger domains (Mohanan 1993, Beckman 1998, Archangeli & Pulleyblank 2002). In this case, phonemic contrasts are maintained in the head foot domain while allophonic alternations occur in the non-head position, which is the larger domain.

Regarding nasal vowels, their behavior constitutes a strong argument in favor of Ohala (1975), Rochet and Rochet (1991) and Bell-Berti (1993)'s viewpoint that there is a universal tendency for high oral vowels in nasal environments to be nasalized through a greater part of their duration (both proportionally and absolutely) than are non-high vowels in the same environment. This view supports a markedness scale where high nasal vowels are represented as less marked than non-high nasal vowels (Ajiboye & Pulleyblank 2008). Another theoretical repercussion of the behavior of high nasal vowels is that a subphonemic feature (nasalization, in this case) can be borrowed and elevated phonologically in loan phonology.

The organization of this article is as follows. First, I present data illustrating the strong tendency in the vocabulary of Yoruba dialects (such as the Standard and Northwestern dialects) to avoid placing /l/ between two high back vowels which are also linked to low tones. Second, adaptation patterns involving the alternation of /l/ and [r] are presented. Third, the important role played by prosodic structure is illustrated. Fourth, the role of phonetics in the adaptation of /l/ is discussed. Fifth, data involving nasal vowel borrowing are presented and analyzed. Finally, the major findings of the paper are summarized.

2. /l/ and /r/ in native nouns

Yoruba has two contrastive liquids, /l/ and /r/, as can be observed in (1):

(1)				
	lá	'lick'	rá	'disappear'
	lù	'beat'	rù	'carry'
	ìlú	'city'	ìrú	'fealty'
	ọ̀lẹ̀lẹ̀	'bean meal'	ọ̀rẹ̀rẹ̀	'sleeping sickness'

Although these consonants contrast in many contexts, a special context is observed which favors /r/ more than /l/. As shown in (2), many nouns exist where /r/ is flanked by two high back vowels (Curu), but there are few cases involving /l/ in the same environment.

(2)	Curu	
	gúgúrú	'popcorn'
	efùrù	'type of white yam'
	túrùkú	'river hog'
	ìsáwùrú	'river snail'
	orúrù	'type of tree'
	lúúrú	'dried, pulverized leaves'
	èkuru	'type of bean meal'
	èsúrú	'type of yam'
	ẹ̀bùrú	'short-cut'
	sùúrù	'patience'
	òtúrúpọ̀n	'type of Odu in divination'
	bùrùkùtù	'type of traditional wine'
	òfurufú	'sky space'
	awúrúju	'fraud'

Culu	
ẹ̀lulùú	'type of bird'
túúlu	'migraine'
kúlúsọ	'an insect'
ẹ̀kùlù ~ ẹtu	'duiker'
fùlù ~ fùkù	'lungs'

In (2), we see that /r/ can be flanked by high back vowels bearing the three possible tones in Yoruba: H, L, M. However, the distribution of /l/ is quite restricted. For instance, only six nouns are found where /l/ is flanked by /u/ (Abraham 1958). Out of the six attested examples, only two cases are found where /l/ can be flanked by low tone bearing high back vowels (fùlù and ẹ̀kùlù). In the two instances, there are alternative forms for the word. Interestingly, the alternative forms are in current use, while the forms with flanking low tone /ù/ have become obsolete. Therefore, there is a strong tendency to avoid /Culu/ words, but there is even a stronger tendency to avoid placing /l/ between two L-tone-bearing high back vowels. On the basis of this restriction, I assume that the following constraint is active in Yoruba:

(3) *(C)ùlù: Within a root, /l/ is prohibited between two HI/RD vowels linked to L tones.

Although the effect of *(C)ùlù is not visible elsewhere in the native grammar, as will be shown (§3), this constraint emerges as a visible force in shaping the output of English loans.

