Vowel elision is not always onset-driven

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Within standard generative phonology, deletion in a hiatus context can be seen as a response to an onset violation. This paper presents arguments and evidence against this position. The evidence is primarily drawn from hiatus resolution strategies in Yoruba. It is demonstrated that the application of deletion is subject to prosodic restrictions on words: in a *vowel + vowel* sequence, deletion removes hiatus if the word supplying the first vowel contains a single syllable; if this morpheme has two or more syllables, then the vowels in hiatus are retained and hiatus is resolved by assimilation. To explain the different patterns of hiatus resolution, the paper argues that hiatus-resolving strategies are subject to foot-based minimality conditions, satisfaction of onset or the lack thereof are merely epiphenomenal.

1 Background

Vowel hiatus is prohibited in many languages. When a hiatus context is created through morpheme concatenation, deletion, among other strategies, may remove the offending configuration. In Etsako (Nigeria/Niger-Congo), for example, vowel hiatus is eliminated by deleting the first vowel in a *V+V* sequence, as illustrated in (1) below (data from Elimelech 1976):

(1) *Vowel deletion in Etsako*

a.	/dɛ akpa/	→	[dakpa]	'buy cup'
	buy cup			
b.	/sese akpa/	→	[sesakpa]	'make a cup'
	make cup			
c.	/owa ɔda/	→	[owɔda]	'a different house'
	house different			
d.	/ukpo ɛnodɛ/	→	[ukpɛnodɛ]	'yesterday's cloth'
	cloth yesterday			

A plausible account for such deletion can be formulated with reference to the undesirability of onsetless syllables (Rosenthall 1994, 1997). Developing an account of the vowel contact data within Optimality Theory, Rosenthall argues that deletion is the direct result of the interaction of ONSET (a condition prohibiting syllables without an onset) with faithfulness: when the insertion of an onset consonant such as a glottal stop is prohibited by an appropriate ranking of the faithfulness constraints, then avoidance of an ONSET violation is only possible by deleting one of the vowels in juxtaposition.

One of the languages examined by Rosenthall is Yoruba (Nigeria/Niger-Congo), a case that has been examined in a large literature including Ward (1952), Rowlands (1954), Abraham (1958), Siertsema (1959), Bamgboṣe (1966), Courtenay (1968), Oyelaran (1971), Akinlabi & Oyebade (1986), Pulleyblank (1988a,b) and Ọla (1991). It has been observed in such work that there are two prominent hiatus sites in Yoruba. At the word level, hiatus results from affixation to vowel-initial roots (2a); at the phrasal level, it results from syntactic collocations involving forms such as verb-object or preposition-object combinations

(2b). In these configurations, deletion may apply to eliminate the hiatus, as the following examples demonstrate:[1]

(2) *Standard cases of vowel deletion in Yoruba*

a.	owó kí owó	→	[owókówó]	'any money at all/bad money'
	money any money			
	ọmọ kí ọmọ	→	[ọmọkọ́mọ]	'any child at all/bad child'
	child any child			
b.	ra ògèdè	→	[rògèdè]	'buy bananas'
	buy banana			
	ní oko	→	[lóko]	'at the farm'
	at farm			
	se ọbẹ̀	→	[sọbẹ̀]	'cook stew'
	cook stew			

As argued for Etsako, Rosenthall proposes that Yoruba vowel deletion is an onset-driven phenomenon, a process that applies to eliminate surface realisations of suboptimal onsetless syllables.

In this paper, we argue for the inadequacy of such a syllable-based account. Unnoticed in prior work on vowel deletion in Yoruba is a body of data which undermine the assumption that deletion applies to eliminate onsetless syllables. We examine such data here, arguing that deletion is the result of hiatus avoidance, independent of onset violations. We argue that there are two ways to avoid hiatus violations, both of which are attested in Yoruba: (i) deletion, (ii) assimilation. In examining the distribution of hiatus avoidance strategies, we propose that the choice between the two is governed by patterns of minimality.

This paper is organised as follows. First, we present data illustrating *V+V* sequences where vowel deletion does not take place. Second, we present an analysis of vowel deletion/retention based on the concept of *minimal word*. Third, we consider the way in which hiatus avoidance manifests itself through assimilation.

2 The problem

Data such as in (2) abound in the Yoruba literature and we refer interested readers to that literature. Of interest are data that have hiatal configurations within phrases but that never resolve hiatus through deletion or any of the other familiar onset-driven hiatus-resolving strategies (e.g., coalescence, epenthesis). Relevant examples appear in (3):

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[1] Yoruba data are presented in standard orthography as well as in a broad phonetic transcription. Relevant orthographic conventions are as follows: ẹ = [ɛ], ọ = [ɔ], *Vn* = nasalised vowel, ṣ = [ʃ], p = [k͡p], acute (´) = H, grave (`) = L, unmarked for tone = M.

(3) *Failure to delete in Yoruba V+V sequences*

	Hiatus tolerated	Assimilation ok	Deletion bad	Gloss
a.	gbàgbé ọmọ	gbàgbọ́ ọmọ	*gbàgbọ́mọ	'forget child'
b.	bẹ̀rẹ̀ òwò	bẹ̀rò òwò	*bẹ̀ròwò	'begin a business'
c.	parí èkọ́	parẹ́ èkọ́	*parékọ̌	'finish studies'
d.	tọrọ owó	tọro owó	*tọrowó	'beg for money'
e.	jẹ́wọ́ ẹ̀sẹ̀	jẹ́wẹ́ ẹ̀sẹ̀	*jẹ́wẹ́sẹ̀	'confess sin'
f.	jáde opó	jádo opó	*jádopo	'come out of mourning'
g.	tàsé ẹnu	tàsẹ́ ẹnu	*tàsẹ́nu	'miss (one's) mouth'
h.	fòró èmí	fòrẹ́ èmí	*fòrẹ́mí	'vex (one's) spirit'
i.	kéde òfin	kédo òfin	*kédòfin	'announce (a) law'
j.	jọ̀wọ́ adétè̩	jọ̀wá adétẹ̀	*jọ̀wádétẹ̀	'permit a leper'
k.	kọjá ọlọ́sà	kọjọ́ ọlọ́sà	*kọjọ́lọ́sà	'pass (by) thief'
l.	pàdé ọ̀mọ̀wé	pàdọ́ ọ̀mọ̀wé	*pàdọ́mọ̀wé	'meet a learned person'
m.	kiri àgbàdo	kira àgbàdo	*kiràgbàdo	'sell (about) corn'
n.	kúndùn àgbàdo	kúndàn àgbàdo	*kúndàgbàdo	'fond of corn'
o.	taari ọmọ	taarọ ọmọ	*taarọmọ	'push child violently'
p.	béèrè ọ̀nà	béèrò̩ ọ̀nà	*béèrọ̀nà	'ask for (road) direction'
q.	pèsè owó	pèsò owó	*pèsòwó	'provide money'
r.	pà*àrà ojà	pà*àrò̩ ojà	*pà*àrọ̀jà	'go to market several times'
s.	pàdánù ẹbí	pàdánẹ̀ ẹbí	*pàdánẹ̀bí	'lose family'
t.	wàhálà òbí	wàhálò òbí	*wàhálòbí	'to trouble parents'
u.	lójú ọ̀nà	lójó ọna	*lójóna	'on the road (way)'
v.	lójú òfurufú	lójó òfurufú	*lójófurufu	'in the sky'
w.	lábé̩ òkúta	lábó òkúta	*lábókúta	'under the stone'
x.	lábé̩ àpótí	lábá àpótí	*lábápótí	'under the stool'
y.	fé̩ràn ẹjọ́	fé̩rèn ẹjọ́	*fé̩rènjọ́	'like talking'
z.	sinmi ẹjọ́	sinmẹn ẹjọ́	*sinmẹnjọ́	'stop talking'

