HIATUS RESOLUTION IN NUPE

Ahmadu Ndanusa Kawu
Rutgers University, New Brunswick
University of Ilorin, Nigeria

In Nupe, hiatus—heterosyllabic vowel sequences—is prohibited. This article argues that the primary hiatus resolution strategy in the language is glide formation. Assimilation is considered a complement of glide formation that occurs when the affected vowel lacks a corresponding glide. Elision is a special hiatus resolution strategy that affects the nominal prefix **e-** in nouns of the form **e**-CV. The analysis is undertaken within the framework of Optimality Theory.

En nupe, une séquence de voyelles hétérosyllabiques est interdite. Dans ce mémoire, je promote l'argument que la stratégie primaire pour résoudre le hiatus dans la langue est la formation des semi-voyelles. On prend l'assimilation comme complément de la formation des semi-voyelles qu'on trouve quand la voyelle affectée manque une semi-voyelle correspondante. L'élision est une stratégie pour résoudre le hiatus réservée pour le préfix nominal **e-** dans les noms du forme **e**-CV. L'analyse s'est éffectuée dans le cadre de la Théorie de l'Optimalité.

INTRODUCTION

In Nupe, a Nupoid language of the Benue-Congo subfamily of the Niger-Congo family of African languages (Blench 1989), heterosyllabic vowel sequences are disfavored. The hiatus created by such sequences is resolved in one of three ways as exemplified in (1): glide formation (1a), assimilation (1b), or elision (1c).[1]

(1) Hiatus resolution patterns

a.	**egi**	**a**	→	**egja**
	child	3pl		their child
b.	**ega**	**u**	→	**eguu**
	visitor	3sg		his visitor
c.	**lá**	**egi**	→	**lági**
	carry	child		carry the child

This article provides an account of hiatus resolution in Nupe[2] using the framework of Optimality Theory (OT; Prince and Smolensky 1993), and relying most especially on constraints of Correspondence Theory (McCarthy and Prince 1995, 1999). I argue that the primary hiatus resolution strategy in Nupe is glide formation as illustrated in (1a). It is shown that assimilation is a complement of glide formation conditioned by the absence of a corresponding glide to the assimilating vowel. I further demonstrate that elision is a special hiatus resolution strategy that affects the initial **e** vowel

---

[1]Smith (1967) describes the behaviour of vowels in juxtaposition in Nupe, and the effects fall into these three patterns.

[2]This research was supported in part by a pre-doctoral research grant from the Center for African Studies, Rutgers University, New Brunswick, and NSF grant #BCS 99-05600. An earlier version of the article was presented at the 3rd World Congress of African Linguistics (WOCAL 2000) held at the Université du Bénin, Lomé, Togo in August 2000. I thank the participants at the conference for their searching questions and useful comments. These have helped to shape the present state of the paper. I am especially indebted to Akinbiyi Akinlabi for comments on earlier drafts, encouraging the development of the ideas in this article, useful discussion on a number of points, and for suggestions that helped in putting the issues in the right perspective. Thanks to the anonymous JWAL reviewer for comments that improved the analysis in significant ways. I take responsibility for any errors therein.

of nouns of the e-CV form. Finally, I identify the implications of the analysis of hiatus resolution in Nupe for the typology of hiatus resolution strategies and the constraint system required to handle cross-linguistic preferences.

In this article I (1) outline the basic tenets of OT and aspects of Correspondence Theory; (2) discuss hiatus and review some of the motivations for its resolution in the literature. I adopt an articulatory motivation for its resolution, and formulate a constraint to this effect. Other constraints that capture the basic effects of hiatus resolution are identified; (3) discuss glide formation as the primary hiatus resolution strategy in Nupe; (4) show that assimilation is a complement of glide formation; (5) discuss the facts of elision as a special hiatus resolution strategy; and (6) identify the implications of the analysis of the patterns of hiatus resolution in Nupe. Suggestions are offered on how to approach the presence of multiple strategies in a language in a constraint-based grammar that is OT. A typology of hiatus resolution strategies is set up based mainly on correspondence-theoretic constraints. The ranking of these constraints determines cross-linguistic preferences.

OPTIMALITY THEORY AND CORRESPONDENCE THEORY

The basic principles of Optimality Theory (Prince and Smolensky 1993) are as in (2)–(5).

(2) Universality
Universal Grammar (UG) provides a set of universal conflicting constraints on representational well-formedness.

(3) Violability
Constraints are violable, but violation is minimal.

(4) Constraint ranking
Grammars are rankings of constraints in a dominance hierarchy.

(5) Optimality
The grammatical form is selected from a number of competing candidates. It is the optimal output form that best satisfies the constraint hierarchy. The nonoptimal candidates are ungrammatical.

The constraints of OT fall into two broad categories: faithfulness and markedness constraints. Faithfulness constraints demand that outputs be no different in any respect from inputs. Markedness constraints regard some output structures as less desirable than others. The interaction of faithfulness and markedness constraints with respect to ranking determines the optimal analysis of any given input.

Correspondence Theory (McCarthy and Prince 1995, 1999) is a development in OT that models identity between input and output mappings among phonological representations. Basically correspondence is a relation between two structures as defined in (6).

(6) Correspondence (McCarthy and Prince 1995:262)
Given two strings S_1 and S_2, CORRESPONDENCE is a relation $\Re$ from the elements of S_1 to those of S_2. Elements $\alpha \in S_1$ and $\beta \in S_2$ are referred to as CORRESPONDENTS of one another when $\alpha \Re \beta$.