3. Loan nouns and /l/ adaptation mismatches

English, like Yoruba, contrasts /l/ and /r/ phonemically (for example, lead/read, flank/frank). In many dialects of English /l/ has two allophones – clear /l/ ([l]), and dark, or velarized, /l/ ([ɫ]) involving a secondary articulation – the retraction of the back of the tongue towards the velum. In dialects which exhibit this allophony, the clear /l/ occurs in syllable onsets (*light*, *love*) and the dark /l/ occurs in syllable codas (*pool*, *milk*); dark /l/s also occur as stand-alone syllabic consonants (*table*, *vocal*). Unlike English, all /l/s appear in onset position in Yoruba, and all /l/s are clear. Thus, when Yoruba borrows English velarized [l]s, they occur as clear [l]s in onset position. In the remainder of this section, I present data illustrating the distribution of English /l / in Yoruba.

As exemplified by the data in (4), the phonemic contrast between English /l/ and /r/ is retained when the two sounds occur in onset position:

(4)	Loan with /l/ and /r/ in onset	Adaptation	Unattested
	rent	rẹ́ǹtì	*lẹ́ǹtǐ
	lent	lẹ́ǹtì	*rẹ́ǹtǐ
	lantern	láńtà	*ráńtà
	rafter	ráfútà	*láfútà

On the other hand, we see in (5) that velarized syllabic /l/ may surface as [r] or [l] depending on whether the speaker is monolingual or bilingual.[2] Whereas monolinguals use forms with [r], bilinguals use forms with /l/ and forms with [r].

[2] The loan word data illustrate these generalizations First, Yoruba is a CV language; consequently, a high vowel (/i/ or /u/) is used to adapt consonant clusters and coda consonants to fit the CV structure (Pulleyblank 1988a). Secondly, the English stressed syllable is adapted with H tone, and the final syllable of the source language is adapted with L tone (Ufomata 1991, Kenstowicz 2004). Third, the tone and vowel of the epenthesized syllable are copies of the final non-stressed source syllable. For details on Yoruba loan tone adaptation, the interested reader can consult the referenced sources.

(5)	Loan with velarized /l/	Monolinguals	Bilinguals
	table	tébùrù	tébùlù
	kettle	kẹ́tùrù	kẹ́tùlù
	bottle	bọ́tùrù	bọ́tùlù
	battle	bátùrù	bátùlù
	settle	sẹ́tùrù	sẹ́tùlù
	buckle	bọ́kùrù	bọ́kùlù
	title	táítùrù	táítùlù
	gentle	gẹ́ńtùrù	gẹ́ńtùlù
	pencil	pẹ́ńsùrù	pẹ́ńsùlù
	bundle	bọ́ńdùrù	bọ́ńdùlù
	candle	káńdùrù	káńdùlù
	council	káńsùrù	káńsùlù
	school	súkúùrù	súkúùlù
	igloo	ígùrù	ígùlù

Crucial to understanding the motivation for the selection of [r] in (5) is the fact that the input velarized English /l/ is surrounded by low-tone-bearing high back vowels. The required conditions for the occurrence of [r] are given below:

(6) a. /l/ is flanked by high back vowels.
b. Flanking high back vowels are linked to low tones.

When velarized /l/ occurs elsewhere, it surfaces as a clear [l], as in these examples:

(7)	Loan with velarized /l/	Adaptation	Unattested
	appeal	àpîìlì	*apîìrì
	scale	síkéèlì	*síkéèrì
	file	fâìlì	*fâìrì
	mile	máìlì	*maîìrì
	vocal	fókà, fókàlì	*fókàrì
	gold	góòlù	*góòrù

The examples in (7) show that the conversion of /l/ to [r] cannot be triggered solely by (6a) or solely by (6b). The selection of /r/ is possible only when the two conditions are satisfied.

Consider, however, the following examples illustrating the retention of English velarized /l/ between two low-tone bearing /ù/:

(8)	Loan	Adaptation	Unattested
	pool	púùlù	*púùrù
	wool	wúùlù	*wúùrù
	rule	rúùlù	*rúùrù
	fool	fúùlù	*fúùrù

These examples are flanked by low-toned high back vowels, yet, they are not changed into [r] as might be expected. This class of examples constitutes a systematic exception to the pattern described in (5). In the next section (§4), I will address the exceptionality of (8) by considering the role of prosodic structure in the conversion of /l/ to [r].