The problem for onset-driven accounts of vowel deletion is apparent: in all of the data in (3), the conditions for deletion are met, but deletion is systematically blocked. If vowel deletion in Yoruba is driven by the need to eliminate onsetless syllables, as claimed by Rosenthall (1994, 1997), then the attested forms should be those that are in fact impossible. The central problem is how to distinguish cases where deletion is impossible (3) from those where deletion is regularly attested (2).

3 A solution: prosodic minimality

There is a simple characterisation of the asymmetrical patterning of vowel deletion seen in (2) and (3):

(4) *Applicability of vowel deletion*

Deletion: Hiatus is resolved by deletion in a V_1+V_2 sequence when the morpheme supplying V_1 contains a *single syllable*.

Retention: In a hiatus configuration, both vowels in a V_1+V_2 sequence are retained when the morpheme supplying V_1 contains *two or more syllables*.

We argue in this section that the account of this distinction derives from a constraint on foot binarity.

3.1 Foot binarity

Prosodic Morphology (McCarthy and Prince 1986, 1993, 1995) and Optimality Theory (Prince and Smolensky 1993) allow for an insightful account of the generalization in (4). In prosodic terms, the difference between the verbs and prepositions in (2) and those in (3) can be characterized as the difference between a syllable and a foot. Assuming syllables are parsed into feet in accordance with Selkirk's (1984)

Strict Layer Requirement, then two syllables constitute a binary foot, and a single syllable constitutes a degenerate foot. Foot markedness demands that feet be binary at the moraic level (McCarthy & Prince 1991, 1993a, Hewitt 1994, among others); as formulated in (5), FOOTBIN is obeyed by the verbal and prepositional forms in (3) (e.g. *pèsè* 'provide', *wàhálà* 'trouble'), but violated by monosyllabic verbs as in (2) (e.g. *pa* 'kill', *rà* 'buy').

(5) FOOTBIN

      A foot must contain exactly 2 moras.

Sample structures are given in (6):

(6) *Sample foot structures*

	Monosyllabic verb	*Disyllabic verb*
	Φ | σ ∧ r a	Φ ⟨⟩ σ σ ∧ ∧ kp e s e
Description of foot:	Degenerate	Binary
FOOTBIN	Violated	Satisfied

We propose that the degenerate status of *CV* verbs causes them to cliticise to a following noun. The resultant form is preferable prosodically because FOOTBIN is thereby satisfied:

(7) *Satisfaction of binarity via deletion*

	Without deletion	*With deletion*
	Φ Φ | ⟨⟩ σ σ σ ∧ | ∧ s e ɔ b ɛ	Φ ⟨⟩ σ σ ∧ ∧ s ɔ b ɛ
FOOTBIN	Violated	Satisfied

Concretely, we adopt a correspondence approach to faithfulness (McCarthy & Prince 1995), and propose that DEPIO outranks FOOT≥2 which in turn outranks MAXIO.

(8) *Faithfulness Constraints*
    DEPIO: Every segment of the output has a correspondent segment in the input.
    MAXIO: Every segment of the input has a correspondent segment in the output.

Ranking DEPIO over FOOTBIN is necessary since binarity cannot be satisfied by epenthesis. Ranking FOOTBIN over MAXIO means that subminimal words will be cliticised onto an adjacent larger word.[2] Both points are illustrated in (9). (Foot boundaries are indicated by parentheses.)

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[2] Syntactic conditions on such cliticisation exist but are not examined here. For example, deletion does not take place between the verb *lọ* 'go' and a following locative: *lọ oko* 'go to the farm' (*loko), *lọ ìbàdàn* 'go' (**lọ̀bàdàn*). This failure to observe vowel deletion correlates with other syntax-dependent phonological processes such as low tone deletion (for a recent treatment, see Déchaine 1998). Note that assimilation (section §4) can apply even in these contexts where deletion is impossible: *lo oko, lọ ọ̀bàdàn*.

(9) *Relation between binarity and faithfulness*

			DEPIO	FOOTBIN	MAXIO
/se/	a. ☞	(se)		*	
	b.	(ise)	*!		
	c.	(see)	*!		
/se ọbẹ̀/	d.	(se) (ọbẹ̀)		*!	
	e. ☞	(sọbẹ̀)			*

When both the verb and its object are prosodically well-formed on their own, there is no pressure for a faithfulness violation. Indeed, a violation of faithfulness (MAXIO) would compound itself by causing a FOOTBIN violation in addition:

(10) *No motivation for deletion with a binary verb*

			DEPIO	FOOTBIN	MAXIO
/tọrọ owó/	a. ☞	(tọrọ) (owó)			
	b.	(tọ) (rowó)		*!	*

The core of our proposed analysis is therefore that words are preferentially bimoraic. By analysing vowel deletion as a response to binarity violations, we immediately account for the observed distinction between monomoraic forms and longer ones. This analysis depends on a number of ancillary assumptions, and has a number of implications. We turn to these issues now.[3]

3.2 Properheadedness

As an alternative to the full parsing of the winning candidates in (9), one might leave a monomoraic verb unfooted. By failing to foot such a word, both FOOTBIN and MAXIO could be satisfied.

(11) *Failure to parse*

			FOOTBIN	MAXIO
/se ọbẹ̀/	a.	(se) (ọbẹ̀)	*!	
	b.	(sọbẹ̀)		*!
	c. 💣※	se (ọbẹ̀)		

We follow Ọla (1995) in assuming that Yoruba words must have a foot, an effect Ọla attributes to properheadedness:

(12) *Properheadedness* (Itô & Mester 1992)
   PROPHEADWORD: A word must contain a foot.
   ("PROPHDWD")

The high ranking of PROPHEADWORD will ensure that there is at least one foot in every word.