Correspondence constraints assess correspondence and identity of correspondent elements. Three families of correspondence constraints are identified, and they are generally characterized as in (7)–(9). These are specifically instantiated along the various dimensions of correspondence. Correspondence Theory is thus a model of faithfulness.

(7) MAX
Every segment of S_1 has a correspondent in S_2.

(8) DEP
Every segment of S_2 has a correspondent in S_1.
(S_2 is 'dependent' on S_1.)

(9) IDENT(F)
Let α be a segment in S_1 and β be any correspondent of α in S_2.
If α is [γF], then β is [γF].
(Correspondent segments are identical in feature F.)

The discussion of hiatus resolution in this article appeals to markedness, alignment, and correspondence constraints. The relevant constraints are motivated as required at each point in the analysis.

HIATUS

Vocalic hiatus is the occurrence of a sequence of vowels in different syllables. It has been pointed out that hiatus contexts arise from morphological or syntactic concatenation (Casali 1996, 1997, Ola Orie and Pulleyblank 2000, Pulleyblank 1998, and Rosenthall 1994, 1997). These optimality-theoretic accounts of hiatus agree that languages prohibit such sequences and find means of resolving them. They, however, differ on the motivation for resolving hiatus. While Casali, and Rosenthall attribute hiatus resolution to syllable well-formedness, Ola Orie and Pulleyblank, and Pulleyblank attribute it to articulatory difficulty. The syllable well-formedness approach attributes hiatus resolution to the ill-formedness of syllables without onset. In the hiatus context, the second syllable lacks an onset. The articulatory approach on the other hand attributes hiatus resolution to the difficulty of resetting the articulators from one vowel to the following in a sequence of nonidentical vowels. A crucial difference between the two approaches is that the syllable-based approach does not have a specific constraint against hiatus. The ONSET constraint is regarded as motivating hiatus resolution. The articulatory approach does have a constraint against hiatus, appropriately referred to as NOHIATUS.

I adopt the articulatory approach for the analysis of hiatus resolution in Nupe.[3] For Ola Orie and Pulleyblank, the constraint against hiatus is crucially dependent on the sequence of vowels being featurally distinct, and the NOHIATUS constraint is formulated factoring in this assumption. I adopt a broader view of hiatus in which the term applies to both featurally distinct and featurally identical vowels in different

[3]Ola Orie and Pulleyblank (2000) advance arguments against the onset analysis and the specific problems associated with it for the analysis of vowel hiatus in Yoruba. See their article for details. A significant argument against the onset analysis is that not all instances of hiatus are resolved by providing an onset for the offending syllable. It must, however, be pointed out that hiatus resolution minimizes onset violations, especially in languages like Yoruba and Nupe in which onsetless syllables abound.

syllables.[4] Hiatus is, therefore, not restricted to a sequence of nonidentical vowels. In the Nupe examples in (10) the outputs with both vowels in the same syllable are well-formed while those with the vowels in different syllables are ill-formed as they remain in hiatus. This is due to the fact that there is an articulatory break between the two vowels.[5]

(10) Identical vowels in hiatus

efê	**è**	**tswãʌ́**	→	**efêè.tswãʌ́**	**(*efê.è.tswãʌ́)**
wind	PROG	blow		the wind is blowing	
ega	**a**		→	**egaa**	**(*ega.a)**
visitor	3pl			their visitor	
etsu	**u**		→	**etsuu**	**(*etsu.u)**
king	3sg			his king	
ègo	**o**		→	**ègoo**	**(*ègo.o)**
worm	FOC			it's a worm	

The question arises with respect to how the syllable that results from articulating the vowels in hiatus in (10) is to be interpreted. This is also pertinent for the cases of hiatus resolution by assimilation. If the output is interpreted as bimoraic, the resulting syllable is heavy. There is, however, no evidence for such syllables in the language. The phonologically attested syllables in the language are V, CV, and N (syllabic nasal). The effect of hiatus resolution however results in the creation of phonetically heavy syllables. This being the case the resulting syllable can be interpreted as heavy without impacting on the phonologically attested syllables in the language. There are, however, words with internal sequences of identical vowels that seem to suggest otherwise. Examples of such words are given in (11).

(11) Word-internal sequences of identical vowels

gbáàní	now
déégi	few
lòózũ	evening
sùúsùúgi	waxbill

The identical vowels in (11) are better analyzed as vowel sequences to conform with the phonologically attested syllable structures in the language, and the lack of heavy (CVV) syllables. In effect the vowels belong to different syllables in the underlying structure. On the view of hiatus adopted here articulating them as such creates hiatus. This is, however, resolved on the surface by articulating them together resulting in phonetically heavy syllables. On this view the absence of heavy syllables in the phonology still holds. Hence, any heterosyllabic vowel sequence, identical or distinct, creates hiatus, and it is resolved accordingly.

---

[4]Ola Orie and Pulleyblank point out in a footnote that a reviewer of the paper noted that hiatus is defined in the dictionary as any heterosyllabic sequence of vowels not separated by a consonant, be the vowels the same or different. It is this definition that informs my formulation of the constraint.

[5]A participant at WOCAL 2000, Ian Maddieson, pointed out to me that the motivation for hiatus resolution may not be articulatory but perceptual. On this view, well-formed syllables, that is, those with onset are more perceptible than those without. This suggests that hiatus resolution is onset-driven, an approach that is noted in footnote 3 as inadequate for the analysis of hiatus resolution.