4. Prosodic considerations

Truncation is one of the most commonly utilized morphological processes in Yoruba. Ọla (1995) provides a detailed study of native and foreign Yoruba words and possible truncation patterns. One

important feature identified by that work is that borrowed words truncate in phono-syntactically constrained ways. For example, loan verbs are shortened to a CV syllable, the canonical shape of verbs in the language. Loan nouns, on the other hand are minimally disyllabic when they are truncated because native nouns are minimally VCV or CVCV in shape. An additional pattern exhibited by disyllabic nouns is the requirement that a CV syllable occur at the right edge of the word, ruling out VV, CVV or CVN nouns. In order to satisfy this structural constraint, some truncated nouns are realized as (C)VVCV instead of CVV. Further, truncation retains only the materials at the left edge of a loan word. Examples of minimality-based truncation patterns in borrowed proper names are given in (9).[3]

(9)	Loan	Full Adaptation	Truncation	Unattested
	Samuel	sámúẹ̀ḷì	sámú	*múẹ̀ḷì
	Solomón	sólómọ́ọ̀nù	sóló	*mọ́ọnù
	Comfort	kọ́ńfọ́ọ̀ṭì	kọ́ńfọ́	*kọn,*fọ́ọ̀ṭì
	Elizabeth	eélísábẹ́ẹ̀ṭì	eélí	*eé,*bẹ́ẹ̀ṭì

Next, consider monosyllabic names, which are adapted as disyllabic forms. As shown in (10), only the fully adapted names occur because minimality blocks truncation:

(10)	Loan	Full Adaptation	Truncation
	Jane	jéèmì	*jéè
	John	jọ́ọ̀nù	*jọ́ọ̀
	Ruth	rúùtù	*rúù
	Paul	pọ́ọ̀lù	*pọ́ọ̀

As mentioned above, in addition to minimality, these examples show that the materials at the left edge of the word are preserved and that segments at the right edge of the base are not preserved. Thus, if a base consists of two or more feet, for example, Eélísábẹ́ẹ̀ṭì 'Elizabeth,' parsed into sequences of binary feet as ((Eélí $_{ft}$) (sábẹ́ $_{ft}$) (ẹ̀ṭì $_{ft}$)) $_{WD}$, only the leftmost foot is retained ((✓Eélí $_{ft}$) *(sábẹ́ $_{ft}$) *(ẹ̀ṭì $_{ft}$)) $_{WD}$. This evidence points to an analysis assigning headedness to the initial bisyllabic foot of a bipodic word in Yoruba (Ọla 1995). Following the theory of Head Dominance (Revithiadou 1999), if we assume that the leftmost foot is the HEAD of a prosodic word, then we can reference the constraint in (11):

(11) ALIGN-LEFT (HEAD FOOT, PROSODIC WORD):
The left edge of the head foot must align with the left edge of a prosodic word.

Furthermore, the truncation patterns show that a truncated copy must be a well-formed minimal word. Minimality is captured by the well-motivated constraint, PWDMIN (12a), which requires the presence of a binary foot in a prosodic word (Orie & Pulleyblank 2002). The requirement that the base head foot and the truncated copy be in full correspondence is explained by the constraint, HEADANCHORL-Pos (12b) (McCarthy 2000).

(12) a. PWDMIN: A prosodic word minimally contains one bisyllabic foot.
b. HEADANCHORL-Pos: The base head-foot segments/tones must correspond to the segments/tones in the truncated copy.

To derive the truncation patterns, these constraints must dominate MAX, the faithfulness constraint requiring all segments/tones in the input/base to appear in the output. In accounting for these patterns, I adopt the approach to loanword phonology taken in Kenstowicz (2005) and Yip (2006) where faithfulness to the loanword source is expressed as Output-Output faithfulness constraint that may be

[3] Note in (9) that the H tone of the first syllable of the borrowed name becomes M if the syllable lacks an onset to avoid a violation of the requirement that a word initial H tone must be parsed in a CV syllable (Orie 2000).

ranked differently from the corresponding Input-Output constraint of native grammar. The following tableau illustrates the ranking which captures the observations described earlier:

(13) PWDMIN, HEADANCHORL-Pos >> MAX

[samuẹli]WD	PWDMIN	HEADANCHORL-Pos	MAX
a. sa	*!		*****
b. sam	*!		****
c. ẹli		*!	****
d. ☞ samu			***

As seen in (13), candidates (a) and (b) violate PWDMIN fatally because they are not a well-formed minimal prosodic word. Candidate (c), which retains the materials at the right edge of the base, incurs a fatal violation of HEADANCHORL-Pos, and is consequently rejected. The successful candidate (d) shows that obedience to high ranking constraints is compulsory: a well-formed truncated noun must be a well-formed prosodic word, and there must be perfect segment correspondence between the initial foot of the base and the truncated copy.