(13) *Properheadedness*

			PROPHDWD	FOOTBIN	MAXIO
/se ọbẹ̀/	a.	(se) (ọbẹ̀)		*!	
	b. ☞	(sọbẹ̀)			*
	c.	se (ọbẹ̀)	*!		

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[3] Augmentation by vowel epenthesis plays no role in the cases considered in this paper, the result of high ranking DEPIO. As a consequence, we exclude DEPIO from subsequent tableaux in the interest of expository simplicity.

3.3 Supraminimal forms

Although the case of bimoraic verbs has been illustrated in (10), an analysis of cases with more than two moras has not been presented. These cases are of interest because strict foot binarity would mean that such forms would either fail to parse certain moras or else have more than one foot, one of which would be subminimal. Consider a verb like *wàhálà* 'trouble'. Since such a word has more than two syllables, there are numerous possible foot structures:

(14) *Possible foot structures for a polysyllabic form*
                                   Assessment

a.	wàhálà	no feet: properheadedness is not respected
b.	(wàhálà)	one foot: violation of FootBin because the foot is too large
c.	(wàhá)(là)	two feet: violation of FootBin because one foot is too small
d.	(wàhá)là	one foot: not all syllables are parsed into a higher prosodic structure
e.	(wà)(hálà)	two feet: violation of FootBin because one foot is too small
f.	wà(hálà)	one foot: not all syllables are parsed into a higher prosodic structure

The structure in (14a) is ruled out by properheadedness since the word has no feet at all. At issue when comparing (14b,c,e) with (14d,f) is whether the parsing of moras into feet is obligatory (PARSEMORA), and if so whether supraminimal feet – feet with three or more moras – are preferred or dispreferred with respect to binarity (FOOTBIN).

(15) *Syllable parsing (McCarthy & Prince 1993b)[4]*
      PARSEMORA   All moras must be parsed into feet.

The behaviour of polysyllabic forms provides clear evidence that unparsed syllables are possible, and therefore that the appropriate prosodic representation of a form like *wàhálà* is as in (14d) or (14f).

      The argument derives from the observation that monomoraic verbs trigger vowel deletion while polymoraic verbs (3 or more moras) do not (3s,t). With this observation in mind, consider a phrase like *wàhálà òbí* 'trouble parents'. If unparsed syllables were disallowed (ruling out a candidate like *(wàhá)là (òbí)*) and if supraminimal feet were disallowed (ruling out a candidate like *(wàhálà) (òbí)*) then the optimal output for such a phrase should involve deletion:

(16) *Supraminimal ≠ subminimal*

/wàhálà òbí/			PROPHDWD	FOOTBIN	MAXIO
	a.	(wàhá)(là) (òbí)		*!	
	b.	(wà)(hálà) (òbí)		*!	
	c. 💣※	(wàhá)(lòbí)			*

Because such forms never do involve deletion, we conclude that *(wàhá)là (òbí)* is the optimal representation for such a form. Since it has already been established that FOOTBIN outranks MAXIO, this means in turn that MAXIO must outrank PARSEMORA.

(17) *Ranking of PARSEMORA*

	/wàhálà òbí/	PROPHDWD	FOOTBIN	MAXIO	PARSEMORA
a.	(wàhálà) (òbí)		*!		
b.	(wàhá)(là) (òbí)		*!		
c. ☝	(wàhá)là (òbí)				*
d.	(wàhá)(lòbí)			*!	

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[4] PARSEMORA can also be phrased as a LINK constraint, following Hewitt (1994) and Crowhurst (1997). On this view, LINK μ-to-Ft is the equivalent of PARSEMORA.

3.4 Left-edge alignment

Note that there are two parsings of *wàhálà* that minimally violate PARSEMORA while respecting FOOTBIN: *(wàhá)là* and *wà(hálà)*. For reasons discussed in Ọla (1995) and below, we opt for the former, attributing its selection to an alignment constraint:

(18) *Foot alignment*
 ALIGNLEFT[Word, Foot]   The left edge of a word is aligned with the left edge of a foot.
 ("ALIGNL")

(19) *Location of a foot at the left edge of a word*

			ALIGNL	FOOTBIN	MAXIO	PARSEMORA
/wàhálà/	a. ☞	(wàhá)là				*
	b.	wà(hálà)	*!			*

Motivation for this alignment constraint can be seen in cases involving long vowels discussed in section §5 below.

3.5 Anchoring

In defense of the onset-triggering hypothesis, it might be argued that potential ONSET violations are a *necessary* trigger for deletion contexts even if such violations are *not sufficient* to result in deletion. There are problems with this, however. First, onset violations per se do not trigger deletion. For example, the canonical noun shape is *VCV*, with longer *VCVCV* forms common. Numerous examples have been seen in (2) and (3). Implicit in Rosenthall's (1997) proposal that ONSET violations trigger deletion is some constraint preventing vowels from deleting in such structures. Note, moreover, that with regard to the presence of onsets, foot binarity and syllable parsing, a form like **gbàdo* is uniformly superior to the actually attested *àgbàdo* 'corn'.

A plausible candidate for the relevant constraint is anchoring.[5]

(20) *Anchoring*
 ANCHORL: Any element at the left edge of a morpheme in the input has a correspondent at the
                    left edge of the morpheme in the output.

Provided that ANCHORL outranks ONSET, a form like **gbàdo* would be nonoptimal for a vowel-initial input like *àgbàdo*.

(21) *Undoing the potential effects of ONSET*

			ANCHORL	ONSET	MAXIO
/àgbàdo/	a. ☞	àgbàdo		*	
	b.	gbàdo	*!		*

As demonstrated in Pulleyblank (1998), the relatively high ranking of ANCHORL in Yoruba has the result that it is the leftmost vowel in a *V+V* cluster that typically survives (cf. Casali 1997 and Lamontagne & Rosenthall 1996).

3.6 Problems with ONSET

In the current context, an important point to be noted is that ANCHORL masks any potential effect of ONSET except in hiatus contexts. This means that there is no independent evidence for attributing the hiatus effects to ONSET. That is, it is not the case that ONSET violations in general trigger repair, and that hiatus contexts are just one sub-case of such repair. This point is of some importance in assessing the

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[5] See McCarthy & Prince (1995) for a general motivation of anchoring (with particular reference to reduplication) and Pulleyblank (1998) for its application to Yoruba.

claim that ONSET triggers hiatus resolution since there have been independent arguments in Yoruba that the initial *V* of a *VCV...* form is in fact not part of a "syllable" at all. In a detailed consideration of prosodic phenomena in Yoruba and various related languages, Ọla (1995) argues that onsetless vowels are defective in their syllabic properties. In Standard Yoruba, for example, onsetless vowels cannot normally be nasalised, cannot normally bear a high tone, do not exhibit the full range of vowel qualities, cannot be reduplicated, and so on. Consider the following example of such behaviour.