In view of the foregoing, the markedness constraint that captures hiatus prohibition is as formulated in (12).

(12) NOHIATUS
Heterosyllabic vowel sequences are disfavored.

The effect of hiatus resolution in Nupe as the examples in (1) and (10) show is syllable reduction via syllable merger or syllable loss. Two faithfulness constraints are required to capture syllable reduction. These are given in (13) and (14).

(13) *MERGER[6]
Syllables may not merge.

(14) MAX-IO
Every input segment has a correspondent in the output.

The constraints (12)–(14) interact with other constraints to account for the hiatus resolution patterns in Nupe.

GLIDE FORMATION

The primary hiatus resolution strategy in Nupe is glide formation. Vowels fall into two classes with respect to this. The front vowels /i, e/ turn to the palatal glide /j/ before a nonidentical vowel. The back round vowels /u, o/ turn to the labio-velar glide /w/ before a nonidentical vowel. The hiatus context in Nupe is better illustrated with lexical words preceding function words. This is necessitated by the fact that of the vowel phonemes of Nupe only /e/ and /a/ begin words in the language as noted by Smith (1967). Other vowels occur as syntactically bound forms. Of these vowels /i/ never occurs as a bound syntactic form. In hiatal configurations, therefore, any of the five vowels can be the first vowel (V_1), while only /e, a, u, o/ can be the second vowel (V_2). The examples in (15) and (16) are thus constrained by this restriction.[7]

(15) Front vowels as V_1 in hiatus

a.	**egi**	**è**	**tígí**	→	**egjè tígí**
	child	PROG	cry		the child is crying
	egi	**o**		→	**egjo**
	child	FM			it's a child
	egi	**u**		→	**egju**
	child	3sg			his child
	egi	**a**		→	**egja**
	child	3pl			their child

[6]This constraint can be regarded as a kind of alignment constraint (McCarthy and Prince 1993a, b) or an anchoring constraint (McCarthy and Prince 1995). As formulated it requires syllables to maintain their integrity by not realigning with each other. On alignment or anchoring views, there is no formulation that adequately captures syllable merger, and so this constraint is adopted for practical purposes. It penalizes the realignment of syllables in the output of vocalic hiatus. As I demonstrate in the course of the analysis it plays a crucial role in setting up a typology of hiatus resolution strategies.

[7]Smith (1967) describes the sequence of /i/ + /e/ as resulting in assimilation to /e:/, while /u/ + /o/ result in assimilation to /o:/. This assimilation does not occur in my speech. Instead, the first vowel becomes a corresponding glide.

b.	**ète**	**o**		→	**ètjo**
	gum	FM			it is a gum
	ète	**u**		→	**ètju**
	gum	3sg			his gum
	ète	**a**		→	**ètja**
	gum	3pl			their gum

(16) Back vowels as V_1 in hiatus

a.	**etsu**	**è**	**tígí**	→	**etswè tígí**
	king	PROG	come		the king is crying
	etsu	**o**		→	**etswo**
	king	FM			it's the king
	etsu	**a**		→	**etswa**
	king	3pl			their king
b.	**ègo**	**è**	**sò**	→	**ègwè sò**
	worm	PROG	crawl		the worm is crawling
	ègo	**u**		→	**ègwu**
	worm	3sg			his worm
	ègo	**a**		→	**ègwa**
	worm	3pl			their worm

The effect of glide formation is that hiatus is resolved by syllable reduction without segmental deletion as the second syllable merges with the first one. Effectively then, all segments of the input are present in the output. The only difference is that V_1 turning into a glide results in a difference in identity between the input and output in violation of the faithfulness correspondence constraint in (17).[8]

(17) IDENT-IO
Corresponding input-output segments are identical.

The question arises as to the interpretation of the syllable that emerges from glide formation. Should the glide be regarded as part of the onset and thus forming a complex consonant-glide onset, or should it be regarded as part of the nucleus forming a glide-vowel rising diphthong? It is not especially crucial to the analysis which interpretation is adopted. The phonotactics of the language, however, favours the rising diphthong interpretation. Smith (1967) actually refers to the resulting forms as rising diphthongs with the glides [j] and [w] as the first element and the following vowel as the second element. In addition complex onsets are not attested in the language, but rising light diphthongs are (see Kawu 2000). The light diphthongs are the oral /ja/ and /wa/ and the nasal /jã/ and /wã/. Examples of their occurrence as nuclei are given in (18).

[8] I have given a general formulation of the constraint without specifying the feature for which the difference in identity is assessed. This is due to the fact that the same constraint is required in the analysis of assimilation in the next section. However vowels and glides can be distinguished in terms of the feature [consonantal] (Hyman 1985), vowels being [–consonantal] and glides [+consonantal]. Of interest is the difference in identity between the input and output, and this general formulation suffices.

(18) Light diphthongs as nuclei

fja	drift	**tswa**	forge
èfjá	gratis	**etswa**	moon
tjãʌ	be thin	**tswãʌ**	winnow
èfjã	two-pronged spear	**ètswãʌ**	stench

One other question that needs to be addressed is why syllable merger does not suffice to resolve hiatus without the initial vowel turning into a glide. Pursuing the assumption that the resulting glide forms a rising diphthong with the merged vowel, it is appropriate to motivate a condition on diphthongs to the effect that they may consist of an onglide or offglide. I formulate the relevant constraint in (19). Given that constraints are rankable, languages may resolve hiatus by diphthong formation without an onglide or offglide. In such cases input-output identity takes priority.