We are now in a position to return to the issue raised in the previous section on why derived [r] is possible in words like *tébùrù ~ tébùlù* but impossible in *púùlù ~ *puuru*. In order to account for this contrast, we must first consider truncation patterns in data such as *tébùrù ~ tébùlù* and *púùlù.* As can be observed in (14), the leftmost foot of the base and the truncated copy match perfectly, just as in the examples already examined in (9) and (10):

(14)	Loan	Full Adaptation	Truncation	Unattested
	table	tébùrù	tébù	*bùrù
	kettle	kẹ́tùrù	kẹ́tù	*tùrù
	bottle	bọ́tùrù	bọ́tù	*tùrù
	settle	sẹ́tùrù	sẹ́tù	*tùrù

In contrast, neither truncation nor /l/ ~ [r] alternation is possible in forms such as *púùlù.* Contrary to *ùlù, /l/ is preserved in these forms:

(15)	Loan	Adaptation	Unattested
	pool	púùlù	*púùrù, *púùù
	wool	wúùlù	*wúùrù, *wúùù
	rule	rúùlù	*rúùrù, *rúùù
	fool	fúùlù	*fúùrù, *fúùù

The preservation of inter-*ù* [l] in a minimal word argues for the dominance of *ùlù by IdentF [lateral] (Correspondents must be faithful to underlying lateral specification).[4]

(16) PWDMIN, HEADANCHORL-Pos >> IdentF[lateral] >> ùlù

[púùlù] WD	PWDMIN	HEADANCHORL	IdentF[lateral]	*ùlù
a. pú	*!		***	
b. ùlù		*!	**	*
c. púùrù			*!	
d. ☞ púùlù				*

In (16), the failed candidate (a) is eliminated because of its failure to satisfy the minimal word constraint. The losing candidate in (b) disobeys the faithfulness constraint requiring correspondence between the left edge of the base and the copy. The interesting pair is (c) and (d). Candidate (c) obeys *ùlù by selecting [r] instead of /l/, leading to a fatal violation of IdentF[lateral]. By parsing /l/,

[4] The conversion of [+lateral] /l/ to [-lateral] /r/ is attested in Campidanian Sardinian (Davis & Baertsch 2005).

candidate (d) obeys IdentF[lateral] at the expense of *ùlù. This turns out to be the best strategy, and (d) emerges as the winner. The form /púù/ is a potential contender with two syllables,[5] but it is ruled out by independent syllable well-formedness in Yoruba, which treats V syllables as defective because they lack onsets (Orie 2000).

In order to explain the conversion of /l/ to [r] outside the minimal word domain, I adopt the Harmonic Domain Ranking approach (Mohanan 1993, Beckman 1998, Archangeli & Pulleyblank 2002), which enables us to capture the fact that constraints hold rigorously in stronger domains than weaker domains. Applied to this particular case, a domain-based IdentF constraint, IdentF[lateral]$_{\text{HEADFOOT}}$ and a general IdentF[lateral] constraint are crucial.

(17) Ident-F Constraints

a. IdentF[lateral]$_{\text{HEADFOOT}}$: Correspondents in the HEAD FOOT must be faithful to underlying lateral specification.
b. IdentF[lateral]: Correspondents must be faithful to underlying lateral specification.