In the native vocabulary of Yoruba, all verbs are *C*-initial; a variety of examples have been seen in (2) and (3). In borrowings, however, there are some examples of *V*-initial verbs: *ẹ́ńfì* 'to envy', *ọ́gìlì* 'to be ugly', etc. Of interest is the result of a productive process of truncation that applies to such loan verbs to signify "an action done secretly" (Ọla 1995, p. 84–85). When truncation applies to *C*-initial verbs, it reduces them to a single syllable (22a,b); when truncation applies to *V*-initial verbs, the result is formed with an epenthetic [h] (22c,d).

(22) *Loan verb truncation*

	Simple verb	*Truncated form*		*Gloss*
a.	páàsì	pá	* á	'to pass'
b.	pọ́m̀bù	pọ́	* ọ́	'to pump'
c.	ẹ́ńfì	hẹ́	* ẹ́	'to envy'
d.	ọ́gìlì	họ́	* ọ́	'to be ugly'

This truncation is straightfowardly analysed as reducing the base to a single syllable. Of interest is what constitutes a syllable. If an onsetless vowel constitutes a syllable, then reduction to *ọ́* (*ọ́gìlì*) or *ẹ́* (*ẹ́ńfì*) should be possible. If all syllables in Yoruba must have an onset, as Ọla (1995) argues, then augmentation is required to meet the templatic requirements of truncation. Crucial for Ọla's account is the proposal that vowels without onsets constitute degenerate, unsyllabified moras.

If Ọla's account of the asymmetric properties of onsetless vowels is correct, the immediate implication is that hiatus effects are not the result of ONSET violations. In a sequence like *se ọbẹ̀* 'cook stew', the syllable structure would be as follows (syllables indicated by parentheses): [(se) ọ(bẹ̀)]. Because it is onsetless, the initial vowel of the second word would have a mora, but not a syllable. The fact that vowel deletion occurs in such cases could not, therefore, be attributed to a violation of ONSET under the assumption that ONSET is applicable to *syllables*.

We do not present additional data in favour of the hypothesis that "V" syllables are not syllables at all, but simply unsyllabified moras – for additional evidence, the reader is referred to Ọla (1995). Our goal here is to cast doubt on the the superficially simple assumptions that (i) if there is a vowel there is a syllable, and therefore (ii) if there is a vowel not preceded by a consonant that there is necessarily a violation of ONSET.

To conclude, we have noted that ONSET cannot motivate deletion independent of hiatus contexts, and it is unclear whether ONSET is actually violated in hiatus contexts at all. That is, Onset is neither a sufficient condition for deletion, nor clearly a necessary one.

4 Hiatus resolution through assimilation

The final aspect of these cases to be considered is assimilation. There are two classic assimilation sites in Yoruba, both involving nouns (see Awobuluyi 1978, Bamgboṣe 1967, Pulleyblank 1988, among others). First, there is a genitive construction, (Noun + Noun), which creates hiatus if the first noun ends in a vowel and the second begins in a vowel. Secondly, intervocalic consonantal deletion creates vowel hiatus within words. At the phrasal level, in (23), regressive assimilation removes hiatus:

(23) *Regressive assimilation in N + N construction*

	N + N		Assimilation ok		Deletion bad	Gloss
a.	ọmọ ẹran	[ɔmɔ ɛrã]	[ɔmɛɛrã]		*[ɔmɛrã]	'goat-kid; son of a bitch'
b.	èrọ owó	[èrɔ owó]	[èroowó]		*[èroowó]	'machine of money: money-making machine'
c.	ará ọ̀run	[ará ɔ̀rũ]	[arɔ́ɔ̀rũ]		*[arɔ́rũ]	'citizen of heaven: masquerade'
d.	owó epo	[owó ɛkpo]	[owéɛkpo]		*[owékpo]	'money of oil'

Within words, as in (24), progressive assimilation eliminates hiatal configurations.[6]

(24) *Progressive assimilation following intervocalic C-deletion*

	Input		Assimilation ok		Deletion bad	Gloss
a.	agogo	[agogo]	aago	[aago]	*[ago]	'bell'
b.	otútù	[otútù]	oótù	[oótù]	*[otù]	'chill'
c.	èsúsú	[èsúsú]	èésú	[èésú]	*[èsú]	'traditional banking'
d.	egungun	[egũgũ]	eegun	[eegũ]	*[egũ]	'bone'
e.	erùpẹ̀	[erùkpɛ̀]	eèpẹ̀	[eèkpɛ̀]	*[ekpɛ̀]	'sand'
f.	odídẹ	[odídɛ]	oódẹ	[oódɛ]	* [odɛ]	'parrot'

While these two sets of data are interesting for issues involving the directionality of assimilation and the impossibility of vowel deletion, the data in (23) are of particular interest in this paper because they pattern exactly like the data in (3), where assimilation eradicates the hiatal configuration between disyllabic verbs and vowel-initial noun objects. In (25), we reproduce a few examples from (3).

(25) *Regressive assimilation in V + N construction*

a.	gbàgbé ọmọ	gbàgbɔ́ ọmọ	'forget child'
b.	bẹ̀rẹ̀ òwò	bẹ̀rò òwò	'begin a business'
c.	parí èkɔ́	parɛ́ èkɔ́	'finish studies'
d.	tọrọ owó	tọro owó	'beg for money'
e.	jẹ́wɔ́ ẹ̀ṣẹ̀	jẹ́wɛ́ ẹ̀ṣẹ̀	'confess sin'

Within previous accounts (Bamgboṣe 1967, Awobuluyi 1978), the observed assimilation is entirely unexpected because it is generally considered that the distinction between assimilation and deletion is categorially based: at the phrasal level, deletion occurs between a verb or preposition and a following noun phrase while assimilation occurs between two nouns in a noun phrase. Bamgboṣe (1967:50) observes as follows:

(26)   It is a characteristic feature of Yoruba that when a word beginning with a vowel is preceded by another word, there is often (in normal quick speech) an assimilation or elision of one of the two vowels in contact. The assimilated vowel is replaced by the other vowel in contact with it, e.g., **ará ìlú** > **aráàlú** 'townspeople'. The elision of one of the vowels in contact results in a contraction of the two words, e.g., **ra ẹja** > **rẹja** 'buy fish'.