(19) DIPHTHONG CONDITION (DIPHCON)
A diphthong may have an onglide or offglide.

The constraints needed to account for glide formation as the primary hiatus resolution strategy in Nupe are now in place. They are ranked as in (20). The ranking is illustrated in (21).

(20) Ranking for glide formation as hiatus resolution strategy
NOHIATUS, MAX-IO, DIPHCON > * MERGER, IDENT-IO

(21) Glide formation as optimal analysis of hiatus resolution

	Input: egi + a	NOHIATUS	MAX-IO	DIPHCON	*MERGER	IDENT-IO
a.	**e.gi.a**	*!				
b.	**e.gi.**		*!			
c.	**e.ga.**		*!			
d.	**e.gia.**			*!	*	
e. ☞	**e.gja.**				*	*

(21a), with input vowels parsed into different syllables, fatally violates (*!) the markedness constraint NOHIATUS. It satisfies all other constraints, but since this is the highest ranked constraint it is knocked out. (21b) avoids a violation of NOHIATUS by deleting V_2. But there is an input segment that lacks a correspondent in the output, a fatal violation of MAX-IO. (21c) also satisfies NOHIATUS by deleting V_1, but fatally violates MAX-IO. (21d), with the input vowels parsed into a single syllable, satisfies NOHIATUS and MAX-IO. It, however, fatally violates DIPHCON as the resulting diphthong does not have an onglide. It also incurs a violation of *MERGER, but satisfies IDENT-IO as the input segments are featurally identical. (21e) is optimal (☞) as it satisfies all higher ranked constraints. Compared to (21d) it avoids a violation of DIPHCON as the diphthong has an onglide. It, however, violates IDENT-IO as the output correspondent of V_1 is a glide. But, this violation is not consequential as the constraint is low-ranked.

The facts that emerge from the analysis of glide formation as the primary hiatus resolution strategy in Nupe are that high and mid vowels turn to glides before nonidentical vowels, syllables are merged, all inputs have output correspondents, and outputs may be featurally different from their input correspondents. These facts are crucial to the analysis of assimilation as a complement of glide formation in hiatal configurations.

ASSIMILATION

Assimilation as a hiatus resolution strategy in Nupe is a complement of glide formation. While high and mid vowels turn to corresponding glides in hiatus contexts, the low vowel /a/ assimilates to the following vowel as in the examples in (22).

(22) Low vowel as V_1 in hiatus

ega	**è**	**tígí**	→	**egeè tígí**
visitor	PROG	cry		the visitor is crying
ega	**o**		→	**egoo**
visitor	FM			it's the visitor
ega	**u**		→	**eguu**
visitor	3sg			his visitor

The examples in (22) show that as in glide formation, there is a syllable merger, every input segment has a correspondent in the output, and the output is not identical to the input. The difference between glide formation and assimilation is what needs to be accounted for.

When light diphthongs occur as V_1 in hiatal configurations, the vowel half /a/ assimilates to the following vowel in the same way that the low vowel occurring alone does. This is exemplified in (23). The outcome of hiatus in the examples in (22) and (23) are regarded as vowel-vowel and rising diphthong-vowel sequences, respectively.

(23) Light diphthongs as V_1 in hiatus

egjà	**è**	**tsɪ̃ʌ́**	→	**egjèè tʃɪ̃ʌ́**
blood	PROG	descend		blood is dripping
egjà	**o**		→	**egjòo**
blood	FM			it's blood
egjà	**u**		→	**egjùu**
blood	3sg			his blood
egwa	**è**	**du**	→	**egweè du**
hand	PROG	shake		the hand is shaking
egwa	**o**		→	**egwoo**
hand	FM			it's a hand
egwa	**u**		→	**egwuu**
hand	3sg			his hand

The account of assimilation as a complement of glide formation rests on why the low V_1 in this case does not turn into a glide as in the case of high and mid vowels. The answer is that low glides are rare cross-linguistically, and Nupe lacks a corresponding low glide. The rarity of low glides is due to the markedness constraint in (24).

(24) *LOW-GLIDE (cf. Casali 1996)
Low glides are disfavored.

A pertinent issue with respect to assimilation is its regressive nature. Progressive assimilation with V_2 assimilating to V_1 is possible. Given this possibility, the

preference for regressive assimilation needs to be explained. I attribute the preference for regressive assimilation to the need to maintain the identity of the vowel which is the only segment of the morpheme. Changing the identity of a monosegmental morpheme has the effect of obscuring its meaning. A constraint to this effect is formulated accordingly in (25).

(25) IDENTMS-IO
Corresponding input-output monosegmental morphemes are featurally identical.

The constraints (24) and (25) are integrated into the ranking (20) to give the ranking (26) that accounts for assimilation of low vowels in hiatus context. The ranking (26) is illustrated in (27) demonstrating assimilation as the optimal analysis of hiatus resolution when V_1 is the low vowel /a/.