The ranking IdentF[lateral] $_{\text{HEADFT}}$ >> *ùlù >> IdentF[lateral] derives the observation that the retention of /l/'s phonemic and phonetic properties is compulsory in a truncated copy. It also explains why /l/ is susceptible to conversion outside the head foot domain. This ranking explains the obligatory conversion of /l/ to [r] by monolingual adapters:

(18) Compulsory conversion of /l/ to [r] by monolinguals

PWDMIN, HEADANCHORL >> IdentF[lateral] $_{\text{HEADFT}}$ >> *ùlù >> IdentF[lateral]

[[tébù]$_{\text{HEADFT}}$ lù]WD	PWDMIN	HEADANCHORL	IdentF $_{\text{HEADFT}}$	*ùlù	IdentF
a. tébùlù				*!	
b. ☞ tébùrù					*

As we can see in (18), the specification of the domain of IdentF[lateral] enables us to directly capture the asymmetry of /l/ adaptation in the speech of monolingual adapters. Candidate (18a) fatally violates *ùlù, while candidate (18b) escapes a violation of the same constraint at the expense of violating the general lower ranked IdentF[lateral] constraint.[6]

5. /l/ becomes [r]: the role of phonetics

The conversion of /l/ to [r] has been shown to be a prosodic domain-based phenomenon. We know from the facts presented that /l/ is converted to [r] by monolingual and bilingual adapters within the larger and less prominent domain of the word. Phrased more succinctly, phonology plays a major role in accounting for the observed alternation of /l/ and [r]. A question remains however, namely, how does one account for why [r] is the optimal onset when /l/ is flanked by low-tone-bearing high back vowels? This question is addressed here. Specifically, I argue that phonetic considerations are crucial in accounting for the selection of [r]. Two phonetic factors—high back vowel roundedness and the low F3 specification of low tones—combine to ensure the optimality of [r]. I elaborate on these factors below.

In Yoruba, high back vowels are rounded. Rounding, as is well-known, typically involves both lip rounding and lip protrusion, which lengthens the vocal tract, resulting in the lowering of the formant frequencies. As demonstrated by work such as Ladefoged (1975), roundedness is especially indicated by F2 and F3 lowering. Further, acoustic work such as Bakare (1995) has shown that Yoruba low tones have a falling F0 and F3. According to this research, Yoruba speakers use both the fundamental

[5] See Orie & Pulleyblank (2002) for prosodic arguments that VV sequences are not single syllables. For example, hiatal VV configurations in Noun -Noun sequences are preserved through assimilation to satisfy noun minimality.

[6] The issue of optionality can be accounted for by adopting Boersma & Hayes (2001)'s view that constraint rankings are expressed as probabilities. On this view, a constraint may have a range of possible rankings. Consequently, one can assume that bilinguals have another ranking where *ùlù and IdentF[lateral] are not crucially ranked. In this way, the free alternation of [l] and [r] will be possible.

frequency and F3 to discriminate the three lexical tones. The F0 and F3 patterns are consistently realized as follows: high tones have a rising pattern, mid tones have a relatively flat pattern, and low tones have a falling pattern. In other words, low tones, like rounded vowels, have a low F3 formant frequency.

In essence, then, the acoustic environment in which /l/ finds itself in data such as (4: tébùrù~tébùlù) is saturated with low frequencies, especially F3 lowering. This acoustic context is a natural environment for the selection of [r], which is also known to have a low F3 (for example, O'Connor, Gertsman, Libermann, Delattre and Cooper 1957, Ladefoged 1975). Apparently, monolingual hearers take these acoustic factors into account, hence the selection of [r] in a *ùlù context. In other words, monolinguals are less influenced by knowledge of the source language and thus display a more native-like adaptation pattern. This phonetic explanation thus answers the question of why [r] is the optimal onset in an inter-*ù* context.

Given the facts presented, we now know that Yoruba has two types of /r/s in loan phonology: an /r/ present in the source form and an [r] that is derived from source /l/. The question that naturally arises is whether the language distinguishes the two /r/s or not. Deletion provides evidence illustrating the phonological difference between underlying and derived /r/s in the loan vocabulary. According to Akinlabi (1993), an intervovalic /r/ is deleted under the following conditions:

(19) a. The two vowels must be identical, OR
b. One of the vowels must be high.