The observation in (26) has generally been interpreted as meaning that verb-object combinations (e.g. *ra ẹja* > *rẹja*) are prime sites for deletion while assimilation is expected to apply in noun-noun combinations (e.g. *ará ìlú* > *aráàlú*).
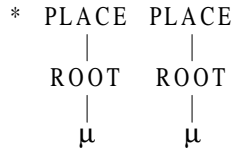
The inadequacy of the categorial analysis can be seen when cases like (25) are brought into the picture. The crucial property observed in assimilation cases appears to be the phonological property of minimality satisfaction, while the deletion cases appear to involve subminimal constituents. That is, the

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[6] See Pulleyblank (1998) for a detailed analysis of these facts.

distinction between assimilation and deletion involves the satisfaction of constraints on prosodic constituency.

To derive assimilation, we assume a constraint against hiatus – a constraint that prohibits sequences of vowels each with an individual set of articulatory specifications (McCarthy 1993, Ọla 1995, Pulleyblank 1998, etc.). By ranking NO-HIATUS above faithfulness, candidates with a single place specification will be preferred to the more faithful candidates that maintain input vowels fully.

(27) *NO-HIATUS*
```
     *  PLACE   PLACE
        |       |
        ROOT    ROOT
        |       |
        μ       μ
```

That assimilation rather than deletion is the optimal resolution of a potential hiatus configurations follows from the incorporation of NO-HIATUS into the constraint set already motivated. Let us reconsider examples like *tọrọ owó*/*tọrọ owó* 'beg for money' (seen in (10)). In such a disyllabic form, foot binarity is satisfied by both words independent of any deletion or assimilation (28a). To resolve hiatus by vowel deletion would result in a binarity violation (28b). Hence the optimal way to avoid hiatus is to have assimilation (28c).[7]

(28) *Assimilation as a resolution of hiatus*

	/tọrọ owó/	PROPHD WD	NO-HIATUS	ALIGNL	FOOT BIN	MAX IO	PARSE MORA
a.	(tọrọ)(owó)		*!				
b.	(tọ)(rowó)				*!	* (μ) * (RT)	
c. ☞	(tọrọ)(owó)					* (RT)	

In assessing violations of MAXIO, we assume that the result of assimilation is a single multiply-linked root node; this means that one root node is lost in the forms that have undergone assimilation and is assessed as a single MAXIO violation. Where there is full deletion of a vowel, both the root and the mora are deleted; such a case is assessed for two MAXIO violations, one for the mora and one for the root. For the relevance of this distinction, consider a longer verb such as in *wàhálà òbí*/*wàhálò òbí* 'to trouble parents':

(29) *Assimilation as a resolution of hiatus*

	/wàhálà òbí/	PROPHD WD	NO-HIATUS	ALIGN L	FOOT BIN	MAX IO	PARSE MORA
a.	(wàhá)là (òbí)		*!				
b.	(wàhá)(lòbí)					*! (μ) * (RT)	
c. ☞	(wàhá)lò (òbí)					* (RT)	

In this example, both vowel deletion and assimilation resolve the problem of hiatus, but deletion involves a more serious violation of faithfulness.[8]

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[7] See Pulleyblank (1998) for a treatment of assimilation that attempts to explain why assimilation in any given case is progressive or regressive.

[8] Note that nothing in these cases hinges on this exact way of assessing faithfulness violations. For example, a comparable result could be obtained by assuming that MAXIO is violated only by the deletion of a mora and that the assimilation cases violate an IDENT constraint.

Finally, the addition of NO-HIATUS does not affect the basic result that deletion is the optimal way of resolving a sub-minimal verb. We revisit the case of *se ọbẹ̀/sọbẹ̀* 'cook stew' to demonstrate this (see (9)).

(30) *Deletion as a resolution of binarity and hiatus*

/se ọbẹ̀/		PROPHD WD	NO-HIATUS	ALIGN L	FOOT BIN	MAX IO	PARSE MORA
a.	(se)(ọbẹ̀)		*!		*		
b. ☞	(sọbẹ̀)					* (μ) * (RT)	
c.	(sọ)(ọbẹ̀)				*!	* (RT)	

NO-HIATUS is violated if the verb and the noun are left intact (30a) – the maximally faithful candidate. If the vowel of the verb is deleted (30b), then faithfulness is violated, but this is less serious than the violation of foot binarity that occurs if there is assimilation (30c).

To conclude, we see that sequences of vowels are prohibited in Yoruba unless they constitute a single set of vowel specifications distributed over two or more vowels. When sequences of vowels occur, they are resolved by deletion (if there is a sub-minimal verb) or by assimilation (if the vowels belong to words satisfying minimality).

5 Some residual issues

Moreover, some interesting cases point to additional formal properties of interest. Consider cases where consonant deletion results in long vowels, cases of the type seen in (24). Of interest is what happens when such forms constitute the second word in a phrase. As seen below, such vowels trigger deletion when the preceding verb is sub-minimal (31a), and trigger assimilation when the preceding verb is longer (31b). Such forms may occur as the second member of a *N+N* sequence, and again, assimilation occurs as expected (31c).

(31) *Nouns with initial long vowels*

		Hiatus	*Assimilation*	*Deletion*	*Double Deletion*	*Gloss*
a.		wo aago	*wa aago	waago	*wago	'look at the time'
		fé eèpẹ̀	*fé eèpẹ̀	féèpẹ̀	*fépẹ̀	'blow sand'
		jẹ áádùn	*ja àádùn	jàádùn	*jádùn	'eat sweet cornmeal'
b.		wàhálà èèyàn	wàhálè èèyàn	*wàhálèèyàn	*wàhálèyàn	'to trouble people'[9]
		dúníbú oódẹ	dúníbó oódẹ	*dúníbóódẹ	*dúníbódẹ	'slaughter parrot'
		kófìrí àádùn	kófìrá àádùn	*kófìrâádùn	*kófìrâdûn	'sight sweetened cornmeal'
c.		owó eégún	owé eégún	*owéégún	*owégún	'money of masquerader'
		owó ààrẹ	owá ààrẹ	*owáàrẹ	*owárẹ	'money of aare'
		owó àádùn	owá àádùn	*owâádùn	*owâdûn	'money for sweetened corneal'

These cases are of some interest because they demonstrate the necessity for a constraint not yet considered. Independent of the phrase-level examples, consider the treatment of derived long vowels in

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[9] In cases like this one where the output of assimilation consists of three identical moras on identical tones, it is somewhat difficult to clearly distinguish two moras from three. We have not conducted instrumental investigation of such cases.

forms such as *aago*, *eèpè*, etc. (24). With the constraint set motivated so far, the optimal candidate should erroneously be a form with a short vowel **ago*, **epè*. Note that we do not consider here the nature of the constraint requiring consonant deletion,[10] nor do we indicate in this and subsequent tableaux constraint violations relating specifically to the consonant deletion itself.