(26) Ranking for assimilation as hiatus resolution strategy
NOHIATUS, MAX-IO, DIPHCON, IDENTMS-IO > *LOW-GLIDE > *MERGER, IDENT-IO

(27) Assimilation as optimal analysis of hiatus resolution

Input:	ega+o	NO HIATUS	MAX -IO	DIPH CON	IDENT MS-IO	*LOW- GLIDE	*MERGER	IDENT -IO
a.	**e.ga.o**	*!						
b.	**e.ga.**		*!					
c.	**e.go.**		*!					
d.	**e.gao.**			*!			*	
e.	**e.gAo.**					*!	*	*
f.	**e.gaa.**				*!		*	*
g. ☞	**e.goo.**						*	*

In (27), the candidate with heterosyllabic vowel sequences (27a) incurs a fatal violation of the constraint against hiatus while satisfying all others. Deletion in (27b) and (27c) is suboptimal as it fatally violates MAX-IO. (27d) incurs a fatal violation of DIPHCON. This violation is avoided by (27e) with the low vowel turning into a glide ('A' for want of an appropriate notation), but it fatally violates the constraint against low glides. (27f) avoids this violation with V_2 assimilating to V_1 (progressive assimilation). But this results in a difference in identity between the input and output of a mononsegmental morpheme, a fatal violation of IDENTMS-IO. The optimal (27g) with the low vowel V_1 assimilating to the second vowel (regressive assimilation) satisfies IDENTMS-IO as it does not obscure the identity of the monosegmental morpheme. With the syllables merged, (27g) satisfies all high ranking constraints but violates the low ranking ones, more crucially IDENT-IO.

A comparison of (21) and (27) shows that both glide formation and assimilation have similar constraint satisfaction-violation profile. This is an indication that assimilation is a complement of glide formation, and that assimilation results from the lack of a corresponding glide to the assimilating low vowel. The analyses of glide formation and assimilation as hiatus resolution strategies suggest that every input in a hiatal configuration has a correspondent in the output, an indication that elision is not an option. But in some hiatal configurations elision is used as a resolution strategy. This is discussed in the next section.

ELISION

The examples of hiatus that have been provided thus far have syntactically bound forms as V_2. In hiatal configurations where V_2 is the first vowel of a noun of the form e-CV, it is deleted whatever the quality of V_1. Thus, unlike in glide formation and assimilation where V_1 is the affected vowel, elision affects V_2.[9] Examples are given in (28).

(28) Elision of V_2 in hiatus

li	**ezà**	→	**lizà**
choose	person		choose a person
de	**ega**	→	**dega**
have	visitor		have a visitor
lù	**eni**	→	**lùni**
cook	stew		cook stew
ló	**èga**	→	**lóga**
enter	barn		enter a barn
lá	**egi**	→	**lági**
carry	child		carry a child

The difference between glide formation and assimilation, and elision is that in the case of glide formation and assimilation every input has a correspondent in the output while in the case of elision, there is an input that lacks a corresponding output. Elision is analyzed as a special hiatus resolution strategy that affects the initial vowel of nouns of the form e-CV. The vowel in this case can be regarded as a nominal prefix (cf. George 1970). Its deletion, in contrast to the retention of other vowels in the same position in the glide formation and assimilation data, is attributed to the fact that it is a prefix while the others are root vowels. The preference for faithfulness to root segments over affixal segments is captured by the Root-Affix Faithfulness Metaconstraint (McCarthy and Prince 1995) given in (29).

(29) Root-Affix Faithfulness Metaconstraint
ROOT-FAITH > AFFIX-FAITH

In view of (29) the MAX-IO constraint featured in the rankings (20) and (26) can be relativized to roots and affixes with the ranking in (30).

(30) MAX-IO-ROOT > MAX-IO-AFFIX

Before demonstrating the interaction between the ranking in (30) with the constraint against hiatus that results in elision as the preferred strategy in the context in (28), it is appropriate to give some evidence for the analysis of /e/ as a nominal prefix in nouns of the form e-CV. Nouns are formed from verbs by è-prefixation as in (31).

---

[9]Casali (1996, 1997) erroneously lists Nupe as one of the languages that consistently elide V_1 at the boundary between two lexical words. As the data in (28) show, this is not the case. He also notes that Nupe elides V_2 at the boundary between a root and a suffix. Vowel initial suffixes are not attested in Nupe. Other than in the context noted here, elision is not the primary hiatus resolution strategy in Nupe.

(31) Noun formation from verbs by è-prefixation

Verb		Noun
fá	→	**èfá**
rest		holiday
rwa	→	**èrwa**
pour		funnel
bo	→	**èbo**
be tired		tiredness
sà	→	**èsà**
be pretty		beauty

When the derived nouns occur in hiatal configurations, the prefix is regularly elided as in (32).

(32) Elision of è-prefix in hiatus

gí	**èfá**	→	**gífá**
eat	holiday		spend holiday
de	**èrwa**	→	**derwa**
have	funnel		have a funnel
wá	**èrwa**	→	**wárwa**
want	funnel		want a funnel
wo	**èbo**	→	**wobo**
feel	tiredness		feel tired
wú	**èsà**	→	**wúsà**
show	beauty		show beauty

In some common nouns in nonhiatal configurations, /e/ is often elided (cf. Smith 1967) as in (33).

(33) e-elision in nonhiatal context

ezà	**nana**	→	**zà nana**
person	this		this person
ejã	**nana**	→	**œã nana**
thing	this		this thing
esìgi	**nana**	→	**ʃigi nana**
dog	this		this dog
enangi	**nana**	→	**nangi nana**
goat	this		this goat

That V_2 elision only affects the nominal prefix is borne out by the fact that in words beginning with /a/, the only other vowel that begins words in the language, the /a/ is not elided in hiatal configurations, as it is not an affix. Instead hiatus is resolved via glide formation as in (34).