The generalizations in (19) motivate the constraint *VrV: /r/ is prohibited intervocalically within a root. *VrV manifests itself in two ways. First, it causes cross-*r* vowel assimilation:

(20)	crane	→	kerenì
	trailer	→	térélà
	brocade	→	borokéèdı̀
	fredrick	→	fẹ́rẹ́dîìkì

Secondly, an underlying loan /r/ can delete optionally according to the demand of *VrV:

(21)	English	[r] retention	[r] deletion
	nursery	nọ́sìrì	nọ́sìì
	driver	dírẹ́fà	díẹ́fà
	trailer	tírélà	tíélà
	brocade	borokéèdı̀	bookéèdı̀

However, observe in (22) that once an underlying /l/ is converted to [r], it must remain in the intervocalic context, contrary to *VrV. In other words, a derived [r] cannot be deleted:[7]

(22) Retention of derived [r]

English	/l/ converted to [r]	No [r] deletion
table	tébùrù	*tébùù
kettle	kẹ́tùrù	*kẹ́tùù
bottle	bọ́tùrù	*bọ́tùù
settle	sẹ́tùrù	*sẹ́tùù

In summary, the contrast in the deletion patterns in (21) and (22) illustrates the language's special strategy to keep underlying and derived /r/s distinct in the synchronic grammar.

[7] Observe that the data in (22) reflect a counterfeeding opacity since the derived /r/ is not deleted. An OT analysis of this pattern is, however, beyond the scope of the present paper.

6. Nasal Vowels

In this section, I examine the adaptation of nasal vowels, and argue that (i) nasal vowels illustrate the significance of phonetics in borrowing, and (ii) nasal high vowel behavior exemplifies the capacity of a borrowing language to phonologize a non-contrastive feature. To avoid any confusion, these notations are adopted in presenting nasal vowel data. First, nasalized vowels are transcribed with a tilde; second, a vowel without a tilde is considered oral even if followed by a nasal consonant; third, where tones and nasality occur on the same vowel, tones are not represented so that the tilde representing nasality can be clearly seen.

6.1. Nasal vowel asymmetric patterning

Yoruba has contrastive nasal vowels (*ɾʊ* L tone 'carry' vs. *ɾʊ̃* L tone 'smell'), but English does not. In English, nasal vowels occur as allophones in tautosyllabic contexts where an oral vowel is followed by a nasal coda (*bɪt* 'bit' vs. *bɪ̃n*, **bɪn* 'bin'). According to the phonological view of borrowing (Paradis and LaCharité 1997, Paradis & Prunet 2000, etc), adapters do not borrow subphonemic features. Thus, for example, according to Paradis & Prunet (1997), whereas English adapters incorporate contrastive French nasal vowels as a Vowel-Nasal sequence (French [kupɔ̃] → [kupan] 'coupon'), non-contrastive Malay nasal vowels do not generate Vowel-Nasal sequences. Instead, they are adapted as oral vowels in English (Malay [ramĩ] → [ramɪ] 'fiber used for making cloth').

Based on this line of thinking, Yoruba adapters should not borrow English vowel nasalization because it is subphonemic. This is especially the case on the view of LaCharité and Paradis (2005) who maintain that borrowers are bilinguals and thus have access to the phonology of both languages. As can be observed in the following data, the adaptation evidence for the phonological view is mixed: nasalization is borrowed when the vowel involved is high (23a), but nasalization is not borrowed when the vowel is non-high (23b).[8]

(23) a. Vn sequence where V is [+high]: V is nasalized

Loan with nasal vowel	Adaptation	Unattested
inspector	ɪ̃nsipẹtọ	*insipẹtọ
ink	ɪ̃nki	*inki
inch	ɪ̃nṣi	*inṣi
pin	pi̱ĩnĩ	*piini
ring	ɾĩngi	*ringi

b. Vn sequence where V is [-high]: V is not nasalized[9]

Loan with nasal vowel	Adaptation	Unattested
handcuff	áńkọ́ọ̀fù	*ã̀nkọọfu
pen	pẹ́ẹ̀nì	*pẽẽ̀nɪ
lantern	láńtà	*lã̀nta
bomb	bọ́m̀bù	*bọ̃mbu
envelope	ẹ́míbílóòpù	*ẽ̀mbiloopu

The asymmetric pattern of vowel nasalization is puzzling if we assume that borrowing is solely driven by phonology. However, if phonetics is taken into consideration, we have a potential answer. As shown in work such as Ohala (1975), Rochet and Rochet (1991) and Bell-Berti (1993), there is a universal tendency for high oral vowels in nasal environments to be nasalized through a greater part of their duration (both proportionally and absolutely) than are non-high vowels in the same environment.