(32) *Problems with long vowels*

/erùpè/		PROP HD WD	NO- HIATUS	ANCHOR L	ALIGN L	FOOT BIN	MAX IO	PARSE MORA
a.	(eùpè)		*!			*		
b.	(eèpè)					*!		
c.	(eè)pè	*!						*
d.	e(èpè)				*!			
e. ●*	(epè)						*	
f.	(ùpè)			*!			*	

Because of the high ranking of PROP HD WD, every word needs a foot, and every foot needs a syllable; it is therefore essential that the onsetful syllable *pè* be incorporated into the single foot of such a word. This eliminates candidate (32c). The foot itself must be left-aligned (eliminating (32d)) and must be binary (eliminating (32a,b)). Hence the optimal output is the incorrectly short form *epè* (32e). Since ANCHOR L (20) requires that the leftmost segment of a morpheme in the input correspond to the leftmost segment of a morpheme in the output, a candidate preserving the initial vowel (32e) would be better than a candidate preserving a non-initial vowel (32f) – but neither of the two best forms is correct.[11]

This incorrect result can be remedied by considering the role of an additional faithfulness constraint, CONTIGUITY (McCarthy & Prince 1995).

(33) *Contiguity*

CONTIGUITY:	If two elements (moras/root nodes) are adjacent in the input, then the
("CONTIG")	correspondent elements in the output must also be adjacent.

Crucially, CONTIGUITY must outrank FOOT BIN to ensure that a trimoraic, left-aligned foot will be optimal. (In this tableau, we do not consider the constraint that requires *r*-deletion itself; the relevant constraint must outrank CONTIGUITY since it forces a violation.)

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[10] For cases involving identical consonants (e.g. *agogo/aago*), one possibility would be to invoke an OCP-based constraint, ranking it above faithfulness, along the lines of Alderete (1997) and Suzuki (1998). As for the *r*-deletion type cases (e.g. *erùpè/eèpè*), we assume that the high ranking of the constraint *r prevents the surface realisation of [r] in contexts where properheadedness is not at stake (Ọla 1995, Pulleyblank 1998).
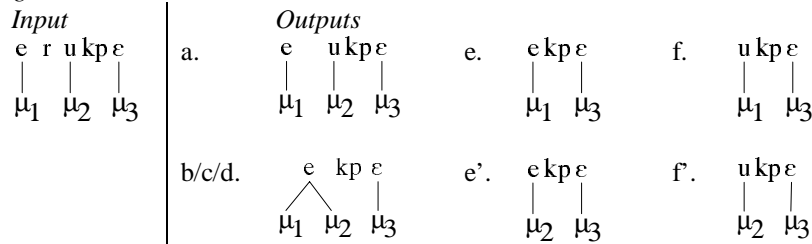
[11] In this particular case, the form with initial [u] would be ruled out independently because Standard Yoruba systematically prohibits *u*-initial words. The general point, however, is that the words resulting from consonant-deletion never retain the second vowel at the expense of the first.

(34) *Long vowels resolved*

/erùpè/		PROPHD WD	NO-HIATUS	ANCHOR L	ALIGN L	CONTIG	FOOT BIN	MAX IO	PARSE MORA
a.	(eùpẹ)		*!			*	*		
b. ☞	(eèpè)					**	*		
c.	(eè)pè	*!				**			*
d.	e(èpè)				*!	**			
e.	(epè)					***!		*	
e'.	(epè)			*!		**		*	
f.	(ùpè)			*!		*		*	
f'.	(ùpè)			*!					

To adequately assess the violations seen in (34), it is important to consider the precise structures involved. In (35), we sketch the basic patterns of root nodes (symbolised by the appropriate vowel phoneme) and moras seen in (34).

(35) *Long vowel structures*

Independent of the question of consonant-deletion, we see that the form in (34a/35a) satisfies both ANCHORL and CONTIGUITY at the moraic level, but violates CONTIGUITY once at the level of root specifications; this candidate also involves a fatal violation of NO-HIATUS. The candidate in (35b/c/d) resolves this NO-HIATUS violation, but in so doing incurs an additional root level CONTIGUITY violation; depending on how feet are assigned, this structure corresponds to (34b,c,d). If a mora is deleted, then ANCHORL is fatally violated if the initial mora is lost (as in (35e'/35f')) or if the initial root node is lost (as in (35f/f')). CONTIGUITY violations in the forms involving mora loss are as follows: if the initial mora is retained and the initial root node is retained, then there are two root level contiguity violations and one mora level violation (34e/35e); if the first mora is lost but the initial root node is retained, then there are still two violations of root level contiguity but there is no violation at the mora level (34e'/35e'); if the first mora is retained but with the root node of the second vowel, then there is a single mora level violation of CONTIGUITY and no violation at the root level (34f/35f); finally, if the first mora is lost along with its associated root specification, then CONTIGUITY is fully satisfied (34f'/35f'). The net result is that satisfaction of properheadedness, no-hiatus, contiguity and left-edge anchoring forces a minimal violation of binarity in such forms (34b/35b).
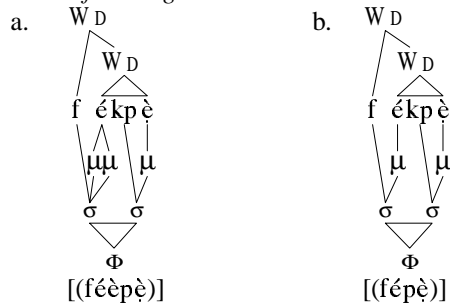
The important issue for this paper is how these constraints affect heteromorphemic vowel sequences. Returning to the examples of (31), we see that exactly the attested patterns of deletion/assimilation are captured. Specifically, a two-mora sequence is maintained within a word, as just seen, but is only retained in a phrasal *...VV...* sequence if compatible with properheadedness, contiguity and left-edge anchoring. Of particular interest, where deletion takes place, it deletes one mora but not two. To illustrate these effects, we consider first a case involving a sub-minimal verb and then a case with a longer verb.

(36) *Deletion with long vowels*

/fé eèpè/		PropHd Wd	No-Hiatus	Anchor L	Align L	Contig	Foot Bin	Max IO	Parse Mora
a.	(fé)(eèpè)		*!			**	**		
b.	(fé)(eèpè)					**	**!		
c.	(fée)(èpè)				*!	**			
d.	(féeèpè)				*!	**	**		
e. ☞	(féèpè)					**	*	*	
f.	(fépè)					***!		**	