(34) Retention of nonprefixal V_2 in hiatus

egi	**árata**	→	**egjárata**	**(*egirata)**
child	fifty		fifty children	
ète	**árata**	→	**ètjárata**	**(*èterata)**
gum	fifty		fifty gums	
etsu	**árata**	→	**etswárata**	**(*etsurata)**
king	fifty		fifty kings	
ègo	**árata**	→	**ègwárata**	**(*ègorata)**
worm	fifty		fifty worms	

Furthermore when the **e** in an e-CV cannot be plausibly analyzed as a nominal prefix, it is not elided in a hiatal configuration. Smith (1967) observes that words of the structure e-CV are all nouns except /ebà/ 'yes'. In the meaningful context in which this occurs in hiatus (35), **e** is not elided; instead V_1, the nasalized low vowel /a/, assimilates its features as the preceding analysis of assimilation predicts.

(35) Retention of nonprefixal **e** as V_2 in hiatus

u	**gã**	**ebà**	→	**u gẽe bà**	**(*u gã bà)**
3sg	say	yes		he said yes	

That the **e** in **ebà** is not a nominal prefix is borne out by the fact that the word can be truncated, and it is the CV part (**bà**) that is cut. In this case, (35) is more commonly rendered as **u gẽe** without any loss of content or meaning, indication that the 'yes' meaning is encoded by **e**.

The constraint ranking required to account for elision is as in (36). This ranking is illustrated in (37).[10]

(36) Ranking for elision as hiatus resolution strategy
NOHIATUS, MAX-IO-ROOT > *MERGER > MAX-IO-AFFIX

(37) Elision as optimal analysis of hiatus resolution

Input: **li + ezà**	NOHIATUS	MAX-IO-ROOT	*MERGER	MAX-IO-AFFIX
a. **li.e.zà**	*!			
b. **lje.zà**			*!	
c. **lee.zà**			*!	
d. **le.zà**		*!		
e. ☞ **i.zà**				*

(37a), with heterosyllabic vowel sequences, fatally violates NOHIATUS. (37b) avoids this violation by turning V_1 into a glide as in the case of glide formaiton. But, the syllable merger that results fatally violates *MERGER. (37c) resolves hiatus by assimilation, V_1 assimilates to V_2, resulting in a fatal violation of *MERGER. The suboptimality of (37b) and (37c) is indication that in hiatal configurations involving the nominal prefix, glide formation and assimilation which involve syllable merger are precluded as hiatus resolution strategies. This is assured by the ranking *MERGER > MAX-IO-AFFIX. Glide formation and assimilation make it possible for the nominal prefix to have an output correspondent satisfying MAX-IO-AFFIX, but since this results in syllable merger,

[10]Implicit in this ranking is the assumption that V_1 and V_2 in the data on glide formation and assimilation are root segments, V_2 as syntactically bound forms notwithstanding.

the higher ranked *MERGER is fatally violated. This leaves elision as the only option. This is the case with (37d) with V_1 elided. This being a root segment it incurs a fatal violation of MAX-IO-ROOT. (37e), the optimal candidate, retains the root segment, and instead, elides the nominal prefix. This results in a violation of MAX-IO-AFFIX. But, given the low ranking of the constraint, it is of no effect.

The foregoing analyses establish glide formation as the primary hiatus resolution strategy in Nupe, assimilation as a complement of glide formation where the assimilating vowel lacks a corresponding glide, and elision as a special strategy that affects the nominal prefix. The final ranking of the constraints that account for hiatus resolution patterns in Nupe, with the crucial dominance relations between the constraints as indicated, is as in (38).

(38) Final ranking for hiatus resolution patterns in Nupe

IDENTMS-IO
:
NOHIATUS MAX-IO-ROOT DIPHCON *LOW-GLIDE
ogpgq
*MERGER IDENT-IO
g
MAX-IO-AFFIX

In (38), the ranking NOHIATUS > *MERGER ensures that hiatus is resolved by syllable merger in Nupe, and thus excludes elision as a primary strategy. Since syllable merger may result in tautosyllabic vowel sequences (diphthongs), the ranking DIPHCON > IDENT-IO ensures that one of the vowels turns into a glide, hence glide formation, and a difference in identity between the input vowel and its output glide correspondent. The high ranking *LOW-GLIDE excludes the low vowel from becoming a glide, and its assimilation rather than elision is guaranteed by the high ranking MAX-IO-ROOT. The identity changes, as with glide formation, are due to the *LOW-GLIDE > IDENT-IO. The assimilation of the low vowel to the following vowel (regressive assimilation) rather than progressive assimilation is ensured by the ranking IDENTMS-IO > *LOW-GLIDE. That elision as a hiatus resolution strategy targets affixal, and not root segments, is asssured by the ranking MAX-IO-ROOT > MAX-IO-AFFIX. In hiatal configurations involving affixes, glide formation and assimilation are precluded as resolution strategies. This is guaranteed by the ranking *MERGER > MAX-IO-AFFIX.

The analysis of hiatus resolution in Nupe indicates that languages may use more than one resolution strategy. This raises issues for the typology of hiatus resolution strategies and constraint reranking as a predictor of interlinguisitic variation. These issues constitute the focus of the next section.