[8] Some cases involving coronal fricatives [s, ʃ, ʒ] are adapted with a non-high nasal vowel, for example, station → *tẹ́sàn*, television → *tẹlifĩsàn*], vision → *fĩṣàn*, sunday → *sánńdẹ̀*. Sibilants also exhibit unique characteristics in loanword back harmony (Adẹṣọla 2004). In works such as Davis & Cho (2006) and Rose & Demuth (2006), the exceptionality of sibilants is attributed to their phonetics, especially their high frequency noise spectrum. A full discussion of the phonetics of sibilants will take me far afield. Therefore, I leave the matter for future research.

[9] Because these adapted nasal codas have tones, they are analyzed as moraic segments (Pulleyblank 1994).

Furthermore, Ruhlen (1975) in a typological study demonstrated, using a sample of 100 languages, that 47 languages in the sample have fewer nasal vowels than oral vowels and of that set, 20 languages lacked mid nasal vowels. Additionally, Hyman (1972) found the absence of mid nasal vowels to be a common property of Kwa languages.[10] Given the universal tendency to favor high nasal vowels over non-high nasal vowels, it is unsurprising that adapters pay particular attention to the combination of [+high] and [+nasal], albeit a non-contrastive combination in English. In contrast, nasalization of non-high vowels is not borrowed because it is not phonetically salient. These patterns argue for a markedness scale such as the following:[11]

(24) Prohibition on nasalized high and non-high vowels

a.	*Non-highV/Nasal:	*[-high, +nasal]
	*HighV/Nasal:	*[+high, +nasal]
b.	Ranking:[12]	*[-high, +nasal] >> *[+high, +nasal]

The ranking in (24b) captures the generalization that non-high vowels are more marked than nasal high vowels. Given that high nasal vowels are less marked, they are naturally preferred.

6.2. Evidence for the phonologization of high nasal vowels: vowel hiatus patterns

The evidence for the phonologization of high nasal vowels comes from vowel hiatus resolution patterns involving high nasal vowels and non-high nasal vowels, which as shown are adapted as oral vowels. Yoruba is well known for its lack of tolerance for vowel hiatus (Bamgboṣe 1966, Oyelaran 1971, etc.). When hiatus arises through morphological or syntactic concatenations, elision or assimilation are the main strategies employed in eliminating hiatus. Deletion applies when the first morpheme is monosyllabic (25a) but assimilation applies if the initial morpheme is minimally disyllabic (25b) (Orie & Pulleyblank 2002). (25c) shows that deletion does not apply if a noun begins in a consonant:

(25) Standard cases of vowel hiatus resolution

a.	Deletion:	rí owó	→	rówó	‘see money’
		pe ọmọ	→	pọmọ	‘call child’
b.	Assimilation:	gbàgbé ọmọ	→	gbàgbọ́ ọmọ	‘forget child’
		wàhálà ẹ̀dá	→	wàhálẹ̀ ẹ̀dá	‘trouble creation’
c.	No hiatus, no deletion				
		rí bàbá	→	rí bàbá	‘see father’
		pe bàbá	→	pe bàbá	‘call father’

Deletion also applies when monosyllabic verbs and borrowed nouns, which begin in non-nasal vowels, are concatenated:

(26)

Input	Output	
mú ẹ́ńbílóòpù	mẹ́ńbílóòpù	‘take envelope’
rí áńkọ́ọ̀fù	ráńkọ́ọ̀fù	‘see handcuff’
ṣe ẹ̀ǹkúárì	ṣẹ̀ǹkúárì	‘make inquiry’
ra ẹ́ńjìnì	rẹ́ńjìnì	‘buy engine’

However, deletion is blocked if the loan begins in a high nasal vowel:

[10] Williamson (1973), however, shows that mid-low nasal vowels are attested in some Kwa languages.

[11] Markedness is stated as a prohibition constraint to reflect the universal property: all languages have oral vowels but not all have nasal vowels (Maddieson 1984). See Ajiboye & Pulleyblank (2008) for a similar proposal.

[12] Given that some languages (French, Mauritian Creole cf. Baker 1972) have non-high nasal vowels but lack high nasal vowels, this ranking may be seen as illustrating a soft universal rather than an absolute.