A form where both verb and noun are maintained intact violates NO-HIATUS fatally (36a); NO-HIATUS can be satisfied by either assimilation (36b-d) or by deletion (36e-f). CONTIGUITY violations within the noun are entirely comparable to the pattern seen in (34): loss of the initial consonant forces one violation of CONTIGUITY and NO-HIATUS forces a second, but no additional violations are tolerated.[12] Of significance in the phrasal context, note that the deletion of the vowel of the verb does not result in a CONTIGUITY violation since there is no input form to be faithful to that includes both the verb and the noun. Since neither the consonant of the *CV* verb nor the vowel is adjacent to any of the segments of the noun underlyingly, this means that CONTIGUITY is irrelevant between the two words. Foot structure and binarity therefore become crucial. With regards to the location of a foot, ALIGNL requires that every word begin with a foot. This is satisfied in the first two candidates where word boundaries and foot boundaries correspond exactly ("[]" indicate word boundaries; "( )" indicate foot boundaries): [(fé)][(eèpè)] (36a) and [(fé)][(eèpè)] (36b). In the next two candidates, it is equally clear that alignment is violated, and therefore that the forms are non-optimal: [(fé)[e)(èpè)] (36c) and [(fé)[eèpè)] (36d). In the final two cases, we observe instances of phonological cliticisation for which we propose the following structures:

(37) *Word and foot alignment*

a. [(féèpè)]   b. [(fépè)]

Assuming that alignment is calculated on the maximal WORD, ALIGNL is satisfied in both cases. Of course, [(fépè)] (36f)/(37b) is non-optimal because of its contiguity violation. The point of the foot alignment is that the contest is shrunk to two candidates, [(fé)(eèpè)] (36b) and [(féèpè)] (36e). Of these two candidates, [(féèpè)] is optimal because its violation of foot binarity is minimal.

The final case to consider with respect to the examples with initial long vowels is one where a verb with two or more moras precedes such a noun. Consider an example like *dúníbó oódẹ*/*dúníbóódẹ* 'slaughter parrot' (31b). In such a case, all of the highly ranked constraints can be satisfied with assimilation; deletion results either in a gratuitous MAXIO violation (38d) or in a gratuitous CONTIGUITY violation (38e):

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[12] In (36f), we have assumed a candidate where the first mora is retained, that is, a candidate analogous to (35e). If the second mora were retained (as in (35e')), the resulting candidate would be excluded because of a fatal violation of ANCHORL.

(38) *Assimilation with long vowels*

/dúńbú oódẹ/	PROP HdWd	NO- HIATUS	ANCHOR L	ALIGN L	CONTIG	FOOT BIN	MAX IO	PARSE MORA
a.　(dúńí)bú (oódẹ)		*!			**	*		*
b. ☞ (dúńí)bó (oódẹ)					**	*		*
c.　(dúńí)(bóo)(ódẹ)				*!	**	*		
d.　(dúńí)(bóódẹ)					**	*	*!	
e.　(dúńí)(bódẹ)					***!		**	

6 Apparent Exceptions

We now have one basic phonological explanation for deletion and assimilation: the two processes are governed by prosodic minimality. Violation of foot binarity compels vowel deletion so that a subminimal word can be incorporated into a well-formed prosodic structure. On the other hand, assimilation is structure-preserving and only applies to remove the hiatus created by the juxtaposition of words that meet the minimal binary foot requirement. Before closing, we consider a few apparent exceptions to this analysis.

6.1 Subminimal verbs that don't delete

Data like the following appear to be counter-examples to the claim that the vowel of a monosyllabic verb deletes because of minimality violation:

(39) *Regressive assimilation: vowel of monosyllabic verb /kú/ does not delete*

	Input	*Assimilation ok*	*Deletion bad*	*Gloss*
a.	kú alé			'greetings at night'
	[kú alé]	[káalé]	*[kalé]	
b.	kú ojúmọ́			'greetings early in the morning'
	[kú oɟúmɔ̃́]	[kóoɟúmɔ̃́]	*[kóɟúmɔ̃́]	
c.	kú ọyẹ́			'greetings during the harmattan'
	[kú ɔjɛ́]	[kɔ́ɔjɛ́]	*[kɔ́jɛ́]	
d.	kú eré			'greetings at play'
	[kú eré]	[kéeré]	*[kéré]	

The monosyllabic verb *kú*, which prohibits deletion in (39), is an imperative verb (Awobuluyi 1978: 62), used mainly in greetings. It behaves like other imperative verbs of greeting in permitting assimilation, as the following data show:

(40) *Other imperative verbs: regressive assimilation, no deletion*

	Input	*Assimilation ok*	*Deletion bad*	*Gloss*
a.	(ẹ) kú onílé			'greetings to the occupant(s) of
	[(ɛ) kú onílé]	[kóonílé]	*[kónílé]	this house'
b.	(ẹ) pèlẹ́ onílé			'greetings to the occupant(s) of
	[(ɛ) kpèlé onílé]	[kpèlóonílé]	*[kpèlónílé]	this house'
c.	(ẹ) ǹlẹ́ onílé			'greetings to the occupant(s) of
	[(ɛ) ǹlẹ́ onílé]	[ǹloonílé]	*[ǹlonílé]	this house'

In (40) the vowel in parentheses is the second person plural pronoun. It is obligatory either when the addressee is plural or an older person. It may also be used optionally when the person being greeted is singular.

As is typical of imperatives, one would expect these verbs not to require external arguments. Quite strikingly, however, *kú* behaves unlike other imperatives: it cannot function as an imperative without an external argument, as illustrated below:[13]

(41) *Monosyllabic imperative /kú/ requires an external argument*
a. ẹ pèlẹ́   pèlẹ́   'greetings'
b. ẹ ǹlẹ́   ǹlẹ́   'greetings'
c. ẹ kú   *kú   'greetings'

What we are looking at is a minimality defined restriction: imperative verbs of greeting must obey foot binarity, even if it amounts to selecting an argument which would otherwise be optional, as is the case in the example involving *kú*. Hence, we treat *kú* as a binary-footed verb, and the observed assimilation in (39) and (40) follow.

6.2 Minimally sufficient forms that delete

Another form that could be seen as counter-example to the claim that only subminimal words undergo deletion is *láti* 'from'. As the following examples demonstrate, the final vowel of *láti* deletes when a following noun is vowel-initial:[14]

(42) *Final vowel of a disyllabic preposition is deleted*

	Hiatus ok	Deletion ok	Assimilation bad	Gloss
a.	láti oko			'from farm'
	[láti oko]	[látoko]	*[látooko]	
b.	láti ɔjà			'from market'
	[láti ɔjà]	[látɔjà]	*[látɔɔjà]	
c.	láti èkó			'from Lagos'
	[láti èkó]	[látèkó]	*[láteèkó]	
d.	láti ɛ̀gbè			'from Ẹgbẹ'
	[láti ɛ̀gbè]	[látɛ̀gbè]	*[làtɛɛ̀gbè]	

To understand this exceptionality, it is again instructive to examine other disyllabic prepositions in Yoruba. The following data show that they prohibit deletion, unlike the preposition in (42):

(43) *Other disyllabic prepositions: no deletion*

	Hiatus ok	Deletion bad	Assimilation ok	Gloss
a.	lórí àga			'on the chair'
	[lórí àga]	*[lórága]	[lóráàga]	
b.	nípa owó			'about money'
	[níkpa owó]	*[níkpowó]	[níkpoowó]	
c.	lábẹ́ aṣọ			'under the cloth'
	[lábẹ́ aʃɔ]	*[lábaʃɔ]	[lábáaʃɔ]	
d.	nítorí owó			'on account of money'
	[nítorí owó]	*[nítorówó]	[nítoróowó]	

Awobuluyi (1978: 99-100) observes that the morphological composition of the prepositions in (42) and (43) is complex. He notes that these forms are not monomorphemic, but constitute prepositional phrases

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[13] The use of these forms is subject to sociolinguistic variables involving age, style, and dialect. For example, the form /ẹ kú/ and /ǹlẹ́/ are more common in the speech of an older generation of speakers whereas the younger generation tends to use /pèlẹ́/. In Ilọrin Yoruba, only the /ẹ kú/ form is attested.