TYPOLOGY OF HIATUS RESOLUTION STRATEGIES

In Optimality Theory, systematic interlinguistic variation is due to differences in language-specific rankings of universal constraints. Analysis of optimal forms that result from all possible constraint rankings results in the typology of possible human languages. Each possible ranking thus instantiates a different grammar. The implication of this is that reranking a given set of constraints each time should result in a different grammar. In the case of hiatus resolution, given the appropriate set of constraints, each possible reranking of these constraints should result in a different resolution strategy,

and hence a different language. A language is thus precluded from using more than one strategy as one resolution strategy requires a particular ranking while another strategy requires a different ranking within the same grammar. The result is the creation of ranking paradoxes.

The mechanism of typology by reranking forms the basis of the approach to the typology of hiatus resolution strategies developed in Casali (1996, 1997) and Rosenthall (1994, 1996). The approach essentially consists of identifying the constraint violated by each resolution strategy. The selected strategy then depends on ranking the violated constraint as lowest in the hierarchy, while the constraints on other strategies are ranked high. Casali (1997) acknowledges that this is an oversimplified view as it does not allow for the co-occurrence of more than one strategy in the same language. The results of his survey show that languages do employ multiple strategies, though they may have a preference for one strategy. This has been shown to be the case in Nupe. In view of this, a different approach to the typology of hiatus resolution strategies is required. The suggested approach integrates universal tendencies with language-particular idiosyncrasies for the choices that languages make, and the attendant intralinguistic variation.

The approach consists of motivating an appropriate set of constraints that capture the choice of strategy as in earlier approaches and factoring in the peculiarities of the language being analyzed. The issue is defining the appropriate set of constraints. Casali (1996, 1997) and Rosenthall (1994, 1996) attribute hiatus resolution patterns to the interaction between syllable well-formedness constraints and correspondence constraints. The syllable well-formedness constraints include those against syllables without onset, long vowels, diphthongs, secondarily articulated consonants, and consonant-glide sequences. The correspondence constraints are MAX, DEP, IDENT, and UNIFORMITY (cf. McCarthy and Prince 1995). Given that these analyses are onset-driven, there is no markedness constraint against hiatus. Other than the constraint against onsetless syllables, the other constraints are informed by the attested syllabic patterns in particular languages. It is these patterns that determine the choice of strategy in any given language. However the possibility of different configurations arising from hiatus resolution that might lead to otherwise unattested syllabic patterns in a language suggests that this might not be an adequate basis for motivating the choice that languages make in resolving hiatus.

The alternative is to dispense with these syllable well-formedness constraints, and instead derive the typology of hiatus resolution strategies from the markedness constraint against hiatus interacting with correspondence constraints that monitor input-output relations, and the alignment constraint on merging syllables. In this regard the facts of each language are examined in terms of the strategies that it employs, and the appropriate constraints are motivated. Multiple forms of hiatus resolution can then be related to one another based on the factors that determine each choice. This is what I have done in the case of Nupe by establishing that hiatus is resolved by syllable reduction without segmental loss via primarily glide formation, and where the affected vowel lacks a corresponding glide, assimilation results. Crucially, all input segments are present in the output. However, this conclusion is contradicted by elision. But, this is shown to be a special strategy that affects the nominal prefix. The approach made it possible to adequately account for the choice of multiple hiatus resoltuion strategies in Nupe without recourse to syllable well-formedness constraints and reranking the constraints to account for the intralinguistic variation that this entailed.

It is, however, possible to abstract away from language-particular idiosyncrasies and set up a constraint system that predicts hiatus resolution strategies by reranking. The constraints that enter into this typology are the markedness constraint NOHIATUS, the alignment constraint *MERGER, and the correspondence constraints mentioned above. The interaction of these constraints allows for constraining the range of grammars with respect to the phenomenon of hiatus, and the possible patterns of resolution. The hiatus resolution strategies identified by Casali (1996, 1997), namely, heterosyllabification, epenthesis, glide formation, diphthong formation, elision, and coalescence can be grouped into a broad typology, and the different strategies can fall into these broader classes. Finer distinctions between and within languages is then determined by language-specific factors.

Grammars can be classified into two types with respect to the phenomenon of hiatus. The two types are hiatus-permitting grammars and hiatus-prohibiting grammars. This broad typology results from the interaction of the constraints against hiatus and merged syllables. The rankings are as in (39).

(39) Typology of hiatus grammars

a. Ranking for hiatus-permiting grammars
*MERGER > NOHIATUS

b. Ranking for hiatus-prohibiting grammars
NOHIATUS > *MERGER

The implication of the above typology is that there are languages that allow hiatus. In these languages there is no need to resolve hiatus since it is permitted in the first place. It is these languages that have been identified by Casali (1996, 1997) as using the strategy of heterosyllabification. This raises the issue of whether heterosyllabification should be considered as a resolution stategy. It should be considered as a strategy only to the extent that hiatus-prohibiting grammars use it as a result of the failure of a primary strategy warranted by certain contexts. In this case a constraint that captures such a context would dominate NOHIATUS without changing the fact that the language prohibits hiatus. The choice of resolution strategy that hiatus-prohibiting languages make is then a matter of the interaction between the typological ranking (39b) and correspondence constraints.

The interaction between the typological ranking and the correspondence constraints splits grammars into two types, namely, merger-permiting grammars and merger-prohibiting grammars. Merger-prohibiting grammars choose epenthesis or elision as a resolution strategy. The choice is dependent on the relative ranking of MAX and DEP. The ranking for each choice is given in (40).