(27) Verb + Nasal high vowel initial noun: no deletion

Input	Output	Unattested	
ra ĩnki	ra ĩnki	*ráǹkì,*rĩnki	'buy ink'
re ĩndia	re ĩndia	*réńdìà, *rĩndia	'visit India'
lẹ ĩnṣi (kan)	lẹ ĩnṣi (kan)	*lẹ́ǹṣì, *lĩnṣi	'glue an inch'

Based on the data in (27), one might ask why these high nasal vowel-initial nouns behave like consonant-initial nouns (25c). To answer this question, we must once again consider another morpheme structure constraint: *#ṽ, which prohibits nasal vowels from occurring in word-initial position (Orie 2000).[13] As can be seen in (28), adapters comply with the demand of *#ṽ by placing a glide that is featurally compatible with the first vowel of the noun at the beginning of the word. Alternatively, as noted by Akin Akinlabi (personal communication), a prevocalic epenthetic [h] may be inserted to satisfy *#ṽ, as these data show:

(28)	Loan	*#ṽ	Glide formation	h-insertion
	ink	ĩnki	yĩnki	hĩnki
	inch	ĩnṣi	yĩnṣi	hĩnṣi
	india	ĩndia	yĩndia	hĩndia

Given the patterns in (28), I suggest that elision is blocked by the prevocalic glide and [h]. This glide (or [h]) performs the dual role of satisfying the morphemic constraint (*#ṽ) and resolving vowel hiatus. Although the glide (or [h]) may not be pronounced in (28), its presence is felt phonologically, hence, the impossibility of elision.

To summarize these results, I have shown that the adaptation of high nasal vowels is a consequence of the less marked status of high nasal vowels. High nasal vowel patterns show that a non-contrastive feature (nasalization in this case) can be elevated phonologically. As demonstrated, although nasality in combination with the feature [+ high] is subphonemic in English, the donor language, upon entering Yoruba, this feature is phonologized. As shown, evidence for its phonologization comes from processes such as glide formation, h-insertion and vowel hiatus resolution patterns. In conclusion, we see that Yoruba patterns present evidence in favor of the proposal that loanword adaptation is governed by phonological and phonetic factors. As demonstrated, neither phonology alone, nor phonetics alone can solve the puzzle posed by the adaptation mismatches.

7. Conclusion

There are three major results of this article. First, the asymmetric behavior of English /l/ demonstrates that adaptation is phonologically-constrained in Yoruba. As shown, the interplay of prosodic, faithfulness, and harmonic domain constraints captures the asymmetric patterns involving /l/ straightforwardly. Second, phonetic factors are also shown to play a crucial role in adaptation. For instance, the selection of [r] in a context involving low-tone bearing high back vowels is crucially shown to follow from phonetic factors. Furthermore, the adaptation of nasal vowels shows that phonetic markedness can drive adaptation patterns. As shown, although vowel nasalization is subphonemic in English, its combination with the feature [+high] causes it to become phonologically salient in Yoruba. Third, the contrast in the deletion patterns of loanword /r/ shows that languages have a way of separating out lexical and derived sounds in the synchronic grammar (Kenstowicz 2003).

[13] Examples such as *ẹ́ńbílóòpù* 'envelope' and ẹ́ńjìnì 'engine,' words which have high tone-bearing initial vowels, again show another contrast between high and non-high vowels in loans. Because there is no high vowel to supply a glide here (**yẹ́ńbílóòpù* 'envelope' and **yẹ́ńjìnì* 'engine), these forms are retained in spite of a *#ý violation.

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Selected Proceedings of the 42nd Annual Conference on African Linguistics: African Languages in Context

edited by Michael R. Marlo, Nikki B. Adams, Christopher R. Green, Michelle Morrison, and Tristan M. Purvis

Cascadilla Proceedings Project Somerville, MA 2012

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ISBN 978-1-57473-453-9 library binding

Ordering information

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This paper can be cited as:

Orie, Ọlanikẹ Ọla. 2012. Two Cases of Adaptation Mismatches in Yoruba Loan Phonology. In *Selected Proceedings of the 42nd Annual Conference on African Linguistics*, ed. Michael R. Marlo et al., 99-111. Somerville, MA: Cascadilla Proceedings Project. www.lingref.com, document #2762.