[14] Additionally, a number of lexical compounds undergo deletion even though their component parts would satisfy minimality. For example, *ọmọ* 'child' + *obìnrin* 'female' gives *ọmọ bìnrin* 'young female'. See Akinlabi & Oyebade (1986) for discussion of this kind of case.

composed of prepositions and object nouns. In (44), the morphological composition of these prepositions is indicated.

(44) *The morphological composition of disyllabic prepositions*

	Full form	*Reduced form*	*Gloss*
a.	ní + orí	lórí	'on top' < at+head
b.	ní + ipa	nípa	'about' < at+path
c.	ní + abẹ́	lábẹ́	'under' < at+underpart
d.	ní + ì + ti + orí	nítorí	'on account of' < at+abstract nominal+from+head

The morphologically complex forms in (44a-c) illustrate combinations of a monosyllabic preposition and a following object pronoun. As expected, deletion applies in these forms because of minimality restrictions, as seen in section §3. Following the incorporation of these forms into well-formed prosodic structure, assimilation kicks in to eliminate the minimal-word concatenation-driven hiatus in (43a-c).

The morphological composition of (44d) is more complex, however. Before we give its internal composition, some background information about the morpheme *ti* in *nítorí* is in order. The morpheme *ti*, which translates as 'from', usually occurs with nouns of place and time, and its vowel deletes if the following noun is vowel-initial, as in (45) (the relevant configuration is bolded):

(45) *ti + noun combinations*

	Full form				*Reduced form*	*Gloss*
a.	Olú	**ti**	**oko**	dé		Olú **toko** dé	'Olu got back from
	Olu	from	farm	arrive			the farm'
b.	Olú	**ti**	**àárọ̀**	bẹ̀rẹ̀	iṣẹ́	Olú **tàárọ̀** bẹ̀rẹ̀ iṣẹ	'Olu worked hard
	Olu	from	morning	started	work		from his youth'

When the prepositional phrase – /ti + noun/ – is preceded by another preposition, it takes a nominalizer, behaving like a verb phrase[15] so that it may be a well-formed object for the preceding preposition, as the composition of *nítorí* illustrates in (46).

(46) *Morphological composition of nítorí*

> ní   ì   ti   orí
> preposition + nominalizer + preposition + noun

In (46), there are two deletion sites. Deletion applies between monosyllabic *ti* and *orí* and also applies between monosyllabic *ní* and its object, *ìtorí*. Together, these two instances of deletion produce the output: *nítorí*. Given that this output is minimally binary-footed, when a noun appears after it, assimilation may apply, not deletion. Hence in an example like *nítorí owó* (42d), *nítoróowó* is attested but **nítorówo* is ungrammatical.

Turning now to *láti*, notice that it is morphologically identical to /nítorí/ in that it is composed of two prepositions, separated by a nominalizer, as in (47):
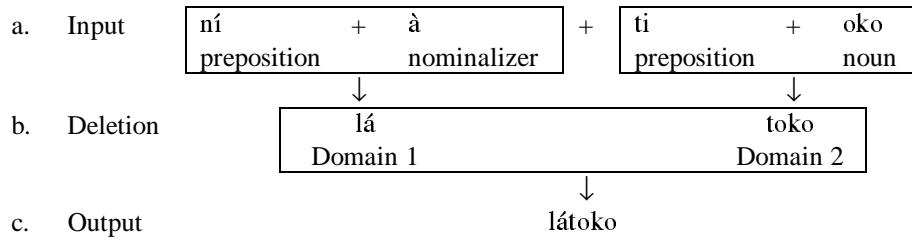
(47) *Morphological composition of láti*

> ní   à   ti
> preposition + nominalizer + preposition

As the morphemes in (47) stand, there is only one deletion site, the context between the first preposition and the nominalizer. However, the second preposition must have an object in order to be well-formed. When a noun follows the second preposition, deletion may also apply, given the degenerate status of /ti/, producing exactly the same result as witnessed in (46):

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[15] See Bamgbọṣe (1967:44) for a proposal that /ti/ has verbal qualities.

(48) *Two prepositional phrases: two deletion sites*

a.	Input	ní	+	à		+	ti	+	oko
		preposition		nominalizer			preposition		noun

b.	Deletion	lá		toko
		Domain 1		Domain 2

c. Output   látoko

Thus, we see that deletion in a form like *látoko* is not a true counter-example to our claim that deletion and assimilation are subject to and triggered by minimality conditions in Yoruba.

7 Conclusion

From a functional perspective, the Yoruba patterns are somewhat surprising. The most flagrant violation of faithfulness occurs when a *CV* verb is followed by a *V*-initial noun – the canonical transitive sequence. Deletion, which most frequently affects the vowel of the verb, results in a heavy loss of phonological content: the only remaining phonological information from the verb is its consonant and a portion of its tonal information (H tones survive; M and L tones are neutralised in this context). It is hard to imagine, therefore, that the trigger for deletion is other than formal.

For example, imagine that deletion was a response to an onset violation, and that functional considerations of information content interacted with such constraints. Since *CV+VCV* and *CVCV+VCV* sequences are equally bad as regards the onsetless status of the *VCV* noun, one might expect deletion to be favoured in the *CVCV* cases since the information content of the verb is more readily recovered given the length of the lexical item. As we have seen, it is the exact opposite that is attested. Of interest, the prosodic solution to deletion – that deletion is motivated by a verb being sub-minimal – produces a result that flies in the face of simple logic.

The behaviour of Yoruba verbs of two or more moras constitutes strong evidence in favour of an approach to heteromorphemic vowel deletion based on hiatus resolution and minimality, where onset violations or the lack thereof are merely an epiphenomenon. This does not mean that onset violations could not constitute a driving force for deletion or glide formation in a different grammar, but there is no necessary causal relation between hiatus resolution and the elimination of onsetless syllables.

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