(40) Rankings for merger-prohibiting grammars

a. Ranking for epenthesis
NOHIATUS >*MERGER > MAX > DEP

b. Ranking for elision
NOHIATUS > *MERGER > DEP > MAX

Grammars that permit syllable mergers may choose either assimilation, coalescence, diphthong formation, or glide formation. All these lead to differences in identity between input-output correspondents. The ranking for merger-permitting grammars is

as in (41). Other constraints that make subtle distinctions between these strategies can be included in the hierarchy depending on the facts of the language being analyzed.

(41) Ranking for merger-permitting grammars
NOHIATUS, MAX, DEP > *MERGER, IDENT

The approach to the typology of hiatus resolution strategies presented above permits a partitioning of grammars into universal sets with several choices possible within each set. It also incorporates the fact that languages may use more than one strategy as determined by language-internal factors without resulting in ranking paradoxes engendered by merely ranking the constraint violated by each strategy lowest in the hierarchy to predict cross-linguistic preferences. Hiatus resolution is, therefore, better acccounted for by combining universal tendencies with language-particular idiosyncrasies.

CONCLUSION

This article has shown that hiatus is prohibited in Nupe. Heterosyllabic vowel sequences are resolved by syllable reduction via syllablle merger or loss. It was argued that the primary hiatus resolution strategy is glide formation with high and mid vowels becoming corresponding glides. Assimilation is demonstrated to be a complement of glide formation as the assimilating low vowel lacks a corresponding glide. These two strategies establish that in hiatal configurations, all input segments have output correspondents. The outputs, however, differ in identity from their input correspondents. Elision on the other hand is argued to affect the nominal prefix **e-** in nouns of the form **e-CV**. That elision affects only the prefix is attributed to the general tendency to be less faithful to affixal segments in contrast to root segments. Input-output mapping maximization as in the glide formation and assimilation data is, therefore, restricted to root segments.

The presence of multiple hiatus resolution strategies in Nupe as in several other languages was shown to have implications for contraint reranking as a predictor of interlinguistic variation. Reranking constraints in this case require remaining in the same grammar. The alternative suggested was to examine the choices that languages make, motivate the appropriate set of constraints, and factor in language-particular tendencies. The appropriate set of constraints are argued to be the markedness constraint against hiatus, as against the syllable well-formedness constraints of earlier approaches, the alignment constraint on syllables merging, and correspondence constraints. An adequate approach to hiatus resolution is thus argued to be one that integrates language-particular idiosyncrasies with universal tendencies.

The article further motivated a typology of hiatus resoltion strategies that derived from the interaction between the markedness, alignment, and correspondence constraints. The general approach to typological variation is to identify grammars based on the ranking of these constraints. Two broad grammars were identified with respect to the phenomenon of hiatus, hiatus-permitting grammars, and hiatus-prohibiting grammars. Hiatus-prohibiting grammars are distinguished by the choice of resolution strategy based on whether they permit syllable merger or not. Within each of these grammars there are different possible choices determined primarily by the relative ranking of correspondence constraints. This makes it possible for languages to make more than one choice of hiatus resolution strategy without the ranking paradoxes that reranking engenders.

REFERENCES

Blench, Roger M. 1989. Nupoid. In John Bendor-Samuel and Rhonda L. Hartell (eds.), The Niger-Congo Languages, 305–322. New York: University Press of America.

Casali, Roderic F. 1996. Resolving hiatus. PhD dissertation, University of California, Los Angeles.

Casali, Roderic F. 1997. Vowel elision in hiatus contexts: Which vowel goes? Language 73:493–533.

George, Isaac. 1970. Nupe tonology. Studies in African Linguistics 1:100–122.

Hyman, Larry M. 1985. A theory of phonological weight. Dordrecht: Foris.

Kawu, Ahmadu N. 2000. Nupe abstractness: A review. New Brunswick, N.J.: Rutgers University.

McCarthy, John and Alan Prince. 1993a. Generalized alignment. In Geert E. Booij and Jaap van Marle (eds.), Yearbook of 1993, 79–153. Dordrecht: Kluwer.

McCarthy, John and Alan Prince. 1993b. Prosodic morphology 1: Constraint interaction and satisfaction. RuCCS Technical Report 3, Center for Cognitive Science. New Brunswick, N.J.: Rutgers University.

McCarthy John and Alan Prince. 1995. Faithfulness and reduplicative identity. In UMOP 18: Papers in Optimality Theory, 249–384. Amherst: GLSA, University of Massachusetts.

McCarthy, John and Alan Prince. 1999. Faithfulness and identity in prosodic morphology. In René Kager, Harry van der Hulst, and Wim Zonneveld (eds.), The prosody-morphology interface, 218–309. Cambridge: Cambridge University Press.

Ola Orie, Olanike and Douglas Pulleyblank. 2000. Yoruba vowel elision: Minimality effects. Tulane University and University of British Columbia.

Prince, Alan and Paul Smolensky. 1993. Optimality theory: Constraint interaction in generative grammar. RuCCS Technical Report 2, Center for Cognitive Science. New Brunswick, N.J.: Rutgers University.

Pulleyblank, Douglas. 1998. Yoruba vowel patterns: Deriving asymmetries by the tension between opposing constraints. University of British Columbia.

Rosenthall, Samuel. 1994. Vowel/glide alternation in a theory of constraint interaction. PhD dissertation, University of Massachusetts, Amherst.

Rosenthall, Sam. 1997. The distribution of prevocalic vowels. Natural Language and Linguistic Theory 15:139–180.

Smith, Neil V. 1967. The phonology of Nupe. Journal of African Languages 6:153–169.